Full Length Research Article

© 2025, Centre for Advanced Research in Agricultural Sciences
Research Journal of Agricultural Sciences
Volume 16; Issue 06 (Nov–Dec 2025); pp 609–612

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

Socio economic Benefits and Perceived Constraints of Agricultural Drone among Farmers in Haryana

Jatesh Kathpalia*[1], Rijul Sihag[2], Rashmi Tyagi[3], Anil Kumar Saroha[4] and Arun Patter[5]

[1-2] Assistant Scientist, Department of Sociology, CCS, Haryana Agricultural University, Hisar - 125 004, Haryana, India
[3] Assistant Professor, Department of Sociology, CCS, Haryana Agricultural University, Hisar - 125 004, Haryana, India
[4] Associate Professor, Department of Farm Machinery and Power, CCS, Haryana Agricultural University, Hisar - 125 004, Haryana, India
[5] Ph. D. Scholar, Department of Sociology, CCS, Haryana Agricultural University, Hisar - 125 004, Haryana, India

Received: 24 Sept 2025; Revised accepted: 11 Nov 2025

Abstract

The adoption of digital tools in agriculture has gained momentum in recent years, with drones emerging as a promising technology for precision farming. Their ability to improve efficiency, reduce risks, and support sustainable practices makes them particularly relevant for regions like Haryana, where farming is central to rural livelihoods. This study examined the benefits and perceived constraints of agricultural drone technology among farmers who had participated in demonstration programs in Haryana. Conducted in Hisar and Karnal districts, the survey covered 60 respondents (30 from each district) using a structured interview schedule. Results showed that the most widely acknowledged benefit was the reduction of farmers' direct exposure to harmful chemicals during spraying, followed by automation of tasks, reduction in manual labour, and improved crop quality. Farmers also recognized drones as a tool to attract youth to agriculture and support sustainable practices. However, major barriers to adoption were reported, including low water storage capacity, high purchase cost, limited flight time, and operational difficulties near electric wires. The findings suggest that while farmers view drones positively, greater adoption will require financial support, technical improvements, and targeted training. Strengthening extension programs and providing subsidies could play a crucial role in expanding drone use in agriculture.

***Key words*:** Agricultural drone, Knowledge, Awareness, Agricultural drone technology, Constraints

The adoption of drone technology in agriculture has attracted considerable attention in recent years for its potential to enhance efficiency, reduce production risks, and support sustainable practices. By enabling targeted pesticide spraying, crop monitoring, and precise resource management, drones address persistent challenges such as labor shortages, rising input costs, and farmers' exposure to hazardous chemicals.

In India, where agriculture continues to employ nearly 43% of the workforce and contributes about 18% to the national GDP, the relevance of such innovations is particularly pronounced [1]. Government initiatives in India, such as the Sub-Mission on Agricultural Mechanization (SMAM), have promoted the use of drones through large-scale demonstration programs, signaling institutional support for their adoption [2]. Yallappa *et al*. [3] developed and evaluated a drone-mounted sprayer, demonstrating its effectiveness in reducing pesticide exposure and improving precision in application. Expanding this perspective, Devi *et al*. [4] reviewed the use of drones for crop health monitoring and spraying, emphasizing their ability to enhance efficiency in precision agriculture. Further, Noor and Noel [5] in their study from Kurukshetra district of Haryana, found that farmers were generally receptive to drone-based pesticide spraying, though adoption depended on awareness levels and local conditions. Also, Singh *et al*. [6] described drones as a modern approach to agriculture, highlighting their potential in precision farming and stressing the importance of training and supportive policies for scaling adoption. Most recently, Singh and Singh [7] provided a comprehensive review of Indian-based drone applications in agriculture, identifying persistent barriers such as high costs, technical challenges, and regulatory hurdles, while also offering practical solutions to strengthen sustainability and adoption.

This study examines the case of Haryana farmers who attended agricultural drone demonstrations. It investigates how these farmers perceive the operational and strategic advantages of drone technology, and which constraints they identify as most limiting. Understanding these perceptions is essential for designing extension programs and policies that effectively address farmers' concerns and leverage drones' potential in agriculture. The specific objectives are as:

- To know the perceived benefits of agricultural drone technology among farmers who participated in drone demonstrations.
- To identify the perceived constraints in use of drone technology.

***Correspondence to:** Jatesh Kathpalia, E-mail: kathpaliajatesh@gmail.com; Tel: +91 9416244846

Citation: Kathpalia J, Sihag R, Tyagi R, Saroha AK, Patter A. 2025. Socio economic benefits and perceived constraints of agricultural drone among farmers in Haryana. *Res. Jr. Agril. Sci.* 16(6): 609-612.

MATERIALS AND METHODS

The study was conducted in Karnal and Hisar districts of Haryana. From Hisar district 4 blocks were selected namely Hisar I, Hansi I, Adampur and Agroha whereas from Karnal district Karnal, Indri, Gharaunda and Munak were taken where farmers had taken demonstration on drone technology. Thirty farmers were selected from the various villages of each district who had taken demonstration on Agricultural drone technology. On the whole, a total of 60 respondents were selected. Interview schedule was prepared to collect the desired information as per objectives. Selected farmers were surveyed with the help of well-structured interview schedule personally. Suitable statistical methods like frequency, percentage, TWS, WMS etc. were used as per the nature of objectives to analyse the data.

RESULTS AND DISCUSSION

Benefits of agriculture drone technology among farmers

In the (Table 1) a descriptive analysis was conducted among respondents to evaluate the perceptions of the advantages associated with drone usage in agriculture. Among all the perceived benefits, the highest-ranked (Rank I) was the use of drones for spraying pesticides and fertilizers, which minimizes farmers' direct exposure to harmful chemicals. This benefit received strong agreement from 76.67 per cent of respondents and achieved the highest WMS of 2.6, indicating a widespread acknowledgment of drone technology's contribution to health and occupational safety in agriculture. The automation of tasks was ranked second (WMS = 2.3; Rank II), with half of the farmers (50.00%) agreeing that drones simplify and automate various farm operations. Closely following in Rank III (WMS = 2.27) was the reduction of manual labour, suggesting that farmers view drones as effective tools to alleviate labour-intensive workloads. The perception of better-quality crops (WMS = 2.25; Rank IV) and increase in crop yield (WMS = 2.23; Rank V) further affirms the positive impact of drone interventions on agricultural productivity. Time-saving in farming activities (WMS = 2.22; Rank VI) and improved efficiency on farms (WMS = 2.17; Rank VII) were also highlighted as significant benefits. However, economic aspects such as cost savings in inputs, labour, and other operational expenses were ranked lower (WMS = 2.12; Rank VIII), suggesting a more cautious or variable perception of financial gains among farmers. Additional operational advantages received moderate ratings, including drones increasing productivity and reducing economic stress (WMS = 2.08; Rank IX), assisting in soil condition assessment (WMS = 2.07; Rank X), and enabling timely identification of issues such as pest infestations (WMS = 2.03; Rank XI). The lowest-ranked operational benefit was the direct perception of increased productivity in farming operations (WMS = 1.67; Rank XII), with only 23.33 per cent of farmers expressing agreement, indicating that measurable productivity gains may not yet be evident or fully experienced among the majority [8-10].

Table 1 Benefits of agriculture drone technology among farmers (n=60)

Statements	Response			TWS	WMS	Rank
	Agree	Neutral	Disagree			
Direct operational benefits (Field-level efficiency and productivity)						
Helps in automation of tasks	30 (50.00)	18 (30.00)	12 (20.00)	138	2.3	II
Reduces manual labour	26 (43.33)	24 (40.00)	10 (16.67)	136	2.27	III
Better quality crops	31 (51.67)	13 (21.66)	16 (26.67)	135	2.25	IV
Cost saving in terms of inputs, labour or other operational expenses	28 (46.67)	11 (18.33)	21 (35.00)	127	2.12	VIII
Drones can assess soil conditions, such as moisture levels and nutrient content, helping farmers make informed decisions about soil management	22 (36.67)	20 (33.33)	18 (30.00)	124	2.07	X
Increased productivity in your farming operations	14 (23.33)	12 (20.00)	34 (56.67)	100	1.67	XII
Increase efficiency in farm	26 (43.33)	18 (30.00)	16 (26.67)	130	2.17	VII
Time-savings in your farming activities	30 (50.00)	13 (21.67)	17 (28.33)	133	2.22	VI
Drones enable timely interventions by quickly identifying issues such as pest infestations	20 (33.33)	22 (36.67)	18 (30.00)	122	2.03	XI
Drones increase farm productivity, leading to better financial stability and reducing economic stress for farmers	25 (41.67)	15 (25.00)	20 (33.33)	125	2.08	IX
Increase crop yield	24 (40.00)	26 (43.33)	10 (16.67)	134	2.23	V
Using drones for spraying pesticides and fertilizers minimizes farmers' direct exposure to harmful chemicals	46 (76.67)	04 (6.66)	10(16.67)	156	2.6	I
Strategic and broader impacts (Long-term, market, safety, and sustainability)						
Drone technology makes farming more appealing to younger generations	40 (66.67)	12 (20.00)	8 (13.33)	152	2.5	I
Drones support sustainable farming practices	35 (58.33)	9 (15.00)	16 (26.67)	139	2.3	II
Access to precise data from drones improves decision-making	20 (33.33)	15 (25.00)	25 (41.67)	115	1.9	III
Drones can perform hazardous tasks, such as inspecting tall structures or difficult terrain, enhancing overall farm safety	6 (10.00)	38 (63.33)	16 (26.67)	110	1.8	IV

In terms of strategic and broader impacts, farmers acknowledged several long-term benefits of drone adoption. The highest-ranked statement in this category (WMS = 2.5; Rank I) was that drone technology makes farming more appealing to younger generations, supported by 66.67 per cent of respondents. This suggests that drones have the potential to attract youth into agriculture, addressing generational gaps in the sector. The role of drones in supporting sustainable farming

practices was also well received (WMS = 2.3; Rank II), reinforcing the idea that precision agriculture contributes to environmentally responsible farming. However, some of the broader benefits were rated less favourable. The perceived advantage of access to precise data for improved decision-making received a WMS of 1.9 (Rank III), and the ability of drones to perform hazardous tasks, enhancing farm safety, was ranked the lowest in this category (WMS = 1.8; Rank IV). These lower scores may reflect limited familiarity or under-utilization of advanced drone functions beyond basic operational roles.

The descriptive analysis highlights that farmers strongly perceive drones as valuable tools for enhancing health and safety, particularly through their use in pesticide and fertilizer spraying, which minimizes chemical exposure. The technology is also recognized for its role in automating farm operations and reducing manual labour, thereby improving efficiency and saving time. Although productivity and crop quality benefits are acknowledged, the perceived economic gains remain moderate, indicating cautious optimism regarding cost-effectiveness. Importantly, the results emphasize drones' potential to make agriculture more appealing to younger generations and support sustainable farming practices, though awareness and utilization of advanced data-driven and safety-enhancing functions remain limited. Overall, the findings underscore growing acceptance of drone technology in agriculture, primarily for operational efficiency and safety, with scope for broader adoption as familiarity increases [11-12].

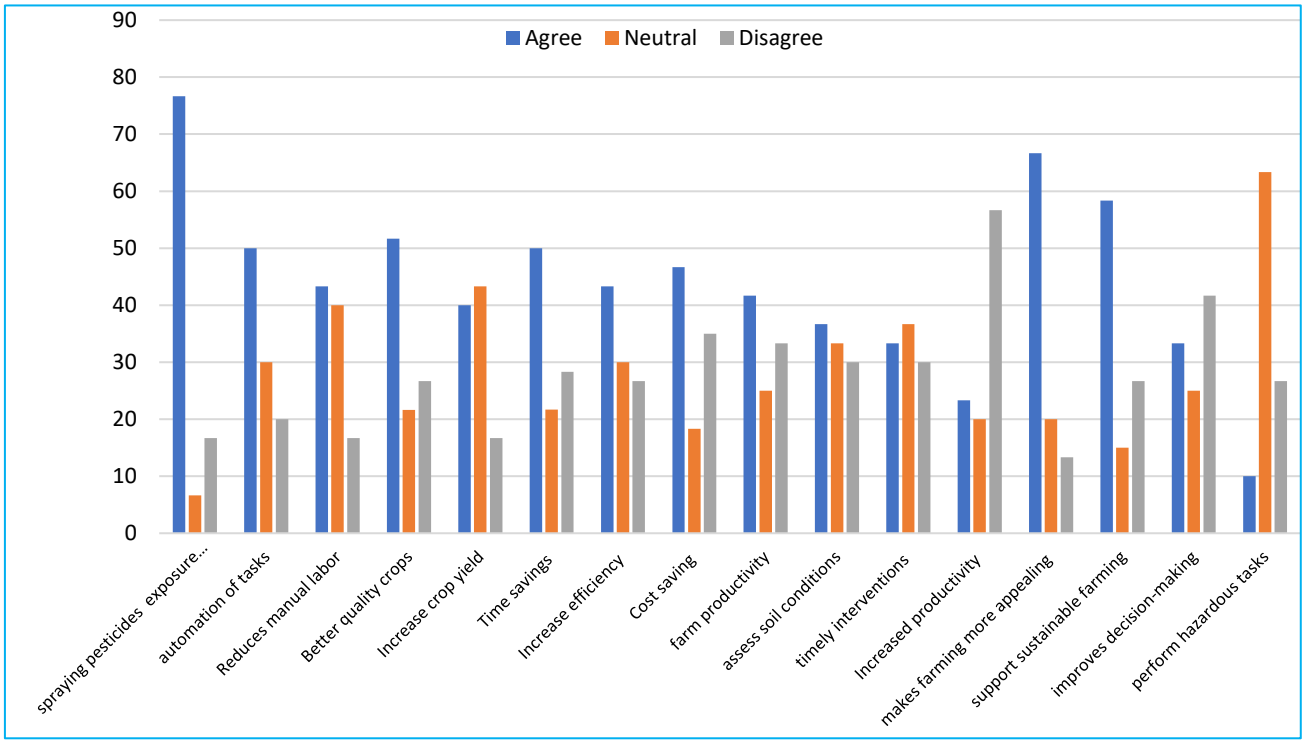

Fig 1 Benefits of agriculture drone technology among farmers

Perceived constraints by farmers who had taken agriculture drone demonstration

The analysis of perceived constraints among farmers who participated in agricultural drone demonstrations in (Table 2) revealed several key limitations impacting the practical adoption of drone technology in agriculture. The biggest concern is low water storage capacity, cited by 76.67 per cent of respondents (WMS = 2.77). High purchase cost follows closely, with 75.00% agreement (WMS = 2.67). The inability to spray near electric wires is another key issue, reported by 63.33 per cent of farmers (WMS = 2.53), ranking third. Weather vulnerability comes next, affecting 60.00% of respondents (WMS = 2.45). Farmers also noted limited flight time and range (55.00%, WMS = 2.42) and insufficient hands-on experience (53.33%, WMS = 2.37). The least pressing concern is difficulty in understanding technical terms, with 43.33 per cent agreement (WMS = 2.12), though still important. These findings highlight key barriers to drone adoption, including cost, operational limits, and technical challenges. While drones offer potential benefits, addressing these concerns is crucial for wider use in agriculture. Overall, the analysis reveals that farmers perceive drones as highly beneficial for enhancing safety, automation, and efficiency in agriculture, though economic and advanced functional benefits remain less recognized [13-15].

Table 2 Perceived constraints by farmers who had taken agriculture drone demonstration

Statements	Response			TWS	WMS	Rank
	Agree	Neutral	Disagree			
Insufficient hands-on practice with the drone	32 (53.33)	18 (30.00)	10 (16.67)	142	2.37	VI
Unable to spray due to electric wires	38 (63.33)	16 (26.67)	06 (10.00)	152	2.53	III
Expensive to purchase	45 (75.00)	10 (16.67)	05 (8.33)	160	2.67	II
Low water storage capacity	46 (76.67)	14 (23.33)	0 (0.00)	166	2.77	I
Vulnerability to weather conditions	36 (60.00)	15 (25.00)	09 (15.00)	147	2.45	IV
Limited flight time and range	33 (55.00)	19 (31.67)	08 (13.33)	145	2.42	V
Difficulty in understanding technical terms	26 (43.33)	15 (25.00)	19 (31.67)	127	2.12	VII

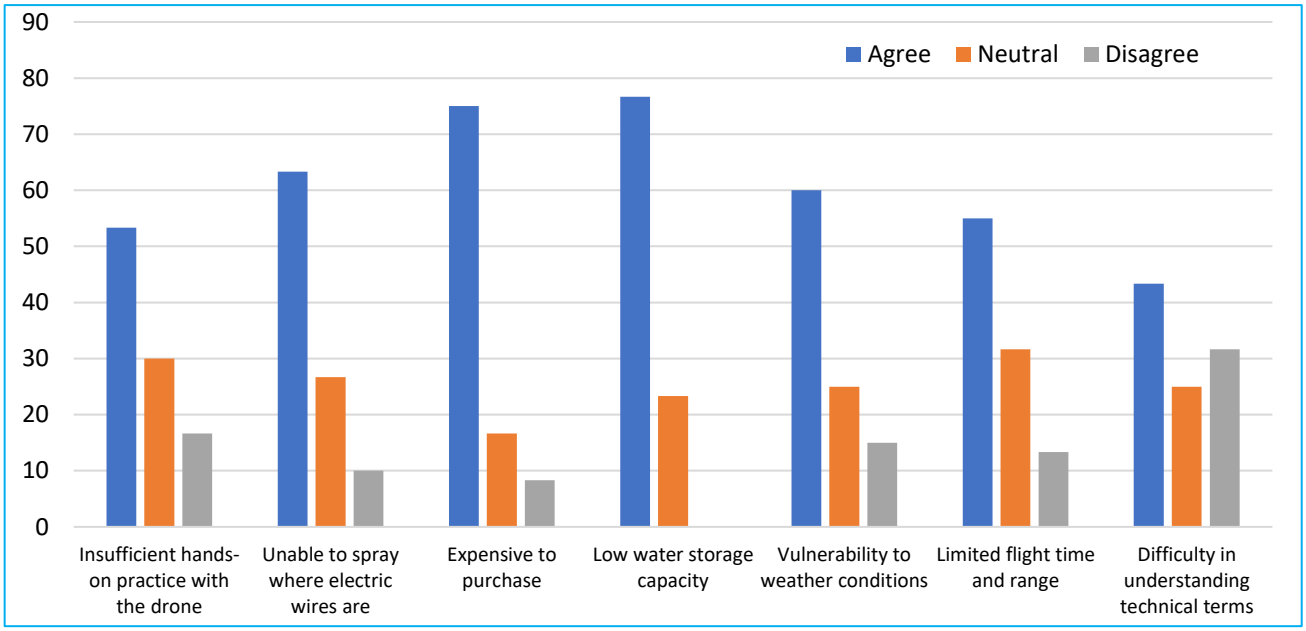

Fig 2 Perceived constraints of agriculture drone technology among farmers

CONCLUSION

The study was conducted in Karnal and Hisar districts of Haryana state of India to examine the perceived benefits and constraints of the among 60 farmers who had taken demonstrations of drone technology. Findings regarding the perceived benefits by the farmers revealed the use of drones for spraying pesticides and fertilizers, which minimizes farmers' direct exposure to harmful chemicals. The automation of tasks that drones simplify and automate various farm operations, reduction of manual labour, better-quality crops and increase in crop yield etc. further affirms the positive impact of drone interventions on agricultural productivity. Time-saving in farming activities and improved efficiency on farms were also highlighted as significant benefits. While low water storage capacity, high purchase cost of drone, the inability to spray near electric wires were some of the perceived constraints reported by farmers.

LITERATURE CITED

1. Bhoir R. 2025. Agriculture and employment: Impact and trends in India. *International Research Journal of Marketing and Economics* 12(2). Available at https://www.aarf.asia/current/2025/Jan/YMD9jUT03cKBYig.pdf
2. Press Information Bureau (PIB). 2023. *Financial assistance for promoting drones under SMAM*. Government of India. https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1985470
3. Yallappa D, Veerangouda M, Maski D, Palled V, Bheemanna M. 2017. Development and evaluation of drone mounted sprayer for pesticide applications to crops. *2017 IEEE Global Humanitarian Technology Conference (GHTC)*, 1–7. IEEE. https://doi.org/10.1109/GHTC.2017.8239299
4. Devi G, Sowmiya N, Yasoda K, Muthulakshmi K, Balasubramanian K. 2020. Review on application of drones for crop health monitoring and spraying pesticides and fertilizer. *Journal of Critical Reviews* 7(6): 667-672.
5. Noor F, Noel AS. 2023. Perception of farmers with reference to drones for pesticide spray at Kurukshetra district of Haryana, India. *Asian Journal of Advances in Agricultural Research* 22(3): 9-15. https://doi.org/10.9734/ajaar/2023/v22i3440
6. Singh N, Gupta D, Joshi M. 2024. Application of drone technology in agriculture: A modern approach. *Journal of Scientific Research and Reports* 30(7): 142-152. https://doi.org/10.9734/jsrr/2024/v30i72131
7. Singh R, Singh S. 2025. A review of Indian-based drones in the agriculture sector: Issues, challenges, and solutions. *Sensors* 25(15): 4876. https://doi.org/10.3390/s25154876
8. Guebsi R, Mami S, Chokmani K. 2024. Drones in precision agriculture: A comprehensive review of applications, technologies, and challenges. *Drones* 8(11): 686. https://doi.org/10.3390/drones8110686
9. Rejeb A, Abdollahi A, Rejeb K, Treiblmaier H. 2022. Drones in agriculture: A review and bibliometric analysis. *Comput. Electron. Agriculture* 198: 107017.
10. Nafar N, Fatemi M, Rezaei-Moghaddam K. 2025. Smart drone in sustainable agriculture: Evaluating four predictive models for technology adoption in Iran. *Smart Agricultural Technology* 12: 101363.
11. García-Munguía A, Guerra-Ávila PL, Islas-Ojeda E, Flores-Sánchez JL, Vázquez-Martínez O, García-Munguía AM, García-Munguía O. 2024. A review of drone technology and operation processes in agricultural crop spraying. *Drones* 8(11): 674.
12. Nagaraja G, Shoba H, Sreedevi MS, Krishnamma PN. 2024. The impact of robotics and drones on agricultural efficiency and productivity. *International Journal of Research in Agronomy* SP-7(9): 1001-1009.
13. Kumar S. 2024. Revealing Constraints and perception of farmers during demonstration of innovative drone technology at farmer's fields. *Ajasraa* 13(11): 50-59.
14. Sreedeepya C, Swamy DK, Lavanya T, Chary DS. 2024. Constraint analysis of adopters and non-adopters of drones in agriculture in the Warangal district of Telangana in India. *Archives of Current Research International* 24(6):483-487.
15. Kamble PN, Ajotikar MV, Suryawanshi PD, Tarde VJ. 2024. Awareness of drone technology application in agriculture amongst the progressive farmers. *International Journal of Agriculture Extension and Social Development* 7(12): 307-310.