Case study

Case study on the Perception of Farmers with reference to Drones for Pesticides Spray at Kurukshetra District of Haryana, India

Abstract

Agricultural productivity and farmer perceptions plays crucial roles in shaping the future of sustainable farming practices. This research paper presents a comprehensive analysis of the impact of drone technology on paddy productivity, specifically focusing on pesticide spraying and explore the perception and attitude of farmers towards the usage of drones in agriculture. Multistage sampling technique was used to select 90 farmers. A mixed-method approach was taken to collect data through well-structured questionnaire, interview, field experiments and survey. Data was analyzed using garret ranking, correlation coefficient and Likert scale. The result shows that farmers find labour factors to be most crucial for adopting drones and problem of water scarcity could be easily overcome. Yield has increased to 6.25% and quality by 2.25%. Result shows moderate correlation coefficient of 0.6 between the factor influencing productivity of paddy before and after usage of drones.

Keywords Drones, Pesticides spraying, Traditional methods, Paddy, Productivity

1. Introduction

India holds the second position in the production of paddy in world. Total production of rice during 2019 – 2020 is estimated at 118.43 million tonnes. (Annual report 2020 – 2021). Rice is grown in almost all the states of India and feed 66% of total population.

Shortage of labour, reduction in water table, change in climatic condition, insect pest and disease hindrance the productivity of crops. Majority of states depends on rainwater of cultivation, due to aggressive use water table is declining continuously. In all India, agriculture suffers annual losses to the tone of about us$ 36 billion due to the ravages of Insect and Pest in fields. (G.S. Dhaliwal.et.al 2015). Scarcity of labour is another core reason for declining in productivity.

To overcome the challenges its' important for Indian farmers to adopt the innovate technology to increase the production despite of challenges. The use of drones for agricultural purposes has been increasing rapidly over the past few years. UAVs are mainly applicable for agriculture operations such as soil and field analysis (Primicerio et al., 2012), crop monitoring (Bendig et al., 2012), crop height estimations (Anthony et al., 2014), pesticide Spraying (Faiçal et al., 2017; Faiçal et al., 2014a, Faiçal et al., 2014b, Faiçal et al., 2014c; Huang et al., 2009).

Although Pesticides spraying using Traditional method has always been challenging as it destroys the crops in process and sudden change in environment in weather washes away the chemicals from the foliage. Using drones for spraying has emerged as a new and innovative way to increase agricultural productivity, in this comparative study, we have analysed the productivity of paddy crops with reference to the use of drones for pesticide spray.

2. Review of Literature

Liu et al. (2018), has was found that using a drone for pesticide spraying resulted in a 30% reduction in pesticide use and a 90% reduction in labor compared to manual spraying.

Candiago et al. (2015), similarly found that that using a drone for pesticide spraying resulted in a 40% reduction in time and a 30% reduction in pesticide use compared to ground-based spraying.

Yuna Seo (2021), concluded that UAVs are comparable to boom sprayers, showing similar pest-control costs and management efficiency at a scale ranging from 0.5 to 30 ha fields.

Huang et al., (2018) There are potential benefits to drone usage in agriculture that include large area coverage, less quantities of pesticides, labour saving, quick response time, and timely operation well before pest occurrence exceeds economic threshold levels

Abdul Hafeez et al., Due to the reduction of weight, cost of UAVs, and increment in payload capability. Drones used in crop health monitoring and pesticides spraying.

FA Rosedi et al. (2022), concluded that the use of drones in chemical spraying saved time and made the spraying process faster and also increases the yield.

3. Objective

The following studies was proceeded with following objectives.

- To understand how the productivity of paddy is affected when drones are used for pesticide spraying.
- To analyze farmer's perception regarding the adoption of drones

4. Research Methodology

Study was done in the Kurukshetra District of Haryana state due to availability of higher number of medium and larger farmers, who are more open to adopting new technology. Multilevel screening was performed on the basis of District, Block, Villages and respondents. Out of seven blocks in Kurukshetra district, Thanesar was selected, and data was gathered was from the population. Fig 1 shows the sampling procedure adopted in the research.

Primary data was selected from personal interview and pre-structured questionnaire. Further, secondary data was collected from total 90 Respondents, including 11small farmers, 48 medium farmers and 31larger farmers, and respondents was divided based on their land holding capacity.

4.1 Analysis of data

The data were analyzed using simple mathematical and statistical tools. The results have been presented using tables, bar, graphs, columns and pie charts. researcher utilized Garrett

ranking technique was employed to determine the most preferred factor for using drones. On the basis of primary and secondary data farmers perception was analyzed and suggestion was gathered.

5. Result and Discussion

5.1 Farmer's Profile

This Objective of the project is to study the perception of Farmers regarding usage of drones for pesticides spray. Knowing Demographics and Psychographic detail of studied area is necessary as it effect the perception of respondents. In survey following results were found. Majority of respondents (39%) were medium farmers (4-10 ha). Large farmers (above 10 ha) were 34.44%. semi-medium (2-4 ha), small (2-1 ha) and marginal farmers (< 1 ha) were 14.44%, 10%, 2.22% respectively. High availability of land made farmers to easily adopt drones for agricultural activity. Literacy level were quite promising as out of 90 respondents 30 was intermediate, 25 were undergraduate, 16 respondents were both post graduate and matriculate and 3 holds doctorate degree. Adopting any new mean of farming at initial level is risk taking being educated helps in easy introduction of innovative ideas. Farmers living in rural, semi-urban and urban were 36, 28 and 26 respectively.

5.2 Farmers perception and attitude towards various factors influencing the productivity of paddy before and after use of drones.

Pesticides are sprayed on paddy during the booting stage to safeguard the crops from dangerous pests. The productivity and quality of the crops are impacted by numbers of factors. The factors before and after the pesticides spraying (booting stage), are kept constant, and only those factors are taken into consideration which effects the productivity and quantity of paddy during the spraying of pesticides.

5.2.1. Analysis the production and quality of Paddy in both traditional and Drones method.

Survey reveals that A total of 90 respondents were selected who practice traditional methods for pesticide spray, and among them, only 20 adopted the agricultural drone for pesticide spray during the initial year of the project. Table 1 Represent the different aspects of variables that affect productivity and quality during the foliage stage. When all the variables were analysed, it was observed that, compared to the traditional method, the mean value of the machine cost used for spraying in the drone. method was 27.77. The government of India is providing 50% subsidy to small and marginal farmers, Scheduled Caste and Scheduled Tribe, women, and North-eastern state farmers, and 50% to other farmers. The recommended dose of pesticides in both methods was the same, so the cost of pesticides has a similar mean value in both conditions.

Drones' method is mostly labour-effective, time-saving, and water-saving, as the mean values in drone methods were quite low as compared to the mean values in traditional methods, which were (200) in traditional methods and (50) in drone methods. Irrigation cost in the traditional method (106.5) and in the drone method (12.25).

The most important factor was time, as drones take only 5-7 mints, whereas 35 mints are taken by labour for spraying 1 acre of land. The mean value of the time factor came to be (0.58) in the traditional method, while in the drone method it was only (0.11). The mean value of other costs in the traditional method was 56.98 and in the drone method was 58.98.

The productivity of paddy via drones was higher than that of the traditional method. Productivity increased by 6.25%. Paddy in drone methods was of better quality as the mean value came to be 98.79%, whereas in traditional methods the value is 95.67%.

Moderate Correlation coefficient of 0.65 came to exist between Traditional and Drone methods. Thus, showing that there is positive moderate relation and productivity and quality of paddy is high when drones are used for pesticide spray.

Variables (while spraying)	**Unit**	**Mean (Traditional Methods)**	**Mean (Drone Method)**
Labor Cost	Rs	200	50
Pesticides Cost	Rs	550	550
Machinery Cost	Rs	27.77	1666
Irrigation cost	Rs	106.5	12.25
Other Cost	Rs	56.98	58.98
Time Factor	hour/acre	0.58	0.11
Productivity	quintal/acre	19.73	25.98
Quality of Paddy	%	95.67	98.79

Source:- Field survey.

Table 1. Factors affecting productivity & quality of paddy while spraying pesticides.

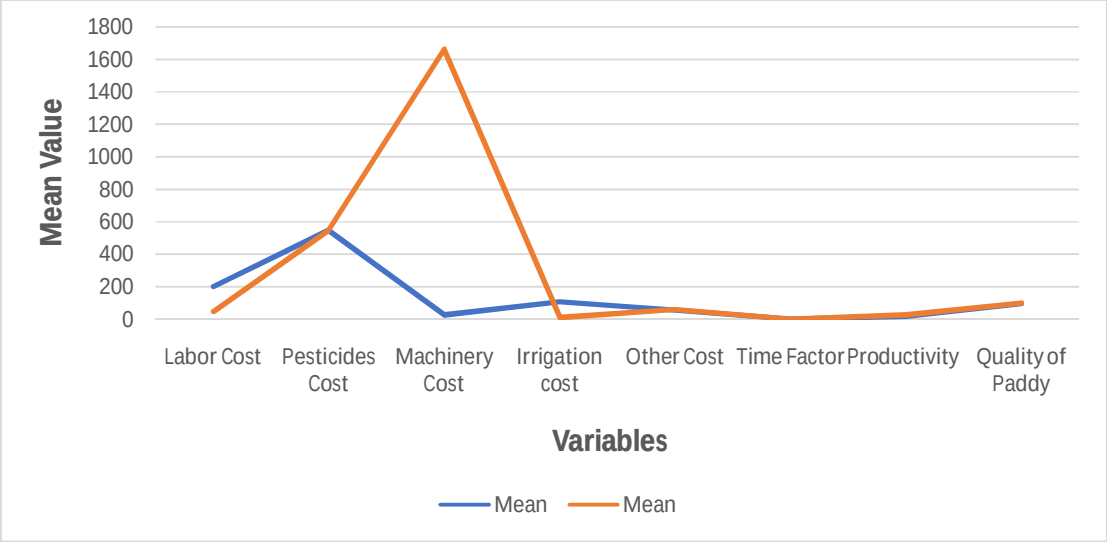

Fig 1. Factors affecting productivity & quality of paddy while spraying pesticides.

5.3.1. Perception of farmers regarding factors effecting productivity of paddy before and after use of drones.

Survey demonstrates that the majority of respondents prioritise labour effectiveness while considering whether to utilise drones for pesticide application. Quantity of production via drones holds the second element. The respondents believe time effectiveness to hold the third factor, and water-saving and price factor were put in fourth and fifth place, respectively. Concern for the environment, peer recommendations, the volume of goods produced using traditional methods, advertisements, and awareness are placed sixth, seventh, eighth, ninth, and tenth, respectively.

Table 2 : Perception of farmers regarding factors effecting productivity of paddy

Factors	Rank Given by Respondents.												
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**Garrett score**	**Mean score**	**Rank**
Water-saving	9	6	20	14	10	9	8	7	5	2	4929	54.98	**IV**
Price	3	9	14	15	8	10	11	10	6	4	4599	51.10	**V**
Quantity of production (Traditional method)	2	3	5	7	3	18	22	11	9	10	3885	42.83	**VIII**
Quantity of production (Drone)	13	10	13	11	10	12	8	7	4	2	5053	56.14	**II**
Reference from others	5	8	5	3	5	15	12	10	15	12	3959	43.93	**VII**
Advertisement	8	5	4	6	8	2	15	11	12	19	3837	42,63	**IX**
Environment concern	10	11	8	7	10	4	2	13	15	10	4382	48.86	**VI**
Awareness	5	6	2	8	9	2	9	9	15	25	3575	39.72	**X**
Time effective	15	15	9	7	12	8	2	10	7	5	4993	55.47	**III**
Labour effective	20	17	10	12	15	10	1	2	2	1	5585	62.08	**I**

5.3.2. Attitude of farmers towards drones.

Farmers were questioned about their views on time, water, labor, yield, crop health, cost, management decisions, training, willingness to invest, and the potential for farming to be revolutionized in order to understand how they felt about drones. It is evident from Table 3.(a) that farmers firmly support the time and water savings element and claim that it requires less time and uses less water than alternative ways. Additionally, they claim that employing drones improves crop health and yield since microdroplets sprayed on leaves have a high

absorption rate. As the government has implemented several plans that have varying costs to different farmers, some farmers found the cost of drones to be too high while others thought that it was too low. They agreed that choosing to use drones for crop management was a better and more cost-effective option than utilizing other methods because they can lower operating expenses while increasing profit margins. They also disapproved to the fact that there is very few options training system. Farmers were eager to adopt innovative practices and make drone purchases. Thus, there is a higher chance for drones in the Indian market when all considerations are taken into account.

Particles	**Factor**	**Frequency**	**% of Response**
Time Effective	**Strongly Agree**	77	85.55
	Agree	13	14.44
	Disagree	0	0
Water saving	**Strongly Agree**	89	98.88
	Neutral	1	0.11
	Disagree	0	0
Labour Efficient	**Very Efficient**	75	83.33
	Neutral	10	11.11
	Less Efficient	5	5.55
Yield	**Increases**	73	81.11
	Remain same	12	13.33
	Decreases	5	5.5
Valuable insight into crop health	**Improves**	59	65.5
	No changes	21	23.33
	deteriorate	10	11.11
Cost of drone	Costly	30	33.33
	Neutral	50	55.55
	Cheap	10	11.11
Crop management decision	**Positive**	67	74.44
	Neutral	5	5.55
	Negative	18	20
Availability of providing Training	High	23	25.55
	Medium	34	37.77
	Low	57	63.33
Willing to invest	**Positive**	45	50
	Neutral	17	18.88
	Negative	28	31.11
Potential to revolutionize the farming.	**Agree**	68	75.55
	Neutral	15	16.66
	Disagree	7	7.77

Table 3(a) Attitude of farmers toward using drones

Row Labels	Sum of Frequency	Sum of % of Response
Agree	**68**	**75.55**
Potential to revolutionize the farming.	68	75.55
Costly	**30**	**33.33**
Cost of drone	30	33.33
High	**23**	**25.55**
Availability of providing Training	23	25.55
Improves	**59**	**65.5**
Valuable insight into crop health	59	65.5
Increases	**73**	**81.11**
Yield	73	81.11
Positive	**112**	**124.44**
Crop management decision	67	74.44
Willing to invest	45	50
Strongly Agree	**166**	**184.43**
Time Effective	77	85.55
Water saving	89	98.88
Very Efficient	**75**	**83.33**
Labor Efficient	75	83.33

Table 3.(b) Pivot table showing dominating factors.

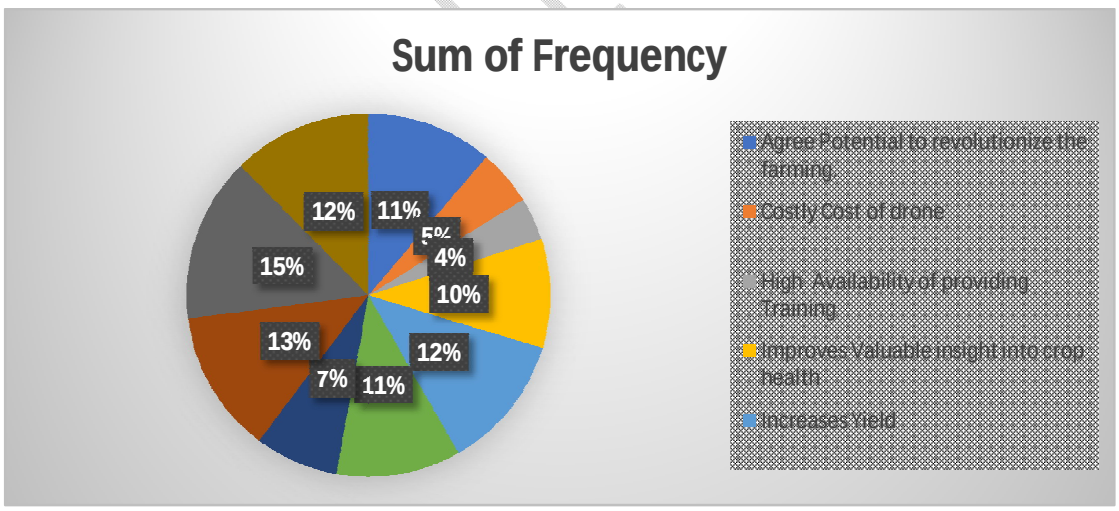

Fig 2. Attitude of farmers towards drones.

6. Conclusion.

The study revealed that potential for usage of drones for pesticides spray in Thanesar district is high due to availability of land. There is 6.25% increment in productivity of Paddy and 3.12% increment in quality when compared to traditional methods of pesticides spray. Employing drones improves crop health and yield since microdroplets sprayed on leaves have a high absorption rate. Significant reduction in water application and labour usage has dropped to ¼ times. Farmers find Cost of drones to be relatively high due to difference in scheme policy. Availability of labour at correct time has becomes big challenge and spraying via drones has become labour efficient, farmers has ranked I to labour factor. Manual spraying has caused many health issues as labour were exposed to harmful chemicals. Spraying via drone takes only 5-7 mints per acres while 3-4 labors were hired for spraying one acre of lands. Calculation shows moderate correlation significant of 0.6 between the factor affecting before and usage of drones. Awareness level among the farmers came to be least due to recent evolution of smart technology in agriculture. It was observed that small farmers follows the practice adopted by large farmers.

The analysis conducted in the research paper demonstrates the positive impact of drones-based pesticides spray on paddy productivity and highlights the nuanced perception and attitude of farmers towards the usage of drones in agriculture. By leveraging the benefits of drones technology while addressing farmers' concern, the agriculture sector can harness the potential of drones to drive sustainable and efficient farming practices.

7. Recommendations.

Policy maker should consider the following suggestions in order to successfully make drones as apart of agricultural practices in India.

1. Awareness plays an important role in the successful implementation of any project. various awareness programmes should be adopted, and training programmes should be initiated.
2. Adopting drone techniques is difficult for small farmers. The government should take some steps to involve small farmers in adopting new techniques.
3. Policymakers must be familiar with the farmers they are trying to influence. A range of factors such as education, risk-factor, and experience impact the willingness of farmers to be agents of change.
4. Providing technical assistance to farmers can make adopting new farming practises easier.

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