Indian J. Applied & Pure Bio. Vol. 40(2), 890-899 (2025). **ISSN: 0970-2091**
A Web of Science Journal

A Socio-economic investigation on the Dynamics of Farm Labour supply in Cauvery Delta Zone of Tamil Nadu

R Singaravel[1], C Prabakar[2*], K Sita Devi[3], P Ramesh[4] and P Stalin[5]

[1,2,3]Department of Agricultural Economics,
[4]Department of Agricultural Extension and [5]Department of Agronomy,
Annamalai University, Annamali Nagar - 608002 (India)
*Corresponding author: prabakaragriecoau@gmail.com

Abstract

This study investigates certain socio-economic aspects of farm labour displacement in the Cauvery Delta Zone (CDZ), a pivotal agricultural region of Tamil Nadu. This region faces persistent challenges of farm labour displacement, driven by socio-economic pressures resulting in labour scarcity and operational inefficiencies. Under this background, the study aimed to quantify the labour supply-demand gap and analyze factors influencing labour displacement[3]. The research was conducted in Thiruvarur district during 2023-24, adopting a multistage stratified random sampling technique. A total of 180 farm labour households were surveyed, with 60 households each selected from three agronomically homogeneous clusters, representing mainstream and tail- end regions of the Cauvery River. To address the objectives, logistic regression analysis was employed to determine factors influencing labour displacement and supply-demand gap analysis was used to evaluate the labour shortfall across cropping patterns. The results revealed a critical mismatch between labour demand and supply, particularly during peak agricultural seasons. The highest demand was observed in September (1,20,15,762 man- days), which exceeded the available supply of 40,02,520 man-days by nearly three times. Additional shortages were recorded in January, June, October and November. These shortages result in delayed farm operations and making labour-intensive crops such as paddy, groundnut and cotton less viable and promoting a shift toward less labour-dependent crops like perennials. The logit regression estimates identified wage rates and indebtedness as significant drivers of labour displacement, with farm labours seeking alternative incomes to manage financial vulnerabilities and loan repayments. To address these challenges, targeted policy interventions are essential. Measures such as wage stabilization programs, financial

[1]Ph.D Scholar, [2*]Associate Professor, [3]Professor and [4,5]Assistant Professor

assistance and employment support schemes can reduce vulnerabilities and create a resilient agricultural framework. Additionally, promoting skill development programs, rural employment opportunities, access to credit facilities, enhancing farm incomes will be vital in mitigating displacement and ensuring sustainable agricultural growth in the region.

Key words : Labour Supply-Demand, Labour Scarcity, Farm Labour Displacement.

The Cauvery Delta Zone (CDZ) of Tamil Nadu is a vital agricultural hub, often referred to as the 'Rice Bowl of Tamil Nadu'. It is one of the most fertile and agriculturally productive regions in Tamil Nadu, contributing significantly to the state's food security and economy. The region has historically depended on the Cauvery river for irrigation, which has facilitated high-yield rice cultivation and sustained the livelihoods of millions of farmers and labours[6]. Despite its importance, the region now a days faces persistent shortage in farm labour supply, driven by labour displacement due to socio- economic pressures, water scarcity and operational inefficiencies. Labour scarcity, resulting from these displacements, disrupts critical farming operations, reduces productivity and undermines agricultural sustainability. In addition to environmental pressures, socio- economic transformations have played a significant role in destabilizing the region's agricultural landscape. Farm labours, who form the backbone of agricultural operations, face challenges such as irregular employment, low wages and the seasonal nature of agricultural work. These factors have led to large-scale labour displacement, creating acute shortages during critical periods of farming activities such as sowing and harvesting. The cascading effects of these challenges have disrupted the agricultural economy of the CDZ. Labour scarcity, in particular, has emerged as a significant issue, delaying farming operations, reducing crop yields and undermining the overall productivity of the region. The displacement of labours has created a vicious cycle, where reduced agricultural output further exacerbates economic hardships, pushing more individuals out of the sector. The displacement of farm labours destabilizes rural communities, breaking traditional economic structures and increasing dependency on non-agricultural income sources and creates socio-economic imbalances in both rural and urban areas. Under this background, an attempt was made to investigate the degree of labour scarcity in Cauvery delta zone and the factors influencing labour displacement in the region, with the following specific objective. For the preparation of the manuscript relevant literature[1-11] has been consulted.

The specific objectives are :

- To quantify the existing level of labour supply-demand gap in Cauvery delta zone of Tamil Nadu
- To analyse the factors influencing farm labour displacement in Cauvery delta zone.

Sampling procedure :

The study was undertaken in the

Thiruvarur district of Tamil Nadu during the agricultural year 2023-24. The study adopted the Multistage stratified random sampling technique for selection of respondents. As the first stage of sampling, Thiruvarur district was purposively selected as sample district, since this is a delta district which accommodates regions representing both the main stream and tail end region of Cauvery river.

As the second stage of sampling, all the 10 blocks of Thiruvarur district which were reclassified into three major agronomically homogeneous Clusters viz., Cluster I (Kodavasal, Mannargudi, Needamangalam and Valangaiman), Cluster II (Koradacherry, Nannilam and Thiruvarur) and Cluster III (Kottur, Muthupettai and Thiruthuraipoondi.) were considered for the study.

As the third and ultimate unit of sampling, 180 farm labour households @ 60 households from each cluster were selected at random. The ultimate sample size was 180.

Cluster Description :

Cluster I is the major Cluster, consisting of 4 blocks located in the main stream region of Cauvery river. Cropping Pattern: Paddy+Paddy+Paddy/Pulse; Source of Irrigation: Borewell, Canal; Soil Type: Clay Loam and sandy coastal alluvium.

Cluster II consists 3 blocks situated between the prominent main stream belt and tail end region. Cropping Pattern: Paddy+Paddy+Pulse/Gingelly; Source of Irrigation: Borewell, Canal; Soil Type: Sandy coastal alluvium and Clay loam.

Cluster III consists remaining 3 blocks, located in tail end region of Cauvery river. Cropping Pattern: Paddy+Paddy/Cotton; Source of Irrigation: Borewell, Canal; Soil Type: Red sandy and Red loam

Analytical Tools :

Labour Supply - Demand Gap Analysis :

A descriptive analysis was undertaken to estimate the month-wise agricultural labour availability (Labour supply) and agricultural job opportunities available (Labour demand) in an agricultural year in Thiruvarur district, with an objective to assess the degree of labour scarcity /surplus trend prevailing during peak and off seasons.

The month-wise supply of labour was assessed by considering the available agricultural labour force in the district (secondary data) and average mandays of work delivered in a month by each labour (primary data).

The month-wise demand for labour was assessed by considering the area under each crop and labour requirement for various cultural operations to be carried out in each month. Estimates were obtained by availing both primary and secondary data.

Logistic Regression Analysis :

This study utilized the logistic regression model to empirically quantify the relative influence of various factors influencing farm labour displacement in the study area

The logit model in this study postulates that, Pi, the probability of the ith respondent's

decision on displacement is a function of an index variable Zi, summarizing a set of the individual attributes. Hence, let us consider the following representation of respondent's decision on displacement.

$$Pi = E(Y=1/X_i) = 1/(1+ e^{(-(\beta_1+\beta_2 X_i))}) \quad (3.1)$$

Where, e is the familiar base of the natural logarithm. Now, let equation (3.1) be rewritten as

$$Pi = 1/(1+e^{([(-Z)]_i)}) \quad (3.2)$$

where,

$$Zi = \beta 1+\beta 2Xi$$

Equation (3.2) represents the (cumulative) logistic distribution function[2].

It could be verified that as Zi ranges from - ∞ to + ∞, Pi ranges between 0 and 1 and that Pi is nonlinearly related to Zi (*i.e.*, Xi). However, we would encounter an estimation problem, because Pi is not only nonlinear in X but in the β's as well, as can be seen clearly from (3.1). This means that the familiar OLS procedure could not be made to estimate the parameters. But this problem is more apparent than real because (3.1) is intrinsically linear, which can be shown as follows:

If Pi, the probability of the respondents' being displaced is as given by (3.2), then, (1-Pi), the probability of not being displaced is

$$1-Pi = 1/(1+e^{(Z_i)}) \quad (3.3)$$

$$P_i/(1-P_i) = (1+e^{(Z_i)})/(1+e^{([(-Z0_i)) = e^{(Z_(i))}) \quad (3.4)$$

Now, P_i/(1-P_i) is simply the odds ratio in favour of the respondent being displaced,

Now, by taking the natural log of (3.4), we would obtain:

$$Li = In (P' /(1-(P_i)^{})) = Zi = \beta 1+\beta 2Xi \quad (3.5)$$

That is, L, the log of the odds ratio, is not linear in X, but (from the estimation view point) linear in the parameters. It might be noted that the linearity assumption of OLS does not require that the X variables be necessarily linear. So we can have X2, X3, etc., as regressors in the model. For our purpose, it is the linearity in the parameters that is crucial. L is called the logit, and hence the name logit model for equation (3.5).

Features of the Logit model :

1. As P goes from 0 to 1 (*i.e.*, as Z varies from - ∞ to + ∞), the logit L goes from -∞ to +∞. That is, although the probabilities (of necessity) lie between 0 and 1, the logits are not so bounded.

2. Although L is linear in X, the probabilities themselves are not.

3. The interpretation of the logit model is as follows: β2, the slope, measures the change in L for a unit change in X.

Estimation of the Logit Model : For estimation purposes, equation (3.5) can be written as follows:

$$Li = \ln [P_i/(1-P_i)] = \beta 1+\beta 2Xi + ui \quad (3.6)$$

To estimate the model, we need, apart from Xi, the values of the logit Li, but now we run into some difficulties. If we have data on individual respondents, Pi = 1 if farm labour is displaced and Pi = 0 for otherwise, and if we put these values directly into the logit Li, we obtain:

Li = ln(1/0) for the respondent being displaced
Li = ln(0/1) if otherwise

Obviously, these expressions are meaningless. Therefore, if we have data at the micro or individual level, we cannot estimate (3.6) by the standard OLS routine. In this situation, one may have to resort to the maximum likelihood method to estimate the parameters.

Within the logit framework discussed above, the study has postulated that the probability of a farm labour being displaced (L_i) has been depended upon attributes like Age, Education, Number of earners in the family, Seasonal employment, Wage rate, Proximity to town/city in kms, Ratio of non-farm income to farm income and Indebtedness. And hence, the logistic regression model has been specified as follows.

$$L_i = \alpha_i + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \mu i \quad (3.7)$$

where,

β_i = Constant
X1 = Age of the respondents, in years
X2 = Education, in years of study
X3 = Earners in family, in numbers
X4 = Seasonal employment (1 for yes, otherwise takes 0)
X5 = Wage rate, in Rs.
X6 = Proximity to town/city, in kms
X7 = Ratio of non-farm income to farm income
X8 = Indebtedness, in Rs.
βi's = Parameters to be estimated
μi = Error term

With the above said econometric constructions and assumptions the logistic regression analyses were undertaken for the study area, to identify and analyse the various factors influencing the farm labours' decision on displacement to an alternative employment.

Supply-Demand Gap of Farm Labour :

Thiruvarur district has high agricultural potential, with a cropping pattern comprising of labour-intensive crops. This district inherently exhibits a vibrant farming scenario, making it a suitable focus area for an informative study on the farm labour supply-demand gap.

Month-wise Agricultural operations due for crops :

The month-wise agricultural operations with labour requirement for major crops such as paddy, pulses, cotton, groundnut and gingelly grown in Thiruvarur district are presented in Table-1. It could be noted that the paddy cultivation involves continuous labour- intensive activities, including transplanting (June-July), weeding (August) and harvesting (September-October). Similarly, cotton and groundnut operations peak during weeding, irrigation and harvesting from February to September. In contrast, pulses and gingelly require fewer tasks, reducing their dependency on manual labour. This monthly schedule reflects the seasonality of labour demand, with the highest concentration occurring between June and October, creating potential periods of severe labour scarcity in the district.

Labour requirement for Different crops :

The specific labour requirements per

Table-1. Month-wise Agricultural Operations and Labour Requirements per Hectare for Crops Grown in Thiruvarur District

S.no	Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.	Paddy (Kuruvai)						Nursery, Main land preparation & Trans-planting (55)	1st weeding + fertilizer application (43)	2nd weeding + Irrigation (38)	Har-vesting (48)			
2.	Paddy (Samba)	Har-vesting (48)								Nursery, Main land preparation & Trans-planting (55)	1st weeding (50)	Fertilizer appli-cation (43)	2nd weeding + Irrigation (15)
3.	Paddy (Kodai)				Nursery, Main prepa-ration &Trans-planting (55)	1st weeding + fertilizer applica-tion (45)	2nd weeding + Irrigation (48)	Har-vesting (44)					
4.	Pulses		Broadc-asting (8)	Weeding (33)	Har-vesting (50)								
5.	Cotton						Land preparation + sowing (38)	1st weeding + fertilizer application (43)	2nd weeding, Topping + Irrigation (58)	Har-vesting (55)			
6.	Groundnut		Land prepa-ration+ sowing (48)	1st weeding + ferti-lizer application (48)	2nd weeding (38)	Harve-sting (48)							
7.	Gingelly	Land prepa-ration+ sowing (13)		Harvest (30)									

Note: Figures in the parentheses represent the labour man-days required for respective activity per Ha.

Table-2. Month-wise Agricultural Labour Supply-Demand for Crops in Thiruvarur District

S. no	Crop	Area (Ha)	Labour Require-ment per Ha	January	February	March	April	May
1.	Paddy (Kuruvai)	61,589	184					
2.	Paddy (Samba)	1,48 317	211	71,19,216				
3.	Paddy (Kodai)	8,202	192				4,51,110	3,69,090
4.	Pulses	66,532	91		5,32,256	21,95,556	33,26,600	
5.	Cotton	16,401	194					
6.	Groundnut	4,761	182		2,28,528	2,28,528	1,80,918	2,28,528
7.	Gingelly	2,593	43	33,709		77,790		
Demand				71,52,925	7,60,784	25,01,874	39,58,628	5,97,618

June	July	August	September	October	November	December
33,87,395	26,48,327	23,40,382	29,56,272			
			81,57,435	74,15,850	63,77,631	22,24,755
3,93,696	5,57,736					
6,23,238	7,05,243	9,51,258	9,02,055			
44,04,329	39,11,306	32,91,640	1,20,15,762	74,15,850	63,77,631	22,24,755
Supply		**2,00,126*×20** = 40,02,520**				

Note: * Thiruvarur district total agricultural labour population (2023)
** man days employed per month per labour

hectare for different crops, emphasizing the high labour needs of paddy, cotton and groundnut could be noticed from Table-1. The highest labour demand is observed in Samba paddy, requiring 211 man-days per hectare, followed closely by Kodai paddy with 192 man-days per hectare and Kuruvai paddy with 184 man-days per hectare. Groundnut demands 182 man-days, while cotton requires 194 man-days per hectare. Pulses and gingelly need 91 and 43 man-days, respectively.

The above said, crop wise labour requirements underscores the challenges faced

by farmers cultivating paddy particularly during peak agricultural seasons.

Agricultural Labour Supply-Demand for crops :

By comparing monthly labour availability to actual labour demand, the labour supply-demand gap in Thiruvarur district has been estimated and presented in Table-2. The district's maximum available labour supply is at 40,02,520 man-days per month, while the highest monthly demand occurs in September, accounting to 1,20,15,762 man-days, nearly three times the available supply. Other months with critical shortages include January, June, October and November, where demand consistently exceeds supply.

The significant gap between required and available labour underscores the district's dependence on seasonal and migrant workers, highlighting the urgency of addressing labour shortages to avoid delayed agricultural operations, which may potentially reduce yield and crop quality. Farmers need to incur higher costs by hiring temporary labour from outside the district or investing in mechanization to bridge the gap. Labour shortages during peak demand periods may escalate seasonal migration of workers into the district, creating logistical challenges. The persistent labour shortages could lead to a decline in labour-intensive crops like paddy, groundnut and cotton, with farmers opting for less labour-dependent crops like perennials.

Logit model :

The Logit model was utilized to quantify the extent of influence exerted by various factors contributing to the displacement of farm labour. The analysis was conducted separately for the three clusters: Cluster I, Cluster II, and Cluster III, with the results presented in Table-3.

Totally, eight independent variables were considered in the model. They were Age, Education, Earners in the family, Seasonal employment, Wage rate, Proximity to town/ city, Ratio of non-farm income to farm income and indebtedness.

Factors Influencing Displacement of Farm Labour :

The Logit analysis for farm labour displacement also revealed distinct trends as presented in Table 3. In Cluster I**,** the Nagelkerke R^2 was 0.798 indicating a better goodness of fit. The results reveal that, education level significantly increases the likelihood of farm labour displacement by 2.542 times. Higher education drives workers toward better-paying non-farm jobs. Seasonal employment also positively influences displacement odds by 2.522 times, as irregular work prompts labours to seek stable jobs outside agriculture. Wage rate shows a significant negative effect, indicating that lower farm wages increases the likelihood of displacement by 1.822 times. Additionally, indebtedness also positively influence displacement odds by 1.799 times, suggesting that mounting financial burdens push workers toward alternative employment.

Logit analysis on Cluster II, had a Nagelkerke R^2 of 0.814, reflecting a strong model fit. The estimates reveal that when age increases by one unit the odds of displacement decreased by 1.899 times. This could indicate

Table-3. Logistic Regression Estimates on the Factors Influencing Farm Labour Displacement in Different Clusters of the Study Area

Sl. no.	Variables	Cluster I			Cluster II			Cluster II		
		MLE Co - efficient	Odds Ratio	P Values	MLE Co - efficient	Odds Ratio	P Values	MLE Co - efficient	Odds Ratio	P Values
1.	Age	0.322	1.376	0.166	-0.032*	1.899	0.061	0.391	1.213	0.151
2.	Education (Years of Study)	0.545***	2.542	0.008	0.456**	1.755	0.029	0.704*	1.352	0.061
3.	Earners in the Family (Numbers)	-0.417	0.566	0.142	-0.312	0.821	0.112	-0.374	0.538	0.516
4.	Seasonal Employ-ment (Yes or No)	0.912***	2.522	0.009	0.899**	2.011	0.036	0.913**	2.736	0.021
5.	Wage Rate ('00 Rs.)	-0.646**	1.822	0.044	0.254**	1.726	0.043	0.612*	1.428	0.089
6.	Proximity to Town/ City (in kms)	0.818	0.881	0.162	1.165*	1.631	0.089	0.730***	1.258	0.007
7.	Ratio of non-farm income to farm income	0.302	1.628	0.103	0.162***	2.948	0.002	0.486	1.298	0.145
8.	Indebtedness ('000 Rs.)	0.241**	1.799	0.031	0.128**	1.323	0.045	0.038**	1.846	0.039
Constant/Intercept		4.455	582.214	0.092	5.873	696.191	0.091	6.311	762.371	0.135
Nagelkerke R^2		0.798			0.814			0.799		
-2 Log likelihood		41.323			63.265			52.321		

Note: *** Significant at 1 % level of Probability, ** Significant at 5 % level of Probability,
* Significant at 10 % level of Probability.

that older individuals are less likely to leave their agricultural work. As like in Cluster I, Education level continues to be a critical factor, with educated individuals seeking non-farm jobs. Seasonal employment remains significant and raising odds by 2.011 times, reflecting the instability of farm jobs. Wage rate positively affects displacement odds by 1.726 times, indicating that even moderate wage increases may not offset labour migration due to better urban job prospects. Proximity to towns/cities positively influences displacement with odds of 1.631 times, as nearby urban areas offer attractive employment opportunities. The ratio of non-farm income to farm income and Indebtedness also play key roles, significantly increasing odds by 2.948 times and 1.323 respectively, further reinforcing this trend by compelling workers to pursue more stable income sources.

For Cluster III**,** the Nagelkerke R^2 was 0.799 which indicates better model fit. As like Cluster I & II, education again emerged as a strong factor, raising odds by 1.352 times. Seasonal employment had the highest impact, increasing odds by 2.732 times, followed by wage rate, which increased odds

by 1.428 times, tend to seek alternative jobs. The ratio of non-farm income to farm income also influenced displacement, increasing odds by 1.298 times. As said above, the variable Proximity to towns is highly significant and raising odds by 1.258 times. Indebtedness continues to drive displacement, indicating that debt-laden farm households are more likely to move away from farms.

Policy Implications :

The findings of this study highlight the significant role of factors such as education, indebtedness, wage rate and seasonal employment patterns in driving farm labour displacement. The widening supply-demand gap for agricultural labour during peak farming periods, coupled with operational inefficiencies, has severely impacted the productivity and sustainability of farming in the CDZ. To address these challenges, targeted interventions are essential. Wage stabilization and financial support systems must be prioritized to reduce vulnerabilities and create a more resilient agricultural frame work.

Additionally, fostering an enabling environment for farm labours through skill development, rural employment opportunities and equitable access to resources can help restore stability to the region. Interventions addressing the challenges, such as enhancing farm incomes, improving resource availability and offering targeted support for indebted farmers, could mitigate displacement rates and support sustainable agricultural livelihoods. The study identifies education, indebtedness, low wages and seasonal employment as critical factors influencing farm labour displacement in the Cauvery Delta Zone.

References :

1. Ahmed, S and M. Mustafa, (2020). *Journal of Rural Development, 39*(2): 110–125.
2. Gujarati, Damoder, N. (1998). Basic Econometrics, *McGraw Hill Book Company,* New Delhi.
3. Kumar, A and P. Ranjan, (2022). *Sustainability, 14*(8): 4901.
4. Martin, P. L and J. E. Taylor, (2000). *American Journal of Agricultural Economics, 82*(5): 1338–1345.
5. Office of Joint Director of Agriculture, Thiruvarur (2023). *Annual report on labour supply and demand.* Government of Tamil Nadu.
6. Palanisamy, K. (2019). *Indian Journal of Agronomy, 64*(4): 498-504.
7. Rao, C.H.H. (2015). *Economic and Political Weekly, 50*(39): 12-15.
8. Singh, R and K. Sharma, (2021). *Indian Journal of Labour Economics, 64*(1): 45–63.
9. https://tnau.ac.in/kvk-thiruvarur/
10. https://tiruvarur.nic.in/departments/fisheries/
11. https://tiruvarur.nic.in/departments/horticultre/