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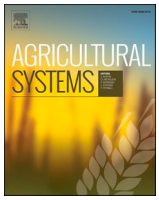

India's COVID-19 social assistance package and its impact on the agriculture sector

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ABSTRACT

Context: CVOID-19 induced significant economic and social disruptions in India. Rural households, including smallholders, were affected by loss in migrant income, livelihood and farm and non-farm incomes. During this lockdown, the Indian government enacted several emergency legislations to provide direct and indirect relief to workers and households. India's COVID-19 social assistance package, namely, PM-GKY, announced in March 2020, was designed to provide immediate relief to the vulnerable population. The PM-GKY provided cash direct benefit transfers (DBT) and in-kind supports (IKS) through existing schemes.

Objectives: This study examines the impact of India's government assistance package (known as *Pradhan Mantri Garib Kalyan Yojana* or PM-GKY), announced immediately after the COVID-19 lockdown, on the procurement of agricultural inputs for the upcoming farming season.

Methods: The study uses a quasi-experimental method and survey data from 1,789 smallholder households in three northern Indian states (Rajasthan, Madhya Pradesh, and Uttar Pradesh).

Results: The result suggests that the fungibility of funds received under the government transfer package was significant in alleviating credit constraints and increasing agricultural investments in agricultural inputs. The farmers who received benefits from the PM-GKY scheme spent significantly more on the procurement of seeds, fertilizers, and pesticides.

Conclusions: The disbursement of cash transfers in the three states showed that emergency relief packages had reached the vulnerable sections of Indian society. Overall, 89-94% of households benefited from direct cash transfers. Perhaps lower transaction costs, minimal leakages, and immediate delivery make a strong case for direct cash transfers. The above advantages facilitate the provision of relief to a large proportion of vulnerable sections of Indian society in a short period.

1. Introduction

The COVID-19-induced lockdowns triggered the biggest disruption of livelihoods in both the developed and developing world. In India, the lockdown was announced by India's prime minister on March 23, 2020. Subsequently, the economic activities have stopped in the country and affected the livelihood of 1.3 billion population. The national statistical office released the estimates of Gross Domestic Product (GDP) for the first quarter (April-June 2020), suggesting a negative economic growth of 23%. In comparison, the construction sector shows a negative growth of 50%, followed by the service sector (47%) and the manufacturing sector (39%). In contrast, agriculture and allied shows a positive growth of 3%. Agricultural policy experts posit several hypotheses to explain the resilience in the agricultural sector, including the pandemic's timing, immediate public policy response, and the creation of infrastructure for social transfers, among others (Mohan et al., 2020; Jhajhria et al., 2020). Although the government's price stabilization policies helped stability in cereal prices initially, prices of essential commodities remained stable in May and June 2020 due to better supply chain management (Varshney et al., 2020a), and the procurement picked up in May and June,

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albeit with a slow start (Lowe and Roth, 2020). The time lag in the procurement of 2019–2020 Rabi season production may have impacted the liquidity concerns of farmers for the upcoming 2020 Kharif season (July-November). Moreover, the trading in the agriculture sector in India is mainly physical, and the farmers failed to receive the payments for their produce immediately after the transaction (Reddy, 2017). At the same time, 85% of Indian farmers are marginal and small, 50% of farmers rely on informal credit, and 20% bought agricultural inputs on credit.

The food grain production for the 2019–2020 Rabi and 2020 Kharif season has increased significantly by 5 and 2%, respectively, compared to the previous year. For the 2019–2020 Rabi season, one can argue that the significant farming activities of the season were completed before the lockdown. In contrast, the 2020 Kharif season (summer crop), considered to be most impacted by the COVID-19 pandemic. The delay in the receipt of farm revenue coupled with the COVID-19 pandemic affected farmers' credit and liquidity to meet input requirements for the Kharif season. The present study explores the role of immediate public policy response by the Indian government in addressing the liquidity constraints of farmers.

The government of India announced the COVID-19 social assistance package of INR 1.7 lac crore (or 25 billion US$) under the *Pradhan Mantri Garib Kalyan Yojana* (PM-GKY) to provide immediate relief to the vulnerable population.[1] The PM-GKY package uses existing schemes to provide additional benefits to farmers and rural households. The study focuses on four major schemes potentially relevant to the benefits of the farmers. These schemes include *Pradhan Mantri Kisan Samman Nidhi* (PM-KISAN), *Pradhan Mantri Ujjwala Yojana* (PM-UY), *Pradhan Mantri Jan Dhan Yojana* (PM-JDY), and *Pradhan Mantri Ann Vitran Yojana* (PM-AVY). Together, these four programs represent about 70% of the total budget of the PM-GKY package.

Under the PM-KISAN, farmers did not receive an additional benefit. However, they received the benefit early, which in general are expected to receive later. Varshney et al. (2020b) show that the timing of PM-KISAN benefits transferred to farmers matters for taking the investment decision for the agriculture sector. However, the remaining three schemes provide an additional benefit under the package. Although these schemes are not directly meant for farmers, the benefits received through these schemes have implications for farmers' liquidity concerns. The theory of fungibility suggests that spending is more sensitive to income and liquid assets as compared to assets such as houses (Levin, 1998). Empirical studies on the fungibility in microfinance for Bangladesh and India suggest that the funds received by farmers have diverted for involuntary commitments (Mahajan and Ramola, 1996; Sharma and Zeller, 1997). Therefore, it is likely that farmers may use the benefits received here to leverage their investments in agriculture.

In the above context, the study has twofold objectives. First, to examine the impact of the PM-KISAN on the purchase of agricultural inputs. Second, the study investigates the complementary role of other PM-GKY package schemes (such as PM-UY, PM-JDY, and PM-AVY) in stimulating the PM-KISAN's impact on the procurement of agricultural inputs. The study uses a unique phone survey jointly conducted by the International Food Policy Research Institute (IFPRI) and the Indian Council of Agricultural Research Council (ICAR) during April and May 2020 in three northern states of India (Rajasthan, Madhya Pradesh, and Uttar Pradesh). The survey included 1789 farmers from an IFPRI survey conducted in 2017–18 and an ICAR survey conducted in 2018–19.

The study contributes to the literature by improving government support in mitigating the potential productivity shock in the agricultural sector amid the COVID-19 pandemic (Jhajhria et al., 2020; Ceballos et al., 2020). The analysis of the complementary role of other schemes contributes to the scant empirical literature on the fungibility of benefits received through social assistance schemes (Mahajan and Ramola, 1996; Sharma and Zeller, 1997). Therefore, it provides insights on policy options amid the crisis (Gerard et al., 2020; Hepburn et al., 2020; Kumar et al., 2020; among others).

The rest of the paper is organized as follows. The next section presents a brief review of PM-GKY, which is followed by a discussion on the data, survey methodology, and summary statistics. Section 4 presents the econometric method employed for impact evaluation, and results are discussed in Section 5. The paper concludes with the implications of the study.

2. India's COVID-19 social assistance package

India's COVID-19 social assistance package, namely, PM-GKY, announced in March 2020, was designed to provide immediate relief to the vulnerable population. The PM-GKY provided cash direct benefit transfers (DBT) and in-kind supports (IKS), through existing schemes. Table 1 provides the scheme features such as the scheme's eligibility, coverage, duration of the relief package, benefit under the existing scheme, and the additional benefit under PM-GKY. PM-KISAN is a cash transfer scheme that aims to augment the income of farmers. All farmers are eligible under the scheme with some exclusions.[2] Farmer is entitled to receive INR 2000 cash transfer in every quarter of the year. As noted earlier, the PM-GKY package do not provide an additional benefit in monetary terms. Still, importantly the scheme payment is frontloaded in the first week of April 2020, which is quite important for farmers for addressing their liquidity constraints. PM-JDY scheme aims for financial inclusion by opening a savings bank account for the unbanked adult person. The existing benefit includes INR 2 lac insurance coverage. Under PM-GKY, there is a provision of additional benefits in cash transfer of three installments of INR 500 each to the 204 million women account holders for April, May, and June 2020.

PM-UY scheme aims to provide clean cooking fuel solutions to poor households. The existing benefit includes free gas connection, including a gas tank, pressure regulator, and safety hose worth INR 1600. Under PM-GKY, there was a provision of three installments of cash transfer of INR 700 for buying three refills in the gas cylinder for April, May, and June 2020.[3] PM-AVY is a new IKS scheme to provide free food rations. The scheme uses the existing infrastructure of the public distribution system under the national food security act (Government of India, 2013), to distribute free food rations. Beneficiaries under existing National Food Security Act (NFSA) of 2013 are eligible here as well in PM-AVY. The NFSA distinguishes households into two categories for receiving the benefit, *Antyodaya Ann Yojana* (AAY, poorest of the poor) and Priority households (PHH, vulnerable families).[4] Under the existing NFSA, these beneficiaries are entitled to food rations (5 kg of wheat/rice per member for PHH and 35 kg of wheat/rice per AAY households per month) at the subsidized prices (which also vary by the type of families). Under PM-GKY, the PM-AVY provides the same quantity of food rations free of cost over and above the existing quantity under NFSA (GoI, 2013).

[1] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1608345; PMGKY in English can be termed as Prime Minister Poor Welfare Scheme.

[2] The scheme excludes state and government employees, pensioners, professionals (doctors, chartered accountant, lawyers).

[3] The first installment of cash transfer was intended for all the eligible beneficiaries. The second installment was made when the beneficiary refilled their cooking gas cylinder using first installment. For third installment, the government extended the duration up to 30th September for reimbursing the benefit.

[4] Identification of AAY and PHH households is done by the state governments on the basis of inclusion and exclusion criteria. For AAY, the inclusion criteria include household without shelter, landless laborer, beggars, sweeper or sanitation worker etc. For PHH, the exclusion criteria include ownership of motorized two, three and four-wheeler vehicles, air conditioner etc.

Table 1
Elements of the PM-GKY relief package, India, 2020.

SN	Scheme	Eligibility for the scheme	Coverage (# beneficiary)	Duration of the relief package	Benefit (per beneficiary)	
					Existing benefit under the scheme	Additional benefit under PM-GKY
1	PM-KISAN	All farmers with exclusion of government employees and professionals (such as doctor, chartered accountant)	87 million	April-June 2020	INR 2000	Provided benefit early
2	PM-JDY	Any adult without bank account	204 million	April-June 2020	Zero balance saving account and accidental insurance for INR 2 lac	INR 1500 for women account holder
3	PM-UY	Below poverty line (BPL) families	80 million	April-June 2020	Free gas connection including cylinder, pressure regulator and safety hose worth INR 1600	Cash transfer of INR 700 per cylinder for buying 3 cooking gas cylinders
4	PM-AVY	Antyodaya Ann yojana (AAY) and Priority households (PHH). Each state has specific criteria to identify these households. For AAY, the inclusion criteria include household without shelter, landless laborers, beggars, sweepers or sanitation workers, etc. For PHH, the exclusion criteria include ownership of motorized two, three, and four-wheeler vehicles, air conditioners, etc.	237 million	April-November 2020	5 kg wheat / rice per member	5 kg wheat / rice per member and 1 kg pulses to the family per month

Source https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1608345
Note: Other elements of the package includes the wage benefits under rural employment scheme, support to senior citizens, health insurance coverage and support to low wage earners in the organized sector.

3. Data and descriptive statistics

The survey data used in this study was conducted in three large states of India—Rajasthan, *Madhya Pradesh, and Uttar Prades*h—that together account for 28% of the total Indian population and home to 93.5 million poor households.[5] The agroecological conditions and cropping patterns of each state are not uniform. For instance, in Rajasthan, the area allocated to the top five crops are pearl millet (16%), wheat (12%), mustard (10%), soybean (5%), and gram (4%).[6] Rajasthan is the largest state of India in terms of geographical area, with considerable variations in agroecological and production systems. The arid region has pearl millet and oilseed-based production system, cotton-wheat based system irrigated land and oilseeds in the rainfed areas.[7] Pearl millet and soybean are grown during the Kharif season and wheat, mustard, and gram in Rabi season.

In Madhya Pradesh, the top 5 crops are soybean (27%), wheat (26%), gram (9%), rice (8%), and maize (4%). In this state, most of the area falls under the rainfed agroecological conditions, with a cropping system dominated by cereal and oilseeds. Soybean, rice, and maize are grown in Kharif season while wheat and gram in rabi season. By contrast, in Uttar Pradesh, the top 5 crops are wheat (39%), rice (23%), pearl millet (4%), maize (3%), and potato (2%). The state includes both rainfed and irrigated agroecological systems and had rice-wheat, sugarcane-wheat and oilseed-based production systems. Rice, pearl millet, and maize are grown in the Kharif season, and wheat and potato are grown in the Rabi season. Overall, these states provide comprehensive coverage of arid, rainfed and irrigated agroecological systems. Note that the wheat is the crucial Rabi season crop in all three study states. In the case of wheat, these states together account for 62% of the wheat area of the country.[8] Moreover, the above states account for 38% agricultural area of the country, reflecting the importance of these states in Indian agriculture.

3.1. Sample design

The phone survey was conducted on a subset of samples of an earlier survey conducted by IFPRI and ICAR. The first survey, conducted during 2017–18, included a sample of 3840 households in Rajasthan (1560) and Madhya Pradesh (2280). In 2018–19, the same survey was repeated in Uttar Pradesh on a sample of 3420 households.[9] These surveys were representative of all agroecological zones (AEZs) within each state. The number of districts under each AEZ was determined based on the total cropped area under selected crops. Once districts are selected, three blocks from each district and two villages from each block were selected randomly. A complete household listing was developed for each of the selected villages, and the households were divided into four quintiles based on total cultivable land. At the final stage, five households were selected randomly from each quintile.

The phone survey was conducted between April 15 and May 15, 2020,[10] involved administering interviews with about one-third of the samples from the earlier surveys. To ensure representativeness of the coverage, households were randomly selected from from the original list ofthe village, district, block, and agroecological zones (AEZs), 6–7 households from each village (out of an original sample of 20 households).[11] Overall, the survey included 1789 households from 327 villages of 51 districts, representing all AEZs in all three.[12] In the 2019–2020 Rabi season, 79% of farmers grow wheat, followed by mustard (7%), gram (2%), while the remaining 12% of farmers grow other crops (Fig. 1). In the 2020 Kharif season, 40% of farmers grow paddy, followed by pearl millet (22%) and soybean (13%), maize (8%), and the remaining 17% of farmers grow other crops (Fig. 1).

3.2. Key questions in the phone survey

Our survey gathers information on four major components of PM-GKY, namely, PM-KISAN, PM-UY, PM-JDY, and PM-AVY. It queries farmers whether they received the benefit under these schemes for April 2020. Fig. 2 shows that 72% of the farmers received the benefit under the PM-KISAN, 73% under the PM-JDY (cash transfer for women), 59% under PM-UY (cash transfer for buying cooking gas), and 76% under the PM-AVY (free food ration). Fig. 3 presents the percentage of beneficiaries by the number of schemes, 38% received the benefits of all four schemes, 24% received benefits of three schemes, 21% received benefits of two schemes, 12% received benefits of one scheme. In comparison, 5% of farmers did not receive benefits of any scheme.

[5] https://www.rbi.org.in/scripts/PublicationsView.aspx?id=16603
[6] Other crop includes maize, groundnut, jowar,cotton and fodder crops.
[7] http://ncap.res.in/upload_files/PME_notes/pmenotes6.pdf
[8] Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.
[9] 90% of the surveyed farmers owned mobile phones.
[10] Our survey follows all protocols as suggested by International Review Board.
[11] Sample frame constitutes of 90% of the earlier surveyed farmers.
[12] Average time duration of the phone survey is 16 min.

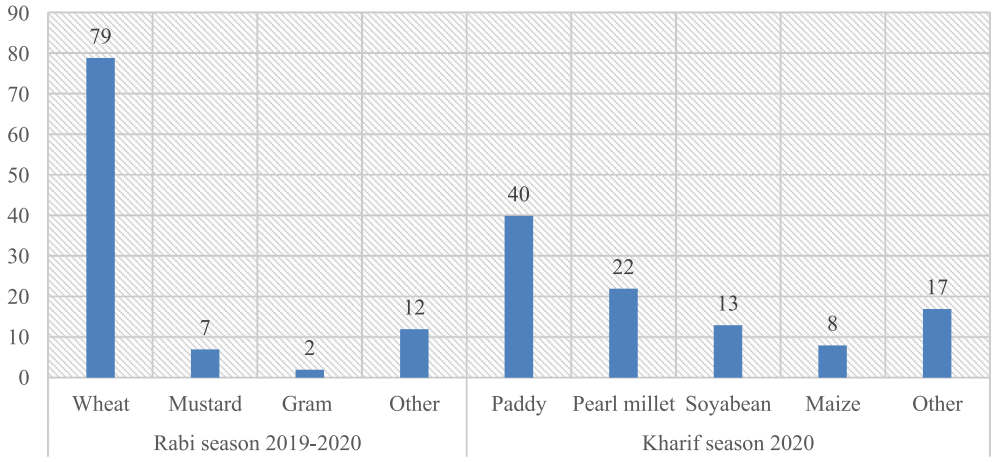

Fig. 1. Cropping pattern (% farmers), Uttar Pradesh, Madhya Pradesh, and Rajasthan, 2020.
Source: IFPRI-ICAR phone survey 2020.

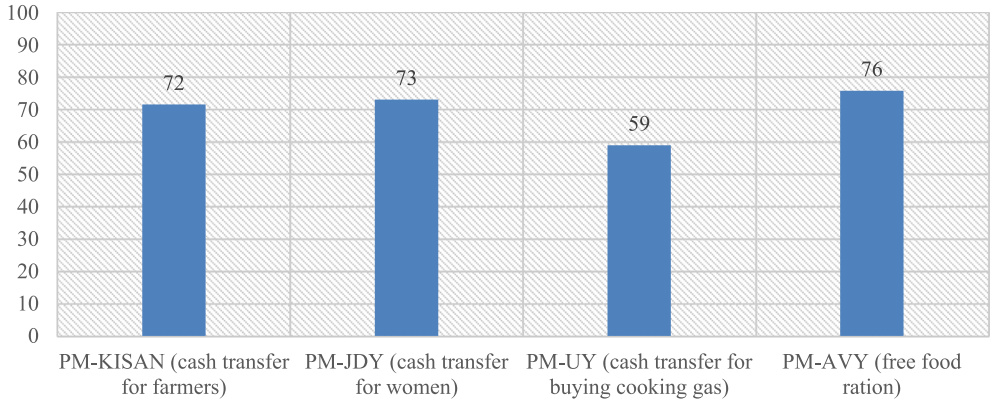

Fig. 2. Percentage of farmers received the benefit of major schemes under PM-GKY package, April 2020.
Source: IFPRI-ICAR phone survey 2020.
Note: PM-GKY refers to Pradhan Mantri Garib Kalyan Yojana i.e. India's COVID-19 social assistance package.

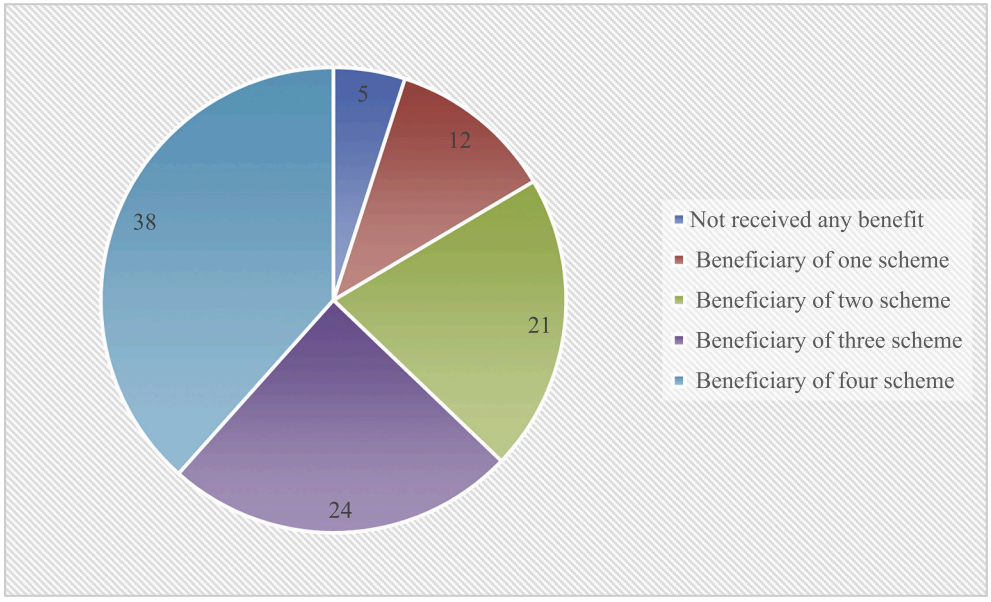

Fig. 3. Percentage of farmers by number of schemes, India, April 2020.
Source: IFPRI-ICAR phone survey 2020.

To assess the impacts of PM-GKY on investments in agricultural inputs, the phone survey collected information about whether the farmers had purchased agricultural inputs (seeds, fertilizer, and pesticides) for the upcoming 2020 Kharif season immediately after receiving the assistance. Our data shows that 20% of farmers bought the farm input, while 80% of farmers did not immediately receive the assistance.[13] Of the households who purchased the agricultural inputs, 82% purchased seeds, and 18% purchased fertilizers and pesticides. It is not surprising that few farmers purchased agricultural inputs (seeds, fertilizers, and pesticides) immediately after receiving the assistance as the Kharif season starts in July. The remaining farmers may purchase inputs later on. However, they may use this assistance for other agricultural expenses (e.g., labor payments) because the timing of cash transfers in the first week of April 2020 coincides with the ongoing harvesting season. The phone survey did not capture those expenses and serves as the limitation of the study. The study provides useful insights on the role of government assistance schemes in addressing liquidity constraints of farmers. This is true if there are no systematic patterns of agriculture spending between beneficiaries and non-beneficiaries. To this end the study includes additional control variables, such as farming conditions (the type of soil, irrigation facilities) and market access variables.

3.3. Summary statistics

Guided by the previous theoretical and empirical literature, the paper considers both household and village level characteristics that may help us determine the investment in agricultural inputs (Feder et al. (1985); Diagne (1999); Covarrubias et al. (2012); Abate et al. (2016); Varshney et al. (2020a); among others). Table 2 presents the variable definitions and their summary statistics for the whole sample, from the earlier surveys.[14] To capture the socio-economic and agricultural profile of farmers, we include gender, age, education, household size, religion, social group, poverty status, access to formal credit, land size, primary occupation, farm experience, access to a smartphone, access to a tractor, and an indicator of wealth.[15]

To capture plot-level characteristics, we include the type of soil and the availability of irrigation facilities.[16] Agriculture extension and soil health cards may affect the investment decision on agricultural investments through an information channel. We include whether farmers have access to agriculture extensions, soil health cards, and crop insurance schemes (that helps to account for the farmer's risk behavior). Guided by the social network literature (see Bandiera and Rasul, 2006; Conley and Udry, 2010), we include the variables to capture the social networks of farmers. These studies highlight that social networks are essential for agricultural technology-related decisions. We consider the distance from the village to the nearest input market, output market, bank branch, block, and district headquarters to capture the market access.

The left panel of Table 3 presents the summary statistics for PM-KISAN beneficiaries vs. eligible non-PM-KISAN beneficiaries. Our results show that PM-KISAN beneficiaries have: smaller household size, a lower proportion of below poverty line households, smaller land size, less access to extension services, reside nearer to banks, resides nearer to block headquarter, to district headquarter, a smaller proportion of farmers depends on the rainfed cultivation, higher proportion of farmers with sandy loam soil. The right panel of Table 3 presents the summary statistics of PM-GKY beneficiaries (who received the benefit from all the four schemes) vs. those who did not receive the benefit from any scheme. Our result shows that farmers who received the benefit from all the four schemes have: less education, smaller land size, lower access to smartphones, lesser tractor ownership, smaller wealth, resides nearer to banks, and a higher proportion of lower castes, namely, Scheduled Castes/Tribes.

Table 2
Variable definition and statistics of farmers in Rajasthan, Madhya Pradesh, and Uttar Pradesh, India, 2020.

Socio-economic and agriculture profile	Mean	Standard deviation
Gender (male = 1)	0.92	0.27
Age (year)	44	13
Education (year)	6.16	4.78
Household size (number)	5.91	3.01
Religion (hindu = 1)	0.94	0.23
Schedule caste and tribe (yes = 1)	0.33	0.47
Below poverty line (yes)	0.29	0.45
Kisan credit card (yes = 1)	0.42	0.49
Land size (hectare)	1.30	1.94
Primary source of income (cultivation = 1)	0.73	0.44
Primary source of income (livestock and other agriculture = 1)	0.18	0.39
Primary source of income (non-agriculture = 1)	0.08	0.27
Primary source of income (other = 1)	0.01	0.11
Farm experience of the head of household (year)	21	11
Smart phone (yes = 1)	0.21	0.41
Tractor ownership (yes = 1)	0.19	0.39
Asset index (number)	0.00	1.53
Soil health card (yes = 1)	0.11	0.31
Crop insured (yes = 1)	0.46	0.50
Access to extension services (yes = 1)	0.03	0.18
Social network		
Discussed farming with friends, relatives, neighbors (yes = 1)	0.39	0.49
Village characteristics		
Distance of village to nearest input market (Km)	6.8	5.3
Distance of village to nearest output market (Km)	9.2	6.4
Distance of village to nearest bank (Km)	5.4	4.4
Distance of village to block headquarter (Km)	9.6	6.9
Distance of village to district headquarter (Km)	26.7	20.0
Plot characteristics		
Soil type (clay = 1)	0.31	0.46
Soil type (loam = 1)	0.17	0.38
Soil type (sandy = 1)	0.06	0.25
Soil type (sandy loam = 1)	0.45	0.50
Rainfed cultivation (yes)	0.41	0.49
Number of farmers	1789	

Source: ICAR-IFPRI Survey 2017–18 and 2018–19.

4. Empirical methodology

The study investigates the impact of the PM-GKY package by defining two different treatment groups of farmers. First, the first treatment group is farmers who received benefits under PM-KISAN, and the control group comprises eligible non-beneficiaries. The treatment variable captures the impact of PM-KISAN on input procurement. The second treatment group is farmers who received benefits from all the four schemes (PM-KISAN, PM-JDY, PM-UY, and PM-AVY) of the PM-GKY scheme, and the control group comprises of farmers who have not received a benefit from any of these schemes. The treatment variable captures the impact of PM-GKY on input procurement.

To evaluate PM-KISAN impacts, we use the cross-section differences between the treatment and control groups. Simple differences between treatment and control groups cannot be interpreted as the causal impact of PM-KISAN on input procurement without controlling for observed

[13] The survey captures the agricultural input procurement as of 15th May 2020. For 2020 Kharif season, the sowing starts in the month of July. Therefore, it is possible that more farmers may purchase modern inputs later.

[14] We consider these variables from the earlier surveys. Rajasthan and Madhya Pradesh (2017–18). Uttar Pradesh (2018–19).

[15] Indicator of wealth is constructed using principal component analysis of asset ownership such as bicycle, radio, television, DVD player, mobile phone (non-smart), two-wheeler, four-wheeler, refrigerator, cooler, fan and computer (or laptop).

[16] In the survey, we asked the plot level characteristics of the plot with maximum area.

Table 3
Unmatched characteristics of farmers for PM-KISAN and PM-GKY, treatment vs. control groups.

	PM-KISAN				PM-GKY			
	Mean		T-Test		Mean		T-Test	
	Treatment	Control	T Statistic	p > |T|	Treatment	Control	T Statistic	p > |T|
Gender (male = 1)	0.93	0.92	0.05	0.96	0.92	0.93	−0.33	0.74
Age (year)	43.9	45.0	−0.97	0.33	43.3	43.5	−0.14	0.89
Age squared (year)	2085	2187	−1.04	0.30	2022	2032	−0.08	0.94
Education (year)	6.22	5.76	1.12	0.26	6.05	7.17	−2.08	0.04
Household size (#)	5.87	6.47	−2.33	0.02	5.87	5.79	0.24	0.81
Religion (hindu = 1)	0.94	0.98	−2.07	0.04	0.93	0.97	−1.34	0.18
Schedule caste and tribe (yes = 1)	0.32	0.34	−0.28	0.78	0.33	0.21	2.20	0.03
Below poverty line (yes)	0.27	0.34	−1.78	0.08	0.27	0.20	1.40	0.16
Kisan credit card (yes = 1)	0.43	0.45	−0.45	0.65	0.42	0.51	−1.55	0.12
Land size (hectare)	1.34	1.88	−3.07	0.00	1.31	1.95	−2.89	0.00
Primary source of income (cultivation = 1)	0.75	0.72	0.89	0.37	0.74	0.76	−0.43	0.67
Primary source of income (livestock and other agriculture = 1)	0.16	0.22	−1.65	0.10	0.17	0.16	0.35	0.73
Primary source of income (non-agriculture = 1)	0.08	0.06	0.97	0.33	0.08	0.08	0.19	0.85
Farm experience of the head of household (year)	21.1	22.5	−1.49	0.14	20.25	20.78	−0.43	0.67
Smart phone (yes = 1)	0.20	0.24	−1.15	0.25	0.18	0.27	−2.16	0.03
Tractor ownership (yes = 1)	0.20	0.18	0.57	0.57	0.22	0.30	−1.85	0.06
Asset index (#)	0.00	−0.20	1.49	0.14	−0.04	0.40	−2.62	0.01
Soil health card (yes = 1)	0.11	0.09	0.73	0.46	0.09	0.12	−0.86	0.39
Crop insured (yes = 1)	0.44	0.41	0.76	0.45	0.40	0.48	−1.58	0.11
Access to extension services (yes = 1)	0.03	0.07	−2.47	0.01	0.03	0.08	−2.29	0.02
Social network of friends/neighbors/relatives	0.38	0.39	−0.31	0.76	0.36	0.35	0.17	0.86
Distance of village to nearest input market (kilometre)	6.96	7.33	−0.81	0.42	7.29	6.57	1.10	0.27
Distance of village to nearest output market (kilometre)	9.15	9.66	−0.97	0.33	9.56	9.79	−0.31	0.76
Distance of village to nearest bank (kilometre)	5.22	7.03	−4.97	0.00	4.92	6.02	−2.35	0.02
Distance of village to block headquarter (kilometre)	9.53	11.27	−2.95	0.00	9.75	10.64	−1.07	0.28
Distance of village to district headquarter (kilometre)	26.34	29.39	−1.77	0.08	25.19	27.27	−0.96	0.34
Soil type (loam = 1)	0.17	0.12	1.48	0.14	0.15	0.19	−1.00	0.32
Soil type (sandy = 1)	0.06	0.04	1.19	0.23	0.06	0.07	−0.22	0.82
Soil type (sandy loam = 1)	0.46	0.34	3.00	0.00	0.49	0.42	1.38	0.17
Rainfed cultivation (yes)	0.41	0.56	−3.43	0.00	0.40	0.45	−0.87	0.39
Observations	1282	158			685	89		

Source: Author's calculation.

and unobserved characteristics. Summary statistics in the previous section reveals significant differences between the treatment and control groups in terms of household and village characteristics. To address this estimation issue, the present study uses the propensity score matching (PSM) technique. In the cross-sectional framework, it is one of the widely adopted procedures to identify the impact accounting for observed factors in the absence of suitable instruments (Mendola, 2007; Becerril and Abdulai, 2010; Abebaw and Haile, 2013).

Unobserved factors such as the ability and personal traits (such as searching for scheme) may also influence the selection into the program. To address this issue, we adopt the following approach. First, we use detailed social, economic and agricultural characteristics of farmers, plot characteristics (e.g., soil type, irrigation), the social network of farmers (e.g., whether farmer interacts with friends, relatives, and neighbors), and the market access (the distance of the village from input and output markets, block and district headquarters) variables (see Table 2). The comprehensive list of variables may not only account for the unobserved variable such as ability, which is proxied by education but to account for any systematic patterns that drive the investment for agricultural inputs (e.g., plot characteristics). Second, as noted earlier, we drop those farmers from the control group who are not eligible for the scheme and retain only those as a part of the control group that was eligible but did not receive the scheme's benefits for various reasons.[17] This strategy helps to layer out the ineligible farmers whose likelihood of being different in terms of unobserved characteristics is high compared to the eligible farmers. Third, we check the results' sensitivity for the deviations from the identifying assumption (selection based on observables). The presence of unobserved heterogeneity (if any) affects both the selection into the treatment and outcome variable simultaneously (Rosenbaum, 2002). To test that, we applied a procedure proposed by Rosenbaum (2002) to assess the degree to which any significant results may rely on the identifying assumption. Following Aakvik (2001), we calculate the Mantel-Haenszel test statistics that give bound estimates of significance levels at the given level of hidden bias under the assumption of either systematic over-or-under estimation of treatment effects.

4.1. Kernel matching procedure

The PSM constructs a statistical comparison group is based on the model of probability conditional on observed characteristics. Treatment is then matched based on this probability, or propensity score, to the control group. We employ a non-parametric kernel matching algorithm to match the treatment and control group, which has the advantage of matching estimator to construct the counterfactual for each treatment using weighted averages of all members in the control group.[18] This feature makes the kernel matching procedure best fit for our case where there is a limited control group set. We may identify the impact as the mean difference in outcomes across matched treatment and control groups. However, the key identifying assumption here is that the selection is solely based on observed characteristics, and all those variables that influence the treatment, as well as potential outcomes, are observed. Another critical assumption is the availability of the common support or overlap condition, which ensures that treatment observations have comparison observations "nearby" in the propensity score distribution (Heckman et al., 1999). To assess that, we plot the distribution of

[17] For example, errors in the bank account detail, delay in uploading data by implementation officer.

[18] Other matching algorithm such as nearest neighbor matching uses only few observations which are available in the neighbor of the treatment to construct the counterfactual.

matched treatment and control groups to see whether the overlap condition meets. Given the above understanding and their underlying assumptions, the average treatment effect on the treated (Heckman et al., 1998; Smith and Todd, 2005) can be written as follows:

$$PSM\ Estimator = \frac{1}{|NT|}\sum_{i=1}^{NT}\left(Y_i^T - \sum_{j=1}^{NC} W_{ji} Y_{ji}^C\right) \quad (1)$$

where Y is the outcome of interest, NT is the number of PM-KISAN beneficiaries, NC is the number of non-beneficiaries, and the W_{ji} are the matching weights that aggregate the outcomes for the matched non-beneficiaries. The PSM estimator captures the impact of PM-KISAN on input procurement. We use a similar procedure to identify the effect of PM-GKY on input procurement.

The matching weights can be constructed using the nearest neighbor method and non-parametric procedures (Caliendo and Kopeinig, 2008), where nearest neighbors construct the counterfactual from the neighbors of the treatment observation comparing propensity score of treatment and control. However, the kernel procedure constructs a counterfactual using all the control observations. It assigns a higher weight to those control observations, which are close in terms of the propensity score to the treatment and provides lower weight to those who are farther in terms of propensity score with the treatment. In the present paper, the main advantage of the kernel matching procedure is that it exploits all the control observations to construct counterfactual for each treatment and help balancing property to hold in the absence of a large control group. We estimate the propensity score (P) using the variables included in Table 2. For robustness check, we adopted different matching algorithms such as nearest-neighbor matching and radius matching to examine whether the results vary by choice of matching algorithms (for more detail on matching algorithm, see Caliendo and Kopeinig, 2008). Moreover, the study conducts a range of test such the comparison of pseudo-R^2 statistics before and after the matching and examines the reduction in bias after the matching.

4.2. Outcome variables

Since the study objective is to assess the impacts of PM-GKY on investments in agricultural inputs, we construct three variants of outcomes, which are defined as (a) '*agricultural inputs*,' (b) *'seed,'* and (c) '*fertilizers and pesticides.'* The first variable takes a value of 1 if farmers purchased any of the three inputs, 0 otherwise; the second variable takes a value of 1 if farmers bought seed and 0 otherwise; and finally, the third variable takes 1 if farmers bought fertilizer and pesticides, 0 otherwise. Fig. 4 presents the common support region for PM-KISAN beneficiaries vs. eligible non-beneficiaries. It clearly shows that the overlap condition is met, and treatment observations have enough comparison observations "nearby" in the propensity score distribution. The left panel Table 4 presents the standardized difference of treatment (PM-KISAN) and control (eligible non-PM KISAN beneficiary) for the matched sample.[19] It shows that the kernel matching procedure reduces biases significantly.[20] The second set of analyses compares the procurement of agricultural inputs such as fertilizers and pesticides and seeds across PM-GKY beneficiaries vs. non-beneficiaries. A potential issue here was a small sample size, but it does seem to meet the overlap condition (Fig. 5). Right panel Table 4 presents the standardized treatment difference (PM-GKY beneficiary) and control (non-PM-GKY beneficiary) for the matched sample.[21] The result reveals that the matching procedure reduces biases significantly.

5. Results and discussion

5.1. Impact of cash transfers to farmers on input procurement

Table 5, Panel A, presents estimates of the impact of cash transfers (PM-KISAN) on farmers' procurement of agricultural inputs for the 2020 Kharif season. Panel A presents all farmers' results, and the right-hand side presents results for small and marginal farmers.[22] We offer the results from the kernel matching and nearest-neighbor matching, and the results show similar patterns.[23] For all farmers, findings show the cash transfer scheme had a positive and significant impact on the procurement of agricultural inputs. In terms of magnitude, the results indicate that beneficiaries of the cash-transfer program were about 16 percentage points more likely than non-beneficiaries to purchase the agricultural inputs for the 2020 Kharif season immediately after receiving the assistance. In the case of seeds, the result shows that program beneficiaries were about 14 percentage points more likely than non-beneficiaries to purchase the seeds for the 2020 Kharif season immediately after receiving the assistance. However, the impact on the procurement of fertilizers and pesticides is modest (2.2 percentage points at a 10% level of significance). Thus, the increased procurement of agricultural inputs may be driven primarily by increased purchases of seed. The above findings underscore the importance of the government relief package under COVID-19 on farmers' behavior in farm inputs procurement. The results, in the case of small and marginal farmers, are similar to those of all farmers. As expected, the magnitude of the impact is lower than for all farmers, even though small and marginal farmers are more vulnerable.

The results presented in Table 5, Panel A, relied heavily on the assumption of conditional independence. It is possible that the results are not robust in the presence of hidden bias. Although we have used a wide range of covariates in conducting matching, it is still possible that results are not robust. To assess the problem of hidden bias, we conduct Rosenbaum bounds sensitivity analysis for all cases to determine whether the results are strong or are insensitive to the bias that triples the odds of access to the government assistance package. The magnitude of hidden bias that makes the findings spurious should be higher than 1.9. Thus, the results remain the same for unobservable characteristics that may increase the likelihood of receiving government assistance by about 1.9 times compared to the control group. Therefore, we conclude that the results are insensitive to the problem of hidden bias.

5.2. Impact of the PM-GKY Scheme on input procurement

Table 5, Panel B, presents estimates of the overall assistance package's impact on agricultural inputs' procurement for the 2020 Kharif season. Again, the results show similar patterns for both kernel and nearest-neighbor matching procedures. For all farmers, we find the assistance package had a significant positive impact on the acquisition of agricultural inputs. In terms of magnitude, the result shows that the

[19] To impose common support, we drop 62 treatment observations whose pscore is higher than the maximum or less than the minimum pscore of the controls. Pscore for treatment group lies between [0.55, 0.99]. Pscore for control group lies between [0.39, 0.98]

[20] We use kmatch Stata module for the estimation. See Jann (2017), for more detail.

[21] To impose common support, we drop 23 treatment observations whose pscore is higher than the maximum or less than the minimum pscore of the controls. Pscore for treatment group lies between [0.45, 0.99]. Pscore for control group lies between [0.48, 0.98]

[22] We are not able to conduct the analysis of medium and large farmers because of the small sample of these farmers.

[23] For the lack of space, we interpret only kernel matching results across the paper.

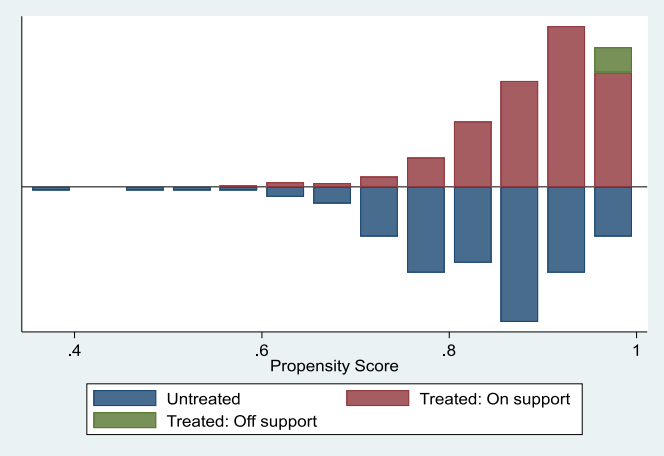

Fig. 4. Common support region, for PM-KISAN beneficiary and eligible non-beneficiary farmers.
Source: Author's calculation.

Table 4
Matched characteristics of farmers for PM-KISAN and PM-GKY, treatment vs. control groups.

	PM-KISAN					PM-GKY				
	Mean		% Bias	T-Test		Mean		% Bias	T-Test	
	Treatment	Control		T Statistic	p > |T|	Treatment	Control		T Statistic	p > |T|
Gender (male = 1)	0.93	0.93	−3.4	−0.87	0.39	0.93	0.90	11.3	1.88	0.06
Age (year)	44.0	43.6	2.8	0.70	0.49	43.4	44.4	−8.2	−1.47	0.14
Age squared (year)	2092	2059	2.8	0.70	0.48	2029	2122	−8.4	−1.45	0.15
Education (year)	6.20	6.29	−1.7	−0.43	0.67	6.13	6.35	−4.7	−0.86	0.39
Household size (#)	5.87	6.18	−8.5	−2.40	0.02	5.75	5.62	4.8	1.04	0.30
Religion (hindu = 1)	0.96	0.96	−1.3	−0.32	0.75	0.94	0.94	−2.2	−0.37	0.71
Schedule caste and tribe (yes = 1)	0.33	0.30	6.4	1.59	0.11	0.32	0.31	2.1	0.36	0.72
Below poverty line (yes)	0.28	0.27	0.4	0.10	0.92	0.27	0.23	9.0	1.62	0.11
Kisan credit card (yes = 1)	0.43	0.45	−3.6	−0.89	0.38	0.42	0.48	−11.5	−2.09	0.04
Land size (hectare)	1.37	1.47	−3.7	−1.25	0.21	1.28	1.33	−2.2	−0.52	0.60
Primary source of income (cultivation = 1)	0.74	0.74	−0.4	−0.10	0.92	0.75	0.81	−15.0	−2.86	0.00
Primary source of income (livestock and other agriculture = 1)	0.17	0.18	−2.1	−0.54	0.59	0.17	0.12	14.9	2.90	0.00
Primary source of income (non-agriculture = 1)	0.08	0.07	2.5	0.60	0.55	0.08	0.07	3.4	0.64	0.52
Farm experience of the head of household (year)	21.1	21.0	1.2	0.29	0.77	20.19	20.47	−2.5	−0.45	0.66
Smart phone (yes = 1)	0.21	0.22	−1.8	−0.45	0.65	0.18	0.19	−3.6	−0.71	0.48
Tractor ownership (yes = 1)	0.19	0.20	−3.1	−0.75	0.45	0.21	0.24	−5.1	−0.97	0.33
Asset index (#)	−0.04	−0.02	−1.5	−0.37	0.71	−0.03	0.20	−15.7	−2.81	0.01
Soil health card (yes = 1)	0.11	0.12	−4.9	−1.13	0.26	0.10	0.11	−4.6	−0.87	0.38
Crop insured (yes = 1)	0.44	0.43	1.9	0.46	0.65	0.40	0.45	−9.1	−1.66	0.10
Access to extension services (yes = 1)	0.03	0.04	−2.2	−0.64	0.52	0.03	0.04	−7.3	−1.62	0.11
Social network of friends/neighbors/relatives	0.39	0.34	9.4	2.34	0.02	0.36	0.31	10.0	1.85	0.07
Distance of village to nearest input market (kilometre)	6.89	7.31	−8.5	−2.11	0.04	6.96	7.16	−3.6	−0.70	0.49
Distance of village to nearest output market (kilometre)	8.98	9.45	−7.3	−1.94	0.05	9.17	9.16	0.2	0.04	0.97
Distance of village to nearest bank (kilometre)	5.37	5.39	−0.6	−0.15	0.88	4.98	5.08	−2.4	−0.46	0.65
Distance of village to block headquarter (kilometre)	9.47	9.78	−4.2	−1.16	0.25	9.47	9.43	0.4	0.09	0.93
Distance of village to district headquarter (kilometre)	26.69	27.98	−6.2	−1.53	0.13	25.32	26.17	−4.6	−0.86	0.39
Soil type (loam = 1)	0.16	0.17	−2.6	−0.60	0.55	0.15	0.14	3.3	0.64	0.52
Soil type (sandy = 1)	0.05	0.05	2.3	0.56	0.58	0.06	0.07	−2.4	−0.43	0.66
Soil type (sandy loam = 1)	0.46	0.42	8.1	1.95	0.05	0.48	0.49	−1.2	−0.22	0.83
Rainfed cultivation (yes)	0.42	0.46	−7.5	−1.84	0.07	0.40	0.39	1.0	0.18	0.85
Observations	1220	158				662	89			

Source: Author's calculation.
Notes: Matching is performed using a kernel matching procedure as described in the text. Matched characteristics are obtained in the common support region.

package's beneficiaries were 17 percentage points more likely than non-beneficiaries to purchase the agricultural inputs immediately after receiving the government assistance. In the case of seeds, the results reveal that beneficiaries of the assistance package were about 14 percentage points more likely than non-beneficiaries to purchase seeds for the 2020 Kharif season immediately after receiving the assistance. Note that the magnitude of the impact of the government assistance package on the procurement of agricultural inputs and seeds is significantly higher than that of the program transferring cash to farmers. A plausible reason could be that when farmers received multiple benefits under the overall package, they had additional benefits (such as cash transfer for women, conditional cash transfer for buying cooking gas, and free food rations). As a result, they could afford to shift their additional spending on purchasing agricultural inputs. Our result is consistent with Kumar et al. (2020), who found that access to credit increased farmers' expenditures on farm-related activities.

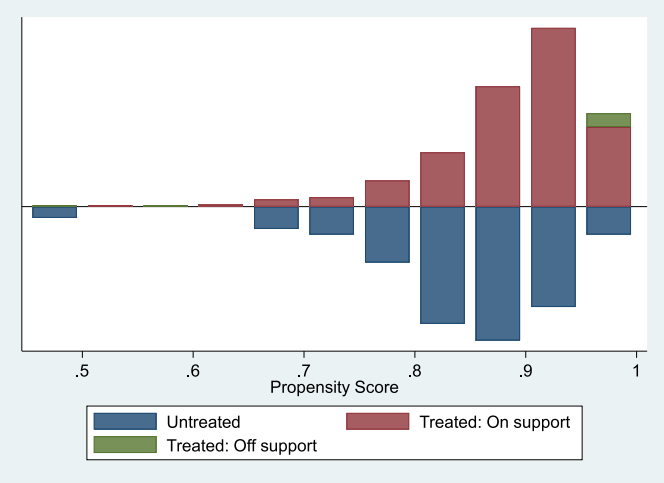

Fig. 5. Common support region for PM-GKY beneficiary and non-beneficiary farmers.
Source: Author's calculation.
Note: We define PM-GKY beneficiaries as those received the benefit from all four components of the PM-GKY, namely, PM-KISAN, PM-JDY, PM-UY, and PM-AVY. And non-PM-GKY beneficiaries as those who did not get the benefit of any of these schemes.

Table 5
Impact estimates of PM-KISAN and PM-GKY on the procurement of agricultural inputs, farmers in Rajasthan, Madhya Pradesh, and Uttar Pradesh, India 2020.

Panel A: Impact of PM-KISAN						
	All farmer			Small and marginal farmer		
	Agricultural inputs	Seed	Fertilizer and Pesticides	Agricultural inputs	Seed	Fertilizer and Pesticides
Kernel matching						
ATT	0.158*** (0.031)	0.137*** (0.029)	0.022 (0.011)	0.133** (0.042)	0.125*** (0.037)	0.009 (0.021)
Rbounds	(1–2.6)	(1–2.8)	(1–3)	(1–1.9)	(1–2.2)	(1–3)
Nearest neighbor (n = 5)						
ATT	0.163*** (0.031)	0.143*** (0.028)	0.020 (0.013)	0.096 (0.056)	0.100** (0.050)	−0.003 (0.031)
Rbounds	(1–2.6)	(1–2.8)	(1–3)	(1–1.9)	(1–2.2)	(1–3)
Obs.	1440	1440	1440	1163	1163	1163
Panel B: Impact of PM-GKY						
	All farmer			Small and marginal farmer		
	Agricultural inputs	Seed	Fertilizer and Pesticides	Agricultural inputs	Seed	Fertilizer and Pesticides
Kernel matching						
ATT	0.173** (0.058)	0.136** (0.058)	0.037*** (0.011)	0.164*** (0.045)	0.129** (0.045)	0.034*** (0.009)
Rbounds	(1–2.5)	(1–2.6)	(1–3)	(1–1.9)	(1–1.7)	(1–3)
Nearest neighbor (n = 5)						
ATT	0.194*** (0.048)	0.157** (0.048)	0.038*** (0.011)	0.153** (0.058)	0.121** (0.058)	0.033*** (0.009)
Rbounds	(1–2.5)	(1–2.6)	(1–3)	(1–1.7)	(1–1.7)	(1–3)
Obs.	776	776	776	624	624	624

Source: Author's calculation.
Notes: Out outcome variable '*Agricultural Inputs*' takes value 1 if farmers procured the inputs such as fertilizers and pesticides or seeds in the month of April-May 2020 for the Kharif season 2020. The outcome variable '*Fertilizers and pesticides*' takes value 1 if farmers procured the fertilizers and pesticides in the month of April-May 2020 for the Kharif season 2020. The outcome variable '*Seeds*' takes value 1 if farmers procured the seeds in the month of April-May 2020 for the Kharif season 2020. In Panel-A, the treatment group is defined as those farmers who received the benefit of PM-KISAN in the month of April 2020 and control group as those eligible farmers who didn't received the benefit of the program. In Panel-B, the treatment group is defined as those farmers who receive the benefit in April 2020 for the following schemes: PM-KISAN, PM-JDY, PM-UY the PM-AVY. The Control group is defined as those farmers who did not get the benefit of any of these schemes. Propensity score matching is performed using a kernel matching procedure, as described in the text. Small and marginal farmers are defined as those who own less than 2 ha of land. Rosenbaum bounds (Rbounds) are estimated to determine the ranges between 1 and 3 on which the results are insensitive to the hidden bias. Analytical standard errors in the parenthesis.
***Significant at 1%. **Significant at 5%.

Interestingly, we find the government assistance package had a positive and significant impact on the procurement of fertilizers and pesticides (about a 4% increase). An explanation for this finding could be that the additional assistance under the package relaxed the liquidity constraint to a large extent, such that farmers purchased expensive agricultural inputs such as fertilizer. It reveals that other components of the government assistance package and the component transferring cash to farmers resulted in increased spending on agricultural activities by all farmers in general and by small and marginal farmers in particular. We find a similar pattern of results for the smaller and marginal farmers. Here as well, the magnitude is lower than for all farmers. Our estimates of Rosenbaum's bounds show that the extent of hidden bias that makes the findings spurious should be greater than 1.7. The results remain the same for unobservable characteristics that may increase the likelihood of receiving assistance from the overall package by about 1.7 times compared to the control group. Here, we conclude that the results are insensitive to the problem of hidden bias within this range. Moreover, we tested for overall bias reduction after matching. Results in Table 6

Table 6
Indicators of matching quality, farmers in Rajasthan, Madhya Pradesh, and Uttar Pradesh, India, 2020.

	Pseudo R^2	LR chi^2	$p > chi^2$	Mean bias	Median bias
PM-KISAN beneficiaries vs. Eligible non-PM-KISAN beneficiaries					
Unmatched	0.082	81.58	0	13	9.5
Matched	0.011	36.92	0.252	4.2	3.1
PM-GKY beneficiaries vs. non-PM-GKY beneficiaries					
Unmatched	0.074	40.68	0.114	12.5	11.1
Matched	0.031	56.95	0.003	6	4.7

Source: Author's calculation.

show a significant reduction in bias for both the component transferring cash to farmers and the comprehensive government assistance package. The value of Pseudo R^2 also indicates that the value of biasness decreased in both cases after the matching, reflecting the matching quality.

6. Summary and conclusions

India, the largest democracy, faces significant effects of the COVID-19 pandemic. The COVID-19 pandemic caught nations by surprise and came as a shock to people around the world. Like other developed and developing countries, the Indian government took swift action to blunt the effects of COVID-19 on the Indian population. Most importantly, the Indian government ordered the lockdown of the economy. Private businesses were shut down, production lines halted, and workers were ordered to shelter in place. During this lockdown, the Indian government enacted several emergency legislations to provide direct and indirect relief to workers and households. The Indian government passed the most extensive relief package in the country's history. Under the *Pradhan Mantri Garib Kalyan Yojana* (PM-GKY) legislation, the Indian government provided cash transfers and in-kind support to Indian households for the first three months of the lockdown (April, May, and June).

The disbursement of cash transfers in the three states showed that emergency relief packages had reached the vulnerable sections of Indian society. Overall, 89–94% of households benefited from direct cash transfers. The study found that the minimum income support program providing cash transfers to farmers increased small and marginal farmers' procurement of seeds for the upcoming cropping season (2020 Kharif season) in the three northern states of India. However, the study found that farmers who received benefits under other components of the overall government assistance program and the cash transfer to farmers spent more on the procurement of seeds, fertilizers, and pesticides than farmers who did not receive benefits under other components. The heterogeneous impact of the overall program on input procurement showed the effect of COVID-19 relief packages in addressing the liquidity constraints facing vulnerable small and marginal farmers in northern India.

Perhaps lower transaction costs, minimal leakages, and immediate delivery make a strong case for direct cash transfers. The above advantages facilitate the provision of relief to a large proportion of vulnerable sections of Indian society in a short period. However, whether these relief measures continued to reach and affect vulnerable farming households in May and June 2020 remains a question for future research. The above finding has broader implications for other countries in efficient and effective disbursement of aid from government relief packages to private citizens.

Declaration of Competing Interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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