Received : 16.02.2023 | Accepted : 22.03.2023 | Online published : 01.04.2023
https://doi.org/10.54986/irjee/2023/apr_jun/120-124
IRJEE SOCIETY OF EXTENSION EDUCATION

RESEARCH ARTICLE

Constraints Faced by the Farmers in the Adoption of Crop Rotation in Ayodhya District

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ABSTRACT

Crop rotation is an agronomic practice of growing a series of different types of crops in the same area in a sequential season. Crop rotation is one of the most important practises in organic farming and carbon sequestration. It improves the soil's physical and chemical properties and also changes the biological environment of the soil. Farmers face obstacles to adopt diverse crop rotation systems. Farmers face numerous barriers when it comes to adopt new or unfamiliar practises such as modified crop rotations. These include market and financial barriers, constraints regarding crop insurance and loans, technical and informational barriers and so on. Major constraints faced by the farmers in knowledge and adoption of crop rotation were 'Estray animal', 'Lack of resources', 'Small land holding', 'Difficult to maintain multiple activity of crop rotation' etc. Here, ranking technique is used to determine the most important factor influencing the response. Main aim of this paper is to identify the barriers in the adoption of crop rotation as well as potential solutions.

Key words**:** *Constraints; Adoption; Crop rotation; Garret ranking.*

Crop rotation is an essential agricultural method that has been used for thousands of years and is commonly used in organic farming. On a certain plot of land, the repeated cultivation of crops or crop and fallow land in a certain sequence is called crop rotation e.g. Rice-Wheat-Moong, Rice-Mustard-Chilli etc. It aids in the reduction of soil erosion as well as the improvement of soil fertility and agricultural productivity. The primary benefit to crop rotation is the breaking of crop pest cycles. It also helps in control of several diseases related to crops in a particular area. When making nitrogen management decisions, it's critical to understand the relationship between nitrogen (N) and crop rotation. There are several benefits for using crop rotation, including improved nutrient cycling, soil tilth and soil physical properties, and enhanced weed control. Crop rotation can also affect the rate of nitrogen mineralization, the conversion of organic nitrogen to mineral nitrogen, through changing soil moisture, temperature, plant residue, and tillage operations. The crop rotation that is practiced by the majority of farmers in an area or locality is termed the "cropping pattern" of that particular area. Socio-economic and technological constraints widely affect the farmer's decision to adopt different crops. According to *Barker (2002),* the major constraints to agricultural production and the influence of these constraints on the sustainability of agricultural diversification were marketing, labour and pests and diseases. The unavailability of extension services, the poor purchasing capacity of farmers, the high risk of crop rotation due to climatic conditions, and the inherent reluctance to accept new innovations, and the unavailability of high yielding varieties were also identified as major constraints in the adoption of crop rotation. *Haneveld and Stegeman (2005)* said that using information about what crop sequences were not allowed on the same piece of land, they determined suitable crop rotations over multiple years, and predetermined crop sequences that are not admissible from an expert point of view were used as constraints. This research article is an attempt to identify the constraints and display them in accordance with the goals and concerns that have been

assigned to it. As such, Garrett's Ranking Technique is used to identify constraints facing by the farmers in the adoption of crop rotation in the Ayodhya district of Uttar Pradesh.

METHODOLOGY

The present study was conducted at the Acharya Narendra Deva University of Agriculture and Technology in the district of Ayodhya, Uttar Pradesh. Out of 11 community development blocks in Ayodhya district, the Milkipur block was purposefully selected for this study because of its convenient accessibility. For selecting the villages, a list of all the villages from this block was prepared, and ten villages were selected randomly. The villages selected for the study were Balarmau, Chirauli, Dobhiyara, Joriyam, Kinhupur, Masedha, Narinda Bhada, Rampur Fakirey, Sarurpur, and Taradih Urf Tarauli . Finally ,a list of farmers according to their farm size was prepared, and categorized as small+marginal, medium, and large. The proportionate random sampling technique was used to select 120 farmers. A semi-structured interview schedule was used to collect primary data from the farmers. In this study, information was collected from the farmers who faced crop rotation constraints and were asked to list the difficulties they confront according to their own experiences. Garrett's Ranking Technique was used to convert preferences, changes in constraint ordering, and benefits into numerical scores.

The Garret ranks had been calculated through the usage of suitable Garret Ranking formula. The garret value was calculated through Garret Ranking Table.

$$\text{Percent position} = \frac{100(\text{Rij} - 0.5)}{\text{Nj}}$$

RESULTS AND DISCUSSION

Socio-personal status of the farmers : Table 1 shows information related to farmers' socio-economic and personal characteristics. It is clear from the data that majority (64.17 per cent) of the farmers belonged to the age group of 40–60 years, followed by those above 61 years (21.67 per cent) while 14.17 per cent had an age group of 25–39 years. According to the caste parameter, most farmers (approximately 55.00 per cent) are from the backward caste, followed by the general caste (38.33 per cent), while only 06.67 per cent are from the schedule and none are from the schedule tribes. A total of 66.67 per cent of the 120 farmers had a joint type family, while the remaining 33.33 per cent had a nuclear family. Table 1 also shows that 30.00 per cent of farmers had land holdings of less than 1.0 ha, indicating that they were marginal farmers, 25.83 per cent had land holdings of 2.0-4.0 ha and were medium farmers, 24.17 per cent had land holdings of 1.0-2.0 ha and were small farmers, and 20.00 per cent had land holdings of more than 4.0 ha and were large farmers.

Table 1. Socio-personal Status of the farmers

Socio-personal parameter	No.	%
Age		
25-39	17	14.17
40-60	77	64.16
above 61 years	26	21.67
Caste		
General caste	46	38.33
Backward caste	66	55.00
Scheduled caste	8	6.67
Type of family		
Nuclear	40	33.33
Joint	80	66.67
Land holding		
Marginal (below 1.0 ha)	36	30.00
Small (1.0 to 2.0 ha)	29	24.17
Medium (2.0 to 4.0 ha)	31	25.83

Table 2. Over all adoption of farmers

Categories (Score)	No.	%
Low (up to 13)	31	25.83
Medium (14-15)	59	49.17
High (16 and above)	30	25.00
Total	120	100.00
Mean= 15.00, SD = 1.46, Minimum=8, Maximum=18		

Over all adoption of farmers : The information gathered from the farmers was divided into three categories: low (up to 13 score), medium (14-15 score), and high (scores of 16 and above) to gain an overall assessment of the farmers' adoption of crop rotation, as shown in Table 2. According to Table 2, the maximum 49.17 per cent of farmers had a medium level of adoption, followed by 25.83 per cent with a low level and 25.00 per cent with a high level.

Constraints in the adoption of crop rotation : A farmer may face many problems when rotating his or her crops. So, problems were ranked according to their severity. Table 3 showed various problems in the adoption of crop rotation . This data was recorded during the field survey.

Calculation of garret value and ranking : The Garret

Table 3. Constraints in the adoption of crop rotation

Constraints	Rank given by the respondents									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Estray animals feeding on the crop. Agricultural land lying uncultivated due to estray cattle.	23	18	11	8	15	9	17	7	8	4
Lack of resources like developed market, machinery, improved seed etc.	16	17	15	17	10	15	12	4	8	6
Lack of Irrigation create problem to rotate crop especially in summer season.	12	8	9	11	19	15	11	12	12	11
Small land holding creates problems to grow number of crops.	14	12	12	9	11	13	10	10	18	11
There is difficult to maintain multiple activities of crop rotation.	12	12	8	11	10	13	16	13	17	8
Shortage of labour pushes up crop production cost and increases the dependency on machinery.	11	14	17	19	9	12	11	13	8	6
Use of traditional system of farming is a major problem to adopt crop rotation.	8	13	12	15	16	10	16	7	19	4
Lack of timely technical advice on crop management practices.	11	8	9	13	11	8	8	31	15	6
Less interest showed by youth of family in farming.	6	13	13	8	11	14	11	7	6	31
Ownership of agricultural land effect what produce and where produce.	7	5	14	9	8	11	8	16	9	33

tables and scores of each problem in Table 3 were multiplied by the Garret value to record scores for each rank and constraint in Table 5, and finally, by adding each row, the total Garret score was obtained. Total Garret scores were divided by the number of respondents, i.e., 120, to calculate the average. Finally, ranking was given based on the average value. The Garret value calculation and ranking of problems encountered by farmers when adopting crop rotations are shown below:

It was observed from Table 5 that based on Garret's Ranking Technique, "estray animals' pose the main challenge to adopting crop rotation as perceived by the farmers in the study area. Estray animals feed on the crop; therefore, agricultural land lies uncultivated due to estray cattle. This constraint had a maximum Garrett score of 6800 and ranked first (average 56.66) among other problems. This was followed by the constraint "lack of resources," which ranked second with a Garrett score of 6673 and an average of 55.60. It was agreement with the result of *Singh et al. (2007[b],* who reported that lack of resources, such as non-availability of quality seed material, affected the pulse crop in crop rotation. It is difficult to produce more crops due to a lack of resources such as developed markets, machinery, improved seed, and so on. The findings supported *Dwivedi et al. (2006),* who reported that a lack of market information was a constraint for farmers. The "shortage of labour' was the third most problem in the adoption of crop rotation, with a Garret score of 6390 and an average of 53.25**.** Similar results were also reported by *Kandpal (2022),* who noted that the shortage of labour was one of the constraints faced by mushroom cultivators. The outcomes of the study were in line with *Kumar et al. (2005),* who reported that a high rate of labour wages, a lack of timely guidance by agricultural agencies, and the non-availability of assured irrigation were the major constraints to the adoption of quality seed. The result was also consistent with the findings of *Jasna et al. (2016)* for constraints in the adoption of Climate Resilient Technologies in rain fed agro-ecosystems. It was also in line with *Sahu et al. (2019)* as shortage of labour pushes up crop production costs. Accordingly, "use of traditional systems of farming," with Garrett scores of 6077 and an average of 50.64, represented the fourth rank. The use of traditional systems of farming was a major problem in adopting crop rotation. The 'Small land holdings" had Garret scores of 5990 and

Table 4. Percent positions and Garret Values

100(Rij-0.5)/ Nj	Calculated Value	Garret Value
100(1-0.5)/10	5	82
100(2-0.5)/10	15	70
100(3-0.5)/10	25	63
100(4-0.5)/10	35	58
100(5-0.5)/10	45	52
100(6-0.5)/10	55	48
100(7-0.5)/10	65	42
100(8-0.5)/10	75	37
100(9-0.5)/10	85	30
100(10-0.5)/10	95	18

Table 5. The Garret value calculation and ranking of problems encountered by farmers when adopting crop rotations

Constraints in the adoption of crop rotation	Rank given by the respondents										Total	Ave.	Rank
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th			
Estray animals feeding on the crop. Agricultural land lying uncultivated due to estray cattle.	1886	1260	693	464	780	432	714	259	240	72	6800	56.66	I
Lack of resources like developed market, machinery, improved seed etc.	1312	1190	945	986	520	720	504	148	240	108	6673	55.60	II
Lack of Irrigation create problem to rotate crop especially in summer season.	984	560	567	638	988	720	462	444	360	198	5921	49.34	VI
Small land holding creates problems to grow number of crops.	1148	840	756	522	572	624	420	370	540	198	5990	49.91	V
There is difficult to maintain multiple activities of crop rotation.	984	840	504	638	520	624	672	481	510	144	5917	49.30	VII
Shortage of labour pushes up crop production cost and increases the dependency on machinery.	902	980	1071	1102	468	576	462	481	240	108	6390	53.25	III
Use of traditional system of farming is a major problem to adopt crop rotation.	656	910	756	870	832	480	672	259	570	72	6077	50.64	IV
Lack of timely technical advice on crop management practices.	902	560	567	754	572	384	336	1147	450	108	5780	48.16	VIII
Less interest showed by youth of family in farming.	492	910	819	464	572	672	462	259	180	558	5388	44.90	IX
Ownership of agricultural land effect what produce and where produce.	574	350	882	522	416	528	336	592	270	594	5064	42.20	X

an average of 49.91 represented the fifth rank. Small land holdings was also reported as major constraints by *Singh et al. (2007)*[a] and *Meena et al. (2009)*. Similar findings were also reported by *Chaturvedani et al. (2018)* for constraints in utilization and accessibility of extension service delivery perceived by KVK beneficiary farmers in Chhattisgarh. The calculation with Garrett scores of 5921 and an average of 49.34 ranked sixth i.e. "lack of irrigation facility". Lack of Irrigation creates problem in the crop production as well as to rotate crop especially in summer season. 'Maintain multiple activities' had a Garrett score of 5917 and an average score of 49.30, placed in seventh rank. It was observed by the farmers in the study area that , it was difficult to maintain many of the crop rotation activities. 'Lack of timely technical advice' had a Garrett score of 5780 and an average of 48.16 and representing the eighth rank. This finding is supported *Onima et al. (2016),* who reported that lack of timely technical advice on crop management practises affects crop rotation in mixed farming. The study's findings were also consistent with those of *Jangid et al. (2012)* and *Vishwakarma et al. (2020),* as they reported that lack of technical information was the most important technological constraint faced by both men and women farmers. Accordingly, "less interest showed by youth' represented the ninth rank with Garrett's score of 5388 and an average of 44.90. Since agriculture has a family approach, showing less interest in farming by the youth of the family affects crop production and crop rotation. "Ownership of agricultural land" ranked tenth, with a Garrett score of 5064 and an average score of 42.20. Ownership of agricultural land affects what and where it produces.

CONCLUSION

It has been observed from the findings that, caste has an impact in the adoption of crop rotation. Further, the crop choice is still influenced by the fact that upper castes own more land. Estray cattle have found the biggest problem in crop rotation from last few years. So, Government should ensure about proper facility for those estray animal. Small and poor land holdings also create problems for the number and choice of crops. Ownership of agricultural land has least affected by the rotation of crops. It determines the choice of what to produce and where to produce. Initially, the farmers had given their preferential

ordering of the unranked frequency constraints. The ranking orders indicate the primary concerns of the farmers in adopting crop rotation. Adoption of crop rotation is very important to ensure sustainable agriculture as well as family requirements regarding cereals, pulses, millets, etc. These constraints were faced by both men and women farmers, irrespective of their gender.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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