

## Supplementary materials

### Tables

**Table S1.** Five steps of PSM analysis.

Step	Detail
1. Estimation of binary logistics regression model and propensity scores	<p>We estimated a binary logistic regression model as follows [1]:</p> $\text{logit}(Z_i = 1 X) = \log\left(\frac{P(Z_i = 1)}{1 - P(Z_i = 1)}\right) = \beta_0 + \beta_1 X_{1i} + \dots + \beta_k X_{ki} \quad (1)$ <p>Where <math>i</math> denotes each sample, <math>P</math> represents the probability of YSF participation, <math>\beta_0</math> is a constant, and <math>\beta_k</math> is the coefficient to be estimated. The dependent variable (<math>Z</math>) is the samples' participation in the YSF programme, with a binary value of either 0 if not participating or 1 if participating. From the literature review [2,3], the independent variables (<math>X</math>) include the farmers' demographic and family, farming, farming problem, and farm location characteristics (Table 1). <math>k</math> is the number of independent variables.</p> <p>Then, a propensity score (<math>e_i(X)</math>) for both participating and non-participating samples which indicates a probability of participating in the YSF was estimated from the following equation [1].</p> $e_i(X) = \frac{\exp(\text{logit}(Z_i = 1 X))}{1 + \exp(\text{logit}(Z_i = 1 X))} \quad (2)$
2. Examination of common support	<p>We used a histogram and a boxplot to examine how much there is a common support between participants and non-participants, an overlapping region among the propensity score distribution of the two groups. Matching among the two groups and estimating the impact of the YSF will be of good quality and accurate if there is the sufficient common support region. Every participant can find a non-participant with the similar propensity score, a score summarising various characteristics of each sample, to match with.</p>
3) Matching non-participants with participants	<p>We used a number of different matching algorithms to extract only matched samples based on the similar propensity score from the whole samples. According to Leite [1], Ho and colleagues [4], and Olmos and Govindasamy [5]; we used eight matching algorithms: 1) one-to-one nearest neighbour matching (NNM), 2) two-to-one nearest neighbour matching with replacement (NNMR 2:1), 3) one-to-one nearest neighbour matching with replacement within a 0.20 caliper (NNMR 0.20), 4) one-to-one nearest neighbour matching with replacement within a 0.25 caliper (NNMR 0.25), 5) one-to-one genetic matching (GM), 6) one-to-one optimal matching (OM), 7) full matching (FM), and 8) subclassification (SUB). The different matching algorithms were used to demonstrate the consistency of the YSF impact estimation.</p>
4) Estimation of the impact of the YSF programme	<p>We estimated the impact of the YSF on the participants' net farm income (continuous variable) through estimating a simple linear regression model with weighted matched samples. The impact of the YSF on the adoption of innovative farming methods other than common machinery and chemicals (dichotomous variable) was estimated through again estimating a binary logistic regression model. A treatment effect on individuals can be divided into three types which are the average treatment effect on the treated individuals (ATT), the average treatment effect on the untreated individuals (ATC), and the average treatment effect on all cases (ATE). In estimating the treatment effect from PSM, researches will mostly focus on estimating ATT [1]. ATT is the average difference between the expected potential outcomes of participants under the presence and absence of the treatment condition (<math>E(Y_i^1 Z_i = 1) - E(Y_i^0 Z_i = 1)</math>). However, under the latter condition, only the outcomes of non-participants can be observed (<math>E(Y_i^0 Z_i = 0)</math>). If ATT is derived from taking the average of <math>E(Y_i^1 Z_i = 1) - E(Y_i^0 Z_i = 0)</math>, it may be overestimated or underestimated, which can be corrected with PSM. The following two equations were, therefore, the models to be estimated.</p> $Y_{1i} = \beta_0 + \beta_1 Z_i \quad \text{and} \quad \text{logit}(Y_{2i} = 1 Z) = \beta_0 + \beta_1 Z_i \quad (3.1) \text{ and } (3.2)$ <p>Where <math>i</math> is each sample after matching and weighting, <math>\beta_0</math> is the constant, and <math>\beta_1</math> is the impact of the YSF to be estimated. The dependent variable (<math>Y_{1i}</math>) is net farm income of the samples. <math>Y_{2i}</math> is the adoption of innovative methods other than common machinery and chemicals with a value of 1 or adoption of only common machinery and chemicals with a value of 0. After estimating equation (3.2), the equations similar to equation (2) was used again to estimate a probability of adopting innovative methods other than common machinery and chemicals.</p>

Step	Detail
5) Examination of matching quality and influence of unobserved factors	<p>According to Austin [6], Leite [1], Olmos and Govindasamy [5], and Zhang and colleagues [7], we used chi-square test to diagnose if, in the overall covariates, there is still an imbalance in the covariates left between the participants and the non-participants after matching. We also used absolute standardised mean difference (<math> SMD </math>) to diagnose whether, for each covariate, non-equivalence still exists. If the covariates are balanced among the two groups, our matching will be considered to be of good quality. <math> SMD </math> for continues and dichotomous variables were obtained from the following equations.</p> $ SMD  = \left  \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2 + s_2^2}{2}}} \right  \text{ and }  SMD  = \left  \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\hat{p}_1(1-\hat{p}_1) + \hat{p}_2(1-\hat{p}_2)}{2}}} \right  \quad (4.1) \text{ and } (4.2)$ <p>Where <math>\bar{x}_1</math> and <math>\bar{x}_2</math> are the sample mean, and <math>s_1^2</math> and <math>s_2^2</math> are the sample variance of the continuous variables for the participants and the non-participants, respectively, <math>\hat{p}_1</math> and <math>\hat{p}_2</math> are the prevalence of the dichotomous variables for each group.</p> <p>In addition, we performed Rosenbaum's sensitivity analysis to determine how large unidentified confounders (gamma: <math>\Gamma</math>) are leading to change in the statistical significance of the estimated YSF programme impact from insignificant to significant or vice versa. If the impacts are insensitive to the remaining bias (larger change in the gamma), confidence about the accuracy of the impacts is strengthened.</p>

**Notes.** YSF=Young Smart Farmer programme.

**Table S2.** Reasons for participation in the Young Smart Farmer programme.

<b>Expectation</b>	<b>Percentage</b>
1. Gaining knowledge and skills related to crop production and livestock and edible insect raising (e.g. organic farming, rice varieties, chicken and cricket raising, production technology, bio fertiliser and pesticide making)	34.31
2. Having a strong network among participants and related parties for sharing knowledge, opinion, and information	30.40
3. Gaining knowledge and skills related to post-harvest management (e.g. marketing, packaging, processing)	16.67
4. Receiving support in other areas (e.g. funds, sufficient water for farming, product processing machinery)	6.86
5. Passing on the knowledge gained to other farmers in the village	4.90
6. No expectations	6.86

**Notes.** n is 102, as some participants had more than one expectation.

**Table S3.** Receipt of knowledge and information from The Young Smart Farmer programme.

<b>Knowledge and Information received</b>	<b>Percentage</b>
<b>1. Post-harvest management</b>	<b>44.74</b>
• General and online marketing (e.g. postal sale, webpage, social media, QR code, e-commerce)	14.47
• Product processing and value addition	10.97
• Product brand, logo, label, sticker, and packaging design and product story creation	9.21
• Product standard request (e.g. Food and Drug Administration, Good Agricultural Practices, Organic Agriculture Certification Thailand)	6.58
• Product testing (taste and customer satisfaction) and product inspection (impurities)	3.51
<b>2. Crop production and shrimp, freshwater fish, and chicken raising</b>	<b>41.23</b>
• Different crop cultivation (e.g. rice, durian, mango, mushroom, vegetable)	11.84
• Cost reduction, bio fertiliser and pesticide making, and dealing with insect pests with predator insects	8.77
• Organic and safe chemical farming	7.02
• Agricultural machinery and technology (e.g. food processing machine, timer or mobile phone application for farm irrigation system, weather forecasting application on mobile phone)	6.58
• Plant diseases, insect pests, and chemical fertiliser and pesticide usage	3.95
• Shrimp, freshwater fish (in floating cages), and chicken raising	1.75
• Soil and water quality inspection	1.32
<b>3. Farming business administration</b>	<b>14.03</b>
• Business and production planning and project proposal writing	5.70
• Business and household accounting, business registration, and related tax management	5.26
• Funding source (loan request)	3.07

**Notes.** n is 228, as some participants received more than one knowledge and information.

**Table S4.** Satisfaction with the Young Smart Farmer programme.

Aspect	Satisfaction level	
	Mean	SD
Overall YSF programme	2.92	0.64
YSF publicity	2.48	0.67
Opportunity for attending training and field visits	2.92	0.61
Opportunity for networking among participants	2.80	0.57
Post-YSF programme follow-up	2.18	0.59

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Satisfaction level = 1 (very dissatisfied), 2 (dissatisfied), 3 (satisfied), 4 (very satisfied).

**Table S5.** Satisfaction with the Young Smart Farmers programme by participants' characteristics.**a1. Net Income**

Aspect	a1: Net income						Difference ( $\chi^2$ statistic)
	Net farm income (baht per rai)						
	5,000 or less (n=34)		5,001-10,000 (n=11)		10,001 or more (n=16)		
	Mean	SD	Mean	SD	Mean	SD	
Overall YSF programme	3.00	0.65	3.18	0.41	2.56	0.63	6.79**
YSF publicity	2.53	0.75	2.46	0.52	2.38	0.62	0.41
Opportunity for attending trainings and field visits	2.97	0.58	3.18	0.41	2.63	0.72	5.48*
Opportunity for networking among participants	2.85	0.56	3.09	0.30	2.50	0.63	7.19**
Post-YSF programme follow-up	2.21	0.54	2.36	0.51	2.00	0.73	3.58

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Satisfaction level = 1 (very dissatisfied), 2 (dissatisfied), 3 (satisfied), 4 (very satisfied); \*, \*\*, \*\*\* significant at 10%, 5% and 1% level.

**a2. Net Income**

Aspect	Net farm income (baht per rai)											
	5,000 or less (%; n=34)				5,001-10,000 (%; n=11)				10,001 or more (%; n=16)			
	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
Overall YSF programme	0.00	20.59	58.82	20.59	0.00	0.00	81.82	18.18	6.25	31.25	62.50	0.00
YSF publicity	5.88	44.12	41.18	8.82	0.00	54.55	45.45	0.00	6.25	50.00	43.75	0.00
Opportunity for attending trainings and field visits	0.00	17.65	67.65	14.70	0.00	0.00	81.82	18.18	6.25	31.25	56.25	6.25
Opportunity for networking among participants	0.00	23.53	67.65	8.82	0.00	0.00	90.91	9.09	6.25	37.50	56.25	0.00
Post-YSF programme follow-up	5.88	67.65	26.47	0.00	0.00	63.64	36.36	0.00	18.75	68.75	6.25	6.25

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Numbers in the table=percentage

**b1. Innovative Method**

Aspect	Innovative farming method adopted				Difference ( <i>U statistic</i> )
	Common machinery and chemicals (n=5)		Other than the machinery and chemicals (n=56)		
	Mean	SD	Mean	SD	
Overall YSF programme	2.80	0.45	2.93	0.66	124.50
YSF publicity	2.20	0.84	2.50	0.66	114.00
Opportunity for attending trainings and field visits	3.00	0.00	2.91	0.64	130.00
Opportunity for networking among participants	2.80	0.45	2.80	0.59	139.50
Post-YSF programme follow-up	2.00	0.71	2.20	0.59	119.50

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Satisfaction level = 1 (very dissatisfied), 2 (dissatisfied), 3 (satisfied), 4 (very satisfied); None of the difference of farmers' satisfaction with each YSF programme's aspect were significant (p-value>0.1).

**b2. Innovative Method**

Aspect	Innovative farming method adopted							
	Common machinery and chemicals (%; n=5)				Other than the machinery and chemicals (%; n=56)			
	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
Overall YSF programme	0.00	20.00	80.00	0.00	1.79	19.64	62.50	16.07
YSF publicity	20.00	40.00	40.00	0.00	3.57	48.21	42.86	5.36
Opportunity for attending trainings and field visits	0.00	0.00	100.00	0.00	1.79	19.64	64.29	14.28
Opportunity for networking among participants	0.00	20.00	80.00	0.00	1.79	23.21	67.86	7.14
Post-YSF programme follow-up	20.00	60.00	20.00	0.00	7.14	67.86	23.21	1.79

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Numbers in the table=percentage

**c1. Size**

Aspect	Farm size (rai)						Difference ( $\chi^2$ statistic)
	29 or less (n=42)		30-59 (n=11)		60 or more (n=8)		
	Mean	SD	Mean	SD	Mean	SD	
Overall YSF programme	2.83	0.62	3.09	0.70	3.13	0.64	2.23
YSF publicity	2.38	0.70	2.64	0.67	2.75	0.46	3.16
Opportunity for attending trainings and field visits	2.91	0.66	2.91	0.54	3.00	0.54	0.14
Opportunity for networking among participants	2.79	0.61	2.73	0.47	3.00	0.54	1.18
Post-YSF programme follow-up	2.10	0.58	2.36	0.67	2.38	0.52	3.69

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Satisfaction level = 1 (very dissatisfied), 2 (dissatisfied), 3 (satisfied), 4 (very satisfied); None of the difference of farmers' satisfaction with each YSF programme's aspect were significant (p-value>0.1).

## c2. Size

Aspect	Farm size (rai)											
	29 or less (%; n=42)				30-59 (%; n=11)				60 or more (%; n=8)			
	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
Overall YSF programme	2.38	21.43	66.67	9.52	0.00	18.18	54.55	27.27	0.00	12.50	62.50	25.00
YSF publicity	7.14	52.38	35.72	4.76	0.00	45.45	45.45	9.10	0.00	25.00	75.00	0.00
Opportunity for attending trainings and field visits	2.38	19.05	64.29	14.28	0.00	18.18	72.73	9.09	0.00	12.50	75.00	12.50
Opportunity for networking among participants	2.38	23.81	66.67	7.14	0.00	27.27	72.73	0.00	0.00	12.50	75.00	12.50
Post-YSF programme follow-up	9.52	73.81	14.29	2.38	9.10	45.45	45.45	0.00	0.00	62.50	37.50	0.00

Notes. n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Numbers in the table=percentage

## d1. Tenure

Aspect	Farmland tenure				Difference ( <i>U statistic</i> )
	Not owned or rented most of land (n=19)		Owned most of land (n=42)		
	Mean	SD	Mean	SD	
Overall YSF programme	3.16	0.60	2.81	0.63	292.00*
YSF publicity	2.58	0.61	2.43	0.70	356.50
Opportunity for attending trainings and field visits	3.05	0.62	2.86	0.61	341.00
Opportunity for networking among participants	2.95	0.52	2.74	0.59	332.50
Post-YSF programme follow-up	2.32	0.58	2.12	0.59	349.00

Notes. n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Satisfaction level = 1 (very dissatisfied), 2 (dissatisfied), 3 (satisfied), 4 (very satisfied); \*, \*\*, \*\*\* significant at 10%, 5% and 1% level.

## d2. Tenure

Aspect	Farmland tenure							
	Not owned or rented most of land (%; n=19)				Owned most of land (%; n=42)			
	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
Overall YSF programme	0.00	10.53	63.16	26.31	2.38	23.81	64.29	9.52
YSF publicity	0.00	47.37	47.37	5.26	7.14	47.62	40.48	4.76
Opportunity for attending trainings and field visits	0.00	15.79	63.16	21.05	2.38	19.05	69.05	9.52
Opportunity for networking among participants	0.00	15.79	73.68	10.53	2.38	26.19	66.67	4.76
Post-YSF programme follow-up	0.00	73.69	21.05	5.26	11.90	64.29	23.81	0.00

Notes. n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Numbers in the table=percentage

**e1. Activity**

Aspect	Farm activity				Difference ( <i>U statistic</i> )
	Produced other products with or without rice (n=45)		Only produced rice (n=16)		
	Mean	SD	Mean	SD	
Overall YSF programme	2.78	0.60	3.31	0.60	209.50***
YSF publicity	2.38	0.61	2.75	0.78	252.50*
Opportunity for attending trainings and field visits	2.82	0.61	3.19	0.54	256.00**
Opportunity for networking among participants	2.71	0.55	3.06	0.57	259.00**
Post-YSF programme follow-up	2.16	0.60	2.25	0.58	325.50

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Satisfaction level = 1 (very dissatisfied), 2 (dissatisfied), 3 (satisfied), 4 (very satisfied); \*, \*\*, \*\*\* significant at 10%, 5% and 1% level.

**e2. Activity**

Aspect	Farm activity							
	Produced other products with or without rice (%; n=45)				Only produced rice (%; n=16)			
	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
Overall YSF programme	2.22	24.44	66.67	6.67	0.00	6.25	56.25	37.50
YSF publicity	4.44	55.56	37.78	2.22	6.25	25.00	56.25	12.50
Opportunity for attending trainings and field visits	2.22	22.22	66.67	8.89	0.00	6.25	68.75	25.00
Opportunity for networking among participants	2.22	26.67	68.89	2.22	0.00	12.50	68.75	18.75
Post-YSF programme follow-up	8.89	68.89	20.00	2.22	6.25	62.50	31.25	0.00

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Numbers in the table=percentage

**f1. Off-farm Income**

Aspect	Off-farm income				Difference ( <i>U statistic</i> )
	Absence (n=20)		Presence (n=41)		
	Mean	SD	Mean	SD	
Overall YSF programme	2.85	0.67	2.95	0.63	369.00
YSF publicity	2.45	0.51	2.49	0.75	397.50
Opportunity for attending trainings and field visits	2.85	0.67	2.95	0.59	367.50
Opportunity for networking among participants	2.70	0.57	2.85	0.57	347.00
Post-YSF programme follow-up	2.20	0.70	2.17	0.54	409.00

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Satisfaction level = 1 (very dissatisfied), 2 (dissatisfied), 3 (satisfied), 4 (very satisfied); None of the difference of farmers' satisfaction with each YSF programme's aspect were significant (p-value>0.1).

## f2. Off-farm Income

Aspect	Off-farm income							
	Absence (%; n=20)				Presence (%; n=41)			
	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
Overall YSF programme	0.00	30.00	55.00	15.00	2.45	14.63	68.29	14.63
YSF publicity	0.00	55.00	45.00	0.00	7.32	43.90	41.46	7.32
Opportunity for attending trainings and field visits	0.00	30.00	55.00	15.00	2.43	12.20	73.17	12.20
Opportunity for networking among participants	0.00	35.00	60.00	5.00	2.44	17.07	73.17	7.32
Post-YSF programme follow-up	10.00	65.00	20.00	5.00	7.32	68.29	24.39	0.00

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Numbers in the table=percentage

## g1. Marketing problem

Aspect	Marketing problem				Difference (U statistic)
	Not facing (n=46)		Facing (n=15)		
	Mean	SD	Mean	SD	
Overall YSF programme	2.91	0.59	2.93	0.80	343.50
YSF publicity	2.48	0.62	2.47	0.83	337.50
Opportunity for attending trainings and field visits	2.87	0.58	3.07	0.70	295.00
Opportunity for networking among participants	2.78	0.51	2.87	0.74	333.50
Post-YSF programme follow-up	2.24	0.57	2.00	0.66	283.50

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Satisfaction level = 1 (very dissatisfied), 2 (dissatisfied), 3 (satisfied), 4 (very satisfied); None of the difference of farmers' satisfaction with each YSF programme's aspect were significant (p-value>0.1).

## g2. Marketing problem

Aspect	Marketing problem							
	Not facing (%; n=46)				Facing (%; n=15)			
	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
Overall YSF programme	2.17	15.22	71.74	10.87	0.00	33.33	40.00	26.67
YSF publicity	2.18	52.17	41.30	4.35	13.33	33.33	46.67	6.67
Opportunity for attending trainings and field visits	2.17	17.39	71.74	8.70	0.00	20.00	53.33	26.67
Opportunity for networking among participants	2.17	19.57	76.09	2.17	0.00	33.33	46.67	20.00
Post-YSF programme follow-up	4.35	69.57	23.91	2.17	20.00	60.00	20.00	0.00

**Notes.** n=61 (number of interviewed participants); YSF=Young Smart Farmers programme; Numbers in the table=percentage



**Table S6.** Result of calculating absolute standardized mean difference and chi-square statistics for examining covariate balance before and after matching.

Variable	Before matching	After matching							
		NNM	NNMR 2:1	NNMR 0.20	NNMR 0.25	GM	OM	FM	SUB
Absolute standardised mean differences									
Gender	0.37	0.00	13.63	10.53	12.05	6.52	0.00	0.50	0.50
Age	47.33	10.29	0.58	1.80	4.30	18.17	10.29	12.74	12.74
Education	113.04	37.32	0.49	17.86	17.39	41.22	37.32	16.85	16.85
Child	2.43	10.22	9.04	6.76	4.64	3.37	10.22	6.38	6.38
Size	1.04	2.84	13.52	2.01	1.75	1.29	2.84	1.94	1.94
Tenure	43.39	13.72	4.63	7.91	6.80	10.34	13.72	7.32	7.32
Activity	3.57	19.68	30.86	25.91	24.93	15.51	19.68	21.56	21.56
Experience	91.93	45.18	19.40	9.77	10.64	51.46	45.18	40.70	40.70
Off-farm income	26.97	14.30	17.06	11.42	10.28	14.30	14.30	12.73	12.73
Other Support	4.66	0.00	9.77	1.20	0.71	0.00	0.00	4.94	4.94
Marketing problem	86.76	38.57	13.23	6.70	7.64	35.17	38.57	25.92	25.92
Pest problem	5.61	14.08	17.54	24.42	25.45	14.08	14.08	18.47	18.47
Weather problem	20.25	3.49	1.15	17.19	14.82	3.49	3.49	3.83	3.83
Soil problem	11.85	21.09	10.34	5.04	0.71	21.09	21.09	18.21	18.21
Distance1	13.25	5.36	13.18	5.23	4.64	7.91	5.36	27.36	27.36
Distance2	12.72	12.42	8.05	10.97	10.90	11.27	12.42	1.03	1.03
chi-square statistics									
Chi-square	64.50***	25.00	9.84	6.07	5.80	25.30	25.00	22.50	22.50
p-value	0.00	0.07	0.88	0.99	0.99	0.07	0.07	0.13	0.13

**Notes.** 1. NNM = one-to-one nearest neighbour matching, NNMR 2:1 = two-to-one nearest neighbour matching with replacement, NNMR 0.20 = one-to-one nearest neighbour matching with replacement within a 0.20 caliper, NNMR 0.25 = one-to-one nearest neighbour matching with replacement within a 0.25 caliper, GM = one-to-one genetic Matching, and OM = one-to-one optimal matching, FM = full matching, SUB = subclassification.

2. \*, \*\*, and \*\*\* is statistically significant at 10%, 5% and 1% level.

3. Absolute standardised mean difference and chi-square statistic are calculated to check match quality. A good quality match should create a balance between characteristics (variables) of non-participants and participants after matching. A variable with the difference greater than 25% may be suspected of an imbalance, and the chi-square with statistical significance indicates that at least one variable in a model has an imbalance.

4. The above result reveals that all matches create a better equivalence of covariates. For covariates with the different high values before matching, their values had decreased after matching. Almost all other covariates also had different values less than 25% after matching, and the chi-square showed statistical insignificance for all matches (p-value>0.05). This could be consequently concluded that all matches are of good quality.

**Table S7.** Result of analysing Rosenbaum's sensitivity

Gamma	Net income		Innovative farming method	
	Lower bound p-value	Upper bound p-value	Lower bound p-value	Upper bound p-value
1.0	0.20	0.20	0.09	0.09
1.1	0.12	0.30	0.07	0.12
1.2	0.07	0.41	0.05	0.14
1.3	0.04	0.51	0.04	0.17
1.4	0.02	0.61	0.03	0.20
1.5	0.01	0.70	0.03	0.23
1.6	0.01	0.77	0.02	0.26
1.7	0.00	0.83	0.02	0.29
1.8	0.00	0.87	0.01	0.32
1.9	0.00	0.91	0.01	0.35
2.0	0.00	0.93	0.01	0.38
2.1	0.00	0.95	0.01	0.40
2.2	0.00	0.97	0.01	0.43
2.3	0.00	0.98	0.01	0.46
2.4	0.00	0.98	0.00	0.48
2.5	0.00	0.99	0.00	0.50

**Notes.** 1. The sensitivity analysis was conducted to measure the influence of unobserved confounders on an estimated treatment effect. Under the analysis, lower bound, and upper bound p-values of an estimated treatment effect will be computed at different given gammas, here ranging from 1-2.5, which measure degrees of hidden bias due to failure to identify all relevant covariates. This shows how much the gamma has to be changed to cause the p-value to change from statistically nonsignificant to significant or vice versa. A change in the gamma close to zero leading to a change in the significance of the p-value indicates that an estimated treatment effect is sensitive to unobserved covariates.

2. The above result reveals that when the gamma equals 1.7, the lower bound p-value of the Young Smart Farmer programme effect on net farm income has been decreased from 0.01 to 0.00, which is below the significant level of 0.01. Additionally, when the gamma equalled 2.4, the lower bound p-value of the effect on adoption of innovative farming methods other than common machinery and chemicals had been decreased from 0.01 to 0.00, which was also below the significant level of 0.01. This could be consequently determined that the estimated Young Smart Farmer programme effect is not affected by the remaining omitted factors.

**Table S8.** Participants' comments on the merits and benefit of the Young Smart Farmer programme

<b>Merit and benefit</b>	<b>Percentage</b>
1. The YSF programme provided the trainings, field trips, or sessions for passing on and sharing a wide range of knowledge, information, skills and experiences; many of which were new to and necessary for participants, meet their needs, and could be practically applied for further development.	31.52
2. Many expectations of participants of the programme had been fulfilled.	18.79
3. The knowledge and information gained from the programme contributed to the participants' developed farming (increased yields and sales and decreased costs).	15.15
4. The programme's activities gave the participants a broader view of the farming career and made them see more opportunities for the career. They also gave them ideas and encouraged them to seek further relevant learning for their farming and products development. Consequently, they inspired and gave them more confidence to continue their farming.	11.52
5. The programme contributed to the knowledge, information, and products exchange networking formed amongst participants in the study area and between them and participants in other areas and non-participants.	9.09
6. The programme had questioned participants' needs prior to providing its activities for them.	8.48
7. Participants got to know the lecturers from the different agencies, who they could later contact for more knowledge and information on their own.	3.64
8. The programme offered field trip abroad opportunities (Italy, Australia, and Japan).	1.82

**Notes.** n is 165, as some participants had more than one comments.

**Table S9.** Participants' comments on the problems of the Young Smart Farmer programme

<b>Problem</b>	<b>Percentage</b>
1. The YSF programme's activities had not yet been held continuously and not yet led to concrete participant development outcomes. The activities focused too much on theoretical sections, giving lectures, in the classroom where some lecturers' teaching techniques had not yet stimulated and attracted the participants' curiosity. There was also no suitable provision of other relevant services and assistances to completely resolve participants' problems.	16.85
2. The programme's development goals were still unclear. Participants included farmers with different levels of knowledge and experience and who undertook diverse types of activities (chemical, safe chemical and organic farming; rice, fruit trees, field crops, vegetables, shrimp and freshwater fish, livestock, and edible insect farming). The provision of development was not classified based on the aforementioned differences among participants	15.73
3. Some contents of the programme's activities were still inconsistent with participants' current farming types and progresses.	13.48
4. Participants were still not really involved in designing the programme's activities as they need.	12.36
5. After joining the programme, participants' development had not yet been monitored and evaluated, particularly by visiting and inquiring them about their need for additional development.	11.24
6. Some participants had no real interest in and intention of taking part in the programme, while many farmers were still inaccessible to the programme. Additionally, using the number and age as the basis for selecting participants each year were still not sufficient.	10.67
7. The programme's activities were sometimes held in other provinces or locations that were too far from participants' homes, for too many days, and with overnight stays in the event areas.	8.99
8. Many target audiences still did not know and understand the programme and the group of participants had not yet been made known the general public.	6.18
9. Participants had not yet been adequately, thoroughly, and continuously informed about the programme's activities.	3.37
10. There was still no formal and permanent place for distributing the products of participants in the study area, same as in other provinces.	1.12

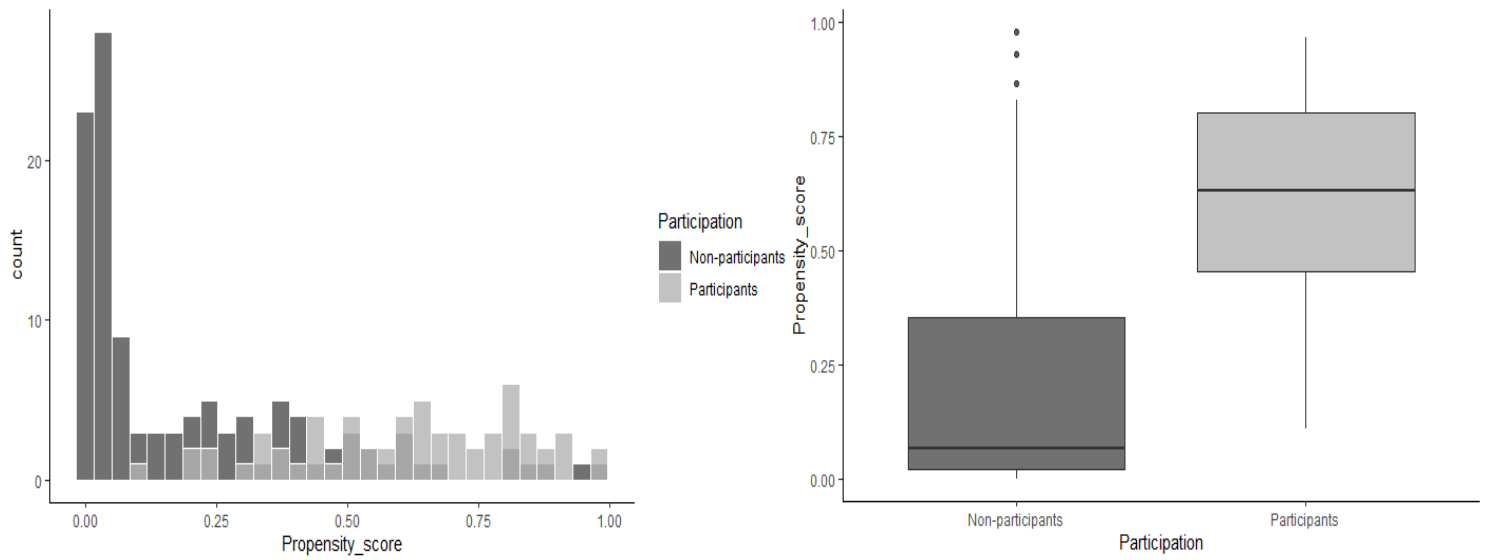
**Notes.** n is 178, as some participants had more than one comments.

**Table S10.** Participants' recommendations on the Young Smart Farmer programme

Recommendation	Percentage
1. The YSF programme's activities to be provided should really be based on its participants' needs. The programme should also provide its participants with additional knowledge and information on areas, such as planting and caring for crops, organic plant diseases removers and pesticides, tailor-made fertilizers, plant nutrients found in nature, watering timer system, soil quality solution, affordable yield enchantment technology, greenhouse design and construction, rice processing, and marketing channel.	32.85
2. The programme should provide its participants with additional supports in the areas of budget, funds, loans, and inputs; including services (e.g. assistance and complaint center services and standardized certification services), product distinctive point development, and product distribution facilities.	26.28
3. The programme's activities should be held on an ongoing basis and should include more practical sections both inside and outside the classroom.	8.76
4. The programme should have a clear primary goal of what types of farming, whether individual or group of farmers, and how many of them will be developed each year. The programme should then divide its participants into groups based on the farming activities they are doing and provide appropriate and continuous development for each group of its participants.	8.03
5. The recruitment of the programme participants should really be based on the defined qualifications. Participants should be persons with the real interest in and intention of joining the programme. They should also be the ones who can extend the use of the knowledge gained and pass them on to others. Additionally, the type of product should be included as a criterion for selecting participants.	7.30
6. The programme should be more promoted to reach its target audiences and should help promote its participants' group to be known to the general public.	6.57
7. The programme's activities should be held close to its participants' homes and for a short period of one to three days.	4.38
8. Rather than developing all participants' knowledge simultaneously, the programme should visit and develop each participant's farm directly, as each farm has different activities, problems, strengths, weaknesses and development needs.	3.65
9. The programme should have more liaisons with its participants regarding the information of organizing its activities.	2.19

**Notes.** n is 137, as some participants have more than one comments.

## Figures



**Figure S1.** Distribution of propensity scores predicted for participants and non-participants.

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