

PROSPECTS AND CHALLENGES OF FARMING IN DELHI: EVIDENCES FROM THE FIELD

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Abstract

The farmers in Delhi are invisible and vulnerable due to the ever-increasing urban character of the city and multifarious challenges in agriculture. The paper investigates the conditions of farming in Delhi with a primary survey of 300 farmers in two districts. The findings indicate that wheat and paddy are the main crops cultivated but only half of the sampled farmers cultivate in both the agricultural seasons. The farmers lack motivation to continue with farming due to rising costs, unremunerative prices, lack of procurement at MSP and lack of policy support in the form of requisite infrastructure and subsidies. It is time that agriculture in Delhi should be made a part of official discourse and public knowledge.

Keywords: Agriculture, Cost of Cultivation, Delhi, Farmers, MSP and Returns.

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Introduction

Agriculture in Delhi has remained obscure both with the policymakers and the common masses. Quickly catching up to become the world's largest urban agglomerate by 2028 (UN, 2018), Delhi is fast losing its rural farmlands. The number of villages has declined from 209 in 1991 to 112 in 2011 (Government of NCT Delhi (GNCTD), 2022a). The Gross Cropped Area (GCA), which was 130 thousand hectares in 2000-01 has come down to 4.3 thousand hectares in 2021-22 (GNCTD, 2021). The percentage share of agriculture to Gross State Value Added (GSVA) of Delhi at current prices has also reduced to 0.36 per cent in 2021-22 from 0.94 per cent in 2011-12 (GNCTD, 2021). The main reasons for decreasing agricultural activity in the city, as cited in the Economic Survey of Delhi 2021-22, are fast urbanisation and shift in the occupational pattern. Delhi's growing urban and peri-urban areas are pushing agriculture and related activities farther from the city, which hampers locally grown food availability and the source of livelihood.

Thus, the overall agricultural activities have declined in Delhi over the years, mainly due to rampant urbanisation. Nevertheless, close to 73,000 people are involved in agriculture either as cultivators or agricultural labourers (Census, 2011). Since the scale of agriculture is very low, the conditions of farming community of the city barely attract attention. Consequently, there is very limited research and data available. Therefore, it is essential to assess the status quo of farming in the city. This paper, largely based on primary data, examines various aspects of the agriculture sector in rural/peri-urban areas of Delhi in an attempt to demonstrate that the agriculture sector in this region, despite having the requisite capacity, has endured infrastructural and structural constraints. Perception of the farmers and intermediaries towards the city's agriculture are also presented.

Literature Review

Peri-urban areas refer to the fringe areas of cities or adjoining rural areas, essentially linked

with the city economy, displaying the characteristics of both rural and urban areas. These areas, generally overlapping rural and urban jurisdictions, are inhabited by native population typically engaged in agricultural and allied activities and also migrant population involved in non-farm occupations (Aijaz, 2019). Agriculture in Delhi intrinsically resembles the characteristics of peri-urban farming. The issues of peri-urban farming, not only in Delhi but also in India, have received little or no attention in research as well as policy dialogue. Precisely, the literature (both national and international) has focused more on the issues of governance, pollution, waste-water management, metropolitan reconstruction and other concerns relating to sustainability. The issues of farming and farmers have been largely under-represented. For instance, Narain (2010) has addressed the issues of water scarcity in peri-urban areas; UNEP (2014) has investigated the dominant characteristics of urban and peri-urban agriculture in Chennai and the factors contributing to vulnerability of peri-urban systems to climatic changes; Hussain & Hanisch (2014) describe the structural change drivers and adaptation measures adopted by farmers in urban periphery of Hyderabad; Bhatt et al. (2016) have assessed the climate resilient actions adopted by small and marginal farmers in peri-urban areas of Gorakhpur in Uttar Pradesh; Marshall & Randhawa (2017) have addressed the issue of food-security in peri-urban areas in India; Aijaz (2019) has looked at the issues of governance in peri-urban areas.

Regarding the studies focusing on agriculture in Delhi, these are very limited with none on the issues faced by the farmers. A study by Kundu (2008) notes wide disparities in access to water between the core and peri-urban areas in Delhi. The issue of clean energy for cooking, lighting and other productive purposes has been examined by Dhingra et al. (2008), while Bhattacharya et al. (2015) have examined the water quality of Yamuna river and Najafgarh drainwater used for irrigational purposes in Delhi, for heavy metal concentrations. Paul et al. (2021) have explored the issues of land use and land cover change in Delhi for the period 1973-2017.

Further, agricultural policies in India have largely focused on rural areas to attain self-sufficiency in foodgrain production and augment farmers' income. Thus, the burgeoning urban food needs are expected to be met by the production in rural areas and not peri-urban areas. With greater emphasis on rural agriculture in the policy dialogue, the contribution that food production in the areas nearby/within the cities can make is hardly been acknowledged. Conversely, this positive contribution has widely been recognised in international studies focusing on Africa, Latin America, the Caribbean, and some Asian and Eastern European countries (Marshall et al., 2001). In India, however, this issue is under-represented in the policy discourse as well as research and has even failed to grab the attention of non-governmental organisations (NGOs).

Specifically in the context of Delhi, which is predominantly of urban character, urban villages or peri-urban areas engaged in agricultural activities have been given negligible attention. This is quite evident from the budget allocations for the agriculture and allied sectors. The percentage share of agriculture and allied sector in the total budget of Delhi in 2019-20 was 0.6 per cent, which plummeted to a mere 0.1 per cent in 2022-23. Although the discussions on urban farming and terrace gardening are a welcome step towards the initiation of discussions on agriculture in Delhi, it is far from sufficient. Thus, given that agriculture in Delhi is an ignored subject in the policy and research domain, we undertake this study to address this lacuna and attempt to examine the status quo of farmers and farming and also the possible interventions needed.

Material and Methods

The Study Area

For the study, we selected two districts of Delhi-North and South-West. The selection of these two districts is based on the operational area under agriculture presented in Table 1. It can be noticed that of the total operational landholdings (20,190), nearly 38 per cent are in South West Delhi with 44

per cent of the total operated area, followed by 31 per cent in North constituting 25 per cent of the total operated area. Also, the average landholding size is 2.9 acres in the North and in the South-West, it is 4 acres. Further, 90 per cent of the GCA is irrigated and the main source of irrigation is tube wells and only 10 per cent is done through canals (GNCTD, 2021), which implies that agriculture in the city is massively dependent on the groundwater.

The sub-districts Narela and Najafgarh were randomly selected. Further, a total of ten villages were surveyed and 30 farmers from each village were interviewed. Thus, in toto, 300 farmers were interviewed. Also, qualitative interviews were conducted with 30 farmers and 10 arhtiyas (intermediaries) to capture their perspectives on farming conditions in the capital city.

Agriculture Scenario in Delhi

Farmers in Delhi are mainly marginal and small with more than 81 per cent share in operational landholdings (Table 2). The average size of landholding for a marginal farmer is 0.4 acres, for small farmers is 1.4 acres and that of large farmers is 16.1 acres (Table 2).

The major crops cultivated are paddy (Kharif) and wheat (Rabi). Wheat constitutes a major share of the total operational area (more than 67 per cent) producing more than 80 thousand metric tonnes of the output. The other major crop, paddy is cultivated in only 20 per cent of the total area under cultivation, producing nearly 17 thousand metric tonnes (Table 3).

To comprehend the efficiency of crop production in the capital city, we compare the productivity of different crops cultivated here vis-à-vis the national average yield of these crops and that in the neighbouring states, in Table 4.

Although, average yield of paddy (1,296 kg/acre) and wheat (1,756 kg/acre) in Delhi is higher than Uttar Pradesh (1,092 kg/acre and 1,442 kg/acre, respectively) and the national average (1,100 kg/acre and 1,425 kg/acre, respectively); it is lower

Table 1*Operational Land Holdings in Delhi (District-wise)*

Indicators	Central	New Delhi	North	North East	North West	Shahdara	South East	South West	West	Total
Number of landholdings	427 (2.1)	207 (1.0)	6,191 (30.7)	272 (1.3)	3,386 (16.8)	15 (0.1)	1,189 (5.9)	7,617 (37.7)	854 (4.2)	20,190.00
Area of operational landholdings (acre)	1528.9 (2.2)	600.2 (0.9)	17,677.8 (25.1)	637.3 (0.9)	13,528.2 (19.2)	12.4 (0.02)	2692.3 (3.8)	30,951.6 (44.0)	2,645.4 (3.8)	70,321.00
Average area per holding (acre)	3.6	2.9	2.9	2.3	4.0	0.8	2.3	1.5	4.1	3.5
GCA (%)	84.5	100.0	92.3	70.0	98.7	100.0	76.0	100.0	87.0	90.4
Un-irrigated	15.52	0	7.66	30.04	1.27	0.0	24	0.0	12.96	9.6

Source: Govt. of India (Gol) (2016-17); Figures in parentheses indicate percentage.

Table 2*Category-wise Operational Land-Holdings (Acre)*

	Marginal	Small	Semi-medium	Medium	Large
Number	28,378 (55.1)	13,427 (26.1)	6,390 (12.4)	2,986 (5.8)	299 (0.6)
Area	12,863 (18.0)	18,858 (26.3)	17,949 (25.1)	17,076 (23.9)	4,821 (6.7)
Average Size	0.5	1.4	2.8	5.7	16.1

Source: Gol, (2016-17). Figures in parentheses indicate percentage.

than Punjab and Haryana (the two states where maximum FCI procurement is done). Even though these two states have similar agro-climatic zones as Delhi (Trans-Gangetic Plains)¹ with similar

weather and topographical conditions, Delhi lags behind in yields. The factors responsible for the city's low performance in agriculture shall be explored in the succeeding sections.

Table 3

Area and Production of Major Crops

Crops	Year	Kharif season				Rabi Season		
		Rice	Jowar	Bajra	Maize	Wheat	Barley	Rapeseed & Mustard
Area ('000 Acres)	2015-16	14.9	8.0	3.8	0.1	47.8	0.2	9.1
	2016-17	14.8	7.9	3.7	0.1	48.6	0.2	8.9
	2017-18	14.5	7.8	3.7	0.1	47.8	0.2	8.9
	2018-19	14.5	7.8	3.7	0.1	47.5	0.2	8.9
	2019-20	14.4	7.8	3.7	0	47.4	0.2	8.9
Production ('000 Tonnes)	2015-16	17.3	3.1	3.8	0.8	85.6	0.0	4.6
	2016-17	17.3	3.1	3.3	0.2	87.2	0.2	4.5
	2017-18	16.8	3.0	3.3	0.2	83.4	0.2	4.5
	2018-19	16.8	3.0	3.3	0.1	82.9	0.2	4.5
	2019-20	16.8	3.0	3.2	0.0	82.9	0.2	4.5

Source: GNCTD (2022b).

Table 4

Yield of Wheat and Paddy in Delhi and Neighbouring States (Kg/ ac)

Crops	Region	2017-18	2018-19	2019-20	2020-21
Paddy	Delhi	1,164	1,165	1,165	1,296
	Haryana	1,288	1,264	1,350	1,350
	Punjab	1,768	1,673	1,633	1,768
	Uttar Pradesh	924	1,095	1,081	1,092
	All India	1,043	1,068	1,102	1,100
Wheat	Delhi	1,745	1,746	1,747	1,765
	Haryana	1,786	1,994	1,898	1,957
	Punjab	2,055	2,100	2,026	1,971
	Uttar Pradesh	1,323	1,389	1,372	1,442
	All India	1,364	1,431	1,393	1,425

Source: GNCTD (2022b).

Insights from the Field

We look at the cost and returns for wheat and paddy in Table 5. The cost of cultivation² (A2+FL) for wheat is Rs. 24,154 per acre and for paddy is Rs. 24,012 per acre. Cost C2 is Rs. 39,201 per acre and Rs. 41,285 per acre for wheat and paddy, respectively. The average value of output is

estimated to be Rs. 36,298 per acre for wheat and Rs. 35,352 per acre for paddy. Hence, if returns are calculated over cost A2+FL, on average, a farmer earns a profit of Rs. 12,144 per acre for wheat and Rs. 11,340 per acre for paddy. In case, returns are calculated over cost C2, a farmer suffers loss to the tune of Rs. 2,930 per acre and Rs. 5,933 per acre for wheat and paddy, respectively.

Table 5

Costs and Returns

Indicators		Wheat	Paddy
Selling price (Rs. per kg)		17.00	18.00
Average value of output* (Rs. per acre)		36,298.0	35,352.0
Cost of Cultivation (A2+FL) (Rs. per acre)		24,154.0	24,012.0
Cost of Cultivation (C2) (Rs. Per acre)		39,201.3	41,285.2
MSP (2021) (Rs. Per kg)		19.70	19.40
Profit/ Loss (Value of Output - Cost) (Rs. per acre)	Over Cost A2+FL	12,144.0	11,340.0
	Over Cost C2	-2,903.0	-5,933.2

Source: * includes value of by-products. MSP: Directorate of Economics and Statistics, Govt Selling Price: CSD Farm level survey 2021.

Additionally, the Minimum Support Price (MSP) for wheat in 2021 was Rs. 19.70 per kg and for paddy, it was Rs. 19.40 per kg (Table 5). Nearly 40 per cent of the surveyed farmers informed that the prices realised were less than the market prices as well as the MSP. Apart from self-consumption, nearly 80 per cent of the output (both crops) is either sold in the market locally or in Agricultural Price and Marketing Committees (APMC) markets (See Table 6). Only 0.5 per cent of wheat is procured by the Food Corporation of India, (FCI). It is almost negligible as the procurement plunged to 276.5 quintals in 2020-21 from the previous procurement of 17,870 quintals in 2015-16, as per the information obtained from the FCI regional office in New Delhi. It is important to mention that the process of selling at the FCI is cumbersome. For every season, the farmer has to fill out a registration form declaring the area sown, the quality of seed used and the expected yield among

other things. He/she has to provide a sample of the produce for examination at the FCI and is asked to visit the FCI again after 3-4 days with the produce, in case it qualifies for the quality check. This delay of 3-4 days is not feasible for the farmer due to lack of storage which makes the entire process of selling the produce to the FCI a tedious one.

Further, farmers face challenges when they sell their agricultural produce in mandis; these mandis are distantly located thus, leading to an increase in transportation costs. Notably, there are a total of eight APMCs in Delhi for selling foodgrains, fruits, vegetables, fodder and flowers. Among these, Narela and Najafgarh mandis are the major foodgrain mandis that are operational round the year. Due to lack of storage facilities in the villages and mandis, the quality of the output degenerates with any delay in transportation, thereby fetching lower prices. Since these transportation costs are

Table 6*Agency-wise Crops Sold (%)*

Crops	APMC	Local traders	Input dealers	Private Companies	Government agencies (FCI)	Cooperatives	Others (includes self-consumption)
Wheat	56.8	23.4	0.5	0.2	0.5	0.1	18.5
Paddy	54.8	28.7	0.4	0.0	0.0	0.0	16.1

Source: CSD Farm level survey 2021.

borne by the farmers and the bargaining power rests with the traders, the farmers are left with no choice but to sell at any price offered. Moreover, as informed by the respondents as well as observed during the field survey, none of the mandis had any provision for the farmers to sell directly to any government agencies and none had any traders buying the produce at MSP. Therefore, with ever-increasing prices of inputs, lesser selling prices and lack of storage facilities, cultivation for the city farmers has become far more challenging.

Another challenge for the city farmers is the waterlogging issue, especially in North Delhi. As informed by farmers, during the monsoons, waterlogging becomes a nuisance due to lack of drainage facilities. Further, farmers are not permitted to install bore wells and submersible pumps due to low groundwater levels. Paddy, which is a water-intensive crop, consumes 3,000-5,000 litres of water to produce just one kg of the crop³. Hence, with such irrigation issues, the cultivation of paddy has become a daunting task. This also persuades the farmers, as revealed in the discussions, to change to less water-consuming crops (fruits and vegetables), but water logging in

the area, lack of technical knowledge, lack of markets and other infrastructural challenges limit their choices.

Lack of awareness was another challenge among the farmers. More than 90 per cent of the surveyed farmers did not take crop insurance and Kisan Credit Card. Only 2 per cent of them were associated with any farmers' organisations. It is very well known that the government provides MSP for various crops to ensure a base price that at least covers the cost of cultivation and safeguards them against any market volatility. It was observed that 62 per cent of the farmers were aware of the annual MSP announced for wheat while it was lesser (55 per cent) for paddy (Table 7). Regarding the recommended MSP as per the calculations based on the M. S. Swaminathan Committee, it was known to just 13.2 per cent of the farmers. Further, among the well-informed farmers (regarding MSP), a mere 2 per cent in North-West and less than 1 per cent in South-West districts were aware of the FCI. Less than 1 per cent in both districts knew about other procurement agencies such as the State Food and Supply Department, NAFED and Delhi State Civil Supplies Corporation.

Table 7*Awareness Regarding MSP and Swaminathan Committee Recommendations (%)*

Crops	Awareness (%)
Wheat	62.3
Paddy	54.8
Swaminathan Committee Recommended MSP	13.2

Source: CSD Farm level survey 2021.

Furthermore, the government also provides assistance to the farmers in the form of technical advice regarding cultivation practices, better seed varieties, fertiliser and pesticide application, farm machinery for various agricultural activities and marketing of various agricultural produce. This is largely provided through the Agricultural Technology Management Agency (ATMA), various agricultural state universities and other government agricultural research centres as well as Farmers Producers Organisations (FPOs) and fellow farmers. During the interactions at the field, it was observed that more than three-fourths of the farmers acquired technical advice, if any, from fellow farmers in the vicinity or ancestors within the family. The advice mainly pertained to the usage of a variety of seeds and fertilisers.

Perception of Farmers and Intermediaries

As seen earlier, Rabi is the main cropping season in Delhi as only 50 per cent of the sampled farmers cultivated wheat and paddy in both seasons. Among the interviewed farmers, 45 per cent said that there was no incentive left for continuing with agriculture-related activities, 25 per cent were continuing only for self-consumption and 33 per cent of the farmers were producing for the markets. Few farmers also mentioned the cultivation is done as it is better than keeping the land fallow. Out of the interviewed farmers, none had done any alterations to the crops grown in different agricultural seasons in the past few years due to low yield, lack of infrastructure, markets and technical advice by experts regarding the alternate crops that may be cultivated as per the changing climatic conditions, soil and water quality. Another important reason mentioned was declining enthusiasm or non-interest in farming due to escalating costs and low returns. Also, 82 per cent of the farmers asserted that the yield of their agricultural produce had declined over the last five years due to poor and deteriorating soil and water quality, and excessive use of fertilisers and pesticides. Further, 100 per cent of the farmers had procured seeds and fertilisers from private input

suppliers, mainly due to ease of accessibility at all times. The farmers faced difficulties in accessing inputs at government-prescribed rates since the government-registered shops, if any, were hardly open or functioning. The entire sample of farmers interviewed was discontented with the distressed sale of their produce as well as no purchase at MSP. Farmers were also enquired about the accessibility to any public space for storage of their harvested produce to which 16 denied having any such space while 14 were unaware if there was any such provision. Further, on enquiring about the availability of market for the farmers' produce, 20 of the interviewed farmers were oblivious to any information regarding the same whereas 10 claimed that there was no market for their produce. Moreover, farmers faced difficulties in selling the output since it required additional expenditure on transportation due to the distant location of the *mandis*. Thus, the problem of no storage space coupled with a longer distance from the village to the *mandis* implying additional cost on transportation to be borne by the farmers reduces their bargaining power, thereby compelling distressed sale of the output. Thus, even though the farmer is aware that the price offered at the *mandi* is less than the MSP, there is not much option other than selling it at the given price. Additionally, none of the intermediaries available at the *mandis* will buy at MSP and there is also absence of government agencies that would buy directly from the farmers. Thus, there is not much expectation of getting a higher bargain even in the next visit.

The interviewed farmers also mentioned the increasing prices of inputs and lack of support from public agencies in purchasing inputs such as fertilizers and seeds at government-controlled rates. On the one hand, most of the agriculture activities are mechanised such as the use of tractors. On the other hand, increase in fuel price has added to the woes of farmers due to ever increasing cost of production. Among all the challenges iterated by the farmers, an underlying common concern was the availability of institutional credit. As discussed earlier, only a handful of

farmers had access to KCC and most of the farmers preferred borrowing from non-institutional sources such as moneylenders (including *arhtiyas*) or family and friends, even though it was at a much higher rate of interest than the formal sources.

Regarding the expectations from the government, most of the farmers were of the opinion that the government must make efforts to diversify their cropping pattern from wheat and paddy to fruits and vegetables; this shift of course needs a big push as the city agriculture is inflicted with several challenges. However, this shift can cater to the local demands of the city residents. Since, Delhi is surrounded by the states known for wheat and paddy, growing the same in the city serves no purpose. Further, farmers proposed that purchase centres be established near the villages, thus saving them from the high cost incurred on transportation and also reducing the losses that occur during the post-harvest period. The issues of waterlogging and poor water quality also need attention. Another factor that needs to be reconsidered is the process of disseminating compensation to the farmers by the government, in case of crop loss due to calamities. As of now, only the landowner receives compensation, if any, while the tenant farmer is left out of the ambit, which needs to be amended. Furthermore, the farmers have been involved in farming for generations; the only technical advice and training towards farming comes from their ancestors or other farmers in the village. The farmers sought to receive advice from some experts to improve their knowledge regarding different agricultural practices to augment their crop production as well as caution them regarding various schemes of the government, thus helping the city's farming community.

In addition to the detailed interviews with the farmers, *arhtiyas* from the *mandis* in Najafgarh and Narela were consulted to gather information on the different aspects of marketing. Major commodities traded by them are foodgrains such as wheat, paddy, jowar, bajra, and some pulses. While the rates for different grades of a product are different, there was no grading facility available with the traders; hence, crop quality is tested by traders

through a random examination. The trader then declares a starting price for the produce and the process of bidding follows. The interviewed traders were aware of the MSP announced annually for the respective crops and claimed to be purchasing the crops at rates higher than MSP. Out of the 10 intermediaries surveyed, three claimed to have lent credit to farmers for one cropping season. This credit taken is generally used by a farmer to buy inputs, by and large for one crop cycle, making it obligatory for the farmer to sell his produce through the same *arhtiya* (at the auction price).

Conclusions and Way Forward

The above analysis indicates that the *status quo* of agriculture in Delhi is not very encouraging due to several production and marketing challenges. First and foremost, as is the scenario in agriculture today, returns are not remunerative in wheat and paddy due to the high cost of cultivation and low selling prices of the produce. Second, infrastructural challenges such as lack of storage facilities and irrigation have affected the quality and quantity of the produce which ultimately affects the returns. Third, lack of procurement by the government at MSP and subsequent sale of the produce in the *mandis* at low prices have left the farmers demotivated. The Delhi farmers, who remain inconspicuous in the face of rampant urbanisation and absence of policy support, should be given their due share in terms of better agriculture infrastructure, subsidised inputs, availability of credit and assured procurement by the government. Instead of wheat and paddy, farmers can be encouraged to grow horticulture crops. With the handful of farmers in Delhi struggling to earn a living from the dying agriculture, it is imprudent to expect a complete overhaul. Hence, these few farmers can be organised as Farmer Producer Organisations which might increase their bargaining power, reduce transaction costs and eventually enhance their income. Needless to say, all this is not possible without the political will. With the recurrent urbanisation in Delhi, one can only hope that the

government has either planned careful agricultural policy support for the farmers or their absorption into other sectors rather than leaving them to their fate.

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Author Contributions:

Nivedita Sharma: Study conception and design, data collection, data analysis and interpretation of the results, preparation of the draft manuscript and approved the final version of the manuscript

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End Notes

1. For details, please see <https://agricoop.nic.in/sites/default/files/Service%204%20SRS%201.1%20NEW.pdf>. Last accessed on June 14, 2023.
2. Cost A1 includes labour, cost of hiring machinery, seeds, chemical fertilizers, bio-fertilizers, manure, chemical pesticides, bio-pesticides, minor repair, irrigation, diesel, electricity and interest on loan
 $\text{Cost A2} = \text{Cost A1} + \text{rent paid for leased-in land}$
 $\text{Cost B1} = \text{Cost A1} + \text{interest on value of owned fixed capital assets (excluding land)}$
 $\text{Cost B2} = \text{Cost B1} + \text{rental value of owned and leased in land}$
 $\text{Cost C1} = \text{Cost B1} + \text{imputed cost of family labour}$
 $\text{Cost C2} = \text{Cost B2} + \text{imputed cost of family labour}$
3. Refer <https://www.thehindubusinessline.com/opinion/time-to-focus-on-more-crop-per-drop/article9778971.ece>. Last accessed on February 1, 2023.

References

- Aijaz, R. (2019). India's Peri-Urban Regions: The Need for Policy and the Challenges of Governance. ORF Issue Brief No. 285, Observer Research Foundation.
- Bhattacharya, A., Dey, P., Gola, D., Mishra, A., Malik, A., & Patel, N. (2015). Assessment of Yamuna and Associated Drains Used for Irrigation in Rural and Peri-Urban Settings of Delhi NCR. *Environmental Monitoring and Assessment*, 187, 1-13.
- Bhatt, S., Singh, A. & Mani, N. (2016). Peri-urban Agriculture and Ecosystems: Resilient Narratives. Gorakhpur Environmental Action Group, Gorakhpur, India.

- Dhingra, C., Gandhi, S., Chaurey, A., & Agarwal, P. K. (2008). Access to Clean Energy Services for the Urban and Peri-Urban Poor: A Case Study of Delhi, India. *Energy for Sustainable Development*, 12(4), 49-55.
- GNCTD (2021), Economic Survey of Delhi, Available at <http://delhiplanning.nic.in/sites/default/files/7.%20Agriculture%20%26%20RD.pdf> Last accessed on January 27, 2023.
- GNCTD (2022a). Economic Survey 2021-22. Planning Department, Government of NCT Delhi.
- GNCTD (2022b). Statistical Abstract of Delhi-2022. Directorate of Economics and Statistics, Delhi.
- Gol (2016-17). All India Report on Input Survey, 2016-17. Agriculture Census Division, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, New Delhi.
- Gol (2021). Farm Harvest Prices of Principal Crops In India, 2017-18. Directorate of Economics And Statistics Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, New Delhi, March, 2021.
- Hussain, Z., & Hanisch, M. (2014). Dynamics of Peri-Urban Agricultural Development and Farmers' Adaptive Behaviour in the Emerging Megacity of Hyderabad, India. *Journal of Environmental Planning and Management*, 57(4), 495-515.
- Kundu, A. (2008). Socio-economic Segmentation, Inequality in Microenvironment and Process of Degradation Peripheralization in New Delhi', in A.L. Singh & S. Fazl (eds.) *Urban Environmental Management*, 45-75. Delhi: B.R. Publishing Corporation.
- Marshall, F; Lintelo, D.TE and D.S. Bhupal. (2001) "Peri-urban agriculture in Delhi, India. Food Nutrition and Agriculture, UNFAO". Available at <http://www.fao.org/DOCREP/004/Y1931M/Y1931M00.HTM>. Last accessed on November 8, 2023.
- Marshall, F., & Randhawa, P. (2017). India's Peri-Urban Frontier: Rural-Urban Transformations and Food Security. International Institute of Environment and Development (IIED).
- Narain, V. (2010). Peri-Urban Water Security in a Context of Urbanization and Climate Change: A Review of Concepts and Relationships. Peri-Urban Water Security Discussion Paper Series. Paper No. 1, SaciWATERs. Hyderabad: SaciWATERs.
- Paul, S., Saxena, K. G., Nagendra, H., & Lele, N. (2021). Tracing Land Use and Land Cover Change in Peri-Urban Delhi, India, over 1973–2017 period. *Environmental Monitoring and Assessment*, 193, 1-12.
- United Nations (2018). World Urbanisation Prospects 2018: Highlights. Department of Economic and Social Affairs, New York.
- United Nations Environment Programme (2014). Building Urban Resilience: Assessing Urban and Peri-Urban Agriculture in Chennai, India. Available at <https://start.assyst-uc.com/wp-content/uploads/chennai.pdf> Last accessed on November 8, 2023.