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A Field-Based Empirical Study Adoption of Modern Agricultural Technologies by Farmers in Budha Khera Village, Julana Block, Jind District, Haryana, India

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ABSTRACT

Agriculture in Budha Khera Lather village, located in the Julana block of Jind district, Haryana, has undergone a marked transformation over recent decades, shifting from labour- and bullock-dependent cultivation toward mechanised, input-intensive farming. This study examines the extent to which farmers in the village have adopted modern agricultural technologies, including machinery, high-yielding variety (HYV) seeds, irrigation systems, chemical fertilisers and pesticides, digital tools, and government support schemes. Primary data were collected from 100 farming households through a structured questionnaire survey conducted in April 2026 and analysed using frequency and percentage distributions. The findings show high adoption of tractors (45%), HYV seeds (90%), tube-well irrigation (71%), and combined fertiliser-pesticide use (60%), alongside more modest adoption of digital applications and eco-friendly machinery such as super seeders and straw reapers. Awareness of government schemes such as PM-KISAN (83%) and the Kisan Credit Card (74%) was relatively high, though awareness of other schemes remained limited. Economic condition, education, landholding size, and access to credit emerged as the principal factors shaping adoption, while cost, awareness, and technical knowledge were the main barriers. The study recommends targeted financial support, extension services, and digital literacy initiatives to promote more balanced technology adoption across the farming community.

Keywords: Agricultural mechanisation, High-yielding varieties, Irrigation technology, Digital adoption, Government schemes

INTRODUCTION

Agriculture forms the backbone of rural livelihoods across Haryana, and Budha Khera Lather village, situated in the Julana block of Jind district, is no exception. Cultivation in the village was traditionally dependent on manual labour, animal power particularly bullocks and the timing and adequacy of monsoon rainfall. Census of India (2011). The Census highlighted population distribution, rural–urban composition, occupational structure, and demographic characteristics, providing a statistical basis for regional geographical analysis. Over the past few decades, however, advances in farm technology have substantially altered these practices. The ICAR (2018) Annual Report highlighted the role of agricultural research, technological innovations, improved crop varieties, and modern farming practices in enhancing agricultural productivity and promoting sustainable agricultural development in India. Haque examined the role of irrigation infrastructure in promoting agricultural development in India, highlighting its importance in improving agricultural productivity and cropping intensity. His studies emphasized that the expansion and efficient management of irrigation facilities are essential for increasing farm output, ensuring agricultural sustainability, and reducing regional disparities in agricultural development.

Chand (2017) emphasized strategies for doubling farmers' income through agricultural diversification, improved productivity, technological advancement, efficient resource management, and better market access in India. Tractors, combine harvesters, high-yielding variety (HYV) seeds, chemical fertilisers and pesticides, and improved irrigation methods have progressively replaced traditional tools and techniques, enabling farmers to raise productivity while reducing their dependence on manual and animal labour. The Government of Haryana, through the Statistical Abstract (various years), provided valuable statistical information on agriculture, irrigation, cropping patterns,

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and agricultural productivity, helping to understand regional variations and trends in agricultural development across Haryana. Despite this broad shift, the pace and extent of technology adoption are far from uniform. Variations in landholding size, income, education, and awareness mean that some farmers have modernised their operations considerably more than others. Rajan (2015) Rajan examined rural transformation, agricultural modernisation, and labour mobility in India, highlighting the changing relationship between agriculture, employment, and rural livelihoods. Sainath (2013) Sainath highlighted the agrarian crisis in India, focusing on farmers' distress, rural inequalities, declining livelihood security, and the socio-economic challenges faced by farming communities.

Understanding these patterns of adoption, and the factors that drive or constrain them, is essential for designing effective agricultural extension and policy interventions. Office of the Registrar General and Census Commissioner, India (2011). The District Census Handbook of Jind provided essential demographic, occupational, settlement, and socio-economic data for understanding the district's rural and agricultural characteristics.

Profile of the Study Area

Budha Khera Lather is a village located in the Julana block of Jind district, Haryana. As with much of the surrounding region, the village economy is predominantly agrarian, with wheat and paddy as the principal crops. Landholding patterns in the area range from small and marginal farms to larger holdings, creating varied capacities among farmers to invest in mechanisation, irrigation infrastructure, and other modern agricultural inputs.

Objectives of the Study

- To examine the extent of adoption of agricultural machinery among farmers of Budha Khera Lather village.
- To assess the level of adoption of high-yielding variety (HYV) seeds.
- To study the irrigation technologies used by farmers and their continued reliance on rainfall.
- To evaluate the adoption of digital technologies for accessing farming-related information.
- To identify the key factors influencing, and constraints limiting, the adoption of modern agricultural technologies.

METHODOLOGY

This study adopts a descriptive, survey-based research design to examine the adoption of modern agricultural technologies among farmers in Budha Khera Lather village.

Primary data for this study were collected through a structured questionnaire survey of 100 farming households in Budha Khera Lather village, Julana block, Jind district, Haryana, conducted in April 2026. The questionnaire captured information on the use of agricultural machinery, HYV seeds, irrigation methods, chemical inputs, and digital technologies; farmers' awareness of government schemes; and their own assessment of the factors and constraints affecting adoption. The data collected were analysed using simple frequency and percentage distributions and are presented in tabular and graphical form in the sections that follow.

RESULTS AND DISCUSSION

Adoption of Agricultural Machinery

Mechanisation is one of the most visible changes in farming practice in Budha Khera Lather village. Table 1 and Fig. 1 present the extent to which farmers have adopted different categories of agricultural machinery.

As shown in Table 1, tractors are the most widely adopted form of machinery, used by 45 per cent of the surveyed farmers, reflecting their versatility across ploughing, tilling, and transport tasks. Super seeders (25%) and combine harvesters (20%) show moderate adoption, while straw reapers, associated with more sustainable residue management, remain the least adopted at 10 per cent. Larger farmers are more likely to own machinery

Table 1 : Adoption of Agricultural Machinery

Machinery	No. of Farmers	Percentage (%)
Tractor	45	45
Super Seeder	25	25
Combine Harvester	20	20
Straw Reaper	10	10
Total	100	100

Source: Field Survey, April 2026.

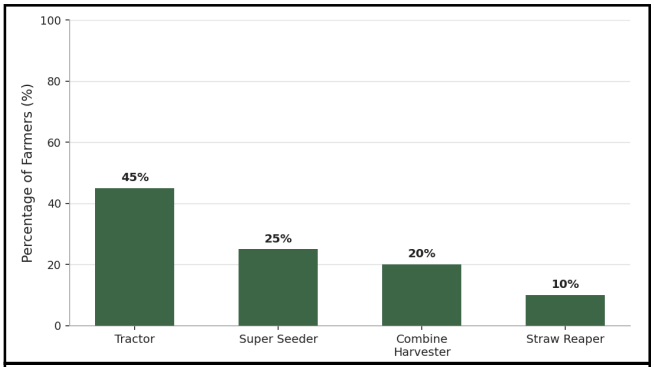


Fig. 1 : Adoption of Agricultural Machinery

outright, whereas smaller and marginal farmers tend to rely on rental arrangements, which, despite certain access constraints, allow them to benefit from mechanised operations without the burden of full ownership costs. The comparatively low uptake of super seeders and straw reapers suggests that while mechanisation for core tasks is well established, the shift toward more environmentally sustainable equipment is still at an early stage.

Use of High-Yielding Variety (HYV) Seeds

Seed quality is a critical determinant of crop yield and disease resistance. Table 2 and Fig. 2 show the proportion of farmers using HYV or certified seeds in place of traditional varieties.

An overwhelming majority of farmers (90%) in Budha Khera Lather have adopted HYV or certified seeds in place of traditional varieties, drawn by their higher yield potential and improved disease resistance. Only 10 per cent of farmers continue to rely on traditional seed varieties. While HYV adoption has clearly contributed to rising productivity, these seeds typically require more intensive irrigation and chemical input to realise their full yield potential, which correspondingly raises the overall cost of cultivation.

Table 2 : Use of High-Yielding Variety Seeds

Response	No. of Farmers	Percentage (%)
Yes	90	90
No	10	10
Total	100	100

Source: Field Survey, April 2026

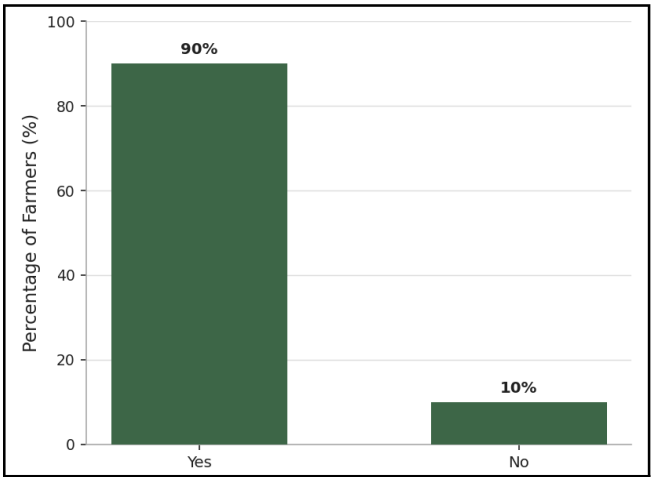


Fig. 2 : Use of High-Yielding Variety Seeds

Irrigation Technology

Reliable irrigation is central to reducing farmers' dependence on rainfall and enabling multiple cropping cycles each year. Table 3 and Fig. 3 summarise the irrigation methods used in the village.

Table 3: Irrigation Technology Used by Farmers

Method	No. of Farmers	Percentage (%)
Tube Well	71	71
Canal	24	24
Rain-fed	5	5
Total	100	100

Source: Field Survey, April 2026.

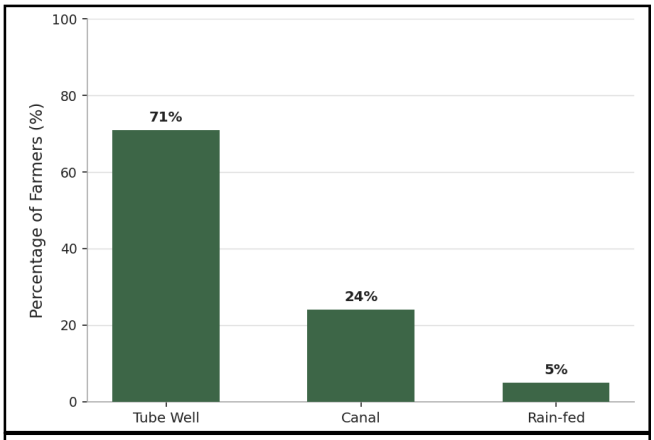


Fig. 3 : Irrigation Technology Used by Farmers

Tube-well irrigation is the dominant method, used by 71 per cent of farmers, followed by canal irrigation (24%), with only 5 per cent of farmers remaining dependent on rainfall alone. This pattern indicates a substantial shift away from monsoon dependence, contributing to more stable and consistent crop production. Water-efficient technologies such as sprinkler and drip irrigation remain uncommon in the village, largely because of their high installation costs; where sprinkler systems have been adopted, this has generally been among farmers with greater awareness of the technology and the financial means to invest in it.

Use of Chemical Fertilisers and Pesticides

Chemical inputs remain a mainstay of soil enhancement and crop protection in the village. Table 4 and Fig. 4 present patterns of fertiliser and pesticide use among the surveyed farmers.

Sixty per cent of farmers use both chemical fertilisers and pesticides in combination, while smaller shares rely on fertilisers alone (22%) or pesticides alone (18%). Inputs such as urea, di-ammonium phosphate (DAP), and potash are used regularly to enhance soil fertility and boost yields, alongside a range of pesticides and insecticides for crop protection. While these inputs have clearly supported productivity gains, their sustained and heavy use has raised concerns among some residents regarding long-term soil health and environmental safety. Organic farming remains

Table 4 : Use of Chemical Fertilisers and Pesticides

Method	No. of Farmers	Percentage (%)
Use Both Fertilisers and Pesticides	60	60
Use Only Fertilisers	22	22
Use Only Pesticides	18	18
Total	100	100

Source: Field Survey, April 2026.

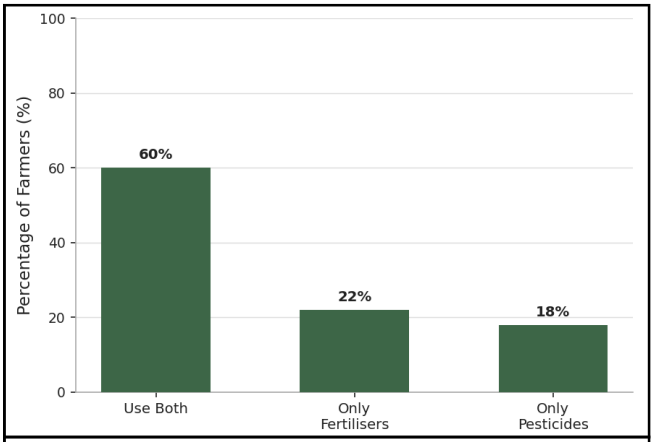


Fig. 4 : Use of Chemical Fertilisers and Pesticides

uncommon in the village, indicating that awareness of the risks of chemical overuse has not yet translated into a widespread shift toward alternative practices.

Adoption of Digital Technology

The spread of mobile connectivity and information technology has begun to influence farming practices in Budha Khera Lather. Table 5 and Fig. 5 present the extent of digital technology use among farmers; as respondents could report using more than one type of technology, percentages do not sum to 100.

Mobile phones are the most widely used digital tool, employed by 86 per cent of farmers primarily for calls and SMS-based communication. WhatsApp (58%) and

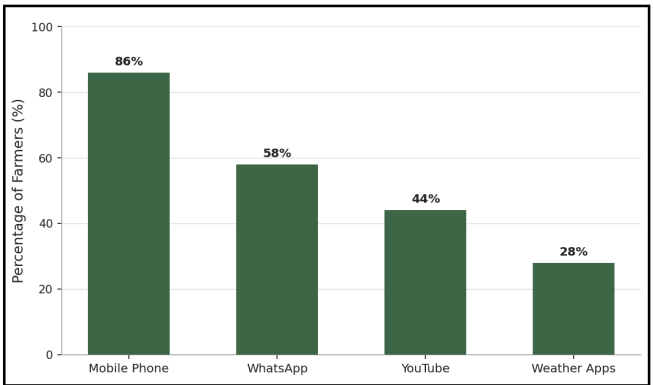


Fig. 5 : Adoption of Digital Technology

Table 5 : Adoption of Digital Technology

Digital Technology	No. of Farmers	Percentage (%)
Mobile Phone (Call/SMS)	86	86
WhatsApp	58	58
YouTube (Farming Videos)	44	44
Weather Apps	28	28

Source: Field Survey, April 2026

YouTube farming videos (44%) are also fairly popular, particularly among younger farmers seeking updated information on farming techniques. Weather applications show comparatively low adoption at 28 per cent. Farmers aged 40 and above are notably less likely to use advanced digital applications and smart-farming tools than their younger counterparts, suggesting that digital adoption in the village is strongly generation-dependent. Overall, digital engagement remains concentrated in basic communication and information-sharing rather than more advanced applications such as e-marketing or precision farming.

Awareness of Government Support and Schemes

Government schemes play an important role in encouraging the adoption of modern agricultural technologies. Table 6 and Fig. 6 present farmers' awareness of key government support programmes; as respondents could report awareness of more than one scheme, percentages do not sum to 100.

Awareness is highest for PM-KISAN (83%) and the

Table 6 : Awareness of Government Support and Schemes

Scheme	No. of Farmers	Percentage (%)
PM-KISAN (Income Support Scheme)	83	83
Kisan Credit Card (KCC)	74	74
Pradhan Mantri Fasal Bima Yojana (PMFBY)	72	72
Soil Health Card Scheme	38	38
e-NAM (National Agriculture Market)	22	22

Source: Field Survey, April 2026.

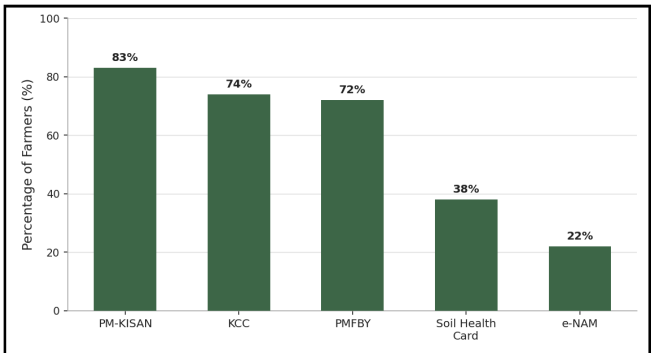


Fig. 6 : Awareness of Government Support and Schemes

Kisan Credit Card scheme (74%), followed by the Pradhan Mantri Fasal Bima Yojana crop insurance scheme (72%). Awareness of the Soil Health Card Scheme (38%) and e-NAM (22%) is considerably lower. These findings suggest that income-support and credit-related schemes have achieved wider outreach than schemes oriented toward soil management or digital marketing, likely reflecting differences in publicity, ease of access, and perceived relevance to farmers' immediate needs. Limited awareness of certain schemes constrains their potential to support broader technology adoption in the village.

Factors Affecting Adoption of Modern Technologies

Several interrelated factors shape the extent to which individual farmers adopt modern agricultural technologies. Table 7 and Fig. 7 present farmers' own assessments of the factors most influential in their adoption decisions; as respondents could cite more than one factor, percentages do not sum to 100.

Economic condition emerges as the most frequently cited factor (76%), followed closely by education and awareness (67%) and access to credit or subsidies (62%). Landholding size (58%) and access to irrigation facilities (56%) are also significant, while government policy and support are cited somewhat less frequently (42%). These results indicate that a farmer's financial capacity and educational background are the primary determinants of technology adoption in the village, with structural factors such as landholding size and irrigation access playing a supporting role.

Table 7 : Factors Affecting Adoption of Modern Technologies

Factor	No. of Farmers	Percentage (%)
Economic Condition	76	76
Education and Awareness	67	67
Availability of Credit/Subsidy	62	62
Size of Landholding	58	58
Access to Irrigation Facilities	56	56
Government Policies and Support	42	42

Source: Field Survey, April 2026.

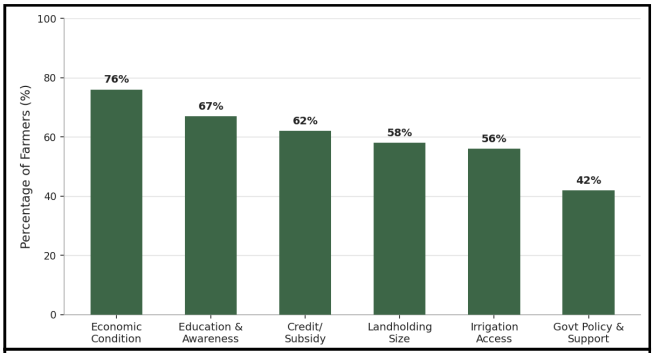


Fig. 7 : Factors Affecting Adoption of Modern Technologies

Problems Faced by Farmers in Adoption

Alongside the factors that facilitate adoption, farmers also face a range of obstacles in implementing modern agricultural technologies. Table 8 and Fig. 8 summarise the principal problems reported; as respondents could cite more than one problem, percentages do not sum to 100.

Table 8 : Problems Faced by Farmers in Adoption

Problem	No. of Farmers	Percentage (%)
High Cost of Technology	82	82
Small Landholding	67	67
Lack of Awareness	64	64
Lack of Technical Knowledge	58	58
Limited Access to Credit	49	49
Risk and Uncertainty	48	48

Source: Field Survey, April 2026.

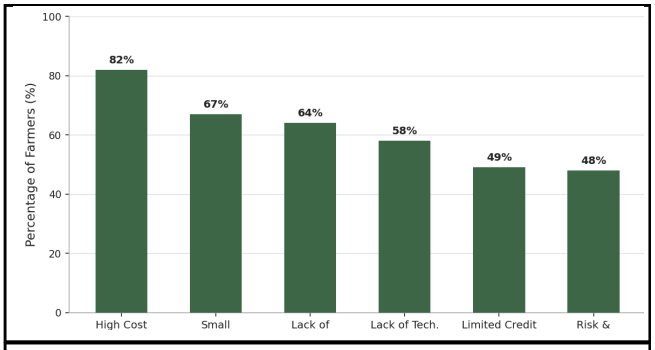


Fig. 8 : Problems Faced by Farmers in Adoption

The high cost of technology is by far the most commonly reported barrier (82%), followed by constraints related to small landholding size (67%) and lack of awareness (64%). Limited technical knowledge (58%), restricted access to credit (49%), and general risk and uncertainty associated with new technologies (48%) further compound these challenges. Taken together, these findings mirror the factors identified as drivers of adoption: farmers with greater financial resources, larger landholdings, and better awareness are best positioned to overcome these barriers, while smaller and less-informed farmers remain comparatively disadvantaged.

Summary of Key Findings

- Tractors are the most widely adopted machinery (45%), while eco-friendly equipment such as straw reapers remains uncommon (10%).
- HYV seed adoption is very high overall (90%),

reflecting a strong shift away from traditional varieties.
- Tube-well irrigation dominates (71%), sharply reducing dependence on rainfall (5%).
- A majority of farmers (60%) use both chemical fertilisers and pesticides together.
- Mobile phones are nearly universal (86%), but advanced digital tools such as weather apps remain less used (28%), with a clear generational gap in adoption.
- Awareness of government schemes is uneven, ranging from 83% for PM-KISAN to just 22% for e-NAM.
- Economic condition and education are the strongest determinants of technology adoption, while high cost and small landholding size are the most significant barriers.

Conclusion

The findings of this study point to a clear, if uneven, transition in agricultural practices in Budha Khera Lather village. Farmers have widely embraced core mechanisation, HYV seeds, and tube-well irrigation, and government income-support and credit schemes have achieved reasonably broad awareness. At the same time, adoption of more specialised or resource-intensive technologies, such as super seeders, straw reapers, drip and sprinkler irrigation, and advanced digital applications, remains comparatively limited, largely on account of cost, awareness, and access constraints. Economic condition, education, and landholding size consistently emerge as the principal factors shaping how far individual farmers are able to modernise their operations. Addressing the barriers identified here, through more accessible credit, wider extension and awareness efforts, and continued investment in irrigation infrastructure, could help extend the benefits of agricultural modernisation more evenly across the farming community of Budha Khera Lather village.

Recommendations

- Expand subsidised access to eco-friendly machinery (super seeders, straw reapers) through custom hiring centres, particularly for small and marginal farmers.
- Strengthen extension and awareness campaigns for underutilised government schemes such as the Soil Health Card Scheme and e-NAM.
- Provide targeted financial support or subsidies for water-efficient irrigation technologies, such as drip and sprinkler systems, to reduce installation-cost barriers.
- Introduce digital literacy programmes aimed at older farmers to close the generational gap in technology use.
- Promote awareness of the environmental and soil-health implications of chemical input overuse, alongside practical support for transitioning toward more balanced input use.
- Improve access to institutional credit for small and marginal farmers to reduce dependence on informal borrowing and support technology investment.

Limitations of the Study

This study is based on a single village and a sample of 100 farming households, and its findings may not be fully generalisable to other villages or regions with different agro-climatic or socio-economic conditions. Data were collected through farmers' self-reported responses to a structured questionnaire, which may be subject to recall or reporting bias. The study also reflects a single point in time (April 2026) and does not capture seasonal or year-to-year variation in technology use.

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