AIP Conference Proceedings

RESEARCH ARTICLE | APRIL 19 2024

Market survey, perception and acceptance of farmers on SRI-tray technology for rice farming FREE

Muhammad Nurfaiz Abd. Kharim ✉; Aimrun Wayayok

AIP Conf. Proc. 2799, 020032 (2024)
https://doi.org/10.1063/5.0181837

AIP Publishing

Market Survey, Perception and Acceptance of Farmers on SRI-Tray Technology for Rice Farming

Muhammad Nurfaiz Abd. Kharim[1,a)] and Aimrun Wayayok[2,b)]

[1]*Faculty of Agro Based Industry, Universiti Malaysia Kelantan Campus Jeli, 17600 Jeli, Kelantan, Malaysia.*
[2]*Department of Biological and Agricultural Engineering, Faculty of Engineering, Universiti Putra Malaysia, 43400, Serdang, Selangor, Malaysia.*

[a)]Corresponding author: nurfaiz@umk.edu.my
[b)] aimrun@upm.edu.my

Abstract. Farm technology plays a crucial role in improving the farming activities for developing countries. Thus, organic-based products are in increasing demand from consumers that concerned about the safety and healthy food. This implies organic-based rice farming with technology is a new way of performing a farm-based operation. This study would like to get insight and responses from rice farmers regarding the current issues and problems of the rice nursery management and nursery planting tray operation. Thus, the study would like to investigate rice farmers' perception and acceptance towards a new rice nursery planting tray that is SRI-Tray within Malaysia and other nearby countries in Southeast Asia. The respondents of the study are 87 farmers and online in-depth interviews are carried out to obtain farmers' responses towards current rice nursery management and SRI-Tray technology. The results from the content analysis reveal factors such as technology perceived benefits, solving the main problems, trialability, and pricing wise are among factors that explain the farmers' perception and acceptance towards new technology for adoption within their farming activities.

INTRODUCTION

The System of Rice Intensification (SRI) is getting popular around the world where over 50 countries are now practicing it within their rice field [1]. It is a system that requires transplanting of a single seedling at a very young age of 8 - 10 days after seed germination in a nursery with a very proper lining and wider spacing patterns depending on climatic and fertility conditions of the rice field [2]. It is also a system that responds to some prevailing situations of climate change which are increasingly manifesting day by day leading to more insecurity in food supply leading to higher food prices. Therefore, innovative contributions to sustainable agriculture become a global mandate in militating against the projected insecurity and SRI is one the key system to improve the rice farming activities. This system is aimed at primarily increasing productivity of land and capital by offering double yields through the use of fewer seeds per hectare, low seeding density, wider spacing pattern, less usage of water, chemical fertilizers, fuel, and tolerant to drought, wind, and storms due to large and deep root system [3].

However, available current seedling nursery practices in conventional rice cultivation and SRI practice are unable to meet the requirement concerning spacing due to inefficient seedling preparation technique, the problem of multiple seedlings per hill roots cutting, traumatic seedlings due to the broadcasting sowing technique, and lack of separators between the individual growing seedlings [4]. The result caused roots being interconnected as well as high inter-plant competition for nutrients, water, oxygen, and sunlight; which eventually endangers the seedling quality and lowers the production. This also makes the transplanting machines plant more than one seedling per hill at a time as well as leaving some places unplanted in the field, thus making farmers paying for replanting leading to high production cost [5]. Since SRI seedling quality and transplanting skills play a vital role in getting an optimum yield, so those problems caused the slow establishment of the planting and remain a constraint for SRI practitioners. Thus, malingering to an unsuitable adaption of full SRI mechanization practice. Therefore, the simple and innovative SRI-Tray technology that have been developed by Zubairu et al. [4] is one of a good way to nurse individual, young, delicate but healthier and root separated rice seedling with low density. The SRI-Tray have 924 square growing cavities with a sliding base attached to it to accurately transfer, safe, and release

Proceedings of the 9th International Conference on Advanced Material Engineering & Technology
AIP Conf. Proc. 2799, 020032-1–020032-6; https://doi.org/10.1063/5.0181837
Published by AIP Publishing. 978-0-7354-4837-7/$30.00

seedlings to the rice field for single transplanting per hill. As mentioned by the Zubairu et al. [4] the SRI-Tray has proven to be effective.

Organic farming is always associated with the issue of environmentally friendly and health concerns according to some of the works of literature. For example, Ashari et al. [6] mentioned that farming practices towards organic farming were looked at as a keen solution to address the issue of agro-ecology degradation and health-related matter. Thus, those concerns have become an underlying principle in promoting sustainability, food safety, healthy lifestyle, and protect the earth movement recently. The movement becomes a rationale factor for the farmers and society to accept and engage the organic farming practices. This has further increased the development of technology associated with organic farming to enhance the practices and adoption among the farmer. However, the technology adoption process among small farmers usually encounters various challenges especially the perception and attitude of new technology. This implies that the perception and attitude of new technology also potentially influences the adoption behaviour based on the risk assessment of small farmers. The small farmer is easily susceptible to the risk however will be an advantage if the perception with low risk is well explained to the farmer for adoption [7]. Understanding comprehensively the adoption process of technology for a new technology like SRI-Tray technology requires indulging the factors that affect the intention to adopt. It is assumed that intention is a proxy of adoption behaviour. Currently, little is known about the farmer's perception, behaviour, and intention in using the SRI-Tray technology since the technology is quite new for the rice seedling planting method. Therefore, this study will provide information about farmers' acceptance on this technology and will be fruitful to formulate effective strategy to accelerate the adoption rate of SRI-Tray technology for single seedling rice planting among the paddy farmers. This study aims to explore and examine the perceptions and behaviour of farmers on the SRI-Tray technology and their intention to adopt the technology.

METHODOLOGY

Target population in this study is focused on the farmers that implement rice farming with any seeds planting technology in their farm. A total of 87 respondents participated in the study and the selection of the sample is based on stratified random sampling method. Stratified random sampling help to identified subgroup that is close as possible to being representative of population that can be observed and hold true within the population [8]. All the respondents participated are from the Southeast Asia region which 75 farmers were mainly from Malaysia while the other 12 farmers that participated were coming from other countries within the Southeast Asia. 3 farmers from Indonesia took part in the market survey, followed by the Philippines (2 people), East Timor or Timor-Leste (2 people), Thailand (2 people), Brunei (1 person), Burma/Myanmar (1 person), and Cambodia (1 people). Meanwhile, there was no participant from Singapore, Laos, and Vietnam due to no available close contact for the interview process.

This study aimed to understand the current situation and problems associated with rice seedling planting. Thus, to get an insight about the current technology that has been adopted by the farmer for the seedling planting procedure. Thus, to get the rice farmer's opinion on the new technology known as SRI-Tray technology that is specifically developed for the rice seedling planting emphasizing on the single seedling procedure. Apart from that, this study would like to observe the farmers' acceptance and behaviour on switching to new technology for their field planting activities.

In data collection, this study entailed distribution of self-administered closed-questionnaire survey, where the farmers were identified and invited to participate in in-depth interviews through face-face online meetings, and online surveys. The interview was carried out using a structured questionnaire consisting of close-ended questions. There were fifteen close-ended questions developed to explore farmers' acceptance, attitude and behaviour of new technology for rice seedling planting. The farmers' demographic profiles including their age, gender, education level, and farming experiences were also asked during the interviews. The duration of the interviews was between 30 to 45 minutes. Content analysis was carried out to analyse the data and information by examined words or phrases within a wide range of texts transcribed during the interview sessions with the farmers.

Further analysis of all the data were performed by using Statistical Package for Social Sciences (SPSS) version 25. Both the descriptive and inferential statistical analysis techniques were used in the study. Specifically, percentage, mean, standard deviation, correlation and regression analyses are used to analyse data.

RESULTS AND DISCUSSIONS

Socio-demographic profile of farmers

A total of 87 farmers were interviewed and all of them are non-adopters for the SRI-Tray technology. The age of the farmers varied between 20 to 60 years above with a majority between 40 - 49 years old (31.0%), followed

by aged 50 – 59 years old (24.1%), while aged from 20 – 29 years old and 30 – 39 years old shows similar in percentage ratio at 16.1% respectively, and aged 60 years old and above showed the lowest percentage 12.7%. This data shows that young people are gaining interest to take part in performing rice farming since the average older age group has declined.

Half of the farmers were male (56.3%) and female (43.7%). As shown in Table 1, the majority of the farmers (44.8%) has been involved with farming for more than 20 years, while 22.9% of them have farming experiences between 10 to 20 years, followed by farmers (13.8%) with experiences between 5 to 10 years and surprisingly 18.5% of the participants just started their career as a farmer.

TABLE 1. Socio-demographic profiles of farmers

Profile	Frequency (n)	Percentage (%)
Age		
20 – 29 years	14	16.1
30 – 39 years	14	16.1
40 – 49 years	27	31.0
50 – 59 years	21	24.1
> 60 years	11	12.7
Gender		
Male	49	56.3
Female	38	43.7
Level of Education		
No general school	2	2.3
Primary school	85	97.7
Secondary school	85	97.7
Diploma/Degree	56	64.4
Number of years farming		
0 – 4 years	16	18.5
5 – 10 years	12	13.8
11 – 20 years	20	22.9
> 20 years	39	44.8

Note: n = 87

Farmers' opinion on conventional tray technology

There is various nursery planting tray technology available in the market and some of them have been used by the farmers to plant the seedling. Each of the nursery planting trays have various features and characteristics namely; different materials (plastic, paper &, etc), various number of holes (110 holes, 30 holes &, etc), specifically made for a specific crop (bubble tray, SRI-Tray, vertical farming &, etc) and some of them are biodegradable. 12 farmers reuse the bottle, vase, porcelain, and 10 farmers Do It Yourself (DIY) for any materials available for planting the seeds. Other types of nursery planting tray that used by farmers are 110 holes tray (9 farmers), 104 holes tray (10 farmers), 200 holes tray (10 farmers), 30 holes tray (6 farmers), polystyrene box (5 farmers), and bubble tray (5 farmers). Most of the farmers (56 people) agreed that a nursery planting tray can save space for the nursery process. Then, 46 farmers choose a planting tray easy to operate. Moreover, 35 of them agreed nursery planting tray can save seeds. Thus, 30 of them choose all the reasons why they used the nursery planting tray for gardening or farming. Only 14 farmers think that the nursery planting tray is cheap and others (73 farmers) think that the nursery planting tray is expensive.

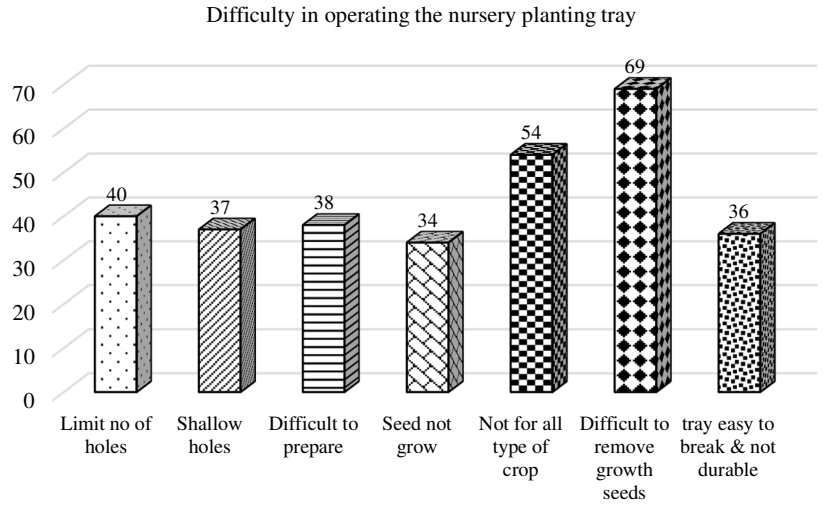

FIGURE 1. Farmers count on the different type of difficulties while operating the nursery planting tray

Figure 1 shows farmer counts on the different types of difficulties while operating the conventional nursery planting tray. 67 farmers stated that they faced difficulties to remove the growth seeds from the nursery planting tray for the transplanting process. Then, 54 farmers stated that the conventional nursery planting tray is not suitable for all types of crops for seedling planting. Moreover, 40 farmers agreed that most of the nursery planting tray has a limited number of holes. Next, 38 farmers faced difficulty to prepare the planting medium for the planting process, followed by the shallow holes of the nursery planting tray (37 farmers). Apart from that, 36 of the farmers stated that the nursery planting tray is easy to break and not durable enough for seedling planting purposes. Moreover, 34 farmers stated that some of the seeds did not grow at all after planting inside the nursery planting tray for any type of crop. This shows that the conventional nursery planting tray still requires further improvement to ease and minimize the difficulties during the farming activities.

Farmers' opinion on current rice nursey planting methods

The success of transplanting rice seeds to the field is depending on the nursery management. To produce a uniform stand and better seeds establishment, the right management of seedling planting is crucial. This can be achieved by ensuring adequate nutrition is supplied to the seeds, correct seedling densities, and transplanting seedlings at the right time represents crucial factors to obtain good yield components of rice planting. Figure 2 shows the type of methods that have been used by rice farmers for rice seedling planting. As shown in Figure 2, 37 farmers still used the broadcasting method to plant the rice seeds at the main planting field. While 30 farmers have changed to the modern method by using a tray mat or DAPOG tray for the transplanter machine to transplant growth rice seedling to the main planting field. Moreover, 20 farmers still practice nursery bed planting before manually transplanting into the main planting field by using human labour. Surprisingly, no farmer has ever used a seedling planting tray with holes to plant rice seeds before transplanting them to the main planting field. Apart from that, through discussion with the farmers, 66 farmers agreed that they faced difficulty while separating the interconnected roots during the removal process from the nursery planting tray for the transplanting process to the main planting field. While other 21 farmers stated they have not faced any difficulty while performing those processes. Meanwhile, some issues arise from practices of broadcasting the rice seeds to the main planting field. 75 farmers agreed that the method of rice seeds broadcasting to the main planting field used a high number of seeds and costly compare to other available methods. While the other 12 farmers did not agree with the statement.

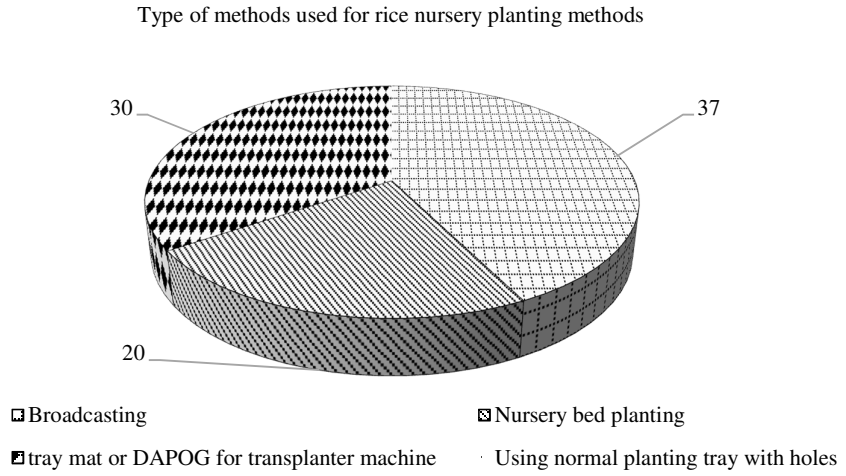

FIGURE 2. The number of farmers has practiced different types of rice nursery planting methods

Factor explaining farmers' acceptance towards SRI-Tray

Acceptance and Attitude towards SRI-Tray technology

Attitude may affect farmers' decisions towards SRI-Tray technology, which can be either a positive attitude or a negative attitude. The study showed that most of the farmers had a positive acceptance attitude in which 38 farmers have heard about the SRI-Tray technology even though the technology is not yet available in the market for purchasing. While other 49 farmers never heard about the SRI-Tray technology for the rice nursery seedling planting. This indicates that farmers are seeking new nursery planting trays and innovation to improve their farming activities at the field level thus improving their production. Thus, this shows that SRI-Tray technology has potential to be sell in the market to the potential farmers for nursery usage.

Technology characteristics and Adoption intention

New technology perceived advantages are utmost criteria for the user before make any decision either to accept or reject the technology. There are five criteria that will affect the decision of user especially farmer to adopt new technology within their norm practices namely; compatibility, testing, complexity, relative advantages and observability [9]. Through the discussion with the farmers, the factor that will influence their acceptance of SRI-Tray technology was encouraged by the perceived benefits of the technology.

Adoption intention is the farmers' decision, whether to adopt SRI-Tray technology in the future. 78 farmers out of 87 farmers will use the SRI-Tray technology if the technology is available in the market. Thus the 78 farmers are willing to adopt and apply within their farming practices due to technology relative advantages that able to solve current problems associated with rice nursery management. For example, like, the SRI-Tray technology can solve the problem of seedling root interconnection, save seeds usage up to 90% of saving, and easy to remove the growth seeds from the planting tray for the transplanting process compared to the current nursery planting tray. This shows that the relative advantages and unique benefits of SRI-Tray technology can solve the farmers' problems and improve their nursery activities. Adoption level is expected to be increase when the user received benefits and solve their problem from the technology advantages characteristics [10]. Thus, farmers preferred the technology that could increase their crop yield with high consistency in the productivity, which will increase their income [11]. Some of the farmers responded that they would like to have trialability to test the SRI-Tray technology at their rice field. Since farmers believed that trialability will accelerate the farmers' adoption through face-to-face observation and feel the technology by themselves. This will help them to make the decision either to adopt or to reject the SRI-Tray technology. As well as to reduce the risk that they will face.

Pricing wise

Farmer decision to switch to use new technology depends on varieties of factors that include price and non-price criteria. Pricing of a technology play crucial part for adoption among the new user especially farmer [12].

This is due to farmer purchasing power is limited and low income obtained. In the study, most of the farmers (57 people) willing to spend RM 5 – 10 for the SRI-Tray technology. Followed by price at the range of RM 11 – 20 (15 farmers), RM 21 – 30 (9 farmers) and only 6 farmers are willing to spend an SRI-Tray technology RM30 and above. This indicates that farmers still considered a lower price of seedling planting tray for the nursery and seedling planting operation. This is due to the high amount of operation cost incurred for the overall rice field operation plus consideration of the profit margin that will be gained at the end of the planting season.

CONCLUSIONS

A new nursery planting tray, SRI-Tray is capable to tap a new market segment of rice nursery management in Malaysia. Implementation of new innovation of rice nursery planting tray in the country can help to improve further the rice productivity and increase farmer's income. The study result shows that there are several factors explaining the farmers' acceptance towards new technology of nursery planting tray in Malaysia such as the innovation characteristics to solve the current nursery problem, market pricing, and trialability. The result also shows that most of the farmers are willing to accept this SRI-Tray technology with positive attitude and adoption intention due to perceived benefits offered by the technology. Thus, it is surprising that SRI-Tray technology has been recognized and acknowledge by some of the farmers even though not yet available in the market. Overall, 65.5% of the farmer willing to spend their money to purchase a single SRI-Tray technology below RM 10 (USD 4), while the other 34.5% of the farmer not mind spending an extra RM 11 and above for the technology. Therefore, it is recommended that the information and knowledge about SRI-Tray technology and SRI planting method should be disseminated further to other rice farmers as an alternative in producing organic-based rice farming practices.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Islamic Development Bank (IsDB) for funding this project under Transform Fund – Engage initiatives and Padeetech Sdn Bhd for facilities and technical support.

REFERENCES

1. M. S. Imran, M. S. Abdul Manan, A. N. M. Khalil, S. Hamat, R. N. Ahmad and M. K. Md Naim, "The transplanter tools for small paddy fields: System of Rice Intensification (SRI) compliance" (*IOP Conference Series: Materials Science and Engineering, 551, 1*, 2019), p. 012014.
2. R. R. Shamshiri, B. Ibrahim, D. Ahmad, H. C. Man and A. Wayayok, Indian J. Sci. Technol. 11, 1-16 (2018).
3. N. Uphoff, Agr. Sust. F. Syst. 41, 825-854 (2017).
4. U. B. Zubairu et al. Jurnal Tekn. 78, 1-2 (2016).
5. Ibrahim, Bala and Wan Ismail, Wan Ishak. Asian J. Agri. Sci. 6, 48-53 (2014).
6. Ashari, Sharifuddin, and Z.A. Mohamed, F. P. Agro, Ek. 35, 45-58 (2017).
7. Thomas et al. J. Eco. Sust. Dev. 8, (2017).
8. J. R. Sa'ari, et al. Int. J. Adv. App. Sci. 4, 220-225 (2017).
9. E.M. Rogers, "Diffusion of Innovations" (5th edn. New York: The Free Press, 2003).
10. M. Mwangi and S. Kariuki, J. Eco. Sust. Dev. 6, (2015).
11. D. Li, M. Liu, and G. Deng, China Agr. Eco. Rev. 2, 456-471 (2010).
12. J. E. Smith and C. Ulu, Op. Res. 60, 262-274 (2012).