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Indra Jeet
ICAR-RCER, KVK, Ramgarh,
Jharkhand, India

Sudhanshu Shekhar
ICAR-RCER, KVK, Ramgarh,
Jharkhand, India

Dharamjit Kherwar
ICAR-RCER, KVK, Ramgarh,
Jharkhand, India

Pradeep Kumar Prajapati
Dr. Rammanohar Lohiya Avadh
University, Ayodhya, Uttar
Pradesh, India

Corresponding Author:
Indra Jeet
ICAR-RCER, KVK, Ramgarh,
Jharkhand, India

Adoption of niger production technologies: Behavioral patterns and constraints

Indra Jeet, Sudhanshu Shekhar, Dharamjit Kherwar and Pradeep Kumar Prajapati

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Abstract

Niger (*Guizotia abyssinica*) is an important minor oilseed crop cultivated predominantly under rainfed conditions in tribal and resource-poor regions of India. Despite its adaptability to marginal soils and low input requirements, the productivity of niger remains far below its potential due to low adoption of improved production technologies. The present study was undertaken to assess the adoption behaviour of farmers and to identify the major constraints influencing the adoption of recommended niger production technologies demonstrated through Front Line Demonstrations (FLDs). The investigation was conducted during 2023-24 to 2024-25 in selected villages of Ramgarh district, Jharkhand. A total of 120 beneficiary farmers were selected using random sampling, and primary data were collected through a pre-tested structured interview schedule. Adoption levels were measured using a scoring technique and categorized into low, medium, and high adoption based on mean and standard deviation. The results revealed that a majority of the respondents (54.16%) belonged to the low adoption category, followed by medium (35.00%) and high (10.84%) adoption categories. Higher adoption was observed for simple and low-cost practices such as timely harvesting, use of high-yielding varieties, and recommended seed rate, whereas adoption of input- and knowledge-intensive practices like seed treatment, biofertilizer application, line sowing, and plant protection measures remained low. The major constraints perceived by farmers were non-availability of quality seeds, high cost of fertilizers and diesel, weed infestation (*Cuscuta* spp.), and inadequate market facilities. The study concludes that strengthening extension support, improving input availability, and addressing market and resource-related constraints are essential for enhancing the adoption of improved niger production technologies and bridging the existing yield gaps.

Keywords: Niger, adoption behaviour, front line demonstrations, constraints, oilseed crops, Jharkhand

Introduction

Niger (*Guizotia abyssinica*) is an important minor oilseed crop of India, predominantly cultivated under rainfed conditions in tribal, hilly, and resource-poor regions. The crop is valued for its adaptability to marginal and degraded soils, tolerance to moisture stress, and low input requirements, which make it particularly suitable for small and marginal farmers practicing subsistence agriculture. Niger seeds contain a high proportion of edible oil (35-45%) with a desirable fatty acid profile, especially rich in linoleic acid, thereby contributing to household nutritional security and local edible oil availability (ICAR, 2018)^[4].

In India, niger is mainly grown in states such as Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, Maharashtra, and parts of the North-Eastern region, where it forms an integral component of traditional farming systems. The crop is often cultivated as a sole crop or as a mixed/intercrop under rainfed conditions during the kharif season. Besides its economic importance, niger plays a significant role in supporting the livelihoods of tribal and resource-poor farmers by providing food, oil, fodder, and supplementary income under low-risk production environments (DAC&FW, 2021)^[3].

Despite its importance and wide adaptability, the productivity of niger in India remains substantially lower than its potential yield. The national average yield is far below that achieved under experimental and demonstration conditions. This persistent yield gap can be attributed to several factors, including the continued use of local and low-yielding varieties, poor seed replacement rates, imbalanced nutrient management, inadequate weed and pest control, and

limited awareness and access to improved production technologies among farmers (Yadav *et al.*, 2019; ICAR, 2020)^[11, 5]. Moreover, extension support for minor oilseed crops like niger has traditionally received less emphasis compared to major oilseed crops, further constraining technology dissemination and adoption. In order to address these constraints and enhance the productivity of niger, the Indian Council of Agricultural Research (ICAR) has promoted Front Line Demonstrations (FLDs) through Krishi Vigyan Kendras (KVKs) across different agro-ecological regions. FLDs serve as an effective extension tool to demonstrate the production potential of improved varieties and recommended agronomic practices under farmers' field conditions, thereby facilitating technology transfer and building farmers' confidence in scientific crop management practices (Samui *et al.*, 2000; Sagar & Chandra, 2020)^[9, 8]. In this backdrop, it becomes essential to assess the effectiveness of FLDs in improving farmers' knowledge and adoption of recommended niger production technologies. Understanding the adoption behaviour of farmers and identifying the constraints perceived by them in adopting improved practices are crucial for refining extension strategies and formulating location-specific interventions. Therefore, the present study was undertaken to evaluate the impact of demonstrated niger production technologies on farmers' adoption behaviour and to analyze the major constraints limiting the adoption of improved niger cultivation practices.

Materials and Methods

The present investigation was conducted during the agricultural years 2023-24 to 2024-25 in ten selected villages, namely Hesapoda, Lodhma, Bicha, Kodi, Korembey, Lem, Jobla, Udлу, Govindpur, and Sondeeha, of Ramgarh district, Jharkhand, where Front Line Demonstrations (FLDs) on niger (*Guizotia abyssinica*) production technologies were implemented. The study area was selected purposively owing to the predominance of niger cultivation and the active participation of farmers in FLD programmes conducted by Krishi Vigyan Kendra (KVK), Ramgarh. A total of 120 farmers, who had directly participated in or were beneficiaries of the demonstrated niger production technologies, were selected for the study using a random sampling technique. Primary data were collected through a pre-tested structured interview schedule designed to elicit information on socio-economic characteristics, awareness, extent of adoption of recommended niger production practices, and constraints perceived by the respondents. Data were collected through personal interviews to ensure clarity, reliability, and completeness of responses.

The extent of adoption of niger production technologies was measured by assigning scores to each recommended practice based on the level of adoption by the respondents. An adoption score for each respondent was obtained by summing the scores across all practices. The data thus collected were analyzed using frequency and percentage analysis to describe the adoption pattern of the respondents. To categorize the respondents according to their level of adoption, the mean and standard deviation (S.D.) of the adoption scores were computed. Based on these statistical parameters, respondents were classified into low, medium, and high adoption categories, following standard procedures commonly used in agricultural extension research.

Formulae Used

Mean ($\bar{X}$)

$$\bar{X} = \frac{\sum X}{N}$$

Standard Deviation (S.D.)

$$S.D. = \sqrt{\frac{\sum (X - \bar{X})^2}{N}}$$

Categorization of Adoption Levels

- Low adoption: Below (Mean - S.D.)
- Medium adoption: Between (Mean ± S.D.)
- High adoption: Above (Mean + S.D.)

Where:
 $\bar{X}$ = Mean adoption score
X = Individual adoption score
N = Number of respondents

Results and Discussion

Adoption Behaviour: The farmers who participated in the niger (*Guizotia abyssinica*) Front Line Demonstrations were interviewed to assess the extent of adoption of the demonstrated package of practices. Information was collected on the adoption of recommended niger production technologies, including varietal selection, seed treatment, sowing methods, nutrient management, weed management, plant protection measures, and harvesting practices. Based on the adoption scores obtained, the respondents were categorized into different levels of adoption. The distribution of farmers according to their low, medium, and high levels of adoption provides an insight into the effectiveness of the demonstrated technologies and the degree to which farmers have incorporated the recommended practices into their existing farming systems. Level of adoption is reported in Table 1.

Table 1: Extent of Adoption of Niger Production Technologies

S. No.	Niger production technology	Full Adoption	Partial Adoption	No Adoption
1.	High yielding varieties (HYVs)	83 (69.17)	29 (24.17)	08 (6.67)
2.	Seed treatment	12 (10.00)	15 (12.50)	93 (77.50)
3.	HYVs according to sowing time	44 (36.67)	12 (10.00)	04 (3.33)
4.	Recommended seed rate	76 (63.33)	20 (16.67)	24 (20.00)
5.	Line sowing method	12 (10.00)	25 (20.83)	83 (69.17)
6.	Bio fertilizer use (Azotobacter + PSB)	06 (5.00)	21 (17.50)	93 (77.50)
7.	Recommended fertilizer doses	08 (6.67)	46 (38.33)	66 (55.00)
8.	Time of irrigation	15 (12.50)	38 (31.67)	67 (55.83)
9.	Proper and effective weed control	14 (11.67)	18 (15.00)	26 (21.67)
10.	Plant protection measures	24 (20.00)	36 (30.00)	60 (50.00)
11.	Harvesting at proper time	90 (75.00)	30 (25.00)	00 (0.00)

Figures in parentheses indicate percentages.

It is evident from Table 1 that the extent of adoption of recommended niger production technologies varied considerably among the respondents. A majority of the farmers had fully adopted harvesting at the proper time (75.00%), followed by the use of high yielding varieties (69.17%) and adherence to the recommended seed rate (63.33%). Moderate levels of full adoption were observed for HYVs according to sowing time (36.67%), indicating partial awareness of varietal suitability and crop calendar among the respondents.

In contrast, the adoption of several key input- and knowledge-intensive practices was found to be low. A large proportion of respondents had not adopted the use of biofertilizers (Azotobacter + PSB) (77.50%) and seed treatment (77.50%), followed by the line sowing method (69.17%). More than half of

the respondents had not adopted recommended fertilizer doses (55.00%) and proper timing of irrigation (55.83%). Similarly, non-adoption levels were also high for plant protection measures (50.00%), suggesting limited awareness or access to plant protection inputs.

Overall, the findings reveal that farmers readily adopted simple, low-cost, and traditional practices, such as timely harvesting and use of improved varieties, whereas the adoption of input-intensive and technically demanding practices remained comparatively poor. This highlights the need for targeted extension interventions, capacity-building programmes, and improved input availability to enhance the adoption of improved niger production technologies and to bridge the existing yield gaps.

Table 2: Distribution of Niger Farmers According to Extent of Adoption

S. No.	Categories	Score Range (Conceptual)	Calculated Score Range	No. of Respondents	Percentage
1.	Low adoption	< (Mean - S.D.)	< (7.71 - 1.97) = < 5.74	65	54.16
2.	Medium adoption	(Mean $\pm$ S.D.)	5.74 - 9.68	42	35.00
3.	High adoption	> (Mean + S.D.)	> (7.71 + 1.97) = > 9.68	13	10.84
	Total			120	100.00

Based on the adoption data of Niger production technologies (Full = 2, Partial = 1, No = 0 scoring) Mean = 7.71 and S.D. = 1.97

Overall adoption level:

Table 2 reveals that 54.16 per cent of the respondents exhibited a low level of adoption of Niger production technology, followed by 35.00 per cent with a medium level and 10.84 per cent with a high level of adoption. These findings are in conformity with the results reported by Akhilesh Kumar and Srivastava (2007)^[1].

Table 3: presents the distribution of respondents according to the perceived constraints in Niger cultivation (N = 120).

Perceived constraints in Niger	No.	%	Rank
1. Technical constraints			
Non-availability of quality seeds	81	67.50	I
High weed infestation (<i>Cuscuta</i> spp.)	66	55.00	V
2. Resource constraints			
High cost of fertilizers	73	60.83	III
High cost of diesel	69	57.50	IV
Inadequate availability of electricity	51	42.50	VII
Non-availability of zero-tillage	47	39.17	VIII
3. Market constraints			
Lack of market facilities	68	56.67	VI

Table 3 depicts the distribution of respondents according to the perceived constraints in Niger cultivation. The findings reveal that technical constraints were the most dominant barriers affecting the adoption of recommended Niger production practices. Among these, non-availability of quality seeds was reported by 67.50 per cent of the respondents and ranked first, indicating it as the most severe constraint. This underscores the importance of timely availability of certified and improved seed material, which plays a pivotal role in enhancing adoption and productivity of oilseed crops. Similar observations were reported by Akhilesh Kumar and Srivastava (2007)^[1] and Singh *et al.* (2015)^[10], who emphasized that inadequate access to quality seed is a major bottleneck in the adoption of improved agricultural technologies.

Another important technical constraint perceived by the respondents was high weed infestation, particularly *Cuscuta* spp., reported by 55.00 per cent of farmers and ranked fifth. The parasitic nature of *Cuscuta* significantly reduces crop vigour and yield, and the lack of effective and economical weed control

measures further aggravates the problem. This finding is in conformity with the studies of Meena *et al.* (2014)^[6], who highlighted weed infestation as a serious constraint in oilseed cultivation. Among resource constraints, high cost of fertilizers (60.83%) and high cost of diesel (57.50%) emerged as major issues, ranking third and fourth, respectively. These input-related constraints increase the cost of cultivation and adversely affect farmers' willingness to adopt improved practices. Similar findings were documented by Rathod *et al.* (2013)^[7], who reported that rising input costs act as a deterrent to technology adoption among small and marginal farmers. With regard to market constraints, lack of market facilities was perceived by 56.67 per cent of the respondents and ranked sixth, indicating inadequate market access and infrastructure for Niger produce. Poor marketing facilities often result in low price realization, discouraging farmers from expanding the area under oilseed crops. This observation corroborates the findings of Chand and Raju (2009)^[2], who emphasized the role of efficient market support in promoting oilseed cultivation.

Conclusion

The present study clearly demonstrates that although Niger (*Guizotia abyssinica*) possesses considerable potential as a climate-resilient and low-input oilseed crop for rainfed and tribal regions, the adoption of recommended production technologies among farmers remains inadequate. The findings revealed that more than half of the respondents belonged to the low adoption category, indicating that the benefits of Front Line Demonstrations (FLDs) have not yet translated into widespread and comprehensive adoption of improved practices. Farmers showed a higher preference for simple, low-cost, and traditional practices such as timely harvesting, use of high-yielding varieties, and recommended seed rate, while the adoption of input- and knowledge-intensive technologies like seed treatment, biofertilizer application, line sowing, balanced fertilization, and plant protection measures remained poor.

The study further identified critical constraints limiting technology adoption, notably the non-availability of quality seed, high cost of fertilizers and diesel, severe weed infestation (*Cuscuta* spp.), and inadequate market facilities. These constraints not only increase the cost of cultivation but also

reduce farmers' motivation and capacity to adopt improved practices, thereby widening the existing yield gaps in niger cultivation.

Overall, the results suggest that FLDs alone may not be sufficient unless complemented by strong follow-up extension support, timely input supply, and market linkages. Strengthening seed production and distribution systems, promoting cost-effective weed and nutrient management practices, enhancing farmers' skills through need-based training, and improving market infrastructure and price support mechanisms are essential for improving adoption levels. Addressing these technical, resource, and market-related constraints in an integrated manner will be crucial for enhancing the productivity and sustainability of niger cultivation and for improving the livelihoods of small and marginal farmers in rainfed regions of Jharkhand and similar agro-ecological settings.

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