Report

Addressing the Labour Barrier in the Transition to Crop Diversification

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WELL LABS

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Table of Contents

Executive Summary 1
1. Introduction 2
2. Methodology 5
    2.1 Literature review 5
    2.2 Focus group discussions 5
    2.3 Expert interviews 6
3. Results 7
    3.1 Labour requirements 8
    3.2 Influence of labour requirements on crop choices 9
    3.3 Gendered aspects of agricultural labour 10
4. Discussion 13
    4.1 Labour and machinery availability 13
    4.2 Crop-wise analysis and scope for labour-saving innovations 14
        4.2.1 Paddy 14
        4.2.2 Cotton 16
        4.2.3 Chilli 17
        4.2.4 Groundnut 17
        4.2.5 Pearl millet 18
5. Conclusion 19
References 23
Appendix 26
    A.1 Focus Group Discussion Questionnaire 26
    A.2 Expert Interview Questionnaire 27
    A.3: List of Machines for Various Agricultural Activities 27

Executive Summary

Crop diversification can improve productivity and profitability while minimising land degradation and other negative ecological impacts of monocropping systems. However, the high labour requirements for diversified cropping systems are a significant barrier to their adoption by farmers.

This study assesses the labour required to grow different crops in Devadurga taluk[1], Raichur district[2], Karnataka and explores pathways to address labour-related challenges that hinder crop diversification. Its research methods comprise a literature review, focus group discussions, and expert interviews.

The focus group discussions revealed that while paddy harvest is mechanised, there is limited use of machines for other crops grown in Devadurga. As a result of this mechanisation, paddy requires the lowest amount of labour for its cultivation (33-38 days), with the exception of pearl millet (13 days). Farmers who can afford tractors use them for tilling.

Agricultural activities are highly gendered. Women do repetitive, labour-intensive activities, such as sowing, weeding, and harvesting, for which they receive lower daily wages than men. The latter perform tasks that require manoeuvring or lifting heavy objects, such as tilling and pesticide application. While all workers experience physical strain from strenuous tasks, more women reported health problems compared to men, perhaps because they spend significantly more time in fields.

This study highlights the significant role labour-saving technologies can play in enhancing cultivation efficiency and reducing drudgery. However, their high costs and limited accessibility remain challenges. Labour groups and farmer collectives that provide machines and skilled labour as a service could help overcome these barriers. There is also a need to design new machines, especially those adapted to the needs of diversified cropping systems. Women's collectives could help address gendered drudgery and customise existing machines to make it easier for women to operate them.

Through these measures, the region can enhance agricultural productivity, improve farmers' livelihoods, reduce drudgery, and adopt diversified cropping systems that can make agriculture more sustainable in the long run.

Keywords: crop diversification, labour requirements, mechanisation, gender, agriculture, Devadurga, Karnataka, India.

[1] A taluk or taluka is an administrative subdivision of a district for revenue purposes. It comprises several villages.
[2] A district is an administrative subdivision of a state in India. It comprises several taluks.

1. Introduction

Crop diversification[3] has emerged as a key strategy to enhance agricultural productivity and sustainability in low-input farming systems.

Crop diversification techniques leverage the ecological interactions among crops, known as economies of scope[4] (Noack & Quaas, 2021). This challenges the conventional preference for monocropping, often justified by economies of scale.

In India, the increasing frequency and severity of climate shocks have exposed the vulnerabilities of monoculture farming, intensifying agrarian distress (Pingali, 2012). Consequently, there is a growing interest in promoting crop diversity and sustainable agricultural practices to bolster the resilience of rural livelihoods (Lal et al., 2017).

With the establishment of the Narayanpur Right Bank Canal, farmers in Devadurga taluk, Raichur district, Karnataka have shifted from traditional polycropping practices to monocropping systems.

Devadurga has a semi-arid climate and an average annual rainfall of 726 mm (Jose, 2020), which pose significant challenges for agriculture. The Narayanpur Right Bank Canal's establishment has led to farmers largely transitioning from cultivating resilient dryland crops[5] like millets and groundnuts to water-intensive crops like paddy (Department of Agriculture, Cooperation & Farmers Welfare, n.d.).

While the canal has transformed the region's agricultural landscape, uneven water distribution remains a critical issue. Tail-end farmers often face water shortages and uncertainty regarding when they might receive water from the canal. Head-end farmers, on the other hand, are forced to cultivate paddy because they have no control over water seepage from canal channels and neighbouring fields, which floods their fields.

Even in areas beyond the canal's reach, there are disparities in water access.

Villages outside the canal command area rely on rainfall and groundwater. Farmers dependent solely on rainfall can usually grow only one crop a year. Dry spells and drought years negatively impact their yield — they might even suffer complete crop failure. Few farmers have access to groundwater sources like borewells, which can

[3] Crop diversification refers to the practice of growing multiple crops on a piece of land. This can involve various techniques, such as intercropping, crop rotation, and agroforestry. In Devadurga taluk, many farmers in the Narayanpur Right Bank Canal's head-end grow paddy in both kharif (June/July to October) and rabi seasons (October/November to March/April). For such farmers, crop diversification might involve growing paddy just in kharif and another crop such as groundnut in rabi.
[4] An economy of scope is when the production of one good reduces the cost of producing another related good.
[5] Dryland crops depend on the capture and efficient use of precipitation rather than irrigation.

help them secure their first crop and potentially grow a second crop (depending on water availability). However, even they struggle with water quality challenges such as salinity, fluoride, arsenic contamination, etc. (Central Ground Water Board, 2013).

The prevalence of paddy monoculture in the region has led to numerous problems.

Groundwater depletion, soil degradation, and broader environmental harm arising from monocropping (Pujara & Shahid, 2016) are challenges in Raichur too. Crop diversification presents a viable alternative for achieving sustainable agriculture, particularly in regions dominated by paddy monoculture. Diversified cropping systems can mitigate climate risks, reduce the risk of soil salinity, and improve productivity and profitability (Lal et al., 2017).

Figure 1: Women harvesting chilli in December 2024 in BR Gunda village, Raichur district. Photo by Nabina Chakraborty

However, labour availability and costs pose challenges to crop diversification.

The availability of machines like combined harvesters reduces the drudgery associated with paddy cultivation. However, this is not the case with crops such as

cotton, chilli, groundnut, etc. These still require significant labour as there are limited labour-saving technologies to cultivate them. This is a challenge for farmers seeking to diversify crops.[6]

This study explores the labour dynamics of various crops, the gendered dimensions of farm work, and the technological interventions that can reduce the labour burden of diversified cropping and make it more accessible and sustainable.

[6] Many factors hinder farmers from adopting crop diversification, such as market access and crop prices. However, this report focuses on the labour aspect. There are many studies that comprehensively analyse the challenges in crop diversification, such as Ojha et al. (2025)'s paper based on farmers in Ayodhya district, Uttar Pradesh.

2. Methodology

This study's research methods comprise a literature review, focus group discussions (FGDs) with farmers and agricultural labourers, and expert interviews.

2.1 Literature review

The literature review used a systematic approach to identify relevant research on labour requirements in agriculture, particularly in the context of crop diversification.

It included studies on the impact of irrigation infrastructure on agricultural practices, gender roles in agriculture, and the socioeconomic effects of crop diversification and mechanisation.

A comprehensive list of keywords was developed, including terms related to labour requirements, crop diversification, paddy cultivation, and the specific region of study (Raichur). These include: "labour requirement," "crop diversification," "paddy cultivation," "Raichur," "North Karnataka," "Deccan plateau," "machinery use," "gender dynamics," "drudgery," "agricultural labour," "farm labour," "labour intensity," "crop productivity," "farming systems," "agroecology," "agricultural policy", and "sustainable agriculture". Several academic databases were searched, including Google Scholar, PubMed, and Web of Science.

Studies were included based on their relevance to the research question, publication year (after 2010 to ensure recency), and language (English). They were excluded if they did not focus on agricultural labour requirements or crop diversification. While no formal quality assessment tools were used, the review was limited to papers published in peer-reviewed journals to ensure quality. There may be additional relevant studies that were not identified and the focus on peer-reviewed journals may have excluded grey literature. Additionally, the potential for publication bias cannot be entirely ruled out.

Information gathered included crop types, labour requirements, machinery use, gender dynamics, study methodology, and other relevant variables. The extracted data were analysed using thematic analysis to identify key themes and patterns pertaining to labour requirements in crop diversification.

2.2 Focus group discussions

The study also included four focus group discussions — two each in the canal command and dryland regions of Devadurga taluk in Raichur, Karnataka.

There were 40 participants: 20 male and 20 female farmers who also work as

agricultural labourers. The participants were chosen based on convenience sampling.

The discussions aimed to capture their perspectives on changes in cropping patterns, labour dynamics, and the impact of mechanisation and water availability on agricultural practices. Key aspects covered included crop choices, labour allocation, gender roles, income, and health implications of the labour required for different crops and the various stages of cultivation. For the list of questions during the focus group discussions, refer to Appendix 1.

2.3 Expert interviews

Expert interviews were conducted with Saravanan Duraisamy, Agriculture Programme Head, Prarambha[7] and Anilkumar Shettihalli Nagaraju, Programme Lead - Sustainable Agriculture, Nature Positive Farming & Wholesome Foods Foundation[8].

Both experts have worked with farmers in the region for many decades, are conversant with agronomic issues, and bring social sciences perspectives to agricultural issues. For the list of interview questions, refer to Appendix 2.

[7] Prarambha is a charitable trust registered in 1985. It works primarily with vulnerable communities in Karnataka, including small and marginal farmers, manual scavengers, and people with disabilities. Prarambha is also the secretariat for the Janara Network, a platform of community-based organisations in the Raichur and Koppal districts of north Karnataka.

[8] Nature-Positive Farming & Wholesome Foods Foundation is a section-8 nonprofit organisation promoting sustainable and pesticide-free agriculture across India. It empowers farming communities to build resilient food systems that prioritise the health of both people and the planet.

3. Results

Key Insights

1. Labour requirements

Chilli is the most labour-intensive crop, followed by cotton. Pearl millet requires the least labour. Paddy transplanting and cotton harvesting are particularly demanding activities.

2. Crop choices

Irrigation access and revenue expectations largely influence farmers' decision to grow a particular crop. The high labour requirements of crop diversification deter farmers from adopting the practice.

3. Gendered aspects of agricultural labour

Women spend far more time in fields and do repetitive, labour-intensive activities, such as sowing, weeding, and harvesting. Men perform tasks that require manoeuvring or lifting heavy objects, such as tilling and pesticide application.

4. Health problems

While all workers experience physical strain from strenuous tasks, more women reported health problems, perhaps because they spend more time in fields compared to men. Paddy transplanting, which is usually women's responsibility, often leads to knee and back pain. In cotton harvesting, long hours without breaks are common.

5. Mechanisation gaps

Machines are mainly used to till the land and harvest paddy. The mechanisation of paddy transplanting, cotton picking, chilli harvesting, etc. has the potential to reduce labour demands (see Appendix A.3 for more details).

3.1 Labour requirements

Table 1: Number of days required per acre for the various stages of crop cultivation (data based on focus group discussions and insights from field experts)

Crops	Manure Application[9]	Tilling[10]	Sowing	Fertiliser Application	Pesticide Application	Weeding	Harvest	Post-harvest[11]	Total number of labour days*
Cotton	1	2	3	8	12	5	36	NA[12]	67
Chilli	1	2	15	7.5	15	20	30	NA	90.5
Pearl millet	1	2	2	0	0	4	2	2	13
Pigeon pea	1	2	2	8	4	18	12	1	48
Groundnut	1	2	3	3	8	36	5	18	76
Paddy (conventional)	1	2	10	1.5	3	15	0.25	5	37.75
Paddy (SRI)[13]	1	2	7	1.5	1.5	15	0.25	5	33.25

*Total number of labour days per acre = Number of persons * Number of days each person works (one day comprises 8 hours of work) per acre of land

Youngsters	Men	Women	Men and Women

While the above-listed agricultural activities are largely gendered, there can be exceptions.

[9] All farmers, including those who use industrially produced fertilisers, apply manure, that is, spread cow dung, before tilling the field. This is generally done once a year. If the family has youngsters (refers to all sub-adults rather than any specific age group), they usually do this in a day. If not, youngsters from the village are given ₹30-50 per acre to spread cow dung across the field.

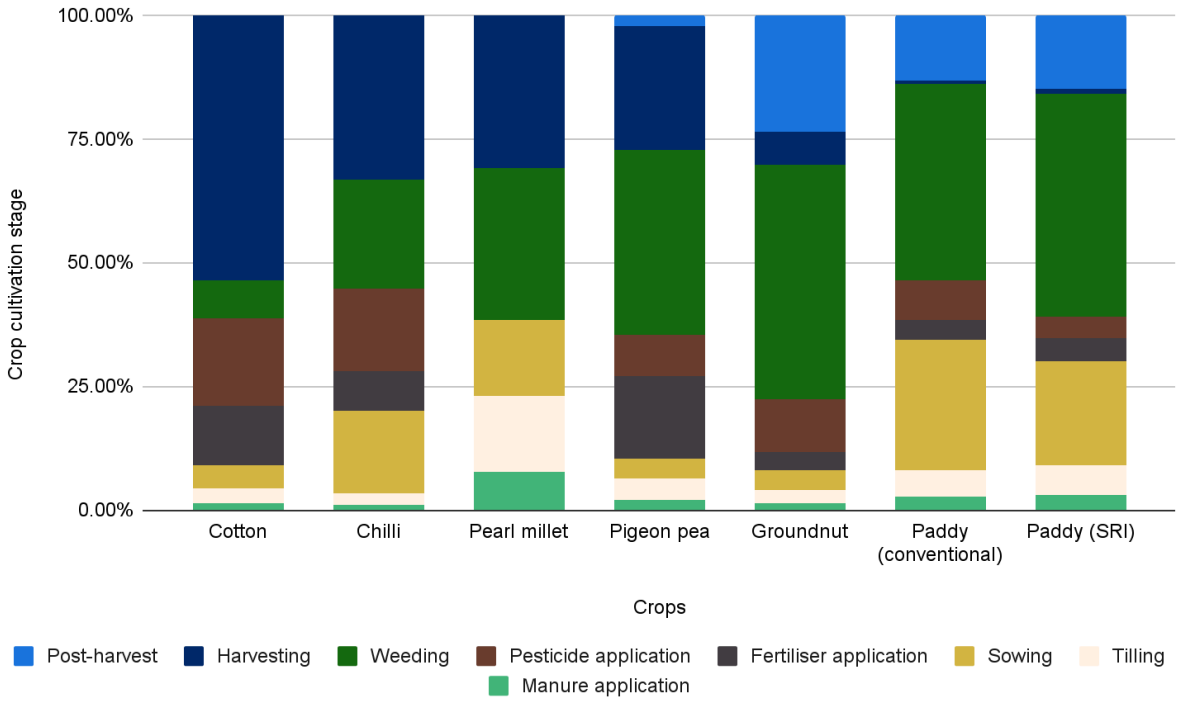
[10] Generally, farmers use a tractor on the first day and bullocks on the second to till the land. However, this depends on the field size and whether they can afford tractors.

[11] This involves gathering the harvest and loading it onto tractors or trucks to transport it to markets. Women usually do the gathering and men the loading. It also includes threshing in the case of pearl millets and groundnuts.

[12] For these crops, farmers do the post-harvest processes, if any, along with the harvest. Hence, they are not listed separately.

[13] The System of Rice Intensification (SRI) is a management system for irrigated paddy production that reduces the costs of irrigation water, seeds, and fertilisers.

Figure 2: Labour requirements for different crops and agricultural activities



The first preference is for family members to divide the farm work among themselves.

However, with migration and an ageing population, there are often fewer people available at home to work in the fields. On such occasions, farm owners hire daily wage labourers. In this study, labour requirements encompass both hired and family labour.

Farmers in Devadurga do most agricultural activities manually, except for paddy harvesting and pearl millet threshing, which are mechanised.

That is why paddy harvesting takes only a couple of hours per acre compared to multiple days for the other crops mentioned in Table 1 (see Section 4.1 and Section 4.2.1 for the reasons behind this). The other place where mechanisation is prevalent is tilling: 20 of the 40 farmers in the focus group discussion use tractors to till their fields.

3.2 Influence of labour requirements on crop choices

For monocropping systems in Devadurga, the amount of labour a crop requires is not as much of a consideration compared to irrigation access and revenue expectations when deciding what to grow.

Farmers in Devadurga with access to canal water tend to choose crops that require more water and can command a good price, such as paddy (in both kharif[14] and rabi seasons[15]). But even if farmers have better control over the water that enters their fields from canals and receive adequate market prices for dryland crops, they might not shift to them. Most dryland crops have higher labour requirements than paddy[16] due to the absence of appropriate machines for agricultural activities such as harvesting. Many crops need additional labour days for weeding as the flooded fields required for paddy are less conducive to weed growth.

Farmers who do not have access to canal water choose monoculture dryland crops (like cotton or chilli) based on their market prices as they do not have enough water to cultivate paddy.

However, labour requirements are a significant consideration in intercropping or polycropping systems.

Labour is a significant barrier for farmers who want to adopt traditional polycropping systems like Akkadi Saalu.[17] With diversified cropping systems, farmers need to spend more time in fields and take into account the staggered growing cycles of different crops (this comes with the advantage of staggered expenses and incomes). They must adopt suitable pest-management strategies, learn the soil and nutrient requirements of different crops, figure out their market dynamics, and harvest and sell them at different times. Thus, labour-saving technologies adapted to diversified cropping systems can play a significant role in promoting the practice.

3.3 Gendered aspects of agricultural labour

The focus group discussions revealed a clear division of labour across gender lines in the various stages of crop cultivation in Devadurga.

For all the crops listed in Table 1, men till the land and water it (mostly through flood irrigation) to ensure that it is ready to sow seeds or saplings. The latter is women's responsibility. Throughout the cropping season, women remove weeds and men apply pesticides and fertilisers. They do this multiple times based on the crop conditions and pest attacks. Generally, after a few continuous days of rainfall, they reapply fertilisers and pesticides to crops. Men periodically irrigate the fields during the rabi season or if there is low rainfall in the kharif season. Women harvest the crop and gather it into bundles. Men load it onto tractors or trucks so that it can be transported to markets.

[14] Kharif crops are sown at the beginning of the southwest monsoon season (June-July) and harvested at its end (October).
[15] Rabi crops are sown in October-November and harvested in March-April.
[16] Pearl millet is a notable exception.
[17] This insight arose from our work on Akkadi Saalu, a traditional intercropping system followed in Karnataka, with 91 farmers in Raichur and Koppal districts in June 2024.

Women engage more in repetitive, labour-intensive tasks, such as sowing and weeding, and spend significantly more time in fields.

On the other hand, men engage in tasks that require manoeuvring or lifting heavy objects, like land tilling or input applications. While the work women do may not require brute strength, it can be backbreaking, which impacts their health. The repetitive nature of women's tasks along with the longer time they spend in fields could be one reason they reported more health problems as a result of agricultural labour during the focus group discussions[18].

We can't use a kunti (plough) with the bullock to till the land as it is heavy and we don't have the physical strength to do it. Men are stronger physically and do it. Similarly, to apply pesticides, one needs to lift a can weighing 25 kg. It is too heavy for us.

- Female, 28 years old, Mandalgudda village

Take the task of transplanting paddy saplings, which falls on women and takes 10 person days per acre. It involves bending down in shallow water and planting each seedling separately, which can be exhausting. This often leads to knee and back pain. Water leeches add to the inconvenience.

Additionally, women work as labourers on others' farms once they finish work in their own fields. This dual engagement not only helps increase the family income, but also reflects the significant role women play in the agricultural labour force.

Farm owners hire women as daily wage labourers for sowing, weeding, and harvesting for ₹200-250 per day. In comparison, men receive ₹350-400 per day.

Women's wages are significantly less than the official minimum wage under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)[19] in Karnataka: ₹349 per day. As a result of this wage disparity, farm owners prefer hiring women for agricultural activities rather than men. Take, for example, spraying

[18] A possible reason for women reporting more health problems could also be malnutrition, which is higher among women as a result of patriarchal norms and gendered inequities. However, this aspect was beyond the scope of this study.

[19] Enacted in 2005, the Mahatma Gandhi National Rural Employment Guarantee Act is the world's largest employment programme. It aims to enhance livelihood security in rural areas by guaranteeing at least 100 days of wage employment in a financial year to every household.

pesticides, deemed a 'men's task'. Farm owners prefer that men in the family apply pesticides rather than hiring labour, which can be expensive due to men's higher wages. On the other hand, they hire women to weed fields and harvest crops since they can pay them lower wages.

Women accept lower pay as the norm — they do not question it or even see it as a disparity; instead, they regard it as a natural consequence of their being women. They reason away the pay difference claiming that the agricultural activities men take up require more physical strength, which they don't have.

Figure 3: Women work for long hours without breaks to harvest cotton. Each worker can sometimes harvest as much as 100 kg of cotton a day. Photo by Nabina Chakraborty

4. Discussion

4.1 Labour and machinery availability

Farmers in the region occasionally face labour shortages.

This can be for various reasons, such as workers migrating from villages to cities for more lucrative jobs. In a study in Telangana, Andhra Pradesh, and Karnataka, Swami et al. (2022) found that social factors such as prestige, embarrassment, and preference for work outside the village led to challenges in finding harvest labourers.

During our focus group discussions, large farm owners mentioned that they could not find agricultural labourers locally on certain occasions. For example, many people take time off to perform religious rituals when *amavasya* (the new moon lunar phase) falls on a Monday. They are also not available during local fairs and festivals. In such cases, farm owners prefer employing migrant workers who have settled in the region.

Paddy harvest is mechanised across Devadurga.

Many rich farmers from the neighbouring state of Andhra Pradesh have bought land in Raichur district, which they use to cultivate paddy. During the harvest season, they work with agricultural merchants to bring in paddy harvesters from Hyderabad[20] and farmers from Punjab to operate them. Given the machines' efficiency, they sensed a business opportunity and rented them to other farmers. Most farmers now use harvesters because it is cheaper than hiring labour. Besides, it reduces labour dependency and saves time. After the harvest season, they send the machines back to Hyderabad. This machine use is also gendered — it is an exclusively male preserve.

There is limited use of machines for other crops.

There is significant scope to mechanise sowing, weeding, harvesting, etc. for other crops and reduce farming costs in the long run. However, mechanisation is limited for crops such as cotton, groundnut, chilli, etc.

While some machines are locally available and are used to an extent, others are not available at all. For example, farmers hire balers[21] and rotovators[22] on rent along with workers to operate them. The tools that farmers buy and use the most are hand-held weeders as these are relatively inexpensive. Machine-operated weeders, however, are not available in Raichur. WELL Labs is conducting an assessment of mechanisation

[20] Hyderabad is the capital of Andhra Pradesh. It is about 200 km from Raichur.
[21] Machines that compress a cut and raked crop (for example, hay) to make them easy to handle, transport, and store.
[22] A kind of tiller.

gaps in Devadurga to explore strategies to increase the use of technology in agriculture and thereby, reduce drudgery and increase productivity.

Purchasing machines and renting them to farmers could be a significant business opportunity.

There is also a need to procure and customise machines to make them more suitable for the smaller agricultural holdings of small and marginal farmers[23]. WELL Labs is exploring community ownership and entrepreneurship models with the Innovation Guild[24] to make machines locally available and train farmers to use them.

At the same time, there are concerns that technology use can reduce the incomes of agricultural labourers and further entrench economic and social inequities (Interview with S. Duraisamy of Prarambha on September 25, 2024).

While many farmers struggle with labour shortages and women workers receive subpar wages for backbreaking work, it is nevertheless important to ensure that all farmers and workers benefit from technological innovations. Collectivisation and community ownership of technology could be a way forward to foster more equitable outcomes.

4.2 Crop-wise analysis and scope for labour-saving innovations

4.2.1 Paddy

A study in Andhra Pradesh found that the use of machines like power tillers, mini-rotary tillers, combine harvesters, and self-propelled power reapers have benefited paddy farmers and reduced labour costs and drudgery (Gupta & Pitre, 2019). Another study in Andhra Pradesh found that during transplanting, 80% of the labour cost can be saved through machinery (Murthy et al., 2020).

In Devadurga, however, farmers use machines only during the paddy harvesting stage. Owing to the availability of machines for rent at ₹3,000 per acre, paddy harvesting has the lowest labour requirement of 0.25 labour days. Despite the machine's high cost, farmers prefer using it as the manual method involves close to 40 labour days (₹250/labourer/day for 1 day for 40 labourers) and costs about ₹10,000 per acre.

[23] Marginal farmers are those who cultivate agricultural land up to 1 hectare (approximately 2.47 acres) and small farmers are those who cultivate agricultural land more than 1 hectare (approximately 2.47 acres) but less than 2 hectares (approximately 4.94 acres).
[24]The Innovation Guild is an initiative aimed at bridging the gap between small-scale innovators and rural communities, particularly smallholder farmers. This ecosystem of support services facilitates the adoption of innovative agricultural technologies and practices across India's rural regions..

The lack of machine use for other agricultural activities could be because of the cheap, skilled labour provided by Bengali migrants who have settled in the district[25] to work on paddy farms. Moreover, while paddy harvest is mechanised, it still requires manual labour for tasks like gathering and bundling the crop residue for use as cattle fodder.

Figure 4: Bengali migrants are in demand in Raichur district for their paddy cultivation skills. Here, they are transplanting paddy in BR Gunda village. Photo by Nabina Chakraborty

The conventional rice cultivation method takes double the time (10 labour days) compared to the System of Rice Intensification method (5 labour days). During focus group discussions, many women in Devadurga reported that they had only recently started learning how to cultivate using the System of Rice Intensification method. Due to the learning curve, they take 7 labour days for the task. As they pick up the skill, this time is expected to reduce.

[25] They are refugees from the 1971 Bangladesh Liberation War who settled in Sindhanur taluk, Raichur district.

As daily wage labourers, we don't get to choose which crop fields to work in. While weeding paddy fields, leeches are a huge problem. We wear pants under our sarees; those who have rubber boots wear them. However, since most of us don't own a pair, we go barefoot. Once leeches latch onto our bodies, it is difficult to remove them. We have tried sprays, medicines, and dung, but they don't die.

- Female, 34 years old, BR Gunda village

4.2.2 Cotton

Cotton kernels are picked manually, which requires a significant amount of labour and increases the cost of cultivation. In 2019, the country-wide expenditure on human labour per hectare of cotton field was approximately ₹13,938.78 (Agarwal, 2023). There has recently been an increase in the adoption of labour-saving technologies, such as no-tillage and direct sowing machines, in northern Karnataka, particularly in the districts of Raichur, Koppal, and Kalaburagi. These technologies have reduced labour requirements by 90-95% and have led to a 50-60% reduction in labour needs for intercultural operations[26] (Gunabhagya et al., 2020). With the introduction of technological interventions such as the knapsack cotton picker, cotton cultivation is seen as a profitable cash crop (Muthamilselvan, 2007). Female labourers are mostly responsible for cotton harvesting. They work for an average of 4-8 hours per day in the picking season.

We get paid ₹10 for picking 1 kg of cotton — the more we pick, the more we earn. There is an option of earning ₹250 as labour charges irrespective of how much we pick, but why would we choose that when we can maximise our earnings? We work for long hours without stopping to eat or take toilet breaks and sometimes pick 100 kg of cotton a day.

- Female, 28 years old, Mandalgudda village

[26] Activities performed in the field after sowing and before harvesting are called intercultural operations.

4.2.3 Chilli

The labour requirement for chilli farming is high. Swami et al. (2022) estimate it to be 360.5 labour days per hectare, that is, 146 labour days per acre. Their figure is significantly higher than the estimate from our focus group discussions in Devadurga (90.5 days). They also found that harvest accounts for 43% of the total labour requirement, followed by transplanting (7.62%). To reduce labour requirements, they suggest that harvesting should be mechanised and the practice of individually raising seedlings should be changed to a community-based or plug-seedling system.

Two years ago, the chilli market was good, so many of us grew chilli the year after. We made a mistake. The market price fell from ₹75,000 to ₹50,000, but we had spent more than ₹1,00,000 on fertilisers and pesticides.

To apply 15 rounds of pesticides, I spent 15 days in the field carrying a 25-litre can on my back. It smells terrible. And if it rains after applying pesticides, the pests come back, so we have to spray again.

- Male, 54 years old, Mukkanal

Although chilli requires the most labour among all crops, the labour cost is not a significant consideration for farmers in Devadurga when deciding to grow the crop. While they sometimes grow chilli owing to the high revenues it can potentially fetch, they are wary of the extreme fluctuations in crop prices. Some farmers reported that they had kept their harvest in cold storage for over a year to get a better price in the market.

4.2.4 Groundnut

Groundnut requires a lot of labour, especially for weeding and threshing. Govindaraj & Mishra (2011) found that most farmers in Andhra Pradesh and Telangana follow bullock-drawn inter-cultivation and hand weeding, which requires about 10 labour days (80.5 labour hours) per acre.

The manual stripping method used during harvesting requires about 8 labour days per acre, whereas mechanical threshing requires only a fifth of that, around 1.5 labour days. Focus group discussions in Devadurga revealed that the crop requires 76 labour days per acre, with harvesting taking up to 5 labour days as farmers use

mechanical threshing[27]. To reduce the labour demand for groundnut, Govindaraj & Mishra (2011) recommend mechanisation and labour-saving techniques with bullock intercultivation and hand weeding.

Sowing, weeding, and harvesting groundnuts are all challenging. Still, I prefer groundnuts to paddy because if I get tired while weeding, I can at least sit, unlike in paddy fields. We use machines for harvesting groundnuts, so that process has become simpler. But sowing and weeding are still tough. While weeding, we get a lot of cuts and boils on our hands, but we continue as it is our livelihood.

- Female, 38 years old, Mukkanal village

4.2.5 Pearl millet

Pearl millet requires the least labour: 13 person days per acre. This is because the crop does not need fertilisers or pesticides and there usually are threshing machines available for rent.

Since farmers consume pearl millet at home, most who have some land grow it, irrespective of field size.

Farmers with access to groundwater grow pearl millet for consumption in a small patch of land along with a commercial crop (generally groundnut) during rabi season. During the kharif season, they prioritise a commercial crop (cotton).

Farmers dependent on rainfall, that is, lacking access to canal or borewell irrigation, grow pearl millet during both kharif and rabi seasons as it does not require much water. Since its labour requirement is low, farmers who primarily grow pearl millet work in other farmers's fields as daily wage labourers.

Farmers with access to canal water generally do not grow pearl millet as they prefer to grow paddy and chilli since they fetch higher returns.

[27] Manual threshing of groundnut takes 20 labour days per acre.

5. Conclusion

This study of agricultural practices in Devadurga taluk highlights the limited adoption of labour-saving technologies and the significant role they can play in enhancing cultivation efficiency and reducing the agricultural labour burden.

While farmers use machines for harvesting paddy, its use in other labour-intensive tasks for the crop, such as transplanting, pesticide application, and weeding, remains limited, due to waterlogging in paddy fields and the delicate nature of transplanting paddy seedlings.

The cultivation of crops like cotton, chilli, and groundnut relies heavily on manual labour due to a lack of access to available machinery and a lack of machines suitable for the soil, terrain, and crops grown in the region. Where efforts have been made to introduce labour-saving technologies, their adoption has been hindered by factors such as high costs.

The gendered division of labour persists across agricultural activities, with women disproportionately engaged in repetitive, labour-intensive tasks and spending more time in fields. This underscores the need for targeted interventions to address gender disparities.

Following are some potential pathways to address these issues and promote crop diversification:

1. Promote labour-saving technologies with training programmes and collectivisation.

Increased access to affordable, suitable, and efficient agricultural machinery can enhance cultivation efficiency and reduce the physical burden on farmers, particularly women. Adopting appropriate machinery such as mini-harvesters for paddy, handheld electric pickers for cotton, and digger-cum-shaker machines for groundnut can significantly enhance productivity and reduce manual labour requirements (see Appendix A.3 for a detailed list of labour-saving technologies).

Subsidies and training programmes focused on mechanisation should be tailored to the needs of small and marginal farmers as they might not be able to capitalise on economies of scale like farmers with larger landholdings can. Models like custom

hiring centres[28], seed banks, and bio resource centres[29] can be explored for the pooling of equipment or agricultural extension services[30].

2. Establish and upskill labour collectives

Beyond providing access, training regarding the use of technology and alternative farming practices can help reduce drudgery. Labour groups can be formed to provide labour as a service to farmers.

Figure 5: Paddy harvest in BR Gunda village, Raichur district. A combine harvester takes only an hour to harvest an acre of paddy. Photo by Nabina Chakraborty

[28] Custom hiring centres are facilities that offer farmers access to agricultural machinery and equipment on rent to promote cost-effective farming and enhance productivity. Custom hiring centres can also provide services such as the repair and maintenance of existing machinery and innovation, design, and sale of new machinery.
[29] Bio resource centres are local hubs that promote sustainable agriculture by supporting eco-friendly farming practices and providing agricultural inputs.
[30] An agricultural extension service "offers technical advice on agriculture to farmers, and also supplies them with the necessary inputs and services to support their agricultural production." It also shares new ideas developed by agricultural research stations. Read more details here.

Prarambha is exploring such practices in Distributary 10 of the Narayanpur Right Bank Canal command area of Devadurga. It is also training women on line planting methods for paddy cultivation. This has a steep learning curve, but can reduce the time and effort required for transplantation (Interview with S. Duraisamy of Prarambha on September 25, 2024).

3. Establish women's collectives to explore ways to reduce gendered drudgery and design machinery suitable for women.

Men largely use agricultural tools like tillers, weeders, harvesters, etc. Since these are not designed keeping women in mind, they can be difficult for women to operate. Thus, there is a need to customise them to make them more women-friendly.[31]

Additionally, women's collectives or women-led labour groups can serve as vital support systems, enabling them to share their experiences and access training on labour-saving technologies tailored to their specific tasks (see Section 3.3 for more details regarding the gendered aspects of agricultural labour). These collectives can provide services such as

1. Renting, selling, repairing, operating, and innovating machines
2. Implementing new practices, such as the System of Rice Intensification
3. Seed conservation
4. Production and supply of liquid manure and bio-pesticides

However, these initiatives would be challenging to implement. Since most women are overworked and balance domestic responsibilities with agricultural labour, they have no time to form collectives or pursue training.

4. Some crop diversification practices can reduce the labour required for weeding.[32]

By bringing back multi-cropping systems such as Akkadi Saalu, farmers can reduce the prevalence of weeds, which often thrive in monocropping systems.

On-farm demonstrations that showcase its advantages can encourage them to adopt this practice. In June 2024, WELL Labs conducted Akkadi Saalu demonstrations in the villages of Mandalgudda, Mukkanal, Chikmyageri, and Malakasamudra in Raichur and Koppal districts with 91 farmers, after which an

[31] The All India Coordinated Research project on Ergonomics and Safety in Agriculture has compiled a list of women-friendly farm tools.
[32] While some crop diversification practices can reduce the labour required for weeding, it comes with its own set of additional labour requirements (discussed in Section 3.2), which the above-mentioned strategies (Pages 20-22) can help address.

additional 70 farmers expressed interest in adopting the practice. Prarambha and SOIL Trust also organise training sessions to promote crop diversification practices.

It is beneficial to include at least four different crop families. Farmers can additionally grow shallow-rooted crops, such as cowpeas, lentils, and chickpeas, as they face less competition from deep-rooted weeds, allowing for healthier plant growth. By diversifying crops, farmers not only enhance productivity, but also reduce the labour intensity associated with weed management.

Moreover, the narrative of weeds being a source of drudgery can be changed if we were to consider them as uncultivated food sources (Interview with A.S. Nagaraju of Nature Positive Farming & Wholesome Foods Foundation on October 17, 2024). Many farmers consume uncultivated weeds that grow in their fields or share it with neighbours. However, they rarely sell them in markets as the harvest amount is low.

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Appendix

A.1 Focus Group Discussion Questionnaire

1. Drudgery

1.1 Which agricultural activity is the most difficult? Can you arrange agricultural activities in the order of labour required?

Probe this with further questions like why, why not another activity, is it the same for all crops, is it the same for all seasons and soil conditions, etc.? Probe activity-wise to understand the labour requirements of each activity.

1.2 Order crops as per their labour requirements.

Use a chart paper to write crop names. Probe further by asking why, why not another crop, what activity associated with this crop is labour-intensive, etc.

2. Labour requirement

Similar questions regarding the requirement for in-house and hired labour

3. Agricultural activities and mechanisation

3.1 What kind of machinery or tools are currently used in agricultural activities? Probe activity by activity; for example, ask if they use cattle for ploughing or tractors.

3.2 For each existing technology they mention, discuss pros and cons: time-saving versus cost, effectiveness versus efficiency, etc.

3.3 Are you aware of any other/new technologies or equipment that can reduce drudgery? If yes, how do you know about it, what is the benefit, cost, time, etc.?

3.4 What kind of labour-saving technology would be most beneficial for your farming practices?

3.5 Which crops and agricultural activities need an urgent technology intervention?

3.6 Are there any traditional practices that are more effective?

4. Availability of machines

Are machines available for hire? What kind of machines are available, for which crops, and at what rates?

A.2 Expert Interview Questionnaire

1. What are the research gaps and how can we bridge them?
2. Based on your field experience, how can we reduce the labour required for agricultural activities?
3. Does the data from our focus group discussions align with your field experience?
4. What are your thoughts on mechanisation? Can small and marginal farmers adopt technological innovations?
5. How will the increasing mechanisation of agriculture impact the livelihoods of farm labourers and small-scale farmers?

A.3: List of Machines for Various Agricultural Activities

Crop	Operation	Machine	Comments
Paddy	Transplanting	Line-sowing markers; manual transplanters (root-washed seedlings)	The Dry Direct Sowing of Rice (DDSR) technique can be practised using drum seeders.
	Weeding	Single-row and three-row battery weeders	Designed for the weeding of line-sown paddy crops.
	Harvesting	Mini-harvester and baler machines	Available for harvesting in villages.
Cotton	Sowing	Manual sowing tool	Prevents workers from bending to sow, reducing physical strain.
	Weeding	Power weeders and semi-automatic cultivators	Adjustable to row spacing for efficient weeding.
	Harvesting	Handheld electric picker with bag attachment	Suitable for Indian cotton varieties, which are multi-picking types; reduces the load on manual pickers.
	Post-harvest processing	Shredders suitable for heavy tractors are available.	Shredders suitable for the region will have to be scouted for.
Ground-nut	Weeding	Controlled track sowing with seed drill; power weeder with tynes	Planned for effective sowing and weeding operations.
	Harvesting	Digger-cum-shaker	Available for efficient

		machines	harvesting of groundnuts.
Red gram	Harvesting	Large combine/reaper (only cutting and conveying)/ brush cutter	
Pigeon pea	Harvesting	Similar options as red gram	Utilising large combines or reapers to enhance harvesting efficiency.