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Causes and Consequences of Supply-Demand Gap for Labour in Sugarcane in India

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Abstract

The paper has estimated the demand for human labour use in sugarcane and other competing crops and changes over time in its use in major cane-growing states. It has also examined the supply-demand gap in human labour for sugarcane and has provided some coping strategies. The study, based on the primary as well as secondary data on the use of human labour for sugarcane for the past 30 years (1980 to 2010), has found that sugarcane cultivation is least mechanized and most labour-intensive in almost all major cane-growing states of India. The labour-use per hectare has increased in all the cane-growing states, except Tamil Nadu and Maharashtra. Study has revealed that the proportion of casual labour has increased over the years in sub-tropical states because of less availability of family labour for cane cultivation. The assured labour in the form of family + attached labour is on decline, impacting sugarcane cultivation adversely. Arduous work and inhuman working conditions, lack of female participation and disintegrating traditional system of cane harvesting have been identified as the major constraints for the increasing demand and supply gaps in sugarcane cultivation. The shortage of labour is reported to hit all sugarcane cultivation operations, driving up the costs and a decline in the profit margin of farmers. The study has also found that area under cane cultivation has reduced drastically in Haryana and cane yield is stagnant or declining in Maharashtra. The coping strategies for reducing demand-supply gap suggested in the paper are: R&D efforts towards development of sugarcane harvester; development of suitable crop geometry to facilitate the movement of machineries up to the knee-high stage of the crop; change in the traditional system of cane planting for fast germination to avoid weed menace and curtailing labour requirement; popularization of cane planting by machines developed at IISR, Lucknow and popularization of multi-functional ratoon management device. The sugar mills must evolve a sound cane development plan in their cane command areas for purchase of machinery and tie up with the manufacturers and research organizations. This will help in ensuring mechanization of cane operations and avoid forced scarcity of labour in situations of labour diversion to schemes like MGNREGS.

Key words: Labour supply, Supply-demand gap, Labour demand, Sugarcane

JEL Classification: J22, J23

Introduction

The participation of human labour in crop cultivation is seen right from the operations like preparatory cultivation to sowing, fertilizer application, irrigation, weeding, intercultivation, plant protection measures, harvesting, etc. Several studies (Anonymous, 2011; Sharma, 2008) have reported that cost on human labour

constitutes about 40-50 per cent of the total cost of cultivation for various crop enterprises, and more than 50 per cent for labour-intensive crops like sugarcane. With rising wage rates and fair as well as remunerative prices, some cereal crops such as wheat that require less labour-use become more remunerative and are also considered as cash crops. This results in switching over from labour-intensive sugarcane crop to other crops and thus adversely affecting the long-term sustainability of the sugarcane crop. In the present

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paper, the extent and nature of labour use in sugarcane *vis-à-vis* other crops have been analysed. The paper has also studied the trends in labour use in sugarcane in major cane-growing states over time, the supply-demand gap and the coping strategies to reduce the supply-demand gap.

Data and Methodology

The paper is based on both secondary and primary data. The secondary data on the use of human labour for sugarcane were compiled from the Comprehensive Scheme for Studying Cost of Cultivation of Principal Crops (COC) of Govt. of India for the past 30 years. Since the COC data are not available for the plant and ratoon crop separately, for different operations and for different categories of farmers, the extent of labour use under these scenarios was compiled as primary data by conducting a rapid appraisal survey through personnel interviews as well as telephonic communications with cane development officials of sugar mills and with farmers. The primary data pertains to the year 2010-11. Simple averages and percentages have been used to analyse the data.

Results and Discussion

Labour Intensiveness of Sugarcane Cultivation

Sugarcane crop is raised in about 4.2-5.0 million ha area and about 50 per cent of this crop remains as ratoon crop, in general. Being a long-duration crop of

12 months and its sowing spreading from October to May, sugarcane is a labour-intensive crop, which requires about 166-325 labour days per hectare (Table 1). Interculture operation is the single largest consumer of labour in sugarcane cultivation in India. Sugarcane requires about five interculture operations, including manual weeding operations and hence the labour-use is spread across five operations. The other main components of labour-use in sugarcane cultivation are harvesting and planting operations. Harvesting requires about 70-100 labour days/ha for a normal sugarcane crop. However, the labour-use for harvesting depends upon the yield and condition of the crop at harvesting time, the labour demand per ha for harvesting the cane is higher, if the yield of the crop is higher or the crop has lodged and the canes are not erect.

Most of the operations in cane cultivation are carried out manually and the use of machinery is limited to field preparation. This is not the case in respect of the main competing cereal crops. The labour-use per ha in wheat in the Indo-Gangetic Plains of Uttar Pradesh is about 60 persondays compared to 166 persondays for sugarcane crop, while it is still lower to 37 persondays in mechanized farms of Haryana state. In tropical states, the per ha labour-use is less in paddy than in sugarcane. The labour-use is also very low for other commercial crops (cotton) and groundnut compared to sugarcane. The extent of mechanization in sugarcane crop is very low compared to that in other crops. The machine labour cost in the total operational

Table 1. Labour-use in sugarcane and other competing crops in major cane-growing states of India

Crop	States					
	Sub-tropical			Tropical		
	Uttar Pradesh	Haryana	Maharashtra	Tamil Nadu	Karnataka	Andhra Pradesh
	Total labour-use per ha (persondays)					
Sugarcane	166.43	173.14	260.15	295.39	275.09	325.13
Wheat	60.04	37.32	-	-	-	-
Paddy	105.92	71.00	-	117.56	150.88	104.35
Groundnut	-	-	87.20	87.58	58.20	80.31
Cotton	96.21	-	104.96	148.80	87.10	103.06
	Machine labour as percentage of operational cost (%)					
Sugarcane	1.24	5.09	10.76	2.22	2.82	1.30
Wheat	24.08	25.88	-	-	-	-
Paddy	9.69	15.52	11.44	17.58	12.73	14.02
Groundnut	-	-	4.87	5.85	8.38	3.90
Cotton	-	11.06	3.15	9.13	7.42	7.99

Note: The figures pertain to the year 2006-07.

Table 2. Labour-use in sugarcane in major cane-growing states of India

Period	Total labour-use (persondays/ha)					
	Sub-tropical states			Tropical states		
	Uttar Pradesh	Haryana	Maharashtra	Tamil Nadu	Andhra Pradesh	Karnataka
1980s	140	125	333	322	246	203
1990s	155	130	237	327	281	206
2000s	156	143	266	289	288	276
Increase/Decrease	+ve	+ve	-ve	-ve	+ve	+ve

Note: +ve means increase while -ve means decrease; The figures given within the brackets have been worked out as average values based on cost of cultivation data for the decade.

Source: The Comprehensive Scheme for Studying Cost of Cultivation of Principal Crops (CSSCOPC) of Govt. of India

cost constitutes one-fourth in wheat and varies from 10 to 18 per cent in paddy in the major cane-growing states. It, thus, highlights that the cane cultivation is the least mechanized and most labour-intensive crop in major cane-growing states.

Trends in Labour-use in Sugarcane

The human labour-use for sugarcane is higher in tropical than sub-tropical states. Presently, it is the highest in Tamil Nadu (289 labour days), followed by Andhra Pradesh (288 labour days), Karnataka (276 labour days) and Maharashtra (266 labour days). In sub-tropical states of Uttar Pradesh and Haryana, the labour-use per hectare ranges between 143 and 156 labour days (Table 2). Amongst sub-tropical states, the human labour-use is higher in Uttar Pradesh than in the neighbouring states. Over the past 30 years, the labour-use has increased in all the sub-tropical and tropical states, except Tamil Nadu and Maharashtra. The labour in these states (Tamil Nadu and Maharashtra) has decreased by 10.25 per cent and 20.12 per cent, respectively compared to the extent of labour-use during 1980s. The reduction in labour-use in these states may be attributed to popularization of mechanization of some of the cane operations. In Maharashtra, the decrease in labour-use is also due to water scarcity problems and it is being reflected in stagnant/declining cane yield levels. The scarcity of water has also resulted in lesser number of intercultural operations and hence, reduced labour-use. In the case of Karnataka and Andhra Pradesh, some sort of labour intensification has occurred during the past 2 decades. It could be due to the absence of wheat crop in this region, and the lesser extent of mechanization in rice.

Amongst sub-tropical states, where labour-use is already low, Uttar Pradesh and Haryana have shown a marginal increase in labour-use in cane cultivation.

A look at the labour-use on individual cane farms reveals that the labour-use per hectare is higher on large than small farms in plant, ratoon and other types of sugarcane crop (Table 3). This highlights that there will be more demand for casual labour on these farms. As 50 per cent of the sugarcane crop on individual farms is the ratoon crop, the labour-use is lower for the ratoon crop compared to the plant crop, as there is no requirement of labour for planting of canes in the case of ratoon. The land preparation cost is also negligible as compared to that of plant crop. Even some of the vital intercultural operations are not performed in ratoon. Hence, there is much less labour use (100 person days) for the ratoon crop on majority of small cane farms.

Table 3. Labour demand on individual cane farms

Type	Small farms	Large farms
Pre-seasonal	184	268
Adsali	193	263
Suru/spring	149	228
Ratoon	100	142

Note: Table adapted from Pawar *et al.* (2007) for Maharashtra state

Supply of Human Labour in Sugarcane Cultivation

The main sources of human labour-use in sugarcane are family labour and casual labour. The attached labour also forms an important component of human labour-

use in sugarcane. The composition of labour-use in the farming has changed over the years. Family labour was extensively used in sub-tropical belt compared to tropical region. In Uttar Pradesh and Haryana, the extent of family labour use was 75 per cent and 67 per cent, respectively during 1980s (Table 4). It was just 9-25 per cent in tropical states. The scenario now has drastically changed. While sub-tropical region is experiencing a decline in family labour, tropical states are using more of family labour, whose extent has increased by 50-100 per cent. The use of family labour has reduced to 57 per cent in UP, followed by Haryana (36%). Amongst tropical states, it is 32 per cent in Maharashtra, followed by Karnataka (29.5%), Andhra Pradesh (22%) and Tamil Nadu (\approx 19%). Consequently, the extent of hired casual labour is highest in Tamil Nadu (72%), followed by Andhra Pradesh (70%) and Karnataka (68%) and is lowest in Uttar Pradesh (38%). Both men and women are hired as casual labour and are engaged for specific agricultural operations on either piece rate or daily wage basis. At the same time, the group labour consisting of 5 to 8 male and female workers of a village engaged themselves under contractual arrangements (Singh and Singh, 2000; Tomar *et al.*, 2000). The contractual labour is engaged in interculture, earthing-up and harvesting of sugarcane. In Haryana, *Tarai* areas of Uttarakhand, and some parts of western Uttar Pradesh, there is higher use of hired labour than family labour. Hired labour is mostly casual and employed on contract basis for specific

operations. Most of the hired labour is migrant labour from the neighbouring labour-surplus areas (Tomar *et al.*, 2000). Since the migrant labour has resulted in lowering of wage rates in the local labour markets, as in Haryana (Tomar *et al.*, 2000), the migratory labour formed the major segment in labour hired in Punjab (Jain and Singh, 2000). It has resulted in making the contract type engagement of labour and is the most predominant form of casual labour-use in the state. With increase in farm size, the use of family labour has declined and of hired labour has increased (Saikia, 2000). The study highlights that where the extent of casual labour was very high, its proportion has decreased and is being replaced by family labour on account of rising wage rates coupled with labour scarcity.

The use of attached labour is low compared to the use of family labour and casual labour and it varied from 5 per cent to 10 per cent of the total labour cost, except in Karnataka and Uttarakhand, where it is very low. Amongst the states, the extent of attached labour is high in Tamil Nadu and Andhra Pradesh (more than 8% of the total labour cost). The higher extent of permanent labour indicates that the existence of large-sized cane holding in these states requires more reliable source of labour for sugarcane cultivation. Table 4 also highlights that assured labour in the form of family + attached labour was on decline and was thus impacting sugarcane cultivation.

Table 4. Contribution of different sources of labour in total labour-use and changes in major cane-growing states: 1980s-2000s

Period	Cane-growing state						
	Uttar Pradesh	Maharashtra	Tamil Nadu	Andhra Pradesh	Karnataka	Haryana	Uttarakhand
Family labour as % of total labour-use							
1980s	75.34	18.99	9.43	11.24	25.47	67.08	-
1990s	58.28	31.86	16.65	27.55	30.09	61.86	-
2000s	57.18	31.69	19.17	22.25	29.50	35.66	29.75
Casual labour as % of total labour-use							
1980s	19.19	75.7	82.75	84.8	72.02	20.48	-
1990s	33.5	64.92	75	63.55	67.18	31.97	-
2000s	37.61	64.17	72.61	70.27	68.63	54.17	68.73
Attached labour as % of total labour-use							
1980s	5.47	5.31	7.82	3.96	2.51	12.44	-
1990s	8.22	3.22	8.35	8.9	2.73	6.17	-
2000s	5.21	4.14	8.22	7.48	1.87	10.17	1.52

Causes of Labour Supply-Demand Gaps in Sugarcane

The main causes of supply-demand gap for labour in sugarcane cultivation may be categorized under the following heads:

(i) Arduous Work and Inhuman Working Conditions

Sugarcane planting, harvesting, and processing is tiring, hot, dangerous work and requires a large number of workers whose work habits are to be intensely coordinated and controlled. It is drudgery to the labourers, and damages or wounds to the hands are caused by the leaves having serrated margin with spines in the leaf sheath. Due to such morphology of the crop, the slavery once got associated with cane cultivation (West, 2008). After many revolutions around the world and independence in India, the practice got abolished and took some other forms. In India, attached labour became an important component of large sugarcane farms. With every effort towards the increase in income and welfare of the labour, and the availability of other avenues generated through employment generating schemes, working in sugarcane fields is generally not preferred thus contributing to supply-demand gap.

(ii) Lack of Female Participation in Cane Operations

The use of women labour in sugarcane cultivation is limited to a few activities. In sub-tropical India, women are engaged for sett-cutting, weeding, hoeing when the crop is to be planted or of low height, and in harvesting in some cases. In tropical India, women also undertake detrashing of the crop. All these operations performed by the females constitute a small portion of the labour requirement. Sugarcane has the lowest demand for female labour, despite its high demand for

total labour (Subrahmanyam, 1999). The demand for female labour is less in sugarcane than for cotton and chillies in AP. In terms of female labour content, sugarcane occupies the lowest position accounting for 18.5 per cent of the total labour requirement, while it is 54 per cent in rice, 60 per cent in cotton, 57 per cent in chillies and 50 percent in groundnut (Table 5). It highlights that while there is feminization of cultivation practices in other crops, it is not so in sugarcane. With the growing urbanization and out-migration of male members of the farming community, the sugarcane crop is likely to suffer on this aspect.

(iii) Disintegrating Traditional System of Cane Harvesting

Harvesting operation of cane in terms of labour-use differs across states. In sub-tropical states like Uttar Pradesh and Bihar, this operation was performed on labour-exchange basis among fellow farmers or landless labourers, marginal and small farmers as well as neighbouring villagers helped in harvesting the cane in exchange for the sugarcane green tops which was used as fodder for their livestock (a sort of barter system). This system was very efficient as it not only helped in reducing the paid-out (cash) costs for the farmer but also helped in better utilization of sugarcane green tops. This system is gradually going out of practice and the paid-out costs have gone very high on account of employment of additional labour for 70-100 persondays at the current wage rate of about ₹ 120 per personday, it comes out to be around ₹ 8400 to ₹ 12000, to be paid in cash. With the initiation of MGNREGA, the manpower available in the rural areas are more inclined to less drudgery inducing operations and working for sugarcane harvesting is not being preferred. The shortage of harvest labour in general and a steep increase in labour costs have reduced the profit margin of the farmers (Balaji, 2011).

Table 5. Female labour-use per ha by crop and operation

Crop	Land preparation		Sowing		Interculture		Harvesting		All operations	
	Female labour	Total labour	Female labour	Total labour	Female labour	Total labour	Female labour	Total labour	Female labour	Total labour
Paddy	0	16	24	33	22	29	27	50	74	137
Cotton	1	19	4	9	32	43	45	58	83	138
Chillies	1	21	17	21	24	31	34	47	77	136
Groundnut	0	14	5	8	16	25	26	44	48	95
Sugarcane	0	18	15	34	13	51	11	86	38	205

Source: Table adapted from Subrahmanyam (1999) in respect of Andhra Pradesh.

Consequences of Labour Scarcity on Cane Cultivation

As mentioned in the above section, the profit margin in cane cultivation is reducing with rising labour scarcity and increasing wage rates to overcome the peak period labour requirements. The wage rate in Haryana is highest at ₹ 162 per day compared to any other state where it is generally ₹ 120 per day. The less labour-intensive and competing crops like wheat are also available. As a consequence, there is reduction in farmers' profit margins and a decline in sugarcane area. The cane area in Haryana has reduced drastically by more than 40 per cent to about 90 thousands ha in 1981-90 (Table 7), and more so during the past 4-5 years. UP is also experiencing such instances in some pockets where better remunerative crops like mentha, and poplar are being grown.

Another major consequence is the stagnant or declining cane yield level as in the case of Maharashtra.

Table 7. Declining cane area in Haryana

Period	Cane area ('000 ha)	Period	Cane area ('000 ha)
1961-70	157.0	1991-2000	138.4
1971-80	155.5	2001-10	131.8
1981-90	129.6	2010-11	90.0

Table 8. Declining cane yield in Maharashtra

Period	Cane yield (tonnes/ha)
1980s	89.69
1990s	83.28
2000s	73.60

Sugarcane is a management responsive crop and yields are lower by 10-15 per cent if one inter-culture operation is ignored. In Maharashtra, the labour use per ha is very high and the labour scarcity leads to omission of some interculture operations, leading to reduction in cane yields (Table 8).

Coping Strategies to Meet the Challenge

Custom hiring of tractor-drawn tillage equipments has become an accepted practice and is expected to be more common on economic considerations. However, tractorization of farm operations is not all mechanization. In the case of sugarcane, the extent of

mechanization is limited to land preparation only, while the labour-intensive operations of cane planting, inter culturing and harvesting are carried out manually and are yet to be mechanized. The planting of sugarcane is an important operation that requires considerable amount of human labour, about 35-40 persondays on an average. This operation has to be completed at the time when there is huge labour demand for harvesting and sowing of other crops which are less drudgery-inducing. Limited success (at IISR, Lucknow, 2011) in developing cane planting machine has been achieved, but being very costly and crop-specific, it has limited use for other crops and therefore farmers are reluctant to purchase it. Some success has been achieved by custom hiring of planting operations and such practice is being followed in a number of sugar mill command areas in UP. These efforts need to be strengthened by encouraging entrepreneurs who are willing and capable of developing such machines as well as providing custom hiring services and after sale and back-up services.

The second major challenge is the mechanization of harvesting operation which will change the entire sugarcane cultivation scenario. Some machineries like ratoon management devices have been developed to improve ratoon yield and labour efficiency in ratoon crop by decreasing drudgery faced by the labourers.

The labour requirement for cane harvesting being 70-100 persondays, sugarcane research needs to be prioritized for developing sugarcane harvesters. Small harvesters have been purchased and tried in some states like Tamil Nadu, but much needs to be done on this front.

The sugarcane research should develop crop geometry which may facilitate the movement of machinery up to knee-high stage of the crop without compromising the yield front, i.e., by ensuring more than 1.25 lakh number of millable canes (NMC). This will help in reducing the labour requirements for at least 1 to 2 operations. A technology is also required which may ensure fast germination of sugarcane setts after planting. Sugarcane generally takes 40-45 days for germination after planting and during this period, the fields remain vacant, giving rise to a number of weeds and thus, more number of weedings, requiring more labour.

The ratoon crop which almost occupies 50 per cent area under the crop remains neglected in respect of timely interculture operations. The ratoon management

device which performs many functions in a single pass needs to be popularized by adequate incentives to manufacturers and farmers so that almost half of the labour requirement of the crop may get reduced.

On the development front, the sugar mills should evolve sound cane development plans in their cane command areas so that they may purchase costly machinery and popularize its use on the farmers' fields on contract basis with a sound tie up with the manufacturers.

Summary and Concluding Remarks

The paper has highlighted that sugarcane cultivation is least mechanized and most labour-intensive in almost all major cane-growing states. Sugarcane harvesting is a gruelling work that labourers want to avoid. The shortage of labour has hit all sugarcane cultivation operations particularly the harvesting, driving up the costs for the farmers. The harvest labour in tropical region costs ₹ 400-500 a tonne, which is twice that of in the sub-tropical region. The scarcity of harvest labour is mostly due to other employment generating schemes like MGNREGS. In the tropical region, it is also due to increasing outflux of labour to gulf countries. As a result of labour scarcity, the planting does not get completed in time. The increase in SMP/SAP is absorbed by the increase in labour costs and there is a decline in the profit margin of the farmers. The shortage of harvest labour and a steep increase in labour costs have reduced the profit margin in sugarcane cultivation in Haryana as well as Maharashtra. Hence, machines developed at IISR, Lucknow, such as sugarcane cutter planters and its variants are needed to reduce the cost of cultivation and also to handle the cane output to meet the daily crushing needs of sugar mills. Cane harvesters

in particular have the potential to make the cane cultivation more lucrative. Hence, research efforts are required in this direction as well as in developing technologies that directly or indirectly lead to reduction in labour requirement in cane cultivation.

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