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ASSESSING IMPACTS OF EARLY RICE PLANTING ON RICE FARMING HOUSEHOLDS' WELFARE IN THE MEKONG RIVER DELTA, VIETNAM

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ABSTRACT

The study was conducted to assess the impacts of adjusted crop calendar (specifically, early planting) during the Winter-Spring 2019-2020 season on the rice farming households' welfare in the Mekong River Delta. Survey data came from 412 rice farmers who were early planters (treatment group) and 764 rice farmers who were non-early planters (control group). These rice farmers came from three provinces (5 districts and 15 communes) in Mekong River Delta: Kien Giang (1 district, 3 communes, Long An (1 district, 3 communes) and Soc Trang (3 districts, 9 communes). Data were collected in September to October 2020. Early planting happens when rice planting for the Winter-Spring 2019-2020 (W-S) season was moved on or before 15 November 2019 and it was the last cropping of the farmer. Basically, the early planters and the non-early planters differ in the number of rice cropping they practiced. Practicing double rice cropping allowed most of the early planters to adjust their cropping schedule during the year 2019-2020, identified as the latest year with worst salinity problem. The results of Propensity Score Matching show that early rice planting increased rice farming income by about VND 22.80 million to VND 24.60 million per farmer or VND 8.62 million to VND 8.77 million per hectare during the W-S season; increased annual rice farming income by about VND 13.7 million to VND 17.1 million per farmer or VND 3.2 million to VND 4.27 million per hectare; increased volume of rice production by about 5.29 to 5.67 tons/farmer or 2.51 to 2.59 tons/ha during the Winter-Spring 2019-2020 season; and increased rice production loss avoided by about 3.88 to 4.14 tons/farmer or 2.33 to 2.62 tons/ha. During salinity years, adjusting rice cropping calendar, specifically early planting as a mitigation strategy can help avert production losses and can increase rice production and income of rice farmers.

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1.0 INTRODUCTION

1.1 Background

Vietnam is one of the largest rice exporters in the world (Maitah et al 2020). The majority of rice production in the country (General Statistics Office of Vietnam, 2019) and about 90% of the country's rice exports come from the Mekong River Delta (Yen et al 2019ab). The low-lying Mekong River Delta (MRD) has been facing some of the worst impacts of climate change in years (Kontgis et al 2019; Chi, Dao, & Kyncl 2017). Flooding, drought, and saltwater intrusion have been threatening agricultural production, which extends to livelihood, and food and nutrition security. In years 2015-2016, severe drought and saltwater intrusion affected 11 of the 13 provinces in the MRD, including 400,000 hectares of cropland (25,900 hectares were left fallow), and 224,552 hectares rice areas by mid-April 2016 (CCAFS-SEA 2016) or equivalent to reduction of rice production by 700,000 tons and affected 339,000 hectares of the Winter-Spring rice cultivation area (21.8% of the total area in the MRD) (Yen et al 2019a).

A number of interventions have been introduced or proposed (Pham et al 2020; Nhung et al 2019; Yen et al 2019a; Chi, Dao, & Kyncl 2017; Can 2015) to respond to salinity and drought problems in the MRD. In 2017, the Department of Crop Production (DCP) has collaborated with the Climate Change, Agriculture and Food Security (CCAFS) to apply Climate-Smart Maps and Adaptation Plans (CS-MAP) in MRD (Yen et al 2019a). The CS-MAP is a participatory approach for mapping climate risks and adaptive interventions to recognize climate-related risks, identify potentially affected areas and develop regional and provincial adaptation plans for rice production.

In 2018, an official directive from the Vice Minister of the Ministry of Agriculture and Rural Development (MARD) led to the application of the CS-MAP in adjusting rice planting calendar during the Winter-Spring season in order to avoid salinity intrusion brought by the 2019 El Niño. Specifically, coastal areas in the MDR, including Long An, Kien Giang, Soc Trang, Ben Tre, Tien Giang, Bac Lieu, and Tra Vinh provinces were directed to plant from early October to early November in 2019. Although the cropping schedule adjustment aimed to cover more than 600,000 hectares, the area planted early during the Winter-Spring 2019 – 2020 season in the

MRD stood at about 429,491 hectares, which is 86.1% higher than the area planted early during the Winter-Spring 2017 – 2018 season (230.804 hectares) (MARD 2019). The use of the CS-MAP has served as guide for MARD and for the farmers to adjust the rice cropping calendar.

To contribute to a better understanding of the role of adjusted cropping calendar in rice production in MDR, an assessment is proposed that will focus on the impact of early planting to rice production and welfare of the rice farmers. The aim is to contribute to information to relevant authorities in making rational decisions related to rice production planning and management, that influence livelihood, food and nutrition security in the area.

1.2 Objectives

This study assessed the impacts of adjusted crop calendar (specifically, early planting) during the Winter-Spring 2019-2020 season on the rice farming households' welfare in the Mekong River Delta. Specifically, the study will:

1) assessed the economic status of the rice farming households;
2) examined the farmers' perceived impacts of early planting on rice farming;
3) determined the financial costs and returns of rice farming;
4) examined the quantitative effects of early planting on rice farming income, nonfarm income, volume of rice production, and production losses mitigated; and
5) to provide policy recommendations concerning early planting as a response to drought and saltwater intrusion in the farming areas.

1.3 Scope and Limitation

The study covered three of the 13 provinces in Mekong River Delta, namely: Long An, Kien Giang, and Soc Trang. The survey was conducted in September to mid-October 2020 when the field team was already allowed to conducted interviews following the necessary health protocols under the pandemic. The survey covered mostly the rice farming period in 2019-2020 of farmers who planted before or after 15 November 2019 for their last cropping. The interviews relied on recall method and conducted only with farmers who voluntarily joined the survey.

2.0 RICE FARMING IN MEKONG RIVER DELTA

2.1 The Mekong River Delta

The Mekong River Delta (MRD) is an agro-ecological region covering 13 provinces in the south of Vietnam (Figure 1). The MRD covers an area of about 39,000 km^2 and roughly forms a triangle West of Ho Chi Minh City (Saigon). It stretches from My Tho City in the East, Chau Doc City and the town of Ha Tien in the Northwest, and Ca Mau province at the southernmost tip of Vietnam, including Phu Quoc Island. It has a flat terrain with an extremely low mean elevation of ~0.8 m above sea level, dramatically lower than the earlier assumed ~2.6 m (Minderhoud et al 2019). Population in MDR (as of 2019) stood at 21.49 million or about 25% of the national population.

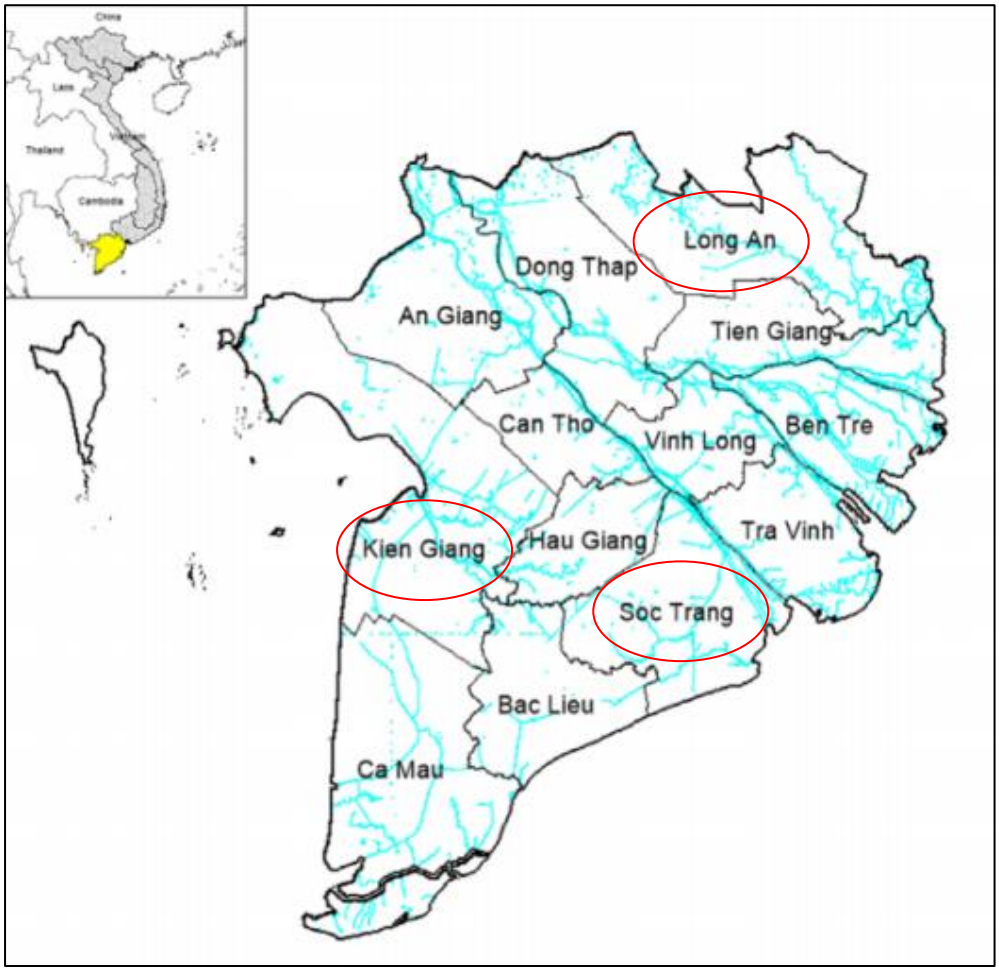

Figure 1. Location of Mekong River Delta, Vietnam indicating the provinces covered in the study

2.2 Importance of MRD as a rice production area

The MRD is a rice producing area of world importance. Known as "Vietnam's Rice Bowl", the MRD has the majority of paddy area planted to rice and yields half of national rice production (GSO 2018), and contributes to 90% of the country's rice exports (Yen et al 2019ab). One of the main reasons for the predominance of rice in agricultural production in Vietnam, particularly in MRD, is the government's policies prohibiting rice paddy farmers from diversifying their livelihood (Kontgis et al 2019) and the government controlling nearly all aspect of rice production to meet export goals (Bong et al 2018, Van Ha et al 2015).

The preservation of rice land and the promotion of rice farming in Vietnam are contained in Decree No. 42/2012/ND-CP[1] enacted in 2012, and was replaced in 2015 by Decree No. 35/2015/ND-CP[2]. Aside from limiting the use wet-rice farming land for non-agricultural purposes, the decree also provide subsidies to farmers such as the annual VND 500,000 per ha directly to produce rice.

2.3 Climate Change Impacts in Mekong River Delta

Rice production in MRD, particularly in coastal provinces, has been strongly affected by saltwater intrusion, especially during the Winter-Spring season (Yen et al 2019b, Tivet & Boulakia 2017, Kotera et al 2008). During the 2015-2016 Winter-Spring season, MDR suffered great losses from saltwater intrusion when rice paddy production decreased by 11.2% compared to the Winter-Spring season in the 2014 – 2015 crop year (GSO 2016). The problem is likely to continue in the future. It was projected that sea level in 2050 will be between 25 cm and 30 cm higher than the 2000 values and will likely cause a salinity greater than 4g/l to intrude up to 50-60 km into the river and affecting approximately 30,000 hectares of agriculture area (Vu, Yamada, and Ishidaira 2018).

One of the adaptation and mitigation measures to salinity problem was to adjust the existing systems by use of stress-avoiding tactics (Bong et al 2018): changing of cropping system and adjusting planting and/or sowing dates. Such is the case of applying CS-MAP that the DCP and CCAFS have developed with the local stakeholders in MDR (Yen et al 2019a). In 2018, MARD released a directive on the application of the CS-MAP in adjusting the rice planting calendar during the Winter-

[1] https://vanbanphapluat.co/decree-no-42-2012-nd-cp-on-management-and-use-of-rice-farming-land
[2] https://vanbanphapluat.co/decree-no-35-2015-nd-cp-management-and-use-of-paddy-land

Spring season of 2019-2020. The risks maps are guides for developing climate change adaptation plans for rice production.

In 2019, saltwater intrusion in the Mekong Delta was predicted to come earlier and with higher level of salinity than that recorded in the 2015-2016 dry season. It was reported, however, that the damage to farming areas was less serious because of measures introduced and farmers took measures to cope with the situation.[3] The use of CS-MAP helped in avoiding the recurrence of major rice production loss in 2016.[4] It saved more than 200,000 hectares affected by salinity intrusion and more than one million tons of rice loss. It was reported that MDR had a record output of about 7.3 million tons of rice in the Winter-Spring crop 2019-2020.[5]

2.4 Rice Cropping System and Changes in Cropping Calendar

Farmers in MRD are practicing either double (Summer-Autumn and Winter-Spring) or triple rice cropping (Summer-Autumn, Autumn-Winter, and Winter-Spring). In a regular year, the Winter-Spring rice season is from November to February, Summer-Autumn rice season is from April to July, and Autumn-Winter rice season is from August to November.

Farmers practicing double cropping can easily adjust their planting calendar, particularly for the Winter-Spring season to plant earlier than usual when environmental conditions such as drought that intensifies salt water intrusion, necessities it. In the Winter-Spring 2019-2020 season, there were farmers who started sowing in October or earlier.

On the other hand, the farmers practicing three cropping annually have difficulty in adjusting crop calendar due to a tighter schedule. However, farmers practicing three cropping mentioned that in a year drought is expected, they sow about 10-15 days earlier compared to their schedule in a normal year (Nguyen 2020). For example, in the 2019-2020 Winter-Spring season, farmers in Long An sowed beginning rather than middle to the end of December. In Soc Trang, the farmers who usually sow during middle to end of January, started planting from end of December 2019 to beginning of January 2020.

[3]https://reliefweb.int/report/viet-nam/s-c-tr-ng-islet-farmers-beat-saltwater-intrusion-drought-storing-water
[4]https://cgspace.cgiar.org/bitstream/handle/10568/106303/10%20Vietnam%20rice.pdf
[5]https://www.vir.com.vn/mekong-delta-enjoys-bumper-rice-crop-75558.html?fbclid=IwAR0K6KEjuJVY8oHln44SBohzZhbkM3HzA4jbng-xfDm1jpAjAaZyJ694PBE

The DCP issued an official document directing the adjustment of planting calendar in the Winter-Spring 2019-2020 season (Official Document No. 1252/TT-VPNN). The planting calendar was a result of coordination among relevant units in MARD, including DCP, Plant Protection Department (PPD) and Directorate of Water Resources (DWR). The planting calendar in the Winter-Spring 2019-2020 season in the MRD is as follows:

- *Early planting*: 1 to 30 October 2019 in provinces affected by salinity in the southern coastal areas to include Long An, Ben Tre, Tien Giang, Tra Vinh, Soc Trang, Bac Lieu and Kien Giang; achieving about 400 thousand hectares, accounting for 25% of total planted area in the winter - spring season.
- *Officially planting*: 1 to 30 November 2019 at the upstream, middle and coastal areas of MRD, achieving approximately 700 thousand hectares, accounting for 42% of total planted area.
- *Late planting*: 1 to 30 December 2019 at the upstream, middle and coastal areas. Planted area is going to plan on achieving at about 400 thousand, accounting for 25% of total planted area in the winter - spring season, decreasing by 120 thousand hectares in comparison with the same period in last year. Some late planting area in the winter - spring season will finish planting before 10 January 2020.

At the local level, the local offices of DCP, PPD, and DWR collaborate to adjust the seasonal calendar issued by DCP to suit local conditions, particularly forecast of saltwater intrusion and water availability. The Provincial People's Committee issues the official document directing district and commune levels to take appropriate actions. At the commune level, the recommended information on planting calendar is provided to farmers through commune loudspeakers or through farmers' training course on rice farming practices at the beginning, the middle and the end of season.

3.0 METHODOLOGY

3.1 Study Site

The three provinces in the Mekong River Delta (MRD) covered by the study were selected through a process: 1) identifying salinity-intrusion-risk provinces; 2) ranking of salinity-intrusion-risk provinces based on their contribution to rice production in the MRD; and 3) identifying provinces to have areas that were planted early during the Winter-Spring 2019-2020 season. The three provinces that emerged from the process were Kien Giang, Long An, and Soc Trang.

The MRD salinity intrusion risk map (Figure 2) identified eight provinces perceived to have high risk areas for salinity intrusion. These are Long An, Ben Tre, Tra Vinh, Kien Giang, Hau Giang, Soc Trang, Bac Lieu and Ca Mau.

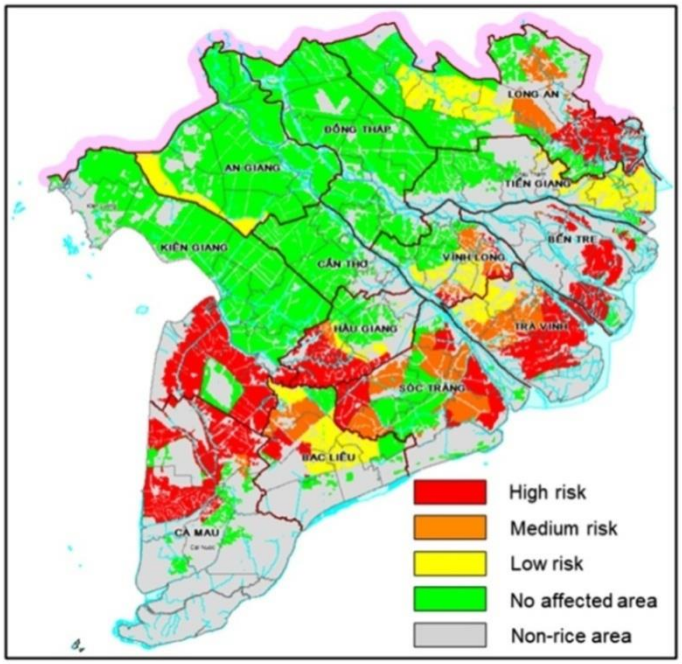

Figure 2. CS-MAP Salinity intrusion risk in the 13 provincial DARDs (Source: Son, Yen and Sebastian, 2018)

Among these eight perceived salinity-risk provinces, in 2018, Kien Giang was the biggest rice planting province and producer in the MRD, accounting for 17.7% of total area of rice paddy planted (4,107,400 ha) and 17.4% of total rice production (24,441,900 tons). This was followed by Long An (12.5% and 11.5%, respectively), and Soc Trang (8.6% and 8.8%, respectively)(GSO 2018).

The three provinces were among the seven provinces in the southern coastal region advised by DCP to plant early. During the Winter-Spring 2019-2020 season, the combined area planted earlier than usual in the three provinces was half of the total area of 429,491 hectares planted in MRD (MARD, 2020). Soc Trang accounted for 22.6%, followed by Kien Giang (16.4%). and Long An (13.9%). Moreover, the

combined number of farming households in the three provinces was one-third of the total number of farming households (1,138,995) in MRD (GSO 2016). Kien Giang accounted for 12.2%, followed by Long An (11.2 %), and Soc Trang (8.5%).

3.2 Study Participants and Sampling

The target sample size of the study for the treatment group was 384[6]. Belonging to the treatment group were the farmers who planted earlier than usual during the Winter-Spring 2019-2020 season or before 15 November 2019 for their last cropping (hereafter early planters). The farmers who did not plant earlier than 15 November 2019 for their last cropping (hereafter non-early planters) belonged to the control group. To ensure higher number of matched samples, the number of control group (i.e., non-early planters) was targeted to be 768 or twice of 384. This made the target total number of study participants at 1,152.

Data requested and collected from DCP and DARD during the pilot testing of the interview schedule were used in sampling at different levels. The three provinces of Kien Giang, Soc Trang and Long An, five districts, and 15 communes were selected. Kien Giang and Long An province had one district each and Soc Trang had three districts. In every district, three communes were selected.

The selection of the districts per province was based on data of area planted before and after 15 November 2019 and the ratio of salinity affected area to total salinity area in the province. This resulted to the selection of districts in a province that: (i) were heavily damaged by salinity relative to others (in terms of proportion of affected area to total area), and (ii) had farmers that changed cropping calendar. Conversely, districts, even where they have farmers that have planted by 15 November 2019, were not chosen if records show that the farmers have been regularly planting before 15 November in recent years (i.e., 2016 to 2018).

The choice of the commune per district was based on top communes affected by salinity. Sampling distribution per commune was based on the proportion of

[6]The sample size of 384 using a formula with unknown population (i.e., unknown population of early planters) and 95% level of confidence. The same number comes out if the existing population of 362,833 (General Statistics Office, 2016) of total number of rice farming households in the three provinces is used.

salinity affected area to total salinity affected area of the chosen communes in the district.

At the commune level, the sampling households were chosen through a two-stage sampling strategy. The first stage was to divide the households in study area into two groups, namely (i) early planters and (ii) non-early planters households. The second stage involved simple random selection of householders from each group. The list of the surveyed households was drawn up by the researchers and data collecting team. The number of householders surveyed per commune is shown in Table 3.1. The survey yielded more study participants than targeted: 412 early planters and 764 non-early planters.

Table 3.1. Total Number of Farming Households Covered by the Survey

No.	Province	District	Commune	Salinity area (ha)	Early planters	Non-early planters	All
1	Kien Giang			6,989	154	266	420
	1.1	U Minh Thuong		2,622.3	154	266	420
			Thanh Yen	602.4	38	65	103
			Vinh Hoa	745.1	48	72	120
			Hoa Chanh	1,274.8	68	129	197
2	Long An			4,877	93	188	281
	2.1	Thu Thua		1,120	93	188	281
			Tan Thanh	398	28	70	98
			My Lac	352	32	61	93
			Binh An	370	33	57	90
3	Soc Trang			8,062	165	310	475
	3.1	Ke Sach		1,672.3	44	114	158
			Ke Sach town	502.0	16	30	46
			Thoi An Hoi	619.5	14	62	76
			Tan My	550.8	14	22	36
	3.2	Long Phu		3,127.0	97	183	280
			Truong Khanh	1,329.1	39	82	121
			Long Duc	679.8	24	40	64
			Tan Hung	1,118.1	34	61	95
	3.3	Tran De		350.0	24	13	37
			Lich Hoi Thuong	80.0	4	5	9
			Lieu Tu	70.0	10	0	10
			Tai Van	200.0	10	8	18
	Total				412	764	1176

3.3 Data Source

3.2.1 Data Collection Methods

A cross sectional survey was conducted among the early planters and non-early planters. The Focus group discussions (FGD) and key informant interviews were

conducted to supplement the data from the survey. The key informant interviews were conducted with heads of the agriculture offices, where secondary data were secured to be used for sampling. The FGD was conducted to generate information that was used in drafting the interview schedule. Representative of DARDs and local communities participated in the FGD. These FGD were held as a forum for participants to discuss (i) their opinions about cropping calendar, planting practices and the impacts of climate change on agriculture activities; (ii) the level of public awareness and perception about the impacts of salinity and early planting practice; (iii) the strategy to cope with salinity and water shortage; and, (v) the overall nature of the socio-economic characteristics of households in the targeted districts and wards.

3.2.2 Data Collection Instrument

The data collection instruments were the interview schedule for the survey, the FGD guide, interview guide for the key informant interviews, and the consent forms. These were originally written in English and then translated to Vietnamese. The interview schedule was mostly composed of closed questions and covered the basic profile of the farmer and the household, profile of farm and farming activities, production, sales, and costs, perception of water salinity and early planting, among others.

Following best practice, a draft of the interview schedule was pilot-tested with 25 households in Long Phu district, Soc Trang province. The issues that were examined in the course of the pilot-testing included: (i) clarity of the questions; (ii) appropriateness of questions and of the possible alternatives presented; (iii) difficulty in answering questions and the probability of a large number of unanswered questions; and (iv) length of interview. In general, the participants to the pilot testing did not find it difficult to answer the questions. The interview schedule was revised and finalized to address the concerns raised by the pilot testing participants. It was also an opportunity for the research team to gain experience in working with farming households, and to find the best strategy of approaching them for the interview.

A team of trained data collectors conducted the survey. The field team was composed of three researchers from Hanoi and 15 people from Can Tho University. The DCP assigned a point person to whom the field team coordinated. In each province, prior to the survey, a meeting with DARD participated by DCP at the provincial level, Division of Crop at the district level, and communes' leaders was

conducted. Such coordination and collaboration was essential to ensure organized entry into the commune, especially in the time of the COVID-19 pandemic.

3.4 Data Analysis

3.4.1 Early planting

In Vietnam, early planting strictly following the DCP calendar is planting within the period of 1 and 30 October during the Winter-Spring season, the season most affected by drought and salinity. Nguyen (2020) found that the farmers, especially those practicing double cropping, in Long An, Kien Giang, and Soc Trang have their own definition of "early planting" that extends start of planting to mid-November. In regular years (i.e., with no drought and high salinity), farmers start planting in middle to late December for the Winter-Spring season. In this study, early planting happens when planting for the Winter-Spring season 2019-2020 started by 15 November 2019 and indicated by the farmer as their last cropping. This means that even if the farmer planted before 15 November 2019 but indicated to have another cropping starting second half of November to February 2020, then the farmer was considered a non-early planter for Winter-Spring 2019-2020 season.

3.4.2 Outcome Indicators

The impact of early planting was measured using indicators of farming household's welfare, production, and mitigated losses.

Economic Welfare

The main indicators of farming household's economic welfare were rice farming income (i.e., financial profit) and nonfarm household income. In the case of MDR, it is expected that agricultural income will largely be composed of income from rice. If ever they have crops, it was found that the level of diversity of non-rice crops did not contribute significantly to increased household income (Dung et al 2018). It was only recently that there are realizations to promote other cash crops (Ferrer & Bernardo 2020). An earlier World Bank (2016) report identified that the two main components of household income in MDR are rice income (41%) and off/non-farm income (39%). A recent study showed that household net income in

four agro-ecological zones in Mekong River Delta, although sourced from diverse economic activities, is composed largely (85%) by income from rice farming activities (Le et al. 2018). Net household income was positively correlated with farm size, land use circle (i.e., number of crops in a field), and non-farm activities (Dung et al 2018). The main reason for the dominance of rice income in agricultural income is the government policies that prohibit farmers in MRD from diversifying their crops or livelihood opportunities (Kontgis et al. 2019) to preserve MRD as a major rice producing area to meet export goals.

Rice farming income for the Winter-Spring 2019-2020 season is the financial profit from rice farming for the season. It was calculated by deducting costs (operating costs) from revenue (price x quantity sold) during the season. The calculations were on a per hectare and per farmer bases.

Moreover, the annual rice income was also calculated to verify if early planting also impacts on income on an annual basis given there are other rice cropping seasons (Summer-Autumn and Autumn Winter). The calculations were on a per hectare and per farmer bases.

On the other hand, non-farm income sources of working family members were identified and income derived was measured at the household level. The non-farm household income of early planters was compared with the non-farm income of their matched non-early planters.

Production

The impact of early planting on the volume of rice production during the Winter-Spring 2019-2020 season was measured by comparing the volume of production between matched early planters and non-early planters. The calculation was on per hectare and per farmer bases. It is likely that production of early planters will be higher than the production of their matched non-early planters.

Mitigation

Earlier theories by Lipton (1968) and Scott (1976) have identified farmers as risk-averse agents. This means they will not pursue profit maximization if it means facing higher risks, but rather they will seek to minimize losses by avoiding risks. The study by Sattler and Nagel (2010) directly pointed out that risk is the most important factor affecting decision-making of German farmers. On the other hand, farmers were

also found to be risk averse, which means avoiding losses is preferred over acquiring equivalent gains. More loss-averse farmers in China were found to be more likely to adapt climate change adaptation strategies such as improved irrigation, access to credit, and increase rotation (Jin et al 2020).

Production loss avoided by the rice farmer was measured to check on early planting as a mitigation strategy. The production loss avoided is the difference between "potential" and "actual" production losses. The potential production loss of the farmer is the difference between the production level of the farmer without early planting during an ENSO year when salinity-intrusion intensifies and the production level during the most recent regular year (with no drought and salinity problems). This can approximated by the difference in the farmer's volume of production during the Winter-Spring season in a most recent regular year of 2014- 2015 and during a salinity-intrusion year of 2015-2016 (ENSO year) when early planting was not yet officially introduced. The actual loss of the farmer is the difference in the farmer's volume of production during Winter-Spring in a regular year (2014- 2015) and in salinity-intrusion year of 2019-2020 (ENSO year). The losses avoided were expressed in tons per hectare and tons per farmer. Formally, this can be expressed as:

$$\text{Production Losses Avoided} = \text{Potential Loss} - \text{Actual Loss}$$

Where

$$\text{Potential Loss} = \text{Yield}_{W\text{-}S\ 2014\text{-}2015} - \text{Yield}_{W\text{-}S\ 2015\text{-}2016}$$
$$\text{Actual Loss} = \text{Yield}_{W\text{-}S\ 2014\text{-}2015} - \text{Yield}_{W\text{-}S\ 2019\text{-}2020}$$

Although the Winter-Spring season 2014-2015 was five years ago and the Winter-Spring season 2015-2016 was four years ago, the likelihood of recall of production levels during these periods is high given these were the most recent regular farming year (2014-2015) and the ENSO year (2015 – 2016) when drought and salinity were worst in MRD causing severe production damage. It is likely that the early planters have lower losses than those who did not plant early during the Winter-Spring 2019-2020 season. Propensity Score Matching was used to find a significant difference in the production losses avoided by the matched early and non-early planting farmers.

3.4.3 Measuring Impact of Early Planting

Propensity Score Matching (PSM) was used to assess the effects of early planting on rice farming income, nonfarm income, volume of production, and production losses avoided. This is the best impact assessment design given the limiting circumstances.

Although Difference-in-Difference is the best design to use, the information requirements pose a problem. There is no baseline data available for rice farmer income during a drought year without intervention (i.e, the 2015-2016). Making the farmer recall their rice farming and nonfarm income data in 2015-2016 can be too difficult, imposing too much on their memory, and the data collected can be highly unreliable.

Moreover, the use of spatial discontinuity was also considered. However, it requires a continuous assignment variable and the cut-off point that will be basis for grouping of farmers. However, there is no available reliable data like actual salinity level of farm areas (Figure 2 shows areas by perceived level of risk of being affected by salinity and not on actual salinity level). Distance to shoreline of the farm can be a good variable. However, this will have ethical issues related to data privacy and may be sensitive in the cultural context of MRD. Given these limitations, PSM was identified as the next best design -- it will compare the outcome indicators for farmers who did early planting with their matched farmers who did not adopt early planting during the Winter-Spring 2019-2020 Season.

In PSM, the early planters (treatment group) were matched with non-early planters (control group). Outcomes (rice farming income, nonfarm income, volume of production, and production losses avoided) were compared. In PSM, it is better to have the observation in the control group to be more than the cases in the treatment group to find better match. In the study, early planters were 412, while the non-early planters were 764.

The logit model was estimated with type of farmer (a binary variable that assumes the value of 1 if the farmer is an early planter and 0 otherwise) as the dependent variable (Table 3.2). Eight independent variables were used ranging from personal characteristics of the farmer (age, educational attainment, membership in organization), to household variables (number of household members with work – male, number of household members with work –female, owns a flat screen tv), and farming information (size of farm, location of farm). Propensity Score Matching

covering four matching methods (Nearest Neighbor, Kernel, Radius, and Stratification) was used in analyzing the impacts of early planting on the welfare of the farming households. Table 3.2 shows the definition of the outcome and matching variables to be used in the PSM.

Table 3.2. Variables Used in Propensity Score Matching Analysis

Variable Category	Definition
Dependent variable	
Early planter	• 1 if the farmer started planting by November 15 during the Winter-Spring 2019-2020 season, 0 otherwise.
Outcome Variables	
Rice farming income	• Estimated financial profit from rice farming during the Winter-Spring 2019-2020 season (per farmer, per hectare) • Estimated annual financial profit from rice farming (per farmer, per hectare)
Nonfarm income	• Estimated income from nonfarm income sources by all members of the household with income source
Volume of production	• Estimated volume of production during the Winter-Spring Season (in tons/farmer and tons/ha)
Production losses avoided	• Difference between production potential loss and actual loss (in tons/farmer and tons/ha)
Matching Variables	
Age	• Age in years of the farmer as of last birthday
Educational Attainment	• Number of years in school
Membership in organization	• if the farmer is a member of a community-based organization, 0 otherwise
Labor force –Male	• Number of male household members in working age (15–60 years old)
Labor force –Female	• Number of female household members in working age (15–55 years old)
Flat screen TV	• 1 if the household of the farmer owns a flat screen TV, 0 otherwise
Size of the rice farm	• Size in hectares of the rice farm cultivated during the Winter-Spring Season 2019-2020
Type of land	• 1 if farm is located in irrigated lowland area, 0 otherwise

4.0 RESULTS

4.1 Profile of the Study Participants

4.1.2 Basic Characteristics of the Study Participants

Rice farming in MRD was dominated by men (78%) and the women comprising only 22% (Table 4.1). The men-early planters were slightly higher in proportion than the men-non-early planters (80% vs. 77%). Almost all were married (92%). On average, the study participants were in their early 50s. The age range was wide (21 to 85 years old) and most of them were over 45 years old (72%). This result points to rice farming as becoming less attractive livelihood for younger people. This is a concern for the future of rice farming in MDR.

Table 4.1 Profile of the farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Sex						
male	327	79.37	590	77.23	917	77.98
female	85	20.63	174	22.77	259	22.02
Age						
mean	53.21		52.70		52.88	
24 below	2	0.49	0	0.00	2	0.17
25 to 35	32	7.77	58	7.59	90	7.65
36 to 45	75	18.20	163	21.34	238	20.24
46 to 55	115	27.91	227	29.71	342	29.08
56 to 60	79	19.17	95	12.43	174	14.80
Beyond 60	109	26.46	221	28.93	330	28.06
Civil status*		402		760		
married	372	92.54	693	91.18	1,065	91.65
single	21	5.22	27	3.55	48	4.13
widow/er	9	2.24	35	4.61	44	3.79
others	0	0.00	5	0.66	5	0.43
Educational attainment						
No schooling	30	7.28	46	6.02	76	6.46
primary school	123	29.85	281	36.78	404	34.35
Junior high school	159	37.59	292	38.22	451	38.35
High school	85	20.63	132	17.28	217	18.45
University/college/vocational	15	3.64	13	1.70	28	2.38
No. of years in school (mean)	6.86		6.44		6.59	

Note:* 402 early planters and 760 non-early planters

The study participants finished, on average, seven years formal education in school, with the early planters staying a little longer in school (6.86 years vs. 6.44 years). More than the majority (59%) reached or finished, at the minimum, junior high school education.

4.1.2 Basic Household Information

The households of the study participants had, on average, four members. Conversely, 85% of the households had three minimum members (Table 4.2). Nine in every 10 households had men and women in the labor force. On the other hand, only half of the households had dependents (51%). As shown, the households of the early planters and the non-early planters had similar basic characteristics.

Table 4.2 Household information of farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Household size						
Mean	4.32		4.36		4.34	
1-2	61	14.81	85	11.13	146	14.97
3-5	267	64.81	506	66.23	773	65.73
6 and more	84	20.39	173	22.64	257	21.85
Have men aged 15-60	369	89.56	702	91.88	1071	91.07
No. of men aged 15-60 years old in the household						
Mean	1.59		1.59		1.59	
0	43	10.44	62	8.12	105	8.93
1-2	314	76.21	606	79.32	920	78.23
3 and more	55	13.35	96	12.57	151	12.84
Have women aged 15-55	374	90.78	685	89.66	1059	90.05
No. of women aged15-55 years old in the household						
Mean	1.57		1.49		1.52	
0	38	9.22	79	10.34	117	9.95
1-2	309	75.00	593	50.43	902	76.70
3 and more	65	15.78	92	12.04	157	13.35
Have children aged 14 years old and below	204	49.51	393	51.44	597	50.77
No. of children aged 14 years old and below living in the household						
Mean	0.77		0.81		0.79	
0	208	50.49	371	48.56	579	49.23
1-2	186	45.14	367	48.03	553	47.02
3 and more	18	4.37	26	3.66	44	3.74

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4.1.3 Farming Experience

Years in farming varied widely among the study participants (Table 4.3). The age when they started farming ranged between the young age of 7 years old and as late as 55 years old, or a mean age of 19 years old. Those who started young were apprentice of their parents who were also farmers.

One in every 10 farmers had stopped farming for about four years. Most of them who temporarily stopped farming found another work, including joining the military (78%). They eventually returned to farming, which reflects the importance of farming as a livelihood to them.

Table 4.3 Farming experience of the farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Age start farming activities (mean)	18.72		18.64		18.67	
Has stopped farming	52	12.62	82	10.7	134	11.39
Number of years stopped farming (mean)	51 3.72		64 4.44		115 4.12	
For another job	40	80.00	51	77.27	91	78.45
Usual source information on farming						
TV	258	62.62	485	63.48	743	63.18
Government technician	248	60.19	408	53.40	656	55.78
Fellow farmer	107	25.97	237	31.02	344	29.25
Village information center	114	27.67	199	26.05	313	26.62
Radio	66	16.02	136	17.80	202	17.18
SMS	3	0.73	6	0.79	9	0.77
Internet	8	1.94	13	1.70	21	1.79
Others	33	8.01	55	7.20	88	7.48
Member of a community-based organization	211	51.21	342	44.76	553	47.02
Has attended farming training/ demonstrations in the past three years	251	60.92	423	55.37	674	57.31
Pest control	207	50.24	335	43.85	542	46.09
Salt tolerant variety	146	35.44	201	26.31	347	29.51
Climate change	69	16.75	114	14.92	183	15.56
Water management	63	15.29	106	13.87	169	14.37
others	64	15.53	111	14.53	175	14.88

The popular sources of farming information were the television (63%), government technician (56%), fellow farmer (29%), and the village information center (27%). Radio turned out to be not popular (17%), and more so the internet (2%). This indicated that farmers preferred closer and personal sources of information like the government technician, fellow farmers, and the village information center.

Television and radio as sources of information can be understood when results in Section 4.2.2 are considered. It showed that 77% of the farmers owned a TV while only 13% owned a radio. On the other hand, 69% of the farmers owned smart phone, and 44% had internet connection but only a few relied on the internet for farming information. This indicates that use of ICT tool such as mobile smart phones still has a long way to go.

Overall, 47% of the farmers were members of a community organization. By type of study participant, there were proportionately more early planters (51%) than non-early planters (45%) who were members of community organization. Membership in a community organization can facilitate the fast exchange of information (e.g., climate, agricultural materials supply, technical training, market, financial assistance, etc), and also social support.

In the past three years, the majority indicated that they have received farming training or demonstration (57%). Among those who attended these farming capacity building interventions, 46% indicated that the topic were on pest control, 30% on salt-tolerant variety, and 16% on climate change. A higher proportion of early planters than non-early planters had received capacity building intervention (60% vs. 55%), and also in all the topics mentioned.

4.1.4 Farm Characteristics

The farms were typically small with mean area of 2.10 hectares. The area devoted to rice farming was slightly smaller at 1.99 hectares per farmer (Table 4.4). As expected, most of the farms (78%) only had rice, while 21% combined rice farming with another crop (e.g., vegetable, fruits, or shrimp). Most of these lands (95%) were also surrounded by rice lands. These reflect the fact that MRD is basically a rice production area and that diversification of crops is not common. The size of the total farm and rice farm (2.14 ha and 2.02 ha, respectively) of the early planters were almost similar as the non-early planters (2.08 ha and 1.96 ha, respectively.

Table 4.4 Characteristics of farms by the farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Total farm area (in ha)	2.14		2.08		2.10	
Total rice farm area (in ha)	2.02		1.96		1.99	
Number of crops						
1 (rice only)	329	79.85	591	77.36	920	78.23
2	80	19.42	169	22.12	249	21.17
≥3	3	0.73	4	0.52	7	0.60
Ricelands surround the farm	393	95.39	734	96.07	1,127	95.83
Ownership status of the farm						
Own all	320	77.67	573	75.00	893	75.94
Partially own	68	16.50	130	17. 02	198	16.84
Fully renting	11	2.67	32	4.19	43	3.66
Partially renting	68	16.50	130	17.02	198	16.84
Distance of farm land to home (in km)	0.92		1.08		1.03	
Location of the farm						
In irrigated lowland	58	14.08	111	14.53	169	14.37
Non-irrigated lowland	138	33.50	260	34.03	398	33.84
Terraced upland	142	34.47	253	33.12	395	33.59
Others	58	14.08	94	12.30	152	12.93
No answer	16	3.88	46	6.02	62	5.27
Nearest water body to the farm						
River	317	76.94	501	65.58	818	69.56
Others water bodies	80	19.42	222	29.06	302	25.68
None	0	0.00	5	0.65	5	0.43
No answer	15	3.64	36	4.71	51	4.34
Distance of the farm to the nearest water body in km*	0.22		0.33		0.29	
With nearby salinity control structures to the farm						
With	256	62.14	400	52.36	656	55.78
None	134	32.52	302	39.53	436	37.07
No answer	22	5.34	62	8.12	84	7.14

*early planter= 373, non-early planter=701, all = 1074

Three-fourths of these farms were fully-owned (76%), while 17% were partially owned or partially rented, and a few (4%) were fully rented. On average, the farms were within a kilometer from where the study participants lived. In terms of location, 14% of the farms were in irrigated lowlands, 34% in non-irrigated lowlands, 34% in terraced uplands, while 18% were either in other type of location or did not identify location.

Almost all farms were identified to be near a water body, with the river being identified by 70% of the study participants. The average distance of the farms to the nearest water body was 0.29 km, with the early planter farms nearer compared to the farms of non-early planters (0.22 km vs. 0.33 km). The majority (56%) of the study participants indicated that there are nearby salinity control measures (e.g., dikes, sluice gates, river barriers). A higher proportion of early planters than non-early planters indicated their farms were nearby salinity control measures (62% vs. 52%).

4.2 Economic Status

4.2.1 Household Income

There mean total household income of early planters were (VND 105.67 million) higher than the non-early planters (VND 83.31 million) (Table 4.5). It was clear that rice farming was the highest source of household income, which was sharing at least 57% of total household income. The mean rice income of non-early planters was slightly higher than of the early rice planters. This can be attributed to the fact that most of the non-early planters were three-rice croppers while the early planters were two-rice croppers (Section 4.4.1). Once source of the big difference is the income during their cropping for the Winter-Spring season, where the early planters received VND 27.96 millions while the non-early planters received VND 5.05 million.

Non-farming income came second to rice farming, which was 29% among the early planters and 34% among non-early planters. Other farming income shared 10% and remittances shared much less (1%).

Table 4.5. Household income by the farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412		Non-early rice planters n=764		ALL N=1,176	
	Amount	%	Amount	%	Amount	%
Total Annual Income (VND)	105,969,493.02	100.00	83,314,030.74	100.00	91,251,148.48	100.00
Rice Farming	62,106, 281.85	58.61	46,328, 365.81	55.61	51,856 ,003.07	56.83
Other Farming	11,017, 475.73	10.40	7,416 ,623.04	8.90	8,678, 146.26	9.51
Non-Farming	30,833, 599.51	29.10	27,946, 921.47	33.54	28,958, 240.65	31.73
Remittances	1,975, 728.16	1.86	1,622, 120.42	1.95	1,746, 003.40	1.91
Winter-Spring Rice Farming Income (VND)	27,955, 290.30	26.38	5,049, 807.88	6.06	13,074, 517.71	14.33

Most of the households had other members earning income (91%). On average, a household had two members who are earning income (Table 4.6). There were other farming income sources (e.g., cattle raising, coconut farming, shrimp culture, fruits, vegetables), off- farm livelihood (hired labor, government jobs, small-scale business, private sector jobs), and remittances. Their share to household income, however, were less than 10% except for cattle raising (15%) and being a hired labor (35%).

Table 4.6. Income other than rice farming by the farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412		Non-early riceplanters n=764		All (N=1176_	
	No.	%	No.	%	No.	%
Has houseold members with income sources	385	94.45	678	88.74	1063	90.39
Number of household members with income sources (mean)	2.21		2.14		2.16	
Other farming activities						
Cattle raising	67	16.26	109	14.27	176	14.97
Coconut farming	12	7.04	49	6.41	61	5.19
Shrimp culture	10	2.43	4	0.52	14	1.19
Fruits	26	6.31	56	7.33	82	6.97
Vegetables	7	1.70	35	4.58	42	3.57
Off farm livelihood						
Hired labor	131	31.80	276	36.13	407	34.61
Government jobs	43	10.44	63	8.25	106	9.01
Small-scale business	29	7.04	44	5.76	73	6.21
Private sector jobs	21	5.10	47	6.15	68	5.78
Remittances	15	3.64	52	6.81	67	5.70

4.2.2 Material Lifestyle Indicators

The house of almost all households had electricity (98%) (Table 4.7). Three-fourths had flat screen television (77%), 60% had smart phone, 44% had internet connection, while only 13% had radio. This can explain why radio was indicated as a source of information by only a few farmers. However, despite a higher proportion of farmers having smart phone and internet connection, few indicated their phones and the internet as sources of information.

Table 4.7. Material lifestyle indicators of the farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412		Non-early rice planters n=764		All N=1176	
	No.	%	No.	%	No.	%
House has electricity	400	97.09	757	99.21	1157	98.38
Owns flat screen tv	319	77.43	584	76.74	903	76.79
Owns smart phone	284	68.93	531	69.78	815	69.30
Has internet connection	189	45.87	324	42.41	513	43.62
Owns radio	61	15.10	96	12.90	157	13.35

4.3 Experience with Salinity and Perception of Early Planting

4.3.1 Salinity Problem

Almost all of the study participants recognized salinity as a problem in their farm (98%) (Table 4.8). In the last decade, the years 2016 (i.e. WS 2015-2016) (26%) and 2019 (i.e., WS 2019-2020) (59%) were identified as the years when salinity was a serious problem. Although salinity was experienced in all seasons, it was identified as mainly a Winter-Spring season problem (84%). This was particularly true among non-early planters (93%) than among the early planters (68%).

Table 4.8. Salinity is a problem faced by farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Salinity is a problem in the farm	398	96.60	752	98.82	1,150	98.04
Years the farm experienced the worst salinity in 2010-2011 to 2019 -2020 (Winter-Spring)						
2010-2011	3	0.75	-	-	3	0.26
2013-2014	-	-	2	0.27	2	0.17
2014-2015	6	1.51	12	1.60	18	1.57
2015-2016	123	30.90	181	24.07	304	26.43
2016-2017	2	0.50	4	0.53	6	0.52
2018-2019	4	1.00	7	0.93	11	0.96
2019-2020	260	65.32	546	72.61	806	70.08
Salinity as a main problem during						
Winter-Spring	280	67.96	708	92.67	988	84.01
Summer - Autum	61[1]	15.06	82[2]	10.78	143[3]	12.26
Autumn-Spring	15[4]	12.61	40[5]	5.92	55[6]	6.92
During the WS 2019-2020 season, expected to have a problem with water salinity	220	53.40	402	52.83	622	53.03

[1] n= 405, [2]n=761, [3]N= 1,166; [4]n=119, [5]n=676, [6]N= 795

Using the scale of 1 to 10, the study participants rated the extent of severity (maximum of 10) by which their farming will be affected if salinity intrusion intensifies (Table 4.9). The mean score was 7.46 indicates that they will be severely affected, particularly the non-early planters (7.84) than the early planters (6.72).

To the study participants, the speed of return to farming (1 is very slow and 10 is soonest) after damage from salinity intrusion could be slow as indicated by the mean score they gave (4.18), with the non-early planters score (4.02) lower than the early planters (4.48)

On the other hand, as indicated by the mean score they provided (3.50), the study participants indicated that they cannot just alter or move to another farming system if there are changes in the production system. This indicates the rigidity present in the production system. This could also be a reflection of their focus on rice farming, which is actually covered by .

Table 4.9 Extent of salinity problem faced by farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412	Non-early planter n=764	All N=1176
Extent the farming system is affected if salinity intrusion intensifies (on a scale of 1 – 10, where 1 is very little and 10 is very much severity)	n=396 (96.12) 6.72	n=743 (97.25) 7.84	N=1139 (96.85) 7.46
In the case of salinity damage, what is the speed to which the farmer re-engage in the farming system (on a scale of 1 – 10, where 1 is very slow and 10 is very much soon)	n=387 4.48	n=726 4.02	N=1113 4.18
Expected water salinity problem during the WS 2019-2020 season	220 (53.40)	402 (52.83)	622 (53.03)
Certainty of problem of water salinity (on a scale of 1 – 10, where 1 is not sure and 10 is very sure	n=212 7.94	n=401 7.57	N=613 7.70
Expectation of the severity of the water salinity problem (on a scale of 1 – 10, where 1 is very little severity and 10 as very much severity)	n=219 7.16	n=399 7.17	N=618 7.56
Extent the farmer can alter/convert farming system to another system if the conditions for production change (on a scale of 1 – 10, where 1 is cannot alter and 10 can change entirely)	n=378 (91.75 3.49	n=714 (93.45) 3.51	N=1092 (92.87) 3.50

Note: n per item is the number of study participants who provided answer out of 412 early planters and 764 non-early planters or 1176 total number of participants. Numbers in ( ) are %s

More than the majority of the study participants expected that water salinity will be a problem during the Winter-Spring season 2019-2020. Those who expected it, were sure that it will be a problem as shown by the high score (with 10 as very sure) they gave (7.70), especially the early planters (7.94) more than the non-early planters (7.57). The salinity problem was expected to be severe (with 10 as very much severity) by early planters (7.16) and non-early planters (7.17).

The main sources of information regarding salinity were their own observation (61%), from the news (51%), and the government agricultural technician (28%) (Table 4.10). The proportion who sourced information from these sources were higher among the non-early planters (66%, 55%, 25%, respectively) than the early planters (53%, 44%, 33%, respectively).

Table 4.10 . Source of information on salinity by farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Own observation	116	52.73	265	65.92	381	61.25
From news	96	43.64	220	54.73	316	50.80
From government agric technician	72	32.73	101	25.12	173	27.81
From fellow farmer	29	13.18	37	9.20	66	10.61
Others	35	15.91	39	9.70	74	11.90

Aside from early planting, which is presented in a section below, there were other measures cited by the farmers that they have adopted to cope or adapt to salinity problem (4.11). These included the use of salt-tolerant varieties (41%), use of alternate wetting and drying (17%), use of short-cycle varieties (15%), practice rainwater harvesting (11%), and the use of organic fertilizer or own farmyard. There were those who cited that they do nothing (12%) and those that did not answer.

Table 4.11. Adaptation strategies employed to cope with salinity problems other than early planting by farmers

	Early planter n=412		Non-early planter n=764		All N=1176	
Use salt-tolerant varieties	166	41.71	303	40.29	469	40.78
Use alternate wetting and drying method	71	17.84	128	17.02	199	17.30
Use short-cycle rice varieties	55	13.82	120	15.96	175	15.22
Do nothing (Can't do anything) to adapt with salinity problems	49	12.31	84	11.17	133	11.57
Practice rainwater harvesting	59	14.82	73	9.71	132	11.48
Use of organic fertilizer /use of farmyard	24	6.03	67	8.91	91	7.91
Others	87	21.86	178	23.67	265	23.04
No answer	14	3.39	12	1.57	26	2.21

4.3.2 Early Planting During the Winter-Spring

As mentioned (Section 3.2), the early planters in the study were those who changed their schedule for planting for the Winter-Spring to a date on or before 15 November 2019 and this was their last cropping. The non-planters, on the other hand, were those who planted before 15 November 2019 for their last cropping.

The planting schedule of eight in every 10 early planters during the Winter-Spring 2019-2020 was earlier than their usual schedule. They planted as early as August (16%) and the rest were almost evenly distributed in the months of September (28%), October (27%), and the first two weeks of November (29%) (Table 4.12). Many of those who planted earlier than October (with others moving to earlier season of Autumn-Winter by planting much earlier in August) also planted earlier than usual during their Summer-Autumn cropping (Section 4.4.3).

Table 4.12. Early planting during the Winter-Spring 2019-2020 the farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Schedule of planting during Winter-Spring* 2019-2020						
August	64	15.53			64	5.44
September	117	28.40			117	9.95
October	111	26.94			111	9.44
November 1-15	120	29.13			120	10.20
November 16-30			293	38.35	293	24.91
December			303	39.66	303	25.77
January			146	19.11	146	12.41
February			22	2.88	22	1.87
Plant early than usual	335	81.31	56	7.33	391	33.25
Benefits of planting earlier than usual during Winter-Spring season 2019-2021						
Avoided high salinity period	246	73.43	50	89.29	296	75.70
Avoided production loss	118	35.22	8	16.00	126	32.22
Avoided income loss	105	31.34	19	33.93	124	31.71
Others	28	8.36	4	7.14	32	8.18
Learn about benefits of early planting during high salinity season						
From experience	185	52.22	39	69.64	224	70.22
From government agriculture technician	88	26.27	13	23.21	101	31.66
From the news	83	24.78	16	28.57	99	31.03
From fellow farmers	30	8.96	13	23.21	43	13.48
Others	12	3.58	1	1.79	13	4.08

* Still labelled as WS even those who planted as early as the last week of August (part of Autumn-Winter season) because this was a decision they made in response to threat of salinity. Otherwise, they would have planted November 2019.

Among the early planters, there were those who did not plant early than usual but still their planting time schedule fell within the early planting schedule of up to 15 November 2019. Most of them were able to do so, because they were practicing two rice cropping. Those who did not plant early than usual cited the reason --- "land preparation time too close from the last season" (Table 4.13). They were the ones among the early planters who practiced three rice cropping.

Table 4.13 . Reasons for not planting early than usual during the Winter-Spring 2019-2020 by the farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Did not plant early than usual schedule	76	18.45	693	90.71	769	65.39
Reasons if did not plant early than usual schedule						
Land preparation time too close from last season	22	28.95	425	61.33	447	58.13
I do not see any difference in harvest when planting early or not	0	0.00	16	2.31	16	2.08
I do not belief in the instructions because of wrong predictions by local government in previous W-S crop	0	0.00	32	4.62	32	4.16
Others	24	31.58	226	32.61	250	32.51

The study participants who planted earlier than their usual schedule cited reasons for doing so as to avoid high salinity period (76%), avoid production loss (32%), and avoid income loss (32%). It can be noted that among early planters, the proportion citing avoidance of production loss (35%) was slightly higher than the proportion that cited avoidance of income loss. This was also higher compared to among the non-early planters. This highlights the behaviour of farmers as loss minimizers more than income maximizers. The study participants cited their own experience (70%), government agriculture technician (32%), the news (31%), and fellow farmers (13%) as the main sources of information on the benefits of early planting during high salinity season.

Among the non-early planters, 38% planted during the last two weeks of November (25%), December (26%), January (12%), and February (2%). Only a few (7%) of the non-early planters did plant earlier than their usual schedule but still the schedule was not early planting as defined. This means that even when the majority of the non-early planters expected salinity problems, only a few of them were able to

plant earlier than usual. They had difficulty in adjusting the calendar even when they expected salinity problems. As shown in Section 4.4.1, most of the non-early planters were practicing three rice cropping. They cited that land preparation time being too close between seasons as the main reason (58%). This was particularly true among 61% of the non-early planters. Other reasons cited by the non-early planters were that they did not see the difference to their output if they plant early or not (2%). A few also cited that they also no longer believe the instructions of early planting because of the wrong prediction during the previous Winter Spring season (4%).

4.4 Rice Farming Practices

4.4.1 Cropping System Practiced

More than three-fourths of the early planters (79%) were practicing two rice cropping (Table 4.14). This gave them the flexibility to adjust their planting schedule to earlier than usual during the Winter-Spring season (Section 4.3.2). On the other hand, most of the non-early planters (87%) were practicing three rice cropping, which mean they had a too tight schedule for land preparation in between rice cropping. Five early planters were also into rice-shrimp rotational farming system.

Table 4.14. Rice cropping practiced by farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Two rice cropping per year	324	78.64	82	10.73	406	34.52
Three rice cropping per year	78	18.93	661	86.52	739	62.84
Rice –shrimp rotational farming	5	1.21	0	0.00	5	0.43
Others	5	1.21	21	2.75	26	2.21

4.4.2 Farming Practices during the Winter-Spring 2019-2020 Season

As the rice cropping season of interest in the study, this is presented first although it is the last cropping rice season. The anticipation of the salinity problem towards the last months of the year prompted a number of farmers to plant earlier than usual for their second or last cropping, which was supposed to happen in the Winter-Spring season of November to February (Table 4.15).

Table 4.15 Farming practices during the Winter-Spring season by farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Use high yielding rice variety	412	100.00	764	100.00	1176	100.00
Use broadcast planting method	412	100.00	764	100.00	1176	100.00
Date of planting						
August	64	15.53			64	5.44
September	117	28.40			117	9.95
October	111	26.94			111	9.44
November 1-15	120	29.13			120	10.20
November 16-30			293	38.35	293	24.91
December			303	39.66	303	25.77
January			146	19.11	146	12.41
February			22	2.88	22	1.87
Use inorganic fertilizer[1]	384	95.29	713	94.44	1,097	94.73
Use pesticide[2]	402	99.50	748	99.47	1,150	99.48
Surface water (as main source of water	375	93.28	732	96.95	1,107	95.68
Number of times water is pumped[3]	4.23		5.36		4.98	
Use AWD only	168	44.09	338	47.67	506	46.42
Number of times the farm re-flooded the entire season	3.87		4.97		4.60	
Adequacy of water availability relative to farm needs[4]						
Met up to 25% of the water needs of the farm	9	2.34	94	13.06	103	9.33
Met 26%-50 % of water needs of the farm	18	4.69	74	10.28	92	8.33
Met 51 – 75% of water needs of the farm	102	26.56	156	21.67	258	23.37
Met 76 to 100% water needs of the farms	255	66.41	396	55.00	651	58.97

Those who provided answer: [1]n=403, n=755, N=1158; [2] n=404, n=752,N=1156; [3]n=283, n= 572, N=855; [4]n=384, n=720, N=1104

*15% planted as early as the last week of August This is still labelled as WS even those who planted as early as August because this was a decision they made in response to threat of salinity; otherwise, they would have planted November 2019;

As presented in Section 4.3.2, among the early planters, there were those who reported to have planted by the last week of August (16%) and there were those by the first half of November (29%), and also in between months (55%). Those who planted as early as the last week of August and September were practicing two rice cropping with the planting schedule of their first cropping in March to first week of May 2019 (Section 4.4.3). Among the non-early planters, there were those who planted during the second half of November (25%) and there were those who planted as late as early February (2%), and also in between months (73%). Most of them were practicing three rice cropping. They started planting rice in March or April for their first cropping, and in July to early September for the second cropping.

All farmers reported that they used high yielding variety and practiced broadcasting to plant rice. Almost all of the early planters and the non-early planters were using inorganic fertilizer (95% and 94%, respectively) and pesticides (99% and 99%, respectively). Their main source of water was surface water that includes the rivers, canal, lake, or irrigation ditches (96%). Near half of the early planters (44%) and non-early planters (48%) were practicing alternative wetting and drying method; had re-flooded the farmer about 4 times (early planters) or 5 times (non-early planters). Among those who provided answer on adequacy of available water to farm needs, 66% of early planters and 55% of non-early planters cited that they met 76-100% of water needs. There were 23% of the non-early planters who met less than 50% of the water needs, while only 7% of the early planters said so.

From planting, it took 18 days for the rice to emerge, about 60 days to reach the flowering stage, and about 97 days to harvest (Table 4.16). The seed density at planting was 17 kg/1000 m^2, with the early planters having lower density at 16 kg/1000m^2 compared to 18 kg/1000m^2 for the non-early planters. They applied fertilizer on the 10^{th} to 11^{th} day, with the early planters used slightly more at 89 kg/ha and the non-early planters at 86 kg/ha. On the 8^{th} to 9^{th} day, farms were irrigated by by up to 35mm of water height.

Table 4.16 Other farming practices during the Winter-Spring season by farmers who participated in the study in the three provinces in Mekong River Delta

		Early planter n=412	Non-early planter n=764	All N=1176
Number of days from planting it takes for to rice emerge (titlering)	n	408	742	1150
	Mean	17.31	18.13	17.84
Number of days from planting when the rice reach maximum height (flowering)	n	410	730	1140
	Mean	59.92	61.04	60.64
Number of days when rice was harvested (harvest)	n	408	708	1116
	Mean	97.04	97.23	97.16
Density at planting (kg of seed per 1000m^2)	n	410	741	1151
	Mean	16. 23	17.90	17.31
Density at emergence (% of planted)	n	404	738	1142
	Mean	83.38	83.24	83.29
Number of days after planting fertilizer was used	n	407	740	1147
	Mean	10.31	10.13	10.21
Fertilization rate per crop (kg ha^{-1})	n	405	737	1142
	Mean	89.39	86.68	87.64
Number days after planting the farm was irrigated	n	360	704	1064
	Mean	8.15	8.89	8.64
Amount of water (mm)	n	370	686	1056
	Mean	35.77	34.82	35.15

n=those who provided data

4.4.3 Summer-Autumn 2019 Season Farming Practices

The Summer-Autumn season was the first cropping season of most farmers for 2019. This was supposed to be from April to July. However, with the forecast of salinity by the last months of the year, many farmers adjusted their cropping schedule for the year. There farmers who planted as early as March (a month ahead of regular usually schedule) and there were those who planted as late as July (Table 4.17).

Almost all farmers planted high yielding varieties (99%) either by broadcast (62%) or transplanting (38%). There was no marked difference between the early and non-early planters.

Table 4.17 Farming practices during the Summer-Autumn season by farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Planted high yielding varieties	408	99.03	758	99.21	1,166	99.15
Planting method	400	97.09	739	96.73	1,139	96.85
broadcast	240	60.00	471	63.73	711	62.42
Transplant	160	40.00	268	36.27	428	37.58
Date of Planting						
March	29	7.25	52	6.96	81	7.06
April	170	42.75	330	44.18	501	43.68
May	145	36.25	295	39.49	440	38.36
June	45	11.25	60	8.03	105	9.15
July	10	2.50	10	1.34	20	1.74

Meanwhile, in their other practices, the early planters and the non-early planters were almost similar (Table 4.18). From the day of planting, it took 18 days for the rice to emerge, about 61 days for rice to reach the flowering stage, and about 97 days to harvest. Their density at planting was 17 kg of seed per hectare for all farmers, but early planters have lower at 16kg/ha compared to the non-early planters at 18 kg/ha. They applied fertilizer on the 10^{th} to 11^{th} day and used 88 kg/ha. On the 8^{th} day, farms were irrigated by up to 35mm of water height .

Table 4.18 Other farming practices during the Winter-Spring season by farmers who participated in the study in the three provinces in Mekong River Delta

		Early planter n=412	Non-early planter n=764	All N=1176
Number of days from planting it takes for to rice emerge (titlering)	n	402	750	1152
	Mean	17.80	18.04	17.95
Number of days from planting when the rice reach maximum height (flowering)	n	404	748	1152
	Mean	60.42	61.09	60.85
Number of days when rice was harvested (harvest)	n	405	751	1156
	Mean	97.23	97.47	97.39
Density at planting (kg of seed per $1000m^2$)	n	405	750	1155
	Mean	16.36	18.00	17.43
Density at emergence (% of planted)	n	400	749	1149
	Mean	84.51	83.47	83.83
Number of days after planting fertilizer was used	n	401	753	1154
	Mean	10.60	10.21	10.34
Fertilization rate per crop (kg ha^{-1})	n	401	747	1148
	Mean	89.71	87.25	88.11
Number days after planting the farm was irrigated	n	321	646	967
	Mean	7.96	8.64	8.42
Amount of water (mm)	n	344	645	989
	Mean	35.31	33.71	34.27

n=those who provided data

4.4.4 Autumn-Winter 2019 Season Farming Practices

A relatively lower number of farmers produced rice, and mostly were the non-early planters during the Autumn-Winter 2019 season (Table 4.19). High yielding varieties were planted by 18% of the early planters and 88% of the non-early planters or 64% of all the farmers. This cropping season was the second cropping for all these farmers. There were non-early planters who planted in the months that could have considered them as early planters for the Winter-Spring season, but this was not their last time cropping . For instance, most of those that planted in early October, planted their last cropping in January to February 2020, and the four who planted in November, replanted in December.

Table 4.19 Farming practices during the Summer-Autumn season by farmers who participated in the study in the three provinces in Mekong River Delta

	Early planter n=412		Non-early planter n=764		All N=1176	
	No.	%	No.	%	No.	%
Produced during this season	80	19.42	683	89.40	763	64.88
Planted high yielding varieties	76	18.45	676	88.48	752	63.95
Planting method	76		658		734	
broadcast	45	59.21	424	64.44	469	63.90
Transplant	31	40.79	234	35.56	265	36.10
Date of planting	72	100	664	100.00	736	100
June	2	2.78	2	0.30	4	0.54
July	29	40.28	76	11.45	105	14.27
August	41	56.94	253	38.10	294	39.95
September		0	263	39.61	263	35.73
October		0	66	9.94	66	8.97
November		0	4	0.60	4	0.54

For this season, the other practices were similar to other cropping in terms of number of days from planting, it took for rice to emerge (18 days), flowering stage (61 days), and harvest (97days) (Table 4.20). Similarly, seed density at planting was 17 kg/1000m^2. Fertilizers were applied fertilizer on the 10th to 11th day at the rate of 88 kg/ha. On the 8th day, farms were irrigated by up to 35mm of water height.

Table 4.20 Other farming practices during the Winter-Spring season by farmers who participated in the study in the three provinces in Mekong River Delta

		Early planter n=412	Non-early planter n=764	All N=1176
Number of days from planting it takes for to rice emerge (titlering)	n	76	671	747
	Mean	17.50	17.88	17.84
Number of days from planting when the rice reach maximum height (flowering)	n	76	671	747
	Mean	59.01	60.33	60.19
Number of days when rice was harvested (harvest)	n	76	670	746
	Mean	95.88	96.21	96.18
Density at planting (kg of seed per 1000m^2)	n	76	670	746
	Mean	15.98	18.09	17.87
Density at emergence (% of planted)	n	75	668	743
	Mean	83.27	83.44	83.43
No. of days after planting fertilizer was used	n	76	670	746
	Mean	10.47	10.11	10.15
Fertilization rate per crop (kg ha^{-1})	n	74	667	741
	Mean	85.81	86.60	86.52
No. of days after planting the farm was irrigated	n	66	598	664
	Mean	9.23	8.67	8.72
Amount of water (mm)	n	69	582	651
	Mean	39.57	33.71	34.12

n=those who provided data

4.5 Financial Analysis

4.5.1 Volume of Rice Production

This section presents rice production of the study participants by season or cropping and total for the 2019-2021. Presented also are volume of rice production during the Winter-Spring season during the years 2014-2015 (considered as the latest regular year before the worst salinity problem year), 2015-2016 (considered as the worst salinity year before 2019), and for year 2019 -2020 (the latest year with worst salinity problem).

Volume of Rice Production in Winter-Spring 2019-2020 Season

The total rice production during the Winter-Spring 2019-2020 season was 8.17 tons or 4.21 tons/ha (Table 4.21). The early planters had higher volume of rice production than the non-early planters (on average, 11. 76 tons or 5.89 tons/ha vs. 6.24 tons or 3.30 tons/ha). The early planters exceeded their target volume of

production of 10.78 tons or 5.29 tons/ha, on average. It was the opposite for the non-early planters who targeted, on average, 9.29 tons or 4.81 tons/ha.

Table 4.21. Rice Production in Winter Spring 2019-2020 by farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412	Non-early rice planters n=764	All N=1,176
Size of the land area used for production (ha)	2.02	1.96	1.99
Target total volume of production (ton)	10.78	9.29	9.81
Target total volume of production (ton/ha)	5.29	4.81	4.98
Actual total volume of production (ton)	11.76	6.24	8.17
Actual total volume of production (ton/ha)	5.89	3.30	4.21

% of the actual volume of production in tons.

Volume of Rice Production in Summer-Autumn 2019 Season

Among the farmers with data for Summer-Autumn season 2019, their volume of production, on average, was 10.90 tons or 5.61 tons/ha (Table 4.22). This was a slightly higher than their target of 10.09 tons or 5.09 tons/ha for the season. The mean volume of production of early planters and the non-early planters slightly differed (11.47 tons or 5.78 tons/ha vs. 10.60 tons or 5.51 tons/ha).

Table 4.22. Rice Production during Summer-Autumn (2019) by farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412	Non-early rice planters n=764	All N=1,176
With production data during time* (no.)	410	764	1,174
(%)	(99.51)	(100.00)	(99.83)
Size of the land area used for production (ha)	2.01	1.96	1.98
Target total volume of production (ton)	10.80	9.73	10.09
Target total volume of production (ton/ha)	5.31	4.99	5.09
Actual total volume of production (ton)	11.47	10.60	10.90
Actual total volume of production (ton/ha)	5.78	5.51	5.61

*% of total number of farmer-study participants ; % of the actual volume of production in tons.

Volume of Rice Production in Autumn-Winter 2019 Season

Only 19% of the early planters and 89% had production data during the Autumn-Winter 2019 season. As shown in Section 4.4.1, 79% of the early planters were practicing two rice cropping, while 87% of the non-early planters were practicing three rice cropping. Among the farmers with data for Autumn-Spring season 2019, their volume of production, on average, was 11.25 tons or 5.69 tons/ha. This was higher than the target of 10.14 tons or 4.98 tons/ha for the season. On average, the volume of production of early planters was higher than the non-early planters (12. 92 tons or 5.462 tons/ha vs. 11.07 tons or 5.71 tons/ha).

Table 4.23. Rice Production during Autumn-Winter (2019-2020) by farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412	Non-early rice planters n=764	All N=1,176
With production data during time* (no.)	80	683	763
(%)	(19.42)	(89.40)	(64.88)
Size of the land area used for production (ha)	2.24	1.96	1.99
Target total volume of production (ton)	12.08	9.74	9.98
Target total volume of production (ton/ha)	4.93	4.90	4.90
Actual total volume of production (ton)	12.11	10.97	11.25
Actual total volume of production (ton/ha)	5.12	5.66	5.60

*% of total number of farmer-study particpants ; % of the actual volume of production in tons.

Volume of Annual Rice Production 2019-2020

In terms of volume of annual total rice production, the early planters were a ton less than the non-early planters (25.52 tons or 12.63 tons/ha vs. 26.61 tons or 14.03 tons/ha) (Table 4.24). This was because most of the early planters were two rice croppers while the non-early practices were three rice croppers. Despite being slightly higher than the volume of early planters, the non-early planters actual production was a ton less that their target (27.73 tons or 14.18 tons/ha). It was the opposite for the early planters who had higher actual production than its target (23.87 tons or 11.53 tons/ha).

Table 4.24. Annual Rice Production (2019-2020) by farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412	Non-early rice planters n=764	All N=1,176
Size of the land area used for production (ha)	2.02	1.96	1.99
Target total volume of production (ton)	23.87	27.73	26.38
Target total volume of production (ton/ha)	11.53	14.18	13.25
Actual total volume of production (ton)	25.52	26.65	26.25
Actual total volume of production (ton/ha)	12.64	13.87	13.44

% of the actual volume of production in tons

4.5.2 Rice production in Winter –Spring Season in 2014-2015, 2015-2016, 2019-2020

The volume of production of the early planters and the non-early planters during the Winter-Spring season was almost the same during the years 2014-2015 and 2015 -2016 but a wide difference was recorded during the 2019-2020. As mentioned, Winter-Spring 2014-2015 season was the year before Winter-Spring 2015-2016 season when farmers suffered unprecedented losses due to salinity. The 2019-2020 was also a salinity year forecasted to be worse than the 2015-2016, but a number of interventions were introduced already so the farmers have learned to mitigate losses such as by planting early.

Table 4.25. Rice Production during Winter Spring Season in 2014-2015, 2015-2016, 2019-2020 by farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412			Non-early rice planters n=764			All N=1,176		
	2019-2020	2015-2016	2014-2015	2019-2020	2015-2016	2014-2015	2019-2020	2015-2016	2014-2015
With production data during time*	412 (100.00)	333 (80.83)	357 (86.65)	764 (100.00)	622 (81.41)	675 (88.35)	1,176 (100.00)	955 (81.21)	1,302 (87.76)
Size of the land area (ha)	2.02	2.04	2.01	1.96	1.97	1.96	1.99	1.98	1.98
Actual total volume of production (ton)	11.76	8.47	11.84	6.24	7.23	11.87	8.17	7.66	11.86
Actual total volume of production (ton/ha)	5.89	4.11	6.48	3.30	4.01	6.53	4.21	4.04	6.52

*number in ( ) are %s of the total number of study participants

4.5.3 Total Annual Operating Cost of Rice Farming

Total annual operating cost, on average, was higher among non-early planters (VND 48.71 million) than the early planters (VND 37.04 million). Almost half of annual operating cost was made up of labor cost and pesticides and other chemicals. The respective share of these cost items to annual cost of the early planters were 33% and 23%, while it was 31% and 24% for the non-early planters. Fertilizer was next comprising 18% and 21% of the operating costs incurred by the early planters and non-early planters, respectively. Seeds shared 14%. Other costs incurred were rental cost (6%), other farm supplies (2%), and fuel (<1%). Depreciation cost had many missing values and the mean of the available values was minimal.

Table 4.26. Annual operating costs incurred (mean, VND/ha) by farmers who participated in the study in the three provinces in Mekong River Delta

	Early Planters		Non-Early Planters		ALL	
	Amount	%	Amount	%	Amount	%
Labor Cost	12,156,461.69	32.82	14,903,338.45	30.60	13,940,997.27	31.24
Pesticides and other chemical cost	8,488,869.93	22.92	11,460,418.05	23.53	10,419,365.48	23.35
Fertilizer Cost	6,770,980.01	18.28	10,438,521.17	21.43	9,153,634.30	20.51
Seeds Cost	5,415,964.00	14.62	7,230,789.37	14.85	6,594,983.21	14.78
Rental Cost	2,348,182.03	6.34	2,907,438.20	5.97	2,711,508.32	6.08
Water Cost	791,395.79	2.14	614,323.04	1.26	676,358.72	1.52
Other farm supplies Cost	849,478.14	2.29	835,670.28	1.72	840,507.73	1.88
Fuel/Petrol/Diesel Cost	220,906.20	0.60	315,721.82	0.65	282,504.10	0.63
Total Operating Cost	37,042,237.79	100.00	48,706,220.38	100.00	44,619,859.13	100.00

4.5.4 Revenue, Costs, and Profit

Revenue, Cost, and Profit in Winter-Spring 2019-2020 Season

In general, the farmers received a price of VND 5,343.59 for a kilogram of their rice (Table 4.27). As expected, the price was almost identical for the early planters (VND 5,352.68) and non-early planters (VND 5,337.34). The revenue earned per hectare widely differed between the two types of farmers. The early planters with higher volume of rice sold (5.51 tons/ha) had a revenue of VND 29.65 million. The non-early planters, with volume sold at 3.09 tons/ha, received almost half of the revenue of the early planters (VND 16.91 million). The operating cost per hectare was VND 17.65 million for the early planters, which was higher than what the non-early planters incurred at VND 13.66 million. This results to an operating profit earned at VND 11.99 million for the early planter, which was almost four times the operating profit received by the non-early planters (VND 3.26 million).

Table 4.27. Revenue, Costs and Profit of Rice Production in Winter -Spring 2019-2020 (VND/ha) by farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412	Non-early rice planters n=764	All N=1,176
Total volume sold (ton/ha)	5.51	3.09	3.94
Price received (VND/kg)	5,352.68	5,337.34	5,343.59
Total revenue (VND/ha)	29,648,158.91	16,913,959.03	21,375,260.35
Total operating cost (VND/ha)	17,653,716.95	13,656,815.32	15,057,090.39
Total operating profit (VND/ha)	11,994,441.96	3,257,143.70	6,318,169.96

Revenue, Costs, and Profits in Summer-Autumn 2019 Season

The price received by the farmers for a kilogram of rice harvested during the summer-autumn season was VND 5,184.43, which was slightly lower than the average price received during the Winter-Spring season (VND 5343.49/kg) (Table 4.28). The price was almost identical for the early planters (VND 5,240.45/kg) and non-early planters (VND 5,213.03/kg). The revenue earned per hectare widely differed between the two types of farmers. The early planters with higher volume of rice sold (5.51 tons/ha), had a revenue of VND 29.25 million. The non-early planters, with volume sold at 3.09 tons/ha, received almost half of the revenue of the early planters (VND 16.59 million). The operating cost per hectare was VND16.89 million for the early planters, which was lower than what the non-early planters incurred at

VND18.43 million. This result to an operating profit per hectare earned at VND 12.26 million for the early planter, which was higher than operating profit received by the non-early planters (VND 9.4 million).

Table 4.28. Revenue, Costs and Profit of Rice Production in Summer-Autumn (2019) by farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412	Non-early rice planters n=764	All N=1,176
With production data during time* (no.)	407	763	1,170
(%)	(98.79)	(99.87)	(99.49)
Total volume sold (ton/ha)	5.59	5.33	5.42
Price received (VND/kg)	5,175.66	5,189.13	5,184.43
Total Revenue per hectare (VND/ha	29,146,185.15	27,913,375.21	28,343,913.61
Total operating cost (VND/ha)	16,878,935.39	18,443,769.26	17,897,277.02
Total operating profit (VND/ha)	12,267,249.77	9,469,605.94	10,446,636.58

Revenue, Costs, and Profits in Autumn -Winter 2019 Season

The price received by the farmers for a kilogram of rice harvested during the summer-autumn season was VND 5,367.40, which was highest in the three seasons. The price was almost identical for the early planters (VND 5241.25/kg) and non-early planters (VND 5,382.21). The total revenue earned per hectare by the non-early planters was higher than the early planters (VND 30.42 million vs. 27.97 million) but its cost was higher (VND 18.57 million vs. 13.45 million) resulting to a lower profit per hectare of VND 11.88 million compared to VND 14 million/ha for the early planters.

Table 4.29. Revenue, Costs and Profit of Rice Production in Autumn-Winter (2019) by farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412	Non-early rice planters n=764	All N=1,176
With production data during time (no.)	80	683	763
(%)	(19.42)	(89.40)	(64.88)
Total volume sold (ton/ha)	4.91	5.50	5.44
Price received per kg	5,241.25	5,382.21	5,367.4
Total revenue per hectare(VND/ha)	27,969,194.62	30,420,999.15	30,163,929.21
Cost incurred per hectare (VND/ha)	13,346,338.44	18,574,971.81	18,026,753.36
Total profit per hectare(VND/ha)	14,272,515.58	11,878,167.79	12,165,946.38

Annual Revenue, Costs, and Profits

The annual revenue earned per hectare by the non-early planters was higher than the early planters (VND 72.02 million vs. 64.08 million) but its cost was higher (VND 48.71 million vs. 37.04 million) (Table 4.30). As shown in preceding sections, a number of early planters were two rice croppers, with a number of them did not produce during the Autumn-Winter. This explains the lower revenue and cost per hectare by the early planter and a higher annual profit (VND 27.04 million vs. 23.35 million). It was during the Winter-Spring when the non-early planters received the lowest income per hectare.

Table 4.30. Annual Revenue, Costs and Profit of farmers who participated in the study in the three provinces in Mekong River Delta

	Early rice planters n=412	Non-early rice planters n=764	All N=1,176
Total revenue per hectare (VND/ha)	64,083,769.31	72,023,070.39	69,241,614.57
Cost incurred per hectare (VND/ha)	37,042,237.79	48,706,220.38	44,619,859.13
Total profit per hectare (VND/ha)	27,041,531.52	23,345,582.89	24,640,422.04

4.6. Impacts of Early Planting

4.6.1 Outcome variables

The outcome variables in the study are rice farming income, volume of rice production, rice production losses avoided, and nonfarm income.

- Rice farming income
  - Estimated financial profit from rice farming during the Winter-Spring 2019-2020 season per farmer and per hectare
  - Annual rice farming profit per kg and per hectare
- Volume of production
  - Estimated volume of production in tones during the Winter-Spring 2019-2020 Season tons per ha and tons per farmer
- Production losses avoided
  - Winter-Spring Production Loss Avoided tons per ha and tons per farmer
- Nonfarm income
  - Estimated income from nonfarm income sources by all members of the household with income source

Table 4.31 shows the summary statistics of the outcome variables used. These variables were also presented in the previous sections. The mean income of early planters during the Winter-Spring 2019-2020 was significantly higher than the mean rice income of non-early planters on per individual and (VND 27,955,290.30 vs. VND 5,049,807,88) and per ha bases (VND 11,994,441.96 vs, VND 3,257,143.70). A number of non-early planters suffered from economic losses during the season. In terms of annual rice income, the early planters received higher than the non-early planters on a per farmer basis (VND 62,106,281.85 vs. VND 46,328,365.82) and per hectare basis (VND 27, 041, 531.52 vs. VND 23,345,582.89). This is despite more than three-fourths of the early planters practiced two rice cropping, while most of the non-early planters practiced three rice cropping.

The volume of production of the early planters (11.76 tons or 5.89 tons/ha) was significantly higher than the non-early planter (6 tons or 3.30 tons/ha). Overall, the non-early planters suffered production losses during the season of 0.91 tons per farmer or 0.62 tons/ha. In contrast, the early planters avoided losses of 3.06 tons per farmer or 1.67 tons/ha.

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Table 4.31. Summary statistics of the outcome variables among early rice planters and non-early rice planters in Mekong River Delta, Vietnam

Treatment Group: Early Rice Planters

	WS 2019-2020 Total Volume of Production (tons/farmer)	WS 2019-2020 Volume of Production (tons/ha)	Annual Rice Farming Income (profit/farmer)*	Annual Rice Farming income (profit/ha)*	WS 2019-2020 Rice Farming income (profit/kg)*	WS 2019-2020 Rice Farming income (profit/ha)*	Annual Non-Rice Farming Income*	Winter-Spring Production Loss Avoided (tons/farmer)	Winter-Spring Production Loss Avoided (tons/ha)
	n=412	n=412	n=412	n=412	n=412	n=412	n=412	n=320	n=320
Mean	11.76	5.89	62,106,281.85	27,041,531.52	994.44	10,295,543.82	43,863,211.17	3.06	1.67
Standard Deviation	12.00	2.71	9.36e+07	2.97e+07	4,509.51	1.77e+07	8.63e+07	7.64	3.69
Min	0	0	(1.29e+08)	(1.22e+08)	(33,328.53)	(1.04e+08)	0	(64.50)	(33.07)
Max	126.00	40.99	7.06e+08	1.42e+08	6,177.50	8.25e+07	8.70e+08	45.00	35.99

Control Group: Non-Early Rice Planters

	WS 2019-2020 Total Volume of Production (tons/farmer)	WS 2019-2020 Volume of Production (tons/ha)	Annual Rice Farming Profit (profit/kg)*	Annual Rice Farming Profit (profit/ha)*	WS 2019-2020 Rice Farming Profit (profit/kg)*	WS 2019-2020 Rice Farming Profit (profit/ha)*	Annual Non-Rice Farming Income*	Winter-Spring Production Loss Avoided (tons/farmer)	Winter-Spring Production Loss Avoided (tons/ha)
	n=764	n=764	n=764	n=764	n=764	n=764	n=412	n=320	n=320
Mean	6.24	3.30	46,328,365.82	23,345,582.89	(2,520.73)	2,001,323.00	36,985,664.92	(0.91)	(0.62)
Standard Deviation	8.29	2.76	8.65e+07	5.45e+07	14,714.70	1.41e+07	5.81e+07	6.57	3.25
Min	0	0	(7.48e+08)	(1.10e+09)	(314,106.70)	(1.18e+08)	0	(42.90)	(22.41)
Max	75	26.78	7.81e+08	3.01e+08	5,958.67	5.14e+07	4.80e+08	32.50	24.50

Note: *1 USD= 23,000 VND

4.6.2 Matching

Meanwhile, the early planters were slightly older than the non-early planters (53.21 years old and 52.69 years old, respectively) (Table 4.2). They almost had identical years in school, on average (6.86 and 6.45, respectively), the percentage of households among early planters than in non-early planters with flatscreen TV was the same (77%), the number of men and women household members who are in the labor force, and the percentage of having farms located in irrigated lowland. The majority of the early planters (51%) were members of a community-based organization, while 45% of the non-early planters were. On average, the area planted to rice was slightly higher among early planters than the non-early planters (2.02 ha vs 1.96 ha). The matching variables were chosen as they related to the outcome variables (and so must be controlled) and not on whether they are early or non-early planters.

Table 4.32. Summary statistics of the independent variables that characterize the early and non-early rice planters in Mekong River Delta, Vietnam (N=1,176)

	Treatment Group: Early Rice Planters n=412				Control Group: Non-Early Rice Planters n=764			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Age of farmer	53.21	11.83	21	85	52.69	12.16	25	84
No. of years in school	6.86	3.55	0	16	6.45	3.55	0	16
Member of a community-based organization	0.51	0.50	0	1	0.45	0.50	0	1
No. of male household members (15-60 years old)	1.59	0.95	0	5	1.59	0.91	0	6
No. of female household members (15-55 years old)	1.57	0.95	0	6	1.49	0.92	0	6
Own flatscreen TV	0.77	0.42	0	1	0.77	0.42	0	1
Area of farm planted with rice (ha)	2.02	1.88	0.10	18	1.96	1.76	0.07	12
Location of farm is on an irrigated lowland	0.14	0.35	0	1	0.15	0.35	0	1

4.6.3 Effects on Rice Farming Income during the Winter-Spring 2019-2020 Season and Annual Income

After matching the early planters and the non-early planters, the effects of early planting is to increase Winter-Spring season rice income by about VND 22.80 million to VND 24.60 million using one period of data (Table 4.33). In other words, the early planters earned more than the non-early planters. The *t*-values of all the matching methods are high (> 1.96) signifying these are significant changes. In terms of income per hectare, the early planters earned more (ranging from VND 8.62 million to VND 8.77 million). The *t*-values of the four matching methods are also high (>1.96), which mean that these are significant changes.

Table 4.33. Average treatment effect on the treated (ATT): early planting on rice farming income

Matching methods	WS 2019-2020 Rice Farming income (VND/farmer)* N=1,176	WS 2019-2020 Rice Farming income (VND/ha)* N=1,176	Annual Rice Farming income (VND/farmer)* N=1,176	Annual Rice Farming income (VND/ha)* N=1,176
t-test				
Coefficient	22,900,000.00	8,737,298.00	15,800,000.00	3,695,949.00
t-value	9.49	9.62	2.90	1.28
Regression				
Coefficient	22,300,000.00	8,554,940.00	13,200,000.00	2,956,289.00
t-value	9.50	9.46	2.68	1.02
Nearest Neighbour				
Matched control	287.00	287.00	287.00	287.00
ATT	24,600,000.00	8,770,000.00	17,100,000.00	4,270,000.00
t-result	6.72	7.36	2.24	0.82
t-result (bootstrapped)	7.78	6.40	2.42	1.28
Radius				
Matched control	757.00	757.00	757.00	757.00
ATT	22,900,000.00	8,650,000.00	15,100,000.00	3,360,000.00
t-result	8.83	8.92	2.69	1.35
t-result (bootstrapped)	9.00	9.74	2.84	1.34
Kernel				
Matched control	757.00	757.00	757.00	757.00
ATT	22,800,000.00	8,620,000.00	14,500,000.00	3,210,000.00
t-result (bootstrapped)	8.48	9.54	2.69	1.24
Stratification				
Matched control	757.00	757.00	757.00	757.00
ATT	22,800,000.00	8,660,000.00	13,700,000.00	3,200,000.00
t-result	8.66	8.93	2.41	1.28
t-result (bootstrapped)	9.24	8.20	2.56	1.14

Notes:

Treatment Variable	Planting Strategy (1-Early Planting, 0-Non-early Planting)
Independent Variable	Age of Farmer, No. of Years in School, Membership in Community-based Organization, No. of Male Household Members aged 15-60 years old, No. of Female Household Members aged 15-55 years old, Ownership of Flatscreen TV, Area of Rice Farm, Location of Rice Farm is in an Irrigated Lowland
No. of Blocks	4 (Total Volume of Production tons/farmer, Volume of Production tons/ha, Annual Profit/kg, Annual Profit/ha, WS Profit/kg, WS Profit/ha Non-rice farming Income); 3 (Production Loss Avoided tons/farmer, Production Loss Avoided tons/ha)
Balancing Property	Satisfied

Meanwhile, the effect on total annual rice income is to increase annual income per farmer by about VND 13.7 million to VND 17.1 million using one period of data. In other words, the early planters earned more than the non-early planters. The *t*-values of all the matching methods are high (> 1.96) signifying these are significant changes. In terms of income per hectare, the early planters earned more (ranging from VND 3.2 million to VND 4.27 million). The *t*-values of the four matching methods are also high (>1.96), which means that these are significant changes.

4.6.4 Effects on Rice Farming Volume of Production during the Winter-Spring 2019-2020 Season

The effects of early planting is to increase total volume of production during their Winter-Spring cropping by about 5.29 to 5.67 tons/farmer or 2.51 to 2.59 tons/ha using one period of data (Table 4.34). In other words, the early planters had significantly higher volume of production and productivity than the non-early planters. The *t*-values of all the matching methods are high (>1.96) signifying these are significant changes.

Table 4.34. Average treatment effect on the treated (ATT): Early planting on volume of production

Matching methods	WS 2019-2020 Total Volume of Production (tons/farmer) N=1,176	WS 2019-2020, Volume of Production (tons/ha) N=1,176
t-test		
Coefficient	5.52	2.59
t-value	9.26	15.46
Regression		
Coefficient	5.20	2.56
t-value	12.96	15.32
Nearest Neighbour		
Matched control	287	287
ATT	5.67	2.51
t-result	6.77	10.23
t-result (bootstrapped)	6.86	9.49
Radius		
Matched control	757	757
ATT	5.59	2.61
t-result	8.40	15.55
t-result (bootstrapped)	8.63	14.60
Kernel		
Matched control	757	757
ATT	5.54	2.61
t-result (bootstrapped)	8.48	14.60
Stratification		
Matched control	757	757
ATT	5.29	2.59
t-result	7.86	15.35
t-result (bootstrapped)	8.51	15.16

Notes:	
Treatment Variable	Planting Strategy (1-Early Planting, 0-Non-early Planting)
Independent Variable	Age of Farmer, No. of Years in School, Membership in Community-based Organization, No. of Male Household Members aged 15-60 years old, No. of Female Household Members aged 15-55 years old, Ownership of Flatscreen TV, Area of Rice Farm, Location of Rice Farm is in an Irrigated Lowland
No. of Blocks	4 (Total Volume of Production tons/farmer, Volume of Production tons/ha, Annual Profit/kg, Annual Profit/ha, WS Profit/kg, WS Profit/ha Non-rice farming Income); 3 (Production Loss Avoided tons/farmer, Production Loss Avoided tons/ha)
Balancing Property	Satisfied

4.6.5 Effects on Production Loss Avoided

For this outcome indicator, the number of early and non-early planters was lower because only those with three production data during W-S 2014-2015, WS 2015-2016, and WS 2019-2020 were included (Table 4.35). As mentioned, the three production data were needed to calculate the potential loss (Yield $_{W\text{-}S\ 2014\text{-}2015}$ - Yield $_{W\text{-}S\ 2015\text{-}2016}$) and the Actual Loss (Yield $_{W\text{-}S\ 2014\text{-}2015}$ - Yield $_{W\text{-}S\ 2019\text{-}2020}$). This yielded data for 911 study participants or 320 early planters and 591 non-early planters.

Table 4.35. Summary statistics of the independent variables that characterize the early and non-early rice planters in Vietnam (N=911)

	Treatment Group: Early Rice Planters n=320				Control Group: Non-Early Rice Planters n=591			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Age of farmer	52.74	11.67	21	85	52.75	11.72	25	83
No. of years in school	6.90	3.60	0	16	6.47	3.53	0	16
Member of a community-based organization	0.53	0.50	0	1	0.46	0.50	0	1
No. of male household members (15-60 years old)	1.54	0.87	0	5	1.61	0.94	0	6
No. of female household members (15-55 years old)	1.56	0.97	0	6	1.50	0.91	0	5
Own flatscreen TV	0.77	0.42	0	1	0.77	0.42	0	1
Area of farm planted with rice (ha)	2.01	1.90	0.10	18	2.00	1.84	0.07	12
Location of farm is on an irrigated lowland	0.13	0.33	0	1	0.15	0.35	0	1

Among the outcome variables, production loss is the measure of early planting as a mitigating measure. The effects of early planting is to increase total volume of production loss avoided by about 3.88 to 4.14 tons/farmer or 2.33 to 2.62 tons/ha using one period of data (Table 4.36). In other words, the early planters had significantly higher volume of production loss avoided than the non-early planters. The *t*-values of all the matching methods are high (>1.96) signifying these are significant changes.

Table 4.36. Average treatment effect on the treated (ATT) : Early planting on production loss avoided

Matching methods	Winter-Spring Production Loss Avoided (tons/farmer) N=911	Winter-Spring Production Loss Avoided (tons/ha) N=911
t-test		
Coefficient	3.97	2.29
t-value	8.22	9.69
Regression		
Coefficient	4.05	2.30
t-value	8.39	9.69
Nearest Neighbour		
Matched control	211	211
ATT	3.88	2.62
t-result	5.59	6.42
t-result (bootstrapped)	6.23	6.45
Radius		
Matched control	582	582
ATT	4.08	2.33
t-result	8.03	9.42
t-result (bootstrapped)	7.76	10.11
Kernel		
Matched control	582	582
ATT	4.12	2.35
t-result (bootstrapped)	8.81	9.58
Stratification		
Matched control	582	582
ATT	4.14	2.39
t-result	8.18	9.55
t-result (bootstrapped)	7.97	9.48

Notes:

Treatment Variable	Planting Strategy (1-Early Planting, 0-Non-early Planting)
Independent Variable	Age of Farmer, No. of Years in School, Membership in Community-based Organization, No. of Male Household Members aged 15-60 years old, No. of Female Household Members aged 15-55 years old, Ownership of Flatscreen TV, Area of Rice Farm, Location of Rice Farm is in an Irrigated Lowland
No. of Blocks	4 (Total Volume of Production tons/farmer, Volume of Production tons/ha, Annual Profit/kg, Annual Profit/ha, WS Profit/kg, WS Profit/ha Non-rice farming Income); 3 (Production Loss Avoided tons/farmer, Production Loss Avoided tons/ha)
Balancing Property	Satisfied

4.6.6 Effects on Nonfarm Annual Income

The effect of early planting on nonfarm income is not significant based on the *t*-values of the matching methods used (Table 4.37). The strictest matching method, Nearest Neighbor, show that early planting will lower income by VND 655,000, but this is not a significant change given the t-values of the matching methods are low.

Table 4.37. Average treatment effect on the treated (ATT): Non-Rice Farming Income

Matching methods	Annual Non-Rice Farming Income* N=1,176
t-test	
Coefficient	6,877,546.00
t-value	1.62
Regression	
Coefficient	4,935,806.00
t-value	1.19
Nearest Neighbour	
Matched control	287
ATT	(6.55e+05)
t-result	(0.11)
t-result (bootstrapped)	(0.10)
Radius	
Matched control	757
ATT	6.90e+06
t-result	1.45
t-result (bootstrapped)	1.25
Kernel	
Matched control	757
ATT	6.65e+06
t-result (bootstrapped)	1.38
Stratification	
Matched control	757
ATT	5.37e+06
t-result	1.12
t-result (bootstrapped)	1.06

Notes:

Treatment Variable	Planting Strategy (1-Early Planting, 0-Non-early Planting)
Independent Variable	Age of Farmer, No. of Years in School, Membership in Community-based Organization, No. of Male Household Members aged 15-60 years old, No. of Female Household Members aged 15-55 years old, Ownership of Flatscreen TV, Area of Rice Farm, Location of Rice Farm is in an Irrigated Lowland
No. of Blocks	4 (Total Volume of Production tons/farmer, Volume of Production tons/ha, Annual Profit/kg, Annual Profit/ha, WS Profit/kg, WS Profit/ha Non-rice farming Income); 3 (Production Loss Avoided tons/farmer, Production Loss Avoided tons/ha)
Balancing Property	Satisfied

5. CONCLUSIONS

The study was conducted to assess the impacts of adjusted crop calendar (specifically, early planting) during the Winter-Spring 2019-2020 season on the rice farming households' welfare in the Mekong River Delta. Survey data came from 412 rice farmers who were early planters (treatment group) and 764 rice farmers who were non-early planters (control group). These rice farmers came from three provinces (5 districts and 15 communes) in Mekong River Delta: Kien Giang (1 district, 3 communes, Long An (1 district, 3 communes) and Soc Trang (3 districts, 9 communes). Data were collected in September to October 2020. Early planting happens when rice planting for the Winter-Spring 2019-2020 (W-S) season was moved on or before 15 November 2019 and it was the last cropping of the farmer. Basically, obvious difference between the early planters and the non-early planters was in the number of rice cropping they practiced. Practicing double rice cropping allowed most of the early planters to adjust their cropping schedule during the year 2019-2020, identified as the latest year with worst salinity problem.

In terms of basic personal and household characteristics, the early and non-early planters did not differ much. Among the study participants, men dominated. On average, the study participants were in their mid-50s and most were above 45 years old, signifying that farming seems to be less attractive to the young people. This is a cause of concern for the future of MRD as a rice granary of Vietnam. Their households, on average had four members, with most households having men and women members in the labor force. Television and more personalized sources of information (e.g., government technician, fellow farmer) were the main sources of information on farming. The use of modern ICT tools (i.e, smart phone and internet) still has a long way to go.

To both the early and non-early planters, farming as a livelihood is important. They were introduced to it at a young age. Few left for other work but returned. Their farms were small and mostly for rice. Crop diversification (rice with vegetables or fruit trees) was practiced by few. More than half of their household income was rice income.

Salinity was identified as a major problem and mostly affecting the Winter-Spring Season. Farmers had sufferred production losses from salinity intrusion.

Their experience showed that recovery from destruction of salinity is slow and there is rigidity in moving away from rice production system. Salinity intrusion was expected by the majority of the farmers during the Winter-Spring 2019-2020 but only the most of the early planters were able to adjust planting to earlier date than usual. Other salinity adaptation strategies adopted were the use of salt tolerant varieties and AWD.

The early planters adjusted their planting for the Winter-Spring 2019-2020 season to earlier schedule than usual. Generally, they adjusted their entire cropping schedule, planting earlier than usual for the Summer-Autumn season and the Winter-Spring season. There were those who moved planting as early late Augus (Autumn-Winter), and with most of them in October to early November for the Winter-Spring season. Among the non-early planters, there were those who adjusted their planting to the second half of November but still did not made it to the 15 November cut.

The main reasons for adjusting the cropping calendar or for planting earlier than usual were to avoid high salinity period, avoid production loss, and avoid income loss. This is consistent with what other studies showing that farmers are risk-averse agents. They seek to minimize losses by avoiding risks. Adjusting cropping calendar was easier for the early planter with most of them practicing two rice cropping. Most of the non-early planters were practicing three rice cropping and thus it was difficult for them to plant earlier than usual. Farmers practicing two rice cropping usually plant during the Summer-Autumn (first cropping) and during the Winter Spring (second cropping). Farmers practicing three rice cropping plant during Summer-Autumn months, Autumn-Winter, and Winter-Spring seasons.

Moreover, the early and non-early planters almost had similar other farming practices. These included their method of planting, density at planting, use of the fertilizer, pesticides and other chemicals, and more. Every cropping, it took 18 days for the rice to emerge, about 60 days to reach the flowering stage, and about 97 days to harvest.

The Propensity Score Matching (PSM) was used to assess the effects of early planting on the impact (treatment) variables. The matching methods used were Nearest Neighbour, Radius, Kernel, and Stratification. After matching the early planter-farmers (treatment group) and the non-early planter-farmers (control group), the effects of early planting are to:

- increase rice farming income by about VND 22.80 million to VND 24.60 million per farmer or VND 8.62 million to VND 8.77 million per hectare during the W-S season;
- increase annual rice farming income by about VND 13.7 million to VND 17.1 million per farmer or VND 3.2 million to VND 4.27 million per hectare.
- Increase volume of rice production by about 5.29 to 5.67 tons/farmer or 2.51 to 2.59 tons/ha during the Winter-Spring 2019-2020 season
- Increase rice production loss avoided by about 3.88 to 4.14 tons/farmer or 2.33 to 2.62 tons/ha

The results of Propensity Score Matching show that early rice planters have higher rice income (per farmer and per hectare), rice productivity (tons/ha), and rice production losses avoided (tons/ha) than non-early rice planters. The study has found evidence that early rice planting as a mitigation strategy works to avert production losses and increase rice production and income of rice farmers.

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