Improving farmers access to agricultural extension services delivery systems: Lessons from a field study in western Uttar Pradesh, India

Ankit Nagar*, Dinesh Kumar Nauriyal and Sukhpal Singh

Department of Humanities and Social Sciences, Indian Institute of Technology, Roorkee 247 667, Uttarakhand, India

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Abstract

This paper examines the key determinants of farmers access to agricultural extension services, and the sources of agricultural extension services preferred and accessed by farmers. An ordered logistic regression model was used to analyse the data of 360 sample households based on a primary survey conducted in western Uttar Pradesh, India. The study finds that farmers decision to engage in the agricultural extension programme is significantly influenced by factors such as education level, gender, farming experience, social group, group membership, farm size, credit access, awareness of the extension scheme, farmers perception and distance from extension sources. The most intriguing finding of this study is that progressive farmers, who have long been regarded as a major source of knowledge diffusion, are the most distrusted sources of information as they are suspected of withholding vital information from potential beneficiaries. The positive relationship between farm size and 'Access' underlines that the extension services should revisit their strategies for targeting more marginal and small farmers by incorporating their priorities into their outreach programs. The study suggests that marginal and small farmers productive potential could still be greatly augmented by the appropriate technology, advisory services, guidance and improved market access.

Keywords: Access, Agriculture, Extension services, Ordered logistic regression.

Introduction

A considerable percentage of the Indian population, 44 per cent of the total and 70 per cent of rural households are economically dependent on agriculture (World Bank 2019), contributing 17.8 per cent to India's Gross Value Added (GVA) (GoI, 2020). However, the agriculture sector is still unable to lookup despite having increased government spending on public research, increased government participation in promoting the application of technology, encouraging diversification, providing relief in the form of loan waivers, involving the private sector to infuse new technology into the agriculture sector, growth in the agro-processing industry as well as organised retailing. Agriculture, in particular, is becoming increasingly information-intensive, necessitating an efficient distribution mechanism for knowledge transfer from the lab to the field. Agricultural extension services provide the channel that facilitates the transition of knowledge from the lab to the field and the closing of the gap between actual and potential yields by disseminating new technologies and farm management practices, encouraging farmers to implement improved varieties, cropping techniques, optimal input usage, prices and market conditions, and more effective methods of production management, storage and nutrition, among others (Rimal and Kumar 2015; Sendhil et al., 2014). Many studies have also estimated the increase in farmers incomes once these services are available. These

*Author for Correspondences: Phone: 8899806999, Email: anagar@hs.iitr.ac.in

estimates range from 11 percent to 61 percent (Wossen et al., 2017; O'Donoghue and Hennessy, 2015).

It is worth noting that India's agricultural extension services system is pluralistic, with multiple outlets and providers rather than a single dominant source (Sajesh et al., 2018). As a result, farmers have a range of knowledge sources to choose from (Kaegi, 2015). However, despite the demonstrated usefulness of extension services worldwide, about 61 percent of farmers do not access any extension service, according to the National Sample Survey Organisation (NSSO) 70th round report. Existing literature on the subject throws light on the various determinants of 'Access'. Some of them are the age of the head of the household (HOH), farm size, farming experience, farmer's education, availability of credit, training, and a few other factors.

It is evident from the existing literature that these factors differ by region due to a variety of socioeconomic and institutional aspects (Akudugu et al., 2012), which necessitate an empirical investigation into the subject. The present study's primary objective is to identify the factors influencing farmers access to various sources of Agricultural Extension Services (AES). It examines the sources and number of extension services accessed by farmers, the reasons for not accessing the extension services, and explores the socio-economic institutional and technological factors that determine access to extension services.

Materials and Methods

This study is based on cross-sectional data collected from 360 farming households through multistage sampling between October 2019 and March 2020. In the first stage, convenience sampling was followed to select the two western districts of Uttar Pradesh, India, namely Meerut and Muzaffarnagar. The acquaintance with the socio-economic and cultural parameters, easy accessibility, time and financial constraints were factored in for this sampling. Also, the selection of these two districts was made due to the presence of two major agricultural teaching and research institutions, i.e., SVBP University of Agricultural and Technology, Meerut, and Uttar Pradesh Sugarcane Institute Training Centre, Muzaffarnagar. In both the districts, KrishiVigyan Kendra (Agriculture Science Centres) are part of the University's Division of Extension. Three blocks from each district, two villages from each block, and 30 agricultural households from each village were chosen randomly in the subsequent stages. The respondents, *i.e.*, households' agricultural decision-makers, were randomly selected. The data were obtained using a semi-structured questionnaire and interview schedule, enveloping information related to personal and household characteristics, farm and institutional characteristics, knowledge, perception, and access to extension services.

The study considered eight major agricultural extension services, *viz.,* Extension agent, KrishiVigyan Kendra, Agricultural university and college, private extension services, progressive farmers, mass media (Radio/TV/internet/ newspaper), Veterinary department, and NGOs.

The variables

The dependent variable access to extension services is divided into three categories, 'No Access', 'Poor Access' and 'Fair Access'. Since the mean number of extension services used by farmers is 2.12, with a standard deviation of 1.79 (Table 1), farmers who are above the mean value are considered as having 'Fair Access', and those who are below the mean value as having 'Poor Access' to the extension services. Farmers that do not have any access form another category, i.e., 'No Access'. The independent variables are household specific and other institutional factors, based on the prior literature on the subject and the pilot survey observations. Except for gender, all household-specific factors, such as farm size (in hectares), years of schooling of the decision-maker in the household, diploma/ certificate of professional education, level of

awareness, access to a smartphone, farming experience (in years), average hours spent on the farm per day (in hours) and farmers perception are hypothesised to have a positive impact on access to extension services. Owing to gender inequity, socio-cultural and religious norms, it is thought that women decision-makers would have less access to extension services (Kumar and Venkatachalam, 2019). They are also often burdened by their tasks, such as caregivers, household chores and other household obligations. Moreover, the contacts may have male dominance, male bias, inappropriate timing, venue and message topics (Magar 2011). The set of other variables, including training in agriculture, access to credit, access to the mass media, and group membership, are also hypothesised to have a positive impact on the dependent variable. Based on prior art, it is hypothesised that marginalised castes have poor access to extension services (Gupta et al., 2020; Kumar and Venkatachalam, 2019; Krishna et al., 2019, Rao, 2017; Singh et al., 2013).

According to the survey data, we found that only 12.50 per cent of farmers are illiterate or just literate. However, the share of the graduate and above education category is poor at 16.39 per cent only. The ratio of farmers who have obtained education from secondary to higher secondary category to the total sample stood at 44.72 per cent. Just about ten per cent of the 360 farmers have a technical course diploma or certificate. Only 2.78 percent of the female farmers, most of whom are widows, are in the role of decision-makers, not by choice but by compulsion. Farmers average age is 46.37 years, indicating a significant ageing problem. Despite a major training institute and an agricultural university in the study field, only 6.94 percent of the total sample of farmers have formal agricultural training. The largest group (71.39 per cent) is OBCs, followed by Others (17.50 per cent). Institutional/ formal credit is accessed by 68.33 per cent of farmers, while others rely on informal credit sources with high-interest rates. It may be noted that 33 per cent of the farmers in the sample are from the marginal category, followed by medium (27.50 per cent), small (22.78 per cent) and large (16.39 percent), and only 24.72 percent of the farmers are active members of any formal body/group like Self-Help Group (SHG), farm organisations, farmers unions and Gram Panchayat/Sabha, among others. This research also investigates the functional relationship between the variable "religion" and access to extension services, as Hindus and Muslims make up 87.22 per cent and 12.7 per cent of the sample population, respectively. Two other variables, *viz.,* 'distance from agriculture university' and 'distance from Krishi Vigyan Kendra', are hypothesised to have a negative impact on access to extension services.

It may be emphasised here that the ordered logistic regression model is the most suitable for analysing the primary objective as the dependent variable has ordered categories. The model is based on the response variable's cumulative probabilities. In particular, a linear function of the covariates with regression coefficients constant across response categories is presumed to be the logit of each cumulative probability (Grilli and Rampichini 2014).

Results and Discussion

The purpose of this study was to investigate the factors that affect farmers access to various providers of agricultural extension services. It investigates the kind and number of extension services used by farmers, as well as the reasons why they are not used, and the socioeconomic, institutional, and technological factors affecting access to extension services. Agriculture, which remains critical to India's livelihood, employment and growth in other sectors, has remained stagnant during the previous two decades, with a few notable exceptions. This has had a profound effect on sustainability of India's rapid economic growth. Additionally, new research findings from universities and other field stations are not reaching a significant proportion of farm households,

Table 1. Number of sources of information accessed by the farmers

Sl. No.	Number of sources accessed	Total (in percent)	Farm-size-wise access (in per cent)			
			Marginal	Small	Medium	Large
1	No access	24.44	59.17	17.07	2.02	1.59
2	One service	16.94	13.33	23.17	17.17	15.25
3	Two services	20.56	15.0	29.27	23.23	15.25
4	Three services	15.83	7.5	15.85	26.26	15.25
5	Four Services	10.56	2.5	6.10	20.20	16.95
6	Five Services	7.50	1.67	6.10	9.09	18.64
7	Six Services	2.78	0.83	2.44	2.02	8.47
8	Seven Services	1.39	0.00	0.00	0.00	8.47
9	Eight Services	0.00	0.00	0.00	0.00	0.00

Source: Authors' field survey 2019-20.
Note: Mean value of number of access to extension service is 2.12 with a standard deviation of 1.79.

indicating a decline in agricultural extension services. Both state and central governments must take this issue seriously.

As is evident from Table 1 that not even a single farmer, out of a sample of 360 sample households, has accessed all eight extension services. At the national level, over 61 per cent of farmers do not have access to any source of extension knowledge (NSSO 2013), in sharp contrast to 24 per cent in our primary data. This difference can be explained by the fact that Western Uttar Pradesh, like Punjab and Haryana, was a forerunner of the green revolution, and the farmers in this part of the state are considered progressive.

As a result, it is presumed that farmers knowledge of and access to various extension-related information sources is much higher than the national average. As is highlighted in Table 2, poor awareness appears to be the prime reason for not having access to the extension services.

However, more revealing is that over 59 per cent of farmers cited other reasons for not preferring access to progressive farmer advice. While almost all studies have emphasised the importance of progressive farmers for knowledge dissemination, most farmers in our survey revealed that they did not trust progressive farmers advice because most crucial information is hidden and not shared. This scepticism stems from the possibility that progressive farmers could receive expert advice by paying in cash and kind, which is why they may be disinterested in sharing their expertise with others for free. Surprisingly, public extension programmes in the research field receive very little attention. This may be true because information transfer is still essentially linear and top-down, i.e., from lab to extension. There is no formalised feedback system between growers, extension personnel and research institutions (Ganguly et al., 2006). Owing to the little participation of marginal and small farmers and farmers living far away from agricultural universities/KVKs/research centres, meetings are

Table 2. Reasons for not accessing various forms of extension services (in per cent)

Sl.No.	Extension service	Not Aware	Not Required	Not Available	Other
1.	Extension Agent	71.43	0.77	27.80	0.00
2	KrishiVigyan Kendra	84.54	7.26	6.94	1.26
3	Agriculture University/College	69.35	20.43	5.57	4.64
4	Private extension agents	63.38	13.38	22.54	0.70
5	Progressive Farmers	19.07	15.98	5.97	59.28
6	Radio/TV/Newspaper/internet	72.91	9.36	16.75	0.99
7	Veterinary	38.27	2.16	58.95	0.62
8	NGO	50.99	0.85	48.17	0.00
	Average	58.74	8.77	24.09	8.44

Source: Authors' field survey 2019-20.

Table 3. Source-wise Access to the extension services among different farm size categories. (in per cent)

Sl. No.	Extension service	Access (in numbers)	Marginal farmers	Small farmers	Medium farmers	Large farmers	Total access
1	Public service Extension personnel	99	7.5	23.17	39.39	54.24	27.5
2	KrishiVigyan Kendra	43	2.5	4.88	19.19	28.81	11.94
3	Agriculture University/College	37	5	8.54	10.10	23.73	10.28
4	Private extension agents	218	27.5	63.41	83.83	84.75	60.56
5	Progressive Farmers	166	21.67	50.0	56.57	72.88	46.11
6	Radio/TV/Newspaper/internet	158	20.83	42.68	58.58	67.80	43.89
7	Veterinary	36	3.33	6.10	12.12	25.42	10.00
8	NGO	5	0.83	0.00	1.01	5.08	1.39

Source: Authors' field survey 2019-20.

Notes: *The percentage figures in each column may not add to 100 as the sample households have had access to multiple sources.*

seldom held, and that too, with the meagre participation of a minimal number of farmers, as was reported during the survey for this study. The low outreach is also attributed to low staff numbers and low operating budgets wherein 85-90 per cent of expenditure goes towards payment of salaries (Glendenning and Ficarelli, 2011). Besides, as time has rolled out, alternatives to public extension services with better functional models have begun to emerge. Due to shifts in market and technology dynamics, private entrepreneurs (for example, input suppliers) have also taken over significant information-diffusion operations. Table 3 demonstrates the source-wise access of the various categories of farmers to the farm extension services.

As is also revealed by data in Table 3, large farmers have far more access to public sector extension services than small and marginal farmers, which is also supported by the prior literature (Bhogal, 2016; Sajesh and Suresh, 2016; Babu et al., 2013). If this is the case, the vast majority of farmers are out of the fold of public extension services as over 85 per cent of the farmers in India are marginal and small land-holders.

The results of ordered logistic regression are shown in Table 4. The model was also checked for multicollinearity among the independent variables, and no such problem was detected as the variance inflation factors (VIF) for all the variables were less than 10.

Table 4. Results of Ordered Logistic Regression Model for Access to the extension services

Access to the extension services. (Dependent Variable) No Access=1, Poor Access=2, Fair Access=3	Odds Ratio	Std. Err
Independent Variables		
Education	1.190***	0.053
Diploma/Certificate holder	1.028	0.476
Gender Dummy	20.130**	26.395
Farming Experience	0.979**	0.011
Average hours spent on the farm	1.069	0.077
Household Size	1.043	0.039
Social group		
OBC	3.437***	1.650
Others	4.614***	2.602
Religion	0.992	0.453
Group membership	2.282***	0.733
Farm Size	1.452***	0.150
Credit Access	2.244***	0.608
Training Dummy	1.304	0.990
Awareness about extension schemes	2.690***	0.760
Farmers perception Dummy	4.664***	1.575
Mass Media Access	1.051	0.432
Use of Smartphone	1.420	0.450
Distance from agriculture University	0.980**	0.007
Distance from KVK	0.981**	0.008
Intercept cut1	5.244	
Intercept cut2	8.356	
Number of observations	360	
LR chi2(16)	289.37	
Prob> chi2	0.000	
Pseudo R2	0.37	
Log likelihood	-244.06	
Hosmer-Lemeshow goodness of fit test	0.43	
Pulkstenis-Robinson goodness of fit test	0.99	

Source: Authors' calculation

*** p <0.01, ** p < 0.05, * p <0.10

Note: cut1 and cut2 are the intercepts for the second and third category, respectively. The intercept for the first category normalised to zero. The goodness of fit test's value is more than 0.05, which shows that the model is a good fit.

The results shown in Table 4 suggest that the farmers educational level significantly impacts access to the extension services as per expectation. A reasonably large number of studies (Nagar et al., 2021; Wossen et al., 2017; Elias et al., 2013) also report that education is positively related to extension contacts due to the receptivity of the literate population to the latest knowledge, which improves their capacities to understand, assimilate and use productivity-enhancing agricultural technologies and practices.

The gender of a farmer is a crucial factor for accessing extension services. If an HOH is male, he has far more probability of having access to such services than a female HOH. Many studies have reported that households with female heads are less likely to access agricultural extension services than their male counterparts (Kumar and Venkatachalam, 2019; Ragasa et al., 2012). The most plausible explanation could be that female-headed households in developing countries are poor and marginalised due to social and cultural taboos and constraints on access to resources, market information, technical knowledge, and credit.

The present study finds that farming experience has a significant and negative relationship with access to extension services. It implies that as farming experience rises, farmers appetite for access to extension services decreases, which is confirmed by similar results from a study that concludes that farming experience has a negative effect on access to extension services (Abdallah and Rahaman, 2016).

In terms of social group's impact on access to extension services, keeping SCs as a reference category, it is found that farmers from OBC and the 'Other' category have a positive and highly significant impact on access to extension services. A few studies have also suggested that farmers from socially-marginalised castes in India have less access to public extension services than their counterparts from higher castes (Krishna et al., 2019; Rao, 2017; Deshpande, 2011).

The impact of a farmer's group membership on access to extension services is positive and highly significant. Table 5 also indicates a highly significant and positive impact of the farm-size on access to extension services. Farm size has been shown to positively affect the likelihood of obtaining agricultural extension services in theoretical and empirical studies (Kumar and Venkatachalam, 2019; Abdallah and Rahaman, 2016). Furthermore, access to agricultural extension services has an important and supportive relationship with structured credit availability. It suggests that the availability of financial capital enables farmers to seek advisory services to raise their agricultural productivity. Many other studies have also reported that having access to credit is a crucial determinant of having access to the most up-to-date technology (Kumar and Venkatachalam, 2019; Lavison, 2013).

The variable 'awareness about extension schemes' also has a highly significant and positive impact on access to extension services. The awareness level of a farmer can probably help him to reach the sources of technical advice. Access to extension services is also affected by the farmers perception of extension personnel's competence to solve farmers agriculture-related issues. This variable also reveals a highly significant and positive impact on access to the extension services.

Other important variables, 'distance from agricultural university' and 'distance from Krishi Vigyan Kendra', show a significant and negative impact on 'Access'. It implies that as the distance from extension sources increases, the 'Access' decreases. Similar findings from other research support the conclusion that distance has a substantial and adverse effect on access to extension services (Paltasingh and Goyari, 2018). All other variables have turned out to be insignificant, though the direction of their influence is positive. The insignificant impact of religion indicates no

discrimination based on religion in the access of farmers to extension services. There have been little to no studies of religion as a predictor of obtaining agricultural extension services since the services are given without prejudice in today's world. The variables of major ramification are 'Access to the mass media' and 'Use of smartphones' have emerged as insignificant and suggest that 'Access' is not much influenced by these two variables (Paltasingh and Goyari, 2018). In their interaction with the authors during the survey, farmers stated that they prefer demonstrations, farm visits and group meetings where the communication is two-way, more than what they get from the mass media, particularly in a setting where farming is primarily characterised by subsistence agriculture. As far as smartphones are concerned, it is worth noting that only 31 per cent of farmers own one and use it for personal communication and entertainment purposes. Previous research has reported mixed findings. While some studies have found a positive impact (Ali and Man, 2017; Syiem and Raj, 2015), others have found an insignificant effect (Mwamakimbula 2014).

The findings of the Ordered Logistic Regression Model for Access to Extension Services indicate that education, gender, farming experience, social group, group membership, farm size, credit access, awareness of the extension scheme, farmers perception and distance from extension sources have significant impact on the probability of having access to the extension services. The most intriguing report of this study is that progressive farmers, who have long been recognised as a major source of knowledge dissemination, are the most distrusted sources of information in the sample area because they are suspected of withholding vital information from potential beneficiaries. The study suggests that strengthening the agricultural extension network, expanding rural formal financial markets, promoting education and Farmer Producers Organisations (FPO) can maximise the potential impact of the agricultural extension services on farm household welfare. The positive relationship between farm size and 'Access' implies that the extension services should revisit their strategies for targeting more marginal and small farmers, who constitute over 85 per cent of the agricultural households, by incorporating their priorities into their outreach programs. Due to the low outreach and sometimes low quality and reliability of services, marginal and small farmers productive potential could still be significantly augmented by the appropriate technology, advisory services, guidance, and improved market access. Since reaching numerous marginal and small farmers is prohibitively expensive, using social networks with a fairly good number of early adopters of technology with more or less similar production environments may undoubtedly act as a cost-effective platform for technology diffusion. It needs an inclusive system of agricultural extension services that incentivises small and marginal farmers to actively participate in these organisations, thereby contributing to overall rural development.

References

Abdallah, A. H. and Rahaman, A. 2016. Determinants of access to agricultural extension services: Evidence from smallholder rural women in Northern Ghana. Asian J. Agric. Ext. Econ. Sociol.,9(3): 1-8.

Ali, M. and Man, M. 2017. Reaching the millions: Accelerating agricultural extension services through Information and Communication Technologies (ICTS). World Appl. Sci. J., 35 (3): 352-355.

Akudugu, M. A., Guo, E. and Dadzie, S. K. 2012. Adoption of modern agricultural production technologies by farm households in Ghana: What factors influence their decisions? J. Biol. Agric. Healthc., 2(3).

Babu, S.C., Joshi, P.K., Glendenning, C.J., Kwadwo, A.O. and Rasheed, S.V. 2013. The State of Agricultural Extension Reforms in India: Strategic Priorities and Policy Options. Agric. Econ. Res. Rev., 26 (2): 159-172.

Bhogal, P. 2016. Policy Imperatives for India's Small Farmers. ORF Issue Brief, December, 8.

Deshpande, A. 2011. The grammar of caste: Economic discrimination in contemporary India. Oxford University Press.

Elias, A., Nohmi, M., Yasunobu, K. and Ishida, A. 2013.

Effect of Agricultural Extension Program on Smallholders' Farm Productivity: Evidence from Three Peasant Associations in the Highlands of Ethiopia. J. Agric. Sci.,5(8): 163-181.

Ganguly, S., Feder, G. and Anderson, J. R. 2006. The rise and fall of training and visit extension: an Asian mini-drama with an African epilogue. World Bank Policy Research Working Paper, (3928).

Glendenning, C.J. and Ficarelli, P.P. 2011. Content development and management processes of ICT initiatives in Indian agriculture. Inf. Dev., 27(4): 301-314.

GOI [Government of India]. 2019. Agricultural Statistic at Glance 2019 [on-line]. Available: https://eands.dacnet.nic.in/ [02 May 2021].

GOI [Government of India]. 2020. Economic Survey 2019-20 [on-line]. Available: https://www.indiabudget.gov.in/budget2020-21/economicsurvey/index.php [03 May 2021].

Grilli, L. and Rampichini, C. 2014. Ordered logit models. In: Michalos A. C. (Ed.). Encyclopedia of Quality of Life and Well-Being Research. Dordrecht, Netherlands: Springer, pp 4510-4513.

Gupta, I., Veettil, P. C. and Speelman, S. 2020. Caste, Social Networks and Variety Adoption. J. South Asian Dev., 15(2): 155-183.

Kaegi, S. 2015. The experiences of India's agricultural extension system in reaching a large number of farmers with rural advisory services.Vietnam.

Karlan, D., Akoto, I. O.,Osie, R. D. and Udry, C. 2010. Examining Underinvestment in Agriculture: Returns to Capital and Insurance in Ghana [on-line]. Available: Karlan-Et-Al-2012-Policy-Brief.pdf (theigc.org) [05 May 2021].

Krishna, V. V., Aravalath, L.M. and Vikraman, S. 2019. 'Does caste determine farmer access to quality information?' PLoS ONE 14(1): e0210721.

Kumar, S. M. and Venkatachalam, R. 2019. Caste and credit: A Woeful Tale?J. Dev. Stud., 55(8): 1816-1833.

Lavison, R. 2013. Factors influencing the adoption of organic fertilisers in vegetable production in Accra, M.Sc. Thesis, Accra Ghana.

Magar, S. B. G. 2011. An Assessment of Men and Women Farmers' Accessibility to Governmental Agriculture Extension Program: A Case of Arghakhanchi District, Nepal, MBA Thesis, Wageningen, Netherlands.

Mwamakimbula, A. M. 2014. Assessment of the factors impacting agricultural extension training programs in Tanzania: A Descriptive Study. Iowa State University. Graduate Theses and Dissertations. 14227.

Nagar, A., Nauriyal, D.K. and Singh, S.P. 2021. Determinants of Farmers Access to Extension Services and Adoption of Technical Inputs: Evidence from India. Univers. J. Agric. Res., 9(4): 127-137.

NSSO [National Sample Survey Office]. 2013. Household Ownership and Operational Holdings in India. [on-line]. Available: http://www.indiaenvironmentportal.org.in/content/422691/household-ownership-and-operational-holdings-in-india-january-december-2013 [15 Dec. 2015].

O'Donoghue, C. and Hennessy, T. 2015. Policy and economic change in the agri-food sector in Ireland. The Economic and Social Review, 46(2, Summer), 315-337.

Ofuoku, A. U. 2013. Influence of extension agents and farmers communications factors on the effectiveness poultry technology messages. Trop. Agr. Res. Ext., 15(1):14-23.

Paltasingh, K. R. and Goyari, P. 2018. Impact of farmer education on farm productivity under varying technologies: case of paddy growers in India. Agric. Food Econ., 6(1):7.

Ragasa, C. and Mazunda, J. 2018. The Impact of Agricultural Extension Services in the Context of a Heavily Subsidised Input System: The Case of Malawi. World Dev., 105: 25-47.

Rao, S. 2017. Caste Discrimination and Agricultural Performance in India. Econ. Polit. Wkly., 52(25-26):32-38.

Rimal, N. S. and Kumar, S. 2015. Yield gap analysis of major pulses in India. J. Inst. Agric. Anim. Sci., 213-219.

Sajesh, V. K. and Suresh, A. 2016. 'Public-Sector Agricultural Extension in India: A Note. Rev. Agrarian Stud., 6(1): 116-131.

Sajesh, V. K., Padaria, R. N. and Sadamate, V. V. 2018. Pluralism in agricultural extension in India: imperatives and implications. Econ. Aff., 63(4): 1017-1025.

Sendhil, R., Singh, R., Ramasundaram, P., Kumar, A., Singh, S. and Sharma, I. 2014. Yield gap in wheat: Approach, quantification and resetting research priorities in India. J. wheat res., 6(2): 138-149.

Singh, S., Singh, R. K. and Singh, R. 2013. Enhancing rice and wheat production by bridging yield gap in western Uttar Pradesh of India. J. wheat res., 5(2): 43-47.

Syiem, R. and Raj, S. 2015. Access and usage of ICTs for agriculture and rural development by the tribal farmers in Meghalaya state of North-East India.J. Agric. Informatics, 6(3): 24-41.

World Bank. 2019. 'Employment in Agriculture', World

Bank Data [on-line]. Available:https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS [21 June 2019].

Wossen, T., Abdoulaye, T., Alene, A., Haile, M. G., Feleke, S., Olanrewaju, A. and Manyong, V. 2017. Impacts of extension access and cooperative membership on technology adoption and household welfare. J. Rural Stud, 54: 223-233.