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Chapter 3
Drought Effect and Adaptation of Farmers in Northeast Thailand

Orawan SRISOMPUN

Abstract: The drought situation in Thailand tends to increase in frequency. In 2019, Thailand experienced its worst drought in four decades. Most of the drought-affected plantations are in the Northeast. So, drought stress has extensively affected the farmer households with high levels of vulnerability to poverty in Northeast Thailand. This study analyzes the effect and adaptation of drought on farmer households in the study area. The results revealed that 80% of the farmers affected by drought in 2019 were small farmers. On average, the decline in paddy yields caused by drought ranged from 1,757 to 4,661 kilograms per household (equating to approximately 25,840–50,171 Thai baht per household). In addition, drought caused 30.12% of farmers in recognized drought areas to have insufficient rice available for consumption. The agricultural income of farmer's households in declared drought areas diminished from 27.82% to 20.49% of total income. Farmers in irrigated areas adapted most effectively to drought by suspending rice growing, searching for additional water sources, adjusting the growing period, reducing the amount of land used for rice growing, adjusting the rice ecotypes cultivated, cultivating different plants instead of rice, and temporarily changing to rearing livestock and other occupations. However, more than 50% of farmers lacked crop insurance because insurance premiums may increase the cost of rice growing. Although the Thai government has continued measures to mitigate the effects of drought, they failed in the long term. It is necessary to have a long-term

plan and extensive investment in drought management, as well as to adjust stakeholders' strategies throughout the supply chain.

1. Introduction

The frequency of drought situations in Thailand is tending to increase. In 2019, Thailand experienced its worst drought in four decades. The drought-affected rice cultivation area is about 3.90 million rai (1 rai=0.16 hectare), or about 6.60% of the country's rice-cultivated area. The amount of damage is estimated to be approximately 8,900 million Thai baht. Most of the drought-affected plantations were in the Northeast regions. In 2015, 2018, and 2019, approximately 62.58%, 94.36%, and 76.29% of the total drought-affected rice plantations were in the Eastern region. The total damage from the drought was 3,649 million Thai baht, or accounted for 40.62% of the total damage value of the country. The Northeast regions have had a serious drought for a long time and face problems with poverty and low rice yields (Figure 3.1).

Figure 3.1 Farmers coping with drought. Source: Author

A serious drought in Thailand in 2019 caused a shortage of water supply for agriculture. Especially, lack of water and weed problems in

rice fields are emerging issues. Consequently, the quantity and quality of rice are adversely affected. In the Northeast region, the main purpose of rice cultivation is mainly for household consumption. If there is rice left over from consumption and it is assured that the following year's rice yield will be sufficient for consumption, then the farmer will sell the remaining rice to the market. Therefore, drought affects not only household income but also food security. To cope with drought and its impacts, farmers applied a variety of coping strategies. They included additional water sources, adjusting the growing period, reducing rice area, changing to other plants, keeping livestock and other occupations. The ability for adaptation is different between resource-based, economic-based, and social characteristics. The conceptual framework of this study is shown in Figure 3.2.

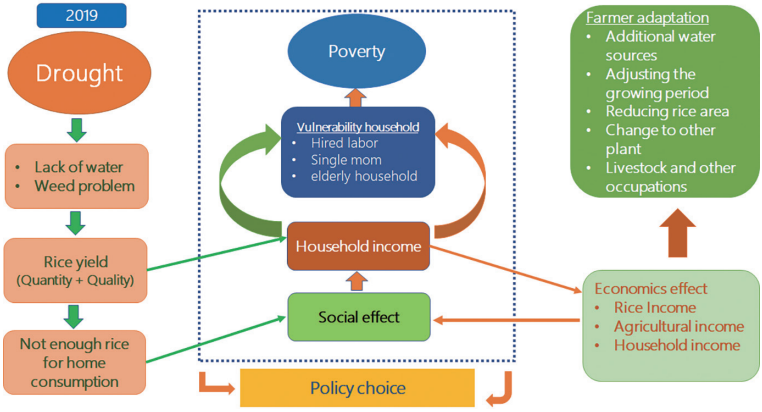

Figure 3.2 Conceptual framework. Source: Author

This study aims to (1) understand the economic and social impacts of the drought situation on farmer households in the Northeast, (2) analyze the pattern of drought adaptation among farmer households

in the Northeast, and (3) analyze the factors affecting the farmers' adaptation to drought problems in the Northeast.

2. Data, Sampling, and Study Area

The sampling method used in this research is the three-step stratified sampling technique. The first step is to determine the target province in the survey by integrating data from three sources: the Department of Agricultural Extension, the Department of Land Development, and the Department of Disaster Prevention and Mitigation (DDPM) (Table 3.1).

Table 3.1 Target province in the survey

No.	Province	Department of Agricultural Extension			Department of Land Development	DDPM	Score
	Year	2019	2018	2017	2004–2014	2019	(Maximum = 5)
1	Khonkaen*	☑	☑	☑	☑	☑	5*
2	Chaiyaphom*	☑	-	-	☑	☑	3*
3	Burirum*	☑	☑	☑	☑	☑	5*
4	Nakonratchasima*	☑	-	☑	☑	☑	4*
5	Mahasarakham*	☑	☑	☑	☑	☑	5*
6	Nongkai	☑	-	-	-	☑	2
7	Buengkan	☑	-	-	-	☑	2
8	Nakornphanom*	☑	-	☑	☑	-	3*
9	Sisaket*	-	☑	☑	☑	☑	4*
10	Surin*	-	☑	☑	☑	-	3*

Source: (Srisompun 2021)

The second step is to select the target district from the Department of Agricultural Extension database.

The final step is to select the target district (Department of Agricultural Extension database and suggestions from local government staff). The samples were divided into two groups: 1) the farmers affected by drought and 2) the unaffected by drought group, the sampling method for each group is as follows:

1. Sub-districts representing drought-affected areas must be sub-

districts that have been affected by drought for at least two years during the past five years (2015–2019); choose one study area in each province. A total of eight sub-districts were involved.

2. Sub-districts representing areas not affected by drought must be sub-districts with no drought-affected areas during the past five years (2015–2019); select one study area in each province. A total of eight sub-districts were involved (Figure 3.3).
3. Samples are randomly drawn from the list of farmers receiving drought compensation. (Department of Agricultural Extension in 2019)

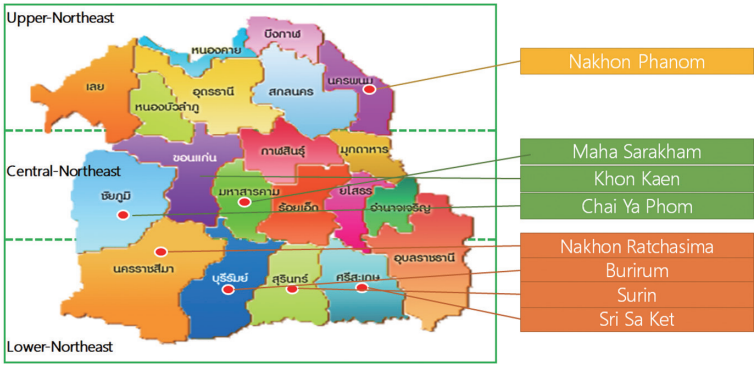

Figure 3.3 Research areas. Source: Adapted from (Boonmas 2021)

This study uses both secondary and primary data. Primary data was collected from 600 questionnaires of farmers in irrigated and rainfed areas of the Northeast region including eight provinces of Nakhon Phanom, Maha Sarakham, Khon Kaen, Chai Ya Phom, Nakhon Ratchasima, Burirum, Surin, and Sri Sa Ket.

Factors affecting decision-making on adaptation among farmers in drought situations were analyzed using the logistic regression model.

3. Economic and Social Effects of Drought on Rice Farm Households

(1) Drought Effect on Farmers in Northeast Thailand

According to surveyed data, 80% of the farmers affected by drought in 2019 were small farmers. Thailand has been suffering from continuous drought since 2015, with severe impacts on rice production. During 2015–2020, most of the surveyed farmers experienced serious impacts, especially farmers in rainfed areas (Figure 3.4).

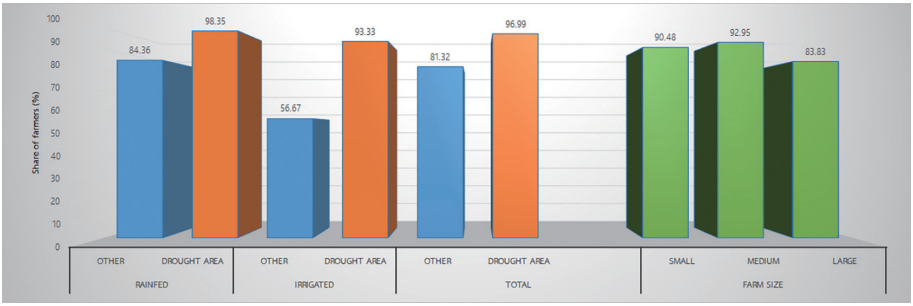

Figure 3.4 Proportion of sample farmers who have been affected by drought in the past six years (2015-2020), by production environment and farm size. Source: (Srisompun 2021)

Paddy quality and yield loss caused by drought varied by farm size. During the serious drought in 2019, farmers faced a water shortage for rice cultivation. Consequently, the lack of water adversely affected rice yield. The average rice yield per Rai and per household in drought-declared 2019 areas was lower than in 2020 in all production environments (i.e., rainfed and irrigated) (Figure 3.5). For small farms, rice productivity in 2019 was also lower than in 2020.

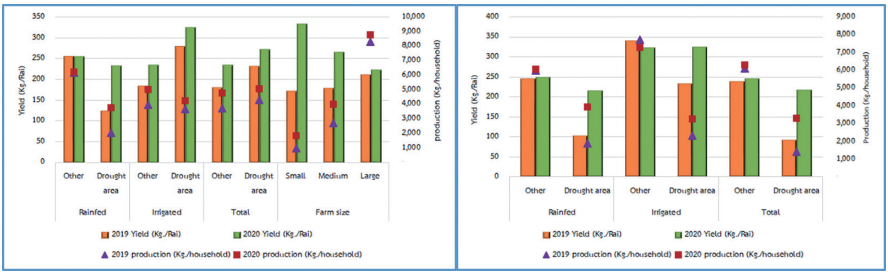

Figure 3.5 Average rice yield of sample farmers in 2019-2020 classified by production environment, type of water source, and farm size. Source: (Srisompun 2021)

The amount of yield and the damage value of rice yield from drought are directly proportional to the size of the planting area. Especially, yield and rice values of small farms are observed to be lower than those of large farms, and the rice yield of large farms is the highest in terms of both quantity and value. On average, the decline in paddy yields caused by drought ranged from 1,757 to 4,661 kilograms per household (equating to approximately 25,840–50,171 baht per household). (Figure 3.6).

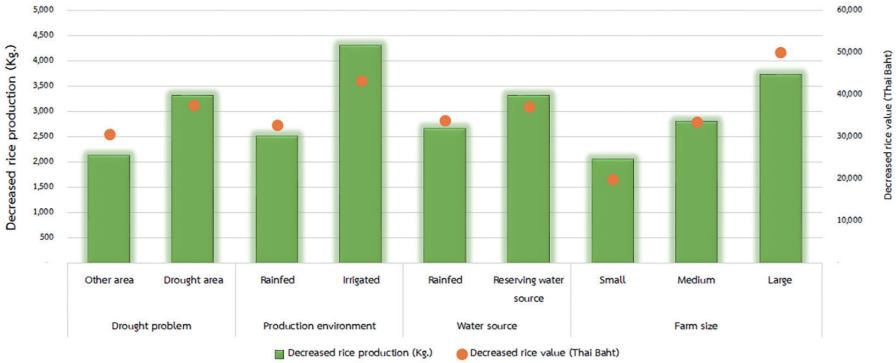

Figure 3.6 The impact of drought in 2019 on the quantity and value of rice yields. Source: (Srisompun 2021)

As mentioned above, rice farmers in Northeast Thailand grow rice not only for commercial use but also for household consumption. When there is excess rice left over from consumption and it is assured that the following year's rice yield will be sufficient for consumption, they will decide to sell the remaining rice to the market. Therefore, serious droughts in Northeast Thailand adversely affect not only households' incomes but also their food security. According to the surveyed result, drought caused 30.12% of farmers in recognized drought areas to have insufficient rice for household consumption. When comparing the proportion of farmers whose rice yield was insufficient for consumption, it was found that the drought-prone areas had a higher proportion of farmers who were affected than in other areas. Farmers in the rainfed areas had a higher percentage of rice damage than those in irrigated areas. Regarding farm size, there was the highest proportion of farmers whose rice production was insufficient for household consumption, although rice production of small farmers was less affected than that of large-scale farmers (Figure 3.7).

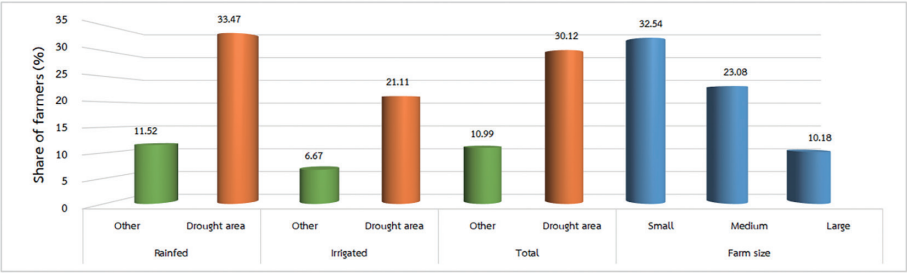

Figure 3.7 Proportion of sample farmers whose drought problems resulted in insufficient rice production for household consumption in 2019. Source: (Srisompun 2021)

To solve the problem of insufficient rice production for household

consumption, most farmers decided to buy milled rice from the market, while others decided to buy rice from other farmers or borrow from neighbors or other farmers in the village (Figure 3.8). Especially in some villages, there are rice bank projects that provide rice for farmers who do not have enough rice for household consumption. However, some farmers became worried about the duration of these projects and thought that they would continuously face insufficient rice for household consumption when these projects ended.

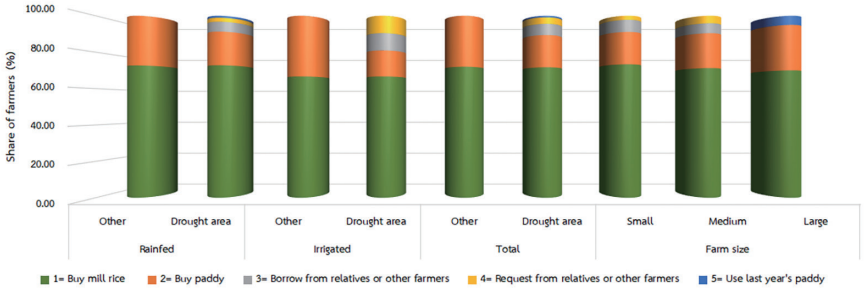

Figure 3.8 Methods for solving the problem of insufficient rice production for household consumption of the sample farmers in 2019. Source: (Srisompun 2021)

The drought affects not only agriculture but also the natural food supply. The result from Figure 3.9 shows that drought-prone areas had the greatest proportion of farmers affected by the decline in natural food supply. There were 8.13% of farmers who experienced an average decrease in the value of food at about 394 Thai baht per household per year. Farmers in irrigated areas had the largest decline in food value. Meanwhile, small-scale farmers were seriously affected by drought and had lower yield values than medium- and large-scale farmers. Most of the small farms are tended by farmers who practice subsistence farming and do not focus on commercial production.

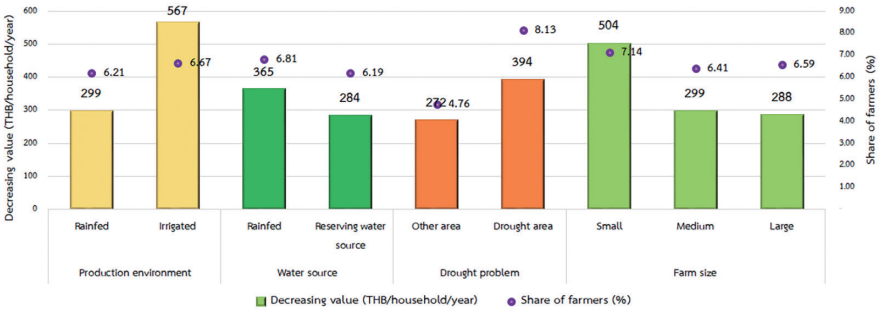

Figure 3.9 The proportion of farmers and the value of food for household consumption decreased by the drought problem in 2019. Source: (Srisompun 2021)

Household income significantly varies by farm size. Large-scale farmers had the highest average household income of 237,645 Thai baht/year (44.25% of total income is agricultural income) (Table 3.2). In 2019, the impact of the drought resulted in severe damage to rice yields and a sharp drop in rice farming incomes. Especially in drought-prone areas, net income from rice cultivation in 2019 decreased by 7,157 Thai baht per household and lower than income from rice in 2020 by about 14,392 Thai baht per household. As a result, the proportion of income from the agricultural sector in 2019 of farmers in drought-declared areas (year experiencing drought) decreased from 27.82% to only 20.49% of total income. In that case, income from non-agricultural sectors has become an important source of income for farmers. The cultivation of other crops such as rubber, sugarcane, cassava, and maize are the main sources of income for most farmers in the study area, especially in areas where farmers do not suffer from drought or unstable weather. Other income sources are about 23,000 Thai baht per household on average, accounting for 10.11–12.90% of total income. However, the income of farmers was affected not only due to the decrease in rice production but

also due to the decline in the production of other crops, it was found that, for example, in 2019, farmers earned an average of only 5,969 Thai baht per household or 3.87% of their total income. Table 3.2 reflects a clear picture of the impact of drought on household income sources in the agricultural sector.

Table 3.2 Income and sources of income of sample farmer households for the year 2019-2020 classified by declared drought areas.

Source of household income	**Income (Share (%))**			
	Other areas		**Declared drought areas**	
	2019	**2020**	**2019**	**2020**
Agricultural net income	45.51	41.02	20.49	27.82
- Rice income	19.88	15.69	-4.64	4.99
- Other crops	10.11	12.90	3.87	8.88
- Livestock/fishery	3.88	1.81	4.28	0.63
- Other farm incomes	6.30	5.43	9.18	7.98
- Non-farm income	5.34	5.19	7.80	5.35
Non-agricultural net income	54.49	58.98	79.51	72.18
Income from non-agricultural labor (daily)	8.37	7.76	11.45	9.62
Salary	17.27	19.92	27.31	26.59
Trading/Business/Services/Handicrafts	11.94	11.97	11.82	8.90
Remittance	11.44	13.24	17.43	15.83
Government support	3.36	4.23	5.40	5.56
Other income	2.12	1.86	6.10	5.67

Source: Author

Farmers with large plantations had the highest average household income of 237,645 baht per year, with income from agriculture at 44.25% of total income. Farmers with large farms have a lower reliance on non-farm income than small and medium-sized farms, where the proportion of non-farm income is as high as 72.03% and 71.50% of total income. In addition, when calculating the change in household income by comparing the year that farmers experienced severe drought (2019) and the current year (2020), it was found that the source of income from the agricultural sector in 2019 was lower than in 2020,

especially income from rice and income from other crops. The decline in income becomes more serious among small and medium-sized farms than large farms. Especially, in drought periods, rice income from small and medium farms decreased by 5,157 Thai baht per year and 6,388 Thai baht per year, respectively. Moreover, small farms accounted for a decrease in remittance income (Figure 3.10).

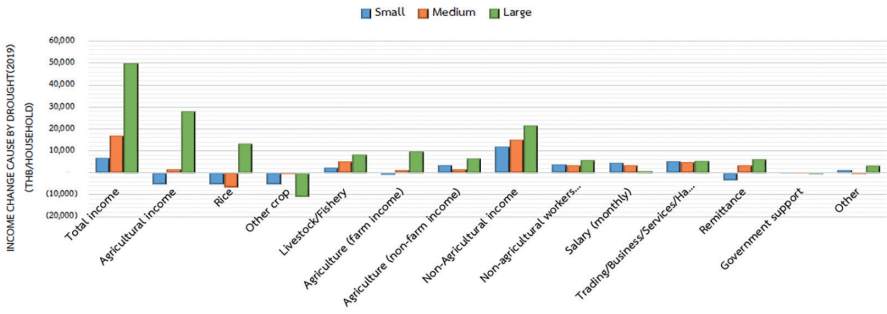

Figure 3.10 Changes in household income in the year of drought (2019), by farm size. Source: Author

Note: Change in income = 2019 household income (drought year) – 2020 household income (non-drought problem)

Large and medium farms had the greatest proportion of farmers whose rice income was reduced by drought (40.12% and 40.06% of those in the group, respectively). Moreover, the decrease in rice yields of large farms in 2019 was less than that of other sized farms, but the price of rice that farmers received in 2019 was higher than in 2020. Therefore, farmers with restricted arable land could earn more from rice in 2019 than in 2020, despite the drought. This is because the average yield was not much different. Despite being offset by higher rice prices, the drought did not affect the average income of large farmers (Figure 3.11).

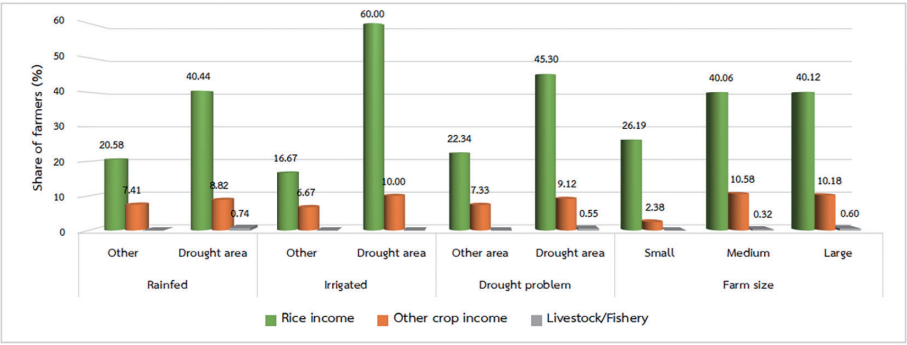

Figure 3.11 Proportion of sample farmers whose household income is affected by drought. Source: Author

(2) The Factors Affecting Farmers' Adaptation to Drought

Farmers' ability to adapt and cope with the effects of drought varies by the resource base, the economic base, and the social characteristics of the household. The survey data revealed that the proportion of farmers in irrigated areas affected by drought had the greatest proportion of farmers who adapted to drought (Figure 3.12).

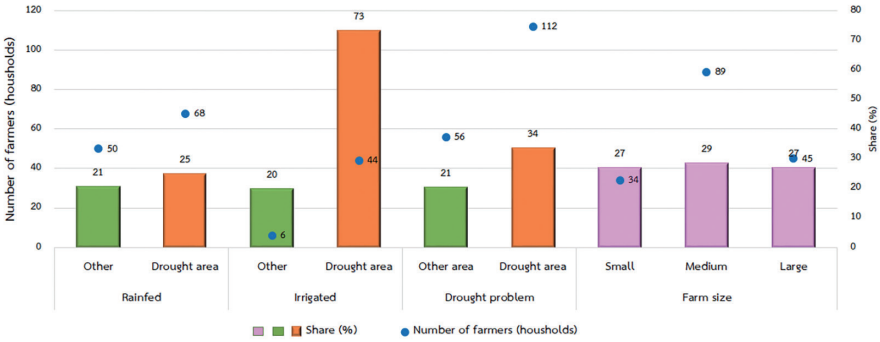

Figure 3.12 Proportion of sample farmers adapted to drought problems. Source: Author

Farmers in the study areas also adapted to drought in various ways, including suspending rice growing, finding additional water sources (for example, digging ponds, wells, or groundwater), adjusting the time of planting or slowing the rice sowing. Some others have reduced the number of rice cultivation areas, adjusted the use of rice varieties, adjusted the types of crops that are grown instead of rice or turned to keeping livestock instead of growing rice, especially in the rainfed area. Some farmers turned to other occupations outside of the agricultural sector instead during water shortages (for example, hiring for construction, trading, housework, security, sewing, other handicrafts, selling food, driving a car, or working as hired labor in the agricultural sector.) Although a greater proportion of small farmers are affected by drought, the adaptation ratio of farmers was not different according to farm size (Figure 3.13).

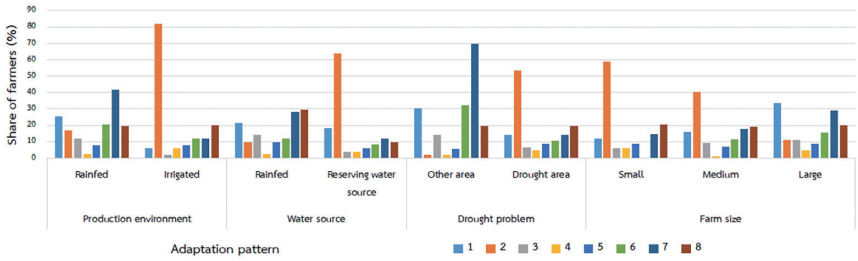

Figure 3.13 Adaptation pattern to drought problems of farmers in study area. Source: Author

Note: Adaptation patterns: 1. Search for additional water sources; 2. Stop growing rice; 3. Adjust the growing period; 4. Reduce the rice area; 5. Adjust the rice cultivars; 6. Cultivate different plants instead of rice; 7. Change to livestock; 8. Change to other occupations

The estimated results (Table 3.3) using the logistic regression model revealed that the factors affecting farmers' decision-making to adapt to drought were statistically significant. They included production environment (rainwater/irrigation), number of years experiencing drought, commercial rice cultivation, main income from non-agricultural sectors, planning to expand the production area in the farm (cultivation/raising animals), planning for the offspring to inherit agriculture careers and the number of smartphones in a household.

Table 3.3 Factors affecting to decision-making on drought adaptation of farmers in the study area.

Variable	**Mean**	**Std. Err.**	**Coefficient estimates**		**Marginal effect model**	
			Coef.	Std. Err.	Coef.	Std. Err.
Human capital						
Sex	0.613	0.021	0.037	0.191	0.009	0.047
Age	0.470	0.021	-0.322*	0.191	-0.079*	0.047
Natural capital						
Dummy of drought declared area	0.578	0.021	0.268	0.197	0.066	0.048
Production environment	0.182	0.016	1.342***	0.297	0.328***	0.072
The number of droughts (2015–2020)	2.250	0.045	0.172*	0.089	0.042*	0.022
Economic capital						
Growing rice for commercial	0.564	0.021	0.520***	0.201	0.127***	0.049
Main income from non-agricultural sector	0.223	0.018	0.646	0.237	0.158	0.058
Access to agricultural credit	0.595	0.021	0.313	0.195	0.077	0.048
Social capital						
Farming career is stable	0.899	0.013	-0.058	0.326	-0.014	0.080
Planning to expand the rice field	0.541	0.021	0.372*	0.198	0.091*	0.048
Planning for the children to inherit the agricultural career	0.719	0.019	-0.186	0.225	-0.045	0.055
A member of a farmer's group	0.879	0.308	-0.021	0.014	-0.005	0.003
Number of smartphones	0.250	0.034	0.261**	0.129	0.064**	0.032
Constant			-1.040***	0.402		
Log likelihood = -353.930			LR λ^2 = 79.46***		Pseudo R^2 = 0.1044	

Source: Author

4. Conclusion and Policy Implications

The drought situation in Thailand tends to increase in frequency. In 2019, Thailand experienced its worst drought in four decades. 80% of the farmers affected by drought in 2019 were small farmers. Rice quality and yield loss caused by drought varied by farm size. On average, the decline in paddy yields caused by drought ranged from 1,757 to 4,661 kg per household (approximately 25,840–50,171 Thai baht per household). Drought caused 30.12% of farmers in recognized drought areas to have insufficient rice available for consumption; accordingly, 8.13% of farmers experienced reduced food sources, worth 394 Thai baht per household a year. The agricultural income of rice farm households in declared drought areas diminished from 27.82% to 20.49% of total income. The Northeast region of Thailand is a significant area for quality rice cultivation. Rice is not only the main household income for small-scale farms, but also an important staple food for this region's residents.

To cope with the impacts of drought, farmers in the study areas performed various adaptation measures including stopping rice growing, finding additional water sources (for example, digging ponds, wells, or groundwater), adjusting the time of planting or slowing the rice sowing, reducing the number of rice cultivation areas, adjusting the use of rice varieties, adjusting the types of crops that are grown instead of rice, or turned to keeping livestock instead of growing rice, especially in the rainfed area. Some farmers decided to turn to other occupations outside of the agricultural sector instead during water shortages. To mitigate the effects of drought, the requirements of some projects were consistent with the demands of farmers. A long-term plan and extensive investment in drought management are necessary. The drought allocation budget process should begin with community-based research to be consistent

with the needs and conditions of drought problems in each area.

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Chapter 3. Drought Effect and Adaptation of Farmers in Northeast Thailand

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