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# One District, One Crop:

## A Study of Crop Value Chains in Manipur

MaolKeki Foundation

आर्थिक विश्लेषण और अनुसंधान विभाग
Department of Economic Analysis & Research

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National Bank for Agriculture and Rural Development

2022

# ONE DISTRICT, ONE CROP STUDY IN MANIPUR

A detailed study of multiple crop value chains covering farmers, traders, processors and consumers in several districts of Manipur

A STUDY CARRIED OUT BY THE MAOLKEKI FOUNDATION

With support from the National Bank for Agriculture and Rural Development (NABARD)

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Value Chain team with Dr. Srinivas Rao, NABARD Regional Manager, Imphal, Jan 2022

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## Remembrances

2021 was a difficult year and sadly, we lost two members of the MaolKeki Foundation family and we would like to remember them here and dedicate this study to them.


**MaolKeki Foundation mourns the loss of a great mentor and founding Trustee**

Imphal, 6 May 2021: It is with profound sadness that MaolKeki Foundation announces the loss of its founding trustee and mentor, Dr. Gurumayum Tonsana Sharma, following a brief period of illness.

Dr. Tonsana grew up in Imphal, Manipur, India, attended Johnstone Higher Secondary School and Dhanamanjuri College before graduating in Civil Engineering from Ranchi University in 1973. Starting as a Junior Engineer in the Public Works Department of the Government of Manipur in the same year, he rose through the ranks to retire as the Chief Engineer in 2009. A true believer in continuous learning with an everlasting thirst for knowledge, he completed a Master of Engineering from the University of Roorkee, now the Indian Institute of Technology Roorkee, in 1977, a Post Graduate degree in Hydrology from Padua University, Italy, on a UNESCO program in

1986, and a PhD from IUEP, Moscow University, in 2001. His latest academic accomplishment was to earn a Bachelor of Law degree with overall third position from the Royal Academy of Law, Manipur, at the ripe age of 70 in 2020.

During his entire career as an engineer in the Public Works Department, he maintained an unblemished record as a man of high principle, uncompromising integrity and fairness across all rank and file. Dr. Tonsana also played a key role in many of the large engineering projects in Manipur and, for a brief period, was posted on Central Government deputation as a Superintending Engineer with the Brahmaputra Board, North Lakhimpur, Assam.

Following his retirement from active government service, he launched the Manipur Democratic People's Front (MDPF) in 2009, a regional political party to create a future based on good governance built on the foundations of Manipur's own agenda. As a party candidate, he contested the Manipur State Assembly and Lok Sabha (Member of Parliament) Elections using these platforms to highlight the need for change in Manipur and shaking the tree to ensure that law makers in the state kept the mandates they were elected for.

In 2017, he co-founded the MaolKeki Foundation, coined with letters from the names of his parents, Gurumayum Madhumangol Sharma and Chanamthabam Ketuki Devi, to catalyse development in Manipur through focused philanthropic initiatives in Agriculture, Education and Healthcare. As a mentor and guide, he provided valuable counsel to many in the organization combining his vast experience, education and knowledge. His last acts of kindness were to visit his alma mater, Johnstone Higher Secondary School, in April 2021 to establish three scholarships to support bright students from poor economic backgrounds, and give his blessings to develop a high-rise building he had started constructing to provide affordable, high quality, accommodation to essential workers in Imphal.

Dr. Tonsana is survived by his wife, son, daughter-in-law and three grandchildren who were all by his side in his last days before departing for heavenly abode. We miss Pabung dearly, and we will continue his legacy and the good work he started with the Foundation.


**Syngenta Foundation India and MaolKeki Foundation mourn the loss of a colleague**

Imphal, 7 July 2021: The second wave of Covid-19 has impacted everyone with many having lost near and dear ones. Syngenta Foundation India and the MaolKeki Foundation are deeply saddened to announce the death of one of our colleagues, Khwairakpam Robert Singh, who passed away from post-Covid complications recently.

Robert previously supported the MaolKeki Foundation (MKF) on various data analysis and Management Information Systems work until he was recruited full time by Syngenta Foundation India (SFI) in April 2021. Robert continued to support MKF as the data specialist for the ongoing NABARD-funded One District One Crop Value Chain Study besides being responsible for creating the web order form for Veg-in-a-Basket, the farm fresh vegetables delivery business supported by the Agri Entrepreneur Growth Foundation, Anaha Trust and Sattva.

Robert, a resident of Lamphel Sanakeithel, Imphal and a former student of Johnstone Higher Secondary School, obtained his Bachelor of Science (Microbiology) in 2006 from Madras University, Chennai, and an MBA (Operations, MIS and Finance) in 2009 from ICFAI Business School, Hyderabad. Mostly self-taught and ever hungry for knowledge, he was UGC NET Certified in Management, Capital Market (Dealers) and Derivatives Market (Dealers) Modules, and also

certified in NISM-Series-V-A Mutual Fund Distributors and Trade Finance from the Indian Institute of Banking Finance. In a career spanning over 12 years, Robert also worked for various multinational and national organizations namely, Royal Bank of Scotland Business Services Private Limited, WIPRO BPO Limited, MAERSK Global Service Centers (India) Private Limited, Barclays Shared Services Private Limited, Globizs Web Solutions Private Limited. Robert was a guest faculty for the B Voc. Agriculture program at Lilong Haoreibi College and a Stock Market trading trainer at Ahelba Trading Academy. As the only son in the family, Robert returned home to Manipur in late 2018 to look after his ageing parents.

A young and dynamic data analyst who not only taught us the right prediction of data but also time management, Robert was a very focused and humble person, with a keen problem-solving attitude. He would say, “We should make something which is very much easy for ground people to use and implement.” His tenure with SFI was dynamic and evening times were his favourite to work. The team at SFI had this to say about Robert, “We will be missing him forever. We never met as he joined us during pandemic times but we had great bonding. His longing to learn new things and use his learnings to build something for all of us has helped the organization a lot. The data interfaces he built for the organization is going to remind him to us forever. Thousand salutes to the departed soul.”

Robert is survived by his parents, young son, four-month pregnant wife*, and two sisters.

*Robert’s widow gave birth to a healthy boy in December 2021.

## Acknowledgement

A study such as this would not have been possible without the interest, leadership and support of a main benefactor so we are very thankful to NABARD for taking the first step in understanding the current lay of the land in Manipur's Horticultural sector. We would especially like to highlight the regular support and feedback provided by Dr. KJS Satyasai (Chief General Manager) and his colleagues at NABARD including Dr. M.S. Rao (Chief General Manager), Ms. Balwinder Kaur (Deputy General Manager) and Mr. Benjamin Thomas (Assistant Manager).

There are many stakeholders and advisors to thank too, and, in no particular order, we would like to acknowledge the support we received from Dr. S. Zeshmarani (Senior Scientist and Head, KVK Thoubal), Mr. Salam Prabin (Thoubal KVK, Prog. Asst. Extension Edu. Agri. & Allied), Longmai-1 Baptist Church, Lupan Self Help Group (Longmai), Ms. Guangjuanliu Gonmei Alias Jessica (Manipur Organic Mission Agency), Mr. Dinesh Ningthoujam (Manipur Organic Mission Agency), Mr. Dipin Wangkheimayum (Senior Research Fellow under NICRA PROJECT, KVK Henbung), Mr. Panii Tao (Village Secretary Oinam Village, Senapati), Mr. R. D. Peter (Owner, Peter Agro, Purul, Senapati), Mr. Armstrong Pame (IAS, then Tamenglong DC), Mr. Rohit Anand (IAS, Tamenglong SDO), Mr. Gaikhamluang Chuilang (Village Secretary, Chuilang Village, Tamenglong), Mrs. Hanjabam Subhra Devi (Proprietor, Meira Foods), Mr. I.K. Muivah (IGP, Manipur), Mr. Bikram Lourambam (IAS, Bishnupur DC), Mr. Thokchom Manoranjan Singh (SDO, Machi Block, Tengnoupal), Oja Lolly (Progressive Farmer, Ukhrul), Mr. Pamrei Rupah (Chairman, Ukhrul Town), Ms. Reema Hemam (ATMA), Mr. Sandeep Jha (IPL Biologicals), Mr. Yunush Khan (Founder, Y Academy), team Agri Entrepreneur Growth Foundation and the NABARD team especially Dr. GHV Ratna Babu, General Manager (Retd.), NABARD, for taking the time to read this report and provide detailed feedback.

We also take the opportunity to thank the hundreds of farmers, traders, consumers and processors without whose time, inputs, and participation, we would not have completed this study. And, finally, the support of our colleagues and stakeholders at the MaolKeki Foundation. We would like to express our deepest appreciation to all those who provided us the support to complete this report.

Furthermore, we would also like to acknowledge with much appreciation the crucial role of the study advisors Mr. Thounaojam Surjeet Luwangcha and Ms. Rajina Potsangbam, who gave various suggestions, advice and walk-throughs to conduct the study to our associates. Lastly but not the least, Ms. Chirom Memory Devi for diligently and transparently monitoring the costs to ensure the project was completed within budget.

## Executive Summary

In many emerging markets, especially in places as remote as Manipur and with limited development, value chains are relatively straightforward with producers selling to traders who sell to consumers, perhaps after some basic processing. This study was an attempt to understand how horticultural produce flowed from farm to mouth, gather a good understanding of the costs involved at each stage, and make recommendations to address some, if not all, of the gaps identified. The study also coincided with the worst phase of Covid-19 in Manipur with the team having to work around multiple lockdowns and movement restrictions leading to limited trading activities. Unfortunately, many of the team members were also affected by Covid, directly or indirectly, and very sadly led to the loss of a team member.

Horticultural sector is a $21 billion market globally, and horticultural crops are also a key part of agriculture in Manipur with an estimated 109,000ha area under production. Manipur's diverse topography and agroecological ranges offer scope for the production of a number of different crops and the sector provides seasonal incomes and nutritional security to thousands of families in Manipur. This study interviewed around 1,700 individuals in multiple districts of Manipur covering both the valley and hill areas with each interview geotagged for monitoring and reference purposes.

Over 500 farmers were interviewed covering crops such as tomato, banana, pineapple, chives, cucumber, kiwi, and watermelon, to name some. A nominative district and crop combination list was established based on common knowledge and available market intelligence however this list was updated as enumerators scoured the district and gained more information. Some 55% of the farmers interviewed were males and most of them were in the 31 to 60 years of age range. Only 57% of the farmers were educated up to primary level while 95% of them were married. 67% of the farmers have been in business for between one and 10 years, and it was also observed that many of the larger households were in the hill districts where living in joint homes is still very common. An overwhelming majority of the farmers own their own farms while 37% of the farmers surveyed were sole female owners. The average farm size also varied by crop; plantation crops such as banana (1.9ha), orange (1.3ha), and pineapple (0.6ha) had much larger acreages versus seasonal crops such as cabbage (0.2ha), cauliflower (0.4ha), king chilly (0.3ha), kiwi (0.2ha), and chives (0.2ha). Tomato, a familiar crop grown by many farmers in Bishnupur district in the outskirts of Imphal valley is an exception with an average of 0.6ha. 83% of the farmers also use their own resources to finance their activities with banks playing only a 1% role in this despite 98% of the farmers reporting having a bank account.

Mechanical land preparation is limited to mostly farmers in the valley due to the difficult terrain in the hills. A majority of the farmers also do not own a nursery often relying on government schemes or neighbouring nurseries to procure young plants. Half of the farmers surveyed did report buying seeds while also relying on farm saved seeds and seeds given out by public bodies to plant in their fields. Farmers also reported a number of pests and diseases

and these have been tabulated in the report. A representative number of farmers were also interviewed in much greater detail to work out their farm sizes accurately, gather all detailed costs and incomes to work out the profitability of their businesses. An interesting observation here is that many farmers think they are making a lot of money because, mentally, they only focus on the income and do not include their own costs. This is a major issue in true costing in many emerging countries where smallholder farmers are predominantly present skewing farmers to believe they were making more money than in reality. All the farmers made money, with per hectare annual profits ranging from Rs14,000 for banana to Rs450,000 for pineapple, except for kiwi farmers who are still recovering the initial cost of establishment and thus incurring a loss of Rs120,000 per hectare.

It was also found that farmers sell to many different actors based on the available opportunity, a situation made worse by the uncertainties arising from multiple Covid-related lockdowns and closures. These uncertainties forced farmers to sell as and when they could or traders to buy whatever (little) was available to ensure they earned something at least. The situation was exacerbated by the lack of infrastructure to store harvested products thus forcing all parties to sell whatever stock they had before incurring a total loss. Therefore, the term 'trader' is a loose agglomeration of anyone who buys and sells. Unlike in parts of India where there is a structured chain with traders playing their distinct parts as wholesalers, retailers or middlemen or women, the definition of a trader in Manipur is loose and broad as many traders buy off other traders as well as farmers in small quantities instead of one large wholesale dealer. A limited number of regular wholesalers are in central Imphal - though many of them, if not all, were shut during the period of this study due to Covid - otherwise most traders are small time dealers going from one opportunity to another.

Nearly 230 traders were also interviewed with a range of questions similar to those that were asked to the farmers. Findings show that some crops like banana, chives, potato and tomato are available and traded more or less throughout the whole year while crops like black rice, cabbage, cauliflower, king chilly, and kiwi have specific times when they are harvested and traded in the state. The first key observation during the interviews was that the fight for survival during the limited trading hours allowed during the Covid-19 lockdowns made traders go beyond their traditional roles and buy and sell as and when possible. This made it difficult for the team to assess traders as wholesalers, retailers or middlewomen.

Second glaring fact was that most of the traders were women, 89% of them, with 90% of the traders between 31 and 70 years of age! Many of them explained how they entered into the trade when their partners left or passed away (total of 18%) in order to continue putting food on the table. 43% of them were only educated up to primary school level and 19% were illiterate while 73% of the traders were home owners. As was the case with farmers, traders also primarily rely on their own financial means to fund their business with only a very small percentage using loans to finance their trade. Half of them earned between Rs1 lakh to Rs3 lakhs per annum though many of them reported having additional non-agricultural incomes to support the family. Household and family expenses made up 44% of their expenses with

26% spent on healthcare. 68% of the traders said they sourced their products from other traders and, whilst the margins varied by crop, most traders made margins in the range of 30% to 50%. Traders also reported being mostly healthy and 12% of them reported having high blood pressure issues. Unsurprisingly, 91% of the traders paid for health on their own similar in many ways to the finding amongst farmers instead of getting help from public sources or private insurances.

Even though there are many small and medium sized processors in Manipur, many of them were closed due to Covid or had shuttered permanently due to poor sales and severe losses experienced during the pandemic. As such, only a handful of processors were interviewed including the proprietor of Meira Foods, one of the large food processors in Manipur. Because of the limited number, we have not presented a detailed analysis in order to maintain the confidential nature of their businesses, incomes and health assessments. What we have presented though are the volumes procured by each one of the processors assessed and the price per kg of the raw materials sourced. At most, these processors only sourced about 15 tonnes of raw materials which is a drop in the ocean but a very small step in the right direction. If anything, this sends a serious message that there is much room for processing to grow in the state, provided the correct infrastructure and support system are put in place.

Hundreds of consumers, 53% of them men, were also interviewed in seven districts. Because of the restrictions around Covid, most of the interviews were conducted over the phone using the social and professional circles of the team members hired for this study. Unlike farmers or traders, a large number of the consumers were well educated with 36% completing an undergraduate degree and 17% having post-graduate degrees. This difference in education creates a level of discrepancy between the players along the value chain that plays out in price negotiations, quality expectations and bargaining power. 81% of them are either employed full-time or part-time with most of them, 74% to be precise, earning between Rs1 lakh per annum and Rs5 lakhs per annum. Based on the findings, a few kilos of the crops are consumed on a weekly basis and some crops such as banana, tomato and chives are consumed for a large part of the year. Most consumers also buy their crops directly from the market but many also reported that small veg vendors on narrow streets within each locality also played a major part. In terms of pricing, most crops are priced within the normal range of each other except for kiwi which, as a relatively new crop, is priced high at about Rs140 per kg on average.

Based on the findings, the average consumption per person of the surveyed horticultural products is 87kg per annum which is slightly above the average in India for fruits and vegetables together. Consumers in general also reported being in good or very good health, though 12% of them did report having high blood pressure. With 93% of the consumers not possessing a private insurance, it is also not a surprise that 94% of them paid for their own healthcare costs.

As will be shown, the study was carried out in the throes of Covid in Manipur so this study was also taken as an opportunity to include questions focused on the health of farmers by asking them to self-assess their own health, provide further info on their health expenses,

etc. These questions revealed much insight such as how 93% of the farmers rated their own health as “Good”, “Very Good” or “Excellent”! However, 18% of the farmers reported fainting and light-headedness so it is not as if all is well at the last mile. Tragically, 98% of the farmers paid for healthcare out of their own pockets leaving them only a catastrophic health event or two away from sinking into poverty. More focused questions on the impact of Covid were also asked and will be discussed in detail later on.

Efforts were also made to capture some of the impact of the pandemic on the different target groups interviewed. Impact in four key areas were measured; revenue loss, health, social life and those not affected. 28% of farmers reported loss in business while 37% reported health problems, mostly related to mental health issues caused by Covid. Most also reported difficulties in selling their produce and in sourcing inputs for production, as well as an increase in labour cost.

Meanwhile, 44% of traders reported business related loss while 35% reported health issues. When it comes to sourcing and selling, traders, interestingly, found it relatively easy to sell but harder to source which could be allocated to the constant lockdowns, limited transport and restricted opening times for strategic markets only in Imphal and other key areas in Manipur. Coming to consumers, only 9% reported loss of income but a much higher 45% reported health issues. Consumers also reported difficulties in buying their horticultural products as well as an average price increase of 28%.

Finally, various recommendations from the study have been covered in the final chapter. To build confidence and strike the iron while it was hot, some of the recommendations were implemented during the study itself and work will carry on with the support of the core team from the MaolKeki Foundation even after the study period is over. Some of these include establishing multiple demo farms to help farmers address some of major pest and disease issues they faced, setting up a banana fibre pilot to reduce waste, and continuing to act as a focal point for farmers in the state now that they know who we are and our support groups. A summary table of investment and development areas that need the most focus in each of the districts based on the findings of this study is given below (red dots being top priority followed by amber vertical lines and green square cells). For any policy maker, politician or bureaucrat involved in the development of the district, these should hopefully act as a strong indicator of what the local population want addressing and include them in their implementation plans.

| Districts | Top Challenges | | | | | |
|---|---|---|---|---|---|---|
| | Irrigation | Production Issues | Marketing & Selling | Storage | Finance | Transportation |
| Bishnupur | | | | | | |
| Churachandpur | | | | | | |
| Imphal East | | | | | | |
| Imphal West | | | | | | |
| Kakching | | | | | | |
| Noney | | | | | | |
| Senapati | | | | | | |

Key actionable items for each of the top challenges have also been presented in the following table. The items presented here are ones that could be implemented within a crop season or two and under the supervision of the district administration. Larger infrastructure requirements such as irrigation canals or constructing inter-village roads that would require inter-departmental and inter-ministerial collaboration with budgets running into thousands of crores and much longer timeframes have been mentioned but not detailed as these would require further extensive studies.

| Sr. No. | District (Primary Crop Surveyed) | Challenges in the Value-Chain* | Recommendations to strengthen the Value-Chain |
|---|---|---|---|
| 1 | **Bishnupur**<br><br>**(Tomato)** | - Marketing & Sales<br>- Storage<br>- Irrigation<br>- Transportation and<br>- Finance | - Low-cost sheds to act as collection and sales points<br>- Cold storage units to keep the produce fresh for longer<br>- Basic solutions such as mulching and irrigation set ups, and rain harvesting ponds<br>- Last mile infrastructure to provide better connectivity<br>- Greater financial literacy, awareness of available financial solutions for smallholder farmers and ways to avail them |
| 2 | **Churachandpur**<br><br>**(Pineapple)** | - Production Issues<br>- Storage<br>- Transportation | - GAP for pineapple cultivation through a network of demo farms, support for small-scale mechanisation and making inputs available<br>- Collection sheds and cold storage units to harvest and store before collection<br>- Last mile infrastructure to provide better connectivity, customised hill rails to 'drop' pineapples for collection |
| 3 | **Imphal East**<br><br>**(Chives)** | - Marketing & Sales<br>- Storage<br>- Irrigation | - Both chives and potato have short shelf lives requiring quick marketing and selling.<br>- Cold storage units to keep the produce fresh for longer<br>- Basic solutions such a sprinkler irrigation kits will improve yield |
| 4 | **Imphal West**<br><br>**(Cucumber)** | - Production Issues<br>- Marketing & Sales<br>- Transportation<br>- Irrigation | - Training to improve cultivation through a network of demo farms, staggered production to extend selling period<br>- Transportation was mostly linked to Covid restrictions<br>- Basic solutions such as mulching and irrigation set ups, and rain harvesting ponds |

| | | | |
|---|---|---|---|
| **5** | **Kakching**<br><br>**(Watermelon)** | - Irrigation<br>- Marketing & Sales<br>- Production Issues | - Dependent on rainfed agriculture so a short-term solution is gen pumps to irrigate the fields<br>- Staggered cultivation with training on GAP using demo plots will create awareness, improve skills and increase yield |
| **6** | **Noney**<br><br>**(Banana)** | - Production Issues<br>- Marketing & Sales<br>- Transportation | - GAP for banana cultivation through a network of demo farms, small scale mechanisation like weeders/ tillers and making inputs available<br>- Additional utilization of the banana plants, not just the banana bunches, to generate extra revenues from fibre<br>- Low-cost sheds to act as collection and sales points with better last-mile road infrastructure |
| **7** | **Senapati**<br><br>**(Kiwi)** | - Production Issues<br>- Marketing & Sales<br>- Finance | - New crop so lack of knowledge therefore there is need for pest and disease training for the farmers from experts in the field<br>- Promote crop before harvest to ensure easy access to market<br>- Farmers have huge sunk costs so important to train them on financial awareness, and short-term opportunities to gain income |

*As identified by the respondents of the survey

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# Chapter 1

# Horticulture in Manipur: An Introduction

## 1.1 Introduction to Horticulture

Horticulture is a form of agriculture that involves the production of fruits, vegetables, ornamentals as well as medicinal and aromatic plants. Horticultural crops provide key nutrients that a human body requires and cannot obtain from consuming just cereals, proteins or meat and are good sources of fibre, vitamins, organic acids and minerals. In other cases, such as ornamentals, they are a much-needed source of mental and emotional wellbeing[1].

The primary production of horticultural crops requires greater care and management however, because they are the food products of choice for an increasingly urban and health-conscious population, they tend to fetch a relatively good price in the market. In some cases, they may be the only reason while very small units of farms remain economically viable. According to the World Health Organization, the average intake per day of edible fruit and vegetables for the prevention of Non Communicable Diseases as well as for the prevention and alleviation of several micronutrient deficiencies should be 400g which roughly translates to five portions per day or 146kg of fruits and vegetables combined per year[2].

Picture 1: A vendor of horticultural produce in Imphal

The average fruit and vegetable consumption in kg per person per year varies widely according to countries. People in the United States consume 90 and 113.41, respectively, while in India, the figures are only 59.69 and 79.86, respectively. The Chinese are relatively high consumers of fruits and vegetables at 97.93 and 377.17, respectively, while Australians consume 75.96 and 92.23, respectively.

In India, the area under horticulture has risen to an estimated 27.59 million hectares in 2020-2021 versus 26.48 million hectares in 2019-2020 yielding a total of 331.05 million tonnes of horticultural crops (roughly 30% fruits[3]). According to Global Market Estimates[4], in 2021, the global horticulture market is estimated to be $20.77 billion and will likely grow at a CAGR of 10.2% to reach $40.24 billion by 2026.

## 1.2 Horticulture in Manipur

Horticulture has long played a key role in the livelihoods of Manipuris, both in the valley and in the hills. The topography of the land (figure 1), the agroclimatic conditions, the small land holdings, etc. have all played a part in the development of fruit and vegetable cultivation in the state. The sections below describe these in more detail.

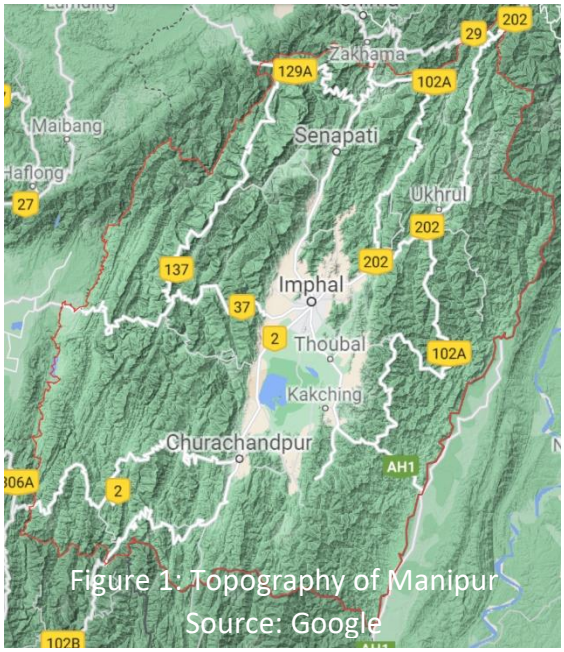


Figure 1: Topography of Manipur
Source: Google

### 1.2.1 Topography and Climate in Manipur

Manipur being located at the tail end of the Himalayan range has a varied topography with a valley at 790 meters above sea level (masl) surrounded by multiple hill ranges with altitudes of up to 3000 masl. The temperature varies from a cold 2°C to a hot 36°C in the summer though not for too long with average temperatures hovering between 15°C and 25°C. Annual rainfall ranges from 975mm to 2,646mm[5].

The range of soil types as shown in the table 1 below for some of the districts in the state coupled with favourable climatic conditions make the state highly suitable for horticulture crop productions.

| Districts | Value | pH | Organic carbon (%) | Available N (kg/ha) | Available P (kg/ha) | Available K (kg/ha) |
|---|---|---|---|---|---|---|
| Bishnupur | Maximum | 6.12 | 3.21 | 712.40 | 71.30 | 213.57 |
| | Minimum | 5.90 | 0.58 | 125.00 | 8.60 | 83.60 |
| | Average | 5.41 | 2.20 | 268.95 | 49.95 | 154.63 |
| Chandel | Maximum | 6.34 | 3.03 | 439.00 | 90.70 | 431.00 |
| | Minimum | 4.67 | 1.25 | 188.00 | 1.60 | 43.00 |
| | Average | 5.38 | 2.35 | 341.90 | 18.83 | 190.67 |
| Churachandpur | Maximum | 6.42 | 3.78 | 631.00 | 58.00 | 627.00 |
| | Minimum | 4.88 | 0.80 | 23.00 | 7.10 | 112.00 |
| | Average | 5.43 | 2.09 | 443.43 | 14.14 | 418.43 |
| Imphal East | Maximum | 6.84 | 2.70 | 924.00 | 47.00 | 401.00 |
| | Minimum | 5.14 | 0.27 | 216.00 | 1.50 | 22.00 |
| | Average | 5.56 | 1.15 | 474.17 | 11.20 | 94.08 |
| Imphal West | Maximum | 6.89 | 3.60 | 942.00 | 35.00 | 902.00 |
| | Minimum | 4.06 | 0.34 | 112.00 | 4.80 | 12.50 |
| | Average | 5.37 | 1.31 | 378.13 | 10.86 | 179.95 |
| Senapati | Maximum | 6.49 | 6.90 | 674.00 | 294.80 | 1276.00 |
| | Minimum | 4.62 | 0.63 | 35.00 | 4.70 | 19.00 |
| | Average | 5.51 | 3.39 | 262.19 | 25.35 | 361.43 |
| Tamenglong | Maximum | 5.66 | 2.41 | 251.00 | 30.10 | 624.00 |
| | Minimum | 4.61 | 1.09 | 63.00 | 21.60 | 97.00 |
| | Average | 5.01 | 1.62 | 148.00 | 27.04 | 381.00 |

Table 1: Average soil nutrient status in selected districts of Manipur[6]

### 1.2.2 Horticulture crops in Manipur

The small plot sizes, a relatively inaccessible terrain, basic infrastructure, higher cost of inputs if at all available and difficulty in accessing markets mean that the environment is more conducive to the production of high value, higher margin horticulture crops.

Crops such as apple, chilli, kiwi, lemon, orange, and pineapple are grown in the hills while crops such as banana, cabbages, cucumber, guava, jackfruits, mango, and watermelon are suitable for the valley regions.

Horticulture plays a critical role in the agricultural scenario of the state with an estimated area of 50,000ha under fruits, and 59,000ha area under vegetables (see figure 2, data source NEDFi[7]). While there is plenty of primary production, processing into value added products is still nascent in the state as we would find out in this study. Horticultural crops play a key role in providing nutritional security as well as seasonal incomes to thousands of families in Manipur.

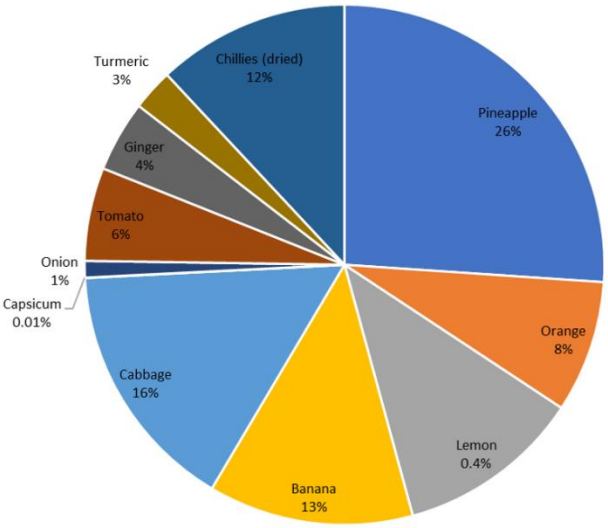



Figure 2: Horticultural crops in Manipur

Across Manipur, there are certain districts which are known for certain crops either because a district was found to have the perfect agroecological environment for a particular crop (orange in Tamenglong, kachai lemon in Ukhrul, banana in Noney, etc.) or farmers and stakeholders have made a concerted effort in recent years to introduce a new crop at scale (kiwi in Senapati) or certain districts have been known historically as producers of key crops (tomato in Bishnupur, pineapple in Churachandpur, chillies in Noney, indigenous potatoes in Imphal East, etc.). This study is an attempt to validate these district-crop combinations and confirm them or where required, explore an alternative new "secondary" crop in the district. Recent district-level information is hard to find however a table of some of the crops and their acreages are shown in table 2[8].

| Crop | Area (ha) |
|---|---|
| Orange | 5,150 |
| Lime/Lemon | 5,850 |
| Banana | 6,700 |
| Tomato | 2,830 |
| Cabbage | 7,104 |
| Cauliflower | 2,750 |
| Chillies | 8,950 |

Table 2: Horticultural crop acreages in Manipur

# Chapter 2

# Value Chain Assessment

## 2.1 Introduction to value chain

The term value chain refers to the full range of activities that are required to bring a product or a service from the initial conception through the different phases of production to delivery to final consumers and disposal after use[9].

The work done here is participatory with data and information collected from different players along the chain to formulate an aggregated response, collated perspective and identify the challenges faced by the participants in the chain[10].

Mapping the various value chains for different horticultural crops in Manipur provided a clear sequence of activities from farm to plate through the roles played by farmers, traders, processors and the consumers.

## 2.2 Different steps in the horticulture value chain

The different key steps involved in the value chain are shown below in figure 3:

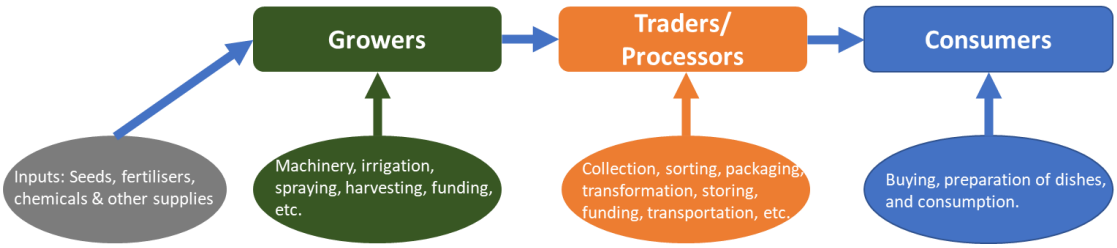



Figure 3: A General view of Value Chain in Horticulture Crops

The chain starts with farmers procuring the necessary materials from various input providers to start the cultivation of a crop. A farmer has to make a complex, multivariate analysis of when to prepare his land, which crop to plant, when to plant, grow or source seedlings, irrigate or not, etc. Depending on whether the crop is annual such as tomato or perennial like orange, a farmer also has to assess the investment needed versus the time taken to recoup the money factoring in the total gestation period (pre-bearing period, applicable in perennial crops) cost and income streams, average payback period, etc. Even during cultivation, a farmer must constantly monitor her or his crop to ensure s/he gets the best possible yield. Once harvested, the crop is passed on further down the value chain to traders or processors or both. Traders may take the crops from farmers to processors or directly to the fresh markets. There may also be traders who take processed products from the processors to the consumers. As found in the mushroom value chain study conducted by this same organization

in 2019, in the context of Manipur, there isn't much value addition as most of the horticultural crops are also sold fresh.

## 2.3 Methodology and Scope of this value chain study

As part of the study, around 1,700 individuals were randomly interviewed covering farmers, consumers, traders and some processors. Interviews included F2F sessions across various locations in multiple districts namely, Bishnupur, Churachandpur, Imphal East, Imphal West, Kakching, Noney, Senapati, and Tamenglong shown in the map on the right (figure 4). The original proposal had been to carry out the study in all the districts of Manipur however limited budget, rising Covid cases and lockdowns curtailed this to only half of the districts. Covid cases subsided in the first quarter of 2021 so the study was finally sanctioned only for cases to spike from April, the month the study commenced. To adapt to the ensuing lockdowns, we changed the strategy to ensure the safety of the staff and spent the initial weeks interviewing consumers over the phone. During the few short periods when lockdowns were lifted, team members then went out following strict Covid protocols to conduct F2F interviews of farmers and traders wherever feasible. As the Covid situation improved after August, the enumerators were able to go out again and complete the remaining F2F interviews. The overlap in the study period and the monthly Covid cases in Manipur has been highlighted in figure 5. Unexpectedly, this study became an assessment of the horticulture value chain during the worst pandemic in the history of the state. Unfortunately, Covid did affect many of us. Unrelated to the study, a few members caught Covid from their close family members and, sadly, we lost a team member while other team members lost close relatives which affected the overall morale of the team.

Figure 4: Targeted districts and crops

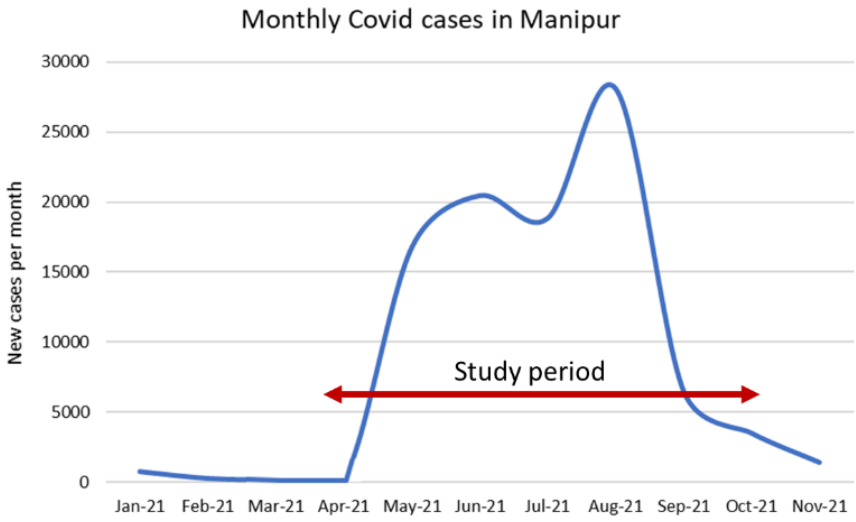



Figure 5: This study coincided exactly with the surge of Covid cases in Manipur

All in all, this has been a study carried out during an exceptionally difficult period when everyone was also going through a personal challenge brought about by Covid. However, the team adapted and responded well to the situation to complete the study as best as it possibly could. All team members had their contracts extended for up to six weeks at no additional cost to NABARD in order to not only support them during a difficult phase but also to keep them engaged until the pandemic had subsided for them to be abe to go out and conduct F2F surveys. It did lead to staff turnover in a couple of districts like Churachandpur and Noney while in Tamenglong, the enumerator resigned in order to look after his ailing father and we could not find a replacement candidate on time. Thus, in Tamenglong, the study was carried out over a few short field visits to meet with farmers and key stakeholders while plans for a study in Ukhrul were dropped after it became impossible to find suitable enumerators.

Wherever and whenever possible, surveys were carried out F2F but remote locations where there were only a handful of farmers were covered by phone interviews. All the interviews were carried out with customised questionnaires loaded on a mobile application called doForms[11]. Detailed questions were asked on production processes, costs, trading, and information was also gathered on consumer preferences. All in all, over 300,000 data and info points were collected. However, only a handful of processors were interviewed as many were not open due to the lockdowns or unwilling to share the intricate details of their businesses.

The breakup of the different players interviewed is shown in figure 6.

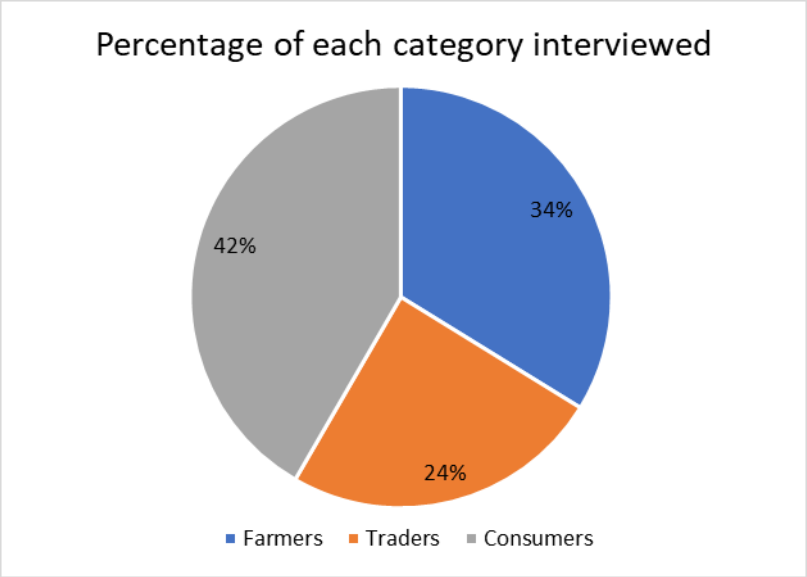



Figure 6: Summary chart of value chain players interviewed

The geographic locations of the interviewees which were GPS tagged in doForms have been plotted with each of the clusters zoomed in for granularity. Attempts to cover as many places as possible were made however, planned trips to some locations like Tamenglong had to be cancelled due to social unrest in Manipur leading up to the State Assembly session while visits to other places were cancelled due to lack of sufficient farmers to interview.

Figure 7 shows the locations covered across Manipur, figure 8 shows the locations in the northern part of Manipur, figure 9 shows the locations in the central areas in and around Imphal valley while figure 10 shows the locations covered south of Imphal valley.

Picture 2: A farmer in Bishnupur

= Farmers; = Traders; = Consumers; = Processors

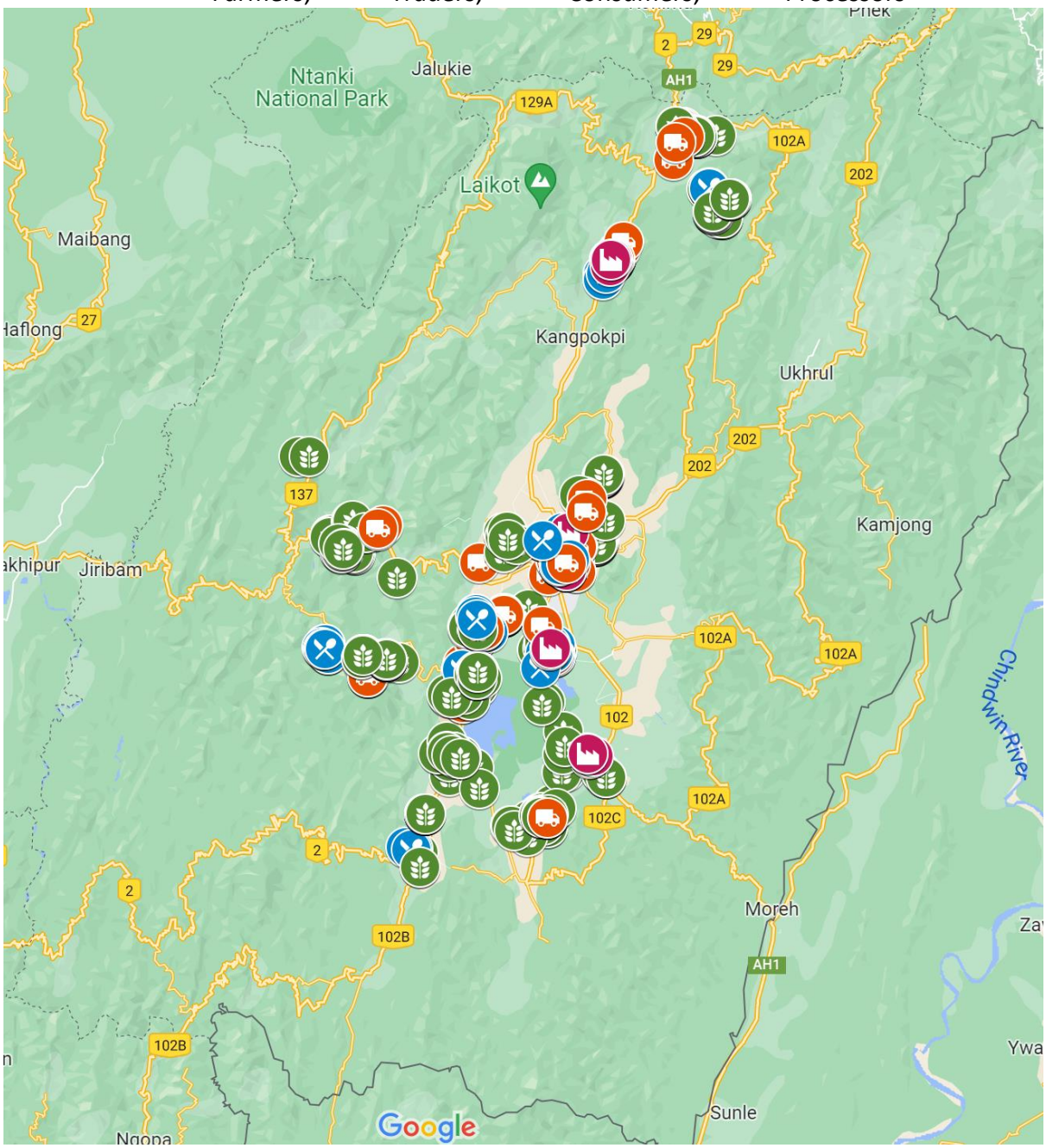



Figure 7: GPS locations of the F2F data collection points across Manipur

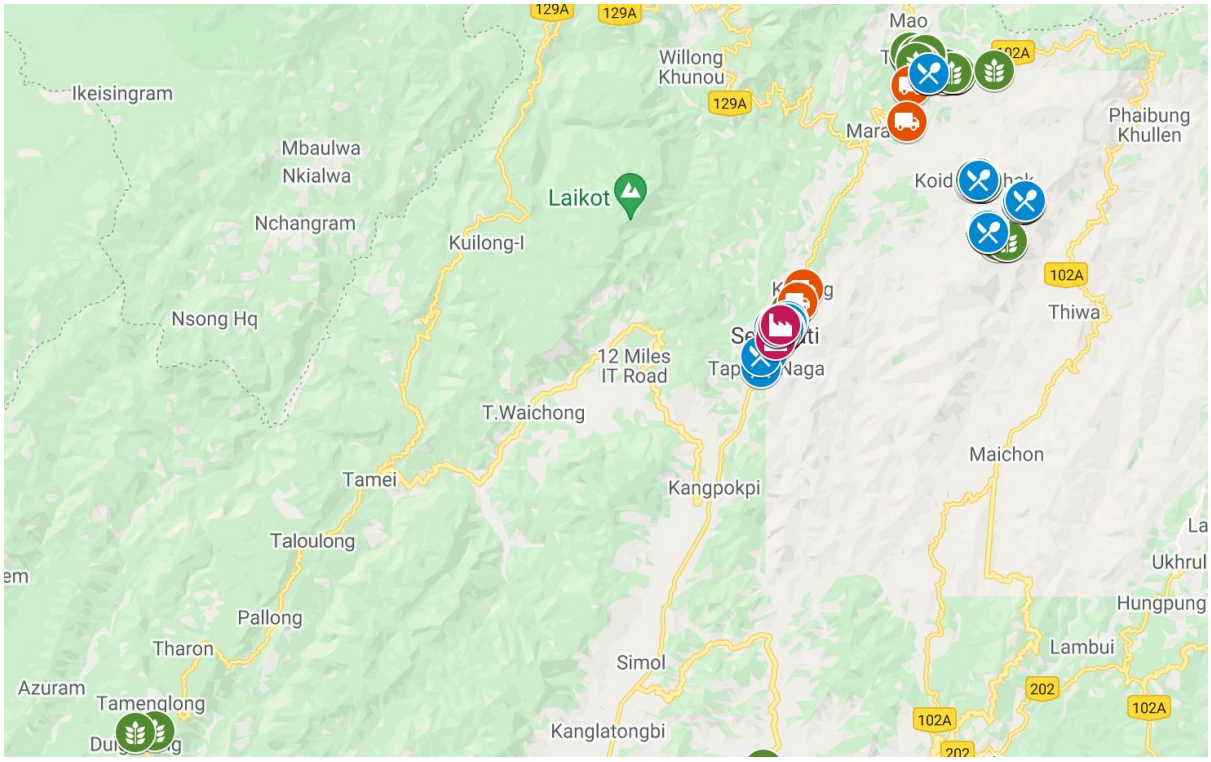



Figure 8: GPS locations of the F2F data collection points in northern Manipur

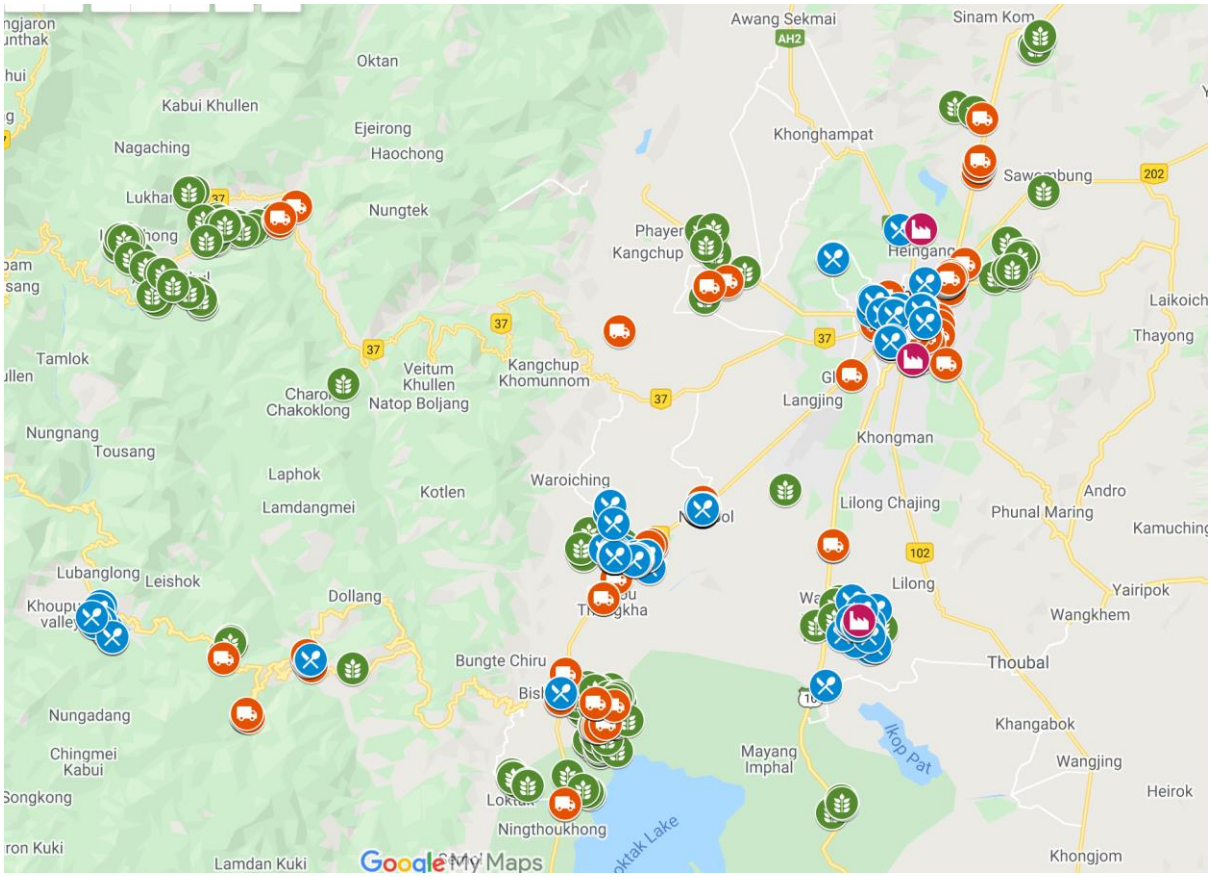



Figure 9: GPS locations of the F2F data collection points in the central areas

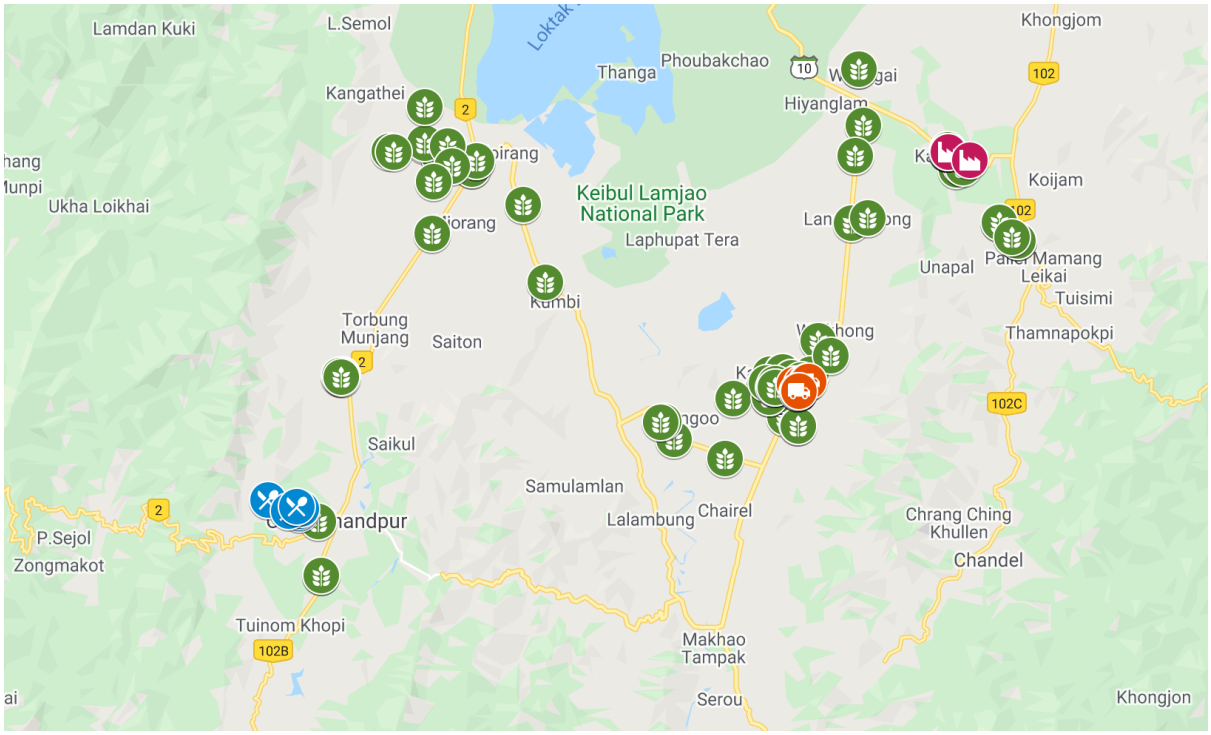



Figure 10: GPS locations of the F2F data collection points in southern Manipur

The data and information collected from the surveys were checked for accuracy, corrected where necessary, and then analysed in various ways to draw conclusions. Though it is quite possible to establish another project and use a skilled statistician to analyse the data in much detail, it is not within the scope of the current project. It is also important to note that all interviewees were asked for permission to continue with the survey. The key conclusions drawn from the analyses have been presented in the following sections.

Picture 3: Traders setting up for the day

# Chapter 3

## Results & Analysis

This chapter has been split into four sections: Farmers; Traders; Processors and Consumers. Each section is then split into further sub-sections to discuss the various study areas covered such as the general demographic data, production data in the case of farmers, trading margins for traders, processing activities and consumer costs, etc. The results have been split by crop/ district so that greater insights can be drawn for each of the crop-district combinations evaluated.

Picture 4: A trader in Kakching

Picture 5: A young progressive farmer

## 3.1 Farmers

A total of 569 farmers were surveyed for this study spread across multiple districts in Manipur as shown in figure 11 below:

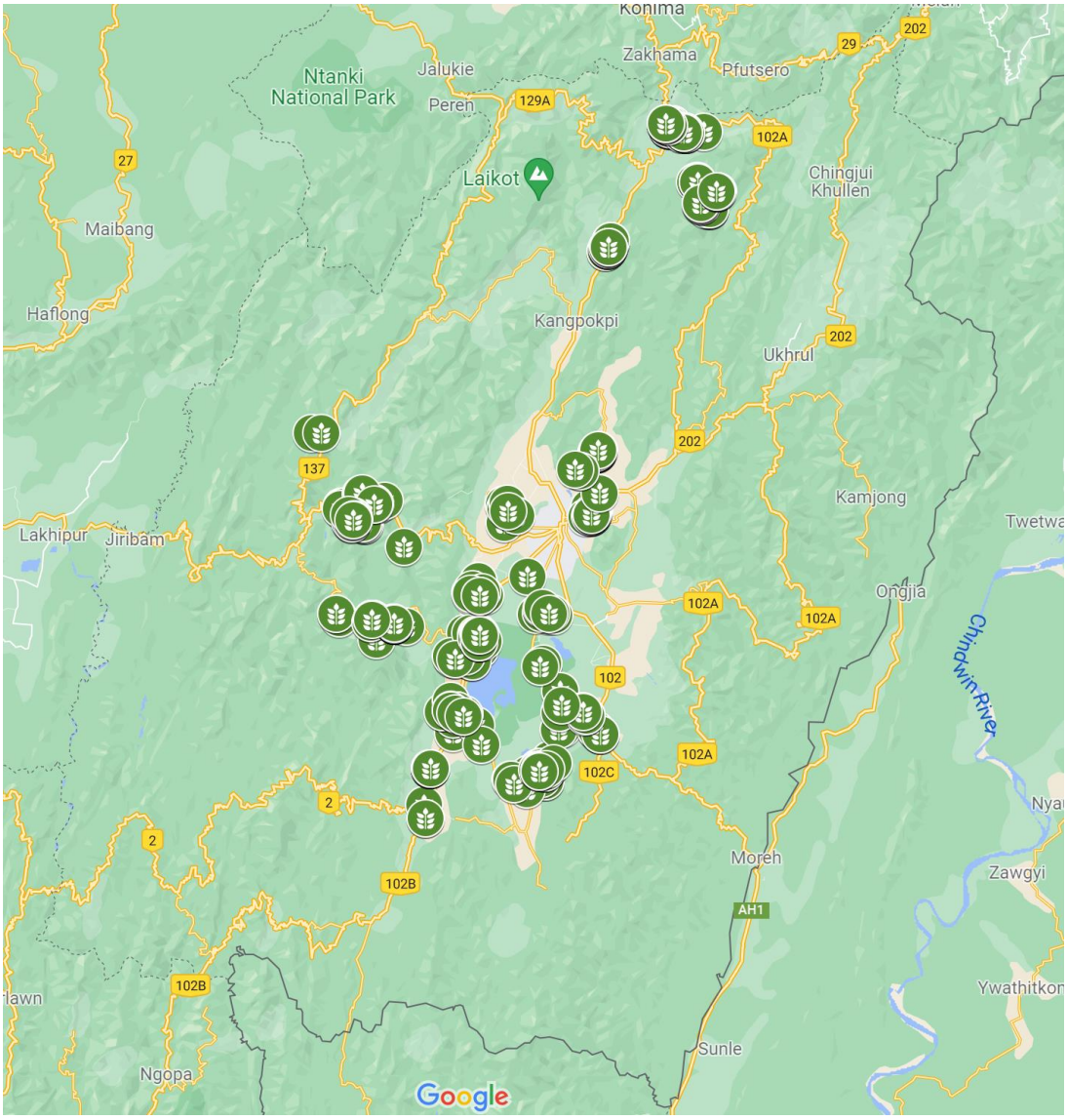



Figure 11: Locations of various farmers interviewed

The main focus was on farmers of the targeted primary crops however, whenever feasible, the team also did its best to capture information on a selected number of secondary crops. The rationale for selecting the primary crops has already been explained in **section 1.2.2**. These crops are listed in table 3, and it must be noted that the study in Tamenglong could not be extended beyond select interviews with groups of farmers on their cost of production after the enumerator had to quit due to an illness in the family and we could not find a replacement in the middle of the pandemic.

| S. No. | District | Primary Crop | Secondary Crop (where feasible) |
|---|---|---|---|
| 1 | Bishnupur | Tomato | Cauliflower |
| 2 | Churachandpur | Pineapple | |
| 3 | Imphal-East | Chives | Red Potatoes |
| 4 | Imphal-West | Cucumber | |
| 5 | Kakching | Watermelon | Black Rice |
| 6 | Noney | Banana | King Chilly |
| 7 | Senapati | Kiwi | Maize |
| 8 | Tamenglong | Orange | |

Table 3: The different districts and the primary and secondary crops surveyed (Tamenglong was dropped for unavoidable reasons but we collected enough data to calculate the cost of production)

### 3.1.1 Socioeconomic Profile

A distribution of the farmers by primary and secondary crops can be seen in figure 12. These farmers were randomly chosen by visiting various locations across the districts. Of all the farmers, 79% were aged 31 to 60 (figure 13) but over 50% of farmers in Imphal West were grouped around the ages of 41 to 50. 55% of the farmers who participated were men but women showed a dominating presence in Churachandpur, and were also a majority in Imphal West and Kakching (figure 14). Overall, almost 80% of the farmers were educated only up to secondary level (figure 15) while 6% of the farmers surveyed were illiterate. Another interesting observation is the % of farmers who have taken up farming of the said crop only in the last one to two years. Overall, this percentage stands at 21% however when broken down by district (figure 16), Senapati stands out with nearly 70% of the farmers having only recently started kiwi production – we understand this is because some key local farmers decided to experiment with kiwi by sourcing young plants from Arunachal Pradesh and when they found that the plants adapted well to the climate in Senapati, more farmers have adopted the crop. In Kakching too, there is a relatively high percentage of new farmers of watermelon. It is also quite likely that these individuals have switched to farming as a means of livelihood following

Picture 6: A farmer in Kakching Khunou

the disruption of all other activities due to Covid. An interesting observation is also that in districts like Bishnupur, Noney, Imphal West, farmers have much longer experience and this confirms the traditional association of the farmers there with the surveyed crops.

A very large 95% of the farmers reported being married (figure 17) with 60% of them reporting a family size of four to six members (figure 18). Further analysis of the ones who reported family sizes of nine or more, 75% of the farmers were found to be in the hill districts. Over 90% of those who have been married have been married for over five years (figure 19).

Most of the farmers also own their own dwelling houses (figure 20) however the concept of letting out part of the house for rent is relatively rare due to the fact that the farmers live in rural communities.

The findings have been plotted in the figures below.

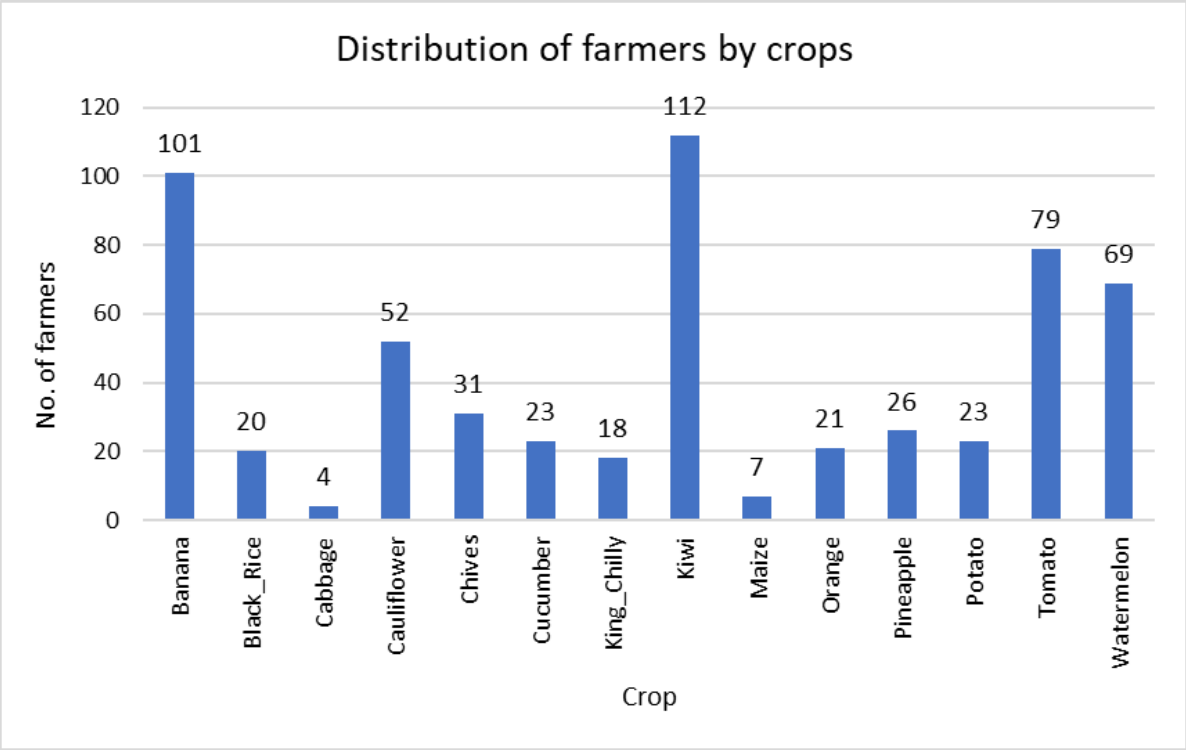



Figure 12: Number of farmers interviewed by crop (cabbage and maize are not primary crops and added as opportunistic interviews when the team came across said farmers)

The final primary crops studied were Banana, Chives, Cucumber, Kiwi, Pineapple, Tomato and Watermelon which is slightly different from the proposal. This was based on feedback the team gave following their initial field visits that provided an opportunity for a reality check on which crops were better suited as primary while others may be considered as secondary in the targeted districts. Data on the secondary crops were also gathered as and when the enumerators could but, due to limited mobility during the many Covid lockdowns encountered during this study, secondary crops were not covered in as much detail as the primary crop in each district. The team in Bishnupur, however, went one step further and

gathered data, albeit limited, on a third crop as well. The varieties of the crops are listed in table 4.

| Crop | Varieties |
|---|---|
| Banana | Jahaji (Dwarf Cavendish), Meitei Laphoi and Chini Champa (Spondias Mombin) |
| Black Rice | Local variety (Oryza sativa L.) |
| Cabbage | Green Hero |
| Cauliflower | White Flash, White Treasure, White England, and Marico |
| Chives | Maroi nakuppi (Allium tuberosum) |
| Cucumber | Alagiri 380, Kalen thabi (local variety) |
| King Chilly | Umorok (CapsicIIm chinellse) |
| Kiwi | Hayward |
| Maize | Chakhao chuzak (local variety) |
| Orange | Tamenglong Orange (Citrus reticulata) |
| Pineapple | Queen and Kew |
| Potato | Lady Rosetta, and Aberchaibi (local variety) |
| Tomato | Tomato-501, Namdhari, Abhimanyu-golden and N92-Namdhari |
| Watermelon | Madhuri 63, Madhavi 10 and Madhubala |

Table 4: Varieties of the crops grown in Manipur

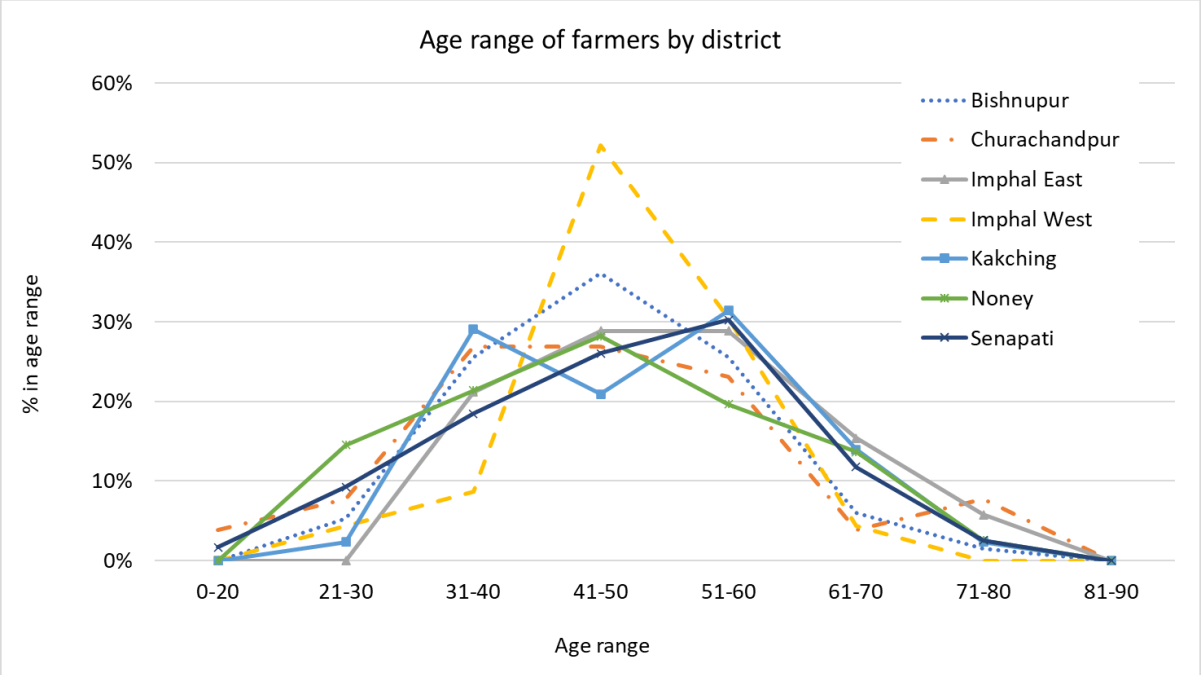



Figure 13: Farmers and their age distributions

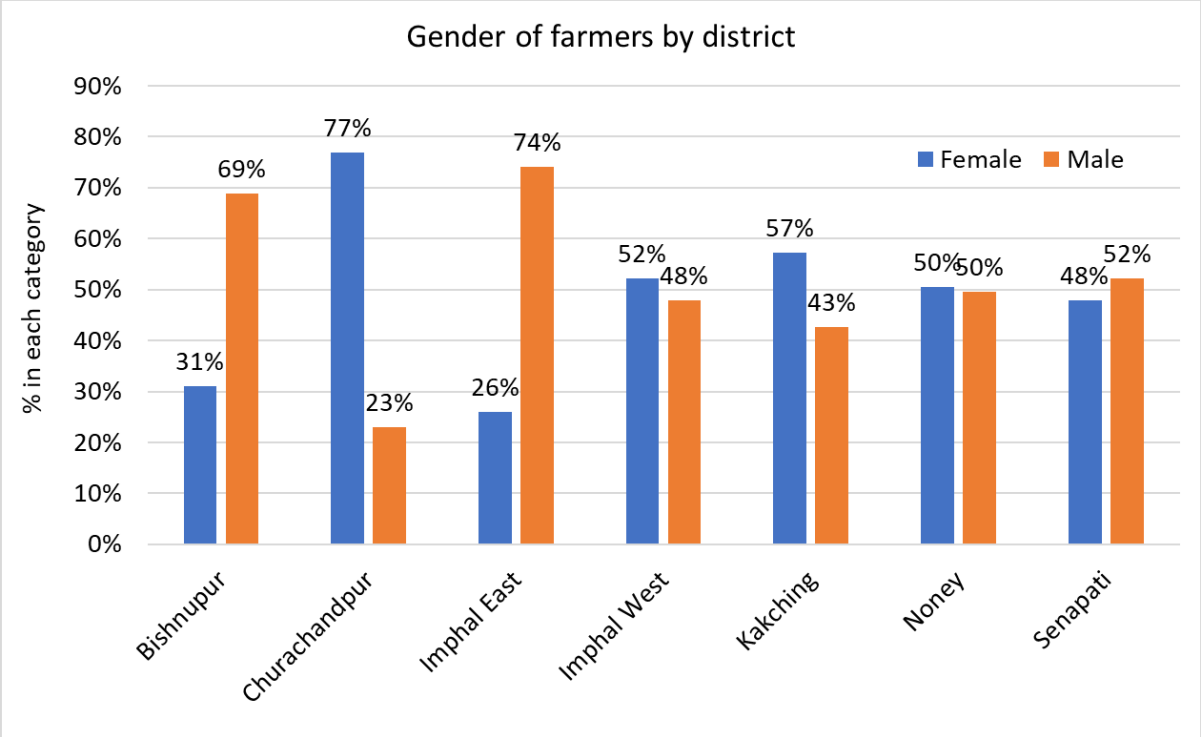



Figure 14: Gender split of farmers

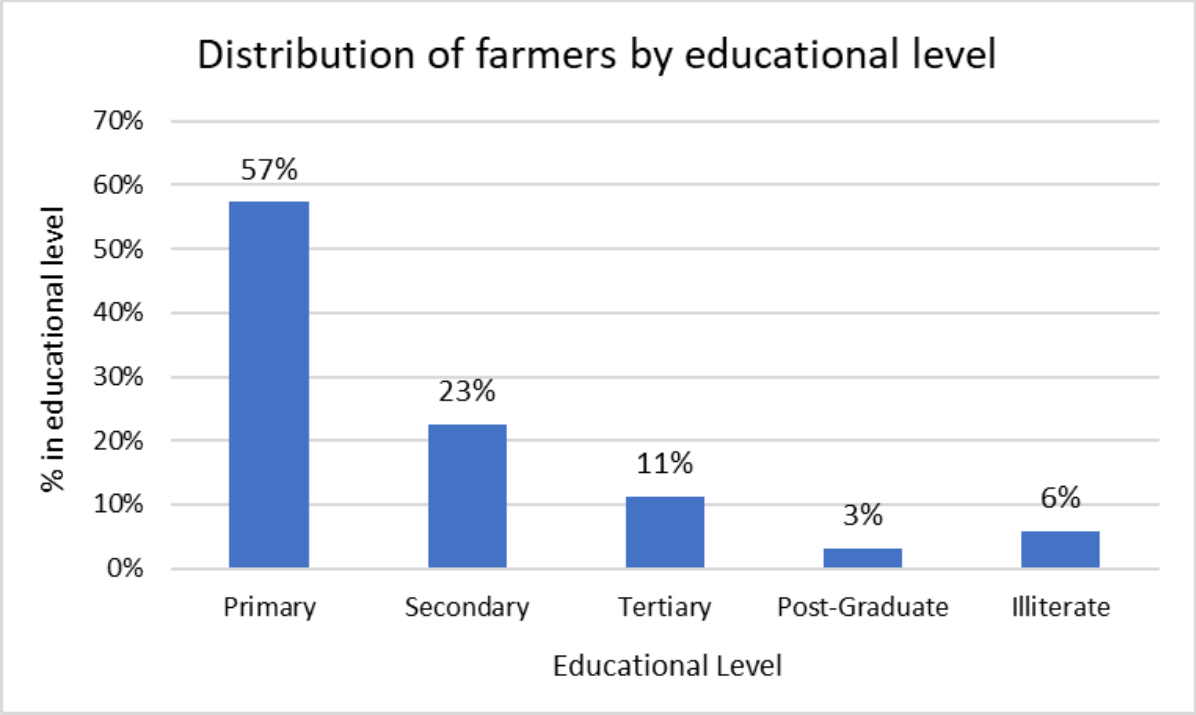



Figure 15: Educational levels of farmers

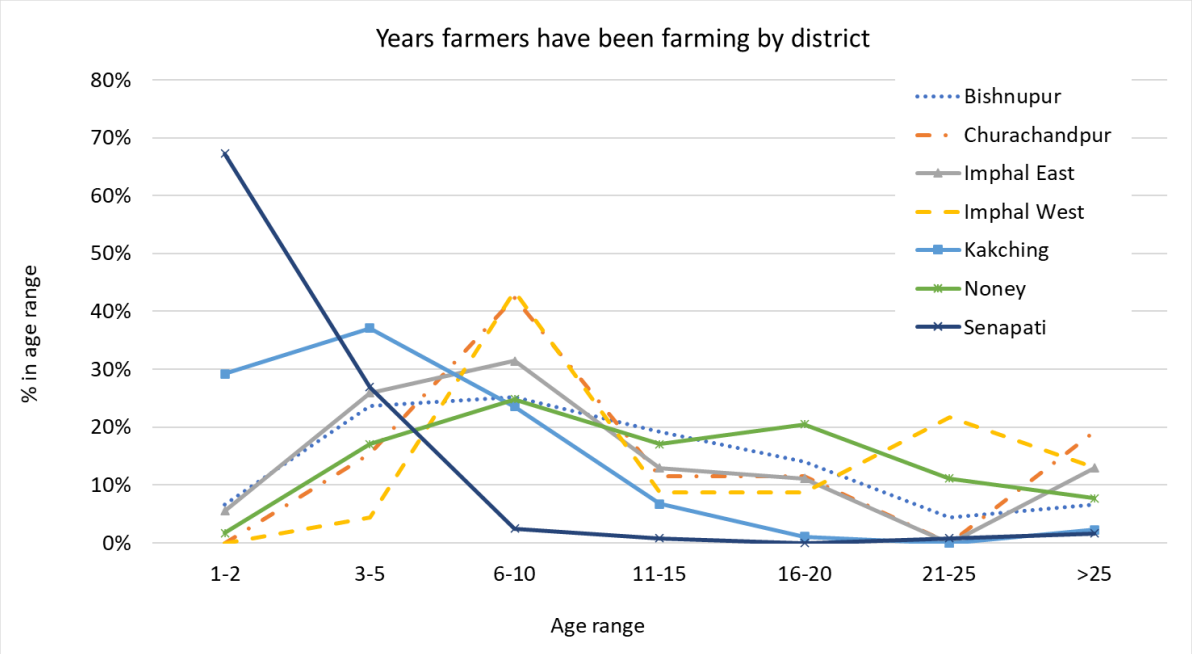



Figure 16: Years farmers have been farming

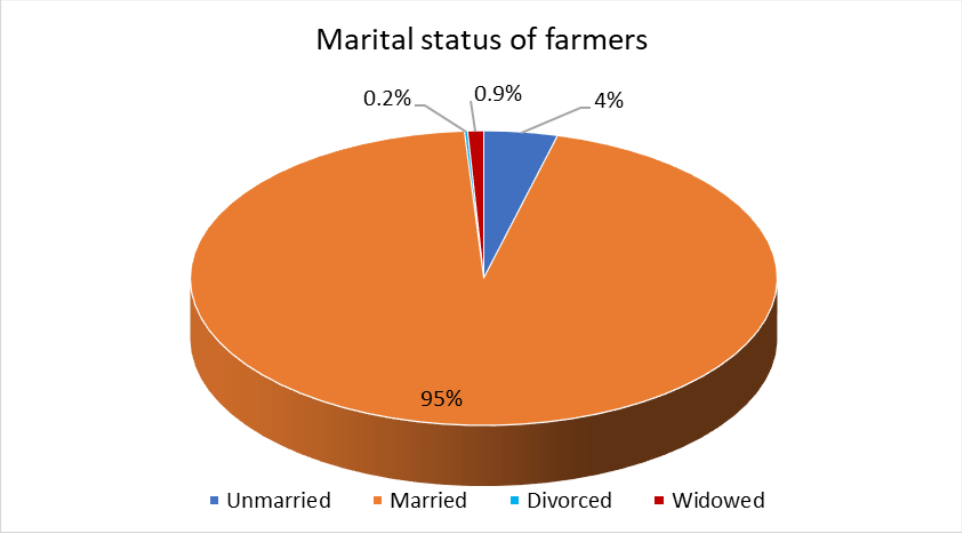



Figure 17: Farmers and their marital status

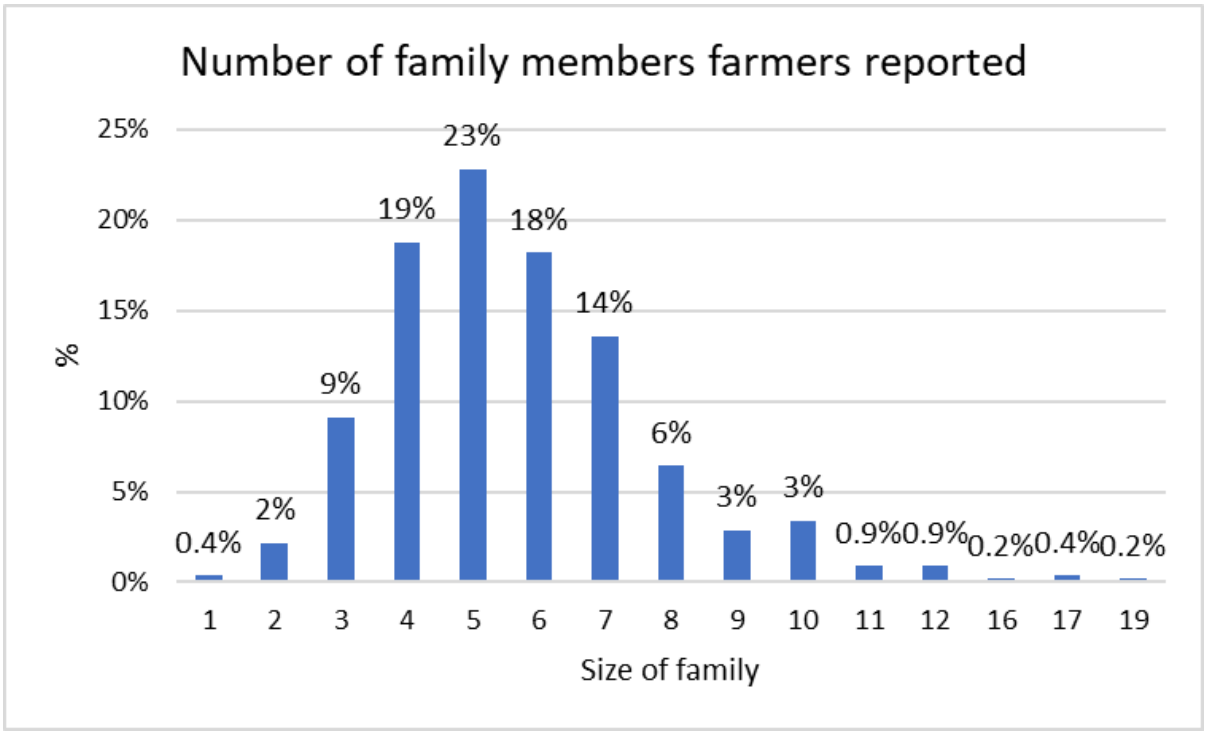



Figure 18: Farmers and their family sizes

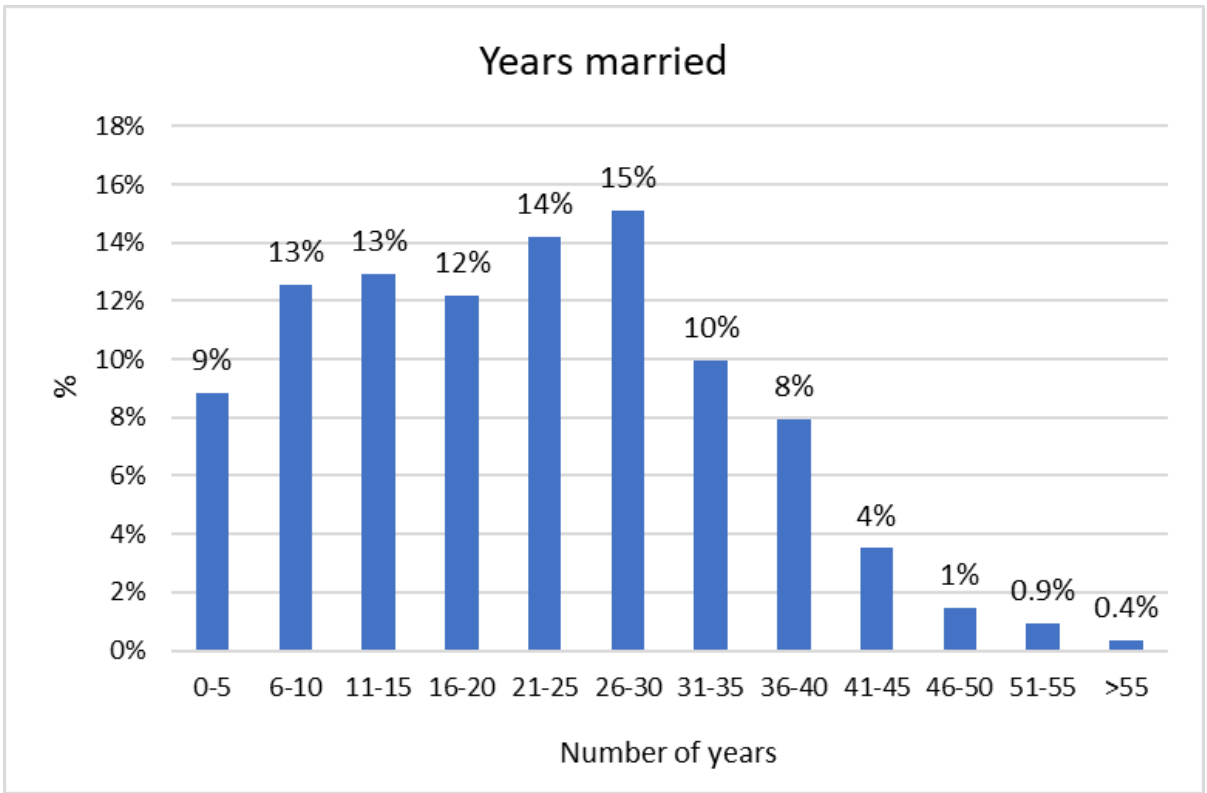



Figure 19: Farmers and years they have been married

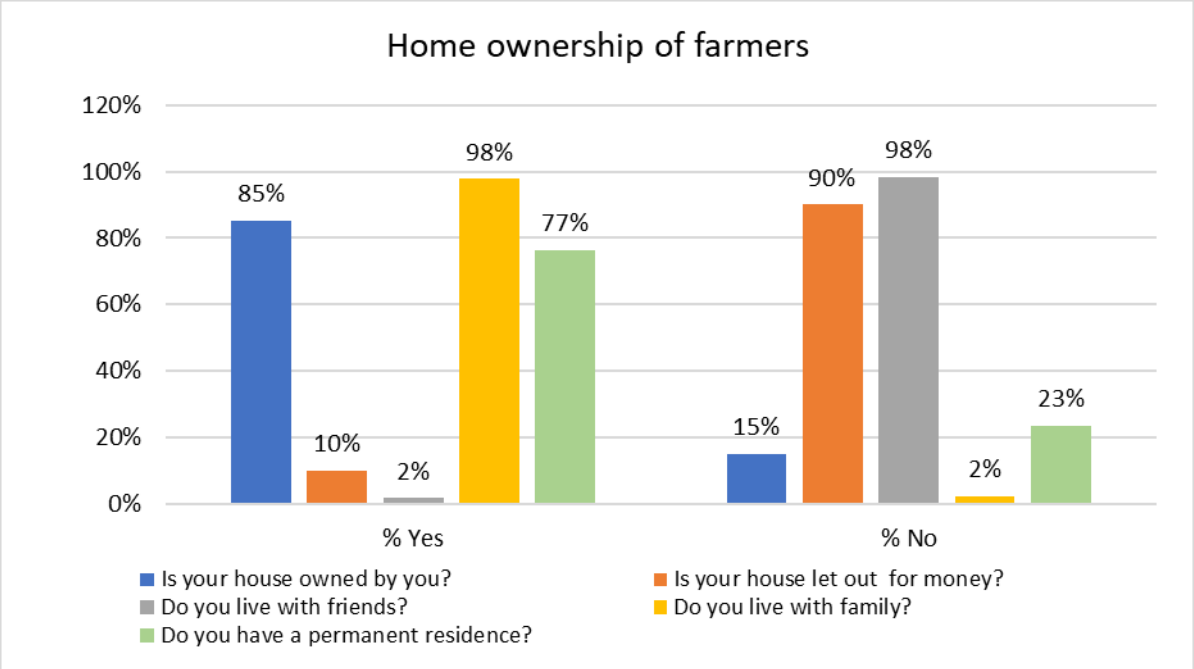



Figure 20: Home ownership and living arrangements of farmers

### 3.1.2 Farm dynamics and economics

In this section, we cover various topics around the ownership and management of a farmer's farm. The surveys revealed that 84% of the farmers had sole ownership of their land with 37% of the farmers surveyed being sole female owners. Broken down by district, farmers in Bishnupur and Churachandpur reported high joint ownerships while Imphal East had a high sole ownership by men (figure 21). The average farm size (figure 22), measured accurately from a sample of the total farmers interviewed, also varies between the crops with plantation or broad acre crops such as banana (1.9ha) and orange (1.3ha) having larger acreages versus crops such as cabbage (0.2ha), cauliflower (0.4ha), king chilly (0.3ha), kiwi (0.2ha), and chives (0.2ha). Pineapple and tomato which have been grown traditionally for longer periods of time in Churachandpur and Bishnupur, respectively, are in the middle of the range with 0.6ha each. Watermelon which is a creeper and grows extensively in Imphal West district also has a larger farm size of 0.8 hectares per farm. 56% of the farmers across all the districts engaged two members of his or her family on the farm but 66% did not have a full-time farm employee, relying solely on own or family labour to farm (figure 23). Looking at this by district, most farmers in Imphal East and Imphal West, where labour is relatively expensive, did not have any full-time employees on the farm while in hill districts like Churachandpur and Senapati, the number of full-time employees on the farm is higher (figure 24). As will be seen later, these are also districts where mechanisation is lower thus relying more on human labour to plant and look after crops like pineapple and kiwi that need regular attention. Many also rely on seasonal employees especially those who grow crops such as banana, potato, and tomato as these are fairly labour intensive during planting, weeding, and harvesting (figure 25). Kakching in Imphal valley is the one district where farmers reported not only having full-time employees but also using a large number of seasonal employees. This could be partly because labour is relatively cheaper there versus Imphal East and West districts while the crops grown, i.e., watermelon and black rice, are also fairly labour intensive to require extra manpower throughout the season.

When it comes to financing farm activities, 83% of the farmers reported using their own personal savings with another 11% using funds from relatives (figure 26). The experience of the MaolKeki Foundation in trying to secure small loans of Rs25,000 from financial institutions for farmers to use the money in agri entrepreneurial ventures also validate these figures that farmers do not either know how to access institutional financing, or their applications are often rejected or they plainly do not like dealing with banks. There is much room here for financial education and awareness to professionalise farm financing. Moreover, 66% of the farmers interviewed do not belong to any farmer groups indicating an area of immense potential for aggregating the individuals into Farmer Interest groups, Farmers' Club or even Farmer Producer Organizations (FPOs).

Picture 7: A chives farm in Imphal East

87% of the farmers also reported working between six to nine hours per day which is no different to many other professional jobs (figure 27). However, the main difference is in the time and physical activity involved. From our field experience, farmers often start very early, at sunrise, in order to complete manual activities before the day gets too hot. Besides this, farmers in the hills have to walk for many kilometres while climbing steep hills to access their banana plantations, kiwi farms or orange orchards. Team MaolKeki Foundation hiked for almost 4km one way over two hours just to access an orange orchard or a banana plantation in the hills of Tamenglong and Noney, respectively!

On a household basis, 59% of farmers on average earn between Rs1 lakh and Rs3 lakhs however the district-by-district assessment shows that while most of the districts are in this range, Churachandpur and Imphal West stand out as relatively high-earning districts where 40% to 50% of farmers earn between Rs3 lakhs and Rs5 lakhs in annual income (figure 28). Kakching district, where we saw earlier that farmers employed the most number of farm workers for a valley district is the one district where more than 50% of the farmers reported earning less than Rs1 lakh per annum. Farmers in Senapati also earn relatively less however this is primarily because Kiwi is a new crop planted only in the last two to three years and hasn't reached full maturity and earning potential yet. Looking at how farmers spent their income by district, many in Bishnupur and Kakching reinvest in agriculture while those in Churachandpur and Senapati reported no reinvestment. A reason for this could be that they leave the pineapple plants to grow for a few years at a time while kiwi is still a young crop. Besides the time the farmers themselves spend tending to the farm, it could be that they actually do not spend any money on it.

Overall, only 7% spent money on healthcare with the highest percentage being in Noney which could be because it is a young district with limited healthcare facilities. Household

spend including education takes up a large share of the spend confirming again that the cost of living in Manipur is high and good education comes at a price, mostly from private schools (figure 29). Anecdotally, many of the farmers would like their children to be educated and secure more stable, less risky, jobs. Interestingly, 98% of the farmers reported owning a bank account (figure 30) however only 72% said they knew how to operate their bank accounts.

A majority of the farmers, 54% on average, do not own a nursery however when looked at by district/ crop, the average is strongly influenced by districts such as Imphal East, Kakching, Noney and Senapati where most farmers do not own a nursery (figure 31) and procure seedlings or saplings from the market, public institutions such as KVK or ICAR, and neighbouring farms (figure 32). For those who reported having an own nursery, it is basically a small bed on the side of the field where they plant seeds that will eventually be transplanted as young seedlings in the case of crops such as tomato in Bishnupur or cucumber in Imphal West. These nurseries are not professional young plant raisers growing high-quality seedlings. For pineapple in Churachandpur and banana in Noney, farmers harvest young plants or suckers from existing plantations and use them to replant new fields. 49% and 41% of the farmers reported acquiring seeds – in reference to primary or secondary crops grown from seeds - from the open market or using farm saved seeds, respectively (figure 33).

In terms of land preparation, there is a clear difference between farmers in the hills and in the valley. Farmers in the hills who grow crops such as banana, kiwi and pineapple (and also including orange in Tamenglong) report using very little, if any, mechanical form of land preparation while farmers in the valley - those who grow crops such as black rice, cauliflower, watermelon, potato and tomato – report over 90% use of machinery to prepare their land (figures 34 and 35). In terms of soil testing, a small percentage in the valley districts reported so but none in the hill districts highlighting the need for increased support in making soil testing facilities available in all districts (figure 36).

Many of the farmers also reported various pests and diseases affecting their farms and these have been categorised in table 5. During the interviews, a large number of farmers also reported having participated in multiple such surveys from various public and private organizations – in some instances, team members were not allowed to enter the farmer's property or asked to leave upon learning the purpose of the visit – so MaolKeki Foundation decided to take a different approach by assuring the farmers that there will be follow-up activities. Two such activities have been reported in this study: 1) establishment of various demo plots targeting different crops so that farmers can be educated on better practices, as well as pest and disease management and 2) the establishment of Noney Banana Company which is described in greater detail in **section 5.3** to address specific issues faced by banana farmers in Noney District.

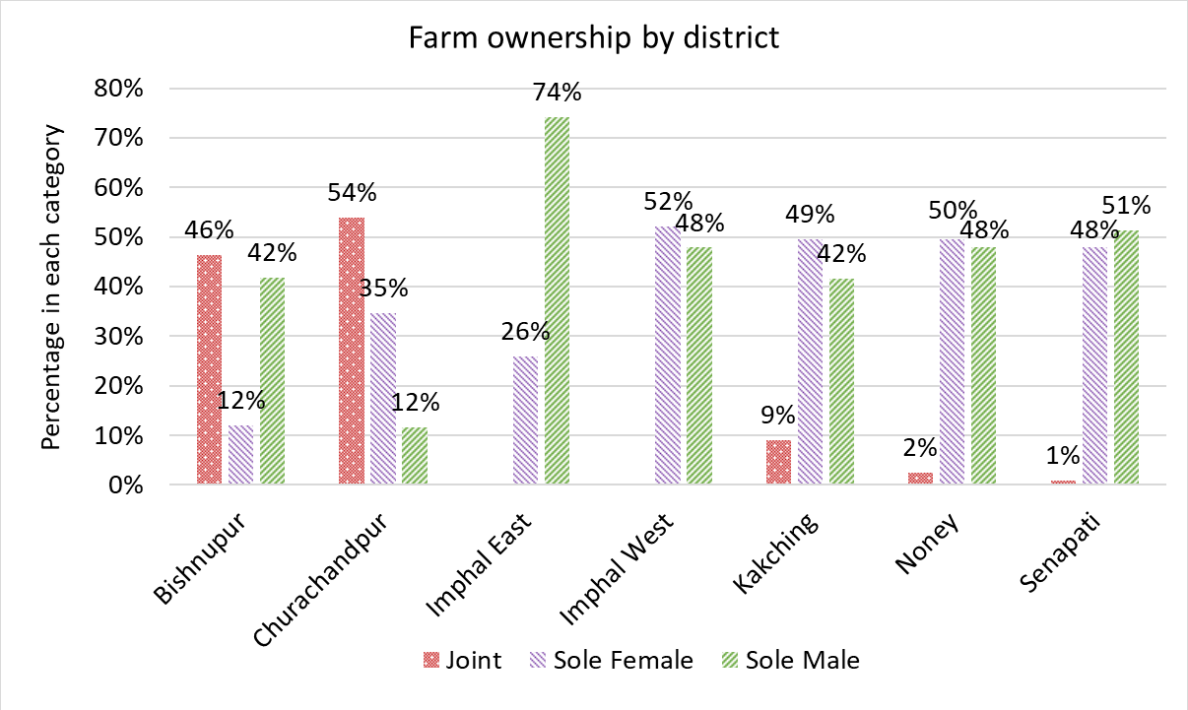



Figure 21: Farm ownership and its gender split

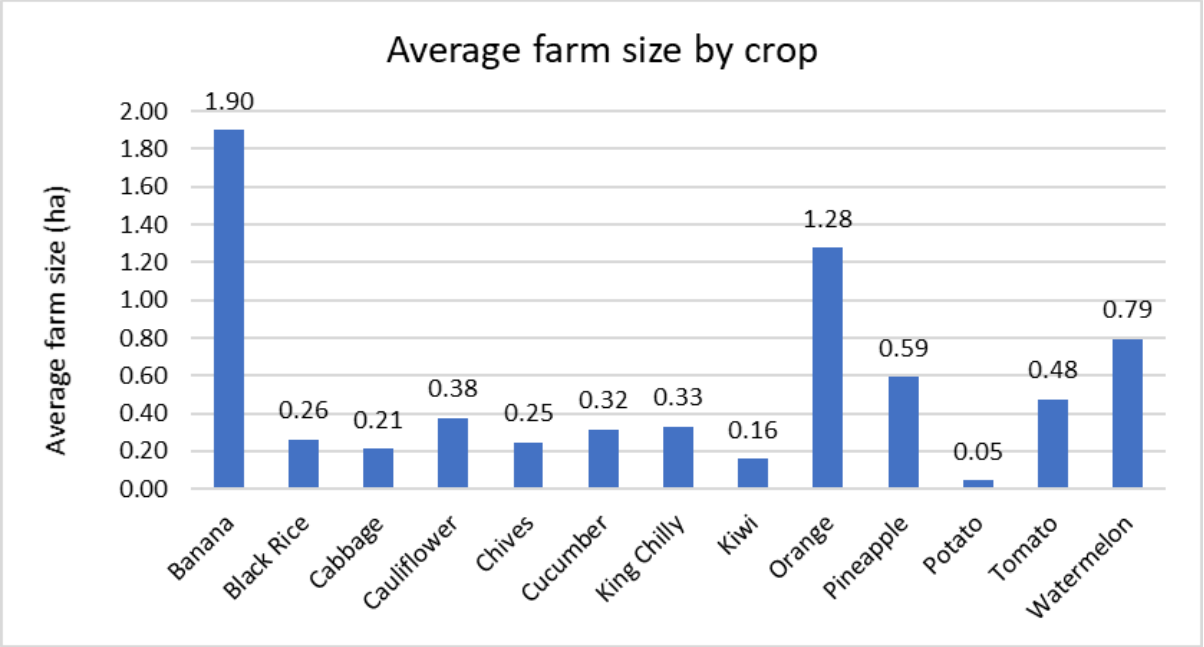



Figure 22: Average farm sizes of different crops

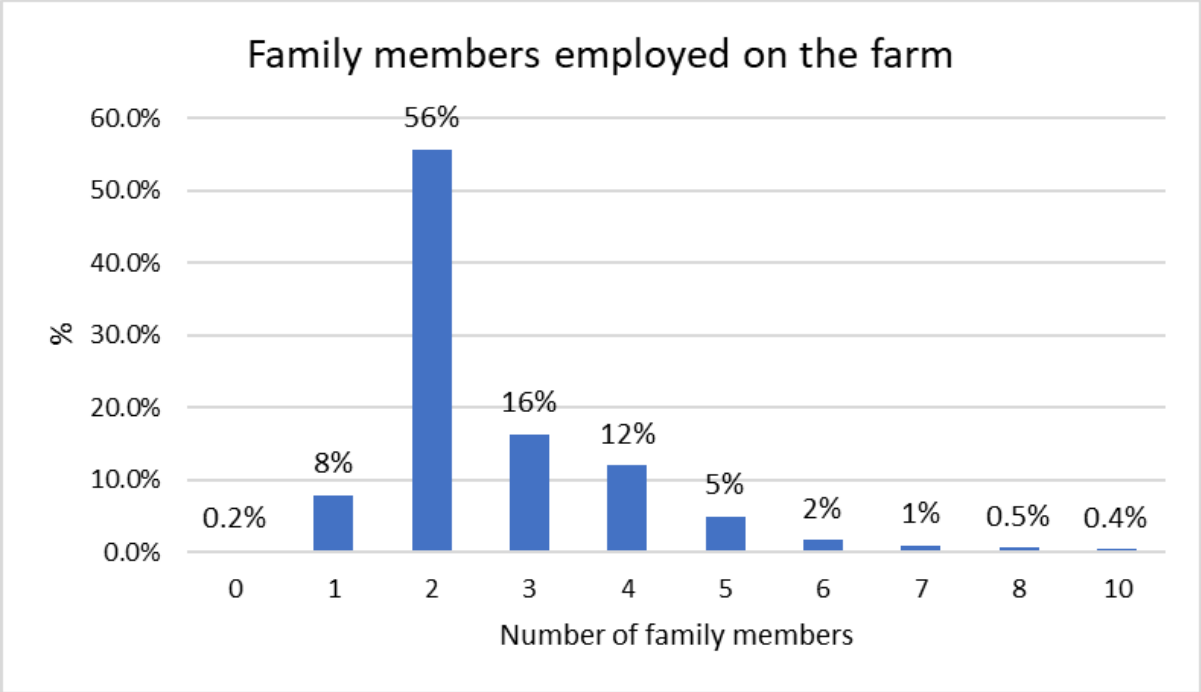



Figure 23: Number of family members engaged on the farm

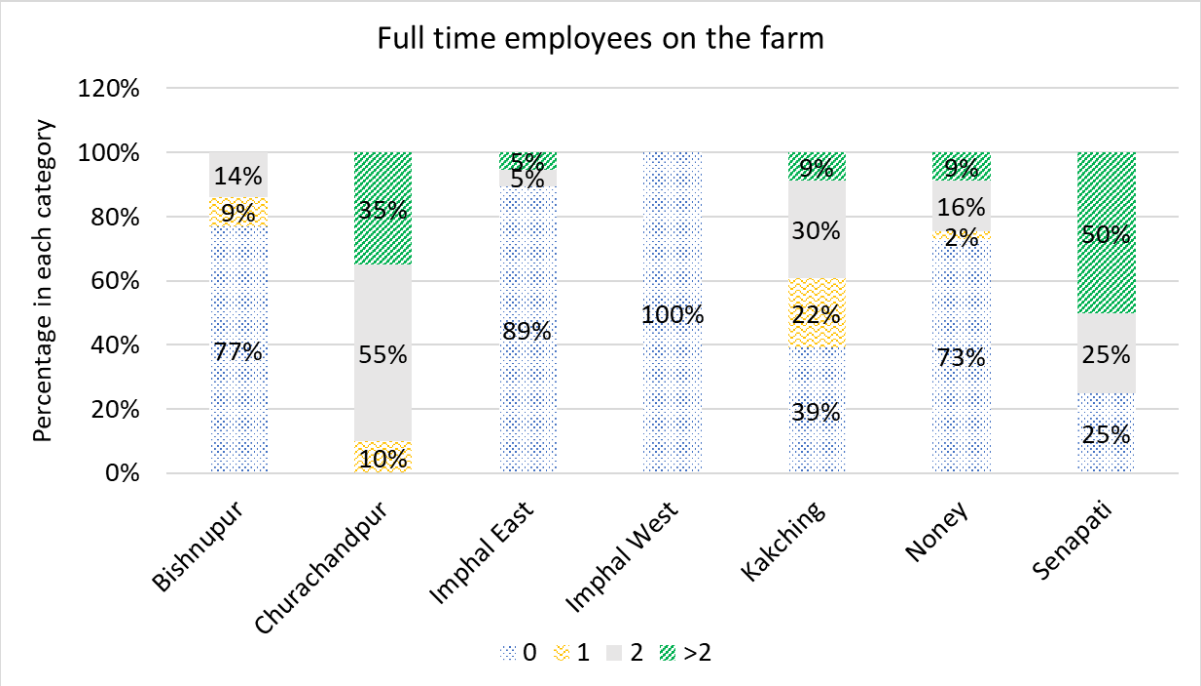



Figure 24: Number of employees engaged on the farm on a full-time basis as against seasonal employees (workers)

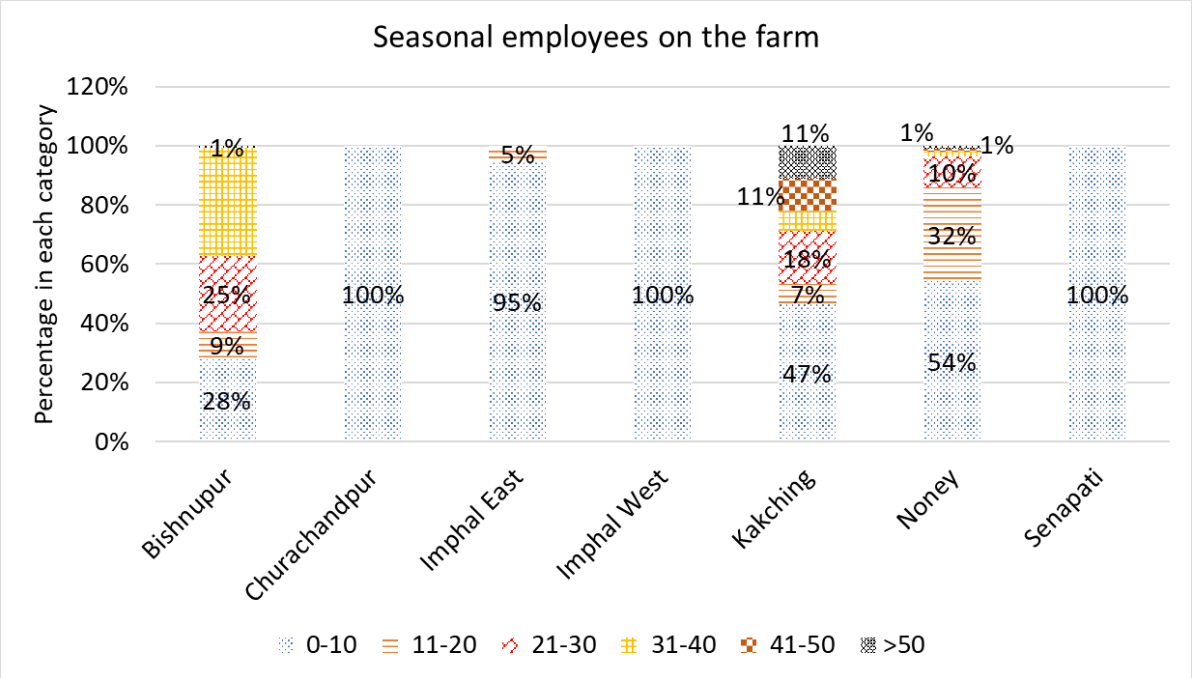



Figure 25: Number of seasonal employees (workers) engaged on the farm

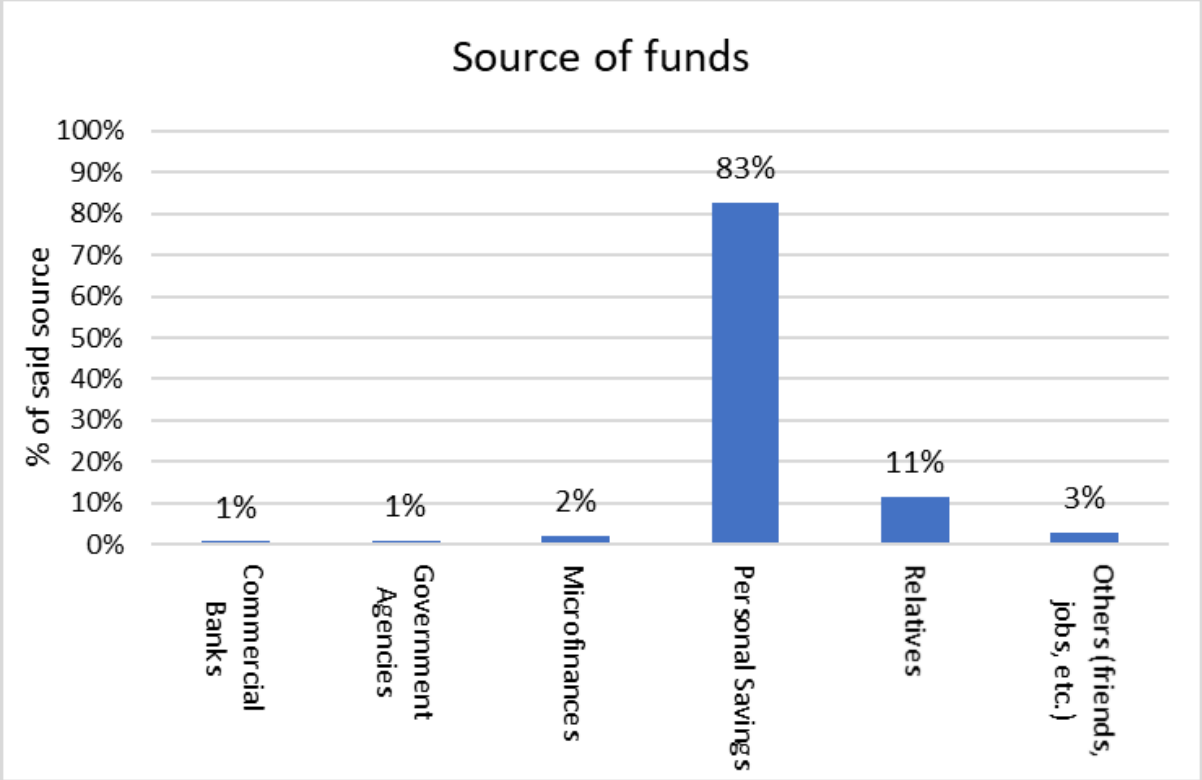



Figure 26: How farmers finance their activities

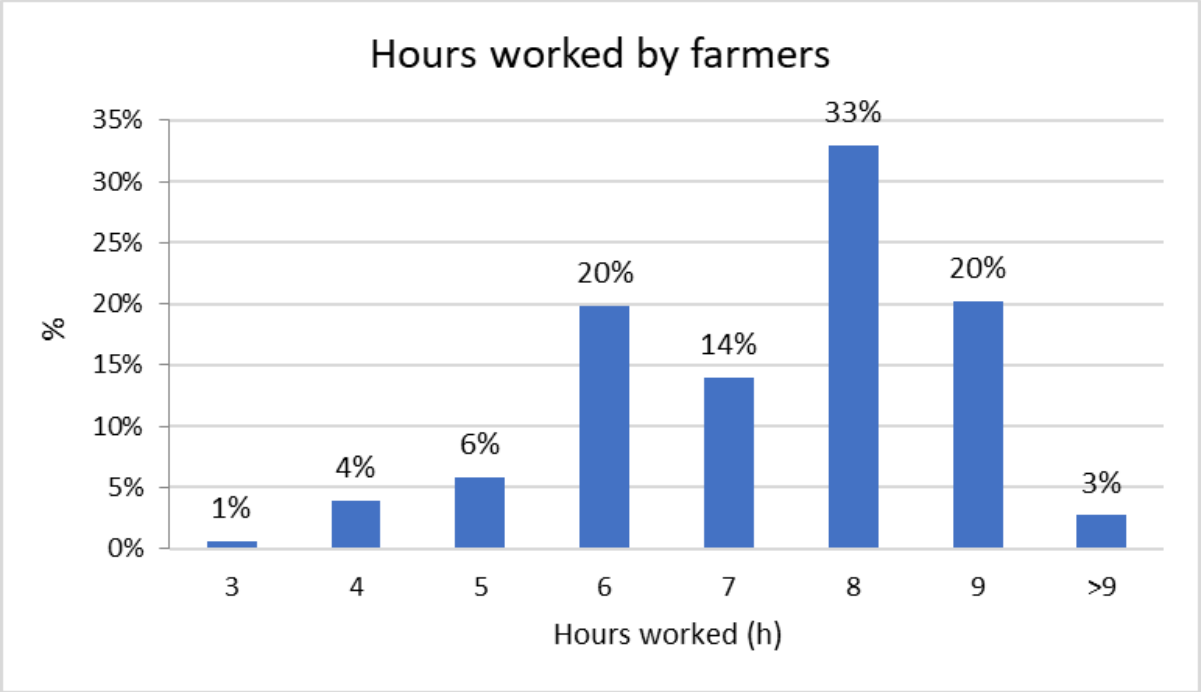



Figure 27: Farmers and the number of hours they work

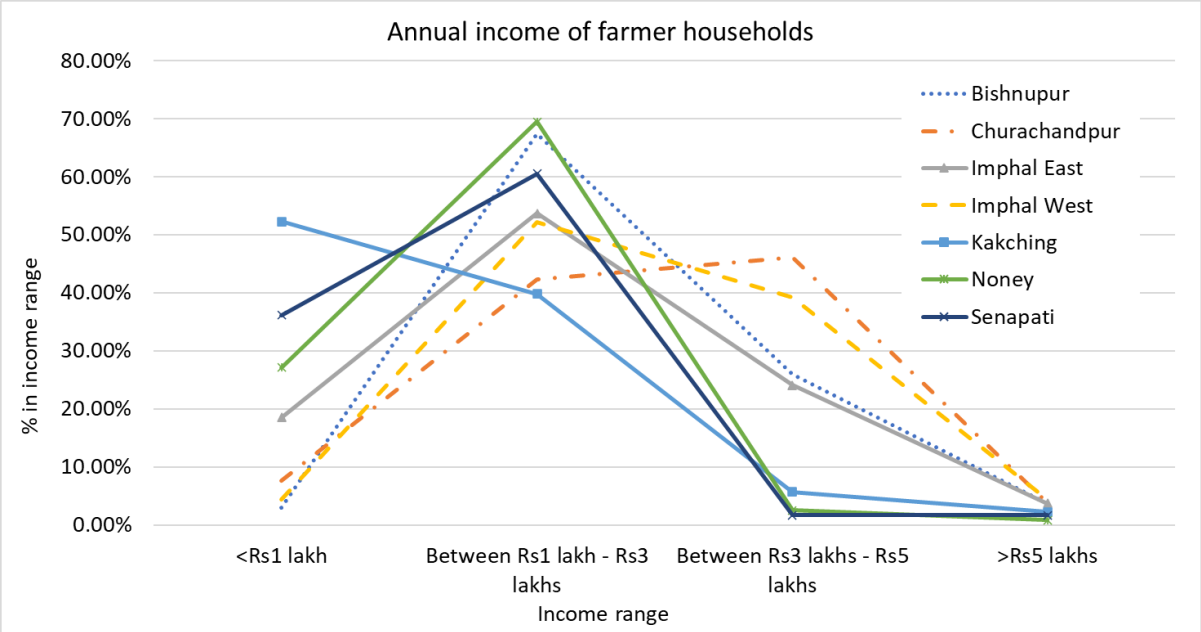



Figure 28: Average farmer household income

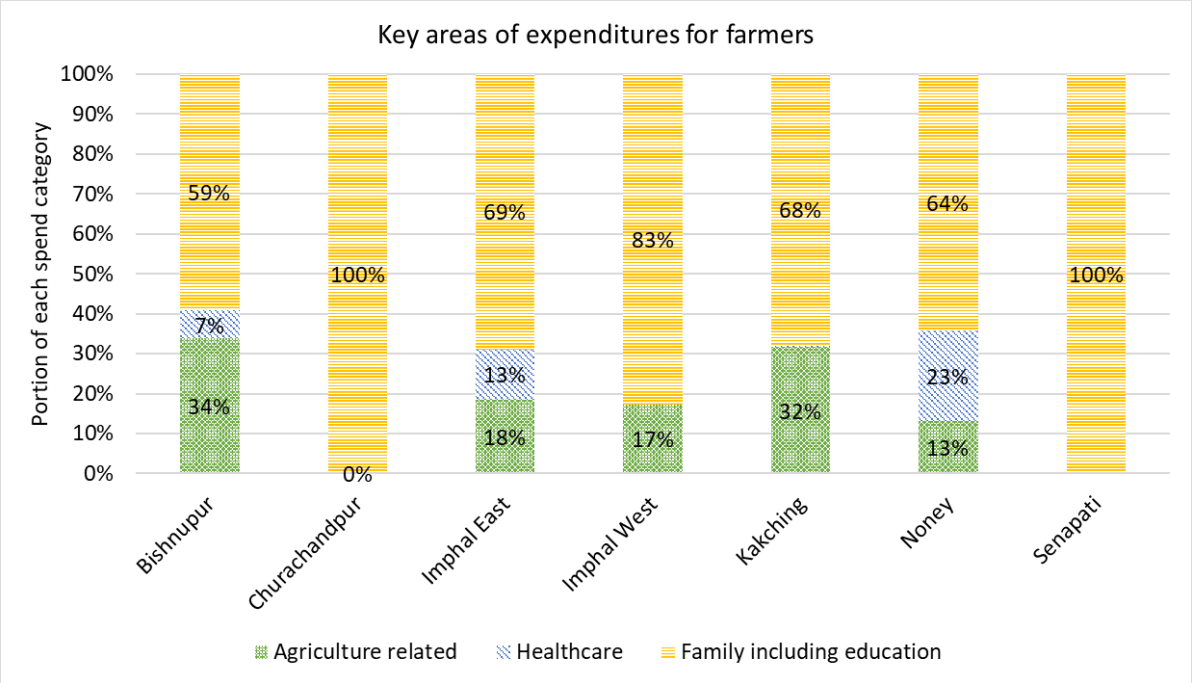



Figure 29: Spend of income in a farmer's household

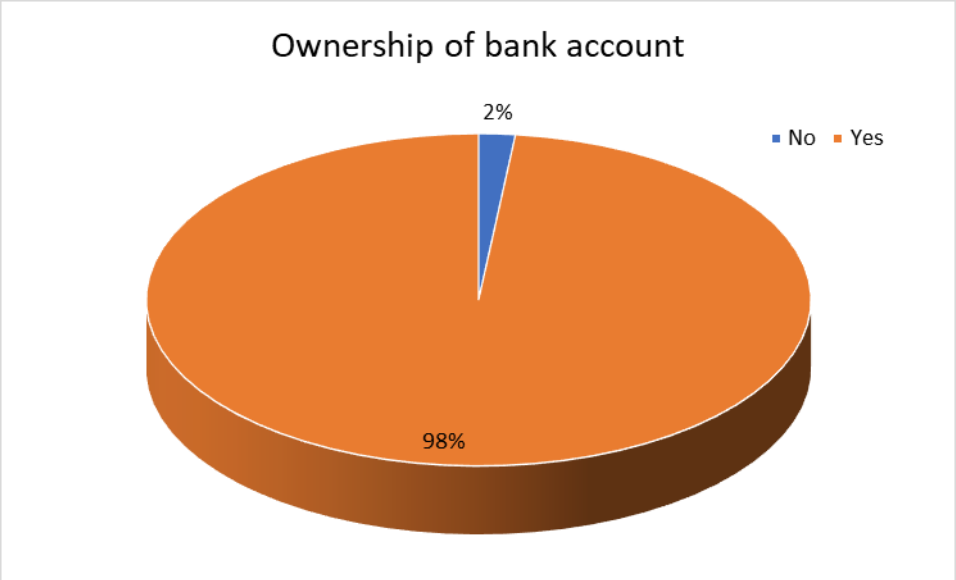



Figure 30: Farmers and bank account ownership

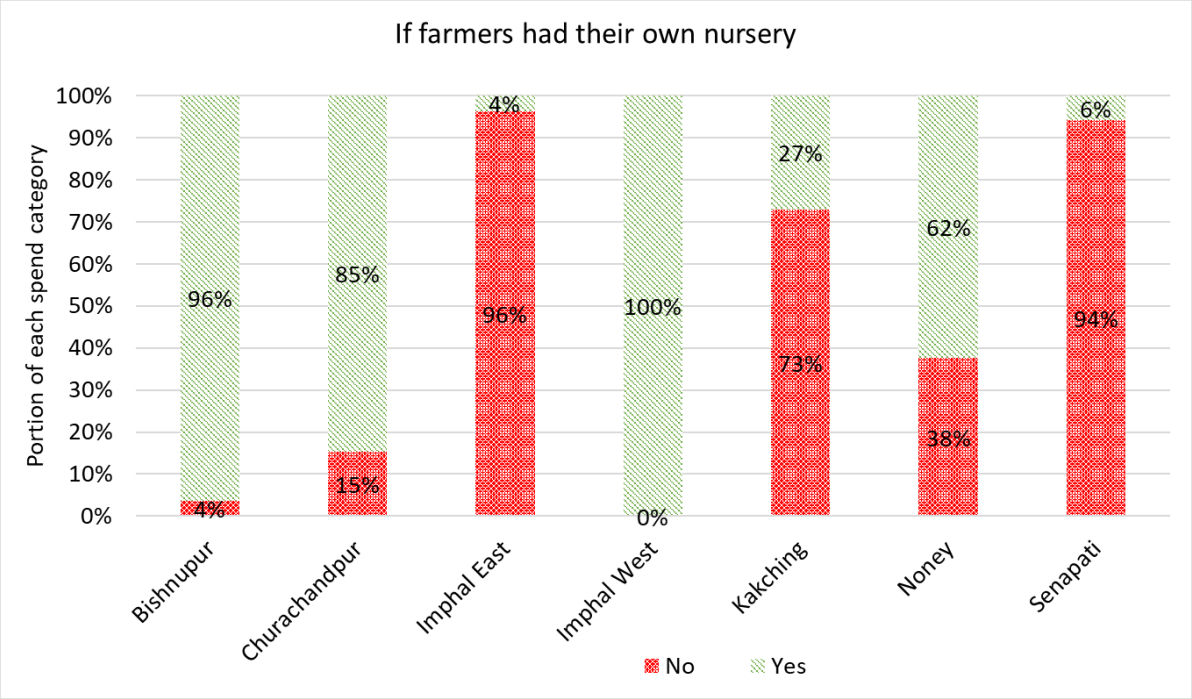



Figure 31: Farmers who have their own nursery

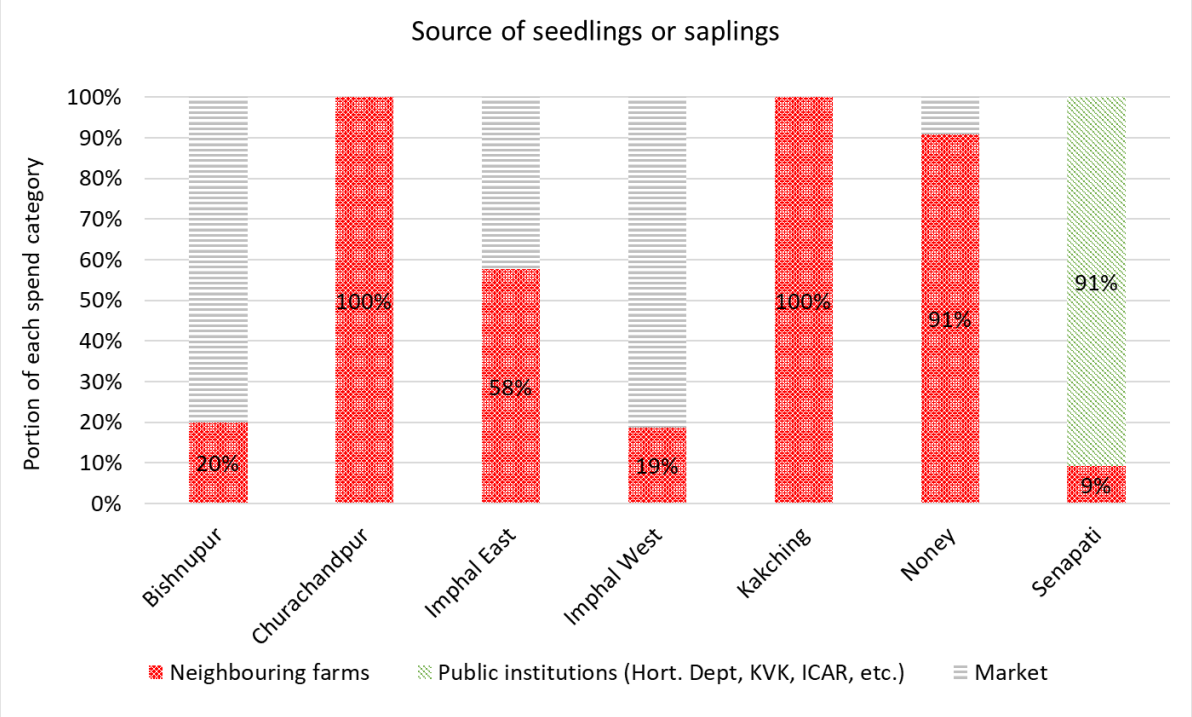



Figure 32: Source of seedlings according to farmers though it must also be noted here that distribution of seedlings by public bodies vary by crop.

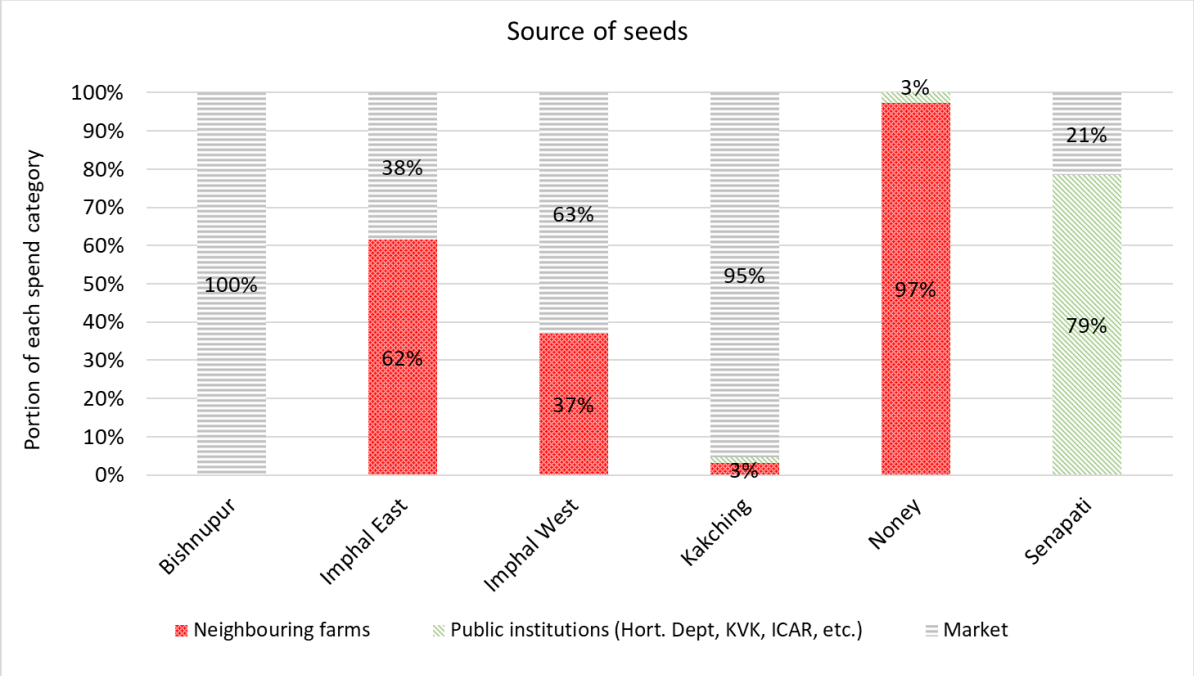



Figure 33: Farmers and their source of seeds

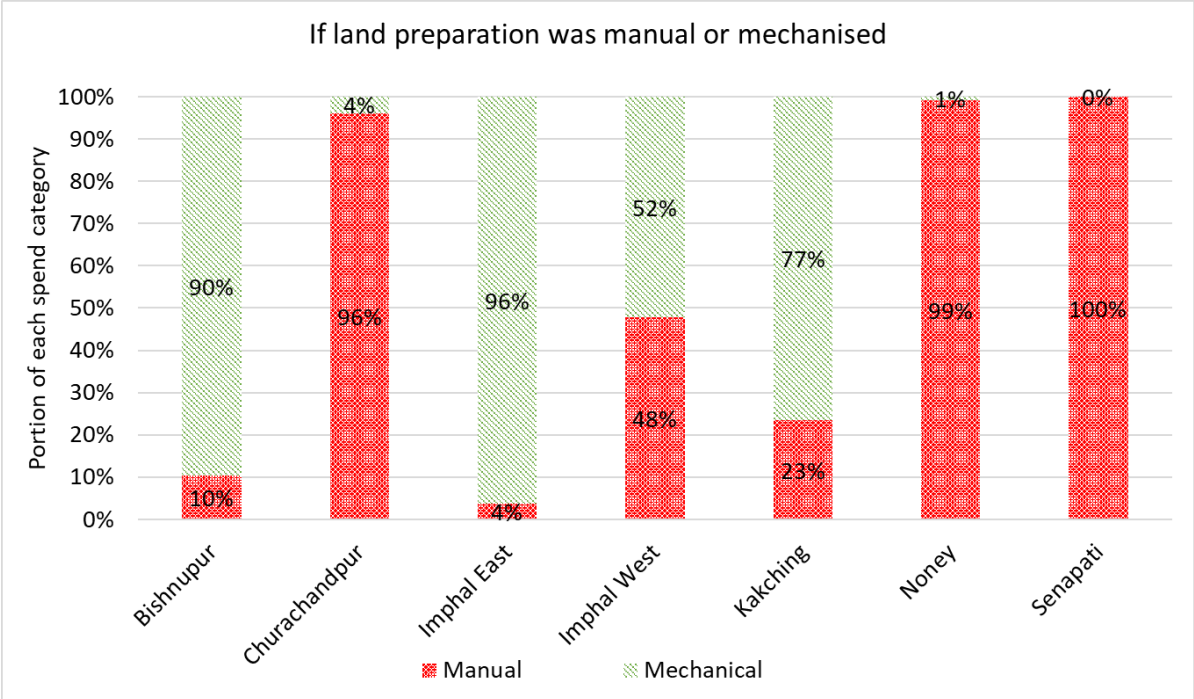



Figure 34: Land preparation methods by district

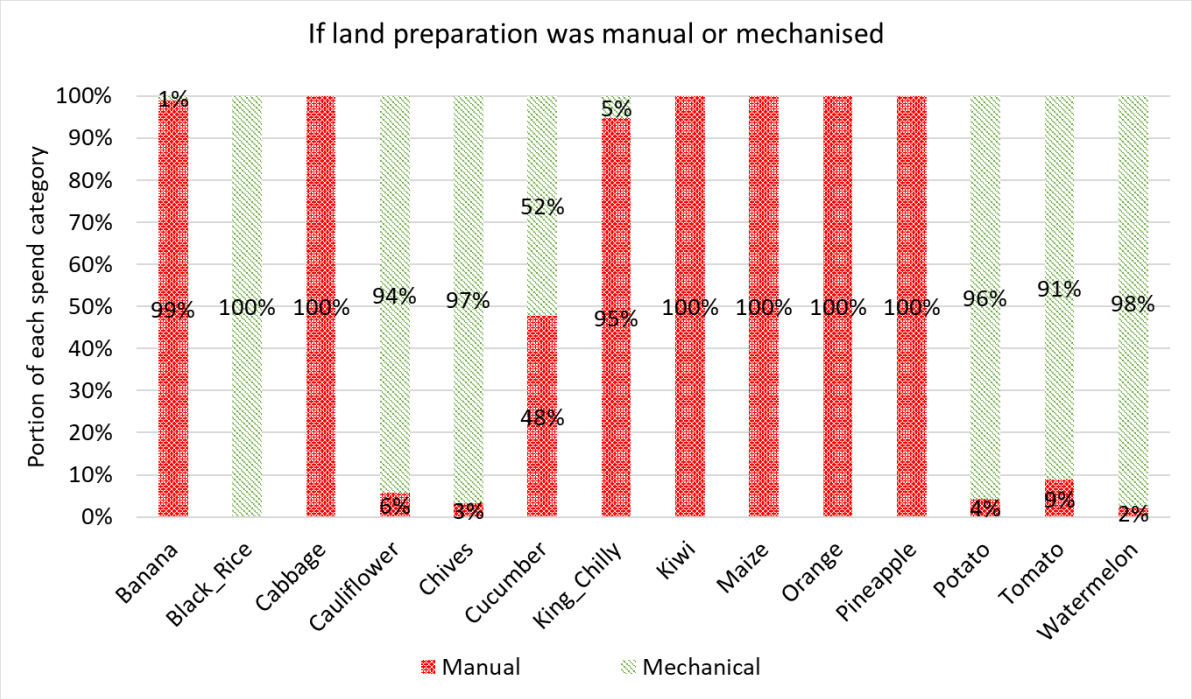



Figure 35: Land preparation methods by crop

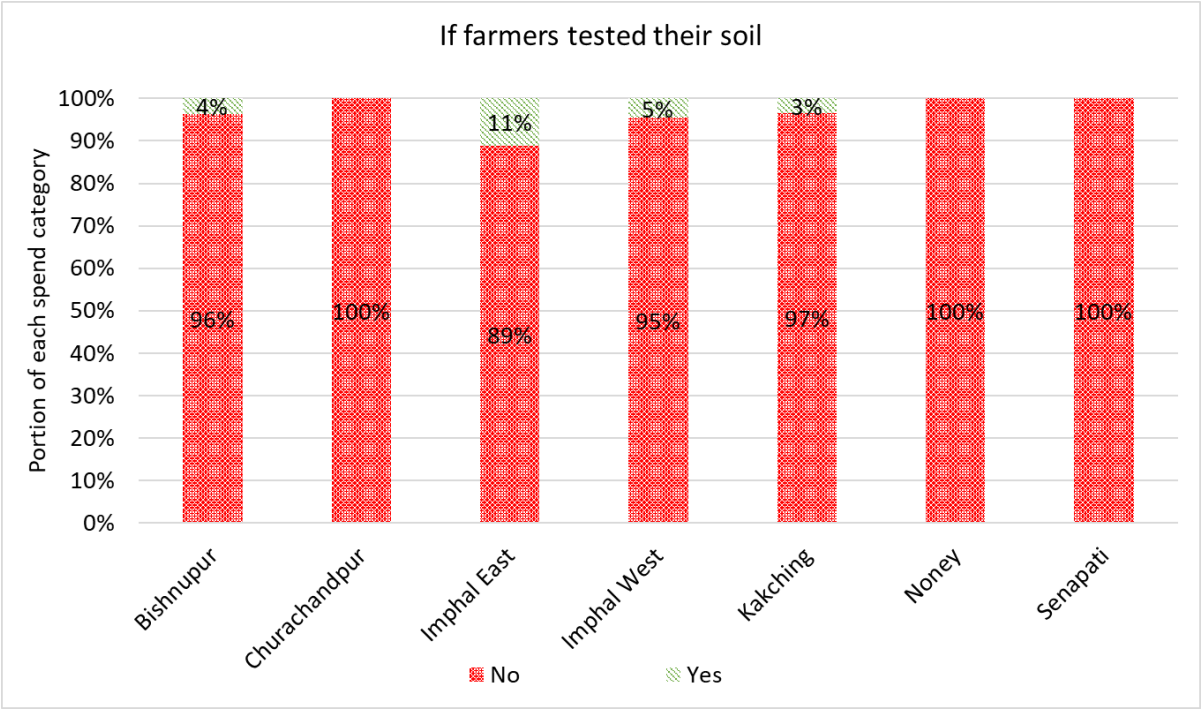



Figure 36: Soil testing percentage by district

Picture 8: Kiwi farmers in Senapati

| | These are as reported by the farmers and could not always be validated with photos as some were not issues at the time of the data collection. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Crop** | **Top Pests** | | | | | **Top Diseases** | | | **Others** |
| **Banana** | Banana pseudostem borer | Banana root borer | Banana skipper/ leaf caterpillar | Banana aphid | Banana lacebug | Panama Wilt | | | |
| **Black_Rice** | Rice aphid | Rice hopper | | | | | | | |
| **Cabbage** | Caterpillar (likely DBM) | Leaf Webber | | | | | | | |
| **Cauliflower** | Aphids | Thrips | Cauliflower whitefly | Cabbage leafminer | Diamondback moth | Black rot Xanthomonas | Club root cruisers/fingers and toe disease | Alternaria leaf spot | Nutrient deficiency disease: Browning, internal tip burn, whiptial. |
| **Chives** | Root grub | Hopper | Whitefly | | | Fusarium | Pink root | | |
| **Cucumber** | Thrips | Hopper | Whitefly | | | Downy mildew | Powdery mildew | | |
| **King_Chilly** | Brown stink bug | Coried bug | | | | Leaf and fruit curl (?) | Decaying/rotting of fruits and plant | | |
| **Kiwi** | Aphids | Spider | Borer | Leaf roller | | New plantations and none recorded to date | | | |
| **Maize** | Fall armyworm | Corn earworm | | | | | | | |
| **Orange** | Fruit borer | Rat | Stem borer | | | | | | |
| **Pineapple** | Bird | Rodents | Mealybug | | | Fruit rotting after sudden rain (Phytophthora root rot?) | | | |
| **Red Potato** | Cutworm | | | | | Early blight | Late blight | Fungus (?) | |
| **Tomato** | Aphids | Thrips | Whitefly | Fruit borer | Leafminer | Blight diseases (late blight and early blight) | Bacterial spot | | Blossom end rot (calcium deficiency) and boron deficiency. |
| **Watermelon** | Aphids | Leafminer | | | | Anthracnose | Powdery Mildew | Cercospora leaf spot | Fusarium wilt |

Table 5: Key Pests & Diseases identified in the interviews

### 3.1.3 Farmers' challenges

Farmers who were interviewed were also asked to identify the top challenges they faced. Farmers faced major issues around irrigation and availability of water, while many farmers in all the districts reported having production issues which include pest and disease problems as well as lack of inputs to ensure a good crop. Once farmers have been able to produce their crops, they also reported challenges around marketing, storing and selling their harvests. Growers of fast perishable crops such as tomato, pineapple, chives, potato and banana also reported challenges around the lack of storage. Though only a small percentage of farmers reported challenges around tools and equipment, we believe this is because most of the farmers in the valley have access to a tractor, if need be, or rely on good old spades and manual labour to get the job done. If made aware of better and more efficient machinery solutions and made these easily available, it is likely that farmers will adopt mechanisation rapidly as labour cost to produce most of the crops surveyed is high.

The results have been plotted in figure 37 below:

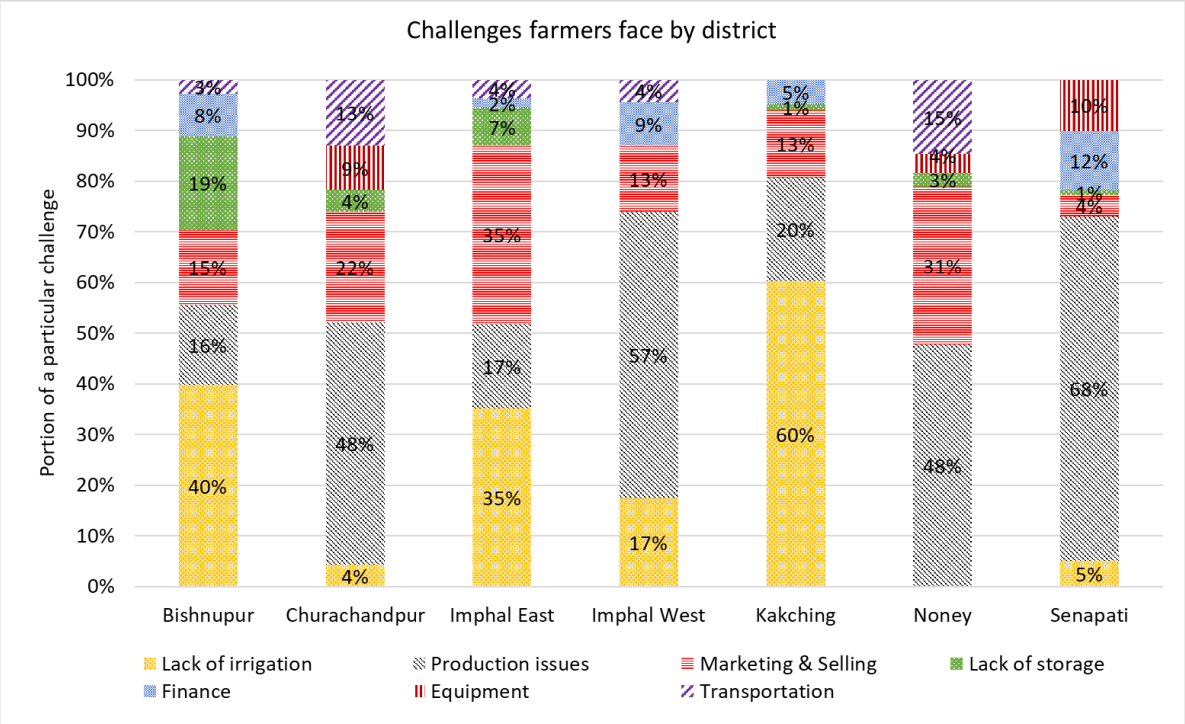



Figure 37: Challenges identified by farmers who were surveyed

### 3.1.4 Cost of production analysis

During the surveys, hundreds of farmers were interviewed in various locations. Multiple questions were asked around their cost of production so that an estimate could be made about the profitability of the farms. During data analysis, it was noticed that many of the farmers could not accurately provide their farm sizes which skewed the calculations and gave wrong figures. As such, around 70 farmers were selected and interviewed again with precise, repeated, questions on their farm sizes, input costs, land preparation cost, labour cost, as well as the yield they got and the price at which they sold their crops. Using these more precise set of data, production costs were worked out as shown in the figures in this section. It must be noted that for perennial crops such as orange, one-time costs to prepare land, saplings, etc. have been spread out over five years.

Though Covid lockdowns limited market access and led to post-harvest wastage, many of the farmers still managed to make a profit. Banana farmers incur a high cost for land preparation as well as for manual weeding and other general maintenance for which labour is required (figure 38). The lack of machinery use means labour cost is high however, despite these high costs, farmers still manage to make an average profit of just under Rs14,000 per season per hectare.

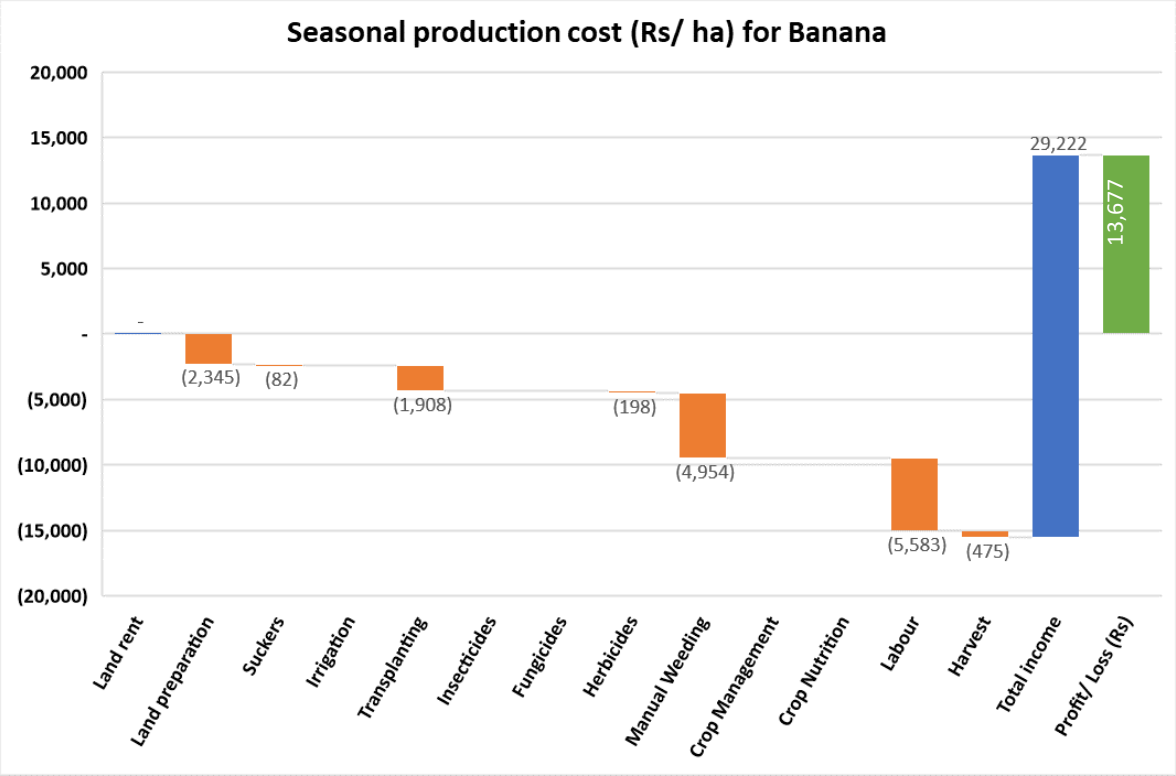



Figure 38: Analysis of production cost, revenue and profit for banana farmers

Black rice farmers also incur a high land preparation cost compared to other costs such as inputs or transplanting (figure 39). Their highest costs are in labour which is required for all activities on the farm such as spraying inputs, weeding, etc. Farmers usually hire labour to do

multiple tasks so it was difficult to split between the different activities which are carried out on the same day. Farmers reported a relatively modest profit of around Rs55,000 per hectare per season.

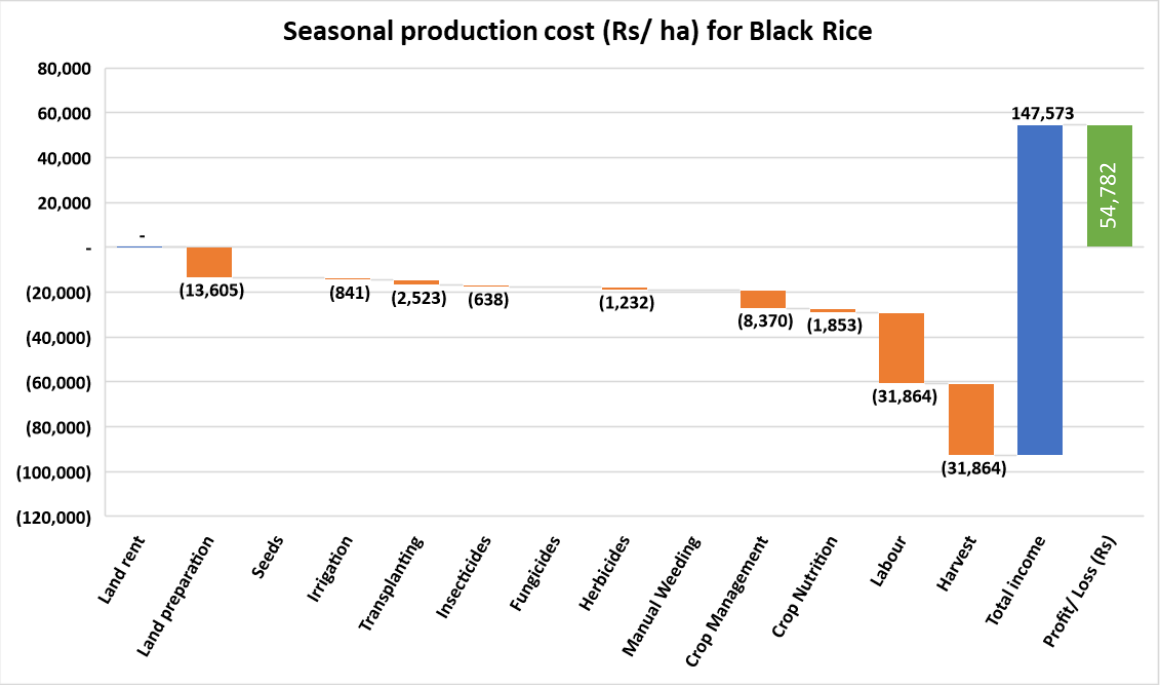



Figure 39: Analysis of production cost, revenue and profit for black rice farmers

Though the average farm size for cauliflower is only about an acre, it is a highly profitable venture (figure 40). For those who grow cauliflower professionally, they lease land which is the highest cost followed by crop nutrition, land preparation and other costs such as seeds and chemicals, and labour. Still, farmers make a good profit of just under Rs1.5 lakhs per season per hectare.

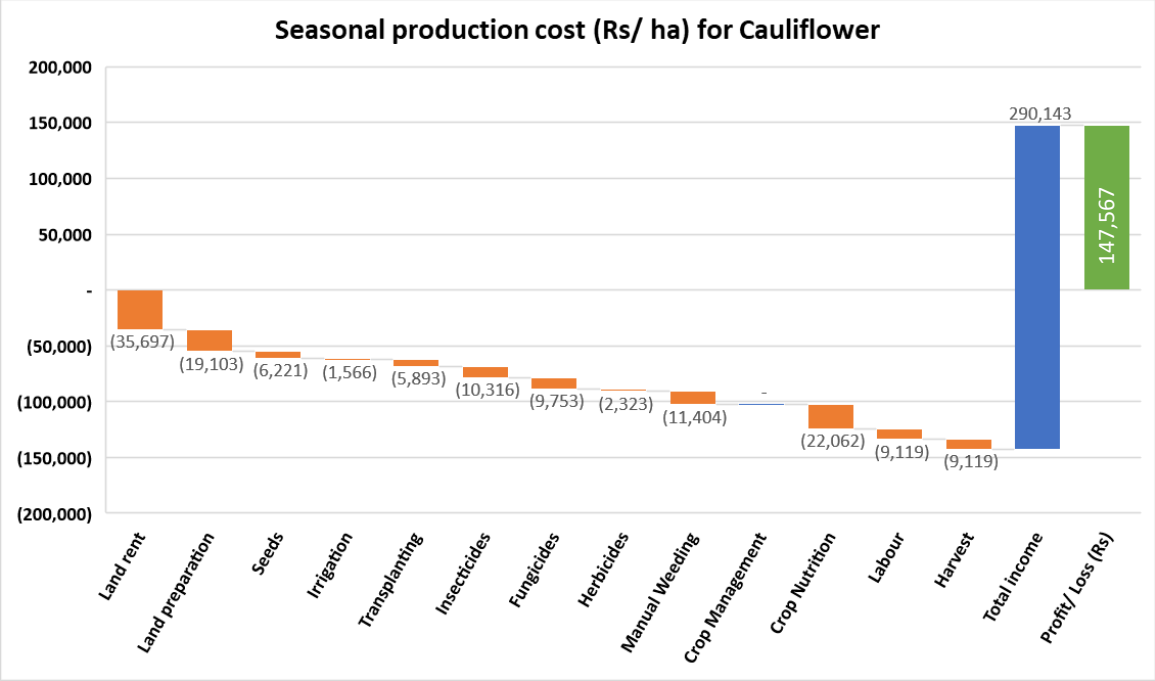



Figure 40: Analysis of production cost, revenue and profit for cauliflower farmers

Chives grown on a vast scale in the valley albeit on relatively small plots of land, is one of the most profitable crops surveyed with farmers making an average profit of just under Rs4 lakhs per hectare per season which can be as long as 10 to 12 months with multiple cuttings from the same crop (figure 41). It is a nutrient and labour intensive crop however the return more than makes up the investment needed.

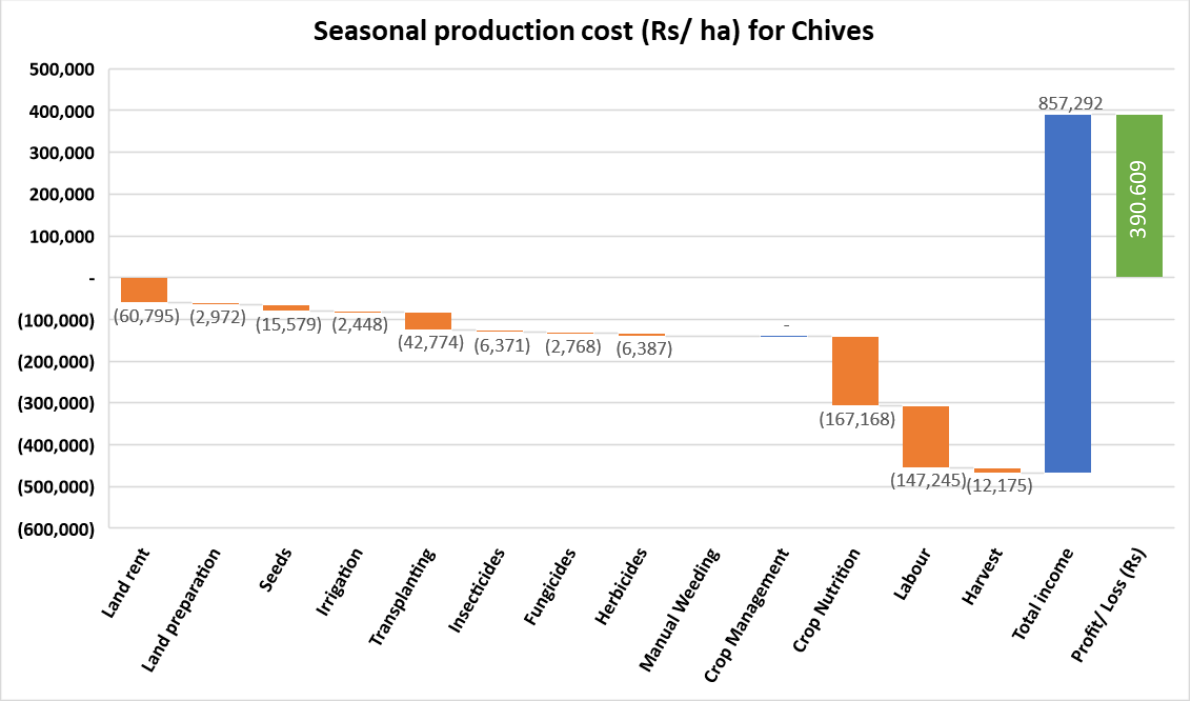



Figure 41: Analysis of production cost, revenue and profit for chives farmers

Cucumber growers also make a good profit considering that it is a short season crop however they do incur relatively high costs for land preparation, transplanting and crop nutrition (figure 42).

Picture 9: Women farmers and traders are very common across Manipur

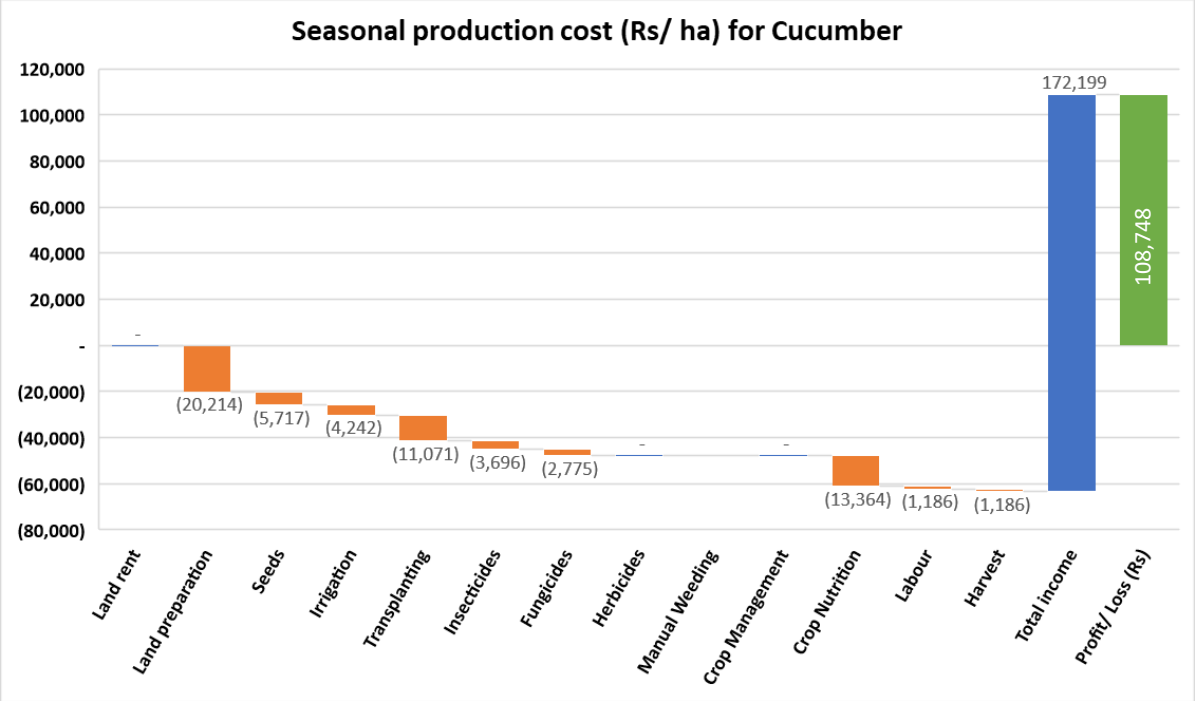



Figure 42: Analysis of production cost, revenue and profit for cucumber farmers

King chilly was studied as a secondary crop in Noney District and is normally intercropped amongst other crops grown on the hill slopes. King chilly has one of the highest returns with a handsome profit of around Rs2 lakhs per season per hectare (figure 43).

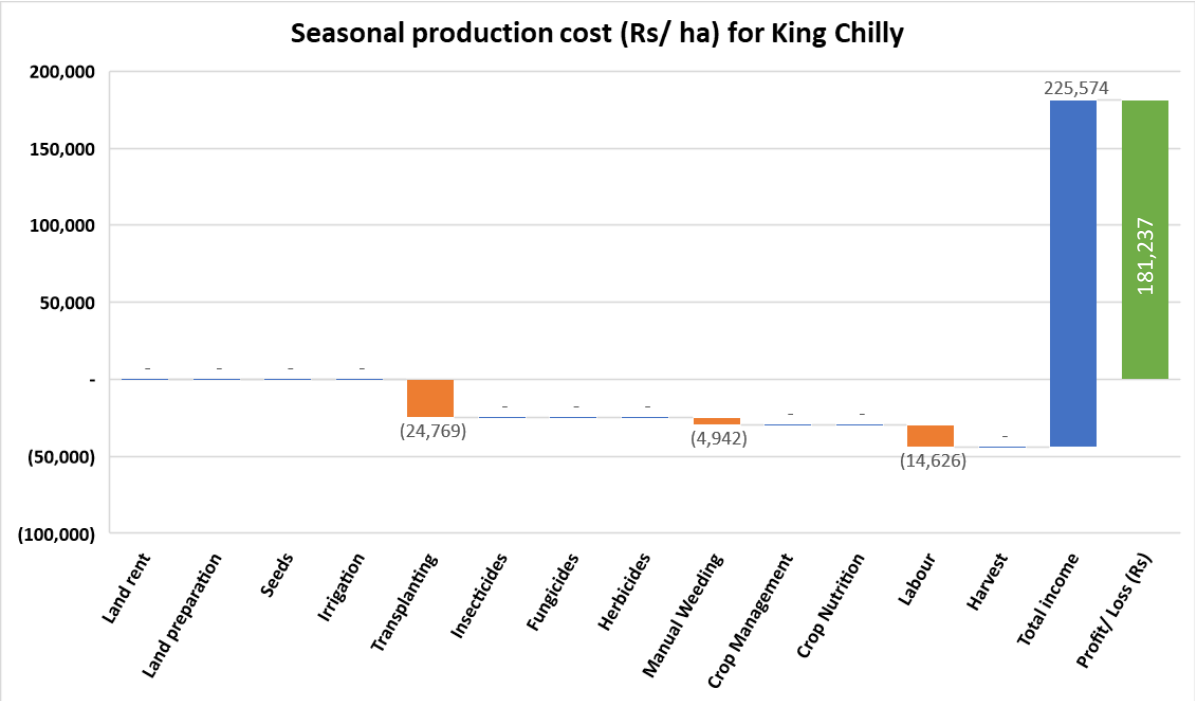



Figure 43: Analysis of production cost, revenue and profit for king chilly farmers

Kiwi, investigated as part of this study in the district of Senapati, is a relatively new crop with farmers only having started growing it in the last couple of years. The plant takes a few years

to bear fruit so many farmers are yet to see the fruits of their hard labour. Land preparation generally involves clearing the bush on a hill slope and cutting trees before making pits in which farmers plant the seedlings of Hayward kiwi brought over in bulk from nurseries in Arunachal Pradesh. The crop is labour intensive as farmers have to set up the trails on which the plants grow, have to check regularly and ensure they are following the trails and keep an eye out for any potential pests and diseases. Weeding manually in-between the plants is also a labour intensive exercise as the soil is fertile and grass can grow rapidly. Because of these, the kiwi farmers surveyed are yet to make any profits from their crops and, in fact, are in red to the tune of Rs1.2 lakhs (figure 44). If the farmers can maintain a healthy crop, it is likely that in two to three years, they will start harvesting a good crop and turn the corner.

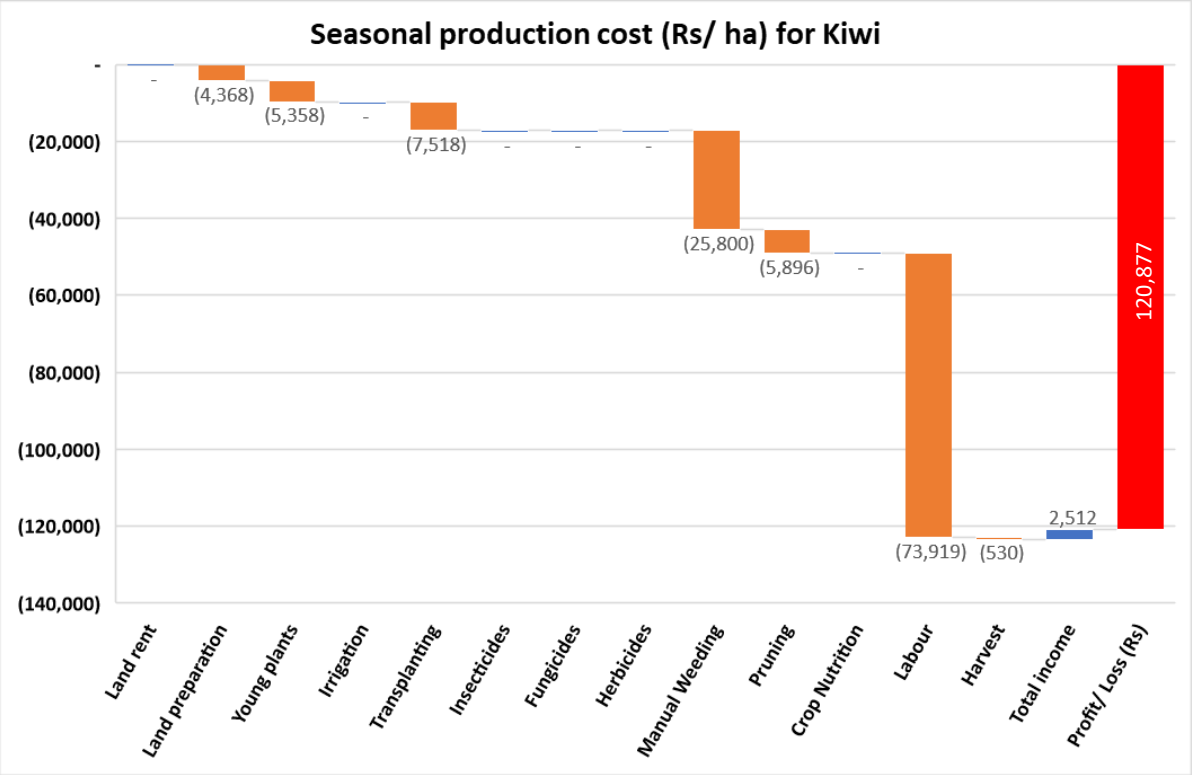



Figure 44: Analysis of production cost, revenue and loss for kiwi farmers

Unlike kiwi farmers in Senapati District, orange farmers in Tamenglong have been growing their perennial crop for many years, some more than a decade. As such, they have passed the initial years of sunk cost and are seeing a positive revenue. On average, the groups of farmers interviewed made a profit of approximately Rs67,000 per hectare per season (figure 45).

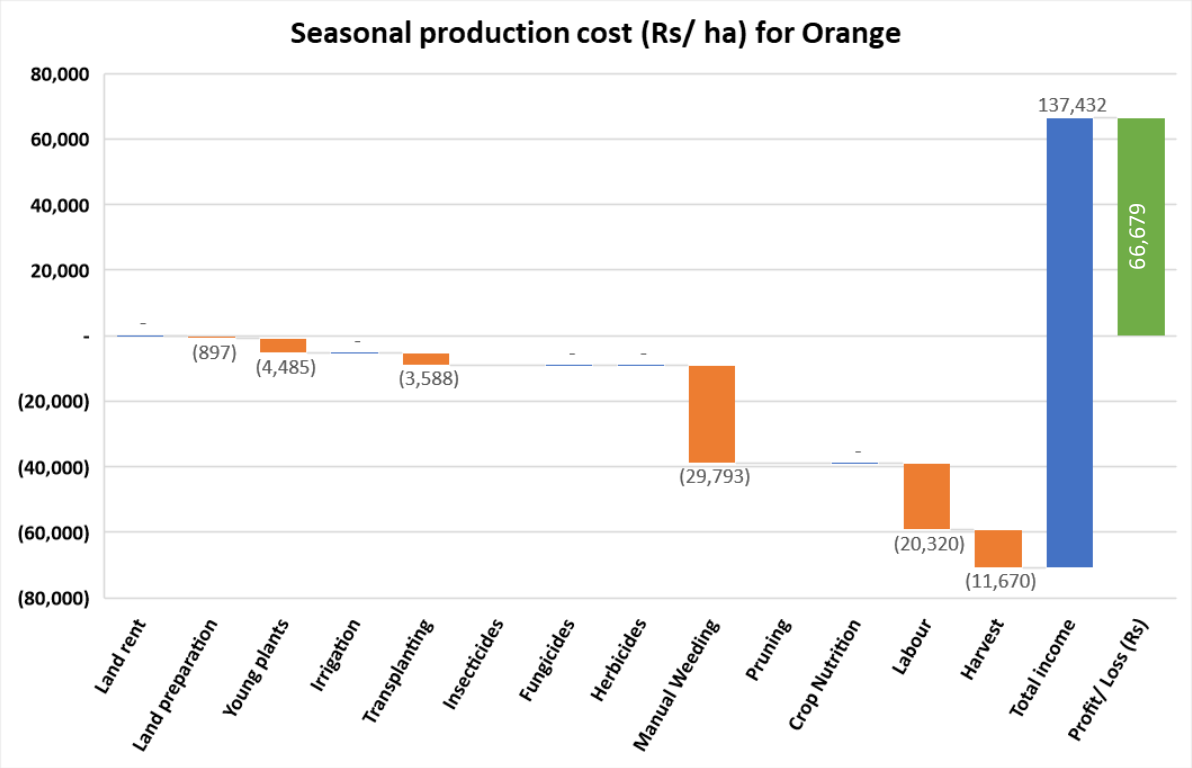



Figure 45: Analysis of production cost, revenue and profit for orange farmers

Pineapple growers in Churachandpur are also enjoying a similar period as they leave the same plants to grow for a few years bringing a profit of over Rs4.5 lakhs per hectare per season (figure 46). They do have to replant portions of the field after a few years so there is some transplanting and labour cost. It must be noted that a reason why farmers leave the plants for years at a time and do not plant every season is because of the cost and availability of labour as well as the investments needed. It does lead to lower yields and poorer quality harvests as the daughter plants do not grow straight and extend sideways but farmers believe it is a worthy compromise.

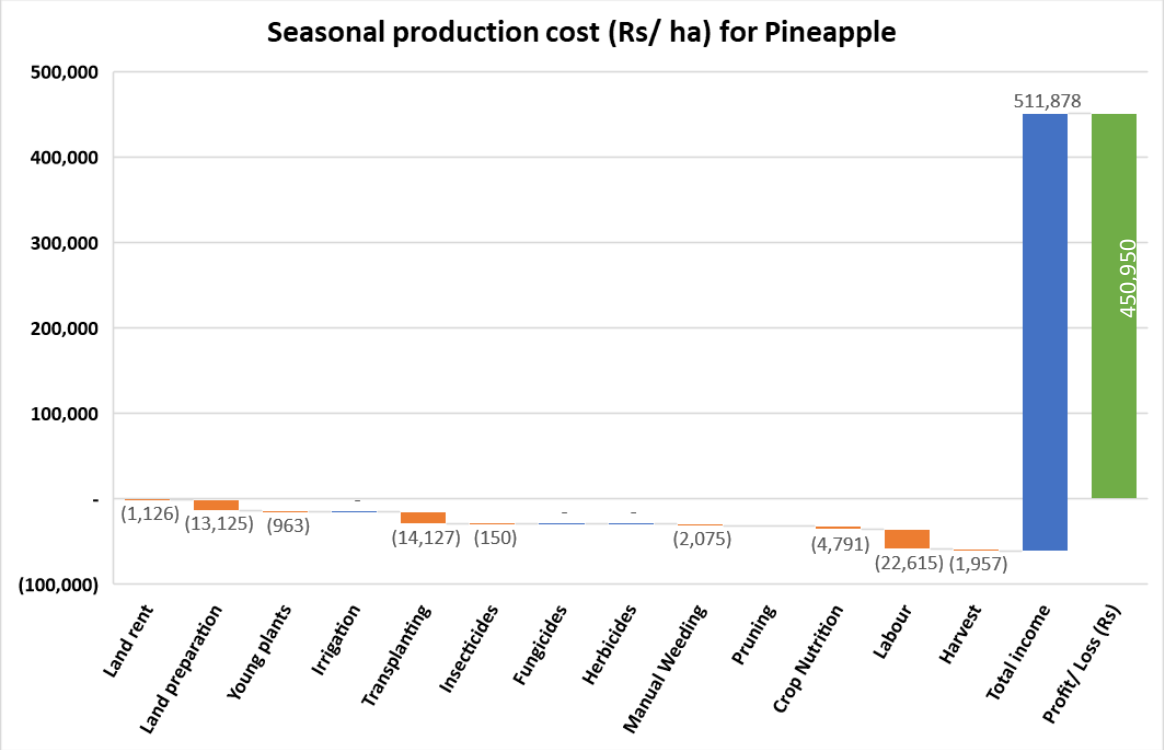



Figure 46: Analysis of production cost, revenue and profit for pineapple farmers

Red potato was investigated in Imphal East and despite its high cost of seeds and labour, it is still a profitable crop to grow generating about Rs4.5 lakhs per hectare of profit per season (figure 47).

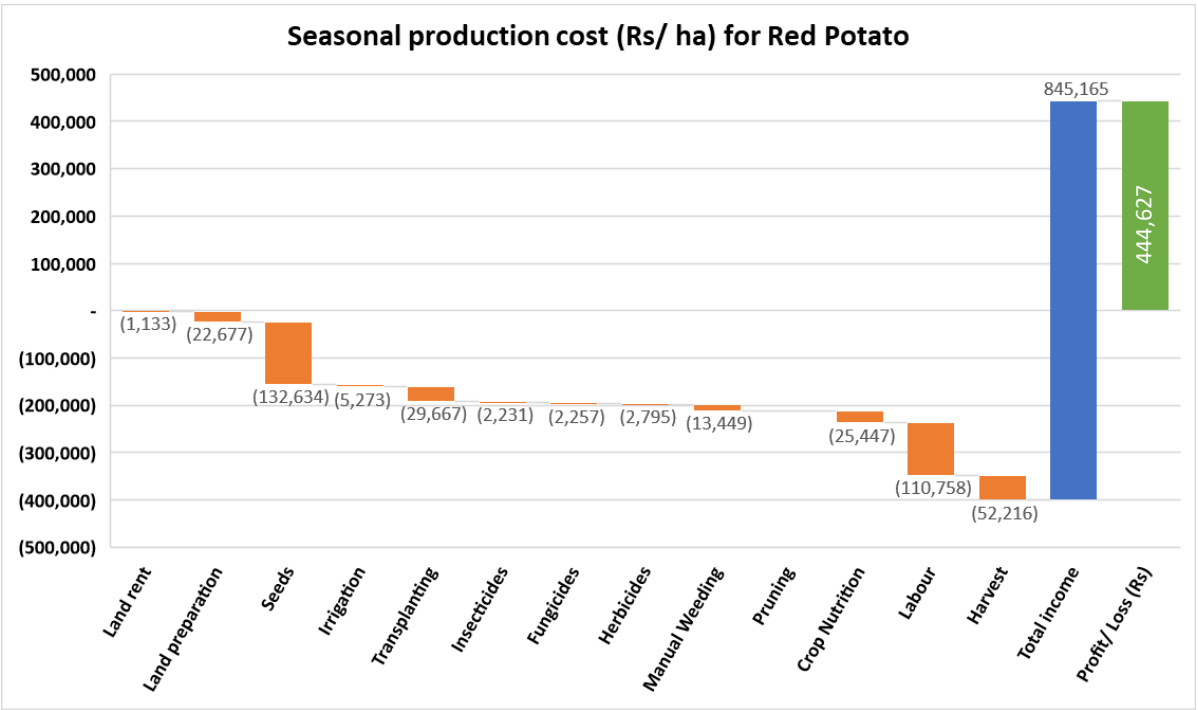



Figure 47: Analysis of production cost, revenue and profit for red potato farmers

Tomato is a crop grown in plenty in Bishnupur district where farmers pay much attention and care to its productivity. It requires multiple activities, inputs and season-long management however, in the short season that it is grown for, the crop does yield a good profit of Rs2.2 lakhs or so per hectare per season (figure 48). Many tomato farmers in Bishnupur also reported how traders would collect goods from them, take to markets in Imphal and then return a few days later to pay them but with a simple rule that the traders cannot lose money even if it means paying the farmers at or below production cost.

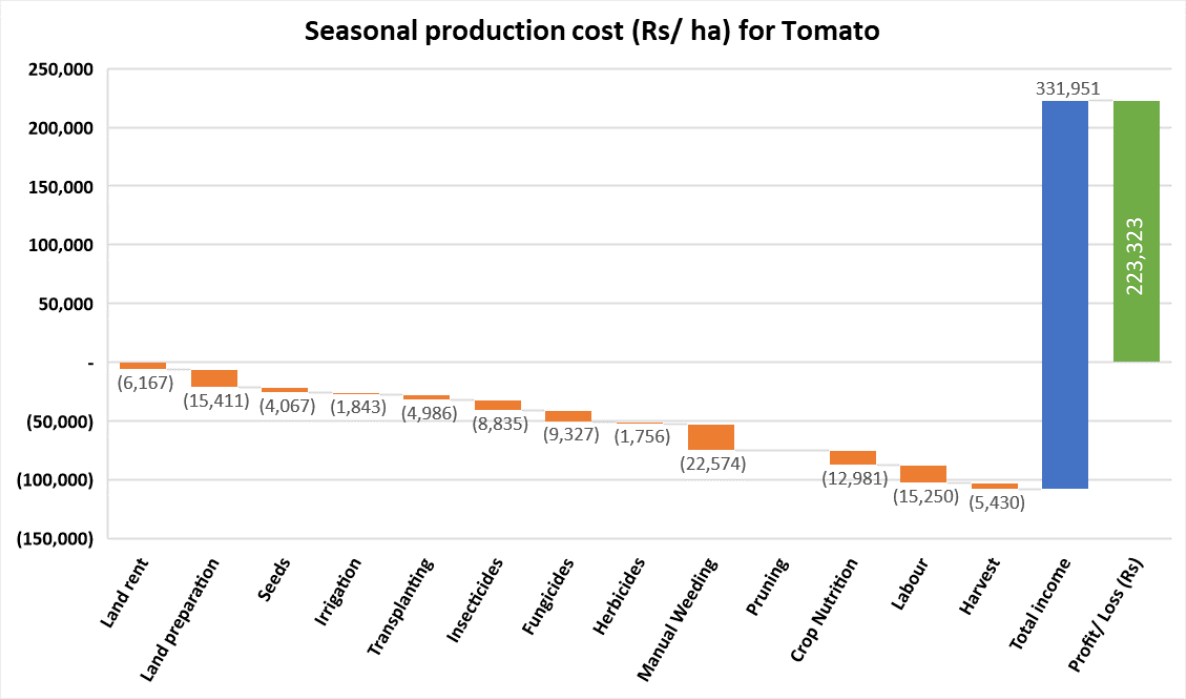



Figure 48: Analysis of production cost, revenue and profit for tomato farmers

Watermelon is the last crop for which enough accurate data were gathered for a Profit & Loss analysis. Like tomato, it requires multiple activities and investments but also yields a good profit of Rs1.1 lakhs in a few-month-long season per hectare (figure 49).

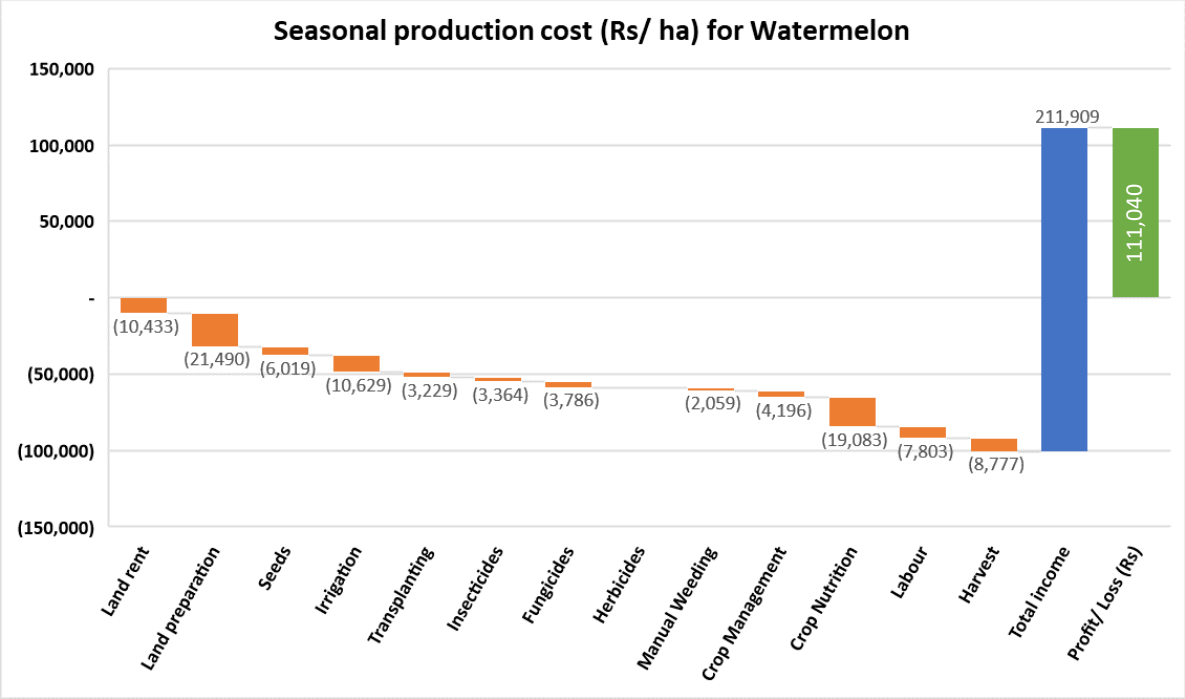



Figure 49: Analysis of production cost, revenue and profit for watermelon farmers

Table 6 shows the cost of production per kilogram of the crop which brings up some further insights. Established plantation crops such as orange and pineapple have a relatively low cost while kiwi, a relatively new crop that is yet to start yielding normally, the cost of production is extremely high. Whilst this may raise questions as to why the crop was selected in the first place, it could be said that it is exactly for this reason that the study was carried out. Farmers have invested a lot in planting kiwi and will not recover cost anytime soon so it is important for the government and other stakeholders to support them and ensure that they do not lose their crop in the coming years.

| Crop | Cost (Rs/kg) |
|---|---|
| Banana | 12 |
| Black Rice | 40 |
| Cauliflower | 13 |
| Chives | 14 |
| Cucumber | 11 |
| King Chilly | 44 |
| Kiwi | 6069 |
| Orange | 5 |
| Pineapple | 2 |
| Red Potato | 19 |
| Tomato | 10 |
| Watermelon | 6 |

Table 6: Cost of production per kg of crop

### 3.1.5 Insights into the health of farmers

A series of health-related questions were also asked to farmers as part of this study. 63% of the farmers surveyed felt that their health was in a good condition while, interestingly, only 0.2% thought they were in a poor health state (figure 50). Of course, farming requires one to be healthy because of the level of physical work involved and, as such, farmers are expected to be healthy. However, this finding must be taken with a grain of salt as last-mile health assessment work done in Bishnupur District by the MaolKeki Foundation revealed that many farmers do not eat a balance diet and suffer from hypertension and eyesight issues. Further detailed questioning on various health related symptoms do reveal some of these underlying issues with 18% reporting fainting and light headedness, 9% with high blood pressure and 8% with irregular heartbeats, to highlight some (figure 51).

A major pain point for many in Manipur, and perhaps the whole country, is the issue of healthcare cost. When farmers were asked about this, 98% paid out of pocket with only 33% getting some form of public healthcare support (figure 52). Private insurance adoption is at a minimum with only 2% reporting to have one. These findings highlight a major cause for concern as farmers live on limited means season after season and it only takes one bad year or a health crisis to sink into poverty.

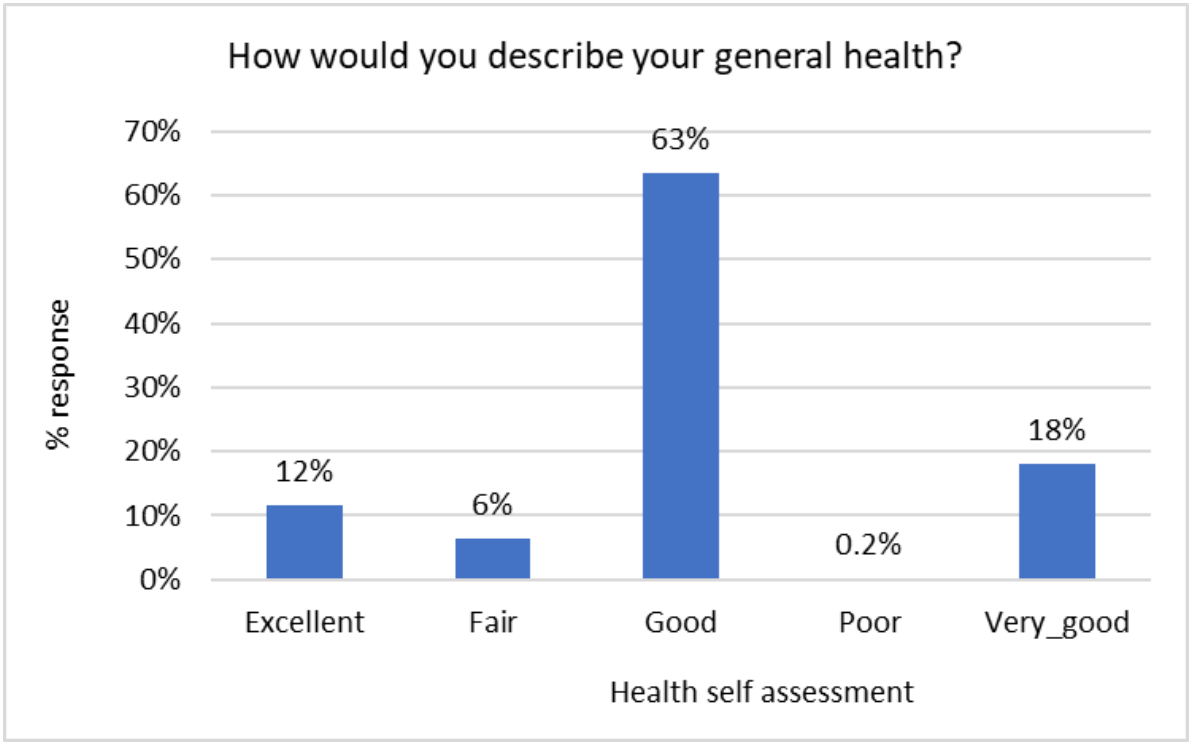



Figure 50: Self-reported assessment of farmers' health

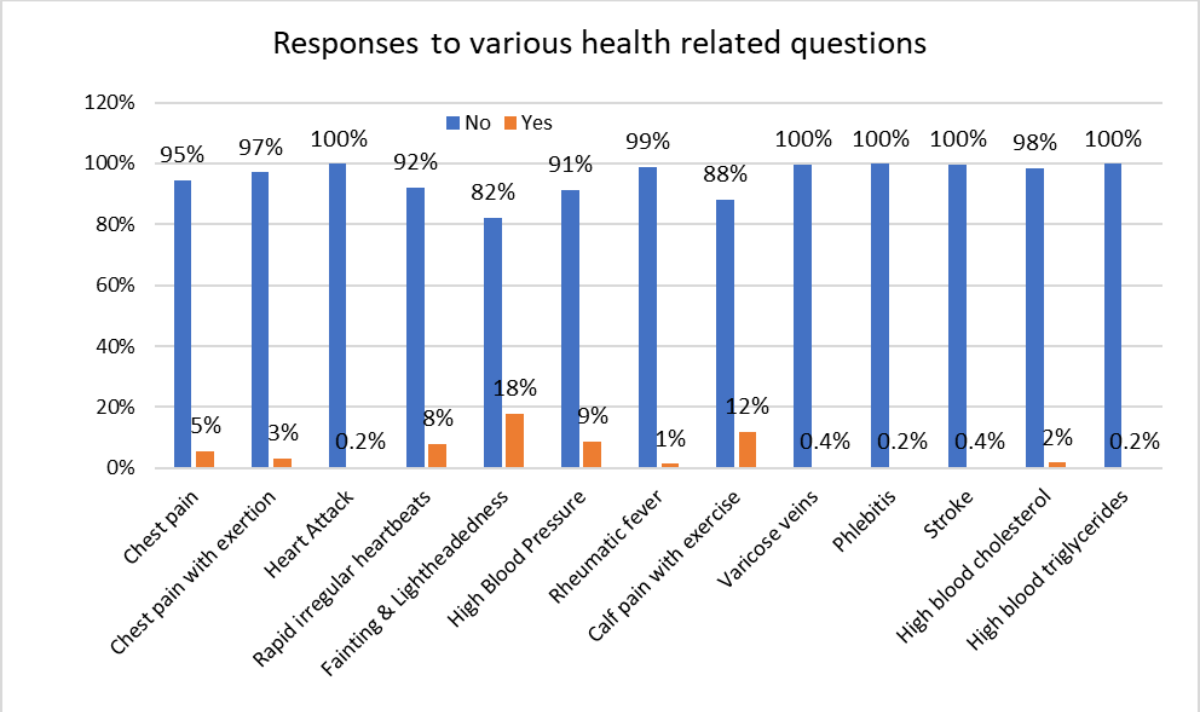



Figure 51: Self-reported assessment of various health conditions of farmers

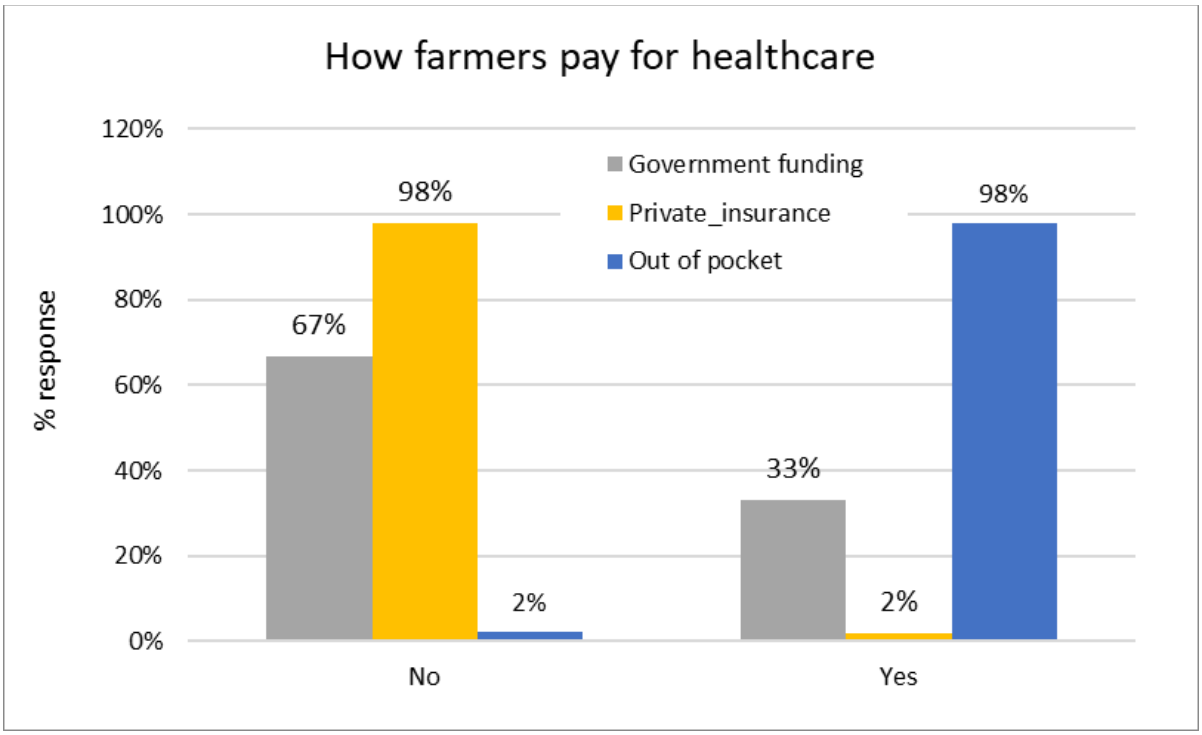



Figure 52: Source of healthcare funding for farmers

## 3.2 Traders

A total of 426 traders were interviewed as part of this study. With the study conducted in the middle of the Covid second-wave in Manipur, it must be noted that the traditional role of a trader became fluid with farmers trading their own products due to lack of regular traders, new individuals stepping in as traders to eke out a living, and an overall lack of traders in the market place, even when open. Besides, as shown in figure 53, a large percentage of the traders were retailers and being a small state, there isn't a lot of difference between a retailer, middlemen or wholesaler and during Covid, the traditional route of a farmer selling to a middlemen/ wholesaler to a retailer was completely disrupted with many so-called retailers going directly to farms to procure vegetables. The traders were asked to categorise themselves and an overwhelming majority of them, 72%, said they were retailers, while 11% considered themselves as middlemen and 18% as wholesalers but it must be noted here that many of them identified as fitting into more than just one type playing the role of wholesaler or middlemen or retailer without clear boundaries. This is why, in these analyses, there is no split by trader types and the term 'trader' has been used as an all-encompassing terminology for the different categories of traders. Wherever relevant, efforts have been made to split between the different districts for greater insights.

With Manipur's rich diversity of climatic conditions and agricultural zones, crop production can happen throughout the year however there are certain periods when some crops are abundantly available. A sense of this can be achieved from the chart in figure 54 based on responses from the traders surveyed as to when they traded the crop the most. Some crops like banana, chives, potato and tomato are available and traded more or less throughout the whole year while crops like black rice, cabbage, cauliflower, king chilly, and kiwi have specific times when they are harvested and traded in the state.

Picture 10: Traders in action

Picture 11: Traders normally sell a range of vegetables

Like in the case of farmers, a series of questions were asked to assess the trader's socioeconomic conditions, trading economics and margins as well as their health conditions. These findings have been presented in the following sections.

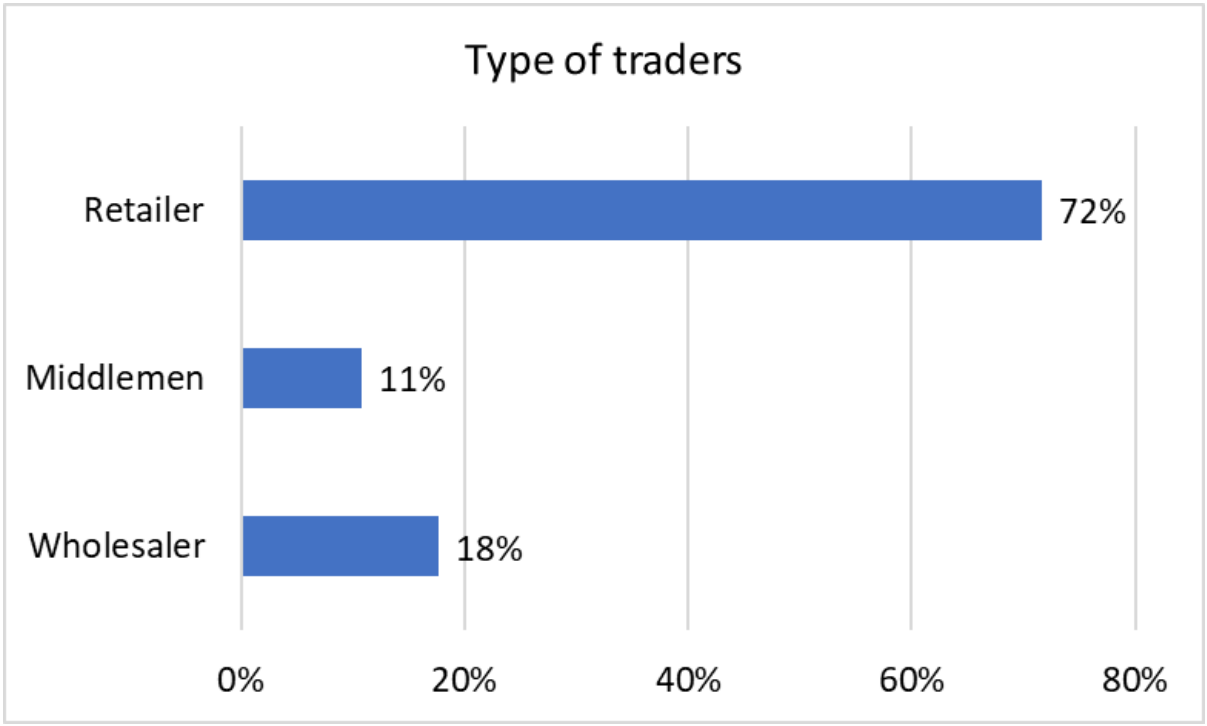



Figure 53: Self-assessment by traders of the type of role they play but important to note that most of them reported themselves as playing different roles with no clear boundaries

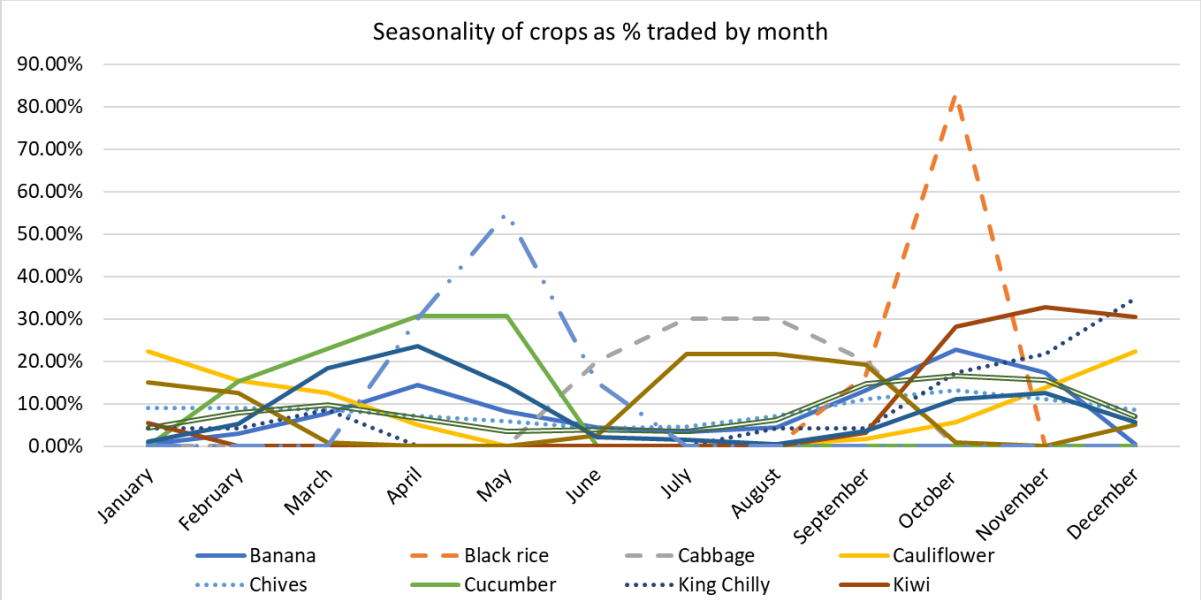



Figure 54: Seasonality of crops based on feedback from traders

### 3.2.1 Socioeconomic Profile

The team of enumerators did their best to interview as many traders as possible despite the multiple lockdowns during the course of this study. Market days were severely limited and to only a certain number of hours even when open. This meant that the team had to work extra hard to find traders and convince them to spare their time in what was already a short and hectic working day for them. The locations of the trader interviews have been shown on the map in figure 55, and their distribution according to the many targeted crops are shown in figure 56.

Picture 12: A trader selling king chillies

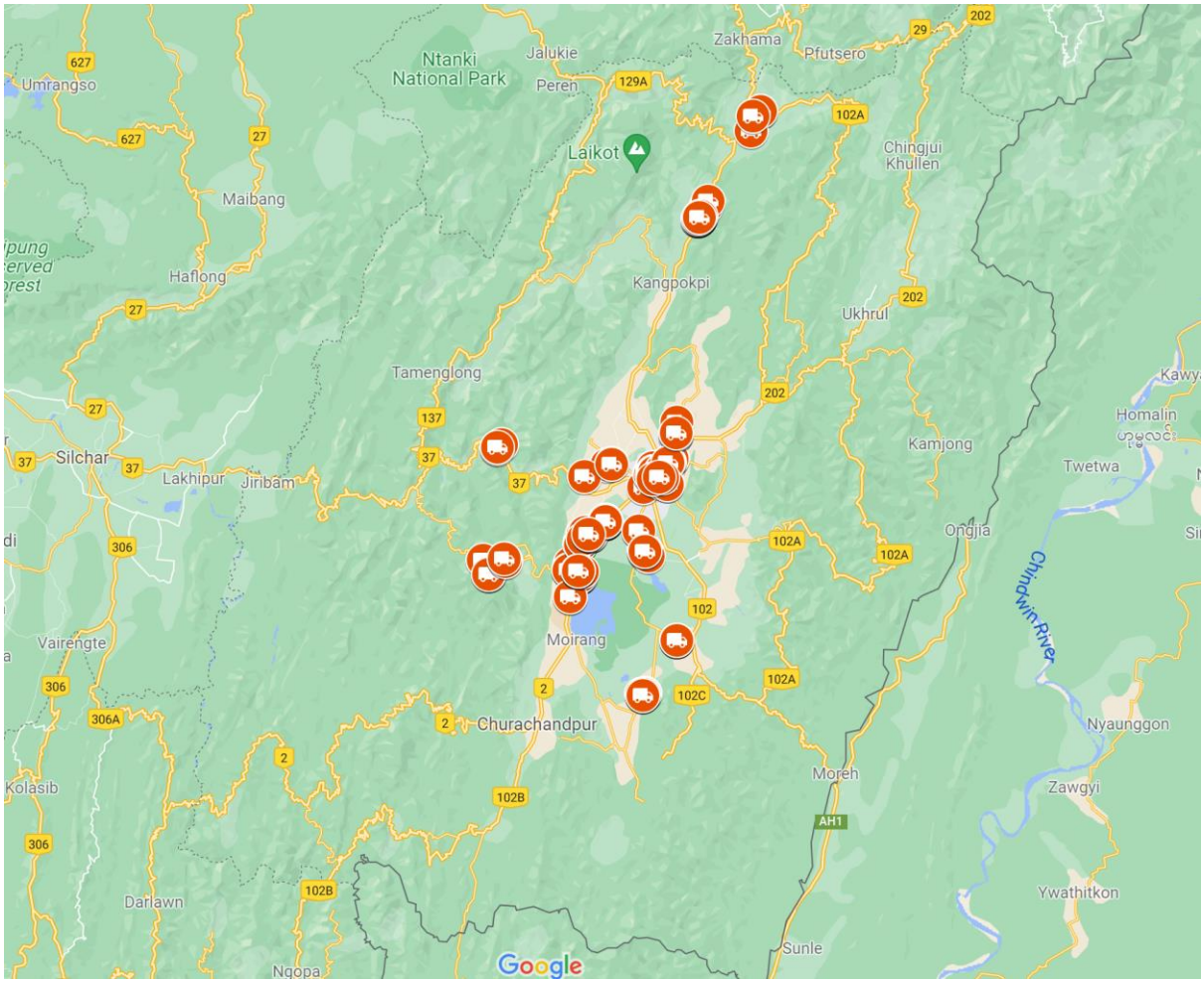



Figure 55: Locations of various trader surveys

The traders are relatively older compared to the farmers surveyed with 75% of them falling in the age range of 31 to 60, and 19% in the range 61 to 80 years of age. By district, those in Senapati and Imphal East are more in the younger age category of 31 to 50 years of age while those in Bishnupur, Churachandpur, Imphal West and Noney are in the older range of 51 to 70 years of age (figure 57). What is a very interesting observation is that an overwhelming 89% of the traders are women and, split by district, it is only in districts like Churachandpur, Imphal West, Kakching and Senapati where the market has more or less 20% of men (figure 58)! This is evident in the various markets around Manipur where one sees mostly women conducting the trade. Many of the traders also told of stories of falling into hard times upon losing their partners that they had no choice but to step up and earn a living. This is backed up by the findings of the survey that 13% of those surveyed were widows (figure 59) versus only 0.9% of farmers (figure 17).

Most of the traders, 43%, have been educated only up to primary level and a large 19% are illiterate – they may not be able to read and write but they certainly can trade from sheer experience (figure 60). In terms of experience, there is a general decline in terms of traders with more experience except in the case of Churachandpur and Imphal West where there is a higher proportion of those who have been trading for six to 10 years (figure 61). In fact,

overall, 18% of those surveyed have been trading only for up to two years. 60% of the trader have family sizes ranging from four to six (figure 62) with quite a few having been married for over 45 years (figure 63). The home ownership pattern for the trader is very similar to that of the farmers with a large majority of them living in their own homes, with family (figure 64).

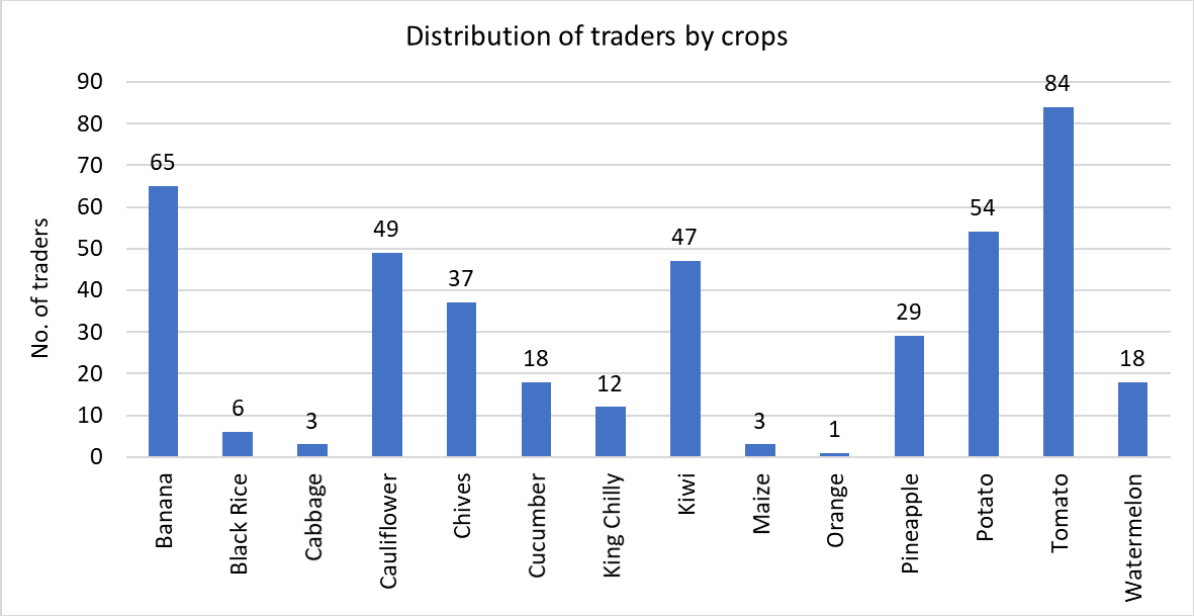



Figure 56: Number of traders surveyed by crop

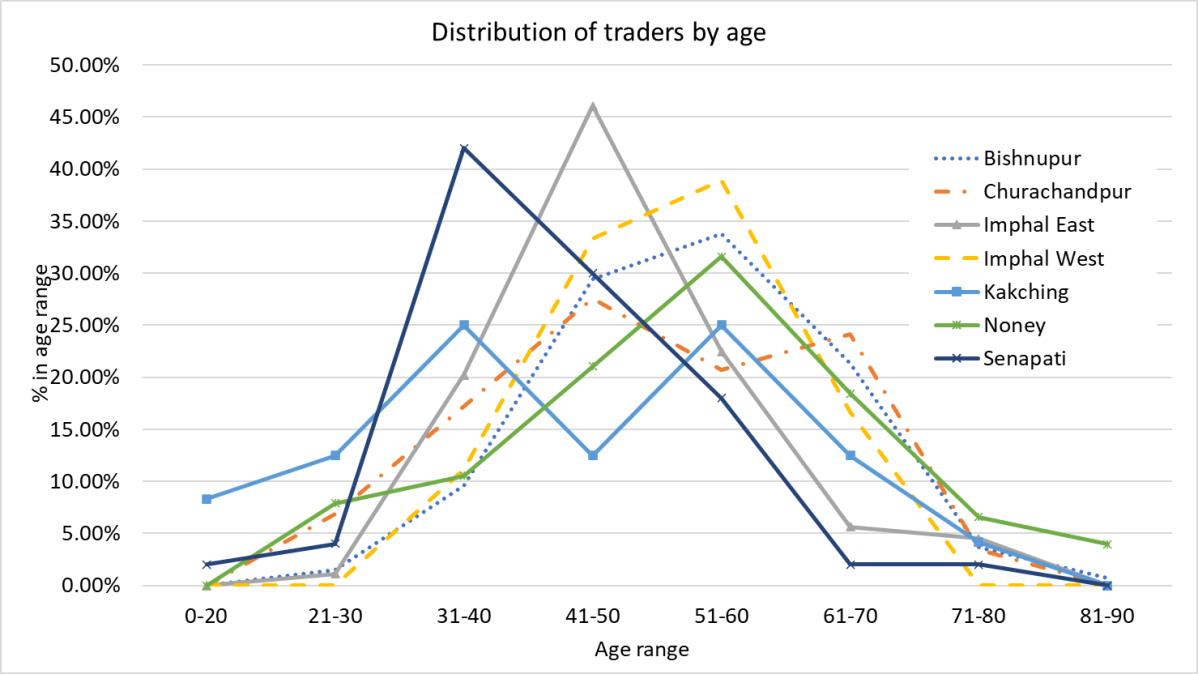



Figure 57: Distribution of the ages of the traders surveyed in this study

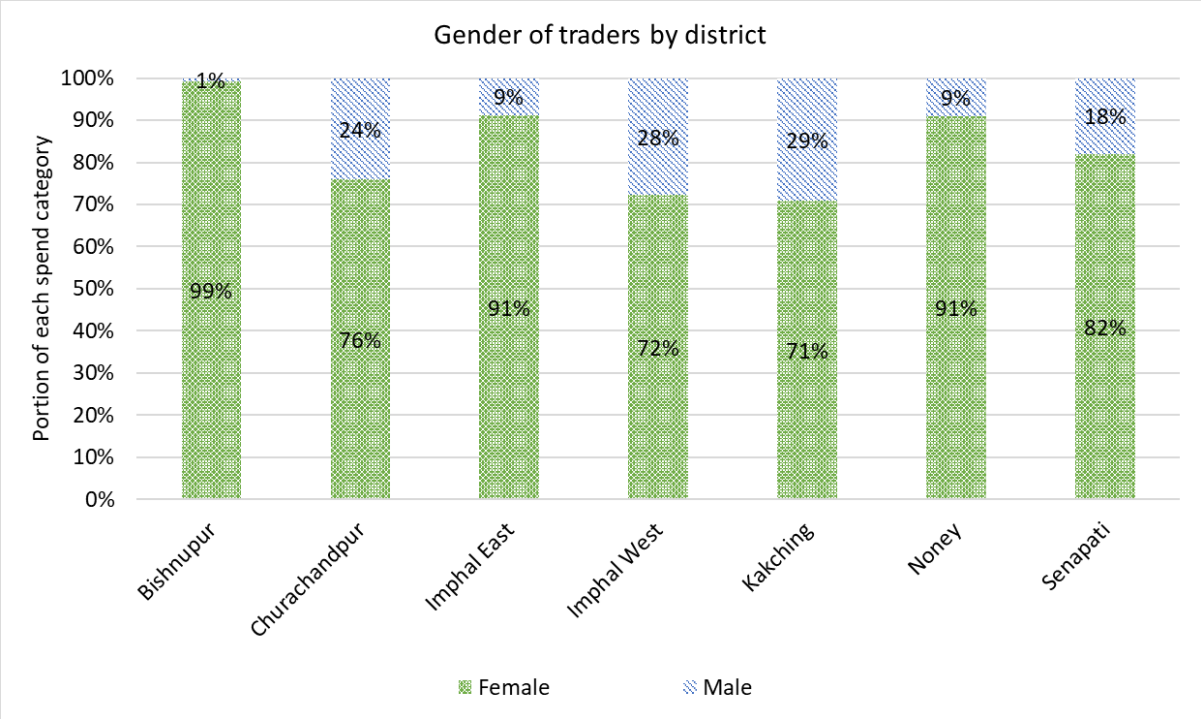



Figure 58: Gender split of the traders surveyed

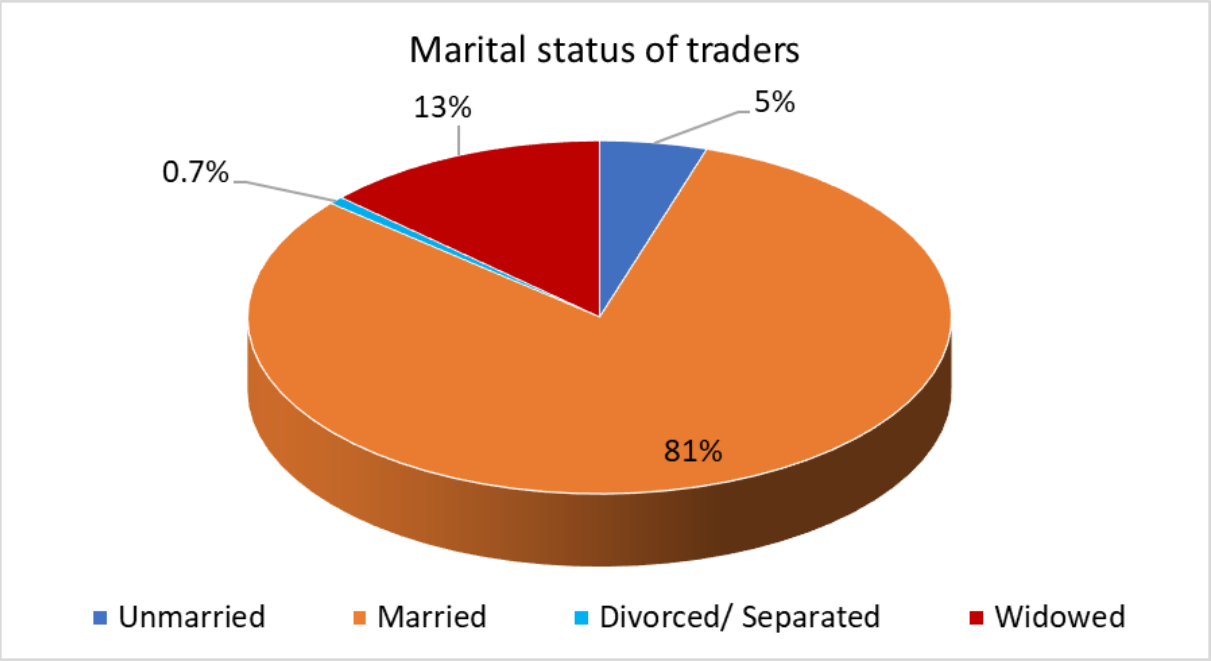



Figure 59: Marital status of traders

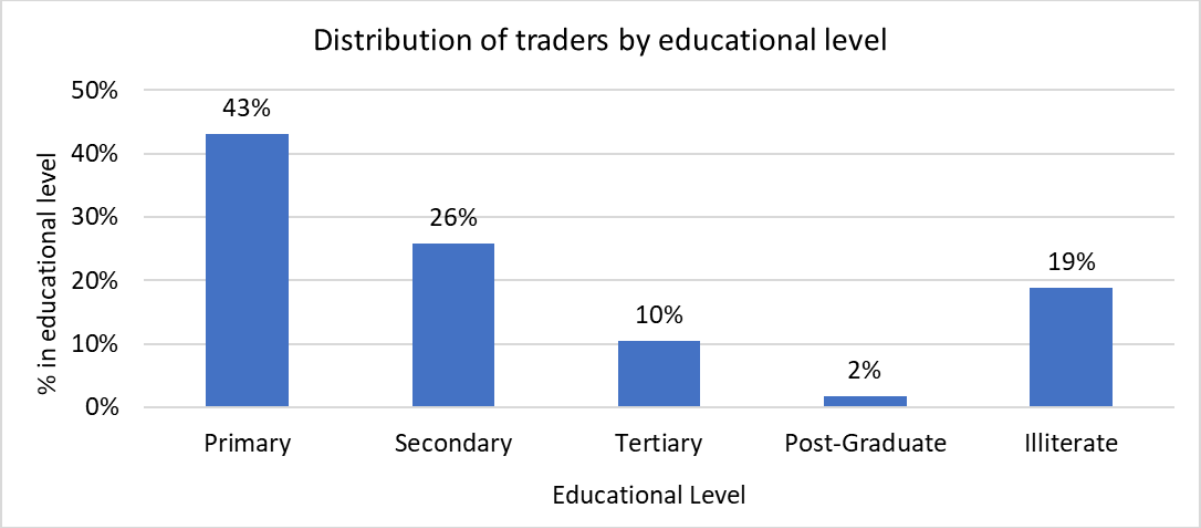



Figure 60: Educational levels of the traders surveyed

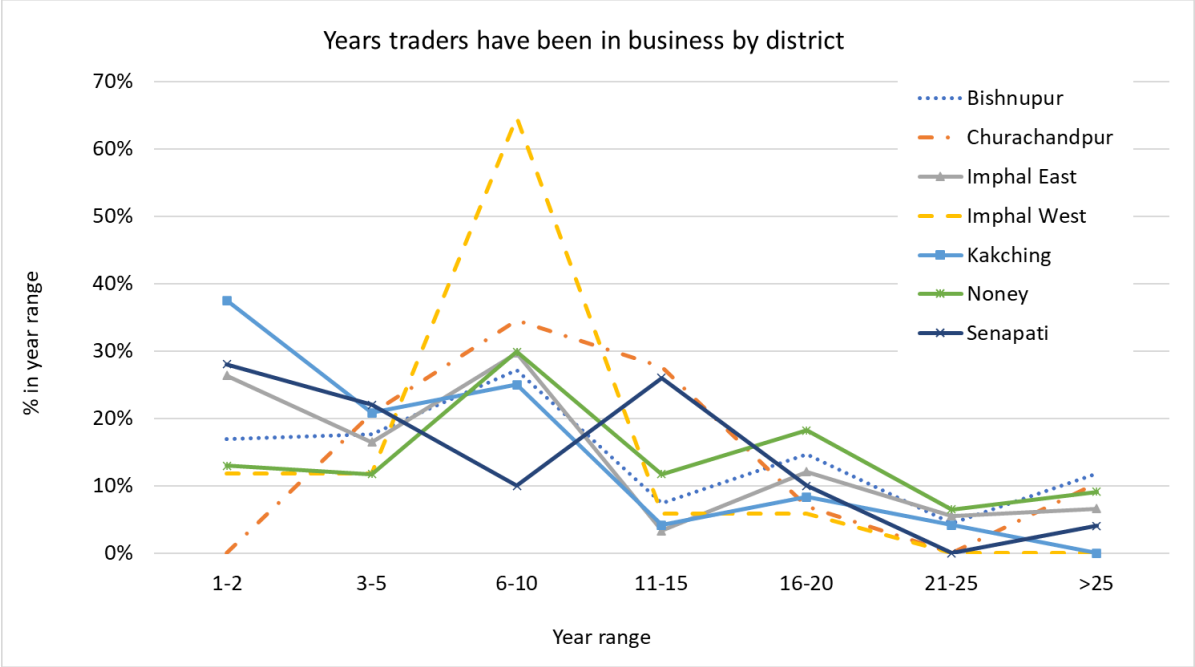



Figure 61: Traders and the number of years they have been in business

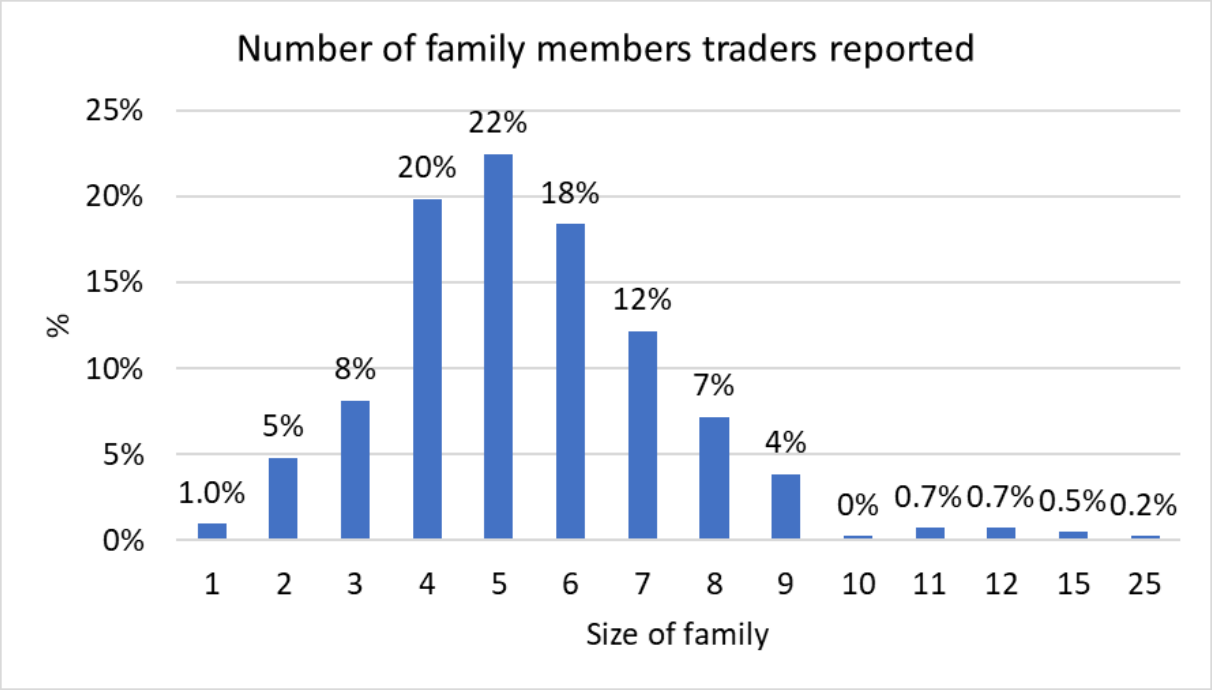



Figure 62: Family members of the traders

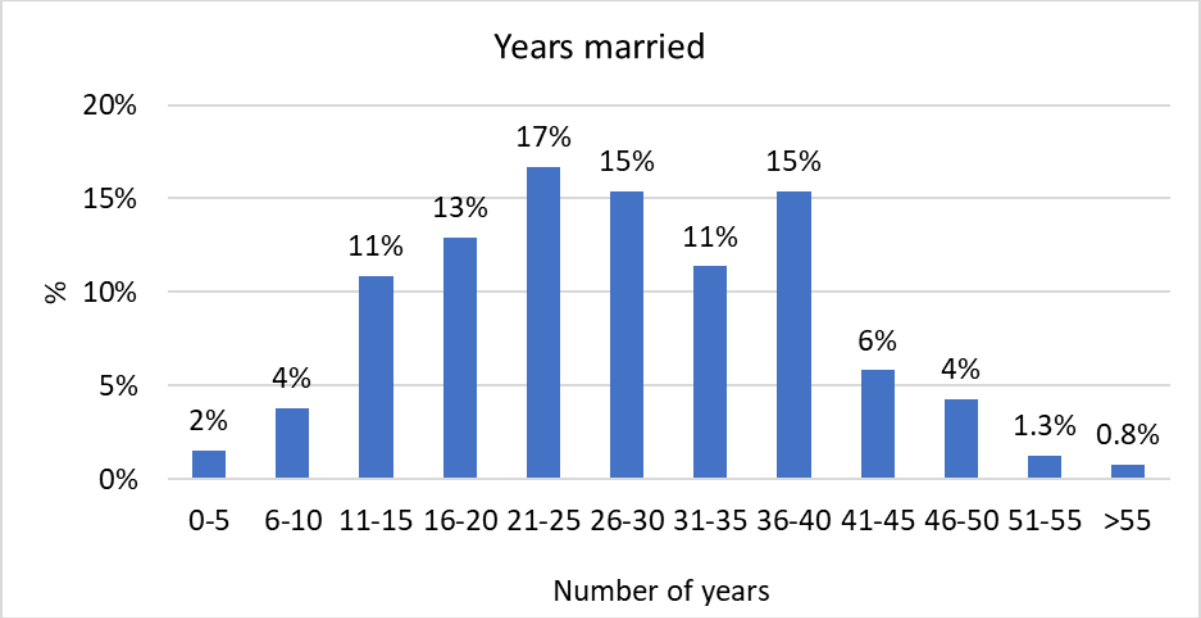



Figure 63: Years trader reported having been married

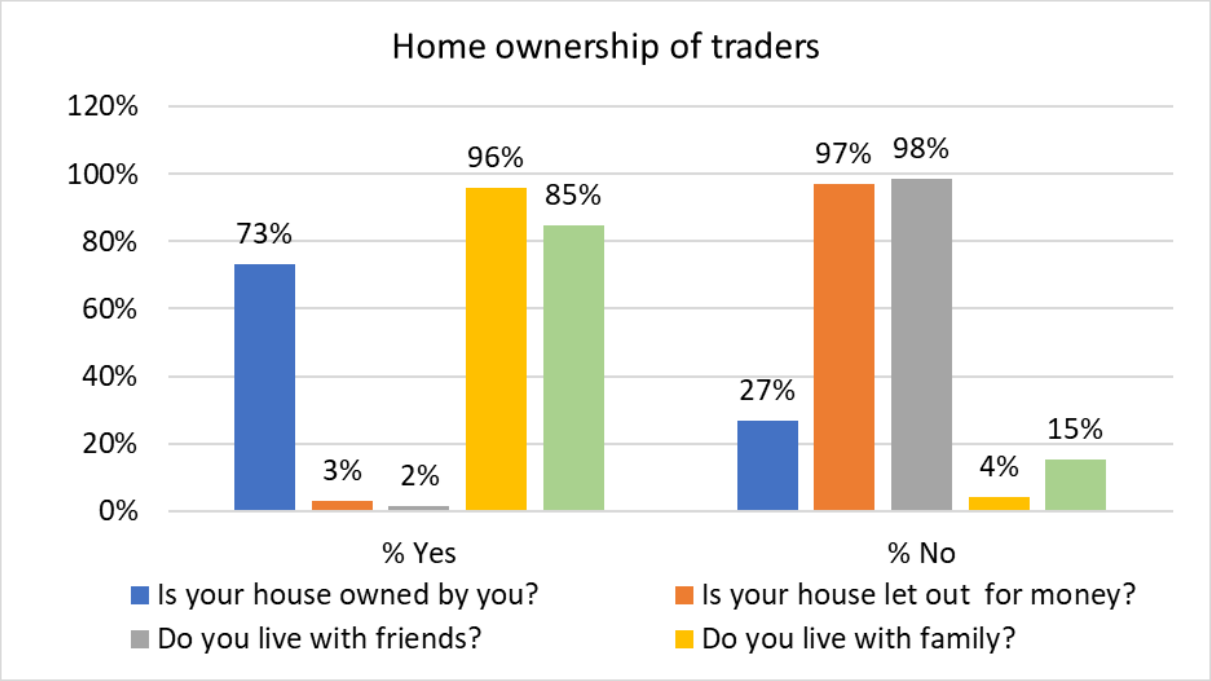



Figure 64: Home ownership status of traders

Picture 13: A range of vegetables on display at a trader's stall

### 3.2.2 Trader dynamics and economics


Picture 14: A trader in Senapati

In this section, we discuss the findings from questions related to a trader's source of funding, working hours, etc. 77% of all traders fund their business with personal savings (figure 65) and only 7% or so reported securing a loan to finance their trade (figure 66). Many of the traders also reported working long hours; 26% reported working longer than nine hours per day (figure 67) versus only 3% of farmers though a farmer's day is limited by day length and, being physically more demanding, they tend to work less hours. On average for all the traders, 50% of them reported earning between Rs1 lakh and Rs3 lakhs but, broken down by district, it can be observed that traders in some districts such as Bishnupur, Imphal West, Kakching and Senapati have higher proportions of those earning between Rs3 lakhs and Rs5 lakhs (figure 68). Trading is certainly more lucrative than farming. Furthermore, a large number of the traders also reported other incomes to support the household with close to 7% reporting an annual additional income of above Rs3 lakhs. In a significant contrast to the findings from the farmer interviews, traders spent a much smaller amount of their income on financing their business, 4% versus 23% for farmers on average, and broken down by district, those in Kakching reinvested the most in their business. Traders spent an average of 26% of their income on healthcare versus 7% by farmers with districts like Bishnupur and Noney spending significantly higher percentages (figure 69). A high 94% of traders reported owning a bank account with every single one of them in Senapati district having a bank account (figure 70). Surprisingly, ATM usage which is generally an indication of whether people are using their bank accounts regularly shows that it is only in Churachandpur and Senapati districts where traders used their ATM cards most (figure 71). Whether this is because of lack of physical branches of banks or not needs further investigation however the overall lack of ATM usage confirms the belief that our society is still a cash-in-hand based society.

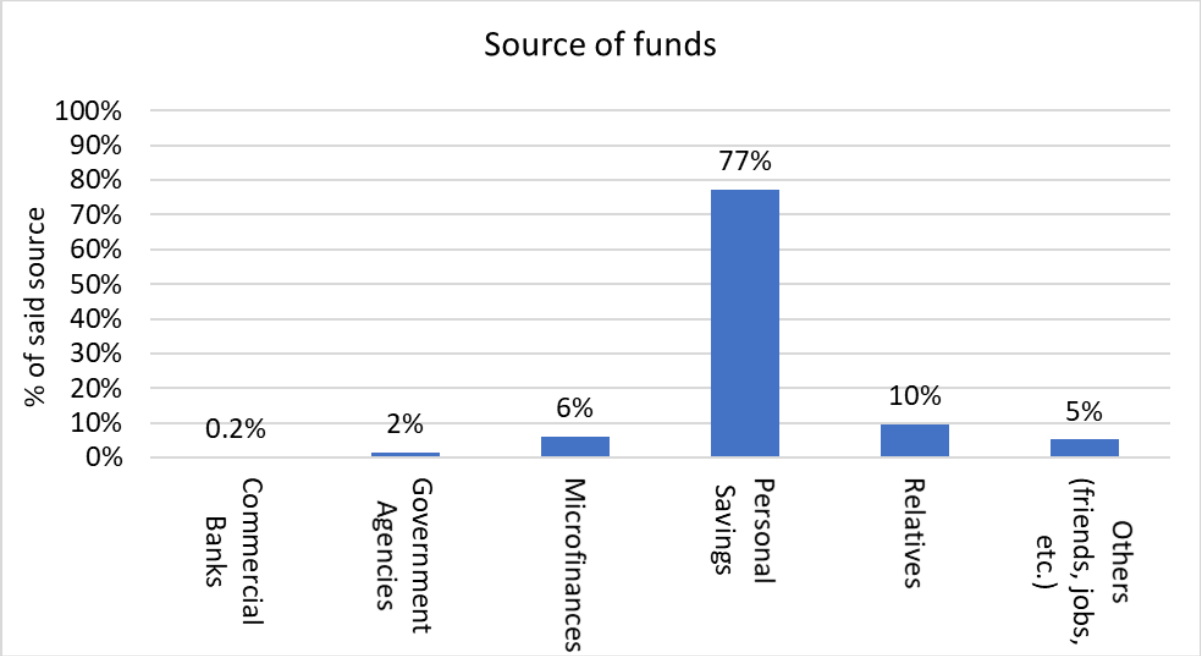



Figure 65: Source of funds for the surveyed traders

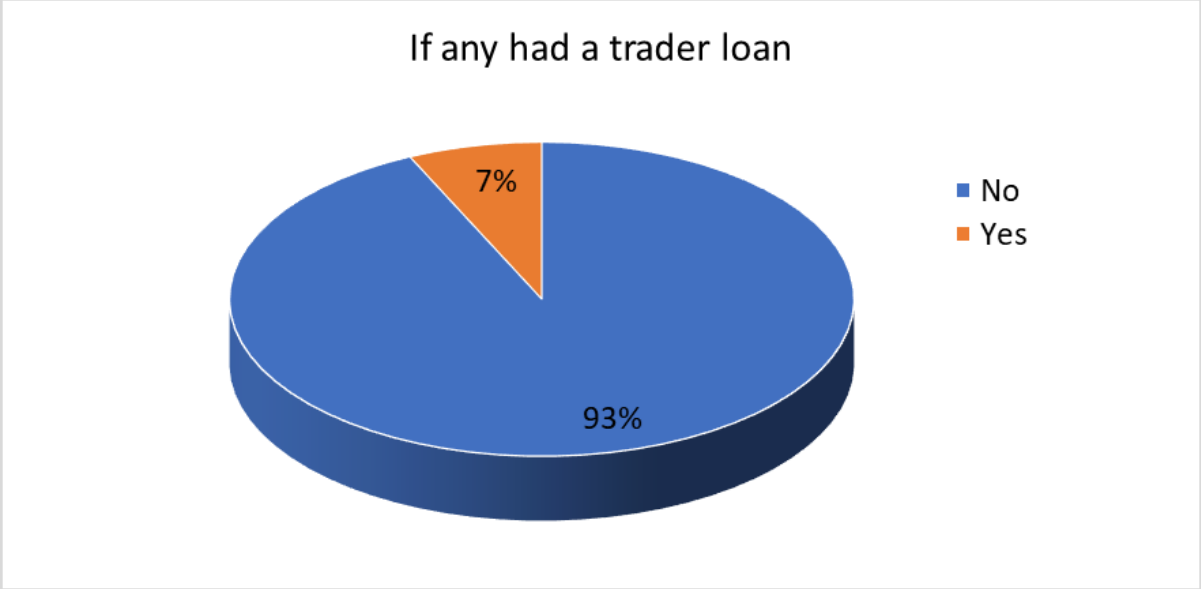



Figure 66: Assessment of whether traders had loans or not

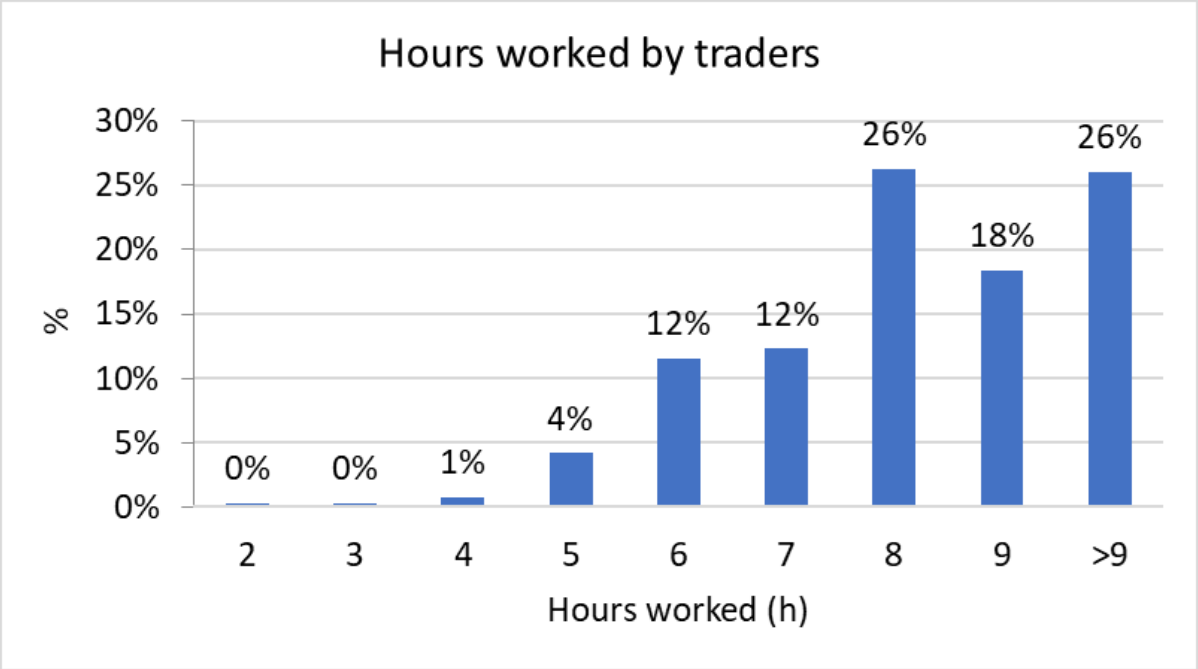



Figure 67: Number of hours worked by traders on a daily basis

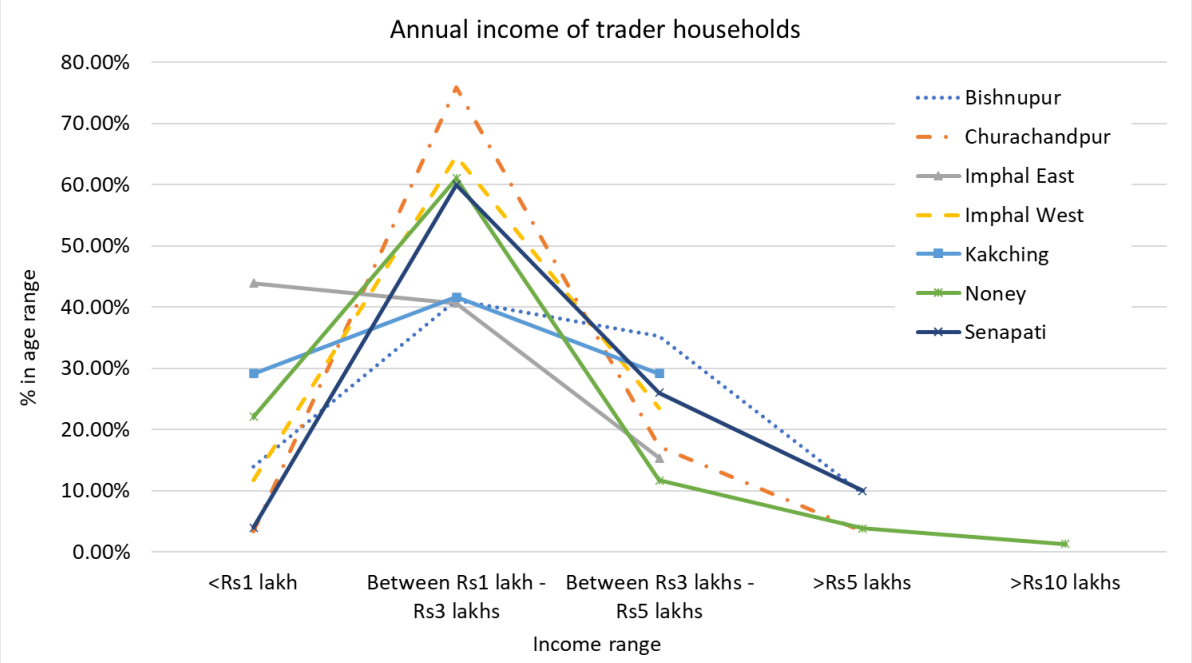



Figure 68: Household income of the traders

Of the traders surveyed, 30% also reported that they had additional sources of income to support the household with 90% of them earning up to Rs3 lakhs on the side.

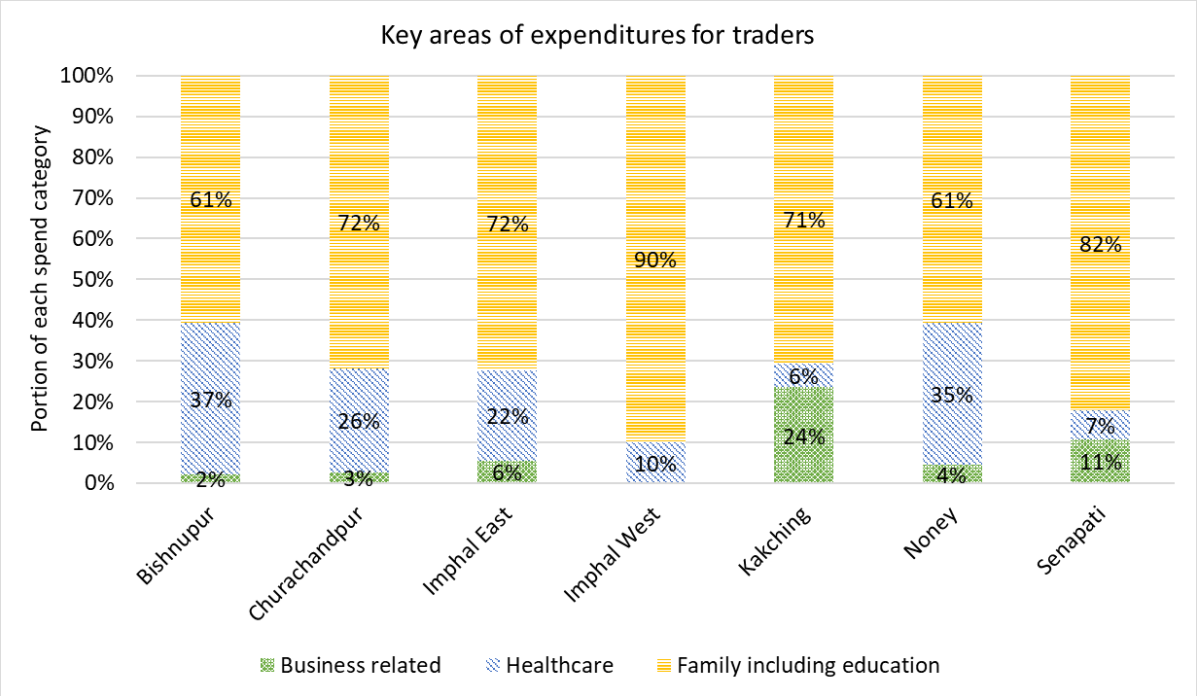



Figure 69: Spend of income on various activities by traders

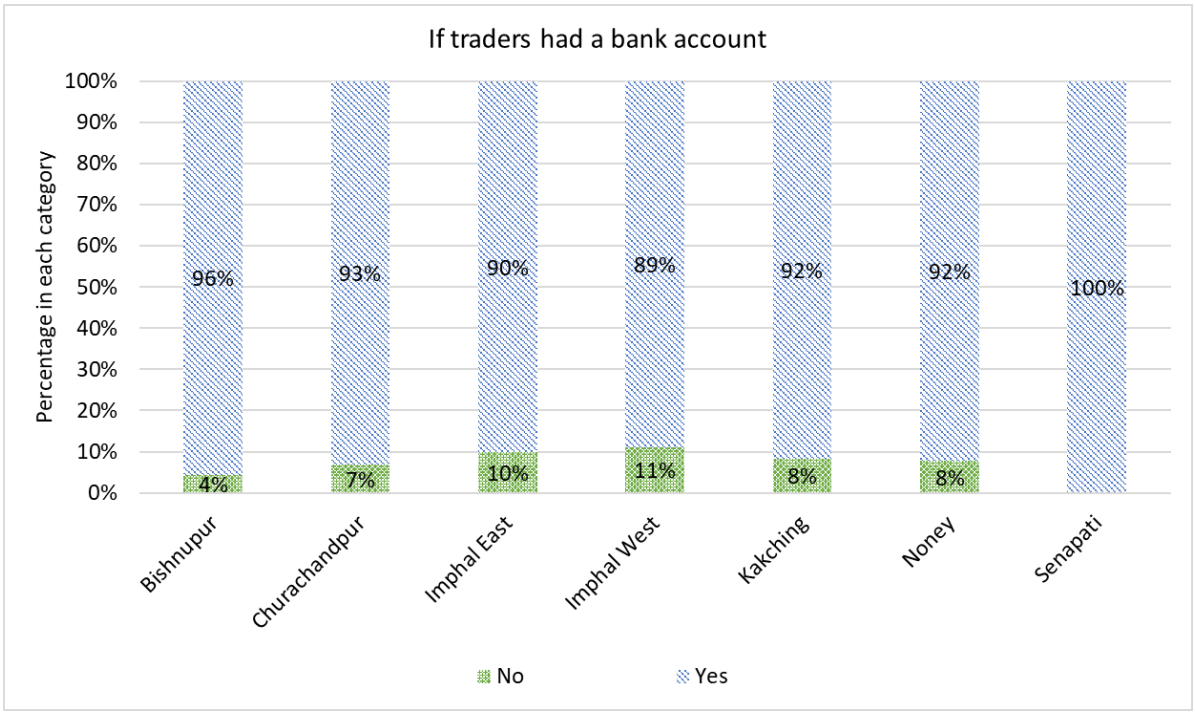



Figure 70: Trader and bank account ownership

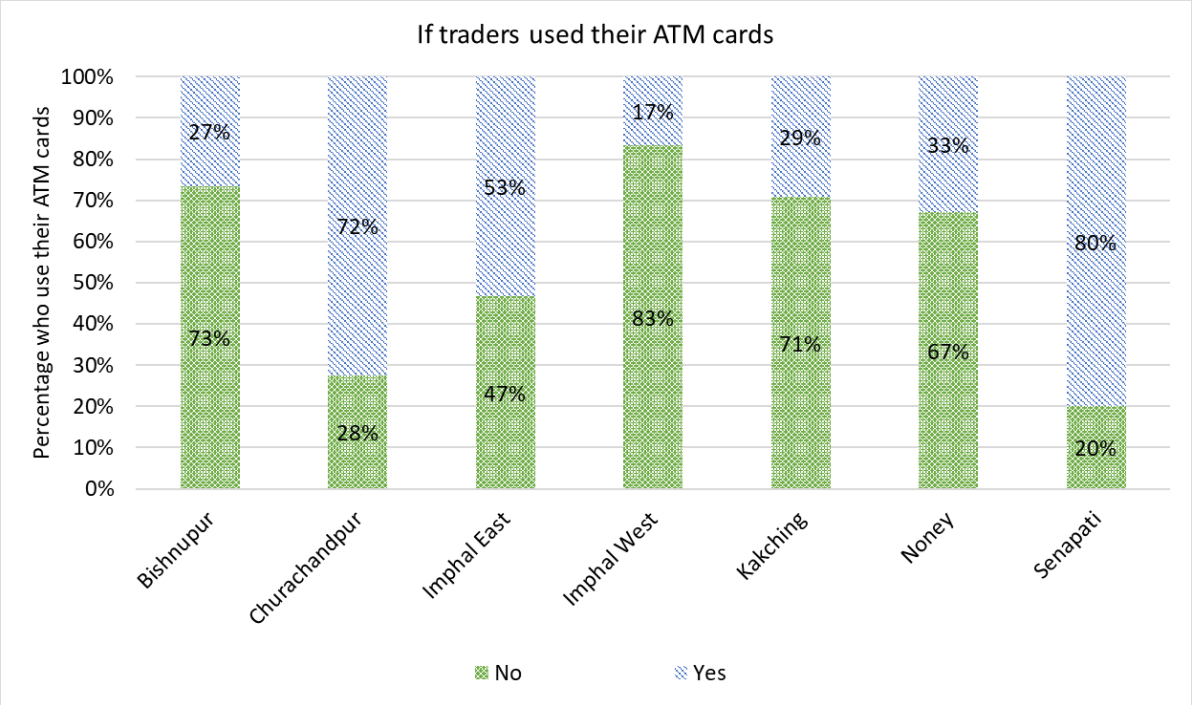



Figure 71: Traders used their bank ATM cards

Figure 72 gives an own assessment of what type of traders those interviewed thought they were. Furthermore, as a whole, 68% of the traders also bought the produce they were selling from other traders while 18% sourced directly from farmers. The sources traders reported have been plotted by district in figure 73. However, if we narrowed this to only those who described themselves as “middlemen”, only 31% sourced from other traders with a majority coming directly from local villages or farmers. Those who classified themselves as “retailers” sourced largely from other traders (73%) while only 38% of those who identified themselves as “wholesalers” sourced solely from other others, focusing on produce from their own farms or directly from farmers instead. Profit (28%), demand (30%) and availability (36%) were the main motivations for selecting a particular crop by the traders (figure 74).

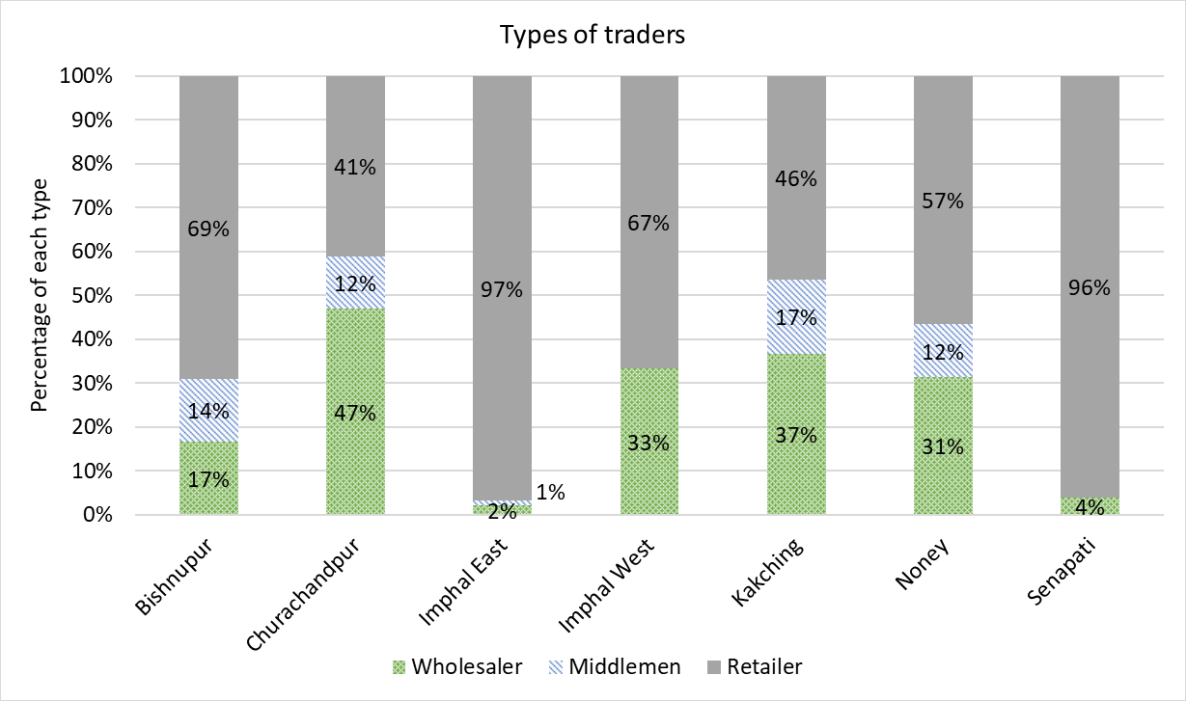



Figure 72: Self-assessment by traders of the type of role they play

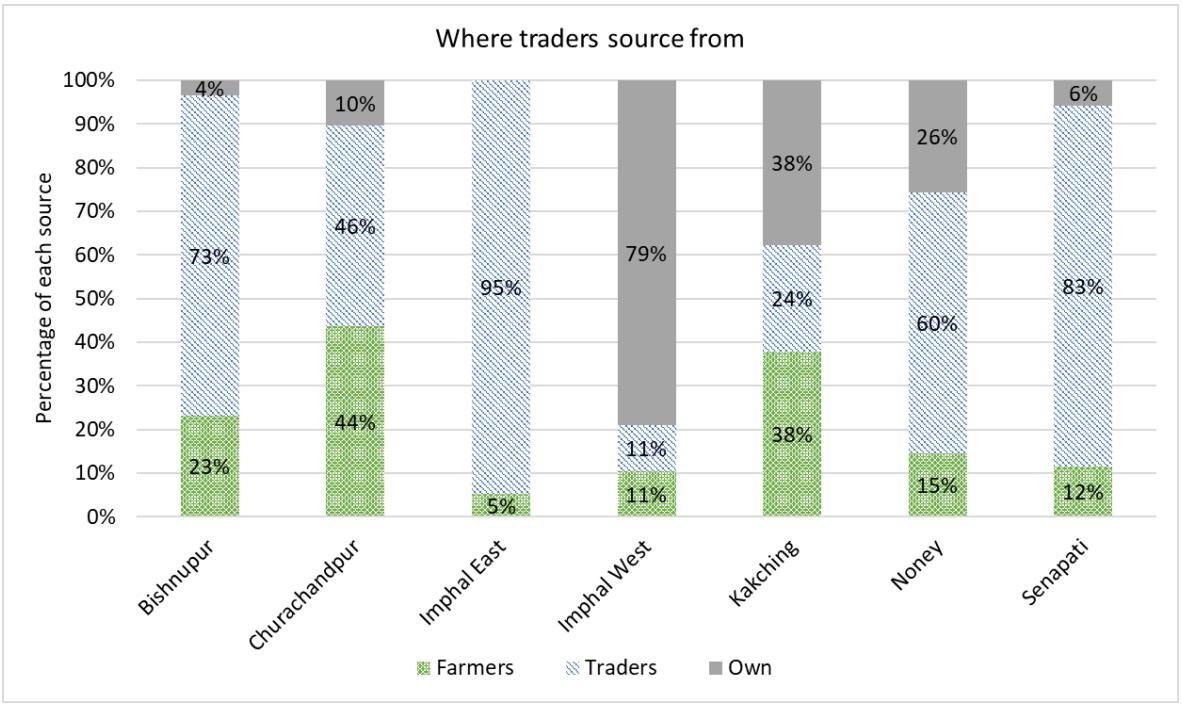



Figure 73: Source of produce traders sell

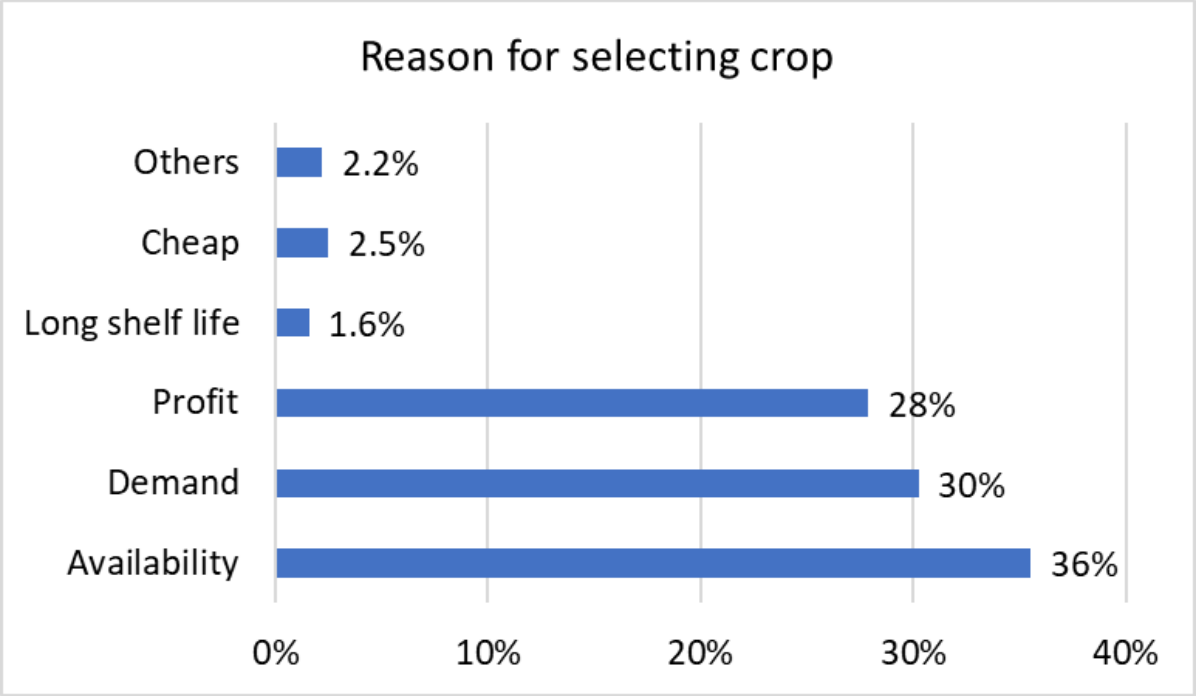



Figure 74: Traders and the reason why they select a particular crop

### 3.2.3 Challenges traders face

As with farmers, traders were also asked to name the top challenges they faced. Unsurprisingly, considering the multiple lockdowns and market closures, a large majority of the traders reported a major challenge around marketing and selling their products. Storage was flagged as another major challenge by traders in all the districts except Senapati where farmers tend to harvest kiwi on order from the traders based on when exactly they were able to pick up. It is also worth noting at this point that kiwi farmers also did not report storage as a major challenge. Next, the second major issue highlighted was on transportation which was also heavily disrupted during the Covid lockdowns and would have also been disrupted by repeated bandhs and strikes which are fairly commonplace in Manipur. Trade financing, loss of stock due to poor quality or improper storage conditions, and storage challenges forcing, for example, traders to fire sale were also highlighted as challenges. The percentages have been charted in figure 75.

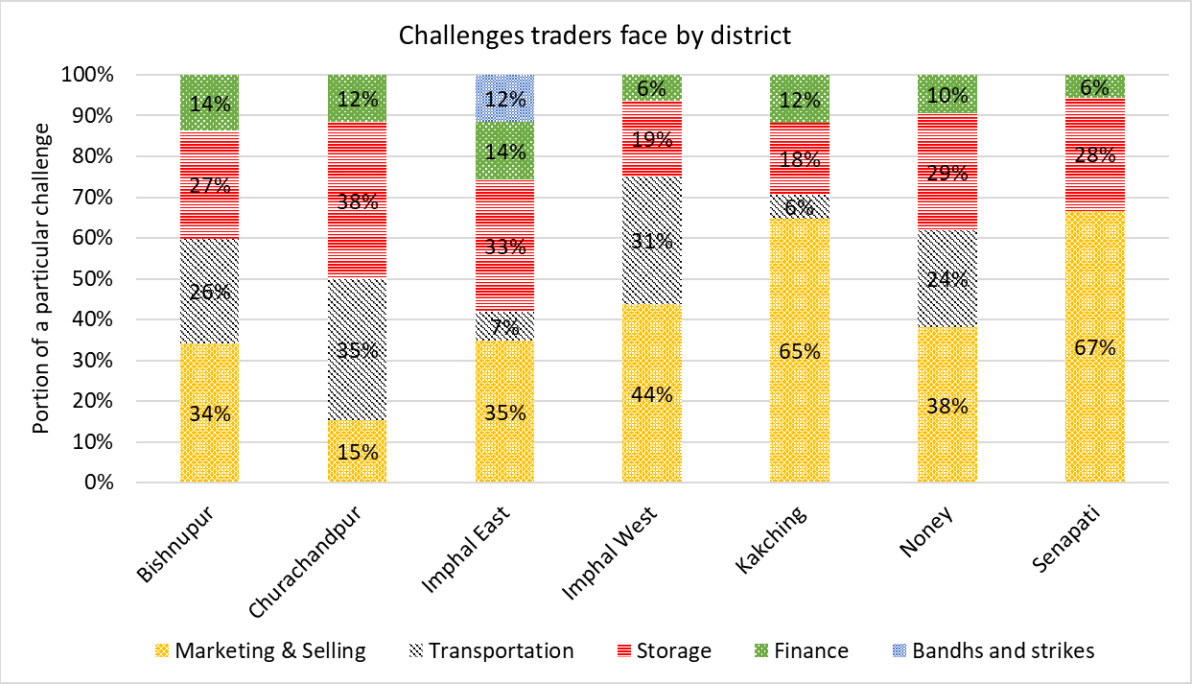
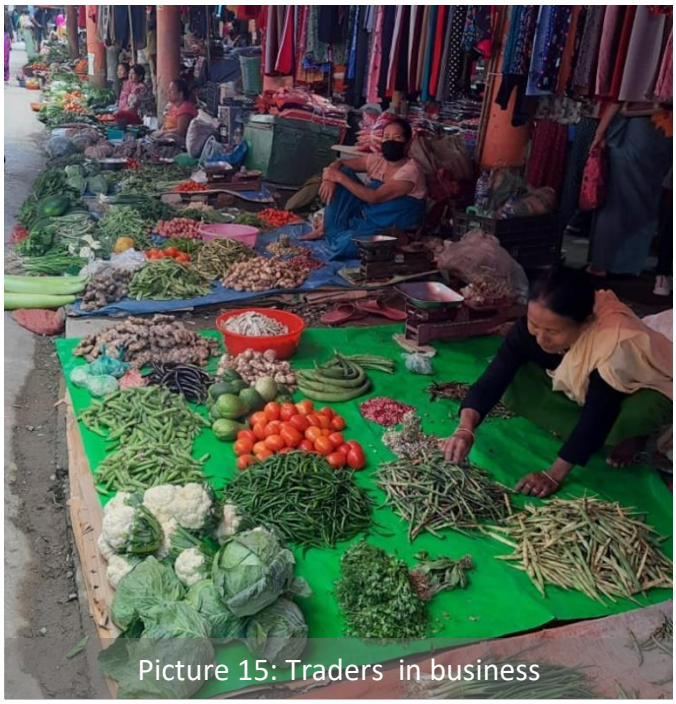



Figure 75: A plot of the different challenges highlighted by traders

### 3.2.4 Cost of trading analysis

In the interviews, recognizing the time constraint we had in the limited hours that traders were allowed to operate during the lockdowns, traders were asked about the prices and margins they made on products that they sold. The prices consumer reported have also been added to table 7 for comparison. Whilst the price trends of the retailer prices and what the consumers actually reported are similar, there are some discrepancies in the actual amounts which could be due to the fact that the consumers surveyed are in the same district as the farmers and hence they are paying a lower price. The retailers are reporting prices at which they would sell on in main markets such as those in Imphal.



Picture 15: Traders in business

Nevertheless, retailers reported making margins ranging from around 20% to 50% which could be considered as high however this was in the middle of Covid with relatively low supply. This ties up well with the Marketing & Selling challenge that farmers highlighted as one of their main challenges. To give an idea of the mark up across the chain for each of the crops whose costs of production were studied in detail, this has also been added in the second column.

| Crop | Farmer Cost of Production (Rs/kg) | Reported Wholesaler Price (Rs/ kg or unit) | Reported Middlemen Price (Rs/ kg or unit) | Reported Retailer Price (Rs/ kg or unit) | Ave Reported Retailer Margin (%) | Consumer Reported Price (Rs/ kg or unit) |
|---|---|---|---|---|---|---|
| **Banana** | 12 | 24 | 21 | 30 | 42% | 30 |
| **Black Rice** | 40 | | | 65 | 33% | 82 |
| **Cabbage** | | | 20 | 40 | 25% | 50 |
| **Cauliflower** | 13 | | | 66 | 17% | 85 |
| **Chives** | 14 | | | 43 | 44% | 41 |
| **Cucumber** | 11 | 25 | | 27 | 50% | 38 |
| **King Chilly** | 44 | | | 287 | 54% | 240 |
| **Kiwi** | 6069 | | | 76 | 45% | 131 |
| **Maize** | | | | 100 | 50% | 96 |
| **Pineapple** | 2 | | | 26 | 43% | 24 |
| **Red Potato** | 19 | | | 70 | 36% | 59 |
| **Tomato** | 10 | 28 | 33 | 42 | 27% | 45 |
| **Watermelon** | 6 | 13 | | 32 | 32% | 30 |

Table 7: Reported prices and retailer margin

### 3.2.5 Insights into the health of traders

As with farmers, retailers were also asked about their health. Generally, the self-assessment was positive with less than 2% considering their health as poor however, unlike in the case of farmers where an overwhelming majority said they were in good health, the responses were split so the chart has been plotted by district for further insights (figure 76). Here, one can see that the only district where traders reported of being poor health was in Noney, a new district with very little healthcare infrastructure. Detailed questioning on symptoms did reveal that 12% of all the traders had high blood pressure (figure 77). And, as seen with farmers, a very high percentage 91% of them paid for healthcare through their own pockets (figure 78).

Picture 16: Many traders are women

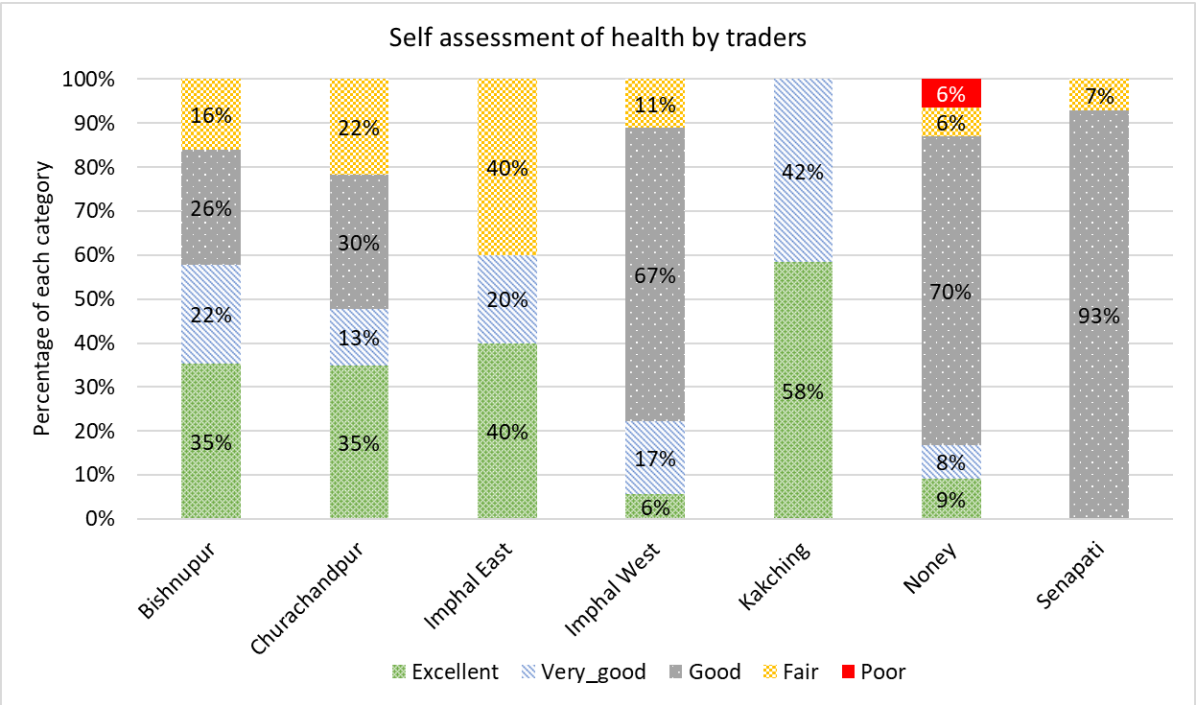



Figure 76: Self-assessment of trader's own health

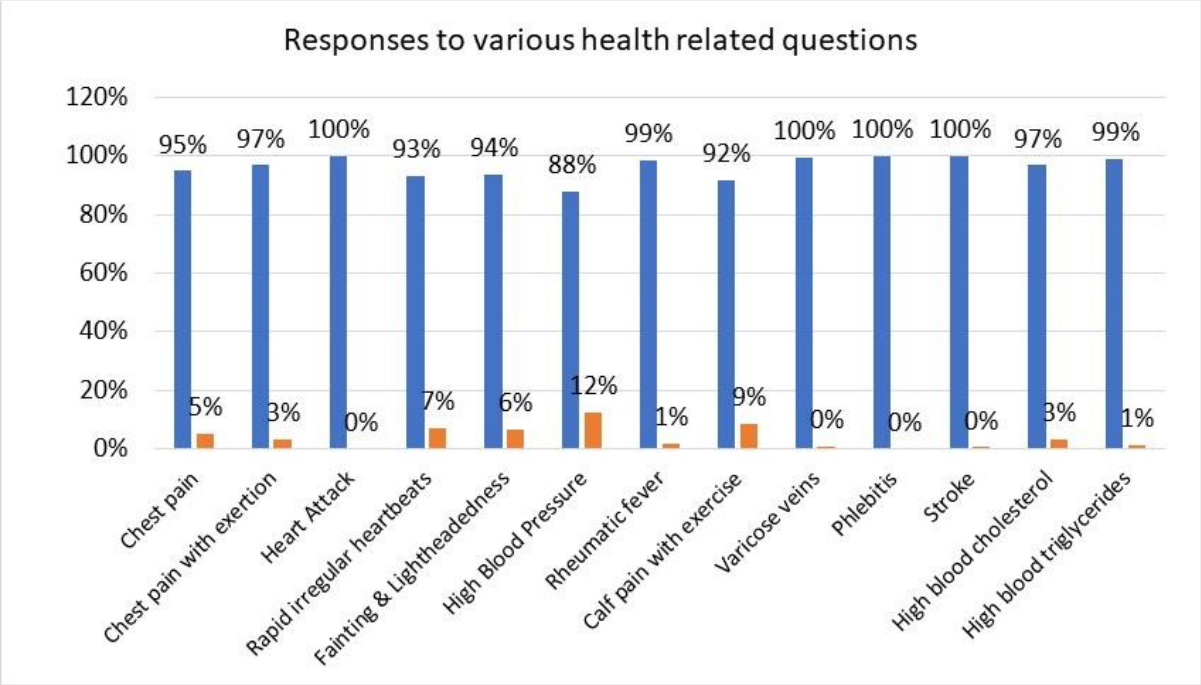



Figure 77: Self-assessment of various health conditions of traders

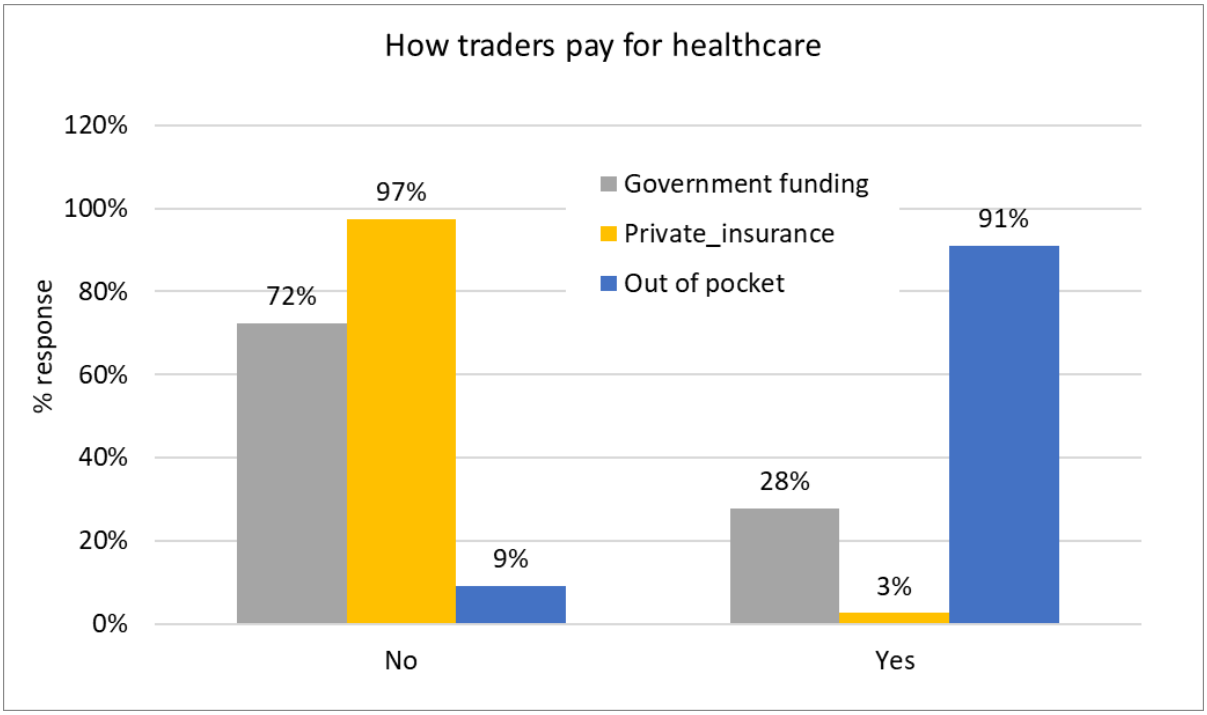



Figure 78: Self-reported funding of healthcare costs

## 3.3 Processors

Manipur does not have much in the form of processing though there are a few well-known ones. As part of this study, the team approached many processors, cottage or fully established, however many were shut for long during the lockdowns for professional and personal reasons. Some did not want to participate concerned that their information may end up in competitors' hands. The team did manage to interview a few processors who were open and supportive enough to participate.

The locations of the processor interviews have been pinpointed in figure 79. In order to protect their personal information including family income, health, family matters, etc., this section only focuses on the amount they procure to process with some info on the cost of raw materials and revenue.

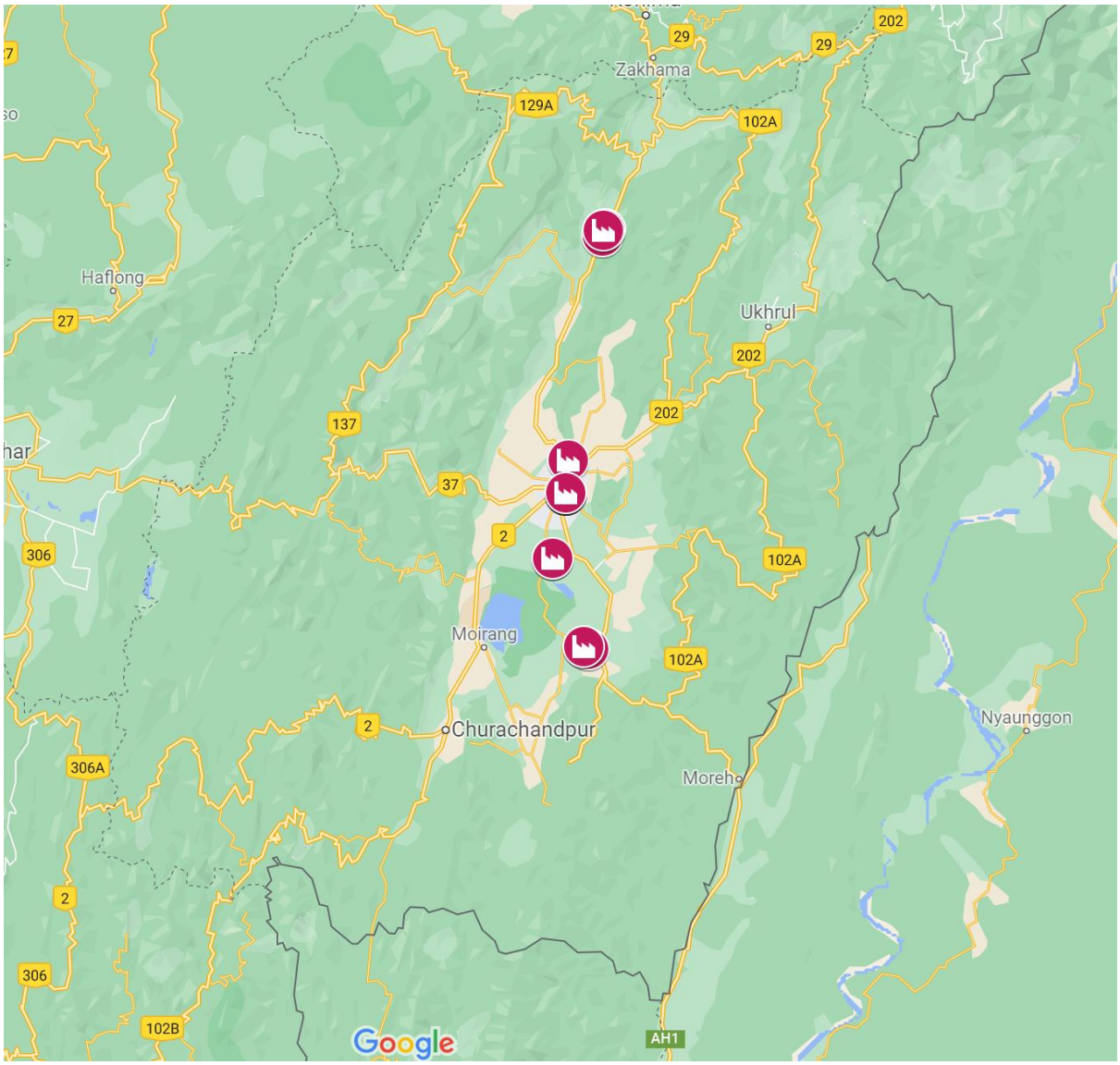



Figure 79: Locations of the few processors who were interviewed in this study

### 3.3.1 Cost of Processor analysis

Crops such as watermelon and cucumber are not processed in the true sense though there have been instances of someone selling watermelon juice on a hot summer day. Because of the lack of willingness of many players to share their full costs, a table of just the raw materials used and the estimated cost of the raw materials is given below in table 8.

| Main Raw Material | Raw material cost per kg (Rs) | Annual Volume (Kg) |
|---|---|---|
| Pineapple | 14 | 1700 |
| Black rice | 65 | 10000 |
| Black rice | 60 | 1095 |
| Black rice | 60 | 730 |
| King Chilly | 75 | 690 |
| Potatoes | 75 | 4000 |
| Black rice | 80 | 950 |
| Potatoes | 80 | 500 |
| Kiwi | 70 | 35 |
| Kiwi | 80 | 300 |
| Kiwi | 70 | 35 |
| Kiwi | 80 | 300 |
| Kiwi | 70 | 35 |
| Kiwi | 80 | 300 |
| Black rice | 70 | 750 |
| Black rice | 70 | 750 |

Table 8: Raw material volume and cost from surveyed processors

In the grand scheme of things, the amount of raw material procured by processors in Manipur is miniscule versus the total production in the state. Often, companies are established with a lot of publicity and subsidy but, without a well thought out plan to procure raw materials and distribution logistics, many of them eventually falter. The team did meet such players however they were even more unwilling to share their costs or be even highlighted as failing as that could affect their other ventures.


Picture 17: Women entrepreneurs who process various crops

### 3.3.2 Pictures of processed and packaged food items


Picture 18: Black rice bhujia from Taret Foods Pvt. Ltd.


Picture 19: Pineapple candy and cubes from Meira Foods

## 3.4 Consumers

A total of 567 consumers were interviewed across the many target districts in Manipur. In order to adapt to the Covid lockdown that started soon after this Study commenced, team members were advised to interview consumers as they sat locked down at home by reaching out to their friends and families, and their contacts. It was only by doing so that the team was able to continue working on gathering data. Still, whenever possible, the team did step out to interview consumers in person and the geographic locations covered are shown in the following map:

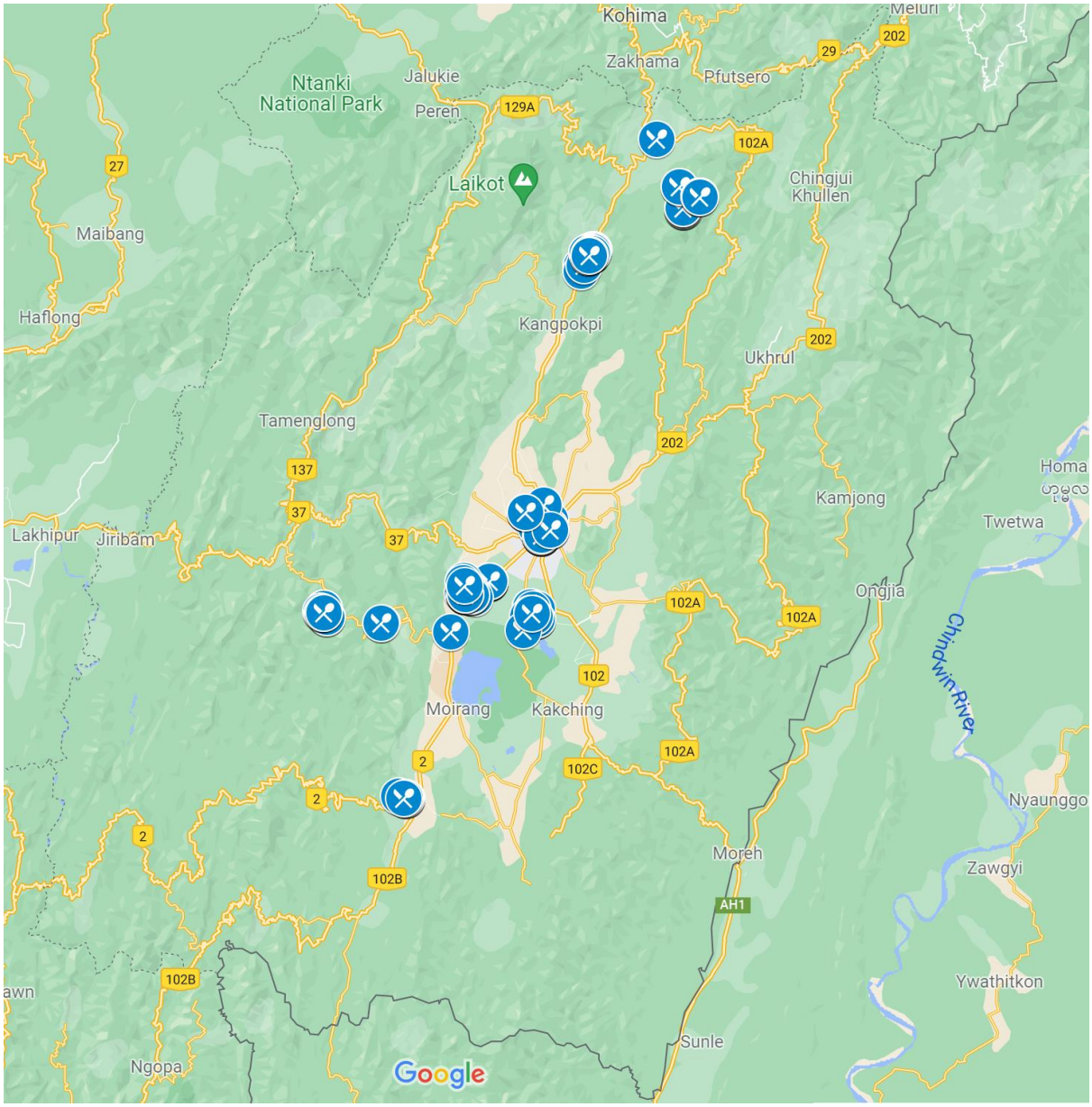



Figure 80: Locations of consumers

A collage of some of the consumers interviewed is shown in the figure below:

Picture 20: A collage of a sample of the consumers who were surveyed

The team in Bishnupur was able to gather the most consumer data (figure 81) despite the fact that an enumerator lost her uncle to Covid and was herself at the hospital alongside her gravely ill uncle for weeks. In Churachandpur, a new enumerator had to be appointed after the previous team member who collected most of the consumer data sadly lost her mother. However, the second enumerator did not continue for long as he took offence to being chased away by farmers who were fed up of being surveyed again and again without seeing anything in return for their participation! This is one of the reasons why MaolKeki Foundation is following up with demo plots as discussed later in this report.

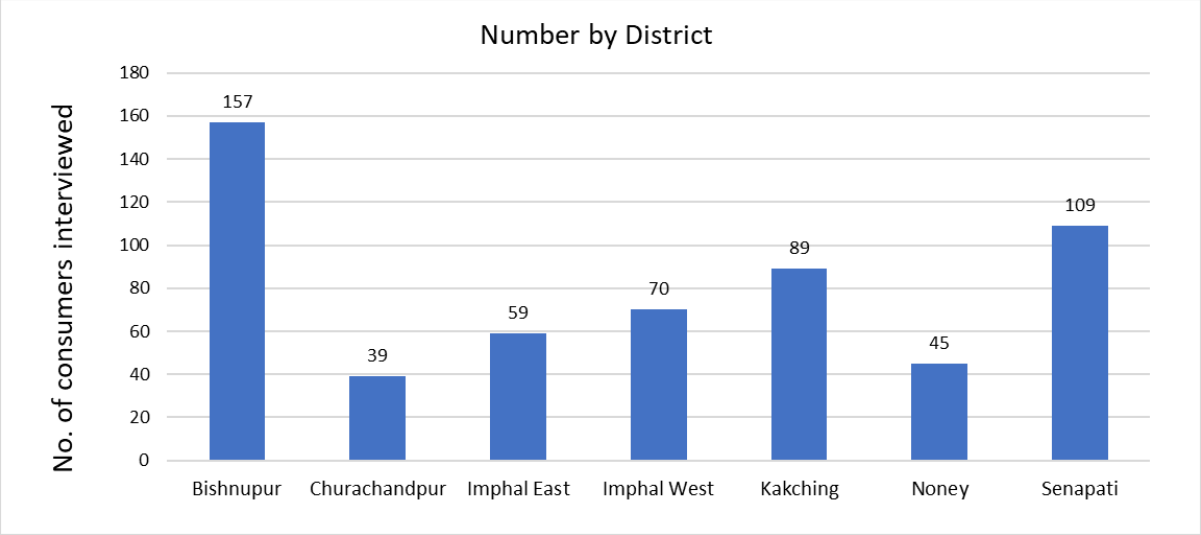



Figure 81: Distribution of consumers by district

### 3.4.1 Socioeconomic Profile

A large percentage of the consumers surveyed were relatively young with 72% being up to the age of 50. Breaking down by district, Imphal East, Kakching and Noney had the highest share of 21- to 30-year-old consumers while Imphal West had the highest share of over 50s (figure 82). Consumers were relatively well educated as all the districts reported around 40% or above number with tertiary or post-graduate qualifications (figure 83). A slightly larger, 53% of those surveyed were males on average but the breakdown by district shows a greater percentage of female respondents in Imphal East and a high percentage of male responders in Imphal West (figure 84). 65% of the consumers were also married (figure 85) and 97% of them live with family (figure 86), while 65% reported living in a household of four to six family members (figure 87).

Breaking down by district, many of the consumers were working full-time or part-time but in districts like Churachandpur, Imphal East, Kakching and Noney, a significant number of them were also unemployed and looking for work (figure 88). 40% of the consumers on average work an average 8h daily (figure 89). Consumers are also generally better off than farmers or traders with 35% of them earning Rs3 lakhs to Rs5 lakhs annually versus 14% and 24% for farmers and traders, respectively. District by district, there are more in this income category

in Imphal East, Kakching and Senapati (figure 90) while a greater percentage of consumers in Bishnupur, Churachandpur, Imphal West and Noney earn in the range of Rs1 lakh to Rs3 lakhs per annum.

Consumers are also more *au fait* with banking as 98% of them have a bank account and 87% said they knew how to operate their accounts (figure 91).

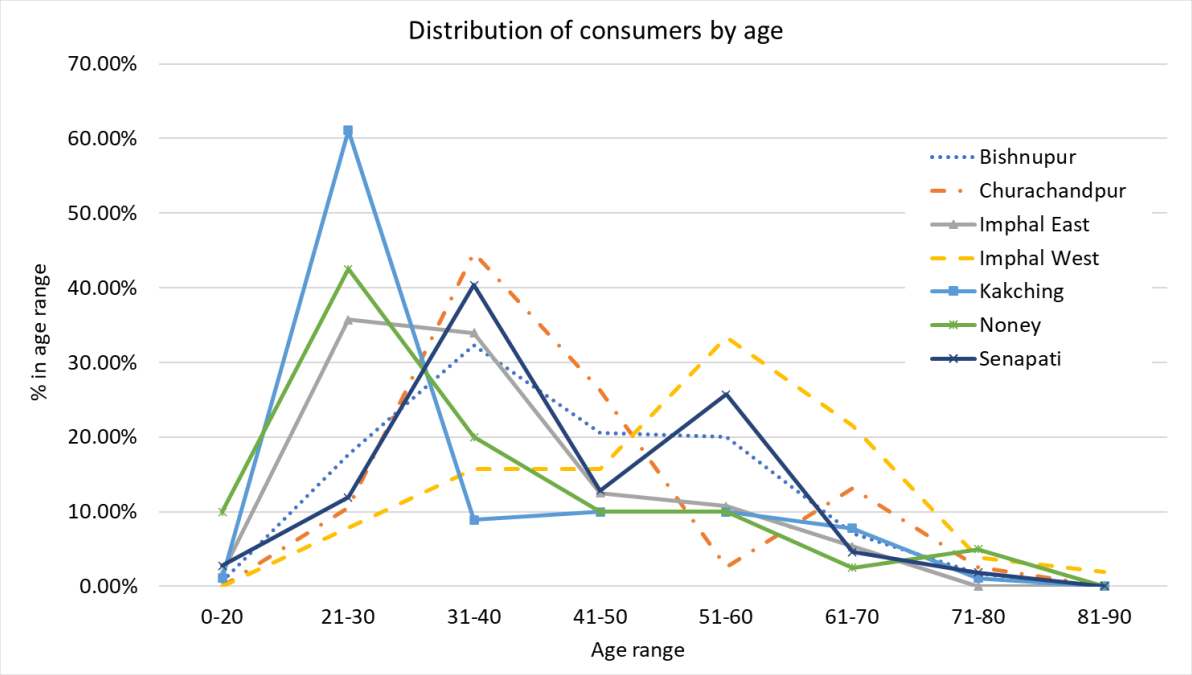



Figure 82: Age distribution of consumers

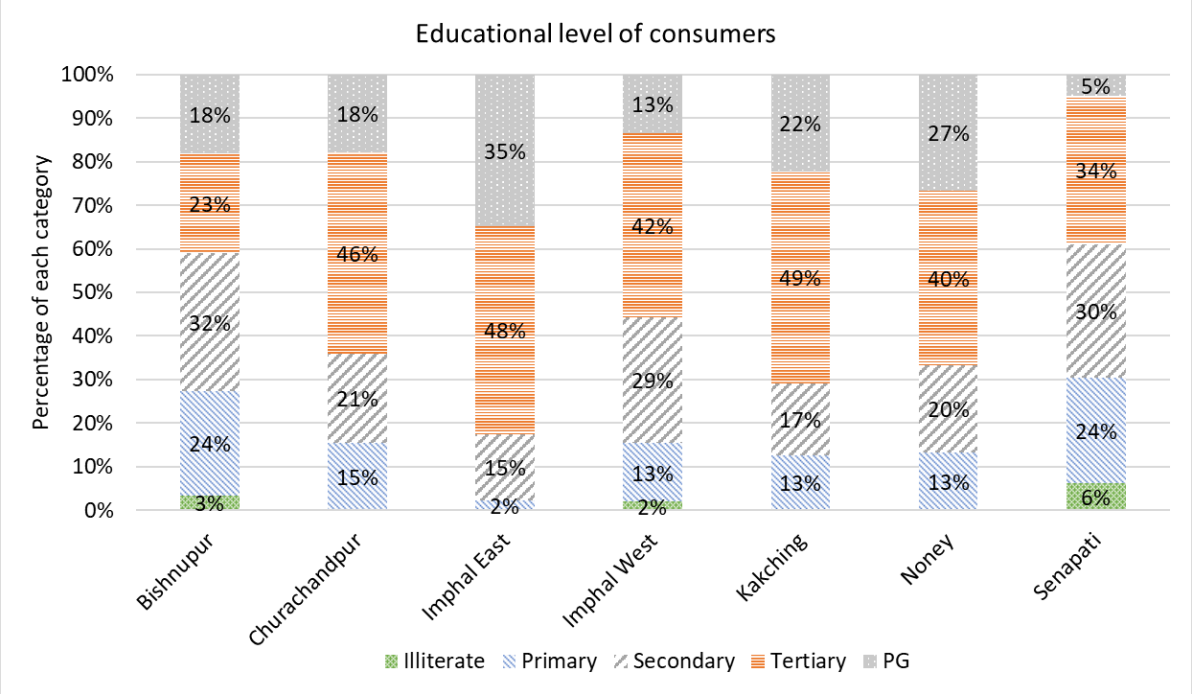



Figure 83: Educational levels of consumers

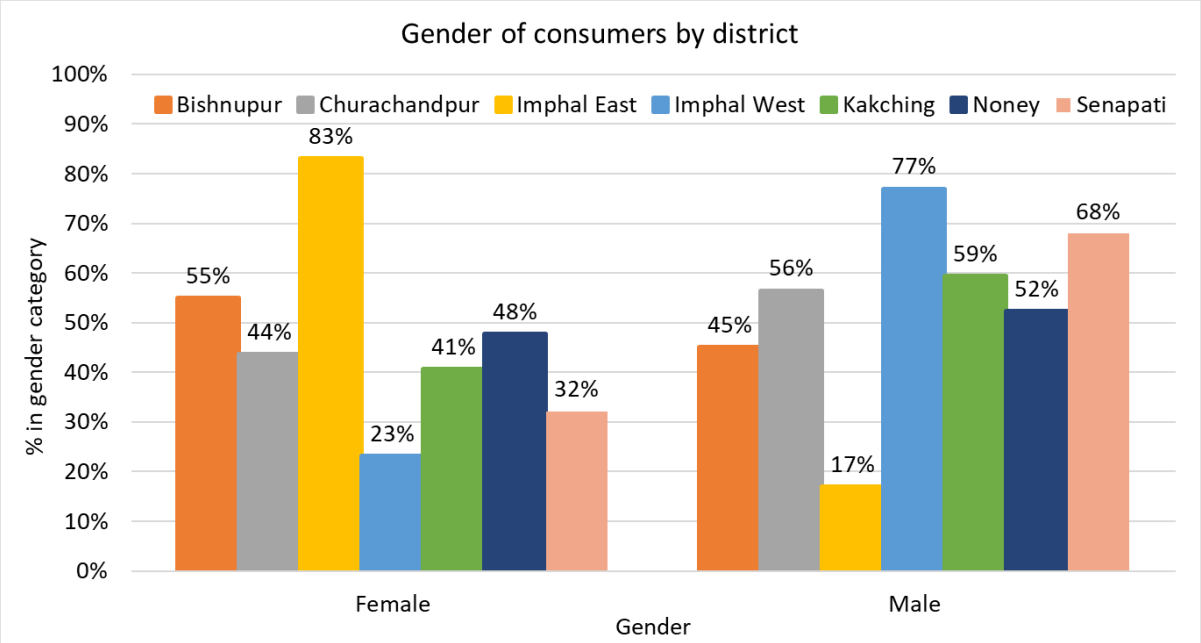



Figure 84: Gender split of consumers

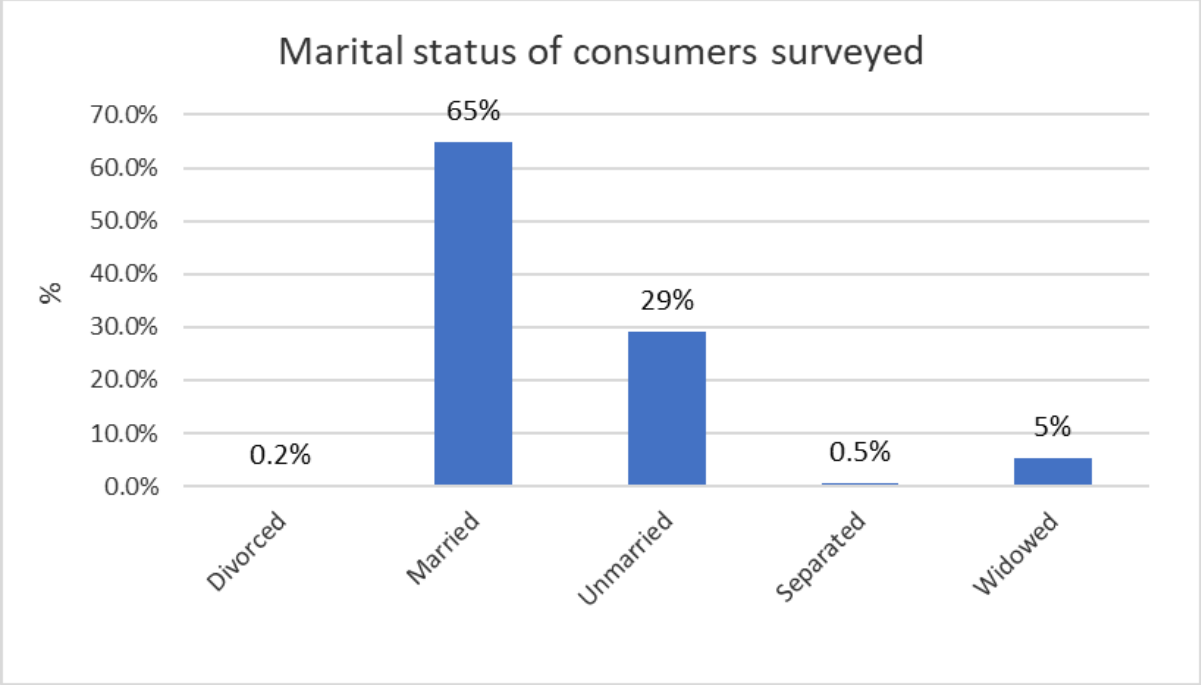



Figure 85: Marital status of consumers

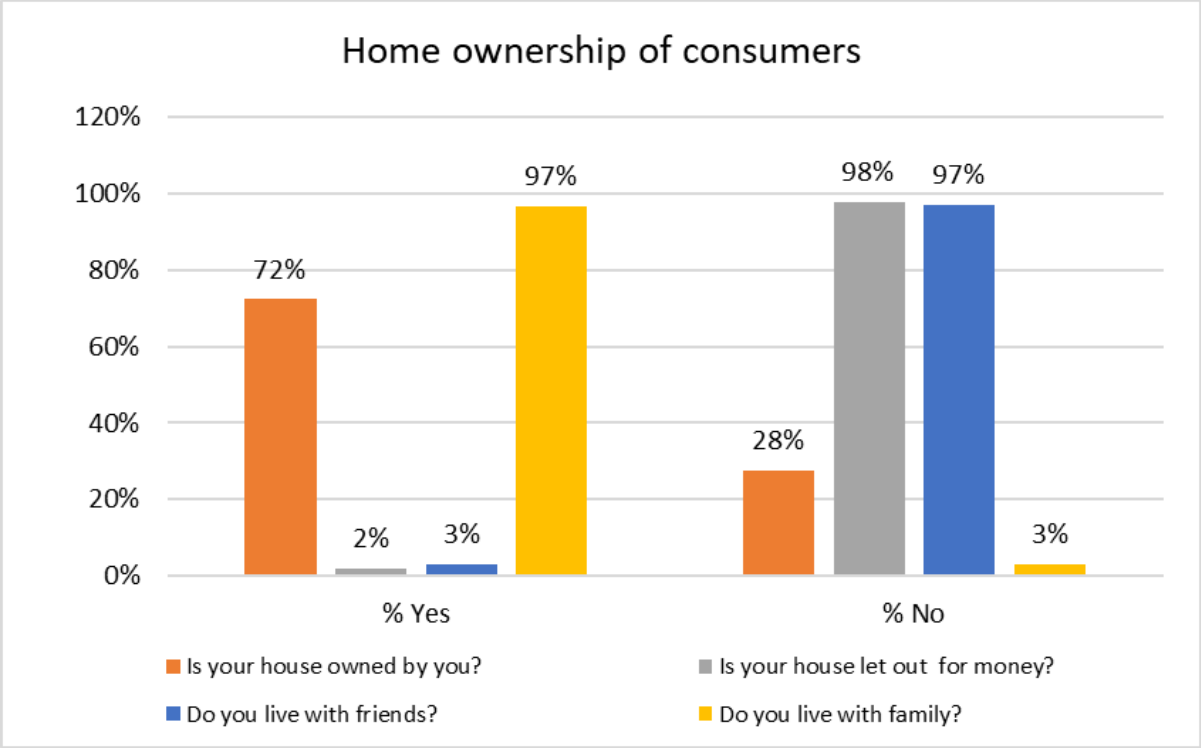



Figure 86: Home ownership of consumers

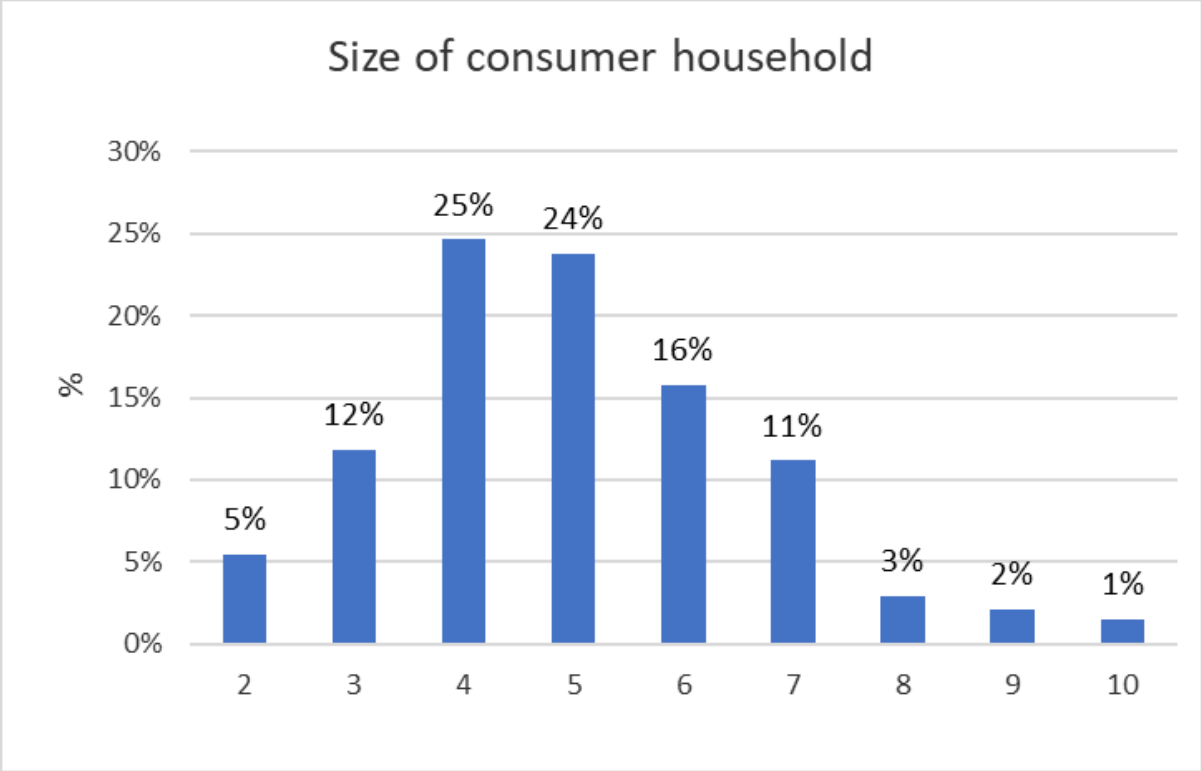



Figure 87: Size of average consumer household

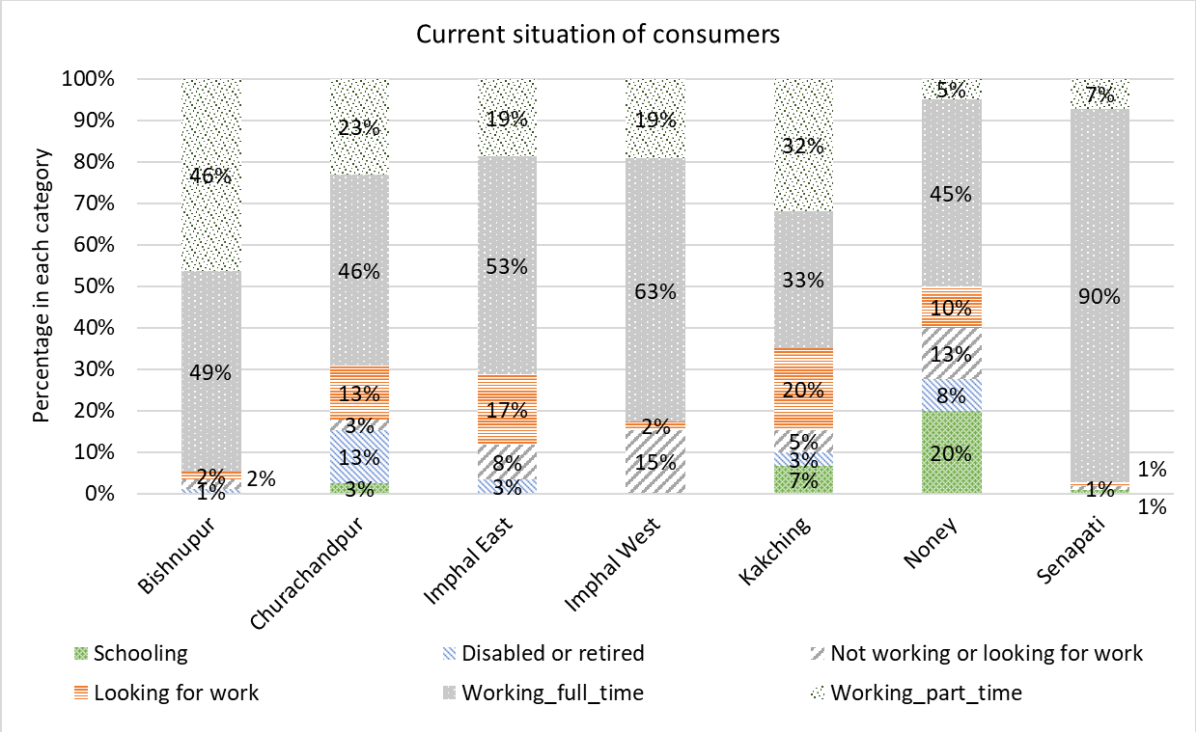



Figure 88: Employment situation of consumers

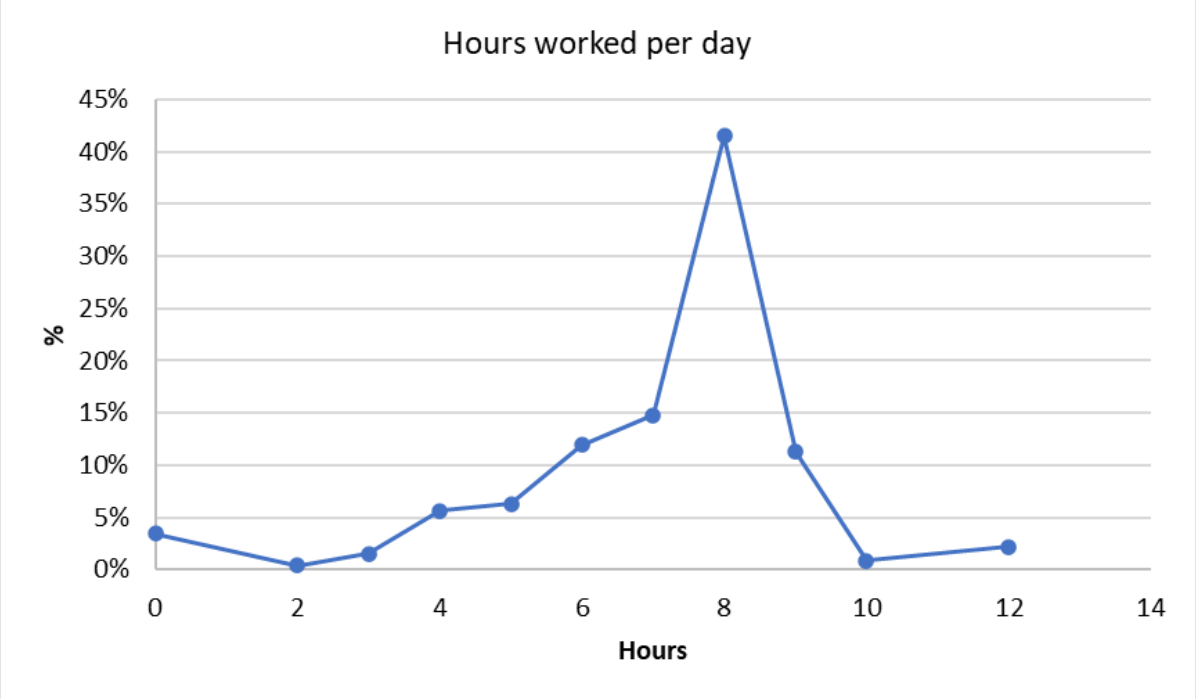



Figure 89: Hours worked by consumers on a daily basis

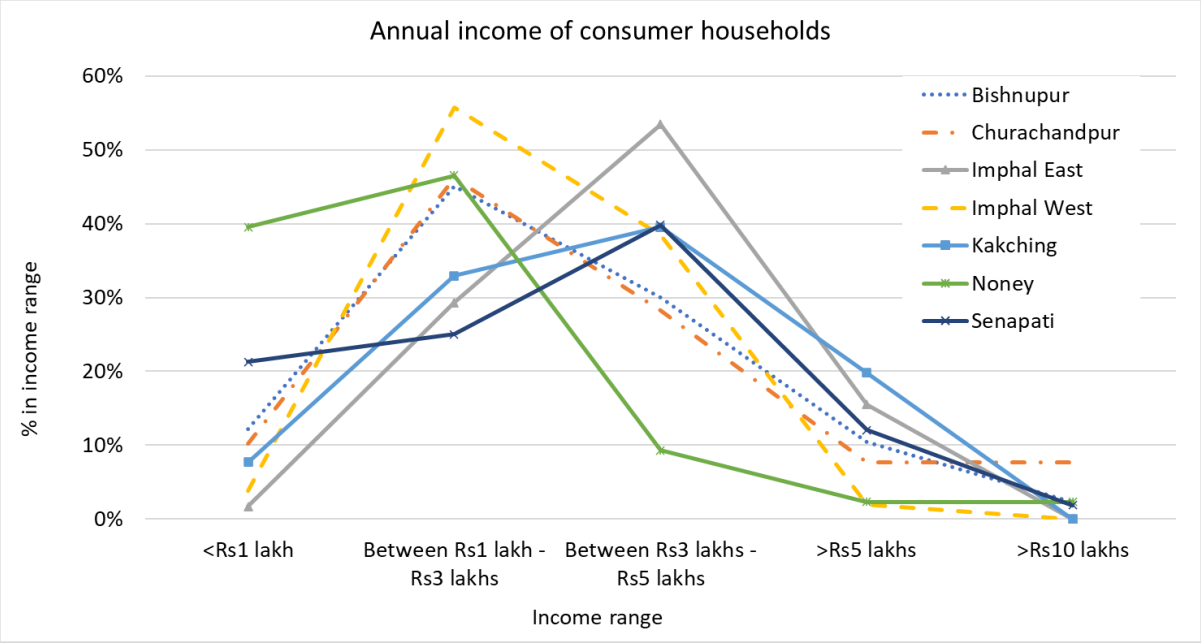



Figure 90: Household income of the consumers surveyed

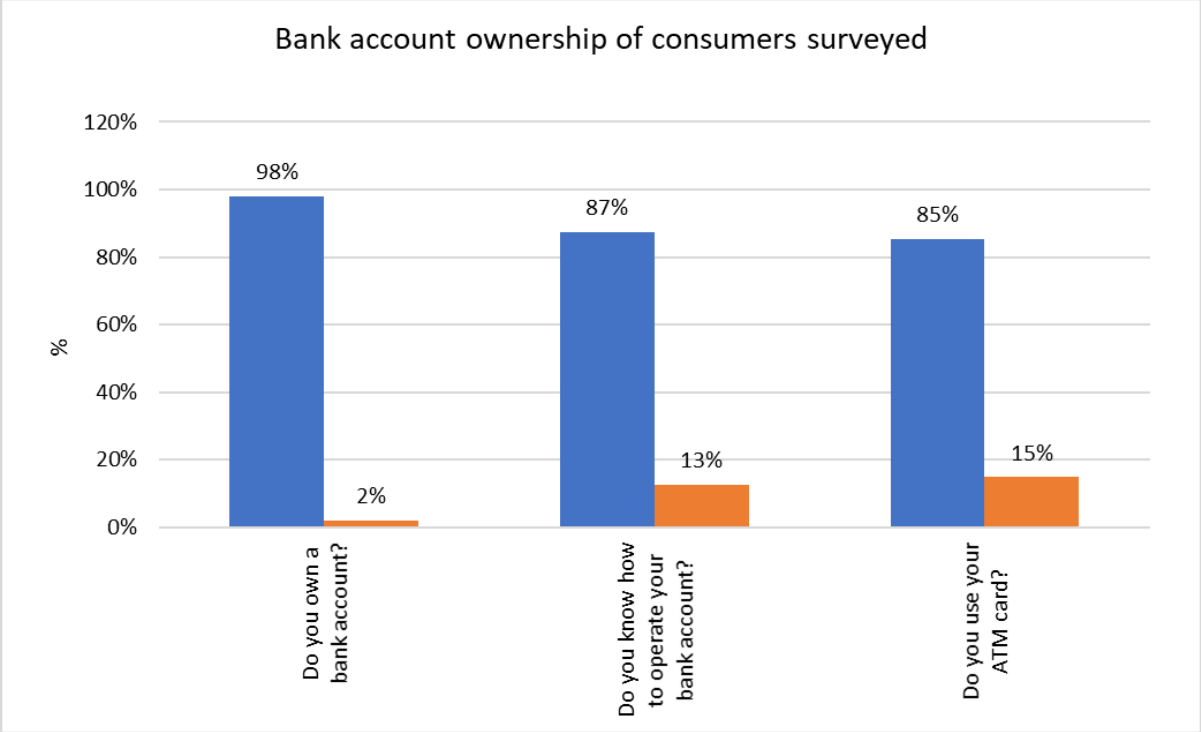



Figure 91: Bank account ownership of consumers (Blue = Yes; Orange = No)

### 3.4.2 Consumer dynamics

Consumers were asked questions about their consumption habits and it revealed that many of them consumed at least a few kilos of the primary crops on a weekly basis in their households. Banana is the one exception where it appears that people in Noney District, home of many banana plantations consume banana in large quantities, some reporting as much as 21 kilos a week (figure 92). Consumption is normally as fresh fruit or cooked or as chips and fried dishes.

In terms of the time period over which the produce are consumed, one can see a clear trend between seasonal trends such as cucumber, kiwi, watermelon and pineapple which are generally consumed for a few months while crops like banana, chives and tomato are consumed for 40 weeks or so of the year (figure 93). Most Manipuri families use chives and tomato in their cooking while banana is a major part of any religious activity thus leading to their constant demand. Manipur's diverse agroecological landscape and favourable climate also mean the crops could be produced more or less throughout the year.

When enquired about where they sourced their produce from, there were overlapping sources but a huge majority, 63% on average across all districts, said they sourced from the markets and this has been broken down by district in figure 94. During Covid, when the main markets were closed or only partially open, there was a mushrooming of small traders who would sell horticultural produce in small corner stores and the likes in the locality. These came up 43% of the time on average during this enquiry while 11% said they also had their own vegetables farm.

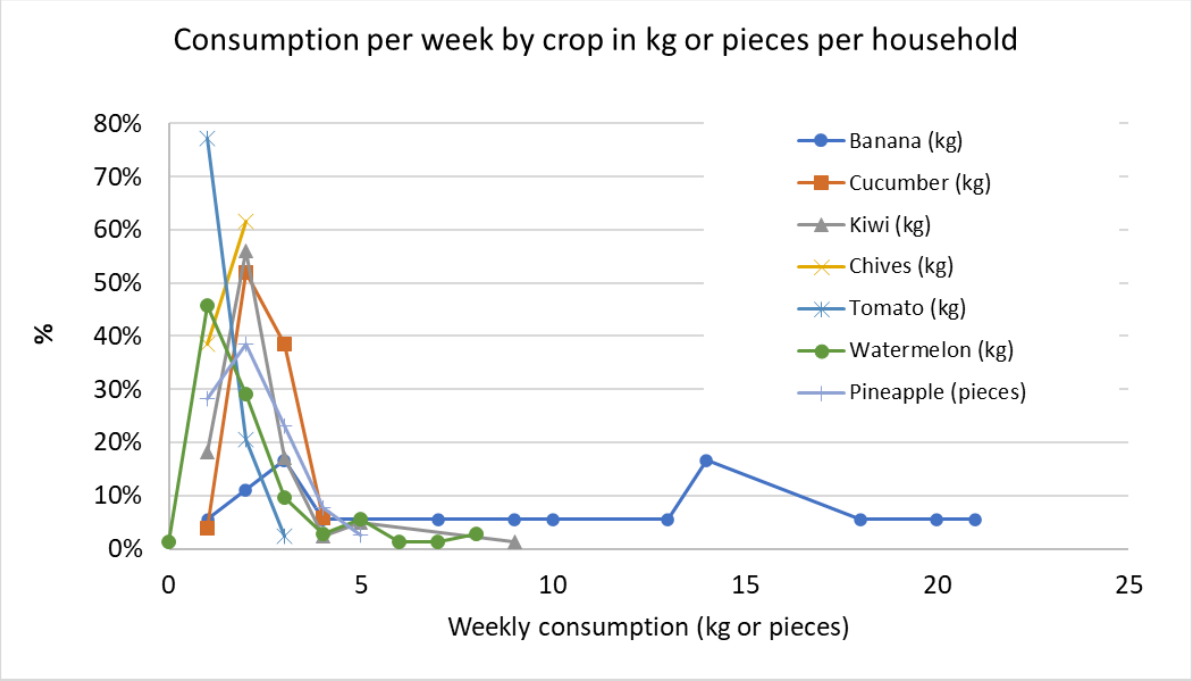



Figure 92: Weekly consumption of the crops

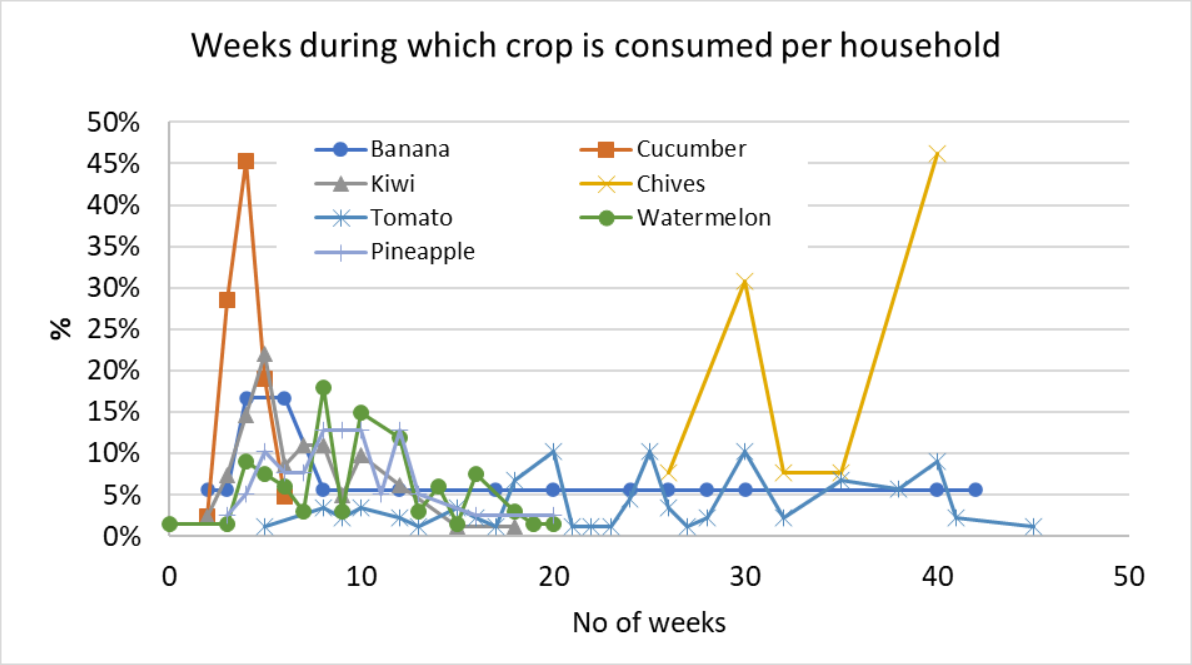



Figure 93: Duration of consumption of surveyed crops

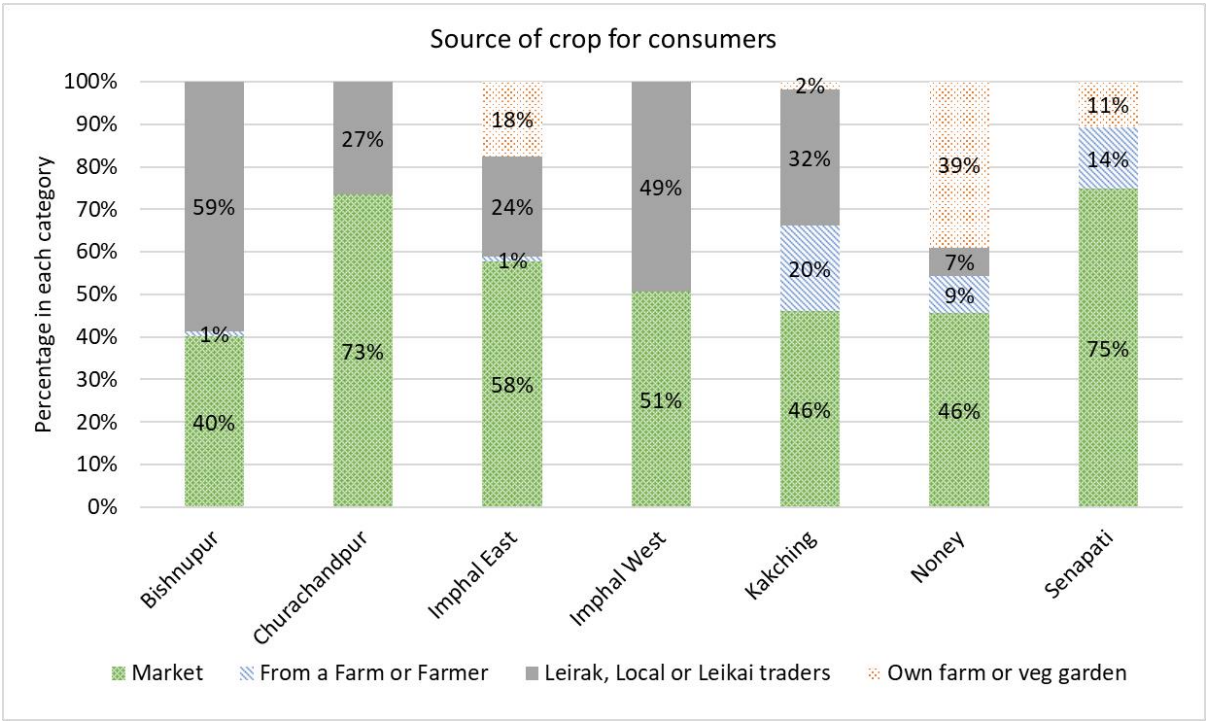



Figure 94: Source of crop for consumers

### 3.4.3 Consumer challenges

As with farmers and traders, consumers were also asked to identify the top three challenges they faced. Their top challenges have been plotted in figure 95 below and it is worth noting that a large number of them in all the districts – 59% on average across the districts – said high prices were a big issue. This is not surprising because prices of many essential commodities, fruit and vegetables shot through the roof due to limited availability during Covid. And when products were available, they were not always the best quality which is also reflected in the feedback from consumers. Another area was availability when consumers wanted the product. Part of this is due to the seasonality of the crop however lack of proper storage for extended shelf life is also a critical issue.

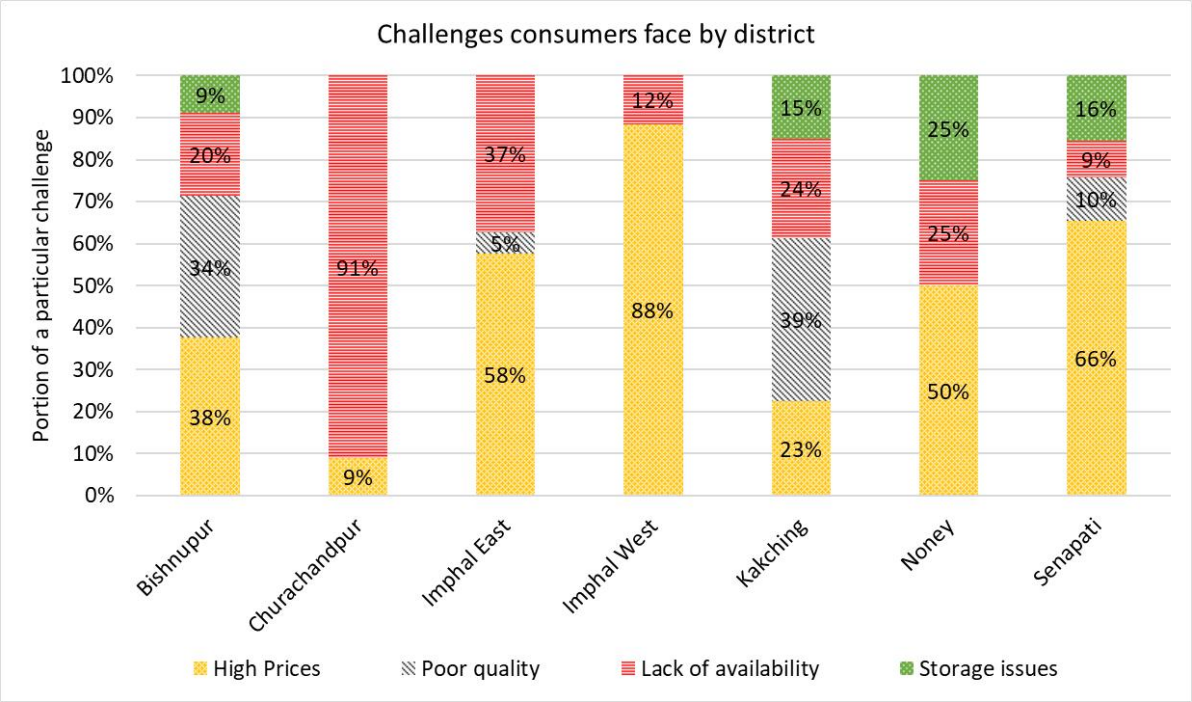



Figure 95: Challenges highlighted by consumers during the many surveys

### 3.4.4 Cost of consumption analysis

The most expensive crop in Manipur currently is kiwi which is a relatively new crop and can cost a consumer as much as Rs200/kg. All the other crops are in the range of Rs10/ kg to Rs90/ kg (figure 96).

Consumers were also asked to name the months when they most consumed a produce. These were then plotted to obtain a picture of the seasonality of the crops which, as one might expect, ties in relatively well with the seasonality chart plotted based on the responses from the traders in **section 3.2** (figure 97).

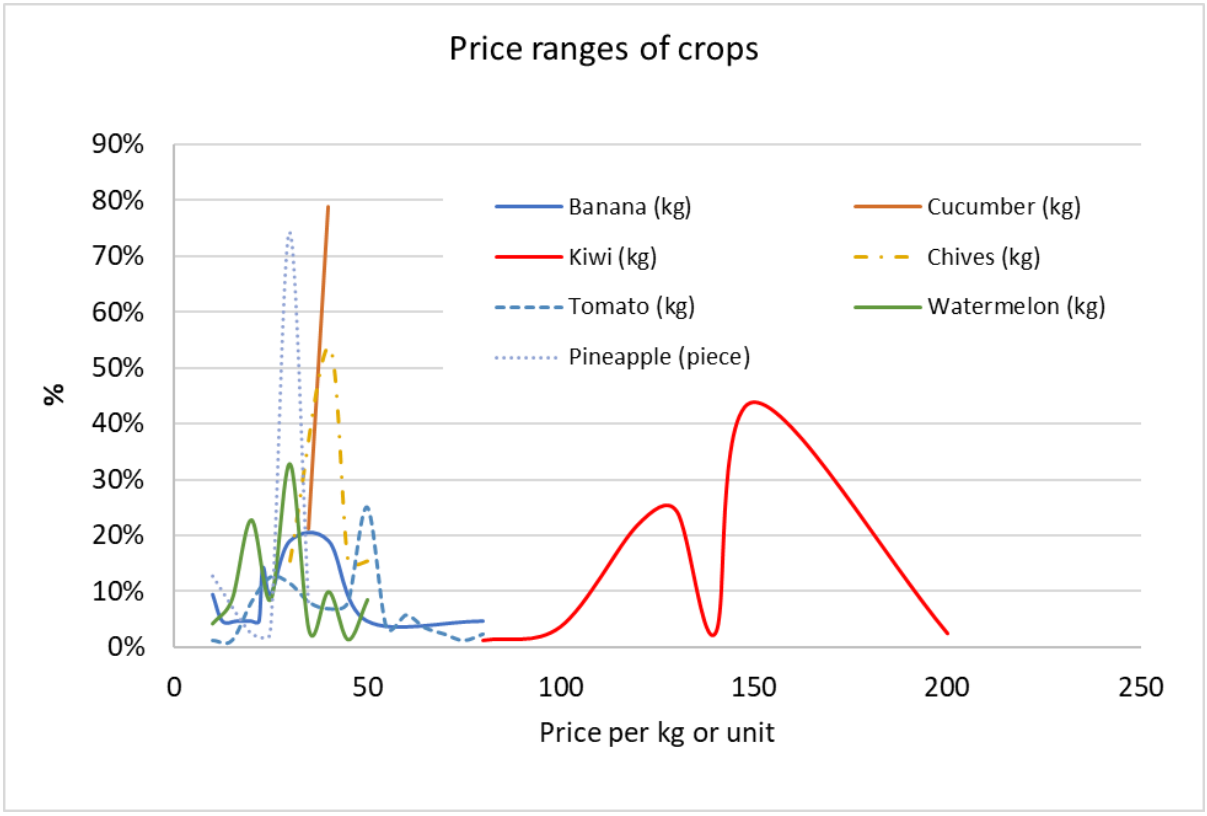



Figure 96: Cost of produce bought by consumers

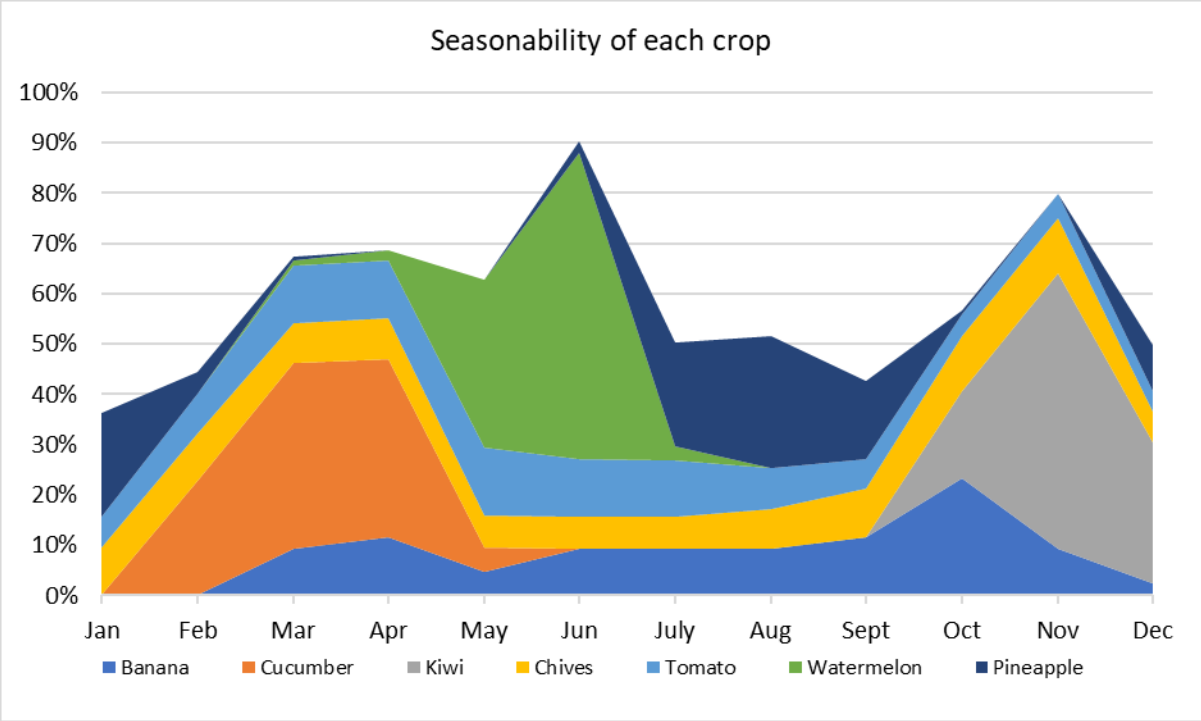



Figure 97: Seasonality of crops based on consumer feedback

### 3.4.5 Insights into the health of consumers

In the same manner as for farmers and traders, consumers were also asked to rate their own health. Only a tiny fraction reported being of poor health with most considering themselves as in good, very good or excellent health (figure 98). It is quite likely that this higher percentages are linked to consumers being better educated, more affluent and having greater access to healthcare independent of the district where they may be based. Their responses to specific health questions have been plotted in figure 99.

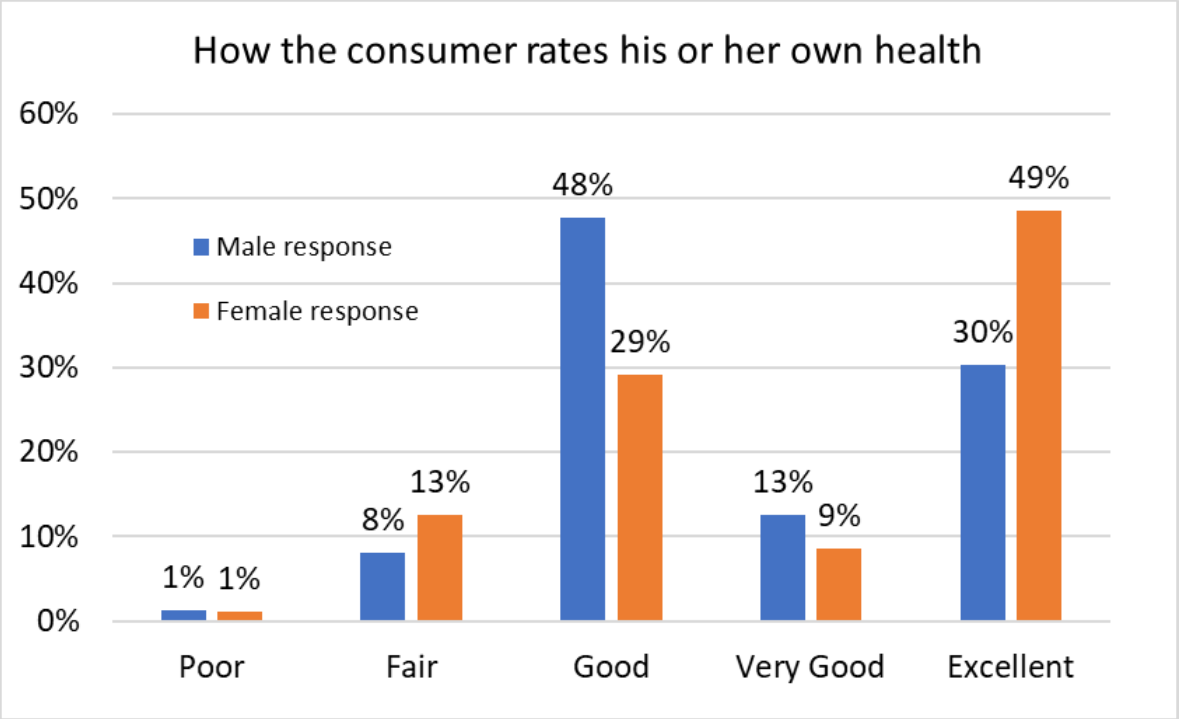



Figure 98: General health assessment of consumers

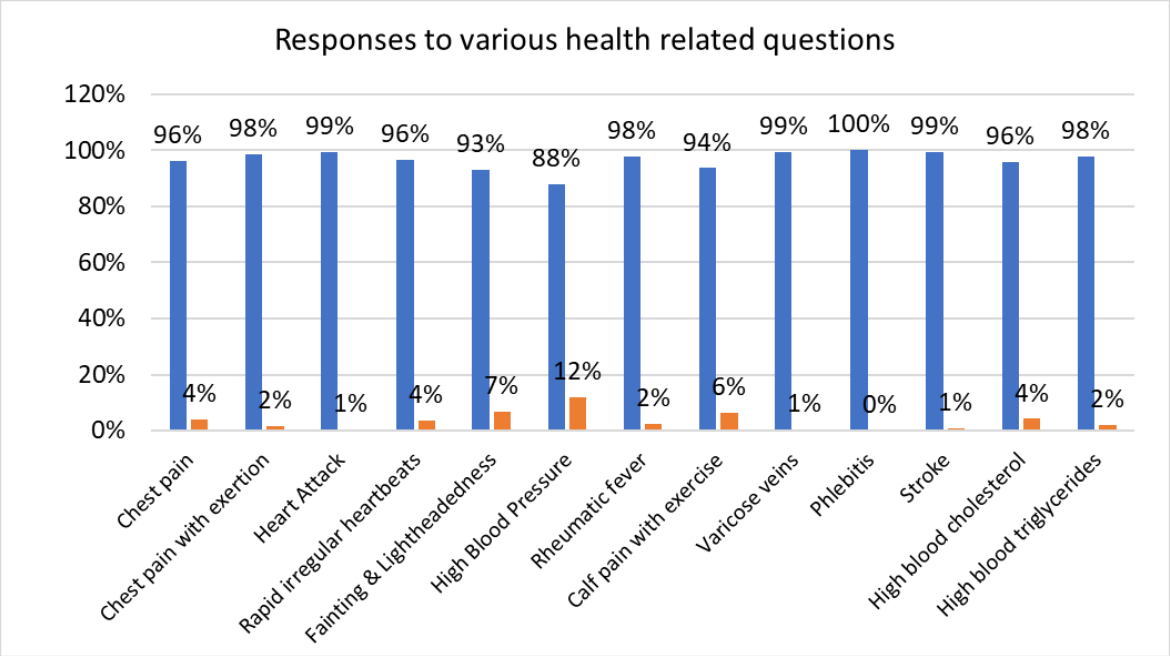



Figure 99: General assessment of consumers on specific health topics

Most consumers also paid for their own healthcare continuing a trend seen across all the segments interviewed as shown in figure 100.

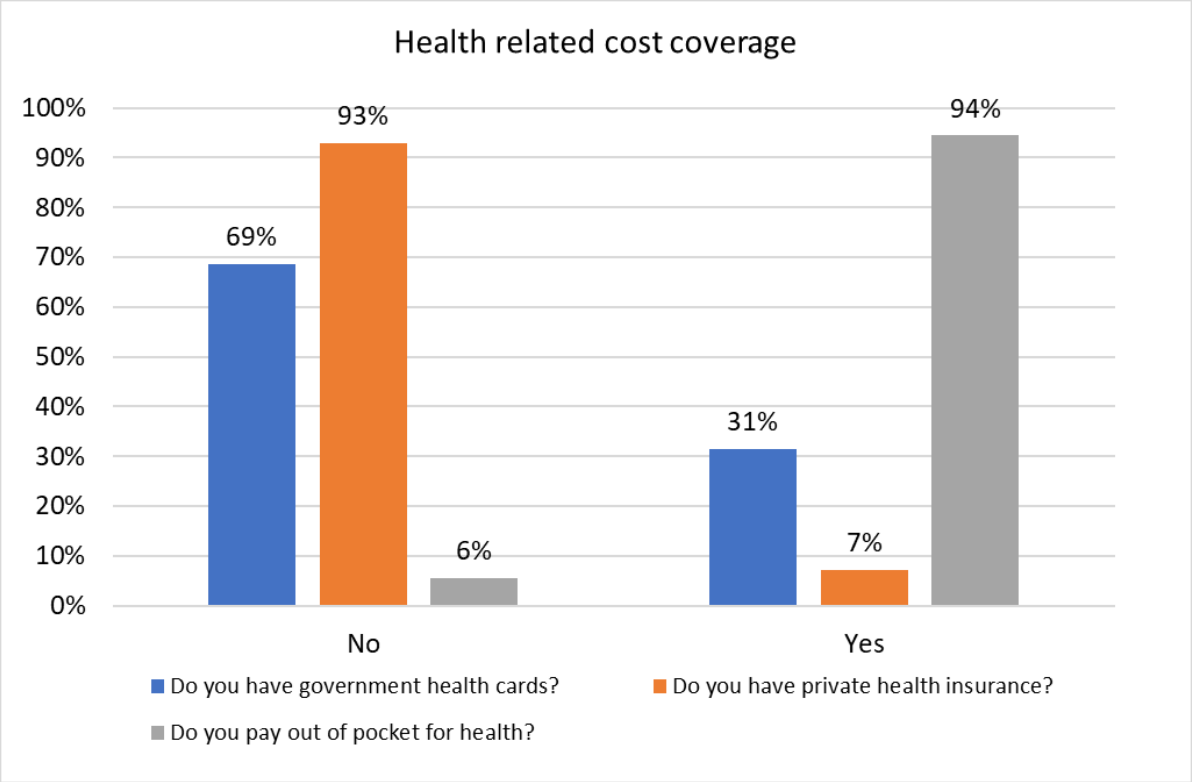



Figure 100: Health costs of consumers

# Chapter 4

# Impact of Covid

## 4.1 On farmers

Farmers rely on selling their harvested crops as a main source of income for their household. As this value chain study was carried out primarily during the peak and many lockdowns of Covid-19, the most significant impact has been on the loss of business i.e., the farmer's ability to sell his or her outputs due to lack of traders/ buyers, and transportation. Covid impacted sales in all the districts except Imphal West and Senapati where farmers seemed to have fared much better than their counterparts elsewhere (figure 101). Furthermore, 43% of all farmers reported Covid affecting their health to a large part, 81% of which was related to mental health (stress, anxiety, general worries, etc.). As expected, the repeated lockdowns also affected the social life of farmers whose daily social routines were disrupted. Such social gatherings are also an opportunity for farmers to interact with one another on the latest farming issues, market opportunities, and help each other out. However, when the gatherings are restricted, it leads to a further gap in information and knowledge sharing further leading to anxiety and worries.

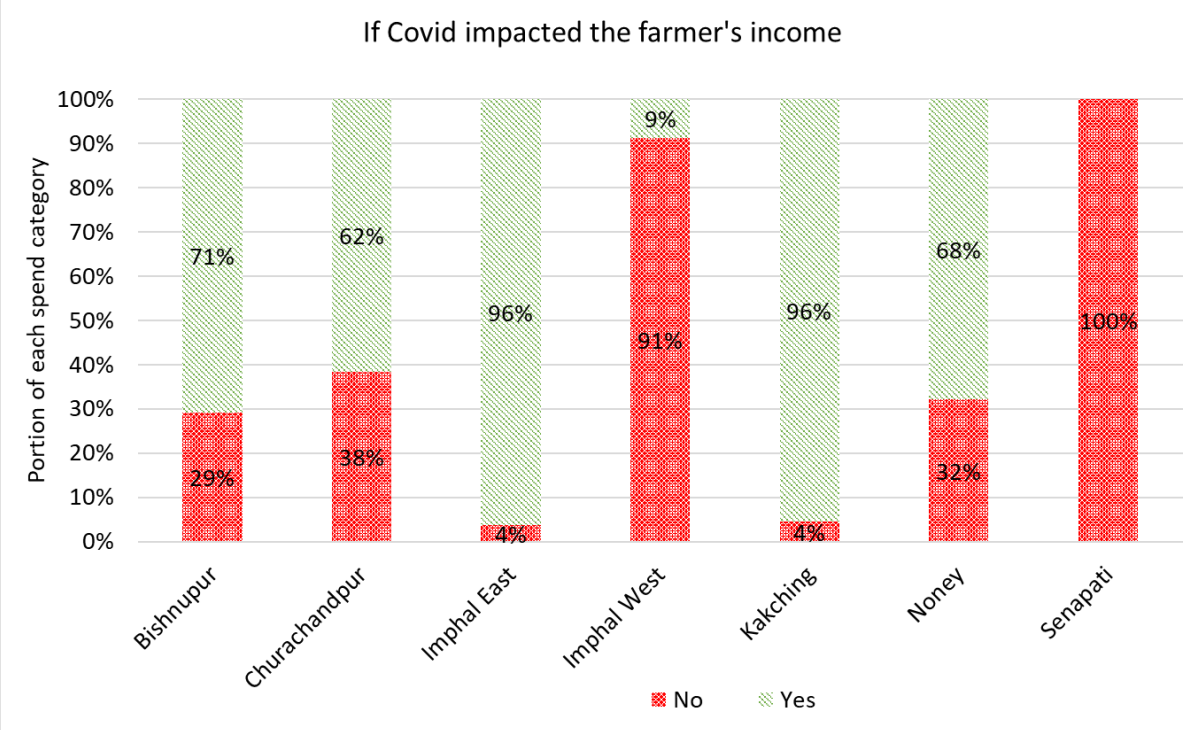



Figure 101: if Covid impacted the income of farmers by district

Farmers also reported on a large scale (80%) that they received various forms of support during Covid as shown in figure 102. This could be in the form of rice distribution by the local clubs, volume procurement by NGOs and youth organizations from other districts and so on. The ease with which farmers were able to sell their harvest was also assessed by asking farmers to rate from 1 (easy) to 10 (difficult). This assessment showed that most farmers found it relatively easy to sell their produce with about 10% finding it relatively difficult to sell

their harvested crops. This is shown in figure 103. It must be noted though that cucumber farmers in Imphal West reported having relatively more difficulties selling which we believe is an impact of the lockdowns and lack of transportation however this did not seem to affect their income levels as already shown in figure 101.

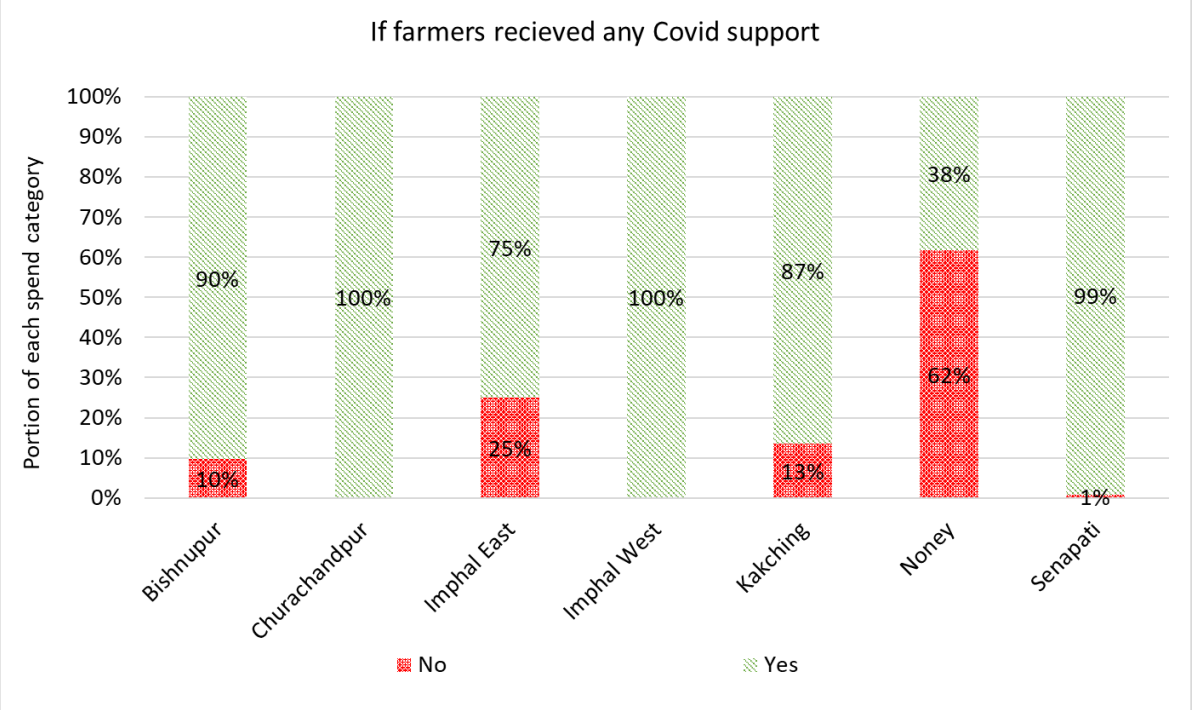



Figure 102: Support received by farmers during Covid

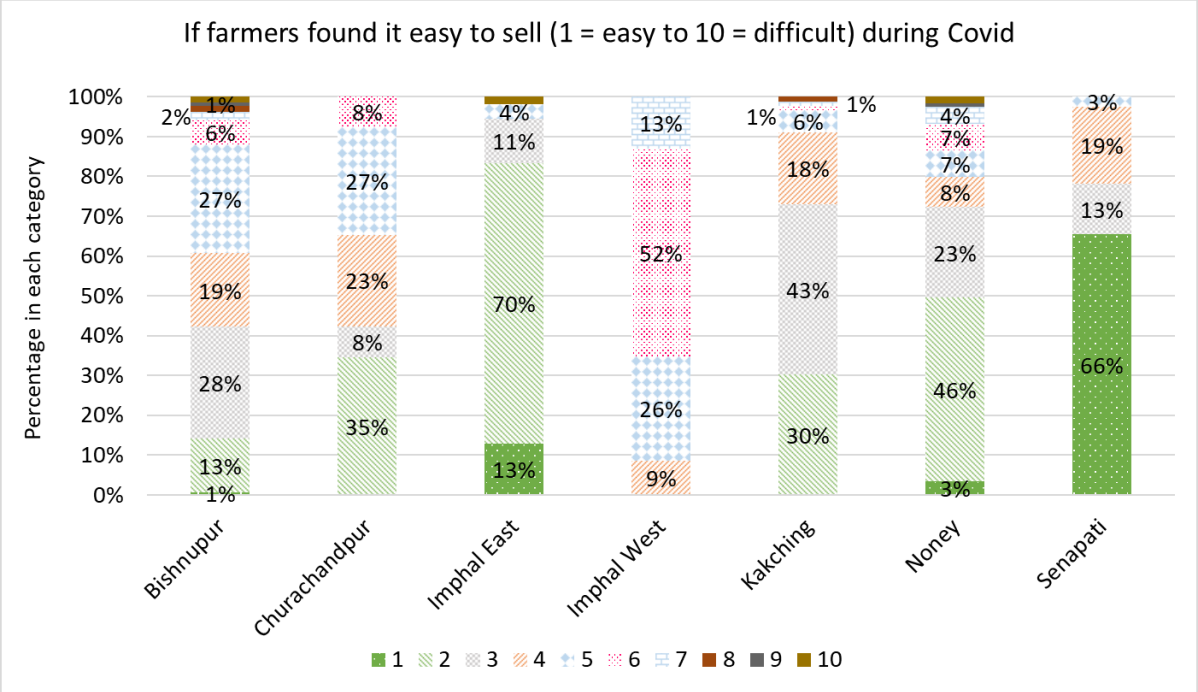



Figure 103: Assessment of ease of selling

Being farmers and based in rural areas where there is a relative abundance of land where they can grow their own food, only a small % of farmers (5%) reported not having enough food as shown in figure 104. However, 64% of the farmers overall reported struggling to secure inputs for their production but there were significant differences by district as a large majority in Imphal West and Kakching did not have these issues (figure 105). Why exactly this was the case is unclear but it is quite possible that inputs retailers had stock and farmers were still able to contact them and secure supplies. In most of the districts except Kakching, a large majority of the farmers reported that labour cost did not go up during Covid (figure 106). There could be two main reasons for this; in urban districts like Imphal West and Imphal East, farmers were mostly reliant on their own labour so they did not have to depend on hired labour as much while in rural areas, the impact of Covid was reportedly minimal with many of them not having to go through the stringent lockdowns experienced by more populated urbanised districts.

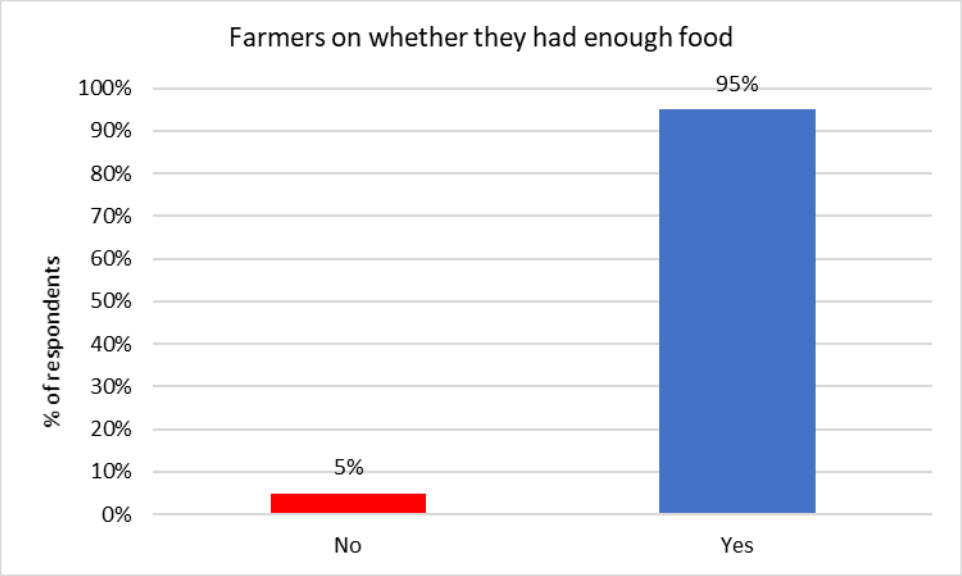



Figure 104: Availability of food for farmers

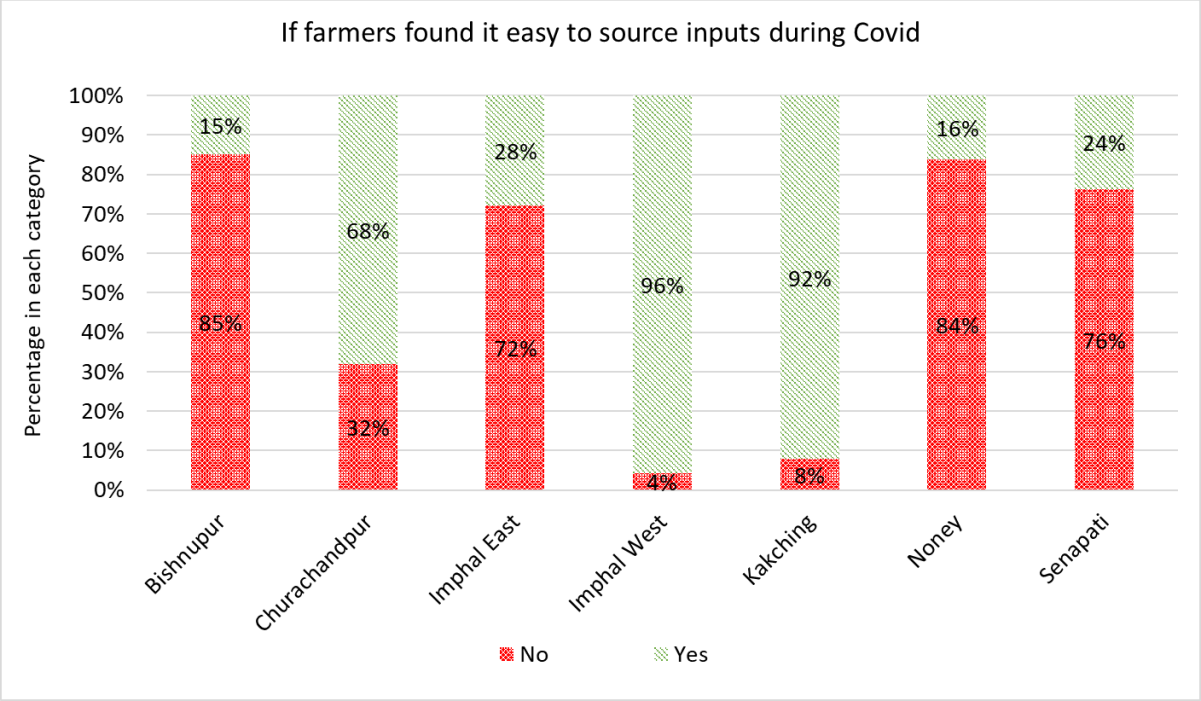



Figure 105: Assessment of ease of sourcing inputs for production

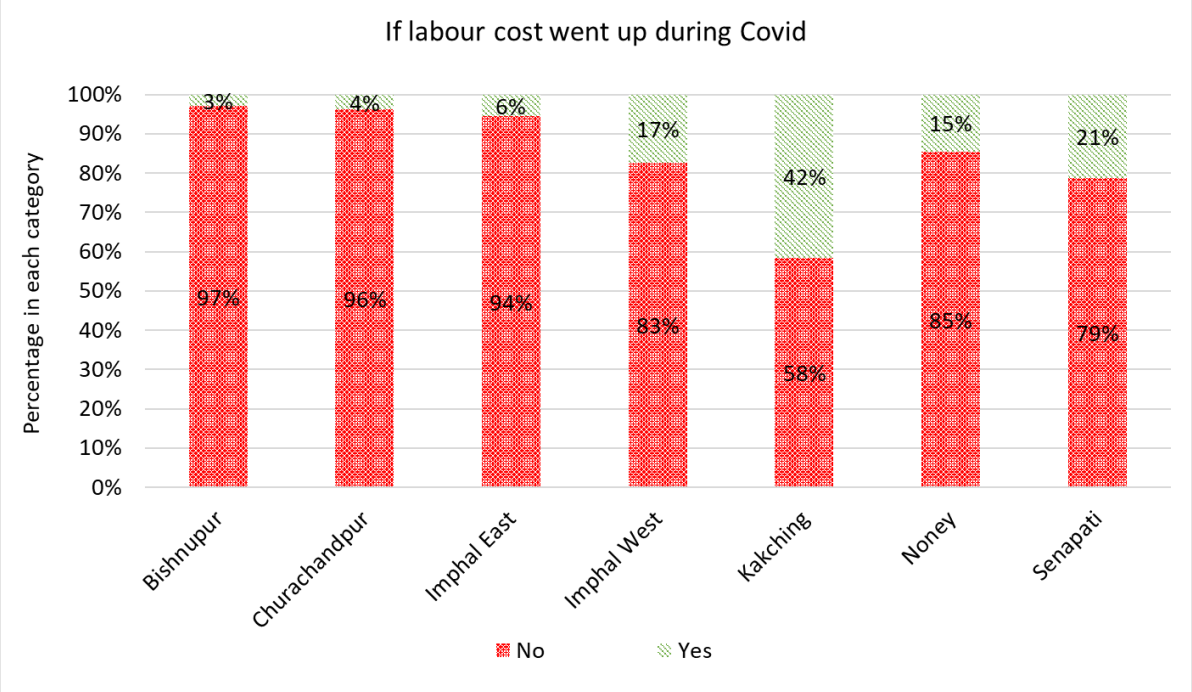



Figure 106: Assessment of labour cost of farming

## 4.2 On Traders

The impact of Covid on traders, who earn their livelihoods by buying and selling farm products, is more profound than those experienced by the farmers. While 28% of farmers reported their business suffering a loss, a much larger 44% reported suffering losses due to Covid (figure 107). A similar % of traders, 35%, reported health concerns to farmers, 37%. Again, a large 74% of the health concerns reported were mental health issues such as stress, anxiety, and distress.

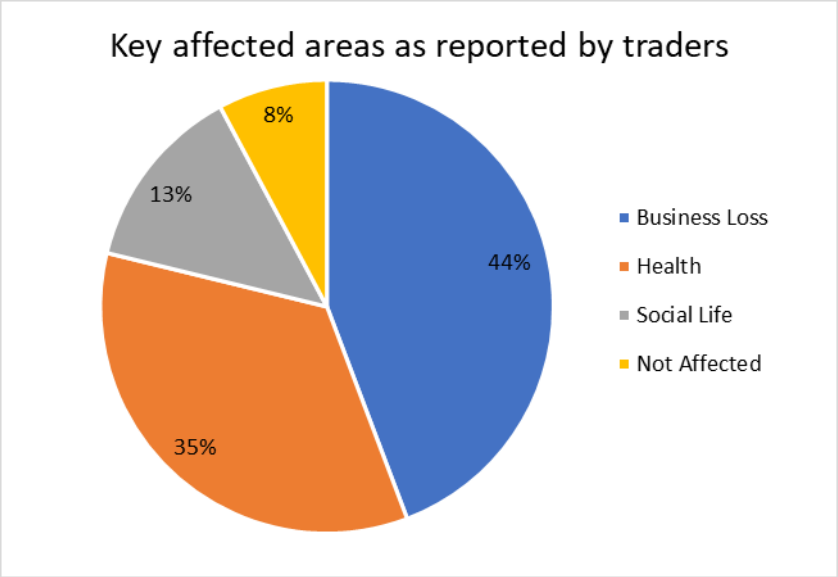



Figure 107: Areas most affected by Covid for traders

At the district level, over half of the traders in Imphal West and Senapati districts did not see an impact on their income level because of Covid. For the remaining districts, close to 90% or more of all traders reported that their income levels were affected by Covid. Despite the lockdowns from Covid, agricultural traders were allowed to move around and sell in markets that were open at specific times. It is possible that traders in Imphal West took advantage of this and passed on any extra costs they incurred to the consumers. Same could be said for other districts too however the big difference is that Imphal West is a highly populated and fairly urbanized district so traders do not have to travel far between sourcing and selling while traders in remote districts would have had to deal with lack of transportation, lack of clarity of when markets were open as government orders were coming out frequently and so on. In the case of Senapati, because of its remoteness and the fact that kiwi is a novel produce that is in demand, traders in Imphal and other towns connect with farmers and local traders to come and collect once they have identified a market. With the farm-to-market chain connected and organizations like the Manipur Organic Mission Agency (MOMA) making committed purchases, it is less likely that traders would be affected.

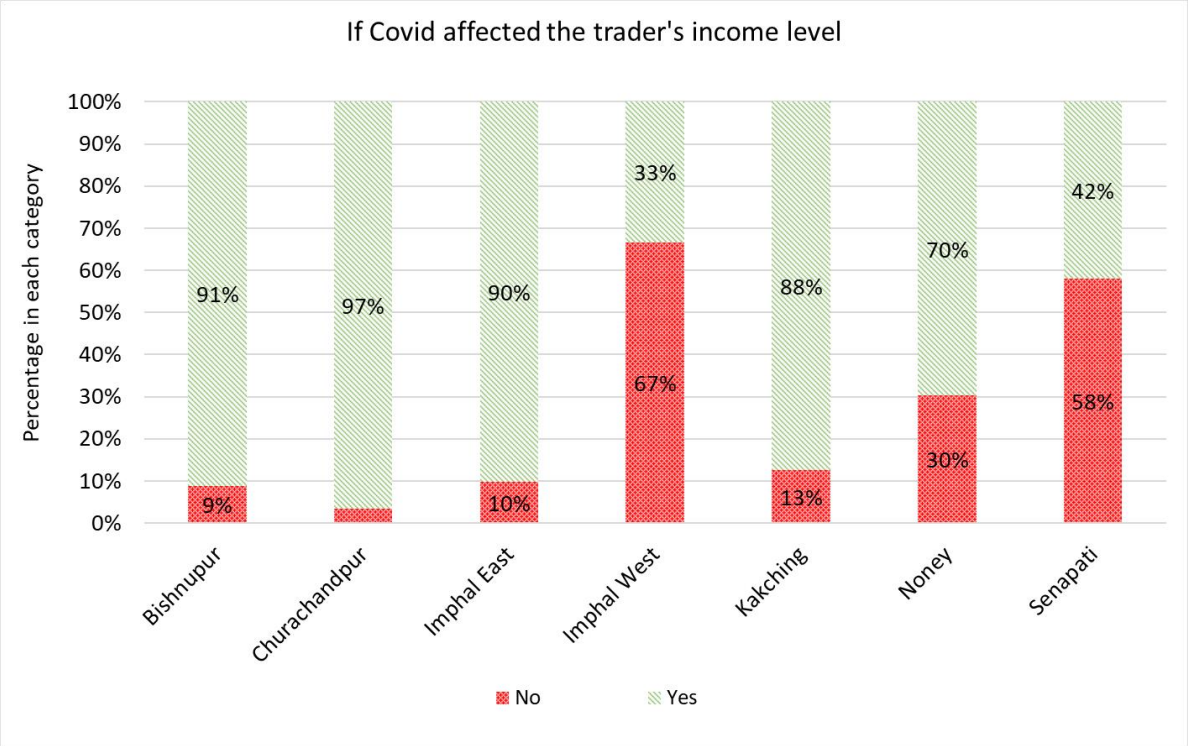



Figure 108: Impact of Covid on the income of traders

76% of traders (figure 109) also reported receiving some form of support during Covid which is also likely to be the services of the local clubs, elected officials and volunteer NGOs. An interesting observation is that a large number of traders (87% below 4/10 in difficulty level) did not have much difficulty in selling their products and this has been broken down by district in figure 110. A major factor here may be that markets were only open for specific hours during the lockdowns and with the limited supply of goods, many consumers were out buying in bulk enabling brisk business for most of the traders.

Picture 21: A trader in the hills waits for customers

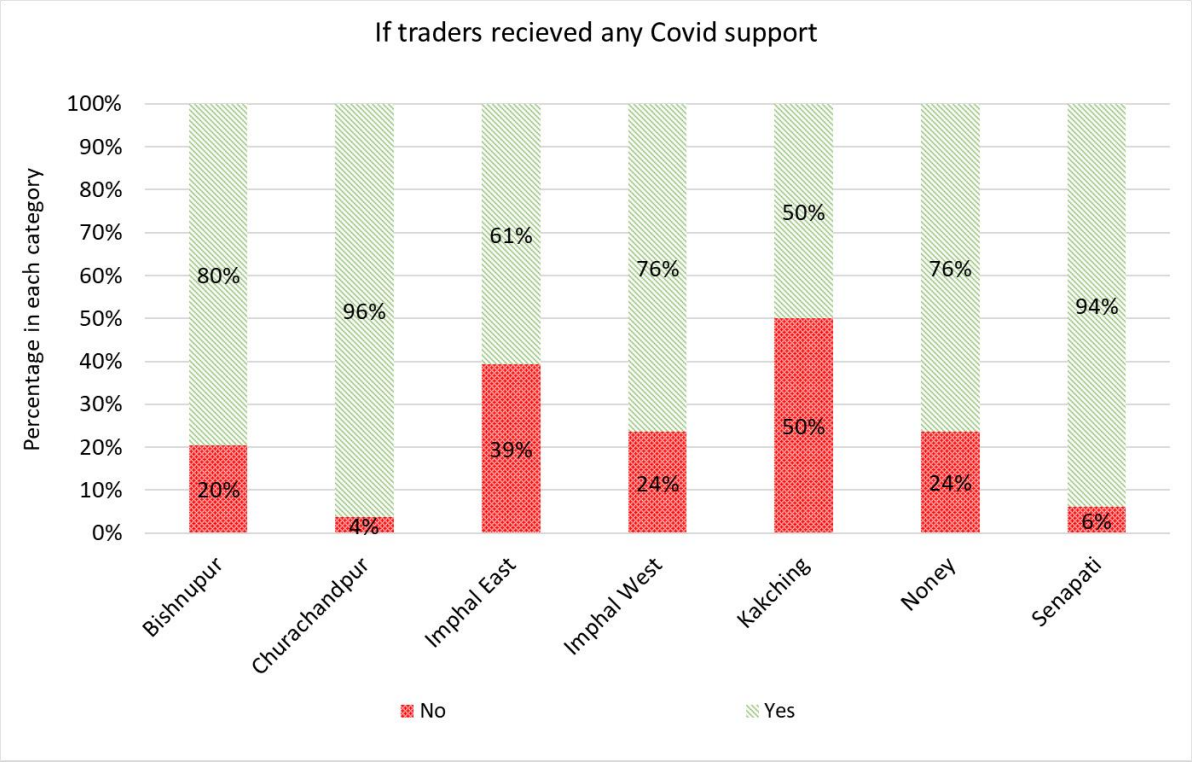



Figure 109: Support received by traders during Covid

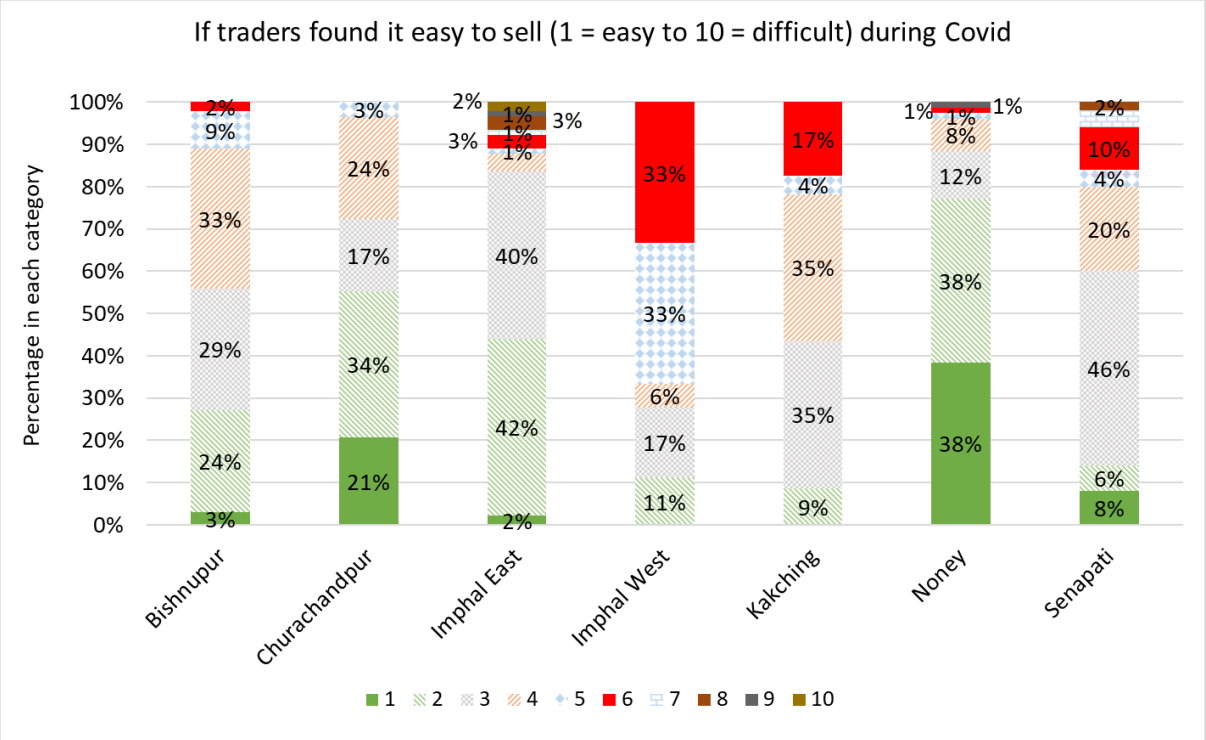



Figure 110: Assessment of ease of selling

Traders in all the districts except Churachandpur reported significant problems in sourcing primarily due to the lack of transportation during lockdowns, restricted opening hours, and

inability to organize farmers in common places of sourcing for those who buy directly from farmers or from marketplaces for those secondary traders who buy from wholesalers at strategic market places (figure 111). As to why traders in Churachandpur, Imphal West and Kakching found it much easier compared to other districts, it could be because of better coordination between farmers and traders and easier access to densely populated areas like Imphal and Churachandpur.

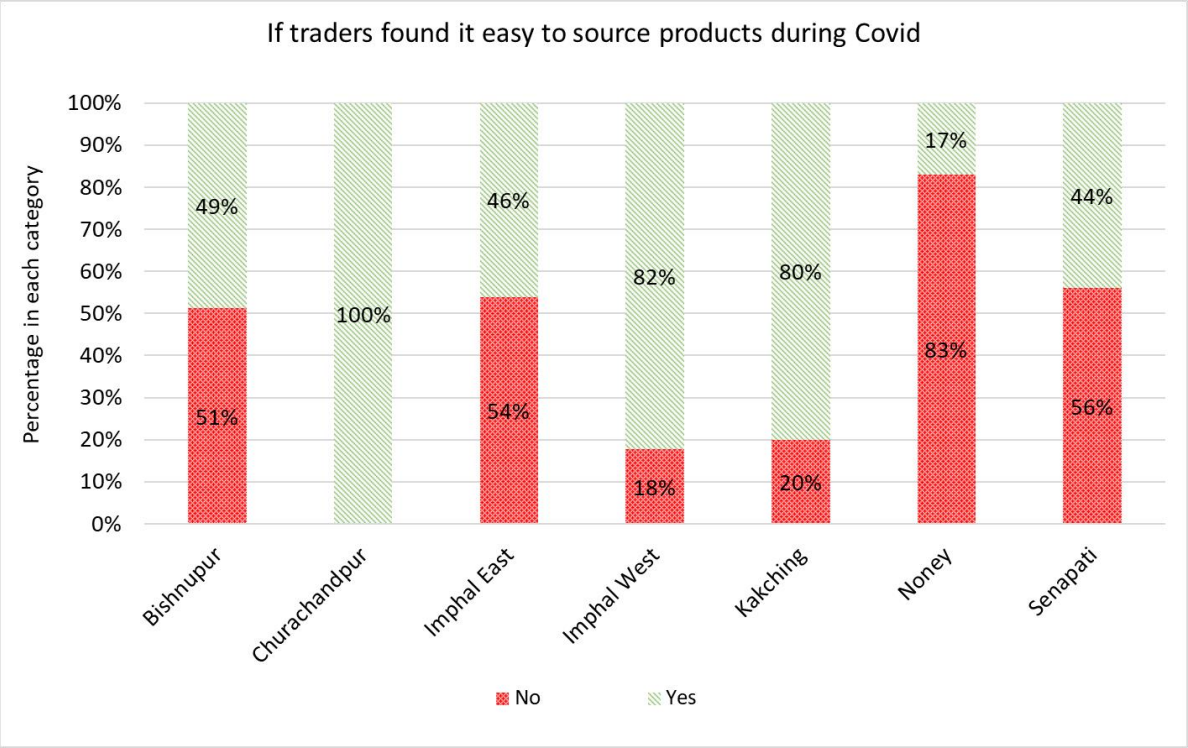



Figure 111: Assessment of ease of sourcing items for traders

Like farmers, traders also saw an increase in the cost of doing business during Covid though this varied quite tremendously by district with many traders in districts like Churachandpur, Senapati and Kakching experiencing a cost increase. At the same time, a large majority of traders in Bishnupur, Imphal East, Imphal West and Noney did not see an increased cost. The increase in cost could have been driven by the fact the constant lockdowns meant labour was not easily available if they had to come from out of town though it would require a further deep dive into the subject to fully understand the differences between the districts (figure 112).

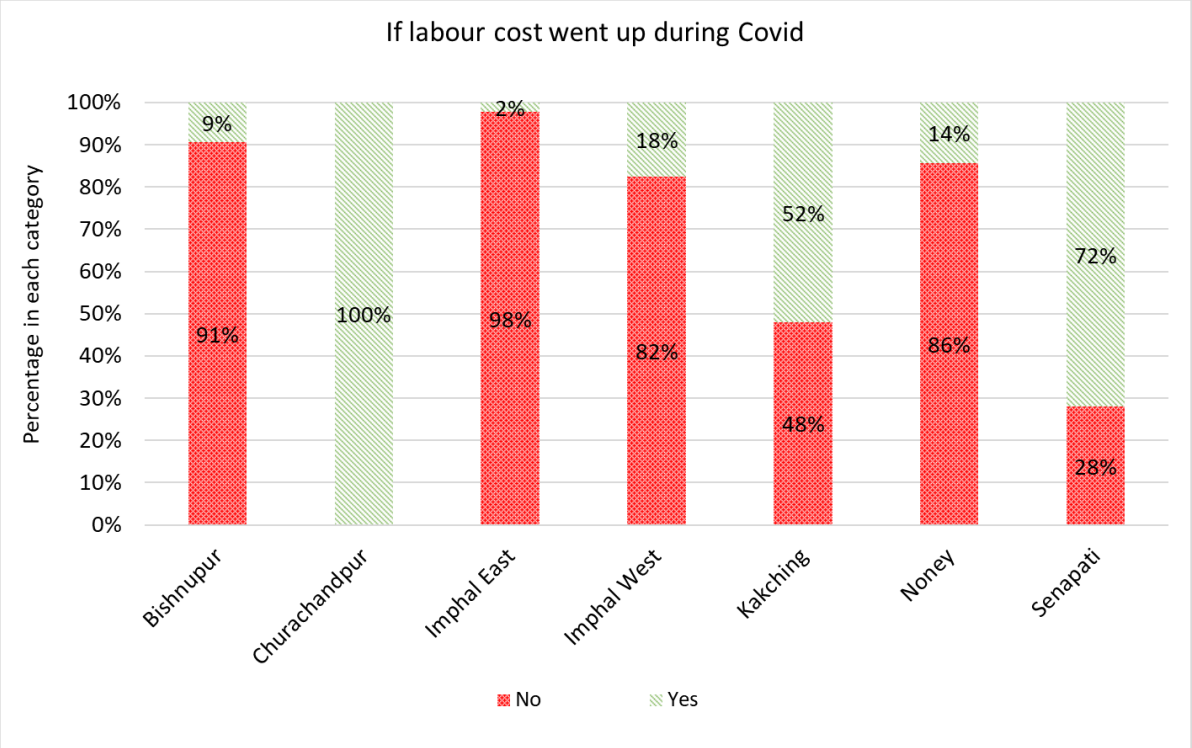



Figure 112: Assessment of increase in cost of trading

Picture 22: A trader in Imphal valley preparing veg for a waiting customer

### 4.3 On Consumers

Unlike farmers and traders, only a single digit percentage (9%) of consumers saw a drop in income during Covid (figure 113). This could be primarily because many of interviewees were in urban areas where employment is mostly in the public sector which did not cut salaries during Covid. The ones who did see reduced incomes were in the private sector who relied on being able to go to work to earn an income. However, a much higher number of consumers (45%) reported health issues, many of whom reported mental health related symptoms (83%).

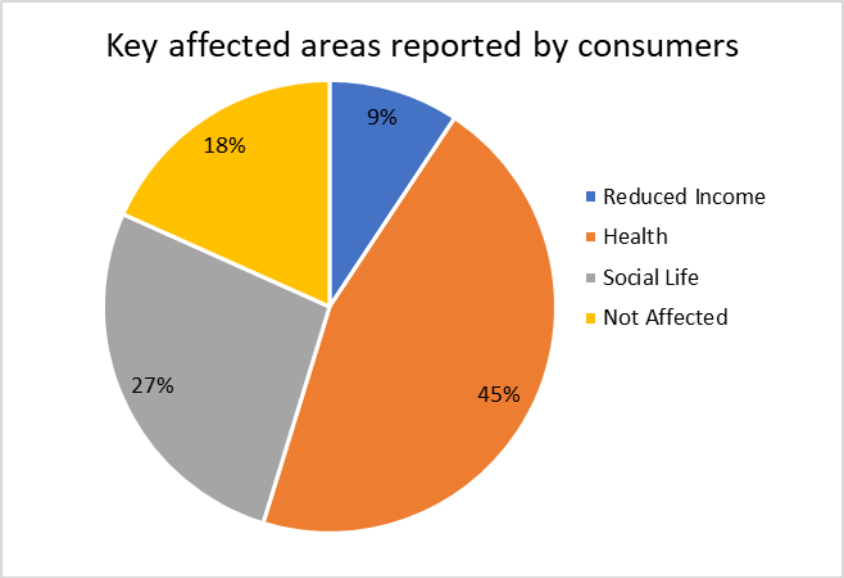



Figure 113: Areas most affected by Covid for consumers

Like farmers and traders, most consumers surveyed except in Imphal East also received support during Covid such as the distribution of free rice to every household as well as fruits and vegetables by social workers and NGOs (figure 114). Building up to the state assembly elections, it was also a time when many intending candidates and social workers took it upon themselves to procure fruits, vegetables and rice on their own and distribute within their communities.

Consumers in all of the districts did report difficulties in accessing food products (figure 115) which, as mentioned before, can be related to the limited hours during which markets were open during Covid, and the limited presence of traders in the marketplace. It would require further data gathering and analysis to understand why a large majority of consumers in Kakching reported difficulties in accessing food. A possibility is that they relied on markets in Imphal which would have created issues with lack of transportation to reach within the restricted opening times. All the other districts except Imphal West being rural, consumers were able to buy food locally while those in Imphal West were able to access main markets whenever they were open as these were all within a short distance.

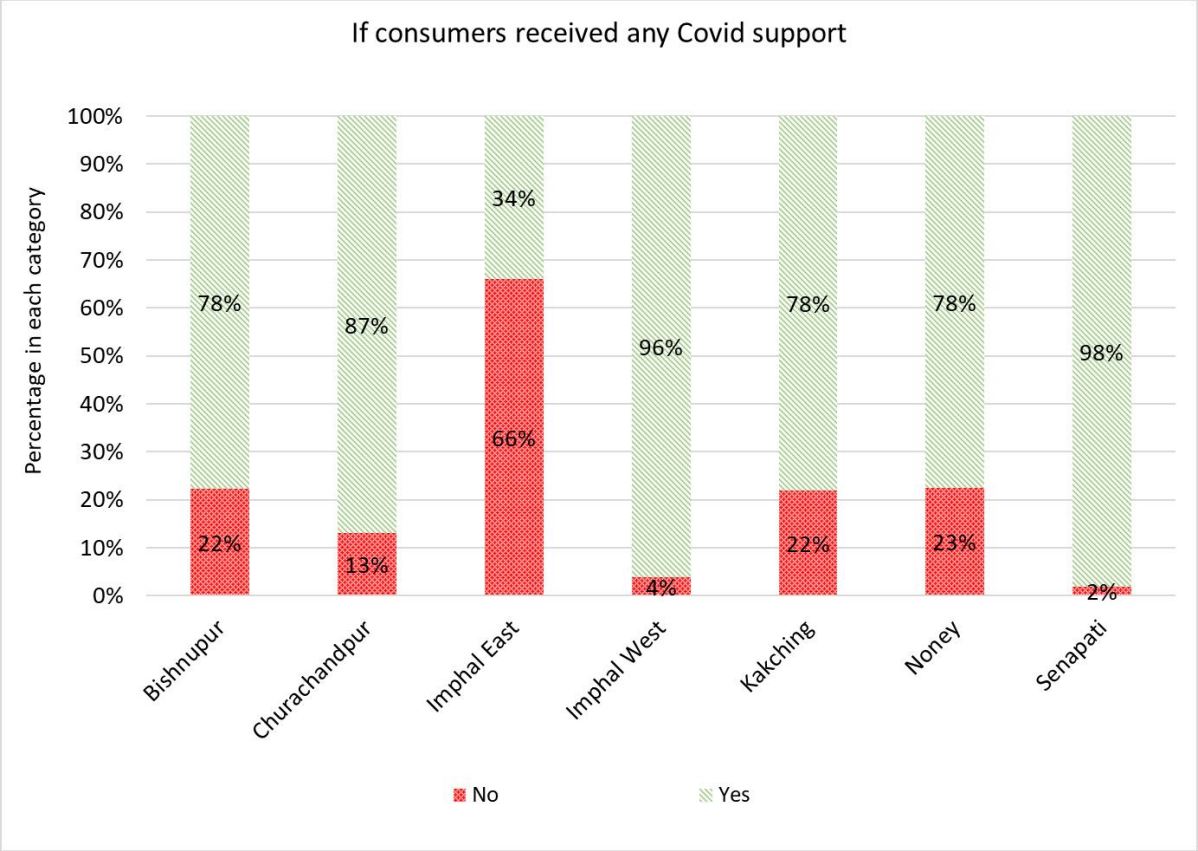



Figure 114: Support received by consumers during Covid

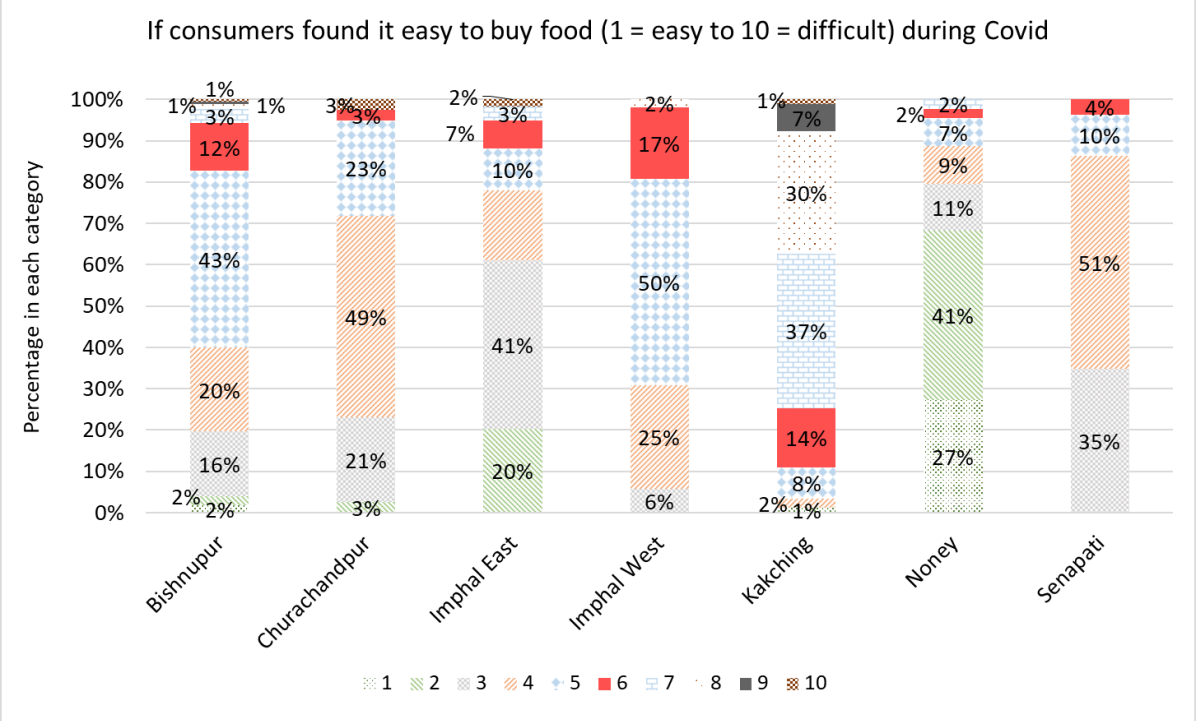



Figure 115: Assessment of ease of buying food

A large 84% of consumers also reported price rises though it appears that Bishnupur district was the least affected (figure 116). This was driven by the constant lockdowns and lack of traders and marketplaces. Consumers were also asked to provide an estimate of the price increases they experienced; this worked out to an average of 28%.

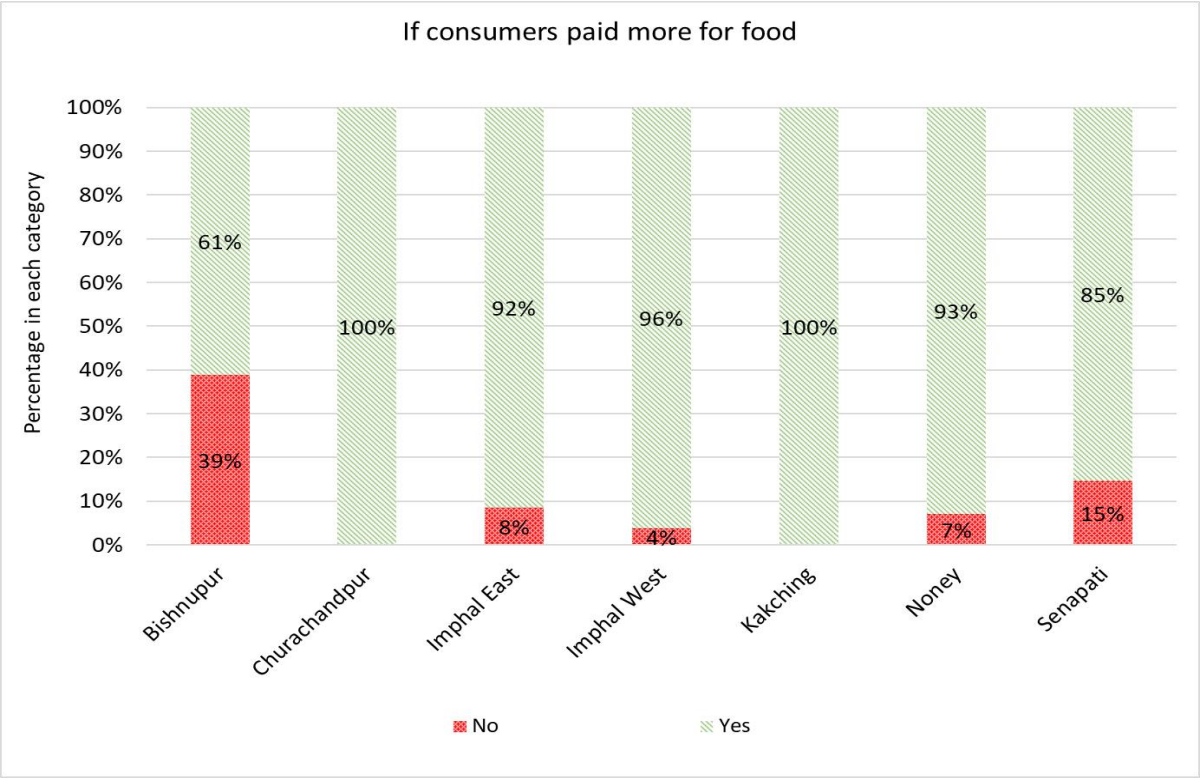


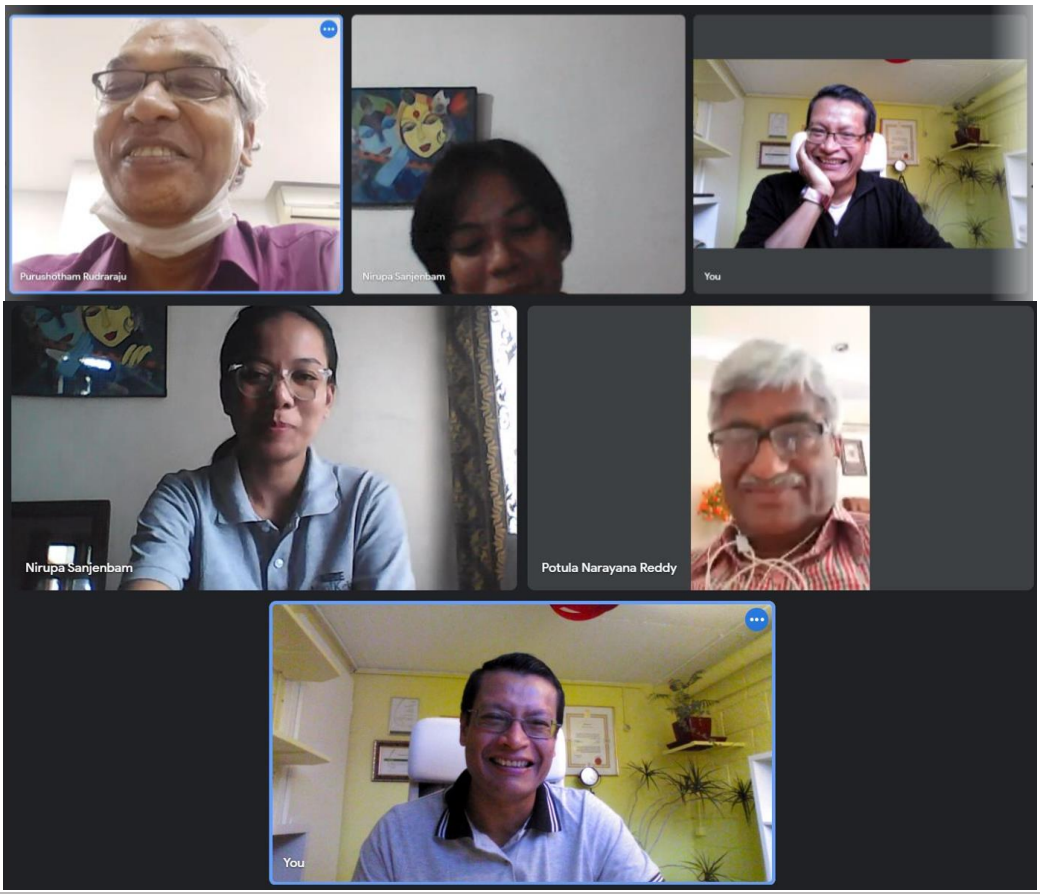

Figure 116: If consumers paid more for food by district

# Chapter 5

# Summary, Recommendations and Investment Areas

## 5.1 Crop Programs

Following the findings of various pest and disease issues during the surveys, MaolKeki Foundation reached out to various professionals namely Dr. Purushotham Rudraraju at ICRISAT, Prof. Narayana Reddy from the School of Agricultural Sciences at Anurag University, and Dr. Irengbam Meghchandra, Joint Director of ICAR Manipur, to name a few. They provided some guidance and reference materials which enabled our in-house technical person, Mr. Surjeet Luwangcha, to develop a range of crop programs for the key crops using also his deep practical knowledge of the crops. Additional support was sought from IPL Biologicals whose technical team helped to put together a variety of biological crop programs for the key crops.




Picture 23: Video calls with advisors to the study

The various crop programs have been shown in the following charts. The products listed are only examples of locally available ones. MaolKeki Foundation does not endorse them in any way while the images are our own, or from our partner Syngenta Foundation India or various sources as mentioned and used in the public interest of farmers.

# Banana

MaolKeki Foundation

| | | Months 0 -3 | Months 4 - 6 | | Months 6 - 8 | Months 9 - 10 | 10 Months onward | Dose |
|---|---|---|---|---|---|---|---|---|
| Category | Pests/ Dieseases | Nursery/Transplanting | Vegetative | inflorescence emerges | Flowering | Fruiting | Harvesting | Per 15L Pump |
| Insects/ Pests | Aphids | Actara Thiamethoxam 25% WG | Tata Reeva/ Syngenta Karate Lambda Cyhalothrin 5% EC | | | | | Thiamethoxam: 5g |
| | Lace bug | | | | | | | Reeva: 15-25 ml |
| | Banana Root Borer | Dow-Success Spinosad 2.5% EC | | | | | | Karate-15-25 ml |
| | Pseudostem Borer | | | | | | | Success: 5 ml |
| | Banana Skipper/Leaf caterpillar | | | | | | | |
| | | | | | | | | |
| Fungal Diseases | Banana Wilt/ Fusarium | Bavistin-Carbendazim 50% WP | | | | | | 20-25g/Pump |

Image source: https://www.dreamstime.com

| Crop | Top Pests | | | | | Treatment | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1 | | 2 | |
| | | | | | | Soil Application | Dose | Foliar Application | Dose |
| Banana | Banana pseudostem borer | Banana root borer | Banana skipper/ leaf caterpillar | | | kalichakra (Powder) + Daman (Powder) | 2 Kg / Acre Each Preferably At soil Preparation or up to 30 Days after transplanting - Total 4 Kg / Acre | Kalichakra L+ Daman L (foliar spray)- Liquid | 1 Ltr Each - Spray after 15 Days of Transplanting - Total 2 Ltrs |
| | | | | | | Soil Gold -Granule | 8 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Phoster - Granule | 8 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Potash Activa ( Granule) | 5 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Vam Shakti - Granule | 8 Kg / Acre - Soil Application at 25-30 DAS | | |

| Top Disease(s) | | | | Others | Treatment | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | | 2 | |
| | | | | | Soil Application | Dose | Foliar Application | Dose |
| | Panama Wilt | | | | Sanjeevni (Powder) + Phasal rakshak (Powder) | 2 Kg / Acre Each Preferably At soil Preparation or up to 30 Days after transplanting - Total 4 Kg / Acre | Bactvipe (Liquid) + Bioharz (Liquid) | 1 Ltr Each - Spray after 15 Days of Transplanting - Total 2 Ltrs |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Figure 117: Banana crop programs

# Black Rice

MaolKeki Foundation

| | | Months 0 -2 | Months 3 - 4 | | Months 4 - 5 | Months 5 - 6 | Month 6 onward | Dose |
|---|---|---|---|---|---|---|---|---|
| Category | Pests/ Dieseases | Nursery | Transplanting | Vegetative | Pinicle formation | Flowering | Harvesting | Per 15L Pump |
| Insects/ Pests | Aphids | Regent-Fipronil 5% SC | | | | | | Fipronil: 25-30ml |
| | Plant Hopper | | | Syngenta-Chess Pymetrozine 50 % WG | | | | Chess-30-35g |

| Crop | Top Pests | | | | | Treatment | | | |
|---|---|---|---|---|---|---|---|---|---|
| Black_Rice | Rice aphid | Rice hopper | | | | | | Varunastra (Liquid) + Wipe Out (Liquid) | 1 Ltr Each - Spray - At Pest Emergence - ETL - Total 2 Ltrs Repeat After 10 Days |
| | | | | | | | | | |
| | | | | | | Soil Gold -Granule | 8 Kg / Acre - Soil Application at Field Preparation | Azadirachtin - 1500 PPM | 1 Ltr Each - Spray - At Pest Emergence - ETL @ 15 Days Interval |
| | | | | | | Phoster - Granule | 4 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Potash Activa ( Granule) | 5 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Vam Shakti - Granule | 4 Kg / Acre - Soil Application at 25-30 DAS | | |

Figure 118: Black rice crop programs

# Chives

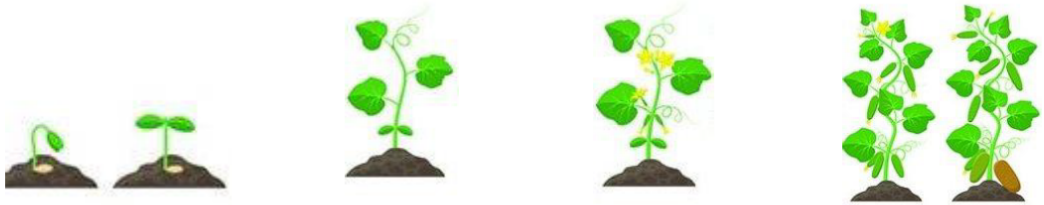


MaolKeki Foundation

| Category | Pests/ Dieseases | Weeks 0 -3 Propagation | Weeks 4 - 6 Transplanting | Weeks 4 - 6 Vegetative | Weeks 6 - 8 Maturity | Harvesting | Dose Per 15L Pump |
|---|---|---|---|---|---|---|---|
| Insects/ Pests | Aphids | Actara Thiamethoxam 25% WG | Tata Reeva/ Syngenta Karate Lambda Cyhalothrin 5% EC | | | | Thiamethoxam: 5g |
| | Thrips tabaci | | | | | | Reeva: 15-25 ml |
| | White flies | Dow-Success Spinosad 2.5% EC | | | | | Karate-15-25 ml |
| | | | | | | | Success: 5 ml |
| | Root Grub | | Profenophos 40% + Cypermethrin 4% EC (Roket-PIL) | | | | 35-40ml |
| Fungal Diseases | Fusarium | | Streptomycin+ Copper Oxychloride | | | | 45-70 gm |
| | White rot | | Seed Traetment with Carbendazim | | | | 100-150g/kg |
| | Basal Rot | | | | | | |

Figure 119: Chives crop programs

# Cucumber



MaolKeki Foundation

| | | Weeks 0 -3 | Weeks 3 - 6 | | Weeks 6 - 8 | Weeks 9 - 10 | Weeks 11 - 12 | Dose |
|---|---|---|---|---|---|---|---|---|
| Category | Pests/ Dieseases | Nursery | Transplanting | Vegetative | Flowering | Fruiting | Harvesting | Per 15L Pump |
| Insects/ Pests | Aphids | Actara Thiamethoxam 25% WG | Tata Reeva/ Syngenta Karate Lambda Cyhalothrin 5% EC | | | | | Thiamethoxam: 5g |
| | Thrips | | | | | | | Reeva: 15-25 ml |
| | White flies | | | | | | | Karate-15-25 ml |
| | Leaf Miner | Dow-Success Spinosad 2.5% EC | | | | | | Success: 5 ml |
| | Fruit Fly/Vegetable Fly | | | | Use Phoromone Trap | | | 4-5 Traps/Sangam |
| | Melon Worm | | | | | | | |
| Fungal Diseases | Downy Mildew | | Folio Gold(Syngenta) Metalaxyl-M 3.3% + Chlorothalonil 33.1% SC | | | | | 35-40ml |
| | Powdery Mildew | | | | | | | |
| | | | | | | | | |
| | Virus | | | | | | | Contol Sucking Pests |

Image source: https://www.thegreenpinky.com

| Crop | Top Pests | | | | | Treatment | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cucumber | Thrips | Hopper | Whitefly | | | Nematofree Plus (Powder) | 2 Kg Per acre - Soil Application at Field Preparation | Varunastra (Liquid) + Wipe Out (Liquid) | 1 Ltr Each - Spray - At Pest Emergence - ETL - Total 2 Ltrs Repeat After 10 Days |
| | | | | | | | | | |
| | | | | | | Soil Gold -Granule | 4 Kg / Acre - Soil Application at Field Preparation | Azadirachtin - 1500 PPM | 1 Ltr Each - Spray - At Pest Emergence - ETL @ 15 Days Interval |
| | | | | | | Phoster - Granule | 4 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Potash Activa ( Granule) | 5 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Vam Shakti - Granule | 4 Kg / Acre - Soil Application at 25-30 DAS | | |

| Top Disease(s) | | | | Others | Treatment | | | |
|---|---|---|---|---|---|---|---|---|
| | Downy mildew | Powdery mildew | | | mildown (500 ml)+ bactvipe (foliar spray) | 500 ml + 500 ml | after transplanting of 30 days (foliar spray) will be done. | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Figure 120: Cucumber crop programs

## King Chilli

MaolKeki Foundation

| Category | Pests/ Dieseases | Weeks 0 -3 Nursery | Weeks 4 - 6 Transplanting | Weeks 4 - 6 Vegetative | Weeks 6 - 8 Flowering | Weeks 9 - 10 Fruiting | Weeks 11 - 12 Harvesting | Dose Per 15L Pump |
|---|---|---|---|---|---|---|---|---|
| Insects/ Pests | Aphids | Actara Thiamethoxam 25% WG | Acephate 75 % SP (Lancer-UPL) or Imidachloprid 17.8% SL (Confidor-Bayer) | | | | | Thiamethoxam: 5g |
| | Thrips | | | | | | | Lancer: 15-25 ml |
| | Mites | | | | | | | Confidor-15 ml |
| | White flies | Dow-Success Spinosad 2.5% EC | | | | | | Success: 5 ml |
| | Leaf Miner | | | | | | | |
| | Coried Bug & Stink Bug | | Acetamiprid 20% SP (Manik –TATA) | | | | | 5-8gm |
| Fungal Diseases | Damping off | | Streptomycin+ Copper Oxychloride | | | | | Blue Copper: 45g |
| | Anthracnose/Fruit Rot | | | | | | | Dhanuka M-45: 45g |
| | Downy Mildew | Dhanuka M-45, Mancozeb 75% WP | | Chlorothalonil (Kavach) 0.1% | | | | Kavach: 25-30 ml |
| | Sercospora | | | | | | | Streptomycin 1.5g |

Figure 121: King chilly crop programs (image source: https://birdhousechillies.com)

Kiwi

MaolKeki Foundation

| Category | Pests/ Dieseases | Nursery | Transplanting | Vegetative | Flowering | Fruiting | Harvesting | Dose Per 15L Pump |
|---|---|---|---|---|---|---|---|---|
| Insects/ Pests | Aphids | Actara Thiamethoxam 25% WG | Tata Reeva/ Syngenta Karate Lambda Cyhalothrin 5% EC | | | | | Thiamethoxam: 5g |
| | Borer | | | | | | | Reeva: 15-25 ml |
| | Leaf Roller | | | | | | | Karate-15-25 ml |
| | Leaf Miner | Dow-Success Spinosad 2.5% EC | | | | | | Success: 5 ml |
| | | | | | | | | 4-5 Traps/Sangam |
| Fungal Disease | Root Rot | Trichoderma | No Chemical treatment once plants are infected with **Armillaria root rot** | | | | | |

Figure 122: Kiwi crop programs


| | | Weeks 0 -3 | Weeks 4 - 6 | | Weeks 6 - 8 | Weeks 9 - 10 | Weeks 11 - 12 | Dose |
|---|---|---|---|---|---|---|---|---|
| Category | Pests/ Dieseases | Germination | Primary Vegetative | Secondary Vegetative | Flowering | Corn Cob formation | Harvesting | Per 15L Pump |
| Insects/ Pests | Army Fall Worm | | Chlorantraniliprole 9.3% + Lambda Cyhalothrin 4.6% ZC (Ampligo-Syngenta) ) | | | | | |
| | Corn Earworm | | | | | | | 8-10 ml |
| Fungal Diseases | | | Metalaxyl 8% + Mancozeb 64% WP (TATA-Master) | | | | | 35-40gm |
| | Leaf Blight | | | Mandipropamid 23.4% SC (Revus-Syngenta) | | | | 12ml |

| Crop | Top Pests | | | | | Treatment | | | |
|---|---|---|---|---|---|---|---|---|---|
| Maize | Fall armyworm | Corn earworm | | | | kalichakra (Powder) + Daman (Powder) + Mahashtra (Powder) | 2 Kg / Acre Each Preferably At soil Preparation or up to 30 Days after transplanting - Total 4 Kg / Acre | Kalichakra L+ Daman L (foliar spray)- Liquid | 1 Ltr Each - Spray after 10 Days After Germination - Total 2 Ltrs |
| | | | | | | Soil Gold -Granule | 4 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Phoster - Granule | 8 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Potash Activa ( Granule) | 5 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Vam Shakti - Granule | 4 Kg / Acre - Soil Application at 25-30 DAS | | |

Figure 123: Maize crop programs (image source: https://www.researchgate.net, Zhandong Liu)

# Orange

MaolKeki Foundation

| | | Months 0 -3 | Months 4 - 6 | | Months 6 - 8 | Months 8 - 10 | Months 10 - 12 | Dose |
|---|---|---|---|---|---|---|---|---|
| Category | Pests/ Dieseases | Nursery | Transplanting | Vegetative | Flowering | Fruiting | Harvesting | Per 15L Pump |
| Insects/ Pests | Stem Borer | | Use Pheromone Trap | | | | | Fruit Fly Trap |
| | Fruit Borer | | | | | | | One Trap per Plant |

| Crop | Top Pests | | | | | Treatment | | | |
|---|---|---|---|---|---|---|---|---|---|
| Orange | Fruit borer | | Stem borer | | | kalichakra (Powder) + Daman (Powder) + Mahashtra (Powder) | 2 Kg / Acre Each Preferably At soil Preparation or up to 30 Days after transplanting - Total 6 Kg / Acre | Kalichakra L+ Daman L (foliar spray)- Liquid | 1 Ltr Each - Spray at the time of flowering repeat after 7 Days - Total 2 Ltrs |
| | | | | | | Phoster - Granule | 8 Kg / Acre - Soil Application at Field Preparation | Azadirachtin - 1500 PPM | 2 Ltr Each - Spray - At Pest Emergence - ETL @ 15 Days Interval |
| | | | | | | Potash Activa ( Granule) | 5 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | | Vam Shakti - Granule | 8 Kg / Acre - Soil Application at 25-30 DAS | | |

Figure 124: Orange crop programs

# Pineapple



MaolKeki Foundation

| | | Months 0 -3 | Months 4 - 8 | | Months 9- 12 | Months 12 -15 | Months 15 - 18 | Dose |
|---|---|---|---|---|---|---|---|---|
| Category | Pests/ Dieseases | Nursery | Transplanting | Vegetative | Flowering | Fruiting | Harvesting | Per 15L Pump |
| Insects/ Pests | Mealybug | | Buprofezin 25% SC (Irvy-Daw) | | | | | 40-50 ml |
| Fungal Diseases | Heart (Top) Rot | | Hexaconazole 5% EC (Contaf-TATA) | | | | | |
| | Root Rot | | | | | | | 25-30ml |
| | Base Rot | | | | | | | |

| Crop | Top Pests | | | | | Treatment | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pineapple | Mealybug | | | | | | | Varunastra (Liquid) + Wipe Out (Liquid) | 1 Ltr Each - Spray - At Pest Emergence - ETL @ Flowering Stage- Total 2 Ltrs Repeat After 10 Days |
| | | | | | | | | | |
| | | | | | | | | Azadirachtin - 1500 PPM | 1 Ltr Each - Spray - At Pest Emergence - ETL @ 15 Days Interval |

| Top Disease(s) | | | | Others | Treatment | | | |
|---|---|---|---|---|---|---|---|---|
| | Fruit rotting after sudden rain (Phytophthora root rot?) | | | | Sanjeevni (Powder) + Phasal rakshak (Powder) | 2 Kg / Acre Each Preferably At soil Preparation or up to 30 Days after Sowing - Total 4 Kg / Acre | Bactvipe (Liquid) + Bioharz (Liquid) | 1 Ltr Each - Spray after 15 Days of Transplanting - Total 2 Ltrs Repeat @ weekly Interval |
| | | | | | Bactvipe (Liquid) + Bioharz (Liquid) | 1 Ltr Each - Drenching 30 Days After Sowing - Total 2 Ltrs | | |
| | | | | | Phoster - Granule | 8 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | Potash Activa ( Granule) | 5 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | Vam Shakti - Granule | 8 Kg / Acre - Soil Application at 25-30 DAS | | |
| | | | | | Soil Gold -Granule | 4 Kg / Acre - Soil Application at Field Preparation | | |

Figure 125: Pineapple crop programs

# Potato




MaolKeki Foundation

| | | Weeks 0 -3 | Weeks 4 - 6 | | Weeks 6 - 8 | Weeks 9 - 10 | Weeks 11 - 12 | Dose |
|---|---|---|---|---|---|---|---|---|
| Category | Pests/ Dieseases | Propagation | Transplanting | Vegetative | Flowering | Tuber formation | Harvesting | Per 15L Pump |
| Insects/ Pests | Cut Worm | | Profenophos 50% EC (Celcron-Excel) | | | | | |
| | | | | | | | | Celcron-40ml |
| Fungal Diseases | Early Blight | | Metalaxyl 8% + Mancozeb 64% WP (TATA-Master) | Propineb 70% WP (Antracol-Bayer) | | | | 35-40gm |
| | Late Blight | | | Mandipropamid 23.4% SC (Revus-Syngenta) | | | | 12ml |

| Crop | Top Pests | | | | | Treatment | | | |
|---|---|---|---|---|---|---|---|---|---|
| Red Potato | Cutworm | | | | | kalichakra (Powder) + Daman (Powder) + Mahashtra (Powder) | 2 Kg / Acre Each Preferably At soil Preparation or up to 30 Days after Sowing - Total 6 Kg / Acre | Kalichakra L+ Daman L (foliar spray)- Liquid | 1 Ltr Each - Spray at the time of flowering repeat after 7 Days - Total 2 Ltrs |
| | | | | | | | | | |

| Top Disease(s) | | | | Others | Treatment | | | |
|---|---|---|---|---|---|---|---|---|
| | Early blight | Late blight | Fungus (?) | | Sanjeevni (Powder) + Phasal rakshak (Powder) | 2 Kg / Acre Each Preferably At soil Preparation or up to 30 Days after Sowing - Total 4 Kg / Acre | Bactvipe (Liquid) + Bioharz (Liquid) | 1 Ltr Each - Spray after 30 Days of Sowing - Total 2 Ltrs Repeat |
| | | | | | Soil Gold -Granule | 8 Kg / Acre - Soil Application at Field Preparation | Bactvipe (Liquid) + Mildown (Liquid) | 1 Ltr Each - Spray after 45 Days of Sowing - Total 2 Ltrs Repeat @ weekly Interval |
| | | | | | Phoster - Granule | 8 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | Potash Activa ( Granule) | 5 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | Vam Shakti - Granule | 8 Kg / Acre - Soil Application at 25-30 DAS | | |

Figure 126: Potato crop programs

# Tomato

MaolKeki Foundation

| Category | Pests/ Dieseases | Weeks 0 -3 Nursery | Weeks 4 - 6 Transplanting | Weeks 4 - 6 Vegetative | Weeks 6 - 8 Flowering | Weeks 9 - 10 Fruiting | Weeks 11 - 12 Harvesting | Dose Per Pump (15L) |
|---|---|---|---|---|---|---|---|---|
| Insects/ Pests | Aphids | | Actara (Syngenta) Thiamethoxam 25% WG | | | | | |
| | Thrips | | | | | | | Actara 5-7 gm |
| | White flies | | | | | | | |
| | Cutworms | | Lamdex Super Lambda Cyhalothrin 5% EC | | | | | Lamdex Super-15 ml |
| | Fruit Borer | | | Novaluron 5.25% + Indoxacarb 4.5% w/w SC (Plethora-Adama) | | | | Plethora- 15-20ml |
| | Leaf Miners | | | | | | | |
| Fungal Diseases | Early blight | Dhanuka M-45, Mancozeb 75% WP | Hi-Dice Copper Hydroxide 77% WP | | Propineb 70% WP (Antracol-Bayer) | | | Antracol-35-40 gm |
| | Late blight | | | | | Mirador Azoxystrobin 23% SC | | Mirador: 15 ml |
| | Leaf spots | | | | | | | |
| | Botrytis | | | | | | | |

Image source: https://www.shutterstock.com

# Tomato: Organic Control

MaolKeki Foundation

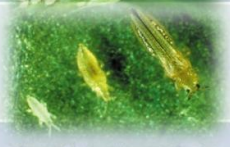
| Sl No | Pests/Diseases | Photo | Soil Application | Foliar Spray | Dose |
|---|---|---|---|---|---|
| 1 | Aphids |  | Kalichakra (Powder) | Varunastra (Liquid) + Daman (Liquid) | 1 Ltr Each - Spray after 15 Days of Transplanting & Repeat After 10 Days Total 2 Ltrs |
| 2 | Thrips |  | Daman (Powder) | | |
| 3 | Whitefly |  | Nematofree Plus | Azadirachtin - 1500 PPM | 1 Ltr Each - Spray - At Pest Emergence - ETL @ 15 Days Interval |

Figure 127: Tomato crop programs

# Water Melon




MaolKeki Foundation

| | | Weeks 0 -3 | Weeks 4 - 6 | | Weeks 6 - 8 | Weeks 9 - 12 | Weeks 12 - 15 | Dose |
|---|---|---|---|---|---|---|---|---|
| Category | Pests/ Dieseases | Nursery | Transplanting | Vegetative | Flowering | Fruiting | Harvesting | Per 15L Pump |
| Insects/ Pests | Aphids | Actara Thiamethoxam 25% WG | Tata Reeva/ Syngenta Karate Lambda Cyhalothrin 5% EC | | | | | Thiamethoxam: 5g |
| | Thrips | | | | | | | Reeva: 15-25 ml |
| | White flies | | | | | | | Karate-15-25 ml |
| | Leaf Miner | Dow-Success Spinosad 2.5% EC | | | | | | Success: 5 ml |
| | Fruit Fly/Vegetable Fly | | | | Use Phoromone Trap | | | 4-5 Traps/Sangam |
| | Melon Worm | | | | | | | |
| Fungal Diseases | Damping off | | | Blue Copper Copper Oxychloride | | | | Blue Copper: 45g |
| | Anthracnose | Dhanuka M-45, Mancozeb 75% WP | | | | | | Dhanuka M-45: 45g |
| | Downy Mildew | | | | | | | Amistar: 15L |
| | Gummy Stern Blight | | | Amistar-Azoxystrobin 23% | | | | Streptomycin 1.5g |

Image sources: https://harvesttotable.com; https://morningchores.com; https://www.gardeningknowhow.com; https://www.gardeningknowhow.com

| Crop | Top Pests | | | | | Treatment | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Watermelon** | Aphids | Leafminer | | | | kalichakra (Powder) + Daman (Powder) | 2 Kg / Acre Each Preferably At soil Preparation or up to 30 Days after Sowing - Total 4 Kg / Acre | Varunastra (Liquid) + Wipe Out (Liquid) | 500 ML Each - Spray - At Pest Emergence - ETL 20 DAS @ Flowering Stage- Total 2 Ltrs Repeat After 10 Days |
| | | | | | | Nematofree Plus (Powder) | 2 Kg Per acre - Soil Application at Field Preparation | | |
| | | | | | | | | Azadirachtin - 1500 PPM | 1 Ltr Each - Spray - At Pest Emergence - ETL @ 15 Days Interval |
| | | | | | | | | | |
| | | | | | | | | | |

| Top Disease(s) | | | | Others | Treatment | | | |
|---|---|---|---|---|---|---|---|---|
| | Anthracnose | Powdery Mildew | Cercospora leaf spot | Fusarium wilt | Sanjeevni (Powder) + Phasal rakshak (Powder) | 2 Kg / Acre Each Preferably At soil Preparation or up to 30 Days after Sowing - Total 4 Kg / Acre | Bactvipe (Liquid) + Bioharz (Liquid) | 1 Ltr Each - Spray after 30 Days of Sowing - Total 2 Ltrs Repeat |
| | | | | | Soil Gold -Granule | 4 Kg / Acre - Soil Application at Field Preparation | Bactvipe (Liquid) + Mildown (Liquid) | 1 Ltr Each - Spray after 45 Days of Sowing - Total 2 Ltrs Repeat @ weekly Interval |
| | | | | | Phoster - Granule | 4 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | Potash Activa ( Granule) | 5 Kg / Acre - Soil Application at Field Preparation | | |
| | | | | | Vam Shakti - Granule | 4 Kg / Acre - Soil Application at 25-30 DAS | | |

Figure 128: Watermelon crop programs

## 5.2 Demo Farms

Over the course of this study, many farmers highlighted their serious concerns around pest and disease infestations and potential loss of crop. Many also flagged that they had been interviewed in the past by other surveyors who had not followed up with any outputs or insights from the studies. We wanted to be different and also address the reputational risk of not following up so MaolKeki Foundation reached out to IPL Biologicals to develop a range of crop protection programs for the key crops that were investigated as part of this study. We chose a biologicals company because most of the farmers preferred biologicals over synthetic chemicals. These programs have been presented in **section 5.1**.

In the months following this study, MaolKeki Foundation committed to establishing multiple demo plots in various districts so that farmers can benefit from the programs that have been put together. To do this, MKF ordered a number of biological crop protection products from IPL worth over Rs50,000. This was to ensure that this study was followed up by some concrete actions that will not only help the farmers but also establish a more positive response from the farmer community to such studies in the future.

Some demo farms have already been established as shown in the pictures below:

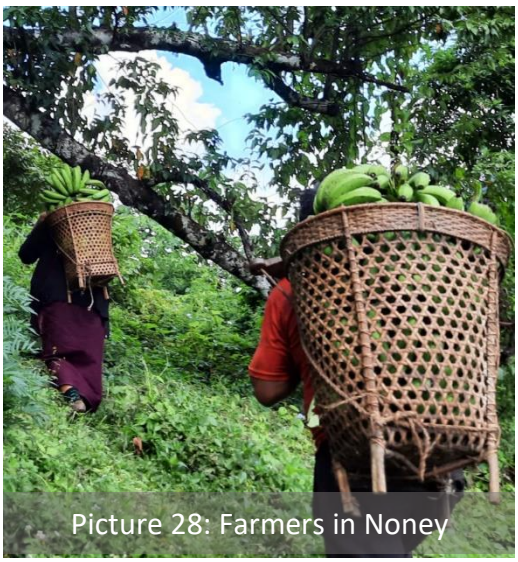
Picture 24: Banana pseudostems for planting in Noney District

Picture 25: Planting banana with biological inputs in Noney

Picture 26: Training of orange farmers in Tamenglong District on biological inputs

Picture 27: Tomato demo farm with mulching in Bishnupur District

## 5.3 Noney Banana Company


Picture 28: Farmers in Noney

During the value chain assessment of banana farmers, many of them described the challenges they were facing with pests and diseases. These pests and diseases could be managed better through Good Agricultural Practices (GAP). One of the GAP recommendations is to take away affected banana plants and dispose of them away from the farm. However, when it takes farmers 30min to an hour to climb up the steep slopes just to access their farms, they have little energy or interest in lugging banana plants away from the farm. Therefore, they leave them on the ground to rot away and in due course become compost. Yet, the same farmers are happy to carry banana bunches in baskets with head straps known locally as *Sam* (picture 28). The difference is that banana has value, is easier to carry while the plant does not have value and is bulky to carry. Solving this is critical to the success of the model being proposed in this Concept Note.

In yet another move to demonstrate that this is not just another theoretical study, we proposed a business solution to the problem and so the idea of **Noney Banana Company** was born. After multiple discussions and iterations of business models, we believe we have found a model that could address the challenge highlighted above that will incentivise farmers for their pseudostem. In this model, banana farmers will be paid for removing the layers of the pseudostem, turning them into strips to dry in the field itself and then carrying the lightweight dry strips down to the roadside or village for collection. Once collected, the fibre strips will be used by a Self Help Group (SHG) of women weavers to make beautiful mats, baskets, rugs, coasters, pen stands, etc. This addresses the problem from multiple fronts: improve primary production, encourage usage of the whole plant, create additional incomes for the farmers, create jobs for the local SHG and develop a sustainable business model (figure 129).

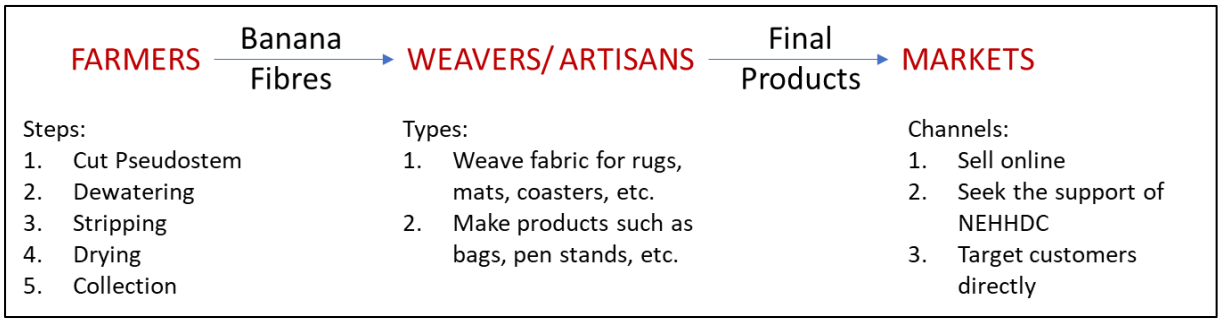



Figure 129: Proposed value chain for sustainable banana fibres

Multiple brainstorming sessions and discussions with the farmers, local weavers, NEHHDC and our own research have highlighted that, unlike in the plains, the best practice for this model

to work would be to have a small machine like a sugarcane juice extractor to dewater the banana pseudostem. Such a machine would be lightweight and could easily be carried up the hill slopes and moved around in the *Sam*. To make the strips, the dewatered pseudostem will be pulled through a row of nails. These nails can be placed at different widths so that varying sizes of the strips can be prepared for various handicraft items. Finally, drying can be done naturally by hanging the wet strips on a bamboo bar.

Finally, a business is only as good as the person driving it. We identified a driven, enthusiastic and local youth whose parents are banana farmers and therefore who fully understands the crop and the challenges farmers face. Besides, farmers also see him as one of their own and are willing to work progressively with him. Having attended Dibrugarh University in Assam for his undergraduate degree, he also has an outside-in perspective on the issues with the right mindset to solve them through entrepreneurship. Given the right guidance and support by the team at MaolKeki Foundation and partner organizations, we believe he can thrive and grow the business. The pilot concept of Noney Banana Company was accepted by NABARD and is being supported as an extension of this Value Chain Study. The team has started the experimental extraction models and is exploring potential partners and best ways to implement.

## 5.4 Investment Areas

Over the course of this study, multiple challenges were identified by farmers, traders and consumers. In this section, possible solutions and investment areas to address these challenges have been proposed including costs and timelines, wherever possible.

### 5.4.1 Irrigation

39% of farmers flagged irrigation, or lack of, as a major challenge. In Manipur, there are multiple irrigation projects that were launched over the last decades however their implementation and use are questionable with many dams and canals still under construction[12,13]. As such, irrigation investment is a major state initiative beyond the scope of this study however what can be done are farmer based efficient water use programs. This can be a combination of training programs with support to combine mulching and irrigation. Mulching provides various benefits such as trapping soil moisture, keeping the soil and surrounding areas around the plant warm during cold nights providing better plant growth and reducing weeds which also saves on manual labour to weed during the season. Irrigating using mulching also reduces the need for frequent watering of the plants or runoffs that wash away top soil. An average package comprising of pipes and pumps for such a mulching project is as shown below in table 9:

| Item | Cost per sangam (0.62acre) farm (Rs) | Total cost for 10 farms per district (Rs) |
|---|---|---|
| Mulching plastic | 4,000 | 40,000 |
| Battery powered nozzle sprayer | 7,000 | 70,000 |
| Generator pump kit with pipes | 15,000 | 150,000 |
| **Total Cost** | **26,000** | **260,000** |

Table 9: Estimated cost of a mulching and irrigation kit unit

It is important to note that the cost in table 9 is only the material cost however implementing such a scheme would require one or two trainers, transport cost as well as variable costs for fuel, oil, etc.

Another model that could be widely promoted in a state like Manipur is rainwater harvesting. During visits by team MKF, this need was much more explicit in the hill districts where people rely mostly on spring or rainwater for daily needs and crop irrigation. With ever increasing deforestation, there is also a risk that the terrain will lose its ability to absorb and retain rainwater leading to a drying up of the natural springs. Rainwater harvesting could be done through the construction of community-based check dams or through harvesting rainwater in small ponds in the field that could be used for crop irrigation. Whilst check dams are a more natural way to manage the flow of local streams and rivulets, the size, construction time and cost will depend hugely on the length and breadth of the catchment area and volume required to irrigate. Such an initiative will require costing site by site. A more standardised costing can be provided for digging ponds, installing a pond liner and using the stored water to irrigate fields using a generator or electric pump.

Picture 29: Water harvesting pond

The costing for the materials and labour needed to dig a pond is given in table 10. The picture on the right is a pond dug by villagers in Konaitong, Tengnoupal district.

| Item | Cost per pond (Rs) | Total cost for 10 per district (Rs) |
|---|---|---|
| Pond liner (16'x100') | 25,000 | 250,000 |
| Digging of pond | 37,500 | 375,000 |
| Installation | 20,000 | 200,000 |
| Generator pump kit with pipes | 15,000 | 150,000 |
| **Total Cost** | **97,500** | **975,000** |

Table 10: Estimated cost of rainwater harvesting pond and irrigation kit

### 5.4.2 Training

29% of farmers mentioned they had issues with lack of knowledge and pests and diseases. The only way to address this is through impartation of knowledge and practical skills via a combination of online and in-person training. Organizations such as ICAR, KVK, FARMS, Urban Farming Manipur and many others regularly organize training programs with costs ranging from zero to a few thousand rupees. These training opportunities are advertised regularly throughout the course of the year however access to them from remote areas remain difficult due to lack of awareness, ICT and time constraints. Further investments could be made to

support these organizations to enhance their training facilities with better platforms, equipment, course materials as well as facilitators.

The experience of our team members and partner organizations has been that farmers learn best when shown with practical examples. This is why demo farms where farmers can see modern agricultural practices in use and regular on-farm training sessions supplemented by a remote advisory service works best. To test if this could be scaled at a relatively affordable cost, MaolKeki Foundation recently launched a pilot initiative in partnership with Tengnoupal District and established the first Residential and Experiential Training Centre in Toubul, Bishnupur District. Toubul was chosen as it is one of the few villages in Manipur where farmers rely primarily on farming to earn their income giving rise to farming as a professional way of life. In this pilot, batches of five horticultural farmers from other districts will spend a week in Toubul visiting, engaging and networking with local farmers to learn about best practices, clarify any challenges they faced during their own production and build a trusted network through which they can continue to learn from each other. After the successful completion of this pilot program in June 2022, the plan is to reach out to each district to promote this unique experience to develop skills and inter-farmer learnings. The final cost per farmer is expected to be around Rs7,000 for the week inclusive of food, drinks, accommodation, note taking materials, and local logistics but not travel costs. Each participating district could then nominate five batches for total a cost of up to Rs2 lakhs. An additional amount could be allocated to provide the farmers with mulching sheet, seeds and compost as shown in table 11.

| Item | Cost per batch of five farmers | Total cost for five batches per district (Rs) |
|---|---|---|
| Experiential Week with food and lodging | 35,000 | 175,000 |
| Travel to and fro | 5,000 | 25,000 |
| Starter package of seeds, mulching sheet and compost | 45,000 | 225,000 |
| **Total Cost** | **85,000** | **425,000** |

Table 11: Estimated cost of an Experiential and Residential Learning week

### 5.4.3 Cold storage units

18% of traders reported issues with storage or loss of stock, while 9% of farmers also reported challenges with storage. Various stakeholders have shown interest in setting up cold storage units in strategic locations which will serve as collection or aggregation facilities for farmers and common storage facilities for traders. This will increase the shelf life for the products and help avoid stress selling and wastage. A five-tonne solar-powered cold storage facility would cost around 15 lakhs. Considering the fluctuation of electricity supply in the hill districts and other remote areas, a solar powered unit is highly recommended however whoever is in charge must ensure regular maintenance and servicing for optimal performance. As a cold

storage unit also requires a pre-cooling space, it is necessary to build a shed nearby where produce can be collected, stored and pre-cooled. Preliminary discussions with an architect have give a rough estimate of Rs5 lakhs for such a shed. With support for start-up costs of up to Rs2 lakhs, a cold storage unit could be built for Rs22 lakhs of capital cost as shown in table 12 below. A detailed costing can be done on behalf of a willing district or sponsor after a visit to the potential site factoring in logistics costs, construction materials needed, etc.

| Item | Cost per solar-powered cold storage (Rs) | Total cost for five cold storages per district (Rs) |
|---|---|---|
| Cold storage unit (5MT) | 1,500,000 | 7,500,000 |
| Construction of pre-cooling unit (15'x10'x10') | 500,000 | 2,500,000 |
| Start-up costs | 200,000 | 1,000,000 |
| **Total Cost** | **2,200,000** | **11,000,000** |

Table 12: Capital cost for establishing a cold storage unit

MaolKeki Foundation has researched potential business models that could be adopted to operationalise a cold storage unit. One model is to set up the unit with an entrepreneur who then charges farmers and traders per crate per day. Another model is to set up the unit under the management of a community of farmers who then share the cost of running the unit. Yet another model could be one where an individual is given the necessary funding to set up the cold storage as a private venture and he or she takes responsibility for procuring and selling horticultural produce via any network. There is willingness from all key stakeholders, including UNDP, to pursue such models adapted to the local context.

### 5.4.4 Road networks

Transportation remains a major issue for farmers and traders who struggle to move goods on time, and also for consumers who often have to pay the extra cost of bringing products from source to them. During the course of this study, team members from the MaolKeki Foundation made multiple trips to the hill districts and across Imphal valley. Whilst most villages in the valley are connected by roads, however poorly maintained, what we found was that many hill districts did not have proper roads and most people relied on footpaths to carry products in baskets.

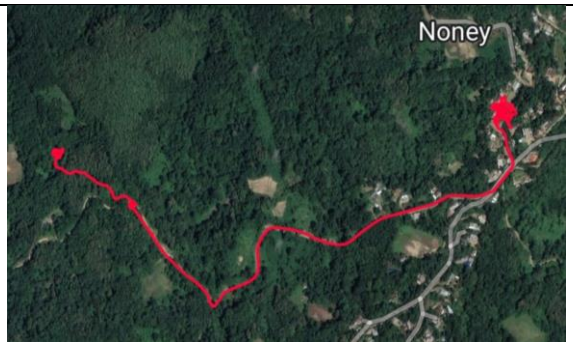
What we did observe though over the period of the study was significant developments to lay tarmacked roads, especially the principal ones. The worst of the roads were in Noney and Tamenglong districts which during our first trips in summer 2021 had been newly carved out and we had to drive through one to two feet of mud causing much damage to the vehicle. By the time we made our fourth and fifth trips to the districts in early 2022, the conditions had improved significantly as shown in the pictures below.

Roadworks, like irrigation dams and canals, are major infrastructure projects with budgets running into crores of rupees. The cost is dependent on the terrain – for example, the road from Khongshang to Tamenglong which is being converted into a dual carriageway runs into multiple hundreds of crores - and it is beyond the scope of the current study to propose estimated costs for building such infrastructure. However, we would strongly urge the concerned authorities to do what is necessary to develop these roads and ease the pain farmers and traders face.

Picture 30: The road to Tamenglong covered in thick mud (July 2021)

Picture 31: Truck had to be pulled out by a tractor (Senapati)

Picture 32: Parts of the road to Tamenglong being prepared for black topping (April 2022)

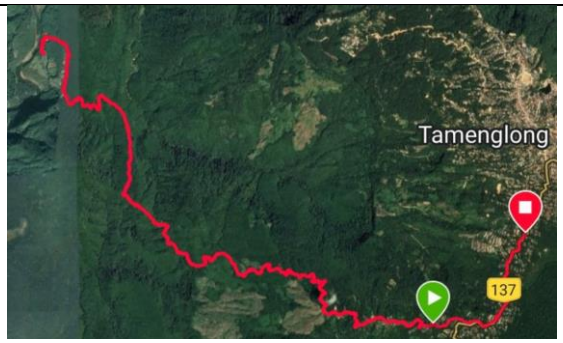



Picture 33: Just over 3km out of Noney, we looked at a potential site for a banana demo farm

Picture 34: Parts of the road to Tamenglong had improved significantly (April 2022)

Picture 35: This was a gravel road before (Noney)

Picture 36: The road from Tamenglong to Barak valley (12Km) needs urgent attention




Picture 37: The drive to Barak valley

### 5.4.5 Sheds

One of the main challenges highlighted by many in the districts is around the need for more support in marketing and selling their products, whether farmers or traders. Districts could roll out collection points in the form of sheds for a relatively moderate investment of Rs3 lakhs each based on initial assessments carried out by the MaolKeki Foundation. These would be built with a simple brick foundation, wooden posts, thatched wall and a tin roof. Such sheds will act as collection points in the interior areas of the districts as well as keep the harvest protected from severe weather conditions making them last longer and better. Also, if farmers can congregate their goods at such collection points, traders would find it easier to ply their business offering better deals to farmers.

A summary (table 13) of what investments and development projects could be taken up in which district with what priority is given below with further details of actionable solutions given in table 14. Because the challenges highlighted by consumers such as price, quality and lack of availability are primarily a result of challenges farmers and traders face, the focus of the table is on the challenges farmers and traders collectively face. For any policy maker, politician or bureaucrat involved in the development of the concerned district, these should hopefully act as a strong indicator of what the local population want addressing and include them in their implementation plans.

| Districts | Top Challenges | | | | | |
|---|---|---|---|---|---|---|
| | Irrigation | Production Issues | Marketing & Selling | Storage | Finance | Transportation |
| Bishnupur | | | | | | |
| Churachandpur | | | | | | |
| Imphal East | | | | | | |
| Imphal West | | | | | | |
| Kakching | | | | | | |
| Noney | | | | | | |
| Senapati | | | | | | |

Table 13: Top challenges to address by district (boxes with red dots are top priority, ones with orange vertical lines are of medium priority and ones with green squares are of relatively less priority though not ignorable)

Key actionable items for each of the top challenges have also been presented in the table 14. The items presented here are ones that could be implemented within a crop season or two and under the supervision of the district administration. Larger infrastructure requirements such as irrigation canals or constructing inter-village roads that would require inter-departmental and inter-ministerial collaboration with budgets running into thousands of crores and much longer timeframes have already been discussed but not detailed in table 14 as these would require further extensive studies.

| Sr. No. | District (Primary Crop Surveyed) | Challenges in the Value-Chain* | Recommendations to strengthen the Value-Chain |
|---|---|---|---|
| 1 | **Bishnupur**<br><br>**(Tomato)** | - Marketing & Sales<br>- Storage<br>- Irrigation<br>- Transportation and<br>- Finance | - Low-cost sheds to act as collection and sales points<br>- Cold storage units to keep the produce fresh for longer<br>- Basic solutions such as mulching and irrigation set ups, and rain harvesting ponds<br>- Last mile infrastructure to provide better connectivity<br>- Greater financial literacy, awareness of available financial solutions for smallholder farmers and ways to avail them |
| 2 | **Churachandpur**<br><br>**(Pineapple)** | - Production Issues<br>- Storage<br>- Transportation | - GAP for pineapple cultivation through a network of demo farms, support for small-scale mechanisation and making inputs available<br>- Collection sheds and cold storage units to harvest and store before collection<br>- Last mile infrastructure to provide better connectivity, customised hill rails to 'drop' pineapples for collection |
| 3 | **Imphal East**<br><br>**(Chives)** | - Marketing & Sales<br>- Storage<br>- Irrigation | - Both chives and potato have short shelf lives requiring quick marketing and selling.<br>- Cold storage units to keep the produce fresh for longer<br>- Basic solutions such a sprinkler irrigation kits will improve yield |
| 4 | **Imphal West**<br><br>**(Cucumber)** | - Production Issues<br>- Marketing & Sales<br>- Transportation<br>- Irrigation | - Training to improve cultivation through a network of demo farms, staggered production to extend selling period<br>- Transportation was mostly linked to Covid restrictions<br>- Basic solutions such as mulching and irrigation set ups, and rain harvesting ponds |

| | | | |
|---|---|---|---|
| **5** | **Kakching**<br><br>**(Watermelon)** | - Irrigation<br>- Marketing & Sales<br>- Production Issues | - Dependent on rainfed agriculture so a short-term solution is gen pumps to irrigate the fields<br>- Staggered cultivation with training on GAP using demo plots will create awareness, improve skills and increase yield |
| **6** | **Noney**<br><br>**(Banana)** | - Production Issues<br>- Marketing & Sales<br>- Transportation | - GAP for banana cultivation through a network of demo farms, small scale mechanisation like weeders/ tillers and making inputs available<br>- Additional utilization of the banana plants, not just the banana bunches, to generate extra revenues from fibre<br>- Low-cost sheds to act as collection and sales points with better last-mile road infrastructure |
| **7** | **Senapati**<br><br>**(Kiwi)** | - Production Issues<br>- Marketing & Sales<br>- Finance | - New crop so lack of knowledge therefore there is need for pest and disease training for the farmers from experts in the field<br>- Promote crop before harvest to ensure easy access to market<br>- Farmers have huge sunk costs so important to train them on financial awareness, and short-term opportunities to gain income |

Tabe 14: Summary of top challenges by district/ crop, and some actionable solutions for the short to mid-term (*as identified by the respondents of the survey)

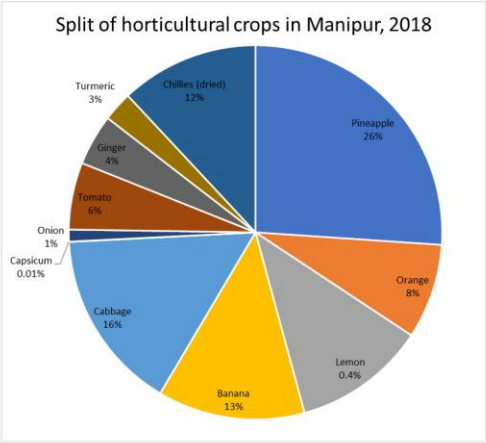
## Appendix I: Terms of Reference

Below are the ToR slides presented to NABARD at the time of proposing this study.

MaolKeki Foundation

### Horticulture in Manipur

- Manipur is primarily an agrarian society with many employed formally or informally in the agricultural sector
- Horticulture is a critical part with an estimated 50,000ha of fruits, and 59,000ha of vegetables grown in the state with key ones shown in the chart with data from NEDFi
- While there is plenty of primary production, processing into value added products is new
- Horticultural crops play a key role in providing nutritional security as well as seasonal incomes to thousands of families in Manipur




MaolKeki Foundation

### MKF Value Chain Analysis: Concept

- This value chain study will assess the flow of fruits and vegetables from the producer/ farmer to the end consumer:


- MKF will identify the key players along each of the assessed value chains and profile them by age, gender, educational level, experience, geographic distribution, etc.
- MKF, in consultation with NABARD, will design a set of questionnaires for each of the key players
- Aim is to understand the role of each player, value addition at each step, assess opportunities and challenges, and identify key gaps
- Profitability analysis will also be conducted for each crop studied
- Gap analysis will provide an understanding for improving efficiency and targeted investment/ funding opportunities

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NABARD

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# Expected study areas

- As there are multiple crops to study, this value chain study will assess selected crops in selected districts as shown in the map:
  1. Bishnupur - Tomato
  2. Chandel - Banana
  3. Churachandpur - Green Chilly
  4. Imphal East - Potato
  5. Imphal West - Cucumber
  6. Senapati - Passion fruit
  7. Tamenglong - Orange
  8. Thoubal - Water Melon
  9. Ukhrul - Lemon & Chilly
- These locations and crops will be confirmed as a first phase of the study through expert interviews and further literature reviews


Following initial investigations and availability of enumerators during Covid, the district-crop combinations were changed to Bishnupur - Tomato, Churachandpur - Pineapple, Imphal East - Chives, Imphal West - Cucumber, Kakching - Watermelon, Noney - Banana, Senapati - Kiwi, Tamenglong - Orange, and Ukhrul - Kachai lemon. However, work was completed as planned in all districts except Tamenglong and Ukhrul.

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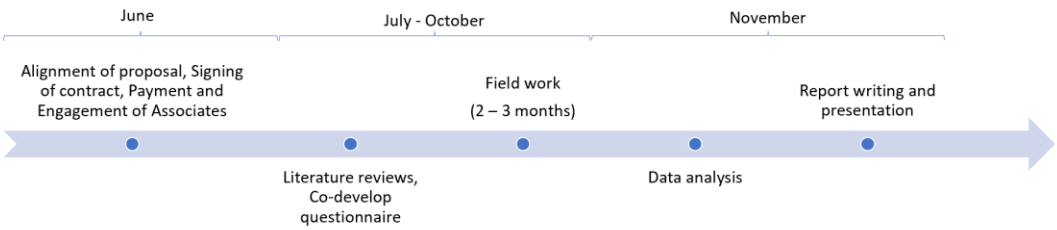
# Value Chain Study Phases




- From conceptualisation to delivery of the final report is likely to take six months, taking into account potential delays due to regular blockades and bandhs across Manipur
- There will be regular interactions with NABARD to ensure work is progressing in the right direction and in a timely manner
- A final presentation will be made in person to NABARD stakeholders

The original plan to submit the final report by January was extended as we established demo farms to follow up on the survey work as most farmers expected us to support them address their pest and disease issues in return for participating in the survey.

## Appendix II: About MaolKeki Foundation

MaolKeki Foundation (MKF) is a pioneering organization established with the purpose of catalysing positive development in Manipur primarily in the areas of agriculture, education and healthcare. Besides providing farmers with training on Good Agricultural Practices, our field nurse carries out last mile health assessments of the farmers and their families. It is MKF's mission to help farmers overcome the common ailments of inadequate last mile services across both agriculture and healthcare. The Foundation also supports an academically bright student from Manipur with proven financial needs through the annual MaolKeki Memorial Scholarship in partnership with St. Stephen's College, Delhi, and three scholarships at Johnstone Higher Secondary School, Imphal.

In numbers, since MKF was founded in December 2017, more than 4,500 farmers have been trained, and the health of over 3,000 farmers and their family members have been assessed. MKF also established a soil laboratory called Leibak Leihao Labs, and has awarded three MaolKeki Memorial Scholarships. In 2020, MKF in continuing partnership with Syngenta Foundation India launched an Agri Entrepreneurs Program which enables farmers to become agripreneurs thus creating more value and employment in rural areas.

MaolKeki Foundation is registered as a trust under the Indian Trusts Act, 1882, and works in a fully transparent, legal and compliant manner.

For more info, visit http://www.maolkekifoundation.org or write to us on contact@maolkekifoundation.org.

## Appendix III: About the Value Chain Study team

**Study Associates**

Bidyapati Thangjam

- 1st Class Post-Graduate in Agricultural Extension from SASRD, Medziphema Campus, Nagaland University (A Central University)
- Currently pursuing Ph.D from SASRD, Medziphema Campus, Nagaland University (A Central University)
- Well established network in Manipur, as conducted various surveys related to agriculture.

Daipu Kamei

- Post Graduate in Life Sciences and Education from Manipur University
- A progressive farmer
- An active member of the civil societies organisation in his village promoting Sustainable and Viable society with holistic approach of harmonious development of nature and its produces

Dennis Darung Kho

- 1st Class Agricultural Graduate from Assam Agriculture University, Jorhat
- Trained under Agri. Entrepreneurship training programme under National Institute of Agricultural Extension Management (MANAGE)
- Worked as an office assisstant with Mt. Pisgah College, Senapati

Gaimeisin Kamson

- Graduate in Arts from Dibrugarh University
- An NSS volunteer
- Currently piloting a Banana Fibre Business

Kiran Laishram

- Agricultural Graduate from Assam Agriculture University, Jorhat
- Completed a certificate course on Development of Soft Skills for Entrepreneurship among Agri Graduates
- Currently pursuing higher studies as well as working part time to support himself

Yumlembam Bilot Singh

- 1st Class graduate in Agriculture, Quantum School of Graduate, Roorkee
- Trained under Agri. Entrepreneurship training programme under National Institute of Agricultural Extension Management (MANAGE)

Roshan Thoudam

- Partner Pukkei Agri Business, Bishnupur
- An trained Agri-Entreprenuer with specialisation in Agriculture Extension Services & Integrated Nutrient Management, from NIAM, Jaipur, Rajasthan
- Well established network of farmers

Nandeibam Alfred Roger

- Post Graduate in Zoology from Delhi University
- Currently pursuing Ph.D in Life Science, Manipur University
- Shapers in Global shapers Imphal hub, a voluntary organization under WORLD ECONOMIC FORUM

Pauneihlal Haulai

- Post Graduate in Political Science, from Manipur University
- Ph.D. scholar (Thesis submitted), Manipur University

**Study Coordinator**

Nirupa Sanjenbam

- Project Coordinator, MaolKeki Foundation
- Post Graduate Diploma in Entrepreneurship and Foreign Trade from Manipur University
- Bachelor of Commerce from Calcutta University
- 10+ years experience in client relations, business communication, management and marketing.

**Study Advisor**

Shachi Gurumayum

- Trustee, MaolKeki Foundation
- 20-yr technical and management experience in Agriculture, Chemicals and Oil & Gas in four continents
- BSc, MSc/ PhD in Formulation Science, MBA in Strategy & Marketing, Advance degree in Healthcare Management
- Manipur Public School, St. Stephen's College, Bristol University, HEC Paris, INSEAD, Purdue, Harvard and Swiss TPH

**References:**


1. Robita Sorokhhaibam and Brahmacharimayum Tarunbala Devi, Agricultural marketing and its impact in north east India with special reference to Manipur, *Interdisciplinary Journal of Research in Business,* Vol. 1, Issue 6, June 2011
2. https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/activities/technical-support-to-member-states/promoting-fruit-and-vegetable-consumption (link correct as of 24 April 2022)
3. https://www.outlookindia.com/website/story/business-news-india-expects-record-horticulture-crops-production/399220 (link correct as of 24 April 2022)
4. https://www.globalmarketestimates.com/market-report/horticulture-market-3414 (link correct as of 24 April 2022)
5. https://www.mastec.nic.in/modern-climate.html (link correct as of 24 April 2022)
6. S. S. Roy, M. A. Ansari, S. K. Sharma, B. Sailo, and Ch. Basudha Devi, Climate resilient agriculture in Manipur: status and strategies for sustainable development, *Current Science*, October 2018
7. www.nedfi.com (link correct as of 24 April 2022)
8. Joint Inspection Team (JIT) Field Visit Report, National Horticulture Mission, Department of Horticulture and Cooperation (DAC), Krishi Bhawan, New Delhi (2014)
9. Raphael Kaplinsky and Mike Morris, *A Handbook for Value Chain Research*, 2001
10. Heiko Bammann, Participatory value chain analysis for improved farmer incomes, employment opportunities and food security, *Pacific Economic Bulletin*, 2007
11. www.doforms.com (link correct as of 24 April 2022)
12. https://indiawris.gov.in/wiki/doku.php?id=dams_in_manipur (link correct as of 24 April 2022)
13. http://darpanmanipur.in/frontend/web/index.php?r=project%2Findex&page=122&sort=name (link correct as of 24 April 2022)


राष्ट्रीय कृषि और ग्रामीण विकास बैंक, मुंबई

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