Economic and Technology Management Review, Vol. 21(2023): 33 – 49

Five seasons in two years: Profitability, challenges and factors influencing farmer's acceptance in IADA, Barat Laut Selangor

(Lima musim dalam dua tahun: Keuntungan, cabaran dan faktor yang mempengaruhi penerimaan petani di IADA, Barat Laut Selangor)

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Keywords: rice cultivation, profitability, challenges, factors, acceptance

Abstract

Rice is an important crop in agriculture and it is receiving special attention from the government to ensure sufficient food supply for the growing population besides addressing national food security. The new initiative by the government to increase intensity of rice production through the five season cultivation in two years is an effort to increase the sustainability of national rice production. The purpose of this article is to evaluate the level of profitability, challenges and identify factors that influence farmers' acceptance of five season in two years of paddy cultivation. The findings show that there is no significant difference in terms of yield, production costs and gross income of farmers in the program compared to normal practices (four season in two years). The benefits obtained by farmers who plant four seasons in two years are higher than those who plant rice five seasons in two years. The results indicates that it was still not feasible to implement this initiative without further improvement on various technical aspects, particularl in reference to rodent issues and the improvement of yield and suitable mechanisation for soil management which will probably reduce costs/unit for the entire five seasons in two years. About 48.3% of farmers are willing to accept rice cultivation with five seasons in two years if they receive all subsidies for entire seasons. Factors such as yield, the condition of the paddy field and family labour are important in influencing farmers acceptance on the five season in two years of rice cultivation. There is still room for improvement especially to develop a suitable mechanisation such as small tractors for soft land conditions, systematic field management to cope with pest and disease problems and improvement of irrigation infrastructure for better water management.

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Introduction

The socio-economic and political importance, such as poverty eradication, has led rice to be ranked as the most important food crop to ensure the country's food security. Export bans or restrictions imposed by rice-producing countries for example India, can disrupt global rice markets and lead to shortages in importing countries. Now, Malaysia is facing a shortage of rice in the market due to the influence from global rice situation. Impact from this situation, the price of imported rice at markets doubled up and consumers changed their consumption from imported to local rice. Due to that, we are challenged with shortage in local rice.

The contribution of rice to economic growth is about 4.51% of agricultural GDP and RM2.53 billion to national GDP in 2022 (DAN 2.0: 2021 – 2030). The Malaysian Ministry of Agriculture and Food Industries (MAFI), now known as the Ministry of Agriculture and Food Security (KPKM), is targeting a self-sufficiency level (SSL) of 80% rice by 2030 with a rice production requirement of 2.32 million tons (DAN 2.0: 2021 – 2030). To achieve a SSL of 80% by 2030, total productivity must be increased to 5.3 mt/ha in 2030 for increase in paddy production to 3.61 million tons (DAN 2.0: 2021 – 2030).

Malaysia needs to produce an average of about 2.7 million tons of rice every year to meet national requirement (author estimation from DAN 2.0: 2021 – 2030). Therefore, to increase SSL, there are many strategies that could be implemented, such as: 1) expanding the area of rice cultivation, 2) increasing the yield/ha, 3) increasing the intensity of rice cultivation or increasing the frequency of the season per year. The normal practice by farmers are two seasons a year across the entire granary area in Malaysia. Meanwhile, in some cases where water irrigation still depends on rain especially in non-granary areas, rice cultivation was done one season a year. Rice is a high risk crop, yet it plays a crucial role in national food security. The competition for resources such as land, water, labour and infrastructure are steadily increasing. Other initiatives need to be carried out to ensure sovereignty and food security for the country.

Therefore, the government provides various incentives and subsidies to develop the rice and paddy industry. The main purposes are to increase rice production by increasing the yield and efficiency of rice fields, increase farmers' income and welfare, as well as to maintain consumer's welfare through affordable market price for rice (Fatimah et al. 2007). The government intervention in rice industries is in line with the economic transformation program to create a high-income country. The rice industry receives a large subsidy from the government every year to ensure that the sector continues to be sustainable and secured.

Various program have been conducted by the government to increase the paddy productivity such as Smart Sawah (SBB), Mini Estate Paddy, etc. The cultivation of five seasons in two years is one of the effort to increase intensity of paddy cultivation besides boosting national rice production and increasing farmers living standards. The initiative taken by the government is a good move which could assist farmers in generating more income compared to the earlier schedule.

These five seasons in two years program was first implemented at the IADA Barat Laut Selangor (IADA BLS) and was introduced to farmers for increasing crop intensity for rice cultivation. It aims to maximise the use of available resources and optimise rice production for sustainability and resilience in rice and paddy production. The potential cropping intensity can provide support for future food security (Zhongen Niu 2020). Increasing cropping intensity could significantly increase the production of food, fodder and bioenergy crops, which would have a positive impact on the economy and food security (Waha et al. 2020). In addition, this program is expected to increase farmers' income and improve their living standard. Despite the innovation and numerous advantages of cropping intensity, cultivating rice five seasons in two years is also challenging (Peng 2009; Kumar 2021 and Bhattacharya 2022). Therefore, an innovative approach is needed to increase crop yields and promote sustainable agriculture. This approach requires proper irrigation infrastructure, intensive field management and awareness among farmers to implement. In general, the effectiveness of the paddy cultivation program involving five seasons within two years is unknown. Therefore, the study was conducted to assess the level of profitability and challenges towards farmer's acceptance of planting five seasons in two years. Economic evaluation is important to assess whether the five seasons in two years rice cultivation is viable compared to the four seasons in two years cultivation practice. If this cultivation practice proves to be economically viable and technically feasible, the probability of farmers acceptance is high. Furthermore, if the cultivation of rice through the five seasons in two years succeeds in increasing farmers' yields, it will simultaneously boost the country's rice production and rice self sufficiency level (SSL).

Literature review

Until recently, there was a scarcity in literature regarding cultivating rice through five seasons in two years method. Commonly, traditional rice cultivation practices were typically based on one or two main seasons per year. However, innovative approaches such as cultivating rice in multiple seasons within a year may not have been extensively studied or documented in literature previously. However, cropping intensity which refers to the cropping frequency in a given cropland area per year, provides another promising opportunity to boost crop production (Liu 2013) and multiple cropping is an important component of Chinese farming practices, especially in southern China, where intensive cropping has been widely deployed (Xiao 2014). In the past decades, multiple cropping has played an important role in ensuring food security of China (Tang 2003; Zhongen Niu 2020).

A few articles suggests that intensive rice cultivation presents several challenges. Kumar (2021) found that the challenges of intensive rice cultivation in India, including declining productivity, multiple nutrient deficiencies, depleting groundwater, labour shortage and higher production costs. Besides, environmental impact is a major challenge for rice cultivation in India (Bhattacharya 2022). Peng (2009) discusses the challenges of rice production in China, including a decline in arable land, increasing water scarcity, global climate change and labour shortage. Gumma (2014) shows the mapping of seasonal rice cultivation areas in Bangladesh, which can help address the challenges associated with rice cultivation. It's believed that increase in intensity of rice cultivation will face multiple challenges, including environmental, economic and social. Thus, addressing these challenges requires a combination of technological, policy and management intervention.

The potential to increase cropping intensity could be further limited by soil degradation, lack of seeds, fertilisers, infrastructure and incentives support program (Waha et al. 2020). Furthermore, the intensification could significantly boost crop productions with positive economic impact and enhanced food security. Achieving this by increasing the cropping intensity on current cropland could avoid expanding physical cropland yet provide enough food to fulfil the demand of a growing population. In other countries, cultivation intensity was rather stable. For example, double and triple cropping areas in China barely changed from the 2000s to 2013, increasing by 1.37% and +0.48%, respectively (Qiu et al. 2017). Meanwhile, increased cultivation intensity was also associated with a decline in yield of around 25% and appeared to be mainly related to increased weed infestation due to 72% more weed biomass and decreasing soil quality, around 20% less organic C content and N supply in the soil (Becker 2001).

Increasing cultivation intensity could avoid the need to expand farmland into natural ecosystems. However, this land-saving effect is highly controversial and depends on local land conditions and other environmental factors. Aside from the direct environmental damage, these unintended consequences of intensification can threaten the long term productivity and profitability of the cropping system. However, these problems are not specific to sequential cropping systems, but to intensively farmed systems where incentives for excessive use of fertilisers, pesticides and water are high (Waha et al. 2020).

Analysing the factors influencing farmers' acceptance and adoption of new technologies in agricultural production has been studied by many researchers (Zakaria et al. 2020; McCormack et al. 2021; Binh 2022; Sanusi et al. 2022; Anupong 2023; Osman and Cinar 2023). Farmers acceptance towards new farming method or technology are influenced by multiple factors in terms of socio-economic and others. Socio-economic factors such as farmer's age, education, marital status, main occupation, experience, family labour, farm size, yield and land status are common variables that included in estimation model (Zakaria et al. 2020; Binh 2022; Sanusi et al. 2022; Anupong 2023; Osman and Cinar 2023). Other factors like training, services, credit, institutions etc. may probably influence farmers acceptance. These factors can influence farmers acceptance in a positive or negative manner. Education has been positively influencing farmers acceptance and that is shown in researches related to analysis factors (Zakaria et al. 2020; McCormack et al. 2021; Binh 2022; Sanusi et al. 2022; Anupong 2023). Meanwhile, age group shows either positive or negative sign depending on types of technology and respondents. Farmer's experience positively influences farmers acceptance (Zakaria et al. 2020; Sanusi et al. 2022; Anupong 2023). Study by Binh (2022) stated that factors such as gender, education level, family labour, cultivation area, non-agricultural income, agricultural extension services, credit, farm training and economic efficiency from high technology application has a positive impact on adoption on technology by farmers in Ho Chi Minh city. Other factors such as age, profit, risk, costs, complexity of technology, popularity of technology has negative impact on the acceptance.

Commonly, univariate probit/logit models are used by researchers to identify factors influencing adoption of new technologies (Zakaria et al. 2020). Probit regression model, which has been widely used to assess the functional relationship between the probability of adoption and its determining factors, such as education, farm size, resource ownership, and social status (McCormack et al. 2021). The binary econometric models enable a more specific analysis of farmers' adoption of new technology (Zhou et al. 2008; Mariano et al. 2012; Muzari et al. 2012). This type of analysis provides more detailed information on the characteristics of the farmers who tend to adopt a specific technology. The probit regression model is preferred over the others due to its favourable properties, particularly the assumption of normal distribution (Wooldridge 2010). In summary, the probit model is a valuable tool for modeling and analysing binary outcomes by relating them to a set of independent variables. It is particularly useful when we want to understand the factors influencing the probability of a specific event occurring or not occurring.

Methodology

The study used data from the paddy cultivation program, which involved cultivation of five seasons within a two year period, at the Integrated Agricultural Development Area (IADA) Barat Laut

Selangor (IADA BLS) from 2015 to 2017. This study uses a stratified and simple random sampling method where respondents are selected from four irrigation block areas for the program and outside the program. The total of 60 respondents from the program five seasons in two years and 30 respondents from farmers outside the program were selected. Data was collected every season from season 1 to season 5 within the program area. Meanwhile, respondents from normal practices (outside the program which planting four seasons in two years) only involved in last two seasons such as season 4 and 5 for comparison. The reason why only fourth and fifth seasons are chosen because this study was expecting a different cost of production and yield after third season planting in the program compared to outside the program. Data collection from respondents outside the program as a control data for analysis comparison.

Data were collected using a set of structured questionnaires divided into nine sections, namely respondent profile, basic information on rice fields, management of rice fields, production input costs, labour costs, basic information on capital assets, information on weeds, pests and diseases, yield information, perceptions and farmers' acceptance of planting five seasons in two years. Likewise, data collection from respondents outside the program also use a set of structured questionnaires. The data was analysed using the frequency method and descriptive statistics to obtain general information about socio-economic background for both practices. Besides that, benefit cost analysis (BCR) was used to evaluate the profitability of new program or project (Rosnani et al. 2013). The BCR ratio is calculated by dividing the net revenue by the production cost for the program and outside program. If the value of BCR>1, then the program is viable and beneficial to farmers. Further, a t-test analysis was performed to compare the two methods of rice cultivation. Farmer's perception in terms of challenges and level of acceptance toward five seasons in two years also was analysed using descriptives analysis. Further, a probit regression analysis was conducted to identify the factors that influencing farmers willingness to accept rice cultivation for five seasons in two years. All data and method were analysed using the SPSS statistical program.

Model specification

Farmers are expected to make decisions on new technologies or program used typically based on their expected maximum utility (Kimbi et al. (2021). They were willing to accept if the production technologies offer a minimum cost while expecting to attain increased levels of yield, profits and improved their income. Theoretically, adoption studies are generally based on different theories and utility maximisation theories was commonly used (Kimbi et al. (2021). A probit model is a statistical model used for analysing and modeling binary or dichotomous outcomes, where the dependent variable can take one of two possible values, typically coded as 0 and 1. It is widely used in various fields, including economics, social sciences, epidemiology and finance, to examine the factors influencing the likelihood of an event or occurring outcome. The probit model is part of a broader class of models known as Generalized Linear Models (GLMs) and is used specifically when the response variable follows a binomial distribution.

The probit model is based on a latent model which is a non-linear model used to analyse the relationship between the dependent variable and the independent variable. The dependent variable Y is a dichotomous variable with a value of 1 for farmers who are willing to accept 5 seasons in two years rice cultivation and 0 for farmers who are unwilling to accept. While the variable χ is the socio-economic factor that is expected to influence the farmers willingness to accept. The probit model uses the Cumulative Distribution Function (CDF) to describe the equation function as follows:

$$Y = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + ... + \beta_i\chi_I + \epsilon_i$$

Y = Dichotomous dependent variable:

1 = Willings to accept,

0 = Not willing to accept

$\beta 0$ = Intercept

$\beta 1$ = Parameter coefficients

χ_{1-i} = Independent variable

ϵ_i = Standard error

Thus, the probability factors that to influencing farmers to accept the five seasons in two years program is expressed in the form:

$$Y = \beta_0 + \beta_1 (Age) + \beta_2 (Marital\ status) + \beta_3 (Education) + \beta_4 (Main\ occupation) + \beta_5 (Hectarage) + \beta_6 (Experience) + \beta_7 (Yield) + \beta_8 (Family\ Labour) + \beta_9 (Land) + \epsilon_i$$

Results and discussion

Farmers' profile

Majority of respondents were male and malay (*Table 1*). About 65% of farmers received education up to secondary school followed by primary school 23% and 8% are farmers who have graduated at diploma level and above. Similarly, for respondents outside the program planting four seasons in two years, most of them have secondary school education (77%) and 20% have at least primary school level of education. The average age of farmers in the program is 51 years old with the majority of them (33%) being in the age range of 51 to 60 years. While for farmers outside the program the average age is 50 years old with the majority being on the age range of 41 to 50 years old. There are also farmers who are over 60 years old, which makes up to 23%. The average experience of farmers in rice cultivation is 26 years for farmers in the five seasons in two years program and 27 years for farmers outside the program (four seasons in two years). Almost 86% of the farmers outside the program are full-time farmers.

The average hectarage area in the program is 2.1 ha, while average hectarage outside program area is at 2.8 ha (*Figure 1*). Besides that, majority (72%) farmers in program and (33%) outside program have hectarage in the range of 1.1 ha to 3.0 ha. All participants are individual farmers except for one farmer who cultivates rice in groups. Before the five Season dweo Year project started most of the farmers, 70% planted MR 220 CL2 variety known as Clearfield rice. The rest of the farmers planted the variety of MR 263. In season one, the participants were recommended to plant MR 263 variety with transplanting method. However, there are 7 farmers who still grow Clearfield rice. Further, in season two of the project, all farmers planted the Clearfield rice variety MR 220 CL2 until seasons five.

Profitability and cost of production

The costs and returns are calculated by season before (baseline data), season one to season five (internal program) and season four and season five (external program) as a data control for normal practices. Benefit cost analysis (BCR) method was used for evaluating the profitability farmers in program compared to farmers in external program. The BCR ratio is calculated by dividing the net revenue or return by the production cost for the program and external program. If the value of BCR>1, then the program is viable, otherwise if BCR<1 the program is considered a loss. BCR analysis was calculated for direct seeding and transplanting method. *Table 2* shows a summary of the production costs and income of rice farmers using the direct seeding method with government input subsidies. The total gross yield before the project was 6.88 tons/ha. The total cost for ownership farmers who owned the land is RM3,663.69/ha and RM7,097.69/ha for tenants. Farmers' net income is RM4,907.62/ha for owners and RM1,473.62/ha for tenants. The owner's cost benefit ratio (BCR) is 2.34 and the rental is 1.21. Meanwhile, for the cost and income without government input subsidies, the total cost of farmers who own their own

Table 1. Profile of farmers according to cultivation practices

Categories	5 season in 2 years program		4 season in 2 years program	
	No. of farmers	Percentage (%)	No. of farmers	Percentage (%)
Gender				
Male	59	98.3	29	96.7
Female	1	1.7	1	3.3
Total	60	100.0	30	100.0
Race				
Malay	60	100.0	30	100.0
Education level				
Never been to school	2	3.3	1	3.3
Primary school	14	23.3	6	20.0
Secondary school	39	65.0	23	76.7
Diploma/College/Institute/ University	5	8.3	-	-
Total	60	100.0	30	100.0
Age	Average: 51 years		Average: 50 years	
Less and equal to 30 years old	3	5.0	1	3.3
31 – 40 years old	10	16.7	4	13.3
41 – 50 years old	13	21.7	10	33.3
51 – 60 years old	20	33.3	9	30.3
> 60 years old	14	23.3	6	20.0
Total	60	100.0	30	100.0
Experience in paddy farming	Average: 26 years		Average: 27 years	
Main occupation				
Paddy	47	85.5	26	86.7
Others crop	2	3.6	1	3.3
Business	2	3.6	1	3.3
Government sector	2	3.6	1	3.3
Private sector	2	3.6	1	3.3
Total	55	100.0	30	100.0

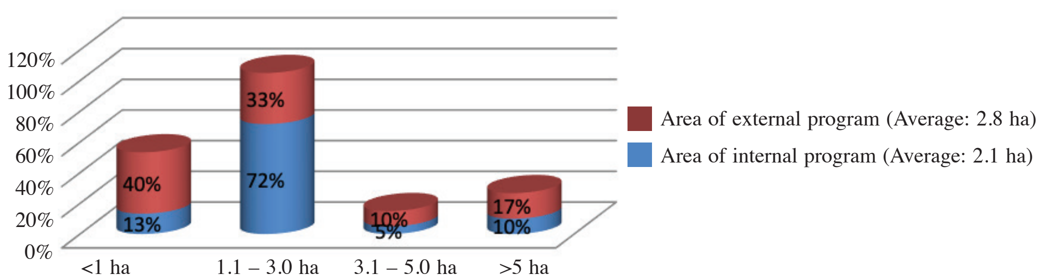

Figure 1. Hectarage of internal program and external program

Table 2. Cost production and income of direct seeding planting method with subsidies

Production cost and income	Baseline data	Five seasons two years (Internal program)					Four season two years (External program)	
		1	2	3	4	5	4	5
Gross yield (ton/ha)	6.88	4.25	3.84	3.89	3.18	4.98	7.36	6.14
Gross income (RM/ha)	8571.31	5293.36	4608.62	4844.77	3955.30	5972.67	8834.67	7370.67
Total cost ownership	3663.69	3443.36	2904.11	4724.74	2594.82	1973.92	2539.18	1696.94
Total cost rental	7097.69	6877.36	6338.11	8174.74	6044.82	5473.92	5989.18	5116.23
Net income ownership	4907.62	1850.00	1704.51	120.03	1360.47	3998.75	6295.48	5673.73
Net income rental	1473.62	(1584.00)	(1729.49)	(3329.97)	(2089.53)	498.75	2845.48	2254.44
BCR ownership	2.34	1.54	1.59	1.03	1.52	3.03	3.48	4.34
BCR rental	1.21	0.77	0.73	0.59	0.65	1.09	1.48	1.44

land is RM5,130.29/ha and RM8,564.29/ha for tenants. The net income of farmers is RM3,441.02/ha for owners and RM7.02/ha for tenants. The owner's cost benefit ratio (BCR) is 1.67 and the tenant's is 1.00.

Season one of rice cultivation in five seasons in two years showed a significant decrease in yield due to haze problems and disease attacks. The total yield obtained in season one is 4.25 tons/ha. The owner's production cost is RM3,443.36/ha, while the tenant's production cost is RM6,877.36/ha. The net income earned by five season program participants is RM1,850.00/ha with a cost benefit ratio of 1.54 for the owner. Meanwhile, for tenants they faced losses due to the high land rent value of RM3,500/ha. In season two the rice yield also experienced a decrease due to a severe rodent attack in the project area. Gross yield in season one was 3.84 tons/ha. The total cost of production for owners is RM2,904.11/ha and RM6,338.11/ha for tenants. The net income earned by the owner is RM1,704.51/ha with a cost benefit ratio of 1.59. While tenants also suffered losses in season two.

Planting season three only involved farmers who participate in the project only planting rice in that season. The gross yield obtained by farmers is 3.89 tons/ha which is a slight increase from season two. The total cost for season three is without government input subsidy which is RM4,724.74/ha for owners and RM8,174.74/ha for tenants. The cost benefit ratio for the owner is 1.03 which means that the farmer only gets a return on the invested capital, while for the farmer who rents the land, he suffers a major loss.

Table 2 also shows the occurrence of a decrease in gross revenue in the fourth season under the five seasons two years project area. However, it was found that the gross yield for the area outside the project was higher at 7.36 tons/ha. The total cost of production for farmers in the project is as much as RM2,594.84/ha and RM6,044.82/ha respectively, for owners and tenants. On the other hand, it was found that the production cost for farmers outside the project was lower which was RM2,539.18/ha for owners and RM5,989.18/ha for tenants. The nett income of farmers in the project is RM1,360.47/ha for owners with BCR 1.52, while land tenants suffered losses.

For farmers outside the project, both owners and tenants' profit with BCR 3.48 and 1.48, respectively.

In season 5, it was found that the yield increased to 4.98 tons/ha for farmers in the project, while for farmers outside the project it was higher at 6.14 tons/ha. The total cost of production for farmers in the project is as much as RM1,973.92/ha and RM5,473.92/ha respectively for owners and tenants. On the other hand, it was found that the production cost for farmers outside the project was lower, which was RM1,696.94/ha for owners and RM5,116.23/ha for tenants. The nett income of farmers in the project is RM3,998.75/ha for owners with BCR 3.03, while the nett income of land tenants is RM498.75/ha with BCR 1.09. On the other hand, farmers outside the project get more profit with BCR 4.34 and 1.44 for owners and tenants**.**

Table 3 below shows a summary of production costs and income for rice cultivation using planting machines. In season three, there were no farmers using transplanting machines for rice cultivation because farmers want to reduce production costs since no input subsidies were given. The analysis found that the production cost for planting using a planting machine is higher than the direct sowing method for each season. The labour cost of planting machines including rice seeds is high which is RM1,200/lot or RM1,000.00/ha. This situation causes farmers to earn a lower income compared to the direct sowing method. For farmers who own their own land, they get profit for each planting season where the BCR is above 1. However, the BCR value is lower for farmers in the five season two year program compared to the four season two year program.

Table 3. Production cost and income for transplanting method with subsidies

Production cost and income	Baseline data	Five seasons two years (Internal program)				Four season two years (External program)	
		1	2	4	5	4	5
Gross yield (ton/ha)	6.88	4.25	3.84	3.18	4.98	7.36	6.14
Gross income (RM/ha)	8571.31	5293.36	4608.62	3955.30	5972.67	8834.67	7370.67
Total cost ownership	3953.73	4185.94	3555.11	3377.00	2813.62	3526.05	2484.21
Total cost rental	7387.73	7619.94	6989.11	-	6015.73	7574.20	6027.93
Net income ownership	4617.57	1107.42	1053.51	1754.42	3935.75	6282.48	4886.46
Net income rental	1183.57	(2326.58)	(2380.49)	(1682.58)	498.75	2845.48	1342.74
CBR ownership	2.17	1.26	1.30	1.17	2.12	2.51	2.97
CBR rental	1.16	0.69	0.66	-	0.99	1.17	1.22

Comparison between five seasons in two year and four season in two year planting

Comparative analysis was performed using the t-test method comparing averages for the selected variables. *Tables 4* and *5* show the results of the t-test performed on rice yield, production costs, gross income and interest. The results of the analysis show that only the benefit variable have a significant value at α<5%, where there is a significant variance difference between the two practices. The benefits obtained by farmers planting four seasons in two years are higher than those who planted rice five seasons in two years. This situation will reduce the confidence of farmers to cultivate five seasons of rice within two years. Meanwhile, the variables of yield, production cost and income are not significant. This means that the variance is the same between four seasons and five seasons planting over a two year period. There needs to be improvement in rice cultivation for five seasons in two years, especially in terms of increased yield and benefits for farmers so that this method would be accepted by farmers.

Table 4. *t*-test analysis of mean comparisons between five season and four season plantings over a period of two years

	Planting method	N	Mean	Standard deviation	Standard error mean
Yield (ton/ha)	Four seasons in two years	30	13.50	2.973	.542
	Five seasons in two years	59	10.00	2.488	.323
Production cost (RM/ha)	Four seasons in two years	30	6943.60	2686.901	490.558
	Five seasons in two years	59	8019.08	2681.510	349.102
Gross income (RM/ha)	Four seasons in two years	30	16788.42	3737.432	682.358
	Five seasons in two years	59	12017.10	3027.496	394.146
Benefit (RM/ha)	Four seasons in two years	30	9844.81	4997.885	912.484
	Five seasons in two years	59	4390.65	3515.104	457.627

Farmers' perception of the five seasons in two years rice cultivation program

Farmers perception towards paddy cultivation in five seasons in two years is a good initiative where, about (39%) agreed that the five seasons in two years rice cultivation could increase their income with systematic management. However, advanced technology in terms of mechanisation is crucial for managing rice fields more effectively and efficiently. *Figure 2* shows that technology in mechanisation is needed by farmers. Among the mechanisations that farmers need is a pesticide spraying machine like drone or UAV (64%) and a smaller machine (18%) to overcome the problem of soft soil caused by intensive cultivation. Another machine needed by farmers are suitable planting machines and land levelling with laser machines.

Besides that, about 36% stated that higher quality seed technology is crucial, resistant varieties and a short maturity period (*Figure 3*). Water is one important factor in rice cultivation in high yield. So, a successful of five seasons in two years strongly depending on proper irrigation infrastructure in rice field. From this study, farmers stated that irrigation infrastructure needs to be improved, better water management and frequent monitoring by the Department of Irrigation and Drainage for maintenance. Farmers view this program as new and requires special attention and monitoring by expert officers.

The finding also shows that there are many problems and challenges that

Table 5. *t*-test analysis

Variables		Levene's test for equality of variances		t-test for equality of means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Standard error difference
Yield	Equal variances assumed	.241	.625	5.873	87	.000	3.502	.596
	Equal variances not assumed			5.541	50.151	.000	3.502	.632
Cost	Equal variances assumed	.532	.468	-1.787	87	.077	-1075.478	601.698
	Equal variances not assumed			-1.786	58.331	.079	-1075.478	602.096
Income	Equal variances assumed	.593	.443	6.485	87	.000	4771.318	735.780
	Equal variances not assumed			6.055	48.860	.000	4771.318	788.013
Benefit	Equal variances assumed	4.219	.043	5.976	87	.000	5454.166	912.610
	Equal variances not assumed			5.343	44.030	.000	5454.166	1020.809

excalated during rice cultivation in five seasons in two years program (*Figure 4*). Among the main problems are rodent attacks (30%) and disease problems (24%) especially at the third season, only this special program has an additional cultivation. Rodent attack is a huge problem and became uncontrolled in third season because of the different rice planting schedule. This problem caused farmers big losses in their yield and further affected their incomes. Therefore, the importance of a systematic field management such as regular pest and disease control to reduce the occurrence of attacks and manage the rice yield. Besides that, weather conditions, land levelling and short land rest (19%) also reduced the rice yield. The usage of planting machines and machinery regularly for five seasons without rest caused land to become soft and damaged. This problem led to significant losses for farmers, resulting in reduced yields and additional costs.

The level of farmers' acceptance of rice cultivation five seasons in two years

The findings show that 48.3% of farmers were willing to accept rice cultivation for five seasons in two years with subsidies and 51.7% stated otherwise (*Figure 5*). Among the farmers who are willing to accept, the majority expressed their willingness to accept if the implementation of this project is done properly and on a bigger scale, which involves all farmers in the area. This is to prevent the occurrence of disease and pest attacks in the third season because it is concentrated in the cultivation area.

The findings show that farmers are willing to accept this program if it increases their income, reduce pest problems, improves their living standards and are even willing to try it even if the yield declines. There are also farmers who agree if additional subsidies are given for pest management. Majority of farmers are not willing to accept without subsidies given in third season where major outbreaks occur. However, about 48.3% of farmers

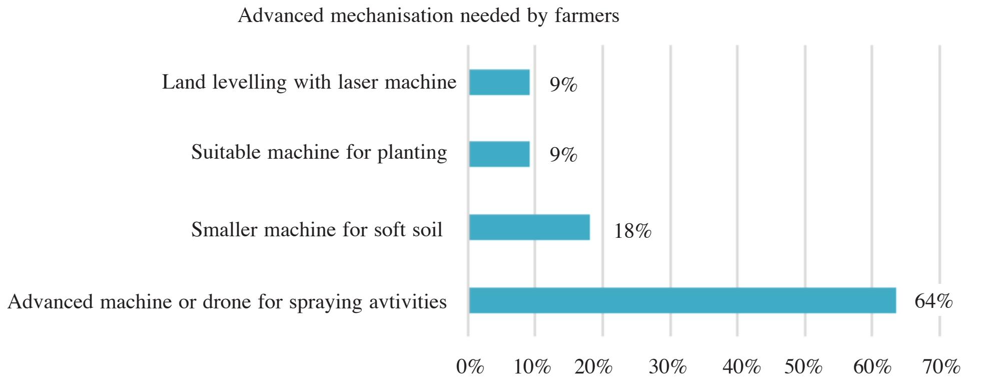

Figure 2. Advanced technology in mechanisation needed by farmers

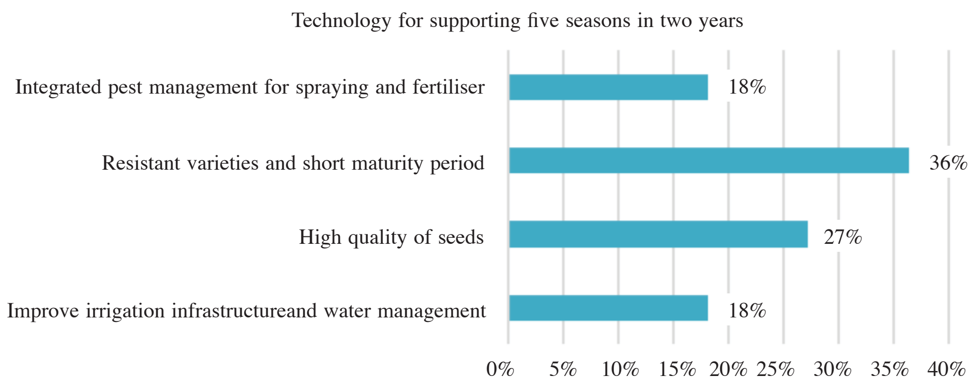

Figure 3. Technology to support five seasons in two years

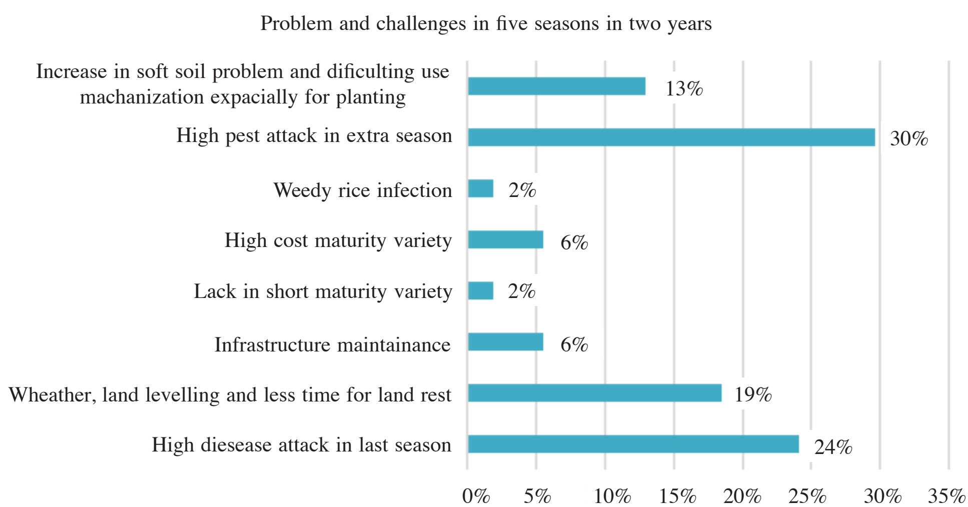

Figure 4. Problems and challenges in rice planting five seasons in two years

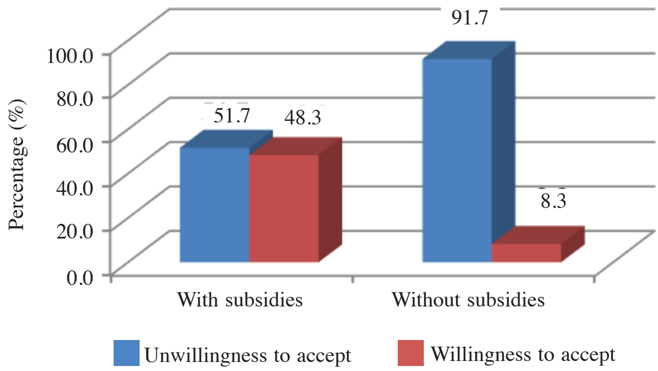

Figure 5. *Farmers' acceptance of rice cultivation five seasons in two years with and without subsidies*

are willing to accept rice cultivation for five seasons in two years with subsidies given by government for all seasons. Consequently, the government would be burdened with providing additional subsidies for all seasons. If there is no input subsidy in season three, rice yield should increase so that farmers will not suffer losses due to high production costs. Here, the importance of pests and diseases management is prevalent so that no attack occurs that will ultimately affect the rice yield.

Most of the farmers who are not willing to accept the five season in two years rice cultivation due to decrease in yield, pest related problems, reduced income and risk on soil damage. Others gave reasons for unsatisfactory results, high disease problems, lack of monitoring from related agencies, water issues, soil does not dry enough in short season, poor quality of subsidised seeds, not enough time for rice straw burning, higher costs of production, a lot of weedy rice, uncoordinated cultivation gives rise to pest and diseases, subsidies are limited for four seasons only. However, a few farmers agreed to cultivate rice for five seasons in two years without a subsidy for one additional season. They stated that the subsidy obtained in season one to four was enough to be used in season five. In addition, farmers used the balance fertilisers from the previous season and most of them are the land owners.

Probit regression analysis

Besides obtaining farmers' perspectives on rice cultivation for five seasons within two years, the study also conducted a probit analysis to identify socio-economic factors that influences farmers' acceptance of rice cultivation for five seasons in two years among the 60 respondents interviewed. As described in the methodology, variable Y is the level of acceptance of farmers where a value of 1 represents a farmer who is willing to accept and a value of 0 represents a farmer who is not willing to accept. The probit model was analysed using nine independent variables that influence farmers willing to accept as described as in *Table 6* below.

Table 7 presents the estimated parameters for the willingness to accept of five seasons in two years by farmers. The result for the probit regression shows that the model is significant at 1% level based on chi-square test. The value of Negelkerke R^2 of the model is 0.321, with 69.5% of the responses predicted correctly. The results in *Table 7* shows that the factors of yield and land are positively and significantly at (α = 1%) influencing farmers acceptance. Yield is important factors that would be attractive to farmers in a new program. Therefore, based on the results, higher yield will increase the willingness to accept by farmers to practices rice cultivation in five seasons of two years by farmers. Increasing

Table 6. Independent variables in probit model

Independent variables	Categories and explanation
χ_1 = Age	Continuous variable (Farmer's age)
χ_2 = Marriage status	Dummy variable where: 1 = Married, 0 = Single
χ_3 = Education	Dummy variables where: 1 = Education SPM, 0 = Others
χ_4 = Main occupation	Dummy variable: 1= Full time, 0 = Part time
χ_5 = Hectarage	Continuous variable (Total farmer's field in hectare)
χ_6 = Experience	Continuous variable (Years of farmer's in rice farming)
χ_7 = Yield	Continuous variable (Total yield in metric tons)
χ_8 = Family labour	Continuous variable (No. of family involve in rice farming)
χ_9 = Land	Dummy variable where: 1 = Suitable land, 0 = Not suitable

Table 7. Factors that influence farmers willingness to accept of rice cultivation in five seasons two years with subsidy

Parameters	Estimated coefficients	Standard error	Z value
Age	–.012	.012	–1.024
Marriage status	–.197	.283	–.696
Education	–.177	.236	–.749
Main occupation	.093	.156	.600
Hectarage	–.092	.085	–1.082
Experience	.018	.013	1.384
Yield	.052**	.017	3.049
Family labour	–.596*	.317	–1.881
Land	.477**	.196	2.434
Intercept	–2.398	.817	–2.937

**Significant at α = 1% dan * Significant at α = 10%
Chi-square test = $p < 0.01$.
Log-likelihood = –65.53
Negelkerke R^2 = 0.321
Pearson Goodness-of-Fit Test Chi^2 = 246.929 prob <0.00
Correctly predited percent = 69.5%

rice yield in five seasons comparing with four seasons would be directly increasing in farmers income.

The land showed a statistically significant and positive relationship with farmer's acceptance. That means, farmers who have a more suitable land, stands a higher chance to accept the five seasons cultivation in two years. This is because, compact land is important to make sure application of mechanisation especially for ploughing and harvesting.

Meanwhile, family labour was negatively and showed significance at (α = 10%) influencing farmers acceptance. This result shows that the increasing number of family labour involved in rice cultivation will reduce the level of acceptance of farmers to plant rice for five seasons in two years. This result is different from findings from a study by Binh (2022) where they found that family labour was positively impact on the ability of farmers to adopt production technology. Other variables like age, marital status, education, main occupation, hectarage and experience are not significant.

Conclusion

The five seasons two years rice planting program is a pilot project implemented in IADA BLS in Selangor. This initiative intends to increase domestic rice supply as well as improving farmers income and to ensure a sufficient, affordable, and stable supply of rice. However, the findings of the project were not promising to be implemented due diseases problems, soft soil condition which hamper planting, ploughing, and harvesting activities. Farmers also highlighted that the needs of the advanced technology on high seeds quality, short maturity and resistant varieties, small mechanization, and proper irrigation infrastructure to support rice cultivation in five seasons in two years. Thus, for the government to implement five seasons paddy farming in two years the above the issues must be overcome and the right strategies and direction need to be underlines and the proven rice check system and Standard Operating Procedures (SOP) must be developed.

References

Anupong, W. (2023). Factors Influencing Farmers' Decisions on Highland Paddy Rice Planting in Chiangmai Province. *Journal of Namibian Studies, 33 S2*(2023): 4382–4396 ISSN: 2197-5523 (online).

KPKM, (2021). Dasar Agromakan Negara (DAN 2.0, 2021 – 2030), Kementerian Pertanian dan Keterjaminan Makanan (KPKM).

Becker, W.E. & Waldman, D. (1987). The Probit model.

Becker, M. & Johnson, D.E. (2001). Cropping intensity effects on upland rice yield and sustainability in West Africa. *Nutrient Cycling in Agroecosystems, 59,* 107–117.

Bhattacharya, U. (2022). Rice Cultivation in India – Challenges and Environmental Effects. NALM.

Binh, N. D. (2022). Factors affecting the application of high technology in agriculture production of farmers in Ho Chi Minh City, Vietnam. International Journal of Health Sciences, 6(S1), 52-63. https://doi.org/10.53730/ijhs.v6nS1.4756

Fatimah, M. A., Nik Mustapha, R. A., Bisant Kaur. & Amin Mahir, A. 2007. *50 years of Malaysian Agriculture: Transformational issues, challenges and direction*. Serdang: Universiti Putra Malaysia Press.

Gumma, M. K., Thenkabail, P. S., Maunahan, A. A., Islam, S. & Nelson, A. (2014). Mapping seasonal rice cropland extent and area in the high cropping intensity environment of Bangladesh using MODIS 500 m data for the year 2010.

Kimbi, T. G., Akpo, E., Kongola, E., Ojiewo, C. O. Vermooy, R., Muricho, G. Ringo, J. Lukurugu, G. A., Varshney, R. & Tabo, R. (2021). A Probit Analysis of Determinants of Adoption of Improved Sorghum Technologies Among Farmers in Tanzania. *Journal of Agricultural Science, Vol.13*, (1) 2021

Kumar, N., Chhokar, R. S., Meena, R. P., Kharub, A. S., Gill, S. C., Tripathi, S. C., Gupta, O. P., Mangrauthia, S. K., Sundaram, R. M., Sawant, C. P., Gupta, A., Naorem, A., Kumar, M. & Singh, G. P. (2021). Challenges and opportunities in productivity and sustainability of rice cultivation system: a critical review in Indian perspective. *Cereal Research Communications, 50*, 573–601

Mariano, M. J., Villamo, R. & Fleming, E. (2012). Factors Influencing Farmer's adoption of Modern Rice Technologies and Good Management Practices in the Philippines. *Agricultural System. Volume 110*, 41–53

McCormack, M., Buckley, C. & Kelly, E. (2021). Using a Technology Acceptance Model to Investigate what Factors Influence Farmers' Adoption of a Nutrient Management Plan. *Irish Journal of Agricultural and Food Research IJAFR, 60*(1), 142–151 DOI: 10.15212/ijafr-2020-0134

Muzari, W., Gatsi, W. & Muvhunzi, S. (2012). The impacts of technology adoption on smallholder agricultural productivity in sub-Saharan Africa: A review. *Journal of Sustainable Development, 5*(8), 69

Osman, P. & Cinar, G. (2023). Technology Acceptance among Farmers: Examples of Agricultural Unmanned Aerial Vehicles. *Agronomy, 13*, 2077. https://doi.org/10.3390/agronomy13082077

Peng, S., Tang, Q. & Zou, Y. (2009). Current Status and Challenges of Rice Production in China. *Plant Production Science, 12*, 3–8

Qiu, B., Lu, D., Tang, Z., Song, D., Zeng, Y., Wang, Z., Chen, C., Chen, N., Huang, H. & Xu, W. 2017. Mapping cropping intensity trends in China during 1982–2013. *Appl. Geogr*. https://doi.org/10.1016/j.apgeog.2017.01.001

Qiu, J., Tang, H., Frolking, S., Boles, S., Li, C., Xiao, X., Liu, J., Zhuang, Y. & Qin, X. 2003. Mapping single-, double-, and triple-crop agriculture in China at 0.5 × 0.5 by combining county-scale census data with a remote sensing-derived land cover map. *Geocarto Int. 18*, 3–13

Rosnani, H., Tapsir, S. & Azmi, M. (2013). Penilaian Ekonomi Sistem Pengeluaran Clearfield. *Economic and Technology Management Review, Vol.8*, 47–57

Sanusi, S. O., Alabi, O. O. & Ebukiba, E. S. (2022). Analysis on Resource Use Efficiency of Smallholder's Rice Production Farmers in Federal Capital Territory of Nigeria. Probit Model Approach. *Agrotech-Food Science, Technology and Environment Vol.1* No.1, 1–9

Sun, X., Lyu, J. & Ge, C. (2022). Knowledge and Farmers' Adoption of Green Production Technologies: An Empirical Study on IPM Adoption Intention in Major Indica-Rice-Producing Areas in the Anhui Province of China. *Int. J. Environ. Res. Public Health*, 19, 14292. https://doi.org/10.3390/ijerph192114292

Taherdoost, H. (2018). A review of technology acceptance and adoption models and theories. *Procedia Manufacturing, 22*, 960–967

Waha, K, Dietrich, Jan P., Portmann, Felix T., Siebert, Stefan., Thornton, Philip K., Bondeau, A. & Herrero, M. 2020. Multiple Cropping Systems of the World. v1. CSIRO. Data Collection. https://doi.org/10.25919/5f1f7bb3270bb.

Walcott, J. J., Chauviroj, M., Chinchest, A., Choticheuy, P., Ferraris, R. & Norman, B. (1977). Long-term Productivity of Intensive Rice Cropping Systems on the Central Plain of Thailand. *Experimental Agriculture*, 13, 305–315

Wooldridge, J. M (2010). Econometric Analysis of Cross Section and Panel Data, second edition.

Wu, W.B., Yu, Q.Y., You, L. Z. Chen, K. Tang, H. J. & Liu, J. G. 2018. Global cropping intensity gaps: Increasing food production without cropland expansion. *Land Use Policy*, 76, 515–525

Yan, H. M., Xiao, X. M., Huang, H. Q., Liu, J. Y., Chen, J. Q. & Bai, X. H. 2014 Multiple cropping intensity in China derived from agro-meteorological observations and MODIS data. *Chin. Geogr. Sci*. 24, 205–219

Zhou, P. & Ang, B. W. 2008. Indicators for assessing sustainability performance. *In Handbook of performing engineering*, edited by K.B. Misra. London: Springer

Zhongen, N., Huimin, Y. & Fang, L. (2020). Decreasing Cropping Intensity Dominated the Negative Trend of Cropland Productivity in Southern China in 2000-2015. *Sustainability, 12*. 10070; doi:10.3390/su122310070.

Zakaria, A., Alhassan, S. I. & Kuwornu, J. K. M. 2020. Factors Influencing the Adoption of Climate-Smart Agricultural Technologies Among Rice Farmers in Northern Ghana. *Earth Syst Environ 4*, 257–271. https://doi.org/10.1007/s41748-020-00146-w

Abstrak

Padi merupakan tanaman penting dalam pertanian dan diberi perhatian khusus oleh kerajaan sebagai keperluan makanan asas bagi memastikan bekalan dan keselamatan makanan negara terjaga. Oleh itu, program inisiatif baharu kerajaan untuk meningkatkan intensiti penanaman padi seperti penanaman lima musim dalam tempoh dua tahun adalah usaha untuk meningkatkan kelestarian pengeluaran padi negara. Tujuan artikel ini adalah untuk menilai tahap keuntungan dan cabaran penanaman padi lima musim dan mengenal pasti faktor-faktor yang mempengaruhi penerimaan petani program penanaman padi lima musin dalam dua tahun. Dapatan kajian menunjukkan tidak terdapat perbezaan yang signifikan dari segi hasil, kos pengeluaran dan pendapatan kasar petani dalam program berbanding amalan biasa (empat musim dua tahun). Faedah yang diperolehi oleh petani yang menanam empat musim dua tahun adalah lebih tinggi berbanding mereka yang menanam padi lima musim dua tahun. Terdapat masalah dan cabaran yang dihadapi oleh petani dalam program seperti serangan perosak dan penyakit didapati telah menyebabkan pengurangan hasil semasa program. Kira-kira 48.3% petani sanggup menerima penanaman padi lima musim dalam tempoh dua tahun jika mereka masih menerima semua subsidi selama lima musim. Faktor-faktor seperti hasil, keadaan tanah sawah dan tenaga kerja keluarga adalah penting dalam mempengaruhi petani menerima penanaman padi lima musim dua tahun. Oleh itu, program penanaman padi lima musim dalam dua tahun ini masih memerlukan ruang penambahbaikan dari segi keperluan benih berkualiti, varieti padi singkat masa dan rintang terhadap penyakit, mekanisasi yang sesuai dan infrastruktur pengairan yang sempurna bagi pengurusan sawah padi yang sistematik. Oleh itu, masalah yang wujud dapat diminimumkan bagi memastikan hasil padi meningkat. Hal ini bagi memastikan peningkatan pendapatan petani dan seterusnya meningkatkan taraf hidup mereka.