Foundation for Agrarian Studies

CURRENT LABOUR USE IN CROP PRODUCTION AND POTENTIAL SURPLUS LABOUR

A PROJECT REPORT PREPARED IN COLLABORATION WITH
NATIONAL INSTITUTE OF RURAL DEVELOPMENT AND PANCHAYATI RAJ
RAJENDRANAGAR, HYDERABAD - 500030

September, 2020

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RESEARCH PROJECT SUPPORTED BY THE NATIONAL INSTITUTE OF RURAL DEVELOPMENT AND PANCHAYATI RAJ RESEARCH FUNDING PROGRAMME

Foreword

This report is an outcome of a research project titled "Current Labour Use in Crop Production and Potential Surplus Labour," conducted by the Foundation for Agrarian Studies (FAS) in collaboration with National Institute of Rural Development and Panchayati Raj (NIRDPR). FAS and NIRDPR signed a Memorandum of Understanding (MoU) on March 07, 2019. As per the MoU, the Foundation was to undertake research projects to study different aspects of the socio-economic characteristics of rural India, in collaboration with NIRDPR. This project was the first to be incorporated under the MoU. The work under this project began in January, 2020.

The research project examines the levels of labour absorption in crop production, and identifies the variations in these levels across 20 villages located in different agro-ecological zones in India. It quantifies the problem of large-scale underemployment among the rural workforce, and estimates the extent of labour that can be withdrawn from crop production for gainful employment elsewhere. The study also provides the socio-economic characteristics of this potential surplus labour, specifically in terms of its gender composition.

The project uses the existing data from the archives of the Foundation. Since 2005, a major activity of the Foundation has been an India-wide programme of village studies. As an outcome of the programme, the Foundation has created a detailed database on various socio-economic indicators from 27 villages, across 12 States located in diverse agro-ecological and socio-economic regions of the country.

The preliminary analysis under the project was completed by April 2020. The findings from the analysis were presented to a research advisory committee constituting Professor Madhura Swaminathan, Dr. Niladri Sekhar Dhar, Professor V. K. Ramachandran, and Professor Venkatesh Athreya. The comments and feedback from this presentation were incorporated in the span of the next two months. A preliminary project report was prepared and presented to the research team at NIRDPR on May 28, 2020. The critical feedback on the preliminary report has been taken into account while preparing the final report.

We are grateful to the research team at FAS, including the two Research Associates, Shruti Nagbhushan and Subhajit Patra, and the Data Analyst, Roshith Krishnan R, for their consistent effort throughout the project. We thank Pinki Ghosh and Divya S Devadiga from FAS for the administrative support. We owe special thanks to the research advisory committee, and

particularly to Niladri Sekhar, for their academic support and guidance. We are also thankful to Dr. Radhika Rani, from NIRDPR, for her constant support in terms of conceptualisation of the research questions, and analysis of data. She coordinated the presentation of the preliminary report to the research team at NIRDPR, and assisted in finalising the report.

Sandipan Baksi
Director
Foundation for Agrarian Studies

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CHAPTER 1

INTRODUCTION

Agriculture in India is the major employer of the rural workforce, both in the forms of family and hired labour. In India, as in many other less-developed countries, the overcrowded agricultural sector is marked by seasonality and the rural economy by the presence of a large reserve of workers, who can, theoretically, be withdrawn from agriculture and gainfully employed in other sectors without affecting agricultural output. This section of the workforce is known as "surplus" workers. In India, the surplus workforce is reflected in the complex problem of large-scale underemployment. To understand the magnitude of this problem among the rural workforce and to estimate surplus labour, and eventually, surplus workers, an in-depth analysis of labour absorption in crop production across agroecological regions is essential.

In any production system, labour absorption in crop cultivation is determined by a variety of factors, the most important being diversity in cropping pattern, and others such as the scale of operation, intensity of input use, farm size, and access to the means of production. Early studies on labour absorption were based on a framework that took farm size, productivity, and total labour use per unit of land into account (Sen 1964; Bhattacharya and Saini 1972; Bharadwaj 1974; Berry and Cline 1979; Athreya et al. 1986; Bharadwaj 1994). Subsequent research examined a broader range of factors that influenced the scale of production and input use, which, in turn, determined the level and pattern of labour absorption in crop cultivation. Ishikawa (1981) categorised these factors as natural (e.g., climate, soil), technological (e.g., irrigation, the use of modern implements, HYV seeds, fertilisers, pesticides), and institutional (farm size, tenancy, levels of knowledge and information, and tradition and customs). The extant literature on the impact of the scale of operation and intensity of input use on the labour absorption pattern can be divided into two broad categories. The major labour-augmenting factors are irrigation and the use of biochemical inputs, and the major labour-displacing factor is the mechanisation of crop operations. In the initial phase of the Green Revolution, changes in cropping pattern, crop intensity, and agricultural modernisation increased labour demand (Mehta 2006). On one hand, changes in the cropping pattern and crop diversification affected both the number of days of labour absorbed and the pattern of employment (Bardhan 1983; Ramachandran 1990; Ramachandran, Swaminathan, and Rawal 2002). On the other hand, the impact of farm mechanisation on employment has been described as "indeterminate" (Osmani 1998). The pure effect of tractorisation on labour use in a single season is negative (Farrington et al. 2006; Basant 1987), whereas studies have also shown that the pure labour-saving effects of mechanisation are

often offset by the labour-augmenting effects of the use of complementary inputs (Rao 1975; Kalirajan and Shand 1982; Estudillo and Otsuka 1999). The net impact of these two opposing forces on labour utilisation has been a continuing point of debate.

Apart from the above-mentioned aspects of production organisation, labour demand can also vary due to seasonality, that is, variation in labour demand during the peak and lean agricultural seasons (Benson 1979; Ryan, Ghodake, and Sarin 1979); the changing composition of family labour and hired labour in total labour use (Hayami and Kikuchi 2000, David and Otsuka 1994); and increasing (or decreasing) use of female labour in total hired labour use (Agarwal 1993; Ramachandran 1990; Ryan, Ghodake, and Sarin 1979). Most studies of labour absorption in Asian countries (most of which were conducted between 1960-1980) were undertaken to illustrate the pattern of labour use in rice production (in different East and South East Asian countries) and wheat production (mainly in India and Pakistan).

The process of commercialisation of agriculture intensified in the 1990s, a process that is evident in the increased cultivation of high-value crops like flowers, fruits, and vegetables. The area under fruits and vegetables in India grew at a rate of more than four per cent per year in the 1990s, a period during which the area under rice and oilseeds grew by one per cent per year (Joshi, Birthal, and Minot 2006). The increase in the cultivation of commercial crops (like fruits, vegetables, and horticultural crops), mechanisation in paddy and wheat cultivation, and significant changes in input structure (Vyas 2004) had a definite impact on labour absorption (Ramachandran and Rawal 2009) and likely had an impact on the pattern of labour deployment by different sections of the peasantry as well as the landlord and capitalist farmers.

CHAPTER 2

REVIEW OF LITERATURE

There have been several attempts to measure the extent of surplus labour in an economy theoretically as well as empirically. In this section, we review the literature on the measurement of surplus labour, as its implicit focus has been to address issues of the labour carrying capacity in crop production. However, the results have been rather confusing and often contradictory. For instance, in the case of India, Mathur (1965) argued that disguised unemployment among rural working force in West Bengal was 33.1 per cent, given the high population density in the State. However, Paglin (1965), contended that the marginal product of labour in Indian agriculture was positive and there was no substantial amount of surplus labour. Though the differences, in some cases, may be real, the fundamental reasons for such differences lie in the conceptual and procedural variations embedded in the estimation techniques.

One popular approach has been to apply the Cobb–Douglas production function and determine surplus labour on the basis of whether or not the marginal product of labour is zero. This method (with land, labour, and non-labour costs as the explanatory variables) has been used by Muqtada (1975) to attempt measuring surplus labour in paddy cultivation in Bangladesh; here, surplus labour amounted to 40 per cent of the existing workforce. Reynolds (1969), who had defined labour in terms of person hours and followed Fei and Ranis (1964), attempted to identify surplus labour as that yielding zero marginal productivity. However, Sen (1975) had cautioned that a work equilibrium at zero marginal product of labour is neither necessary nor sufficient for the theory of disguised unemployment. Moreover, to adopt Cobb–Douglas functions in specifying agricultural production may be misleading insofar as some crucial input relations are complementary or supplementary in nature (Ishikawa 1976). In the absence of any unique measure of surplus labour, an alternative approach has been to directly infer it from observable relationships such as those of labour and crop output or of labour and cropped land. If land is considered to be an independent factor, computing the "required" labour force per unit of land can be calculated from the known amount of cultivated land. Surplus labour can be derived by comparing the required and the actual labour force. Mehra's (1966) study on surplus labour in six Indian States uses a similar "norm" – a stock definition of surplus labour time per worker. She assumes the phenomenon of underemployment to be true of only family labour and further that the largest landholding would require the maximum number of hired workers. She then calculates a labour-intensity index (with eight hours as a standard workday) for the various size-holdings, taking labour intensity for the largest size-group as unity. Once the required labour in

each size-holding is derived, surplus labour can be found after deducting the required labour from the actually employed.

To account for seasonal surplus labour – a common phenomenon in the agricultural sector – individual workers are considered to work "full-time" for only a few months of a year, or perhaps when the workload is unevenly spread over the year, they work only a fraction of the work-units worked during the busy season in the slack season (Muqtada 1975). This type of unemployment, though real and widespread, is perhaps "not removable" à la Rosenstein-Rodan (1957). Labour cannot, in other words, be moved out of agriculture without affecting production unless there is agricultural reorganisation. Hence, for a measure to be useful, it must be able to decompose the seasonal component of unemployment and measure the labour force that is "truly surplus," even when labour requirements are at seasonal peaks. It is difficult to conduct such an exercise unless a direct survey is conducted on the availability of labour and its use over different seasons, if not exact periods in a month. Using this method, Tims (1965) calculated an average of 600 person-hours per cropped acre in erstwhile East Pakistan in 1960–61 and 2,200 hours as a full year's equivalent of employment (cited in Muqtada 1975). In addition, the labour force employed in livestock and fisheries was estimated to be one-third of the person-years employed on crops.

Estimating the "transferable" and disguisedly unemployed labour using the population unemployed in the peak season may still generate an upward bias because, for any operation, work is assumed to be evenly distributed over the entire period. In practice, however, work may be unevenly distributed even within this period. Cross-sectional studies of India and Pakistan suggest that smaller farm units apply more labour and other material inputs per acre and also generate a larger output per acre (Mathur 1964; Mazumdar 1965; Paglin 1965). Regressions of total input per acre against output per acre show diminishing returns, but these are far from zero even on the smallest and most intensively cultivated farms. It is also interesting that farms of every size use a certain amount of hired labour, which suggests that its marginal productivity can scarcely be zero (Reynolds 1969).

On peasant family farms, surplus labour can be eliminated either if these farms hire labour or if family farm workers labour out in jobs earning a positive but variable real wage (which would imply a non-constant supply price in terms of the wage rate for such workers). Nonetheless, this inference only holds for the particular assumption about the relationship between inputs of

labour at different times in the crop cycle, i.e., in the agricultural production function. If labour inputs at different points of time were perfect substitutes for each other, then the labour requirements over the crop cycle could simply be aggregated. Moreover, the marginal product of a unit of labour time would be equalised in each time period on each farm. In these circumstances, if any labour was hired on the farm, or if any family labour was hired out at any time during the crop season, then there could be no surplus family labour on the farm during any part of the crop cycle. However, it is extremely unlikely for labour inputs in agriculture to be perfect substitutes or even substitutes. They are much more likely to be complements; for instance, the marginal productivity of an extra hour of weeding is increased if a larger area of crop is planted. It is also likely that the marginal product of labour at peak periods such as during harvesting and planting is greater than in lean periods – this is evidenced by seasonal wage rate data for India, which show that agricultural wages do fluctuate with the seasons and are higher during harvesting and planting than in other periods. It is thus possible for peasant farmers to hire casual labour at peak periods when the total labour time requirements are high and greater than can be supplied by family labour; the higher marginal product of labour at this time makes such hiring worthwhile. But, during the lean periods, when total labour time requirements on the farm are likely to be less, strictly speaking, family workers may become seasonal surplus labour (if leisure is an inferior good for them during this period). However, it should be noted that even with seasonal complementarities in labour inputs, if a farm hires a permanent farm worker or uses at least one casual labourer in all or most farm operations, there cannot be surplus family labour on such farms, even in the slack season. Though, as is usual in the estimation of industrial shadow wage rates, it is the permanent withdrawal of an agricultural worker that is relevant; a seasonal surplus of family farm labour could still be associated with a fall in agricultural output as a result of the withdrawal of family labour input during the peak season. To this extent, even with these more realistic assumptions about the agricultural production function, the hiring of workers by family farms will be relevant in determining whether family labour is in surplus throughout the year (Lal 1976).

According to Mitra (1976), "surplus labour" is not really surplus unless it could be mobilised for development needs. He argued that it is incorrect to compute surplus labour by assuming 365 days of availability per worker, because in reality, a worker is not available for farm work for all days in a year. Similarly, one has to take into account the labour days spent in different activities in agriculture; the farm workforce does not confine itself to crop production, and so any attempt to compute the surplus by only considering labour spent in crop production would lead to an

upward bias. Another important activity considered for this purpose is tending to cattle, as it uses a considerable amount of labour. Likewise, to estimate surplus labour among family workers engaged in self-cultivation, the number of labour days hired out, besides the days spent in crop production and related activities, should also be considered. Otherwise, the surplus estimated would again contain an upward bias inasmuch as a number of surplus labourers might, in fact, be hiring themselves out and hence would not be unemployed. Moreover, because much unemployment and underemployment in agriculture arises out of the seasonality factor owing to the nature of crops grown and their corresponding farm operations, there are busy and lean periods in agriculture. Attempts at estimating surplus labour without considering the seasonality of employment would result in an incorrect appraisal. If the consequent surplus estimation is free from the seasonality factor, any notion of removing the surplus from farm work would affect the peak period labour requirement.

CHAPTER 3

JUSTIFICATION OF THE RESEARCH PROBLEM

The literature reviewed could be considered outdated. In the 1950s and 1960s, issues related to surplus labour in traditional agrarian societies were intensively debated, both theoretically and empirically. In India, the major data source for such studies was from the Studies of Economics of Farm Management. After significant engagement for nearly two decades, studies on surplus labour, both theoretically and empirically, receded into oblivion, especially in India. Moreover, the prevailing data collecting agencies in India have failed to reproduce an exhaustive database to study different aspects of farm economics.

To fill the gap, in the first decade of the twenty-first century, the Foundation for Agrarian Studies (FAS) initiated the Project on Agrarian Relations in India (PARI) to conduct village studies to revisit some of the major issues related to farm economics, including issues related to labour and employment, in the era of neoliberalism. Till now, the FAS has conducted studies in 25 villages in 11 States of India. For this study, we use data from 20 PARI villages located across 10 States of India.

Adding to the existing work, we enquire about the prevailing labour absorption in crop production in India vis-à-vis available labour. The specific questions we seek to answer are the following:

i. What is the level of labour absorption in crop production in different agroecological regions of India?
ii. Given the supply of labour and actual labour use in crop production, what extent of labour can be withdrawn from crop production for gainful employment elsewhere?
iii. What are the characteristics of potential surplus labour, specifically its gender composition?

Objectives

In this context, the objectives of the present study are the following:

i. to examine the levels of labour absorption in crop production and identify the variations in levels across 20 villages located in different agroecological zones of the country
ii. to estimate the magnitude of surplus labour in each village, given its labour supply and actual labour use in crop production
iii. to disaggregate labour available in a village by gender and estimate the size of excess labour available in rural areas by gender

CHAPTER 4

PRIMARY DATABASE

This study is based on the detailed PARI data archive for 20 villages across 10 States of India (see Table A1). For labour absorption in crop production, data on labour days and work-hours were collected for all crops and crop combinations (including mixed crops and intercrops) cultivated on all operational holdings for all crop operations, each type of labour (family labour, wage labour on daily/piece-rate wage contracts, exchange labour, and long-term labour), and the hours of machine labour utilised. Wage data was also collected for all types of human and machine labour.

To streamline the analysis, we have used a subset of the 20 villages to explore the objectives. Specifically, to estimate surplus workers, we have used information from eight villages situated in four States with distinct agrarian production systems and populations. Of these eight, three (Ananthavaram in Andhra Pradesh, Nimshirgaon in Maharashtra, and 25F Gulabewala in Rajasthan) are agriculturally prosperous villages and two (Katkuian and Nayanagar in Bihar) are highly populated and have a substantial workforce annually migrating to different parts of India. The remaining three villages are from West Bengal that all practise three-season agriculture and have a large migrant workforce. In the analysis, we use descriptive and inferential statistics to address the objectives.

CHAPTER 5

LEVELS OF LABOUR ABSORPTION IN CROP PRODUCTION

5.1 Inter-season Variation

Crop production continues to be seasonal, even though over the years, improvement in the forces of production like irrigation, land improvement measures, and mechanisation have increased crop intensity and helped reduce the impact of seasonality in crop production. The literature on regional disparity in agriculture suggests that the provision of the forces of production and production organisations have been markedly variable across the agroclimatic zones of India. Such variability led to remarkably different levels of labour use in crop production. In this section, we consider the impact of inter- and intra-season variation in labour use and of variation in labour use due to cropping pattern.

The data suggest that in 10 of the 20 villages, a major share of the total labour employment was generated in the kharif season. For instance, in the dry villages, such as Bukkacherla (Andhra Pradesh), Warwat Khanderao (Maharashtra), and Zhapur (Karnataka), labour employment in kharif was as high as 84, 89, and 82 per cent, respectively and very low in rabi. The lack of irrigation either compelled cultivators to leave their land fallow or cultivate less labour-intensive crops. However, the distribution of labour use across seasons was less skewed in the irrigated villages. In four villages (Gharsondi in Madhya Pradesh, Amarsinghi and Panahar in West Bengal, and Nayanagar in Bihar), the major share of total labour employment was generated in the rabi season. Therefore, in these 14 villages, labour employment was compartmentalised by season. In at least five of these villages, labour use was evenly distributed over the production year, owing to the cultivation of perennial and annual crops.

Table 1 *Proportion of total labour use in crop production, by season, study villages* in per cent

State	Village	Pre-kharif	Kharif	Rabi	Annual	Miscellaneous	Total
Andhra Pradesh	Ananthavaram	-	37	19	43	-	100
	Bukkacherla	-	84	15	-	-	100
Telangana	Kothapalle	-	66	25	9	-	100
Uttar Pradesh	Harevli	-	16	12	72	7	100
	Mahatwar	-	54	30	-	16	100
Rajasthan	Rewasi	-	38	21	5	36	100
	25F Gulabewala	-	59	29	-	12	100
Maharashtra	Nimshirgaon	-	10	16	38	36	100
	Warwat Khanderao	-	89	-	-	11	100
Madhya Pradesh	Gharsondi	-	10	58	-	32	100
Karnataka	Alabujanahalli	-	36	-	55	8	100
	Siresandra	-	53	-	47	0	100
	Zhapur	-	82	12	-	7	100
West Bengal	Amarsinghi	11	35	48	1	6	100
	Kalmandasguri	35	39	17	-	9	100
	Panahar	-	45	52	-	4	100
Punjab	Hakamwala	-	77	20	-	3	100
	Tehang	-	57	18	-	26	100
Bihar	Katkuian	-	40	4	54	1	100
	Nayanagar	-	0	58	18	25	100

Note: The share of labour days was high for miscellaneous crops on account of pulses and fodder crops in Rewasi, vegetables in Nimshirgaon, oilseeds and fodder crops in Gharsondi, and fodder crops in Tehang – all were grown in different seasons.

Source: PARI survey data

5.2 Intra-season Variation

On seasonal variation, the literature primarily focuses on inter-season variation in labour use, which is also a prominent reason for the non-utilisation and underutilisation of labour. In the study villages, intra-season variation in labour employment was remarkably high; within a crop season, the major agricultural tasks were the following:

- land preparation
- sowing/transplanting
- irrigation
- weeding
- intercultural operations

- harvest and post-harvest operations

Some agricultural tasks also overlapped within the same time period. For instance, irrigation, weeding, and applying fertiliser and pesticides were undertaken either simultaneously or in quick succession to each other during the intermediate period of crop duration. Among all major agricultural tasks, harvest and post-harvest operations demanded a large share of labour for most crops and in most seasons across the study villages.

The data suggest that land preparation operations were the least labour intensive across all study villages for the obvious reason of the extensive use of tractor ploughing. The use of tractor and tillers for land preparation reduce human drudgery and simultaneously save family labour time. Total labour use in weeding has also been another important labour-absorbing operation performed in the majority of the study villages. Hence, labour use within a crop season has been strikingly skewed – this pattern of labour use within a season complicates the estimation of surplus labour in crop production.

The complication can be understood with absolute numbers of labour use for various operations within a crop season. In Hakamwala, Punjab, total labour use to cultivate crops in the kharif season (cotton and rice) was 73,828 standard labour-days, of which 40,254 were spent picking cotton and harvesting and post-harvesting operations of rice. Among other tasks, sowing/transplanting and weeding respectively constituted only 25 and 29 per cent of harvest/post-harvest labour use (peak labour employment). This implies that the first three months of the kharif season could absorb a maximum of 29 per cent of the peak-period labour employment; the remaining 71 per cent of labour used for harvest and post-harvest operations could not be utilised for the period of three months. This phenomenon of excess labour was observed for all seasons and across all the villages, however, the level and period of unutilised labour varied. In Hakamwala, this unutilised labour could be moved away from crop production, but only for three months, as this intermediate, unemployed labour would be recalled for harvest and post-harvest operations. Because failure to mobilise labour during harvest and post-harvest operations would certainly impact the output, risk-averse production organisations would try to ensure peak labour employment throughout the entire season, even if most labour days remained unutilised for most of the crop season.

OP_1 = Land preparation, OP_2 = Sowing/transplanting, OP_3 = Irrigation, OP_4 = Weeding, OP_5 = Intercultural operations, OP_6 = Harvest and post-harvest operations, OP_7 = Miscellaneous operations

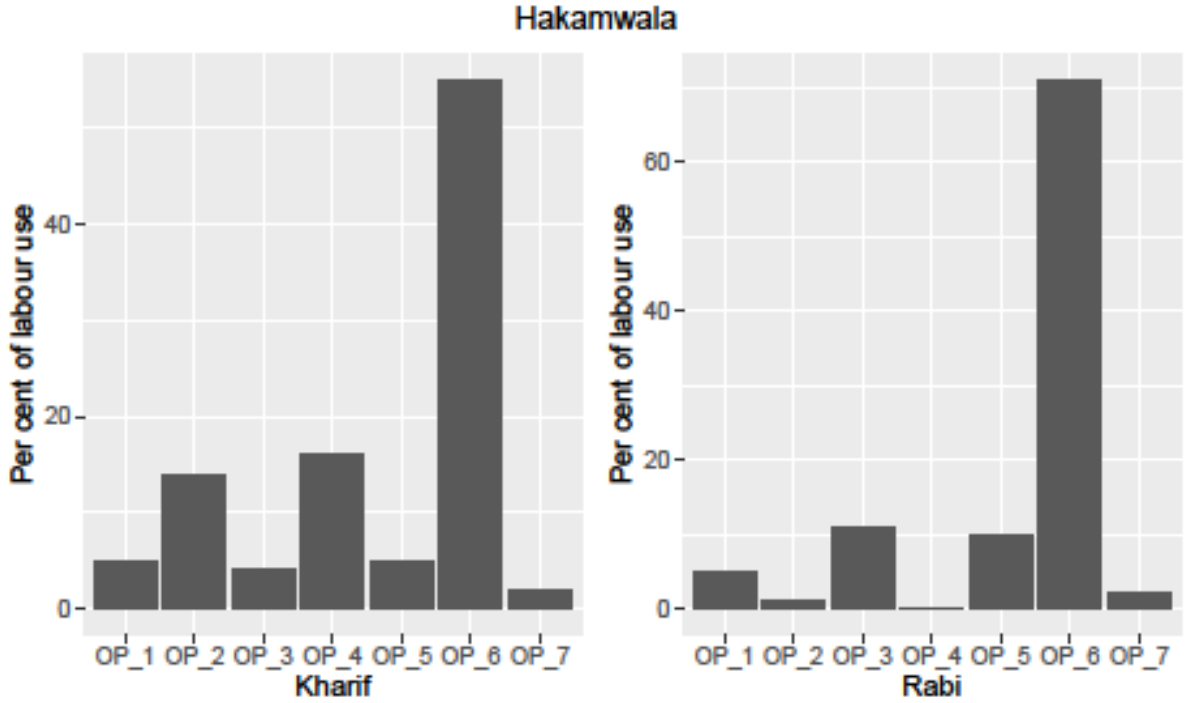

Figure 1 *Proportion of eight-hour labour days used in a crop season, by crop operation, Hakamwala (Punjab)* in per cent

Source: PARI survey data

5.3 Labour Use by Crop

One of the key determinants of labour absorption in crop production has been the combination of crops grown in any production system. However, the adoption of crop cycles by different strata of cultivators is determined by the agroecological conditions and the availability and access to forces of production. It has been observed that, across all the study villages, there were different crop cycles. The majority of the cultivators adopted crop cycles dominated by cereal crops like rice, maize, and pulses (red gram, green gram, etc.). It has been also observed that a relatively small section of cultivators – those who owned or had access to good quality land in terms of irrigation (in many cases, many had multiple options of irrigation facilities), soil quality, and the capacity to invest in crop production (both large initial investments and working capital) – cultivated high-value crops. For example, the landlord and richer section of the peasantry in most study villages produced crops like betel leaf, sugarcane, and turmeric (Ananthavaram in Andhra Pradesh); fruits and vegetables (Nimshirgaon in Maharashtra, Bukkacherla in Andhra Pradesh); and sugarcane (Katkuian and Nayanagar in Bihar, Alabujanahalli in Karnataka, Nimshirgaon in Maharashtra, Harevli in Uttar Pradesh). The above-mentioned cropping patterns

were highly labour-absorbent, deploying a large contingent of labour, especially hired labour. The members of the landlord households and the richer section of peasantry did not participate in manual labour and rather performed supervisory activities to ensure timely completion of agricultural tasks. Moreover, crop operations for high-value crops required a large contingent of labour at a specific point in time, and the primary source of labour was the rural wage-labour market. Apart from that, cotton (cultivated in Warwat Khanderao, Maharashtra; Hakamwala, Punjab; and 25F Gulabewala, Rajasthan) was also a labour-intensive crop creating a substantially large demand for labour. Rice dominated in the crop cycles of the middle and small peasantry and was cultivated in a large extent of land in 11 out of 19 survey villages – it had a significant impact on aggregate labour use, as it generated a large number of days of employment particularly in these 11 villages. However, the labour intensity of rice (measured in terms of labour use per acre of land) was low and varied significantly across the study villages. In fact, studies have shown that labour absorption in rice cultivation has been declining. In Ananthavaram, Andhra Pradesh, Sundarayya (1977) noted that labour use in rice cultivation was 70 days per acre in 1974. Our survey in 2005–06 showed it to be 41 days per acre of land, a decline of 40 per cent over 32 years. A similar decline was also observed in other parts of the country. On the variability of labour intensity in rice cultivation, it can be argued that the reasons for the difference in labour use across villages were differences in the method of irrigation, level of mechanisation, and type of wage contract (Dhar 2012). Among major crops grown in the study villages, the labour intensity of wheat cultivation was the lowest. Grown in 7 out of 19 villages, wheat generated minimal labour days – they ranged between 3 (Tehang, Punjab) and 57 (Nayanagar, Bihar). In the other four villages, labour use per acre of wheat was less than 30 labour days, as almost all major agricultural tasks were mechanised (see Appendix).

5.4 Distribution of Labour Use in a Production Year

Labour use in crop production throughout the year provides a clear picture of labour employment in the slack and peak periods. In the three West Bengal villages (Figure 2), the major crops grown were jute (Amarsinghi and Kalmandasguri) and rice (Panahar) in pre-kharif; rice in kharif; and potato, rice, and sesame in rabi. In Amarsinghi, the distribution of labour use suggests the following major labour-absorbing months schedule: the harvesting and post-harvesting operations of jute in May and June, the sowing and transplanting of rice in June and July, the harvesting and post-harvesting of rice in November–December, and various operations for potato in December and January. The two peak labour-absorbing periods were May–June and November–December, which absorbed almost 44 per cent of the total labour use. Moreover,

almost 81 per cent of the total labour use in crop production was concentrated in five months of the production year. In the remaining months, labour use in crop production was negligible, specifically from February to May when there was only 3.2 per cent of the total labour use. In Kalmandasguri, about 94 per cent of the total labour use was concentrated in the five months. Specifically, the two peak labour-absorbing times were July–August (absorbed 28.2 per cent of the total labour use for jute harvesting and post-harvesting operations) and November–December (absorbed 27.1 per cent of the total labour use for rice harvesting). No labour was absorbed in crop production from August to November, January–February, and April–May; a similar pattern was observed in Panahar as well. This clearly suggests variability in labour use over the months in the production year, even with the three-season crop cycle in the Bengal villages.

In Warwat Khanderao in Maharashtra, a predominantly cotton-growing village in kharif and with almost no crops cultivated in rabi, the month-wise variability in labour use was even sharper. Figure 3 suggests that no labour was absorbed in five months of the production year, and another four months absorbed only 11 per cent of the total labour use. The major share of labour was absorbed in August–September (45 per cent for weeding in cotton and harvesting and post-harvesting operations in green gram and pigeon pea intercropped with cotton). In June–July and October–November, the major labour-absorbing agricultural tasks were sowing and picking cotton, respectively, and they absorbed 66 per cent of the total labour use. Even if cultivators preferred to retain peak-period labour throughout the year to avoid any shortage of labour during the peak period, 55 per cent of unutilised labour time could be shifted from crop production for at least the five months (November–January and again from February to April–May), as no labour time was absorbed during this period. This indicates the inability of crop production to consistently generate labour employment throughout the production year.

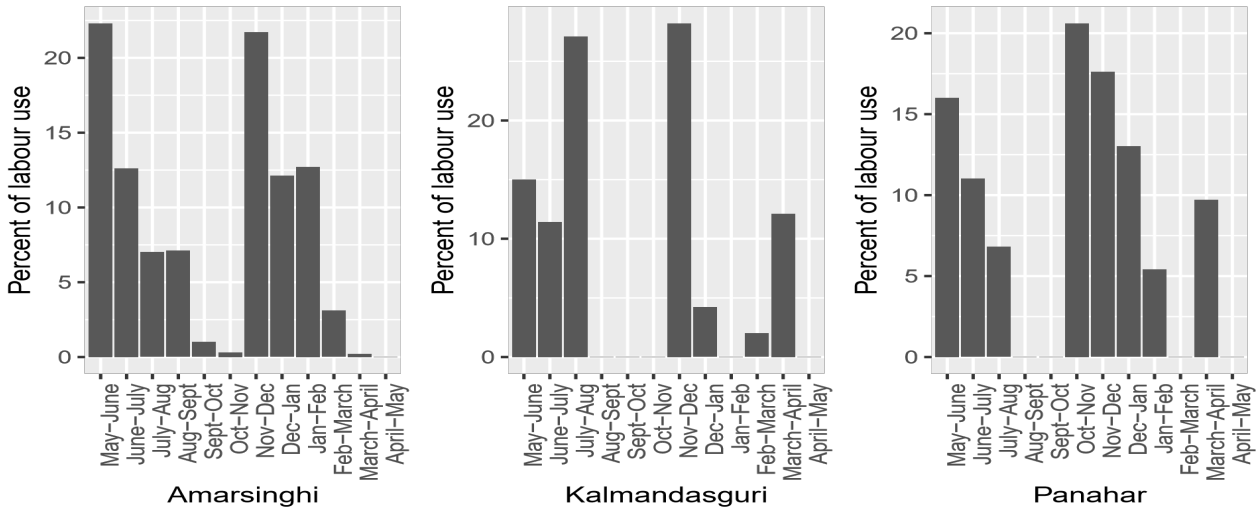

Figure 2 *Labour use in crop production, by month, West Bengal study villages in per cent*

Source: PARI survey data

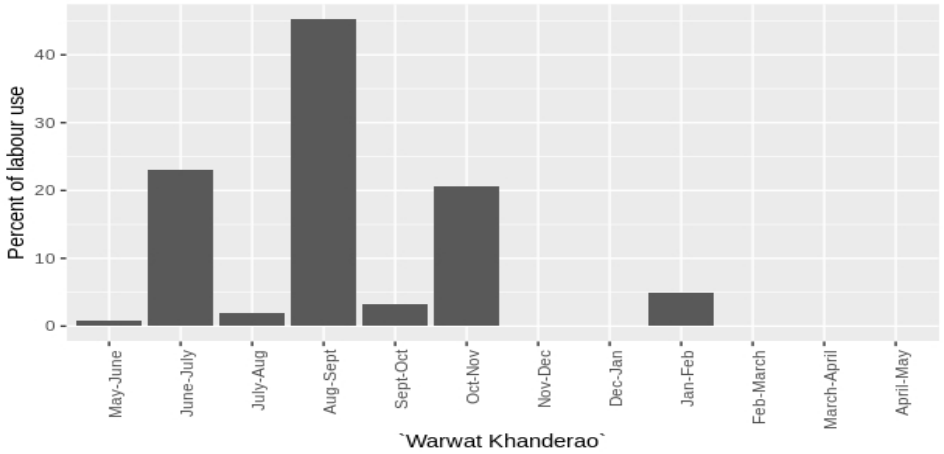

Figure 3 *Labour use in crop production, by month, Warwat Khanderao (Maharashtra)* in per cent

Source: PARI survey data

CHAPTER 6

LABOUR SUPPLY[1]

In an agrarian economy, the labour supply in any production process is the outcome of the interplay of economic, social, and demographic factors. This section discusses the extent of the availability of workers for crop production and other economic activities and uses different indicators to measure the extent of labour supply for own production as well as production processes in other spheres by rural households belonging to different socio-economic classes.

6.1 Average Size of Households in the Study Villages

Mukherjee and Krishnaji (1995) arrived at the conclusion that large landholdings are correlated with large family sizes, as these households remain joint, whereas small landowners and agricultural-labourer households form nuclear households.

The PARI village-level data confirm the hypothesis that the probability of household division increases with reductions in the level of ownership of productive assets. In other words, the poorer the household, the smaller it is likely to be. Across all villages, the average size of small-peasant and manual-worker households ranged from four to seven, being largely concentrated between four and five. The average size of landlord and rich-farmer households ranged from four to fifteen and were largely concentrated in the five-to-eight range. In Ananthavaram, Bukkacherla, and Kothapalle in Andhra Pradesh; Nimshirgaon in Maharashtra; and Tehang in Punjab, the economically better off households phased out of the joint-family norm because of economic and demographic transitions during the last two generations. Landlord and rich-farmer households invested in modern technical and high-income-generating higher education, which in turn resulted in migration and smaller household sizes of their village residences. In other villages, landlord and rich-farmer households continued with undivided households to reap economic opportunities available in the village and neighbouring towns (Ramachandran, Rawal, and Swaminathan 2010).

The nuclearisation of the joint family was most prominent among the class of middle peasants. Except in some villages with high total fertility rate TFR, especially Mahatwar in Uttar Pradesh, Katkuian and Nayanagar in Bihar, Gharsondi in Madhya Pradesh, and Zhapur in Karnataka, this nuclearisation was almost completed. The household size of the class of middle peasants ranged between four and seven. The nuclearisation process was even more prominent in agriculturally

[1] This section is a modified version of "Labour in Small Farms: Evidence from Village Studies," chapter 3 of *How do Small Farmers Fare? Evidence from Village Studies* (Swaminathan and Bakshi 2017).

progressive villages like Ananthavaram, Nimshirgaon, Alabujanahalli, and Panahar. Two explanations can be given for such a tendency: Firstly, the fragmentation of families is due to the patrilineal inheritance of the paternal asset – primarily land. Secondly, following the above-mentioned point of landlord and rich-peasant households' realisation of the importance of investing in further education, middle-peasant households have also started investing in education and other businesses in urban locations. This diversification away from agriculture might have further induced the process of nuclearisation of the joint family.

In the case of manual-worker households, the average household size ranged from three to seven, and in most cases, it was concentrated between three and five. As landholding size – the primary productive asset of small-farmer households – decreases, the probability of divided households increases, thus leading to smaller household sizes.

In all the study villages, the average household size of small-peasant households was less than that of landlords and other farmers. A closer look reveals that small-peasant households resemble manual-worker households in terms of the average size of household in the study villages.

Table 2 *Household members, by class, study villages* in number

State	Village	Landlord and rich peasant	Middle peasant	Small peasant	Manual worker	Other
Andhra Pradesh	Ananthavaram	4	4	4	3	3
	Bukkacherla	4	4	5	4	3
Telangana	Kothapalle	4	4	4	4	4
Uttar Pradesh	Harevli	8	6	6	5	5
	Mahatwar	13	11	7	7	7
Maharashtra	Nimshirgaon	9	5	5	4	5
	Warwat Khanderao	10	6	5	5	5
Rajasthan	25F Gulabewala	8	6	NA	5	5
	Rewasi	12	7	5	5	5
Madhya Pradesh	Gharsondi	10	9	7	6	6
Karnataka	Alabujanahalli	7	6	5	4	4
	Siresandra	10	7	5	4	6
	Zhapur	8	9	7	6	5
West Bengal	Amarsinghi	NA	NA	4	4	4
	Kalmandasguri	NA	NA	5	4	4
Punjab	Panahar	8	5	4	4	4
	Tehang	6	6	5	5	4
Bihar	Katkuian	10	10	7	6	6

Nayanagar	15	8	5	5	5

Note: NA = Not applicable
Source: PARI survey data

6.2 Average Number of Workers per Household and Quality of Occupations Thereof

The number of workers per household is positively correlated with household size across all socio-economic classes. Among the landlord and rich-peasant households, those with older working-age members were better posed to take advantage of diversified economic activities. The working members of these households primarily took supervisory roles in their own farm production process and diversified their sources of income into remunerative business, salaried jobs, and other non-farm activities.

In almost all villages, at least two to three household members participated in economic activities. Among the middle- and small-peasant households, members expended their labour primarily in their own cultivation and the rest of the unspent labourers either sold their labour in the rural wage-labour market or engaged in self-employment activities. One reason for a larger number of workers per household among these classes was their high degree of diversification of income-generating activities. For small-peasant households, the average number of occupations per household varied from three to five, with crop production, wage employment, and rearing animal resources being the most prominent economic activities. Members of small-peasant households also worked on their own farms as well as participated in manual wage work in agricultural and non-agricultural activities; very few engaged in remunerative business and salaried activities.

In 12 out of 19 villages, the average number of workers per manual-worker households was two. These households were primarily engaged in both agricultural and non-agricultural wage employment and had less diversification of economic activities.

Table 3 *Workers per household, by class, study villages* in number

State	Village	Landlord and rich peasant	Middle peasant	Small peasant	Manual worker	Other
Andhra Pradesh	Ananthavaram	1	2	2	2	1
	Bukkacherla	2	3	2	2	1
Telangana	Kothapalle	2	2	2	2	2
Uttar Pradesh	Harevli	3	2	3	2	1
	Mahatwar	4	5	3	3	3
Maharashtra	Nimshirgaon	4	3	3	2	2
	Warwat Khanderao	4	3	3	3	2
Rajasthan	25F Gulabewala	3	3	NA	3	2
	Rewasi	6	4	3	3	3
Madhya Pradesh	Gharsondi	4	3	4	3	3
Karnataka	Alabujanahalli	4	3	3	2	3
	Siresandra	6	4	3	2	3
	Zhapur	2	4	4	3	2
West Bengal	Amarsinghi	NA	NA	3	2	2
	Kalmandasguri	NA	NA	3	2	2
Punjab	Panahar	4	3	2	2	2
	Tehang	2	3	3	2	2
Bihar	Katkuian	4	4	4	3	3
	Nayanagar	7	2	2	2	2

Note: NA = Not applicable
Source: PARI survey data

6.3 Dependency Ratio

The data suggest that the worker to non-worker ratio, for persons aged 15 years and above, varied across the socio-economic classes. A clear pattern can be observed from Table 4: Moving from the class of landlords and rich peasants to that of the manual workers, the ratio of worker to non-worker increases substantially. For the former class, the ratio varies from 0.4:1 to 3.4:1 across villages; for manual-worker households, it ranges from 1.5:1 to 8:1; and for small-peasant households, it ranges from 1:1 to 11.2:1. The reason for such a high ratio of manual workers was their lack of ownership and access to the means of production and their current occupations that generated meagre incomes. To earn a subsistence level of income, more household members were required to participate in the village labour market, primarily as wage workers in crop production for the classes of landlords and rich peasants, middle peasants, and even small peasants. Though the worker to non-worker ratio for the classes of middle peasants and small peasants were very similar, the reasons for such a pattern were different. In case of small peasants, along with being engaged in own cultivation, household members participated in the village labour market (both agricultural and non-agricultural) to supplement their low incomes

generated from crop production. In the case of middle-peasant households, the high worker to non-worker ratio indicates that, along with working in crop production, household members were also engaged in relatively better remunerative economic activities such as business, trade, and salaried jobs or in village-specific jobs. For instance, the worker to non-worker ratio in Siresandra was 4.5:1 – one key reason for this high ratio was the participation of household members in home-based sericulture work and also in the cultivation of labour-intensive vegetables and fruits.

Table 4 *Ratio of worker to non-worker among persons aged 15 years and above, study villages*

State	Village	Landlord and rich peasant	Middle peasant	Small peasant	Manual worker	Other
Andhra Pradesh	Ananthavaram	0.8	0.7	1.2	4.3	3.5
	Bukkacherla	2.3	2.7	1.3	6.1	3.8
Telangana	Kothapalle	3.3	2.3	2	4.8	3.1
Uttar Pradesh	Harevli	1.4	1.1	1	3.4	2.4
	Mahatwar	0.5	1.7	1.5	2.8	2.9
Maharashtra	Nimshirgaon	1	2.5	1.6	2.6	6
	Warwat Khanderao	1.9	2.8	2	4.7	5.7
Rajasthan	25F Gulabewala	0.8	1.7	1.3	4.8	NA
	Rewasi	3.4	6	11.2	3	4.8
Madhya Pradesh	Gharsondi	1.4	1.5	2.1	4.9	3.3
Karnataka	Alabujanahalli	2	1.9	2.8	3.5	3.1
	Siresandra	2.1	4.5	4.3	3.9	5.8
	Zhapur	0.5	2.1	2.4	3.4	5.6
West Bengal	Amarsinghi	NA	NA	5.2	6.6	4.9
	Kalmandasguri	NA	NA	2.8	8	6.5
Punjab	Panahar	2	1.9	1.6	4.9	5
	Tehang	1.2	1.9	1.4	1.5	2.1
Bihar	Katkuian	1.1	1.8	2.7	4.7	3
	Nayanagar	1.7	0.7	1.2	2.3	1.4

Source: PARI survey data

CHAPTER 7

ESTIMATION OF CURRENT LABOUR USE IN CROP PRODUCTION AND POTENTIAL SURPLUS LABOUR IN THE STUDY VILLAGES

To estimate excess labour in the rural production systems, we have considered two variables, namely, the potential labour supply and total labour use. Household level data on both variables are available in the PARI database. The potential labour supply at the household level was obtained by assuming that a worker worked for 25 days (eight hours per day) per month for 12 months. It is also assumed that workers were willing to supply their labour for the entire production year. We have adopted the SNA definition of worker: For instance, in a five-member household with two workers supplying their labour throughout the production year, the potential labour supply of the household would be 600 standard labour-days. The calculation of standard labour-days is based on the existing literature on the calculation of surplus labour. It seems that the 300 standard labour-days per person per year is high compared to the existing norms on the number of days of work in other sectors of the economy. For instance, across all States of India, government employees work in their offices between 220 and 240 days, without considering entitled leaves like earned and medical leaves. A similar pattern is seen for formal sector factory workers, as per the provisions established in the Factories Act, 1948. Realistically, workers engaged in own cultivation and wage employment could also avail such leave structures and consider, in aggregate, 240 days of work per person per household, which amounts to 80 per cent of the 300 standard labour-days per person previously assumed. However, the schedule of working days and leaves for workers engaged in crop production might differ from that of workers employed in other sectors of the economy because, for the former workers, schedules and leaves for would be solely determined by the cropping pattern and timing of performing various agricultural tasks. Hence, we amend our previous assumption of potential labour supply at the household level to consider a worker having worked for 20 days (eight hours per day) per month for 12 months. When a five-member household with two workers supplies their labour throughout the production year, the potential labour supply of the household would be 480 standard labour-days.

Furthermore, to estimate the potential supply of workers and subsequently that of the surplus workers at the village level, we have considered only the agrarian classes of the landlords and rich peasants, middle peasants, small peasants, and manual workers. The class of manual workers provides a major share of its labour for crop production and also participates in the non-agricultural wage labour market in and around the village. As mentioned earlier, members of

landlord and rich-peasant households did not participate in manual work and their crop production was entirely dependent on hired labour from the rural labour market. Different sections of the peasantry expend family labour in their own production in varied proportions and also sell their unspent labour power in the wage labour market. In the study villages, the size of the landlord and rich-peasant class was relatively small, whereas the small peasants and manual workers predominated among the socio-economic classes in the study villages. Labour for crop production and other economic activities was drawn from these two classes. Our analysis shows that surplus labour is primarily concentrated among these two classes along with the middle peasantry.

Total labour use can be approached in two ways: (i) total household labour use and (ii) total labour use in crop production. Total household labour use consists of household labour use in crop production (includes labour provided by both male and female workers in own cultivation), household labour use for livestock, labouring out in crop production against wage, labouring out in non-agricultural work against wage, and salaried/regular wage employment. The aggregate of the above-mentioned components will give the estimate of total household labour use. The difference between total household labour use and potential labour supply at the household level gives the estimate of excess or deficit of labour at the household level. To estimate total labour use in crop production at the household level, information on household labour use in crop production (this includes labour provided by both male and female workers of cultivating households) and hired labour use in crop production provide an estimate of labour use in crop production in the specific production organisation.

The PARI village surveys collected data on labour days and work hours for all crops and crop mixes cultivated on all operational holdings; for all crop operations undertaken on each type of labour (family labour, wage labour on daily wage payment; wage labour on piece-rate payment, exchange labour, and long-term labour); and the hours of machine labour utilised. The labour schedule also incorporated wages paid to hired labourers on both daily wage and piece-rate contracts as well as rental charges for hired machine. Data on the actual work hours were collected but calendar days were converted into standard eight-hour labour days for analysis. Information pertaining to hours of work and the number of days of employment for non-agricultural wage workers were also collected. Workers engaged in salaried/regular wage employment are considered fully employed for the entire production year, unless the time period was specified in the PARI data. In the case of household labour use in livestock, we assume that

a household spends half an hour per day per animal for 365 days in the production year and also converted the time into standard eight-hour working days. The norm of labour use for livestock is provided by Vijayamba R. (2018).

To understand the extent of utilisation of total household labour use, the following four ratios provide a complete picture:
(1) Household labour use in crop production (HLU-CP) as a proportion of total household labour use (THLU) – Given the cropping pattern and the number of workers available at the household, this represents the extent of household labour used for crop production on the operational holding of the household.
(2) household labour use in livestock (HLU-L) as a proportion of THLU
(3) labouring out in crop production (LO-CP) as a proportion of THLU
(4) working in non-agricultural work and salaried/regular wage employment (LO-O) as a proportion of THLU

Table 5 and Figure 8 suggest that HLU-CP/THLU varies between 3 (Nayanagar in Bihar) and 40 per cent (Rewasi in Rajasthan). In 12 out of 19 villages, HLU-CP/THLU was below 20 per cent, indicating minimal labour use in own crop production. The inability of own crop production to absorb available labour at the household level was compensated by household labour use in livestock in some study villages. For instance, HLU-L/THLU was more than 30 per cent in 8 out of 19 villages, with the highest in Nayanagar at 52 per cent, and varying between 20 and 30 per cent in another 8 out of 19 villages. Here, it is important to mention that estimated figures at the village level conceal large variation across different socio-economic classes – this requires more exploration.

Before analysing LO-CP/THLU and LO-O/THLU, these two ratios must be qualified, as both are applicable to the lower strata of the peasantry and manual workers. It is observed that, in most of the villages, the primary source of labour in the village-specific wage labour market came from the lower strata of the peasantry – who required supplementing their household incomes by working on others' fields for wages and simultaneously utilising their unspent household labour – and the manual workers – who, in the absence of land and other means of production, participated in the wage labour market by selling their labour power to earn their livelihood. It is also observed that wage labour markets in the study villages were fairly developed, as a significantly large proportion of labour for crop production was derived from

these markets. Similarly, a significant proportion of workers from peasant and manual-worker households participated in non-agricultural wage employment and also engaged in low remunerative salaried/regular wage employment. However, the engagement of workers in relatively better-paid, regular employment was observed among workers from the upper section of the peasantry.

Except for in Tehang in Punjab, Rewasi in Rajasthan, Mahatwar in Uttar Pradesh, and Panahar in West Bengal, LO-CP/THLU across villages was significantly high, accounting for more than 20 per cent of total household labour use. Particularly, in seven villages, it was more than one-third of the total household labour use. LO-CP/THLU being higher than HLU-CP/THLU indicates a contradictory phenomenon – why would a section of the peasantry participate in the wage labour market when they could expand their labour on their own production? The answer to this lies in the nature of the production organisation, primarily the extent of owned land, crop choice, timeliness in performing the agricultural tasks, and the indivisibility of labour in performing a specific agricultural task within a short duration of time. For a cultivating household, the available amount of household labour was not sufficient to complete the operation in a short duration of time. The cultivating household hired labour from the village labour market to complete the task on time. In many cases, the majority of labour was hired on piece-rate contracts, as this ensured completion of certain labour-intensive tasks in a short period. This led to the institutionalisation of piece-rate operations for the majority of labour-intensive operations like transplanting of rice, harvesting and threshing of paddy and wheat, cotton picking, and most tasks of sugarcane cultivation. Thus, the use of hired labour was a key component of total household labour use in the study villages.

Relatively higher wage earnings in non-agricultural activities and salaried/regular wage employment attracted underutilised household labour, however the availability of non-agricultural employment remains a concern. LO-O/THLU was significantly high in Tehang in Punjab (at 52 per cent), Zhapur in Karnataka (at 46 per cent), Mahatwar in Uttar Pradesh (at 41 per cent), and Kalmandasguri in West Bengal (at 31 per cent). Among the other 11 villages, it was around 20 per cent.

As previously mentioned, non-agricultural activities in some villages provided significant employment and utilised unspent labour. However, HLU-CP and LO-CP together constituted a significantly large proportion of THLU. In 7 out of 19 villages, more than 50 per cent of THLU

was expended either to cultivate own land or to hire labour for crop production. In another 10 villages, HLU-CP and LO-CP together constituted 30 and 50 per cent of THLU, respectively, thus a major share of expended labour was utilised for crop production. The non-agricultural sector could not create an alternative to absorb the under spent and unspent labour in the village production system.

Table 5 *Components of household labour use as a proportion of total household labour supply, study villages* in per cent

State	Village	HLU-CP/ THLU	HLU-L/ THLU	LO-CP/ THLU	LO-O/ THLU
Andhra Pradesh	Ananthavaram	16	27	41	17
	Bukkacherla	36	18	36	10
Telangana	Kothapalle	14	37	29	20
Uttar Pradesh	Harevli	28	27	39	6
	Mahatwar	30	23	7	41
Maharashtra	Nimshirgaon	16	47	23	14
	Warwat Khanderao	18	26	45	11
Rajasthan	25F Gulabewala	16	15	48	21
	Rewasi	40	38	5	17
Madhya Pradesh	Gharsondi	10	51	21	18
Karnataka	Alabujanahalli	33	29	30	7
	Siresandra	22	27	27	24
	Zhapur	10	19	25	46
West Bengal	Amarsinghi	14	34	33	19
	Kalmandasguri	19	26	24	31
	Panahar	21	40	13	26
Punjab	Tehang	4	42	2	52
Bihar	Katkuian	12	28	42	18
	Nayanagar	3	52	23	23

Source: PARI survey data

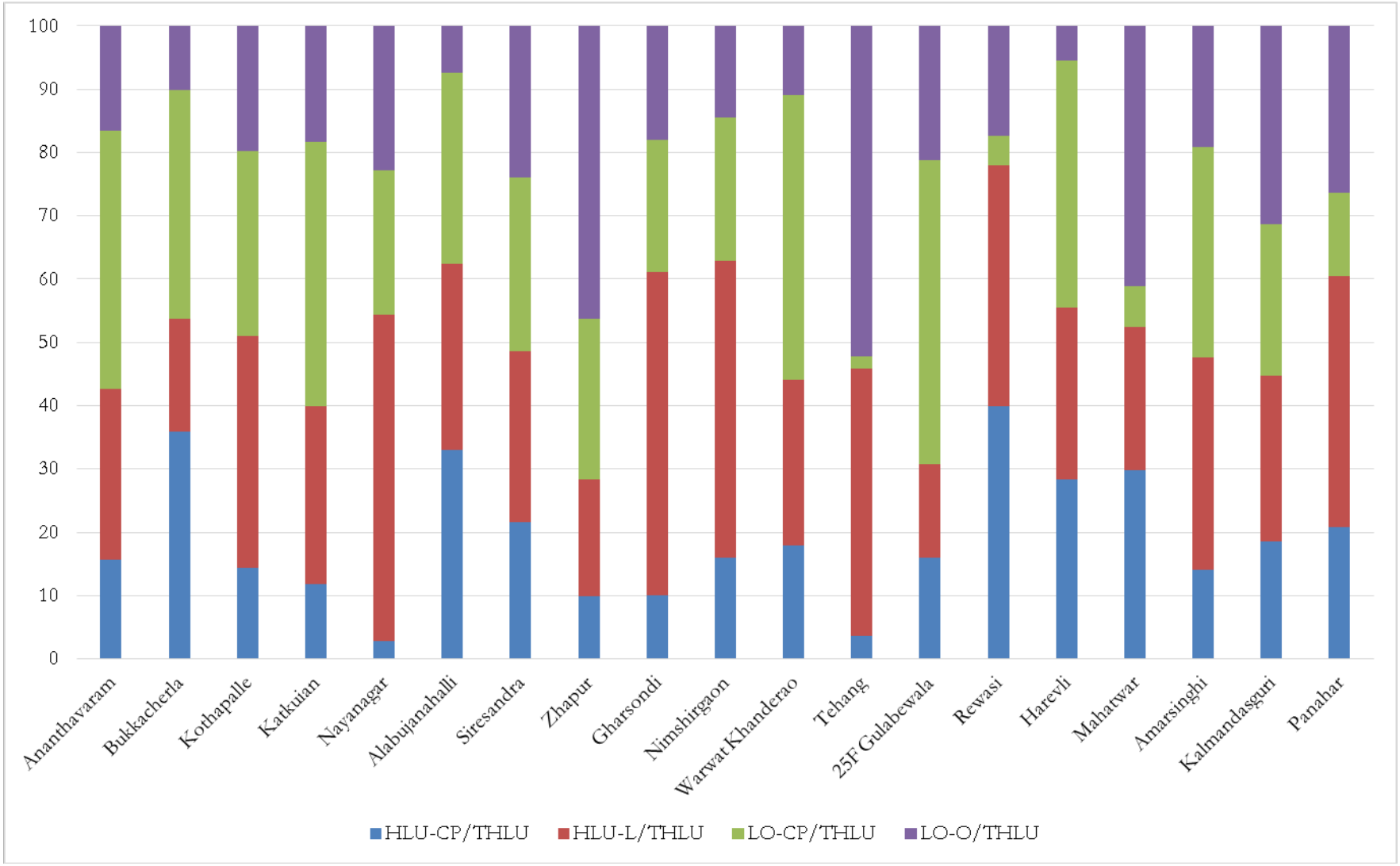

Figure 4 *Components of household labour use as a proportion of total household labour supply, study villages* in per cent
Source: PARI survey data

The current total household labour use in relation to the potential labour supply suggests that serious underemployment prevails among the working-age population at the village level. Not even 50 per cent of available labour was expended in any of the study villages. In 10 out of 19 villages, the ratio of THLU as a proportion to potential labour supply was less than 30 per cent, indicating the magnitude of underemployment among workers in rural India. It also suggests that current village-level production systems (both agricultural and non-agricultural) are not equipped to absorb all available labour, indicating an employment crisis in the countryside. Policymakers have always resorted to state-driven employment generating schemes to mitigate the employment crisis, however a crisis of this magnitude cannot be solved with the limited allocation of resources for such schemes when market-based economic activities miserably fail to generate employment themselves.

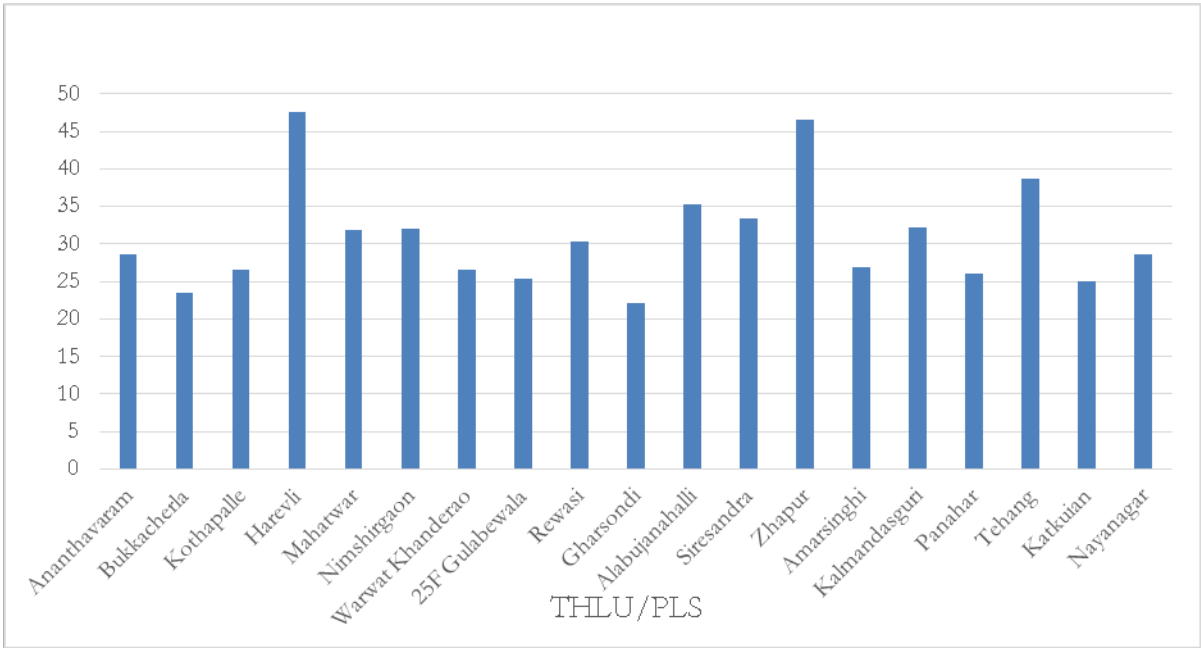

Figure 5 *Total household labour use as a proportion of potential labour supply, study villages* in per cent
Source: PARI survey data

The labour absorption in crop production vis-à-vis potential supply of labour has been depicted by a ratio (Table 6). The aggregate of household and hired labour use in own cultivation, referred to as labour use in crop production (LU-CP) is taken as a proportion of the potential labour supply.

The data suggest that, with respect to potential labour supply in the village, the capacity to deploy labour in crop production was very low across all villages. In 15 out of 19 villages, LU-

CP/PLS was less than 15 per cent. Among the villages, LU-CP/PLS was relatively high in Harevli (29 per cent), Ananthavaram (28 per cent), Bukkacherla (27 per cent), and Alabujanahalli (26 per cent) and abysmally low in Amarsinghi (9 per cent), Nayanagar (8 per cent), and Gharsondi and Tehang (5 per cent) (see Table 6).

Table 6 *Labour use in crop production as a proportion of potential labour supply, study villages* in per cent

State	Village	LU-CP / PLS
Andhra Pradesh	Ananthavaram	28
	Bukkacherla	27
Telangana	Kothapalle	10
Uttar Pradesh	Harevli	29
	Mahatwar	13
Maharashtra	Nimshirgaon	11
	Warwat Khanderao	13
Rajasthan	25F Gulabewala	19
	Rewasi	16
Madhya Pradesh	Gharsondi	5
Karnataka	Alabujanahalli	26
	Siresandra	15
	Zhapur	12
West Bengal	Amarsinghi	9
	Kalmandasguri	11
	Panahar	13
Punjab	Tehang	5
Bihar	Katkuian	12
	Nayanagar	8

Source: PARI survey data

CHAPTER 8

ESTIMATION OF SURPLUS WORKERS

Surplus workers can be estimated by using the following method:

Labour absorption (in person-days) in crop production in i^{th} month = $\sum_{i=1}^{12} L_i^a$, i=1(1)12

where L_i^a is the number of person-days generated in crop production over the i^{th} month

If the number of workers required to perform $\sum_{i=1}^{12} L_i^a$ days of agricultural work in the i^{th} month is N_i^d, i = 1(1)12

then $N_i^d = \frac{\sum_{i=1}^{12} L_i^a}{T}$, for the ith month, where i = 1(1)12

The number of days of work per month per worker T=20 (assuming 20 standard labour days per month)

The supply of workers is N_i^s, for the ith month, where i = 1(1)12

N_i^s is assumed to be constant over the entire production year. This implies there is no inflow and outflow of workers to be engaged in crop production

So, $N_i^s = \overline{N^s}$, for all i

The number of surplus workers for the ith month is $N_i^p = \overline{N^s} - N_i^d$, where i = 1(1)12

Given the level of technology and production organisation, min(N_i^p) can be withdrawn from the crop production permanently.

To explain the method, we use the example of 25F Gulabewala, a village growing cotton (kharif), wheat, and rapeseed (rabi). The number of available workers was 579, which is assumed to be constant for the entire production year. Labour absorption was concentrated in October–November for harvesting cotton and required 559 workers to perform the task, though the number of workers required to perform this month-wise agricultural task varied greatly. There was no requirement of workers in June–July and negligible in the months of May–June and December–January, during which the entire workforce was surplus. Because the deployment of workers was highest in October–November, the number of surplus workers was lowest at 20 workers. This suggests that at least 20 workers could be withdrawn from the production system without any apprehension about a labour shortage during the peak period. However, as the

labour use for crop production in other months was abysmally low, it would leave a large contingent of workers unemployed or underemployed if they were retained to avoid a peak period labour shortage. In the remaining 11 months, 59–100 per cent of workers were surplus; if they were retained in the village production system, they could face serious unemployment and underemployment for a major portion of the production year.

The proportion of surplus workers among all available workers was very high among all the study villages. In Amarsinghi, at least 68 per cent of all available workers could be permanently withdrawn from the production system without affecting the production process, which would certainly not increase the burden of the remaining workers in crop production. The situation was even more serious in Katkuian and Nayanagar in Bihar. In Katkuian, at least 72 per cent of all available workers were surplus and could be permanently moved out of crop production. Here, outmigration has been historically very high, and a substantially large section of migrants did not feature in the calculation of surplus workers due to the assumption of constant supply of labour during the production year. It was observed that 257 workers had migrated during the survey year, which was 19 per cent of the total size of the workforce. In the case of Nayanagar, at least 75 per cent of workers could be withdrawn permanently from crop production; cultivation practices could not absorb more than 93 per cent of available workers for eight months of the production year. A high degree of unemployment and underemployment prevailed among the workforce, and data further suggest that 901 workers (26 per cent of the total workforce) migrated to various parts of India to work in the informal sector. Apart from the permanent withdrawal of workers from crop production, a substantially large section of surplus workers could be withdrawn from the crop production for a short time period and return to crop production during the peak period.

In the case of Ananthavaram, the cropping pattern was highly labour absorbing. The cultivation of betel leaf, sugarcane, and rice absorbed much labour, and labour use was distributed across the production year. This was the only study village that experienced a labour shortage during November–December, the busiest time of the production year. Harvest and post-harvest operations of rice, followed by sowing of maize and harvesting of betel leaf created a labour shortage on the magnitude of 50 per cent – the estimated shortfall of 597 workers. This implies that, during this time, workers were hired from neighbouring villages to perform agricultural operations, especially in the case of betel leaf, which is considered a specialised job performed by workers from outside the village. In another distinct case, labour use in Nimshirgaon was almost

evenly distributed across the months, except in March–April and April–May. Crop cultivation here actually required 8–25 per cent of available workers, and almost 75 per cent of them could be withdrawn without increasing the burden of remaining workers.

The identification of female surplus workers in crop production is a complex exercise, as female workers were engaged in multiple activities like participating in own farm work, maintaining animal resources, and participating in the wage labour market in the case of women from manual-worker and peasant households. Considering these as economic activities, the number of female workers as a proportion of all workers ranged from 25.9 to 39.1 per cent in the study villages. A large proportion of female workers were surplus workers in crop production. For instance, in Panahar, the magnitude of female surplus workers over the production year varied from 73 per cent (October–November) to 100 per cent (in four months). The difference between male and female surplus workers was considerably large. In the peak time (October–November), the difference was as high as 37 percentage points, and a similar pattern was observed for all months. In the cases of Katkuian and Nayanagar, the unemployment and underemployment crisis among the female workers was serious. The absolute number of female workers vis-à-vis male workers was 1.5 times in Katkuian and 2.4 times in Nayanagar. The obvious reason for such an overwhelming number of female workers in rural production system was the high rate of male migration, as mentioned earlier. Of all migrants, the share of female migrants was only 1.2 and 3 per cent in Katkuian and Nayanagar, respectively. Therefore, the near immobility of female workers outside the village production system forced them to participate in the rural wage labour market to access limited employment opportunities. This resulted in a large contingent of female surplus workers. The month-wise distribution of female surplus workers suggests that at least 74 and 83 per cent of female worker in these respective villages could be withdrawn from crop production system.

Though female surplus workers could be withdrawn from the crop production, their transfer to other sectors might be difficult, as women bear the additional burden of housework. The pressure of the care giving role of female workers greatly restricted their mobility, confining them within the village boundary. For such a large contingent of surplus workers, the creation of employment opportunities within the village production system is an significant task for policymakers. The emergence of home-based production could have generated some employment for the female surplus workforce, but the scope of home-based work was too narrow to solve the critical problem of surplus workers. More innovative forms of off-site work

must be evolved to comprehensively address the complex issue of female surplus workers, whose mobility is determined by social norms along with prevailing customs in the villages.

The analysis suggests that crop production cannot carry such a large workforce with the current provision of the forces of production. Any improvement in technology would further shrink the labour absorption capacity of crop production, leaving more workers unemployed or underemployed. From a policy perspective, employment generation must happen in other sectors of the economy, as crop production does not have any capacity to absorb more workers; rather the withdrawal of a significant proportion of the workforce from the crop production would improve the overall employment situation.

Table 7 *Estimation of surplus workers in crop production, 25F Gulabewala* in number

Month	Total labour used	Required workers	Available workers	Surplus workers
May–June	43	2	579	577
June–July	0	0	579	579
July–Aug	564	28	579	551
Aug–Sept	2354	118	579	461
Sept–Oct	4741	237	579	342
Oct–Nov	11181	559	579	20
Nov–Dec	1502	75	579	504
Dec–Jan	310	16	579	564
Jan–Feb	2032	102	579	477
Feb–March	1564	78	579	501
March–April	3297	165	579	414
April–May	1135	57	579	522

Source: PARI survey data

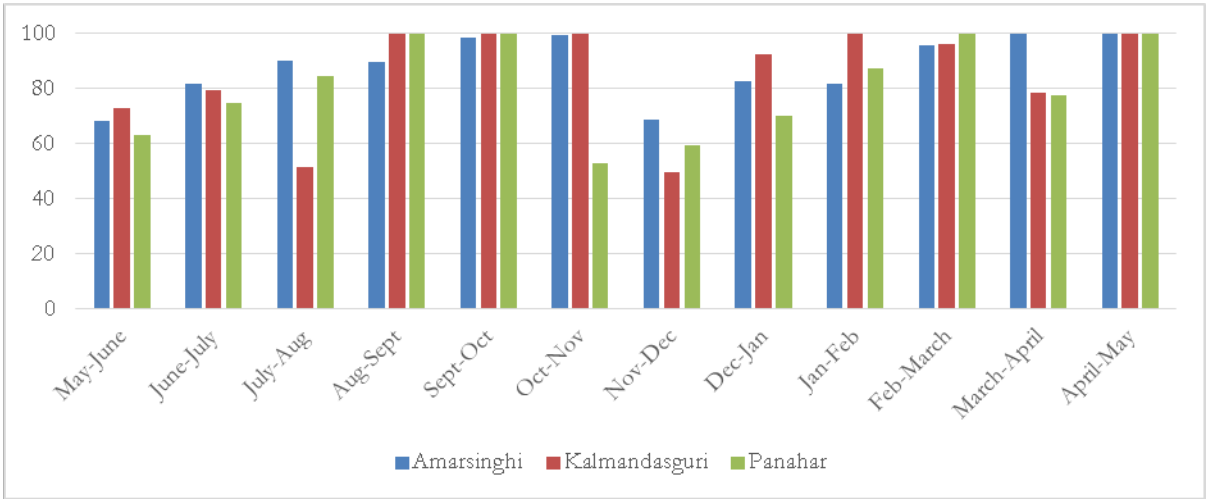

Figure 6 *Extent of surplus workers in crop production, West Bengal study villages* in per cent
Source: PARI survey data

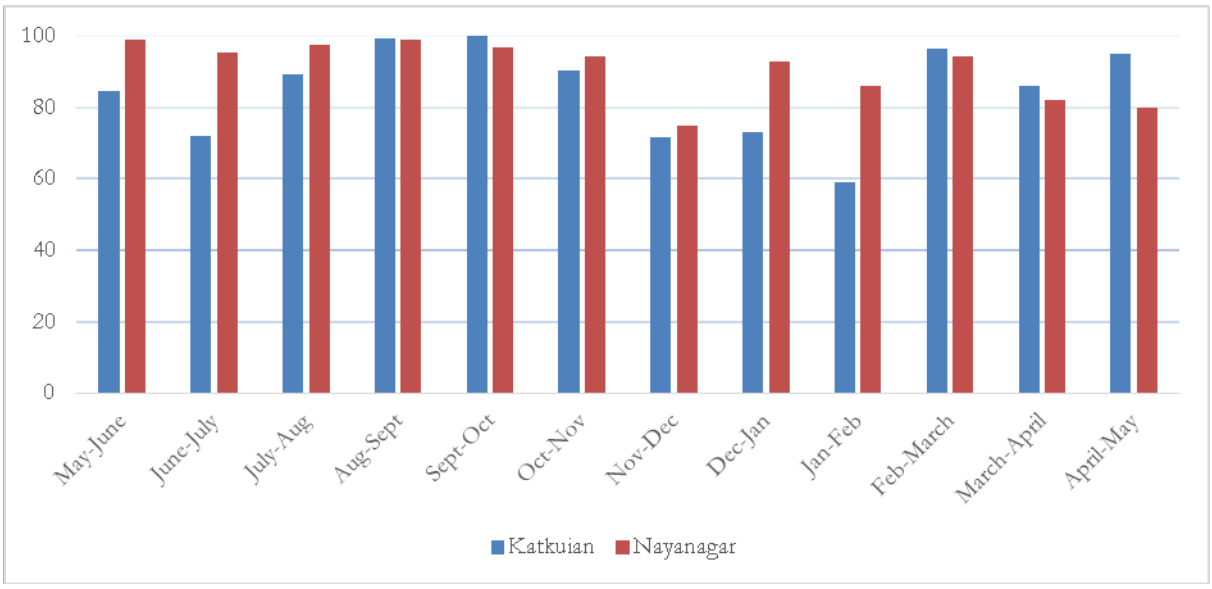

Figure 7 *Extent of surplus workers in crop production, Bihar study villages* in per cent
Source: PARI survey data

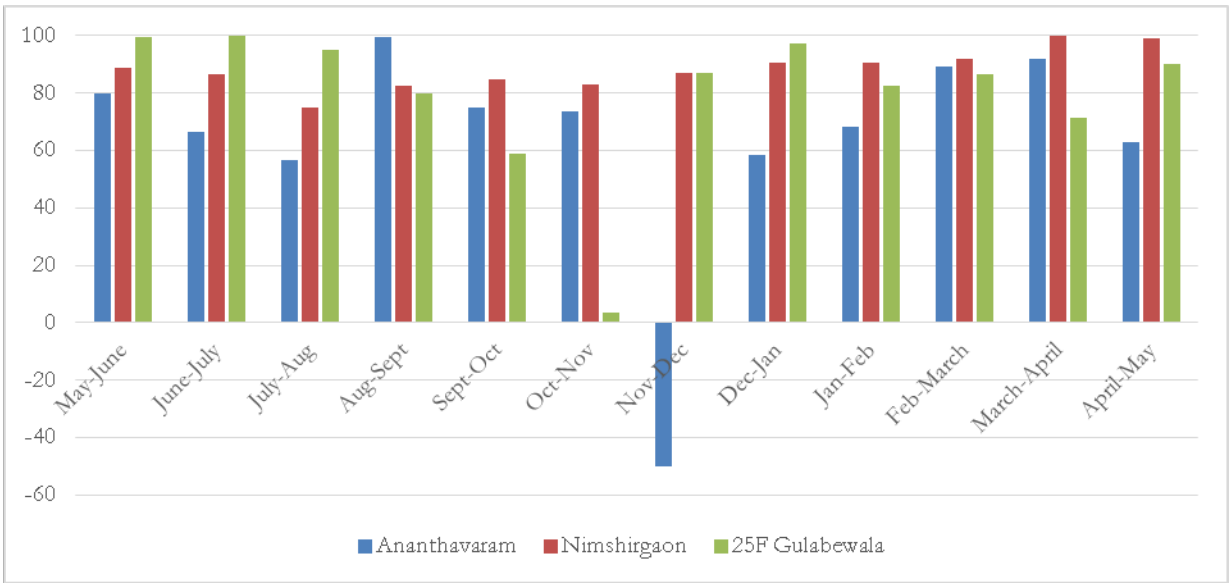

Figure 8 *Extent of surplus workers in crop production, Ananthavaram (Andhra Pradesh), Nimshirgaon (Maharashtra), and 25F Gulabewala (Rajasthan)* in per cent
Source: PARI survey data

Table 8 *Extent of surplus workers in crop production, study villages* in per cent

Month	West Bengal			Bihar		Andhra Pradesh	Maharashtra	Rajasthan
	Amarsinghi	Kalmandasguri	Panahar	Katkuian	Nayanagar	Ananthavaram	Nimshirgaon	25F Gulabewala
May–June	68	73	63	85	99	80	89	100
June–July	82	80	75	72	95	66	87	100
July–Aug	90	52	84	89	97	57	75	95
Aug–Sept	90	100	100	99	99	99	82	80
Sept–Oct	99	100	100	100	97	75	85	59
Oct–Nov	100	100	53	90	94	73	83	3
Nov–Dec	69	50	60	72	75	-50	87	87
Dec–Jan	83	92	70	73	93	59	91	97
Jan–Feb	82	100	88	59	86	68	91	82
Feb–March	96	96	100	96	94	89	92	86
March–April	100	78	78	86	82	92	100	72
April–May	100	100	100	95	80	63	99	90
No. of available workers	254	312	433	1101	2530	1191	1772	579

Source: PARI survey data

Table 9 *Extent of surplus workers in crop production, by sex, study villages* in per cent

Month	Panahar		Katkuian		Nayanagar	
	Male	Female	Male	Female	Male	Female
May–June	50	87	69	96	96	100
June–July	73	76	85	74	88	98
July–Aug	78	94	80	85	95	99
Aug–Sept	100	100	98	100	98	99
Sept–Oct	100	100	100	100	96	100
Oct–Nov	36	73	79	100	94	100
Nov–Dec	44	84	58	82	55	89
Dec–Jan	59	85	38	92	81	100
Jan–Feb	80	98	32	82	55	91
Feb–March	100	100	94	100	82	99
March–April	72	85	79	94	70	87
April–May	100	100	88	100	65	83
No, of workers	252	179	440	661	734	1796

Source: PARI survey data

CHAPTER 9

CONCLUDING REMARKS

Before concluding the major findings from the village studies, we note that most of the theoretical and empirical work on surplus labour in the Indian context was done in the 1950s and 1960s, and enthusiasm to study the current status of surplus labour has greatly receded. In recent times, the persistence of surplus labour, unemployment, and underemployment and identifying sectors to absorb surplus labour to solve unemployment and underemployment have become stylised facts. Though the nature and description of this problem is correctly described, the magnitude of surplus labour and the characteristics of production systems that generate it are under-researched due to the lack of adequate data. To fill the gap, in the first decade of the twenty-first century, the Foundation for Agrarian Studies (FAS) initiated the Project on Agrarian Relations in India (PARI) to conduct village studies to revisit some of the major issues related to farm economics, including issues related to labour and employment, in the era of neoliberalism. This study tried to undertake in-depth and context-specific analysis of existing labour use in crop production and estimate the amount of surplus labour.

The FAS household level surveys collect detailed information on demographic profile, production systems and livelihood of different strata of the rural population. The data on crop production includes detailed information on income from crop production, among other tangible sources of income, all possible cost components including human labour, labour days worked, work hours for all crops and crop mixes cultivated on all operational holdings; for all crop operations undertaken using each type of labour (family labour, wage labour on daily wage payment; wage labour on piece-rate payment, exchange labour, and long-term labour), and the hours of machine labour utilised. The labour schedule also includes wages paid to hired labourers on both daily wage and piece-rate contracts as well as rental charges for hired machines. Data on the actual work hours were collected but calendar days were converted into standard eight-hour labour days for analysis. Information pertaining to hours of work and the number of days of employment for non-agricultural wage workers were also collected. This detailed and disaggregated data on labour and employment helps to analyse labour surplus issues by imposing fewer restrictions and fewer assumptions.

Firstly, the impact of seasonality in crop production was prominent across all the study villages. In most of them, the total labour use in crop production was higher in kharif than that in rabi, primarily due to the cropping pattern and large gross cropped area in kharif season. In the

presence of annual crops like sugarcane, or with cultivation of horticulture crops, distribution of labour use was less skewed, as various crop operations would engage labour over the entire production year. While crop diversification from the point of view of higher income has been discussed, there is a need to examine crop diversification from the point of view of labour absorption.

Secondly, there was high intra-season difference in labour use for various tasks in the study villages. In most of them, the largest share of labour employment was generated for harvest and post-harvest operations. The variation in labour use within a crop season complicated the estimation of labour use in crop production and withdrawal of excess labour. As the case of WarwatKhanderao village (Buldhana district, Maharashtra) suggests, labour use varied over the months and crop production could not generate employment consistently throughout the production year. In other words, there is both large inter-seasonal and intra-seasonal variation in demand for labour in crop production.

Thirdly, the distribution of labour use by month shows the enormity of underutilisation of labour time. In most of the study villages, irrespective of the level of agricultural development, the deployment of labour was concentrated in few months, specifically the harvesting months. Even labour deployment during these months was much lower compared to the available labour. Thus, the month-wise distribution of labour indicates the magnitude of unexpended labour for the entire production year. The proportion of unexpended labour that can be withdrawn from crop production and the time span for which it can be withdrawn varies depending upon the size of the surplus labour during the peak month(s) of labour deployment.

Fourthly, given the limited capacity of crop production to absorb labour, members of cultivating households were compelled to undertake multiple economic activities. In most villages, within the household, a significantly large proportion of labour was utilised to rear livestock, especially in Nayanagar in Bihar, Gharsondi in Madhya Pradesh, and Nimshirgaon in Maharashtra. However, for most peasant and manual-worker households, labouring out in crop production was an important activity. Given the shortage of non-agricultural work at higher remuneration in most of the study villages, non-agricultural wage employment and salaried/regular wage employment constituted a very small portion of total household labour use, with a few exceptions such a villages of Tehang (Punjab), Zhapur (Karnataka), and Mahatwar (Uttar Pradesh).

Fifthly, as discussed in Chapter 7, total labour use in crop production vis-à-vis the potential labour supply was minimal in the study villages, ranging between 5 and 29 per cent. This emphasises the fact that, given the current level of adoption of technology, the labour carrying capacity of crop production cannot be sustained. In fact, any technological improvement in crop production might further lower the labour carrying capacity. One option to utilise unspent labour was participation in the wage labour market within and outside villages. The data suggest that in 16 out of 19 villages, a substantial number of persons obtained wage work in crop production outside the study villages. It is important to note that the workers would have moved away from crop production if better remunerative, non-agricultural wage work was available within or outside the study villages. However, the lack of employment opportunities in the non-agricultural sector forced them to remain in wage employment in crop production to maintain their livelihood.

Lastly, almost every production system contains a large number of surplus workers throughout the production year as discussed above. Except for one instance of a 50 per cent shortage of workers in November–December in Ananthavaram village (Guntur district, Andhra Pradesh) the popular claim of a shortage of workers in crop production is completely devoid of any empirical evidence. Our findings suggest that cultivators faced no shortage of agricultural workers at any point in the production year. Many surplus workers across the study villages could be permanently withdrawn from crop production without affecting the level of output nor increasing the burden on the remaining workers in crop production. Even more surplus workers could be temporarily withdrawn from crop production and provided with short-term employment opportunities in other sectors. Though the data of 20 villages cannot be generalised for all villages of India, this study highlights the importance of the size and characteristics of surplus labour being at the centre of any discussion on labour and employment in the context of rural India.

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APPENDIX

Table A1 *Details of study villages*

Village	Sub-district	District	State	Agroecological zone*	Survey year
Ananthavaram	Kollur	Guntur	Andhra Pradesh	Krishna-Godavari Zone	2005–06
Bukkacherla	Raptadu	Anantapur		Scarce Rainfall Zone of Rayalaseema	2005–06
Kothapalle	Thimmapur	Karimnagar	Telangana	North Telangana Zone	2005–06
Harevli	Najibabad	Bijnor	Uttar Pradesh	Bhabar and Tarai Zone	2006
Mahatwar	Rasra	Ballia		Eastern Plain Zone	2006
25F Gulabewala	Karanpur	Sri Ganganagar	Rajasthan	Irrigated North-Western Plain Zone	2007
Rewasi	Sikar	Sikar		Transitional Plain Zone of Inland Drainage	2010
Nimshirgaon	Shirol	Kolhapur	Maharashtra	South Konkan Coastal Zone	2007
Warwat Khanderao	Sangrampur	Buldhana		Western Maharashtra Plain Zone	2007
Gharsondi	Bhitarwar	Gwalior	Madhya Pradesh	Gird Zone	2008
Alabujanahalli	Maddur	Mandya	Karnataka	Southern Dry Zone	2009
Siresandra	Kolar	Kolar		Eastern Dry Zone	2009
Zhapur	Gulbarga	Kalaburagi		North East Dry Zone	2009
Kalmandasguri	Cooch Behar-II	Cooch Behar	West Bengal	Terai Zone	2010
Amarsinghi	Ratua-I	Malda		New Alluvial Zone	2010
Panahar	Kotulpur	Bankura		Old Alluvial Zone	2010
Hakamwala	Budhlada	Mansa	Punjab	Malwa	2011
Tehang	Phillaur	Jalandhar		Central Plain Zone	2011
Katkuian	Bagaha	West Champaran	Bihar	North-West Alluvial Gangetic Region	2011–12
Nayanagar	Rosera	Samastipur		North-West Alluvial Gangetic Region	2011–12

Source: PARI survey data

Table A2 *Labour use in land operated, by crop, Andhra Pradesh study villages, 2005–06* in eight-hour days

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
Ananthavaram	Maize	559	19,139	34
	Others	138	45,513	330
	Rice	963	39,304	41
Bukkacherla	Groundnut	874	16,206	19
	Groundnut (intercropped)	514	6151	12
	Rice	200	17,824	89
Kothapalle	Maize	181	5,806	32
	Rice	179	13,625	76

Source: PARI survey data

Table A3 *Labour use in land operated, by crop, Telangana study village, 2005–06* in eight-hour days

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
Kothapalle	Rice (Kharif)	200	17,824	89
	Maize	181	5806	32
	Rice (Rabi)	179	13,625	76

Source: PARI survey data

Table A4 *Labour use in land operated, by crop, Karnataka study village, 2008–09* in eight-hour day

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
Alabujanahalli	Mulberry	47	10,470	223
	Sugarcane	56	18,747	335
	Rice	284	19,262	68
Siresandra	Others	339	4,438	13
	Carpet legume & others	70	3,639	52
	Finger millet	90	1,468	16
	Finger millet (Intercrop)	27	1,845	68
	Mulberry	50	2,353	47
	Tomato	29	3,889	134
Zhapur	Pigeon pea	240	4,254	18
	Pigeon pea (Intercrop)	212	4,383	21
	Sorghum	111	1,448	13
	Sunflower	214	1,313	6

Source: PARI survey data

Table A5 *Labour use in land operated, by crop, Rajasthan study villages, 2006–07 and 2009–10* in eight-hour days

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
25F Gulabewala	Cotton	552	17,731	32
	Cotton (Intercrop)	138	1,557	11
	Others	636	4,079	6
	Rapeseed	1,099	5,124	5
	Wheat	834	4,319	5
	Rapeseed and others	1,258	11,737	9
Rewasi	Pearl millet	271	4,033	15
	Pearl Millet (Intercrop)	260	8,193	31
	Wheat	245	6,933	28

Source: PARI survey data

Table A6 *Labour use in land operated, by crop, Madhya Pradesh study village, 2007–08,* in eight-hour days

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
Gharsondi	Chick pea	497	2,150	4
	Others	1,024	4,171	4
	Soybean	1,178	1,309	1
	Wheat	878	4,268	5
	Wheat (Intercrop)	220	1,039	5

Source: PARI survey data

Table A7 *Labour use in land operated, by crop, Maharashtra, 2006–07* in eight-hour day

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
Nimshirgaon	Fruits and vegetables	661	26,032	39
	Sorghum	315	5,361	17
	Soybean	365	7,470	20
	Sugarcane	439	27,751	63
Warwat Khanderao	Cotton	303	7,660	25
	Cotton (Intercrop)	614	15,249	25

Source: PARI survey data

Table A8 *Labour use in land operated, by crop, Punjab study villages, 2010–11* in eight-hour days

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
Hakamwala	Cotton	1,382	52,901	38
	Rice	721	18,096	25
	Others	167	4,658	28
Tehang	Others (Intercrop)	393	690	2
	Rice	1,345	11,773	9
	Wheat	1,355	3,643	3

Source: PARI survey data

Table A9 *Labour use in land operated, by crop, Uttar Pradesh study villages, 2005–06* in eight-hour days

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
Harevli	Rice	55	4,094	74
	Sugarcane	261	16,521	63
	Wheat	85	2,494	29
Mahatwar	Rice	140	9,654	69
	Wheat	140	3,362	24

Source: PARI survey data

Table A10 *Labour use in land operated, by crop, West Bengal study villages, 2009—10* in eight-hour days

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
Amarsinghi	Jute	16	928	58
	Rice (Summer)	54	2,990	55
	Rice (Rabi)	44.5	2,960	67
Kalmandasguri	Jute	55	4,259	77
	Rice	96	4,749	49
	Potato	32	2,143	67
Panahar	Rice (Kharif)	182	8,616	47
	Rice (Summer)	24	1,189	50
	Rice (Rabi)	84	4,709	56
	Potato	103	6,550	64

Source: PARI survey data

Table A11 *Labour use in land operated, by crop, Bihar study villages, 2011–12* in eight-hour days

Village	Crop	Extent (acre)	Labour use	
			Total	Per acre
Katkuian	Rice	331	16,510	50
	Sugarcane	600	20,817	35
	Maize	101	16,570	164
Nayanagar	Wheat	214	12,229	57
	Sugarcane	101	10,674	106
	Others	550	14,728	27

Source: PARI survey data

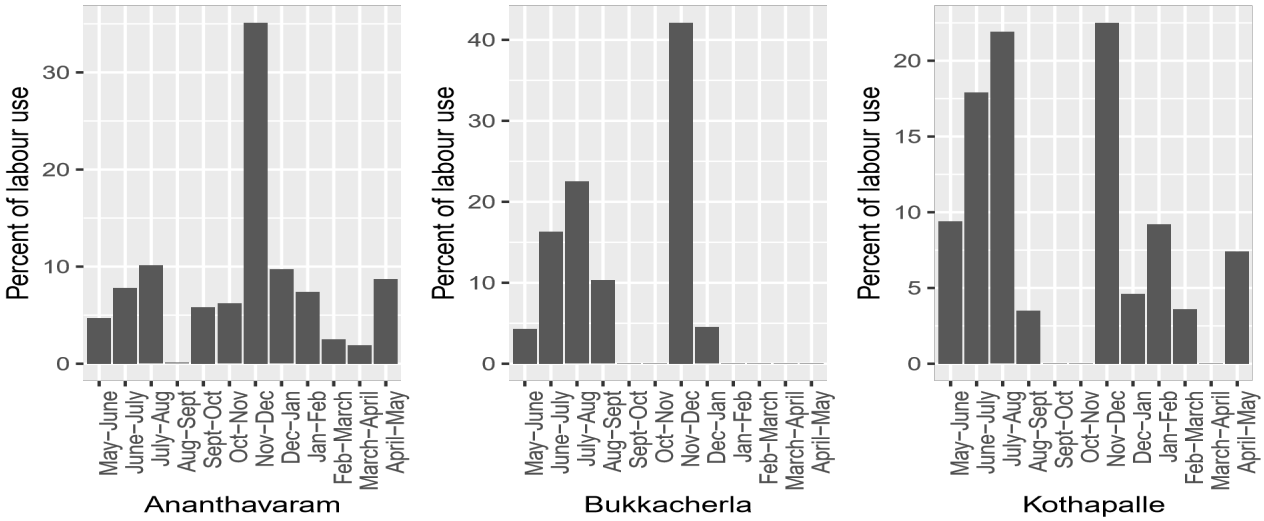

Figure A1 *Labour use in crop production, by month, Andhra Pradesh study villages, 2005-06* in per cent

Source: PARI data

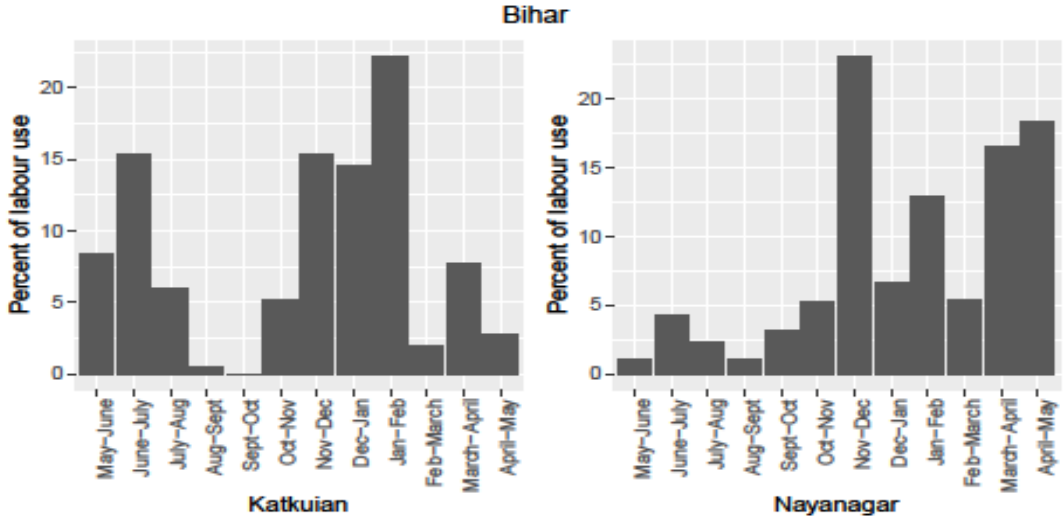

Figure A2 *Labour use in crop production, by month, Bihar study villages, 2011–12* in per cent

Source: PARI survey data

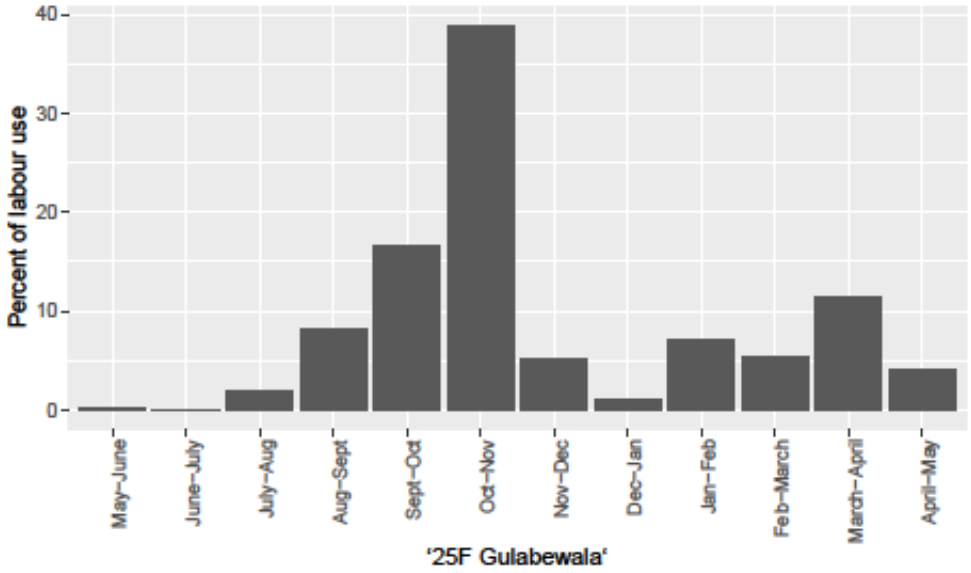

Figure A3 *Labour use in crop production, by month, Rajasthan study village, 2007* in per cent

Source: PARI survey data

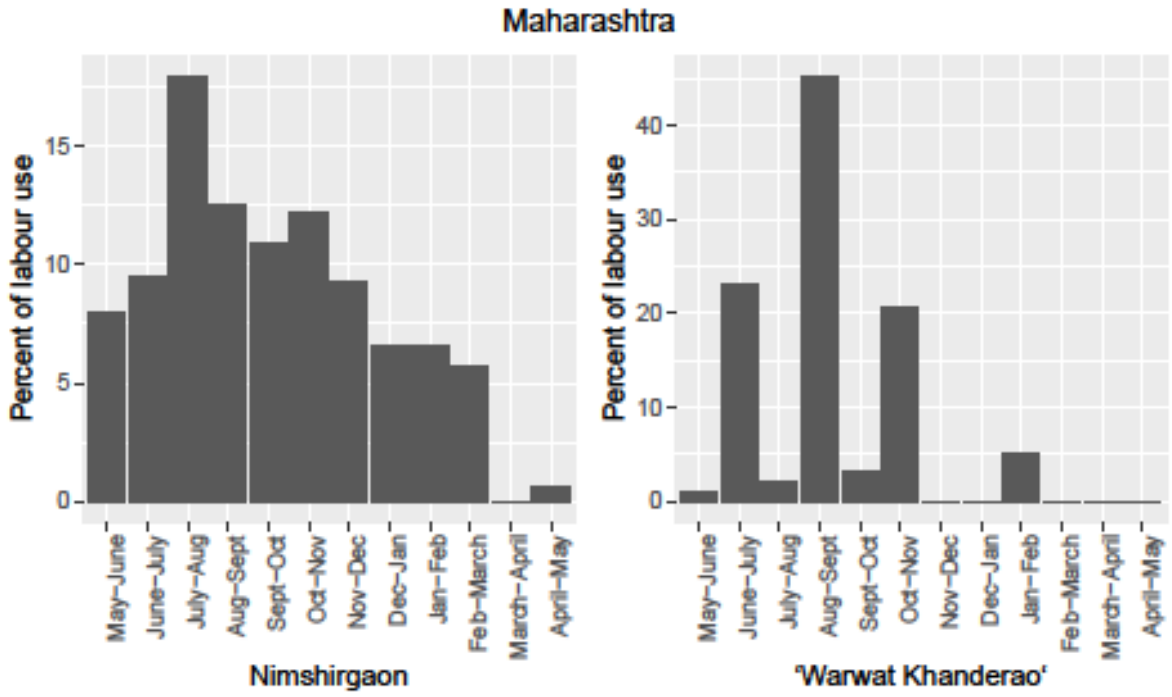

Figure A4 *Labour use in crop production, by month, Maharashtra study villages, 2007* in per cent

Source: PARI survey data