The Pharma Innovation Journal 2023; SP-12(8): 272-276

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(8): 272-276

www.thepharmajournal.com
Received: 01-06-2023
Accepted: 12-07-2023

Hridya Raveendran
MBA (ABM), Department of Agricultural and Rural Management, Tamil Nadu University, Coimbatore, Tamil Nadu, India

Dr. K Uma
Professor and Head, Department of Agricultural and Rural Management, Tamil Nadu University, Coimbatore, Tamil Nadu, India

Dr. K Divya
Associate Professor, Directorate of Agribusiness Development, TNAU, Coimbatore, Tamil Nadu, India

Dr. Ravikumar Theodore
Professor (Agricultural Extension), O/o the DPM, TNAU, Coimbatore, Tamil Nadu, India

Dr. R Pangayar Selvi
Associate Professor, Mathematics, Department of Physical Science and Information Technology, TNAU, Coimbatore, Tamil Nadu, India

Corresponding Author:
Hridya Raveendran
MBA (ABM), Department of Agricultural and Rural Management, Tamil Nadu University, Coimbatore, Tamil Nadu, India

Farmer's awareness and adoption of agricultural drones in Alappuzha district of Kerala

Hridya Raveendran, Dr. K Uma, Dr. K Divya, Dr. Ravikumar Theodore and Dr. R Pangayar Selvi

Abstract
Drones, or unmanned aerial vehicles (UAVs), have the capacity to bring about a revolution in agriculture as they can effectively address various challenges such as labor shortages, high input costs, difficulties in detecting diseases in crops etc. Despite their potential benefits, the majority of farmers are still unaware of this technology, and a significant number of them are hesitant to integrate it into their agricultural practices. This study focused on examining the level of awareness and adoption of agricultural drones among farmers in the Alappuzha district of Kerala. The study involved 120 farmers who participated in a survey. The data collected from the survey was analyzed to determine the extent of awareness and adoption of agricultural drones. The study also give preliminary understanding of relationship between demographic factors, such as age, education, and farm size on the awareness and adoption of drones and the main challenges and obstacles faced by farmers in adopting drone technology for agricultural-purposes. From the study it was found out that 70.83% of farmers were aware of agricultural drones and 22.5% are adopters. Lack of technical knowledge, non-availability of drones and unsynchronized farming practices are the major reasons for not adopting drones.

Keywords: Agricultural drones, awareness, adoption

Introduction
Drones commonly referred to as unmanned aerial vehicles (UAVs) and micro aerial vehicles (MAVs) were employed to photograph unmanned airplanes that operate over long distances for purposes of surveillance and weapon deployment. For almost 150 years, the Austrians have been acknowledged as the forerunners of drone technology since 1849, when they pioneered the development of explosive-filled balloons for military use. This groundbreaking achievement has earned widespread recognition and acclaim [2]. Drones have the capacity to fly over long distances, navigate confined spaces, and operate without a pilot on board. They can also gather information from various angles using different sensors, often for extended periods and continuously [1]. Recently drones have expanded their applications beyond their traditional uses, and one notable area is in commercial activities, specifically agriculture. Drones are becoming increasingly valuable tools for precision farming. The integration of UAVs (Unmanned Aerial Vehicles) in agriculture shows great potential, especially in accurately predicting agricultural yields through the collection of spatial data. Agricultural drones have the capability to provide real-time images and sensor data from farm fields that are challenging to access quickly on foot or by traditional vehicles [6]. Unmanned aerial vehicles provide farmers with a comprehensive and detailed aerial view of their fields, allowing for improved inspection. This bird's-eye perspective enables farmers to identify various issues on their farms, including irrigation problems, soil variations, fungal and pest infestations, changes in climate, and the presence of weeds and insects [4]. Furthermore, agricultural drones are considered among the most cost-effective and efficient methods for regularly monitoring crops and assisting in crop health detection. This capability enables farmers to promptly respond to issues and locally enhance crop conditions by applying fertilizers or insecticides as needed [5]. Different types of agricultural drones are available. The first variant is the multi-rotor, which represents the most straightforward drone form used for aerial photography in farming. These drones offer precise control over their photography positions, resulting in more accurate outcomes. The second type is the fixed-wing rotor drones, featuring a wing-like structure and a distinct take-off method from other drones. The third category comprises single rotor helicopter drones characterized by larger rotor blades, leading to higher efficiency compared to other drone types.

These drones have significant advantages in agricultural applications. Lastly, there are fixed-wing hybrid VTOL (Vertical Takeoff and Landing) drones that combine features of both traditional UAVs and the ability to hover in one position [3].

The utilization of agricultural drones is on the rise among Indian farmers due to their transformative potential in farming practices. Moreover, the Indian government is actively endorsing drone usage in agriculture and has implemented various policies to incentivize and facilitate their integration. In Kerala, farmers have begun embracing this cutting-edge technology, particularly for fertilizing paddy fields through drone spraying. Even Panchayats in the state are initiating projects to assist farmers in adopting drones, leading to time and labor savings. However, at present, there is limited information regarding the farmers' awareness and adoption of agricultural drones.

This study focused on the awareness and adoption of agricultural drones among farmers in Alappuzha district of Kerala and how different demographical characteristics affect the awareness and adoption rate of agricultural drones.

2. Materials and Methods

2.1 Study area

The research gathered information through a survey administered to farmers residing in Kerala's Alappuzha district. The agricultural sector in Alappuzha predominantly relies on traditional farming practices, which has hindered the widespread adoption of modern agricultural technologies. Additionally, a significant challenge faced by the farmers in the region is the scarcity of labour. Agricultural drone adoption can overcome major problems faced by farmers in this area. Convenience sampling method was used for this study. Samples were taken from four taluks in the district, namely Kuttanad, Cherthala, Chengannur and Ambalappuzha, with data collected from 30 farmers in each taluk, resulting in a total of 120 farmers.

2.2 Tools for analysis

Simple percentage analysis, Chi square test and Garrett ranking were used in analyzing the data collected from survey for this study. Percentage analysis is used to analyse the demographic characteristics of farmers in Alappuzha district. Chi square test is used to determine relationship between farmer's awareness with their education and farm size with adoption as well as awareness of agricultural drones. Garrett scoring technique was used to analyse the constraints in adopting agricultural drones.

3. Results and Discussion

3.1 Demographic characteristics

Table 1: Demographic characteristic of respondents

Sl. No	Particulars	No. of respondents (n=120)	Percentage
1.	**Gender**		
	Male	88	73.33
	Female	32	26.67
2.	**Age**		
	20-30	15	12.5
	31-40	20	16.66
	41-50	37	30.83
	Above 50	48	40
3.	**Educational status**		
	No formal schooling	0	0
	Primary School	31	25.83
	Secondary school	48	40
	Higher secondary school	26	21.66
	Graduate	15	12.5
4.	**Farm size**		
	Below 1acre	14	11.67
	1 < 3 acre	39	32.5
	3 < 6 acre	26	21.67
	6 < 9 acre	29	24.17
	Above 9 acre	12	10
5.	**Annual income**		
	Below 1 Lakh	73	60.83
	1-5 Lakh	35	29.16
	5-10 Lakh	10	8.33
	Above 10 Lakh	2	1.66
6.	**Years of farming experience**		
	Below 5 years	3	2.5
	5 – 15 Years	27	22.5
	15 – 25 Years	48	40
	Above 25 Years	42	35

Table.1 revealed that the majority of the respondents were male (73.33%), and 26.67% were female. In terms of age, the farmers were distributed as follows: 12.5% were between 20-30 years, 16.66% between 31-40 years, 30.83% between 41-50 years, and 40% were above 50 years old. In educational status, 25.83% of respondents had primary schooling, 40% had secondary schooling, 21.66% had higher secondary schooling, and 12.5% were graduates. The farm size varied, with 11.67% having below 1 acre, 32.5% owning 1 to less than 3 acres, 21.67% owning 3 to less than 6 acres, 24.17% owning 6 to less than 9 acres, and 10% owning above 9 acres. Regarding annual income, 60.83% had an income below 1

lakh, 29.16% had an income between 1-5 lakhs, 8.33% had an income between 5-10 lakhs, and 1.66% had an income above 10 lakhs. The farming experience of the respondents varied, with 2.5% having below 5 years of experience, 22.5% having 5-15 years of experience, 40% having 15-25 years of experience, and 35% having above 25 years of experience.

3.2 Association between education and awareness

Education level of farmers always had an influence on awareness about new technologies that can be implemented in agriculture

The research hypothesis is

H_0: There is no significant relationship between education level of farmers and awareness about agricultural drones

H_1: There is a significant relationship between education level of farmers and awareness about agricultuaral drones.

Table 2: Education level and awareness cross tabulation

			Awareness		Total
			Yes	no	
Education Level	Primary	Count	19	12	31
		Expected Count	22	9	31
	Secondary	Count	30	18	48
		Expected Count	34	14	48
	Higher secondary	Count	22	4	26
		Expected Count	18.4	7.6	26
	Graduate	Count	14	1	15
		Expected Count	10.6	4.4	15
Total		Count	85	35	120
		Expected Count	85	35	120
χ^2 value = 9.046 P value = 0.029*					

From table 2 it can be inferred that the chi-square value is 9.046 and P value is less than 0.05. The results of the chi-square test indicates that the education level of farmers have significant relationship with agricultural drones awareness.

3.3 Association between age and awareness

The rapid adoption of innovative technologies is more pronounced among younger individuals. Analyzing how age affects awareness can assist in the development of targeted educational programs and outreach strategies.

The research hypothesis is

H_0: There is no significant relationship between age of farmers and awareness about agricultural drones

H_1: There is a significant relationship between age of farmers and awareness about agricultural drones

Table 3: Age and awareness cross tabulation

			Awareness		Total
			Yes	no	
Age	20 – 30	Count	14	1	15
		Expected Count	10.6	4.4	15
	31 – 40	Count	17	3	20
		Expected Count	14.2	5.8	20
	41 – 50	Count	22	15	37
		Expected Count	26.2	10.8	37
	Above 50	Count	32	16	48
		Expected Count	34	14	48
Total		Count	85	35	120
		Expected Count	85	35	120
χ^2 value = 8.339 P value = 0.040*					

From table 3 it can be inferred that the chi-square value is 8.339 and P value is less than 0.05. The results of the chi-square test indicates that the age have significant relationship with awareness about agricultural drones.

3.4 Adoption of agricultural drones

Farmers were classified into three groups based on their adoption behavior towards agricultural drones. The first category includes adopters, who are actively using drones for farming practices. The second category comprises prospective adopters, who were aware of agricultural drones and express a willingness to adopt them. The third category is non-adopters, who showed no interest in utilizing drones for agricultural purposes.

Table 4: Categories of adopters of agricultural drones

Category	Current adopters	Prospective adopters	Non adopters
No of respondents	27	36	57

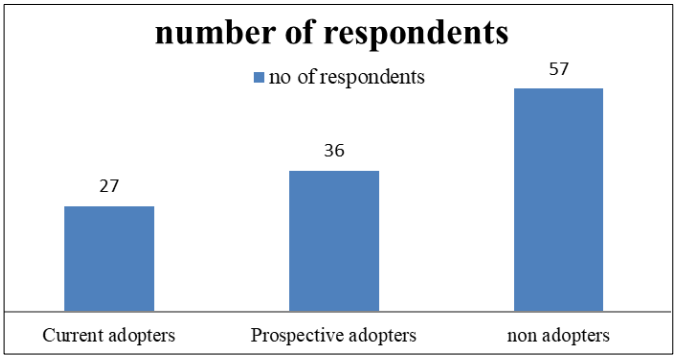

Fig 1: Adoption of agricultural drones among farmers

3.5 Association between Farm land holdings and adoption

According to Pivoto *et al*., (2019) the adoption of agricultural drones are greatly influenced by farm size [13]. Pierpaoli *et al*., (2013) found out there is a positive relationship between farm size and precision farming adoption [14].

The research hypothesis is

H_0: There is no significant relationship between farm size and adoption of agricultural drones

H_1: There is a significant relationship between farm size and adoption of agricultural drones

Table 5: Association between Farmland holdings and adoption

			Adoption		Total
			Yes	no	
Farm size	Below 1Acre	Count	1	13	14
		Expected Count	3.15	10.85	14
	1<3Acre	Count	3	35	38
		Expected Count	8.55	29.45	38
	3<6 Acre	Count	5	21	26
		Expected Count	5.85	20.15	26
	6<9 Acre	Count	11	19	30
		Expected Count	6.75	23.25	30
	Above 9 Acre	Count	7	5	12
		Expected Count	2.7	9.3	12
Total		Count	27	93	120
		Expected Count	27	93	120
χ^2 value = 18.99 P value = 0.0007*					

From table 5 it can be inferred that the chi-square value is 18.99 and p-value is less than 0.05. The results of the chi-square test indicates that the farm size of farmers have significant relationship with adoption of agricultural drones.

3.6 Constraints in adopting agricultural drones

There are different factors that influence farmer's adoption of agricultural drones. The factors are ranked by each farmer those who have awareness about agricultural drones. And according to Garret mean score they are ranked to find out which factor is the major hindrance in adoption.

Table 6: Factors constraining adoption

Sl. No	Factors	Rank scale value	I	II	III	IV	V	VI	VII	Total score	Garett mean score	Rank
		X	78	66	57	50	43	34	22			
1	High initial cost	F	9	10	15	19	15	12	5	85	54.8101	IV
		Fx	702	660	855	950	645	408	110	4330		
2	Lack of technical knowledge	F	24	26	14	10	9	2	0	85	67.6076	I
		Fx	1872	1716	798	500	387	68	0	5341		
3	Drones are not accessible	F	25	21	12	10	11	5	1	85	65.6329	II
		Fx	1950	1386	684	500	473	170	22	5185		
4	Maintenance and repair issues	F	3	4	10	9	20	17	22	85	43.5443	VI
		Fx	234	264	570	450	860	578	484	3440		
5	Government regulations	F	4	6	8	12	14	20	21	85	44.4051	V
		Fx	312	396	456	600	602	680	462	3508		
6	Non uniformity of farming	F	16	15	20	15	9	10	0	85	61.4557	III
		Fx	1248	990	1140	750	387	340	0	4855		
7	Compact ability issues with local crops and farming practices	F	4	3	6	10	7	19	36	85	39.1266	VII
		Fx	312	198	342	500	301	646	792	3091		

F – Frequency, x – Garret score

The data presents the factors influencing the adoption of agricultural drones among farmers, ranked on a scale. The factors are categorized based on their rank scores and Garrett mean scores. The factor "Lack of technical knowledge" obtained the highest rank, indicating its significance in influencing farmers' decisions to adopt drones, with a Garrett mean score of 67.6076. The factor "Drones are not accessible" ranked second, with a Garrett mean score of 65.6329. "Non-uniformity of farming" ranked third, with a Garrett mean score of 61.4557. "High initial cost" ranked fourth, with a Garrett mean score of 54.8101. "Government regulations" ranked fifth, with a Garrett mean score of 44.4051. "Maintenance and repair issues" ranked sixth, with a Garrett mean score of 43.5443. Lastly, "compatibility issues with local crops and farming practices" ranked seventh, with a Garrett mean score of 39.1266.

4. Conclusion

This study conducted an investigation into the awareness and adoption of agricultural drones among farmers in the Alappuzha district. The demographic characteristics of the respondents were collected, and the effects on the awareness and adoption of drones were determined. The results revealed significant and positive relationship between education level and age of farmers with awareness of agricultural drones and farm size on farmer's adoption. And lack of technical knowledge, non-availability of drones and non-uniformity of farming practices are the major reasons for not adopting drones. The reason for the lower adoption rates of agricultural drones might be attributed to insufficient information, lack of knowledge, limited awareness about the technologies, and the perception of limited practical usefulness. We thus recommend enhancing awareness programs, conducting training sessions at the village level, and sharing success stories of farmers who have successfully adopted agricultural drones through WhatsApp groups as the farmer's WhatsApp gropes are very active in that region.

5. Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

6. References

1. Cavoukian, Ann. Privacy and drones: Unmanned aerial vehicles. Ontario: Information and Privacy Commissioner of Ontario, Canada; c2012.
2. Lum, Christopher, Gauksheim K, Deseure C, Vagners J, McGeer T. Assessing and estimating risk of operating unmanned aerial systems in populated areas. In 11th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, including the AIAA Balloon Systems Conference and 19th AIAA Lighter-Than; c2011. p. 6918.
3. Dileep MR, Navaneeth AV, Ullagaddi S, Danti A. A study and analysis on various types of agricultural drones and its applications. In 2020 Fifth International Conference on Research in Computational Intelligence and Communication Networks (ICRCICN). IEEE; c2020. p. 181-185.
4. Yinka-Banjo, Chika, Ajayi O. Sky-farmers: Applications of unmanned aerial vehicles (UAV) in agriculture. Autonomous vehicles; c2019. p. 107-128.
5. Ahirwar S, Swarnkar R, Bhukya S, Namwade G. Application of drone in agriculture. International Journal of Current Microbiology and Applied Sciences. 2019;8(01):2500-2505.
6. Ayamga, Matthew, Akaba S, Nyaaba AA. Multifaceted applicability of drones: A review. Technological Forecasting and Social Change. 2021;167:120677.
7. Blackmore BS, Wheeler PN, Morris J, Morris RM, Jones RJA. The role of precision farming in sustainable agriculture: A European perspective. In Site-Specific Management for Agricultural Systems. Madison, WI, USA: American Society of Agronomy, Crop Science Society of America, Soil Science Society of America; c1995. p. 777-793.
8. Batte, Marvin T, Michael W. Arnholt. Precision farming adoption and use in Ohio: case studies of six leading-edge adopters. Computers and electronics in agriculture. 2003;38(2):125-139.
9. Choudhury, Amitava, Biswas A, Singh TP, Ghosh SK. eds. Smart Agriculture Automation Using Advanced Technologies: Data Analytics and Machine Learning, Cloud Architecture, Automation and IoT. Springer

Nature; c2022.
10. Mandal, Subrata KR, Maity A. Precision farming for small agricultural farm: Indian scenario. American Journal of Experimental Agriculture. 2013;3(1):200.
11. Daponte, Pasquale, Luca De Vito, Glielmo L, Iannelli L, Liuzza D, *et al*. A review on the use of drones for precision agriculture. In IOP conference series: earth and environmental science. IOP Publishing. 2019;275(1):012022.
12. Mogili, Rao UM, Deepak BBVL. Review on application of drone systems in precision agriculture. Procedia computer science. 2018;133:502-509.
13. Pivoto, Dieisson, Barham B, Waquil PD, Foguesatto CR, Corte VFD, *et al*. Factors influencing the adoption of smart farming by Brazilian grain farmers. International Food and Agribusiness Management Review. 2019;22(4):571-588.
14. Pierpaoli, Emanuele, Carli G, Pignatti E, Canavari M. Drivers of precision agriculture technologies adoption: A literature review. Procedia Technology. 2013;8:61-69.