TECHNICAL REPORT

ACCELERATING METHANE REDUCTIONS IN RICE PRODUCTION SYSTEMS THROUGH MARKET-BASED MECHANISMS

Results of Farmer Surveys and Choice Experiments in Vietnam

Imprint

Authors

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The Accelerating Methane Reductions in Rice Production Systems through market-based mechanisms (AMR) project, funded by CCAC aims to facilitate enabling conditions for changing producers' and value chain actors' perception and behavior towards climate-smart practices or low-emissions practices as not only an approach that is good for climate and environment but also the most economically practical option.

Methane Accelerator for Southeast Asia (MASEA) project, funded by USAID, evaluates investment opportunities and proposes policy options for promoting carbon mitigation in rice production in the Philippines, Thailand, and Vietnam.

International Rice Research Institute, October 2025

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EXECUTIVE SUMMARY

Overview

Vietnam is a major rice producer and exporter, with its rice paddies also being a significant source of methane emissions. This study surveyed 597 rice farmers across five provinces – Thai Binh (Red River Delta), Nghe An (North Central Coast), and An Giang, Kien Giang, Soc Trang (Mekong Delta) – to take stock of current practices and assess farmers' awareness, adoption, and willingness to accept incentives for low-emission climate-smart agriculture (CSA) practices. The goal is to inform policies and investments that encourage farmers to adopt CSA, reducing methane emissions while improving farm productivity and livelihoods.

Farmers' Profile and Climate Risks

The survey reveals an experienced farming population (average 32 years in rice cultivation) with an average age of 55. Notably, 30% of rice-farm decision-makers were women, underscoring the importance of gender inclusion in outreach. Farm sizes differed markedly by region – in the Mekong Delta, farms average 2.76 ha (Soc Trang) to 5.62 ha (Kien Giang), compared to 1.05 ha or less in Thai Binh and Nghe An, respectively. Most of the farmers in the Mekong Delta who belong to an organization were members of cooperatives (e.g., 94% in Soc Trang), while the majority of those in the north chose to participate in farmer associations. Over half of farmers (59%) experienced climate-related hazards in recent years, with region-specific challenges: storms in the north and coastal areas, pest/disease outbreaks in An Giang, and flooding in Soc Trang. Almost half of farmers (46%) took no adaptive measures against these risks, highlighting an urgent need to build resilience through better practices.

Awareness of Low-Emission Practices

A relatively high share (33%) of farmers reported familiarity with direct-seeded rice (DSR) techniques, reflecting the prevalence of direct seeding; however, knowledge of other innovations was low. For instance, 74% were unaware of the Sustainable Rice Platform (SRP) standard. Even for rice straw management (RSM) – where 73% said that they were aware of the concept – significant gaps remain, with provinces like Kien Giang and An Giang reporting 30–36% of farmers uninformed about improved straw management. Among those who were aware, farmers often understood specific aspects of the techniques. For instance, in alternate wetting and drying (AWD), over one-third were highly aware of the proper field conditions (34%) and water management strategies (41%) for intermittent irrigation. Moreover, 50% of respondents acknowledged that burning rice straw is detrimental to the environment. Farmers may be aware of the benefits of collecting straw, but currently, there are no businesses that buy straw. Additionally, livestock farming is typically small-scale, so straw is not used as feed. Hence, farmers often find it easiest still to burn the straw.

Farmers broadly perceived CSA practices as offering multiple benefits, including higher yields, improved soil health, reduced crop losses due to climate extremes, lower methane emissions, and increased income. However, awareness alone does not guarantee adoption. Forty percent (40%) of farmers thought that RSM demands high technical skill, and 37% fear RSM would be more expensive than the current practice. Still, the majority (65%) agree that RSM could increase their net income and provide new revenue streams, indicating farmers do see economic upsides if barriers can be overcome.

Current Adoption Patterns

Adoption of climate-smart practices in Vietnam's rice systems is uneven across regions and practices. DSR was already widespread in the Mekong Delta –100% of farmers in Kien Giang and Soc Trang used DSR across seasons – driven by labor shortages and mechanization. In contrast, in the Red River Delta (Thai Binh), only about 55%-57% of farmers practiced DSR (the rest still practiced transplanting) during the Winter-Spring and Summer-Autumn seasons. In contrast, AWD has been partially adopted in practice. This report used two definitions of AWD: loose and strict. Loose AWD was based solely on the water regime, where farmers practiced intermittent drainage. In contrast, for strict AWD, aside from periodic drainage, farmers were aware of the concept and practice of AWD, and field observations guided their drainage decisions. Field data indicate that approximately 63–77% of farmers practiced multiple drainage in their fields per season, suggesting some form of intermittent irrigation. In provinces with active water management programs (e.g., An Giang's 1M5R initiative), reported AWD adoption was high – in Kien Giang, 87% of farmers in the Winter–Spring and 90% in the Summer–Autumn seasons practiced multiple drainages. In addition, the majority of farmers in the Mekong Delta had some level of awareness regarding the 1 Must do, 5 Reductions (1M5R) program, with 77% to 83% awareness. On the other hand, most (80%) of the farmers in Nghe An were unaware of this initiative.

Meanwhile, RSM remains a challenge. Traditional straw disposal methods (burning or removal) dominated in the absence of viable markets or equipment for straw reuse. In Soc Trang and Nghe An, many farmers removed straw from fields, whereas in Kien Giang and An Giang, open-field burning and shallow incorporation were more common. Farmers acknowledged the negative impacts of burning, but lack alternatives – no businesses currently purchase surplus straw, and small-scale livestock operations are unable to absorb it. This underscores the need for innovations in straw utilization (e.g., as animal feed, mulch, or bioenergy) to make RSM a viable option. Additionally, only a quarter (26%) of the respondents were aware of the SRP, with awareness ranging from 9% (Nghe An) to 37% (Thai Binh) - further highlighting the importance of information dissemination and support initiatives to introduce the technology to farmers.

Willingness to Adopt CSA Practices

Farmers' interest in low-emission rice practices is high, as shown in Figure A. When asked hypothetically, large majorities indicated willingness to adopt key CSA techniques if suitable support is provided. Specifically, 81% of farmers were willing to implement AWD, 79% would adopt DSR, and 82% would improve their RSM under the right conditions. Similarly, about 78% were open to the 1M5R package of improved practices. In contrast, enthusiasm was more muted for labor- or knowledge-intensive methods like the SRP standard – only about 51% would try SRP, and roughly one-third were undecided. This hesitation likely stems from unfamiliarity and perceived complexity of these latter approaches. Notably, farmers' motivations for adoption were primarily economic, wherein the top reasons cited were the perceived increase in yield and income as shown in Figure B. Many also cited that CSA can improve soil fertility and farm conditions (71% noted this for RSM) and reduce losses from climate hazards (e.g., 29% saw RSM as a way to cut climate risk losses). Environmental benefits (like pollution reduction or emissions mitigation) were only rarely mentioned as a primary motivator – farmers tend to prioritize immediate agronomic and financial gains, which suggests climate policies should be "co-benefits forward" (i.e., emphasize yield, cost savings, and resilience).

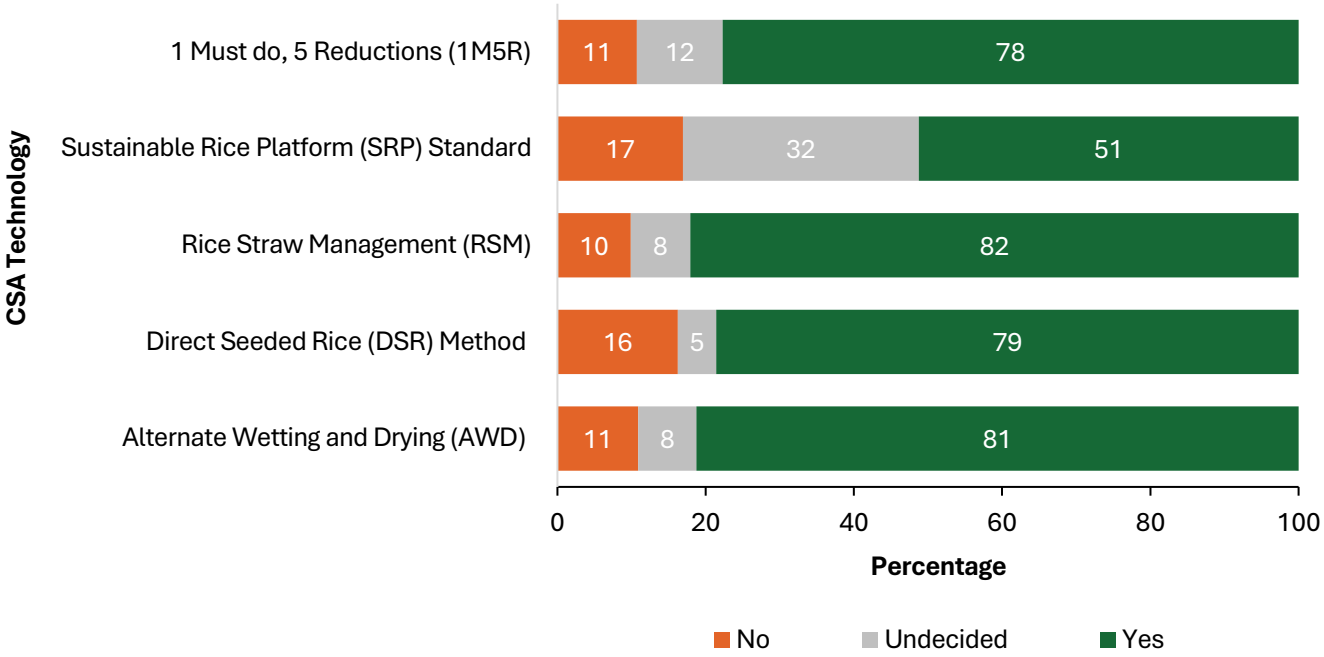


Figure A. Distribution of the respondents based on their willingness to adopt CSA practices (in percent), by technology, 2024-2025.

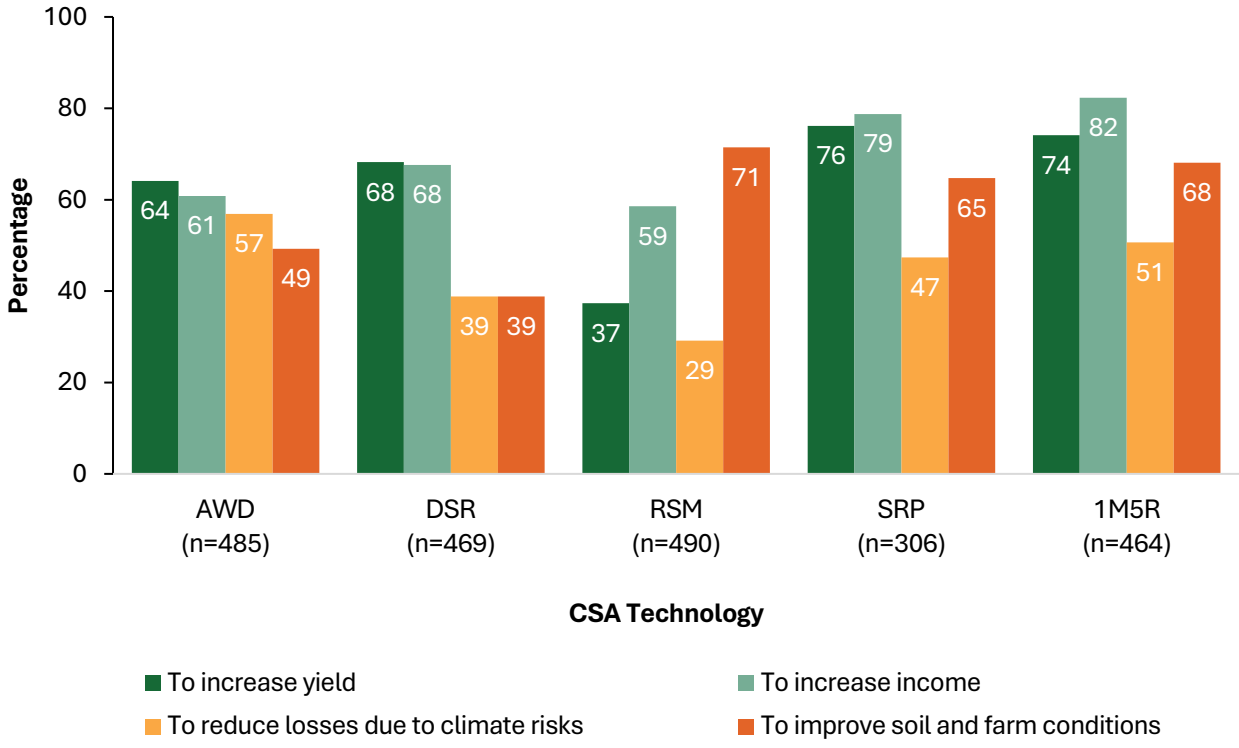


Figure B. Cited reasons of the respondents to adopt CSA practices (in percent), by technology, 2024-2025.

Barriers to Adoption

The surveys and interviews identified several institutional and behavioral barriers that currently hinder farmers from adopting CSA practices, even when they are interested. Figure C illustrates that a lack of technical knowledge and guidance was the most pervasive obstacle, which was the primary concern of the farmers. Farmers worry they cannot implement new techniques correctly without support. The second significant barrier was limited access to necessary machinery or equipment, which was particularly acute in the Mekong Delta. For instance, 63% of farmers in Kien Giang and 51% in Soc Trang said they lack the machines to adopt certain RSM practices. Up-front costs were also an issue – a significant number of respondents noted the additional costs of shifting practices (such as buying new seed or equipment, or potential yield penalties during transition) as a barrier. Many farmers were also risk-averse and hesitant to adopt alone in their community. About 15% to 25% said they were unwilling to adopt unless others in their village do so as well. In addition, some farmers expressed satisfaction with current techniques or distrust of unproven methods (about 31% stated they are already content with their existing practice, hence the hesitation to adopt AWD).

Compounding these barriers is a knowledge gap about climate finance opportunities: nearly half (48%) of respondents were unaware that CSA practices can reduce carbon emissions, and an even larger majority did not know that farm emissions can be measured and rewarded (69% did not know about measurement/verification, and 68% did not know about available support incentives). This indicates low awareness of carbon market programs among farmers, meaning current extension services have not yet connected climate mitigation with farmer benefits in the messaging.

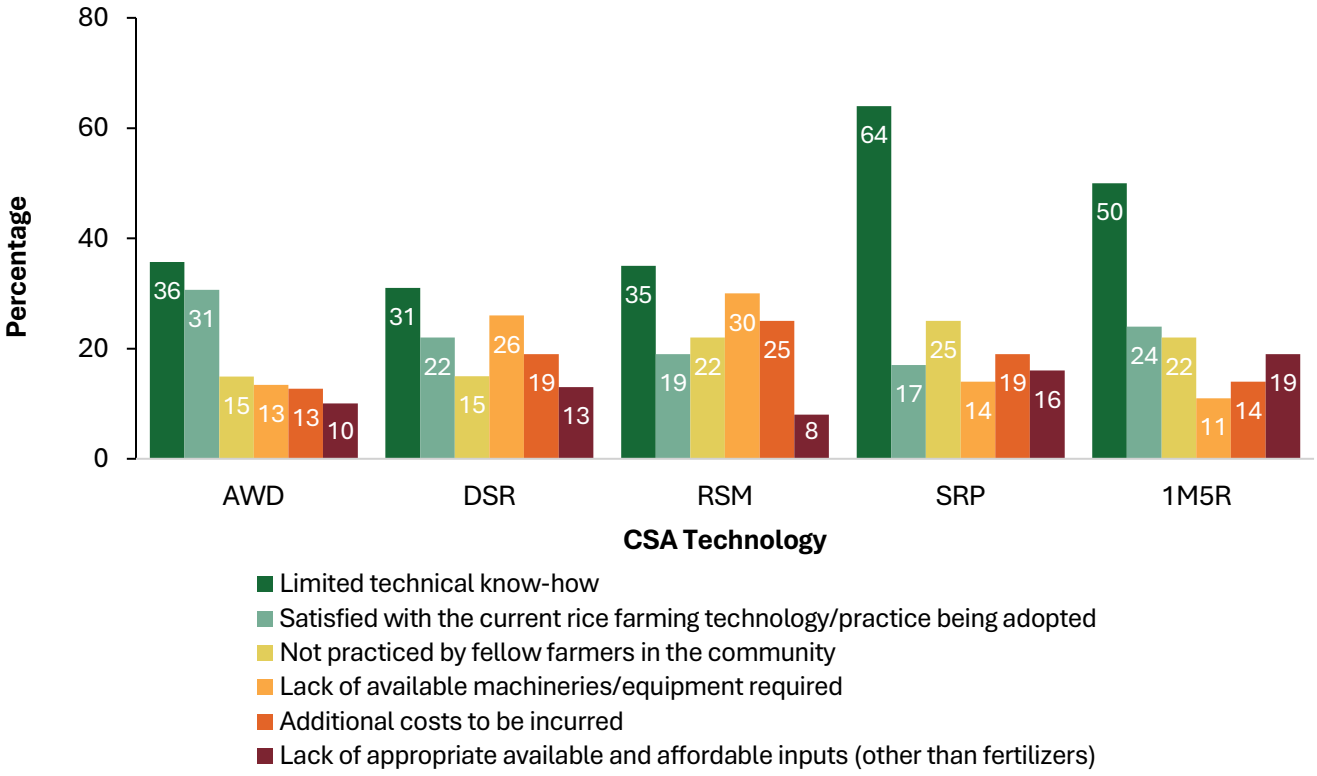


Figure C. Reasons for the hesitation of the respondents to adopt CSA practices (in percent), by technology, 2024-2025.

Insights from the Choice Experiments

To support the design of effective incentive programs, the study conducted choice experiments presenting farmers with hypothetical CSA adoption contracts (for AWD and DSR) featuring different benefit packages. The results are instructive for policy and carbon market program design:

- **Nearly all farmers will adopt if the incentives are attractive.**

When offered supportive packages, 97–98% of respondents chose to adopt AWD/DSR over the status quo option (Figure D). This underscores that farmers are not fundamentally opposed to new practices – given the right mix of incentives and support, adoption rates could be very high.

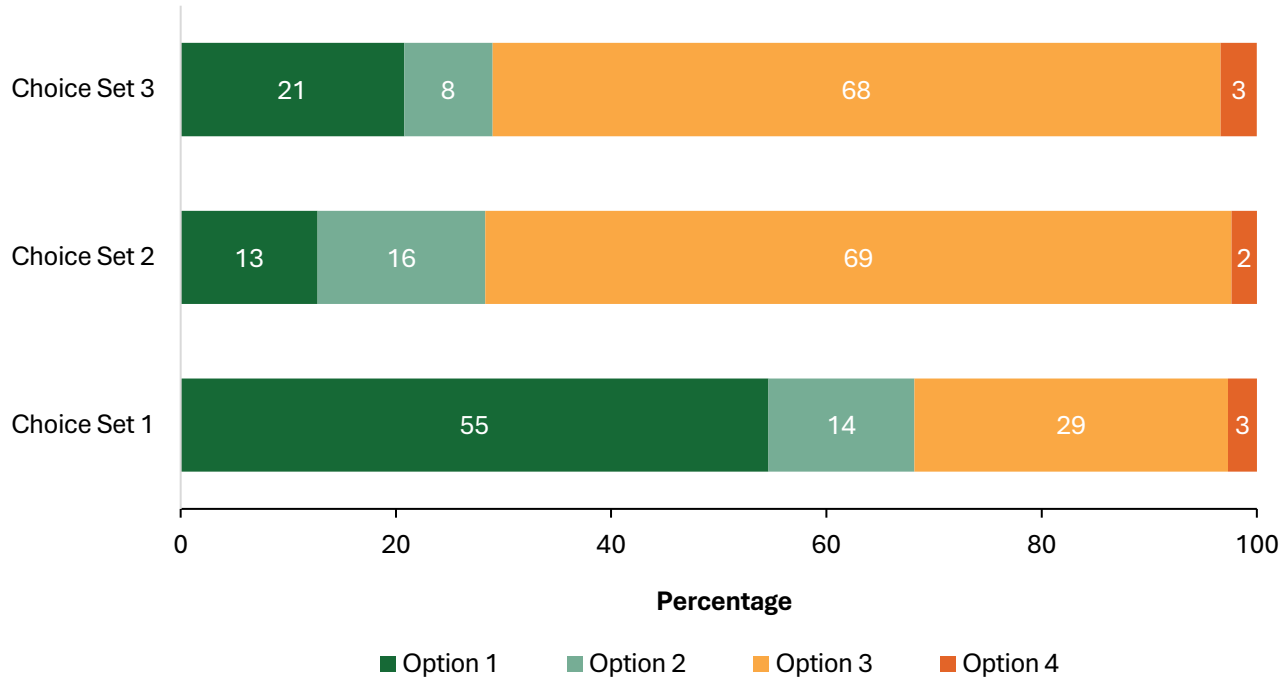


Figure D. Respondents' program preferences based on different attributes (in percent), by choice set, 2024-2025.

- **Direct financial incentives are the biggest draw**

Farmers consistently preferred options with higher rice price premiums, as summarized in Table A. In fact, it was the most favored contract attribute: providing roughly an 11–15% premium on the rice price was generally seen as sufficient incentive for farmers to embrace AWD and DSR. This finding suggests that linking low-carbon rice to premium markets or carbon credit payments that raise farm-gate prices could drive participation. Additionally, farmers clearly valued being compensated for additional implementation costs. The acceptable level of compensation for additional costs ranged widely (1% to 60% in the scenarios), but importantly, the analysis shows that at least a 21–40% compensation of extra costs may be the minimum threshold to get broad farmer buy-in. In other words, if a program can cover about one-quarter to two-fifths of the farmers' costs for things like new seed, equipment, or labor, most farmers are willing to participate.

Table A. Summary of the option most selected in each choice set and its corresponding attributes.

	Choice Set 1	Choice Set 2	Choice Set 3
Most selected option	Option 1 (Adopt DSR)	Option 3 (Adopt AWD and DSR)	Option 3 (Adopt AWD and DSR)
Support services per hectare of adoption per season	Fertilizer discount/ vouchers	Fertilizer discount/ vouchers	Fertilizer discount/ vouchers
Compensation for additional cost per hectare of adoption per season	1% - 20% compensation	41% - 60% compensation	21% - 40% compensation
Price premium for produce	11% - 15% premium	11% - 15% premium	11% - 15% premium
Access to training	With training	With training	With training

- **In-kind support (input vouchers) is highly appealing**

Aside from price, the availability of support services significantly influenced choices. The majority of farmers gravitated towards the contract option that offered their preferred support service, as presented in Figure E, and the top choice was fertilizer discount vouchers. Fertilizer is a major cost in rice farming; thus, a program that offers fertilizer subsidies or vouchers for adopters serves as a strong immediate benefit. This also opens opportunities to promote climate-friendly inputs alongside AWD/DSR. Other support services like guaranteed market off-take or machinery access were also valued by some farmers, indicating that different local needs should be considered (for example, in one choice set, about one-third of farmers opted for a package with no training but with marketing agreements and machine access, reflecting a subset who prioritize market and mechanization support over formal training).

- **The role of training and extension**

Interestingly, training was not often the top-ranked factor in the choice scenarios – only ~5–12% of farmers chose the option because it included a training component. Many farmers seem to prioritize tangible economic incentives first. However, this does not mean training is unimportant. The qualitative findings show farmers themselves call for more technical guidance and demonstrations as key solutions to adoption barriers. The takeaway is that while training may not "sell" a program by itself, it remains a critical enabling factor. Policymakers should bundle training and advisory services into incentive programs, even if farmers are taking them for granted – successful adoption will require building farmers' capacity to implement practices correctly. Training should be designed in practical ways (field demonstrations, farmer-to-farmer mentoring) to address the prevalent knowledge gaps.

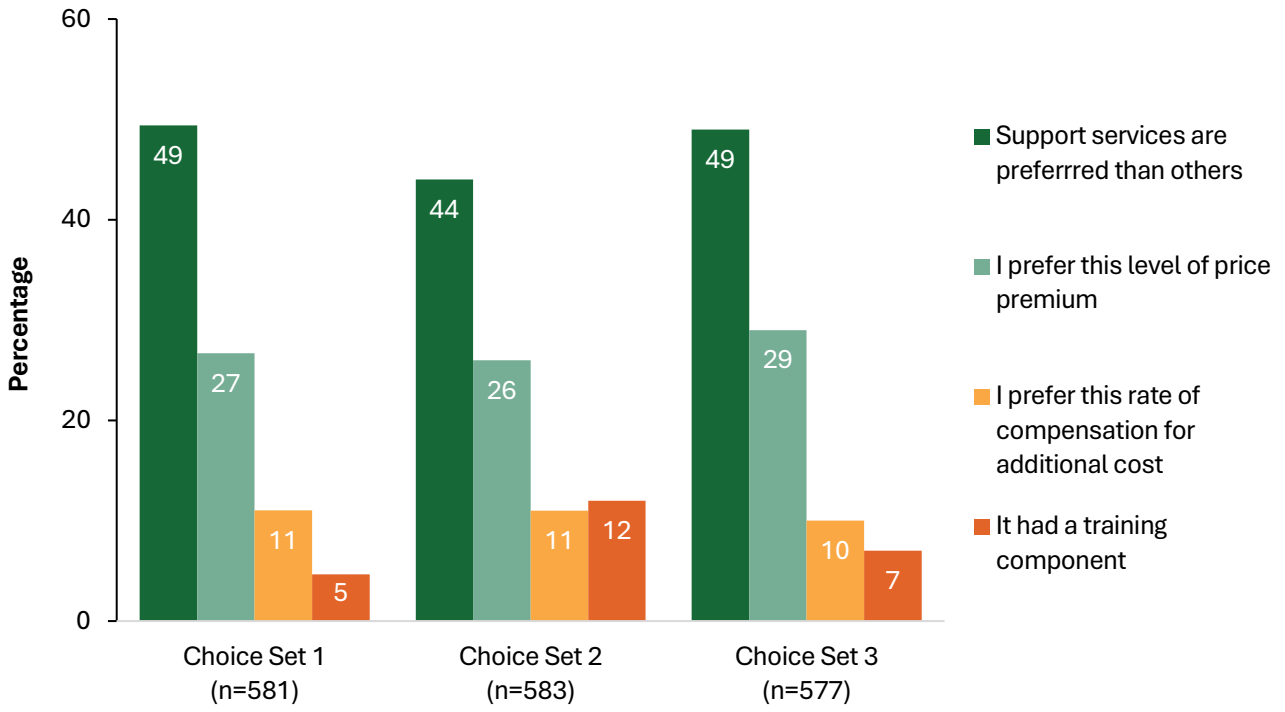


Figure E. Top reasons of the respondents for selecting option 1,2, or 3 (in percent), by choice set, 2024-2025.

Economic and Climate Rationale for Adoption

The synergy between economic gains and climate benefits in these practices should be emphasized. From an economic standpoint, the study confirms that climate-smart practices can be win-win: farmers who implemented multiple drainage achieved the highest yields and net incomes among all groups in most cases. Same with DSR, except in the Coastal Regions wherein transplanted rice had higher yield. Across multiple seasons, the use of multiple drainage increased yields (ranging from approximately 6.09 to 7.55 t/ha), while DSR achieved yields between 6.08 and 7.37 t/ha. Both practices improved profitability by reducing input costs compared to conventional methods. These findings demonstrate to policymakers and investors that promoting CSA in rice is not just about climate mitigation; it is also an economic development strategy for farmers.

The climate rationale is clear as well: rice emits large amounts of methane, and practices like AWD and better straw management can cut methane emissions by 30–50% according to agronomic research (figures not from the farmer survey) while maintaining yields (Asian Development Bank, 2023; Xuan, 2025). Farmers in the survey already intuitively sense this – strong majorities agreed that practices like RSM and AWD benefit the environment by reducing emissions and pollution. By leveraging carbon finance (e.g. crediting these methane reductions), there is potential to channel additional funds to farmers as incentives, creating a virtuous circle of climate and livelihood benefits. The Government of Vietnam's goal to develop one million hectares of low-carbon rice (the "1Mha" program) and participation in carbon markets can build on these findings: farmers are willing, and with the right support structure, CSA adoption can scale rapidly while delivering measurable climate outcomes.

Policy Implications and Actionable Recommendations

This research yields several actionable insights into climate-smart agricultural policy, carbon market program design, and investment strategies:

- **Targeted Incentive Packages**

One-size-fits-all approaches will not maximize adoption. Incentives should vary by region and farmer needs. In provinces like Thai Binh and Nghe An, where farmers are more risk-averse with smaller farms, higher direct economic incentives (cash or input subsidies) may be necessary to offset perceived risks. In the Mekong Delta, where farmers are already experimenting with AWD/DSR, smaller nudges like price premiums or fertilizer vouchers could suffice since the practices are better understood. Any carbon market or green finance program for rice should consider combining a modest price premium (≈10–15%) for low-emission rice grain with cost-share payments (≈20–60% of inputs) – this study suggests such a combination would be attractive to the majority. Incentives can also be tied to performance (e.g., verified methane reduction) to ensure climate effectiveness, but simplicity and upfront support are key for farmer buy-in.

- **Integrate In-Kind Support and Services**

Monetary payments alone are not enough. Farmers clearly value in-kind support that reduces their operational hurdles. Fertilizer support, or repurposing of fertilizer subsidies, should be considered in any program, as it was the most preferred benefit. Similarly, facilitating access to machinery will be crucial, especially for straw management and direct seeding – this could involve government or donor programs providing equipment pools, rental services, or mechanization subsidies. Regions such as Kien Giang with high demand for machines to implement CSA should be prioritized. Moreover, offering market linkages (such as contracts with rice buyers who pay a premium for sustainable rice) can address farmers' output price concerns and should be part of the package when possible.

- **Strengthening Technical Support Systems**

Building farmers' capacity is fundamental. Scaling up technical training, extension services, and farmer-to-farmer learning can help overcome knowledge barriers. Practical demonstrations of AWD timing, proper use of direct seeding equipment, and on-farm trials of straw utilization are vital. The study shows farmers themselves suggest community demonstration sites as a solution to prove the feasibility and benefits of new practices. Governments and development programs should invest in demonstration plots in each district or cooperative, allowing early adopters to showcase CSA practices. Extension messaging should also explicitly cover the why and how of these practices (e.g., how AWD cuts methane and saves water) to convert the high level of general awareness into deeper understanding. Notably, extension strategies might differ by region: in the north, formal trainings and the farmers' union network can be leveraged (as Thai Binh farmers reported seminars as a main info source), whereas in the south, peer learning and cooperative networks might be more effective (many Kien Giang farmers were self-taught or learned from fellow farmers). Donors can support the creation of locally adapted training curricula and ICT tools (e.g. mobile apps, SMS advisories) to spread technical knowledge widely at low cost.

- **Design Farmer-Centric Carbon Market Programs**

The willingness-to-accept findings provide concrete guidance for designing carbon market projects or green financing schemes for rice farmers. Carbon credit programs should address farmers' priorities by providing upfront input support, ensuring an attractive price premium for

sustainable rice production, and simplifying enrollment through cooperative structures. Moreover, instead of complex or purely results-based payments, programs should focus on immediate benefits. Since the lack of awareness is high, any carbon program must start with awareness campaigns that explain the concept of carbon credits and how farmers can benefit. Contract design should also heed farmers' preferences: include training and extension components (even if not demanded, it is necessary) and consider giving them some choice in support, whether they prefer a fertilizer kit, a cash bonus, or equipment access as part of their carbon project benefits. Finally, to address the hesitation of farmers to adopt the technology alone, programs should be designed to enroll groups of farmers simultaneously (e.g., entire cooperatives or villages). This community approach can build mutual confidence and create peer pressure to participate.

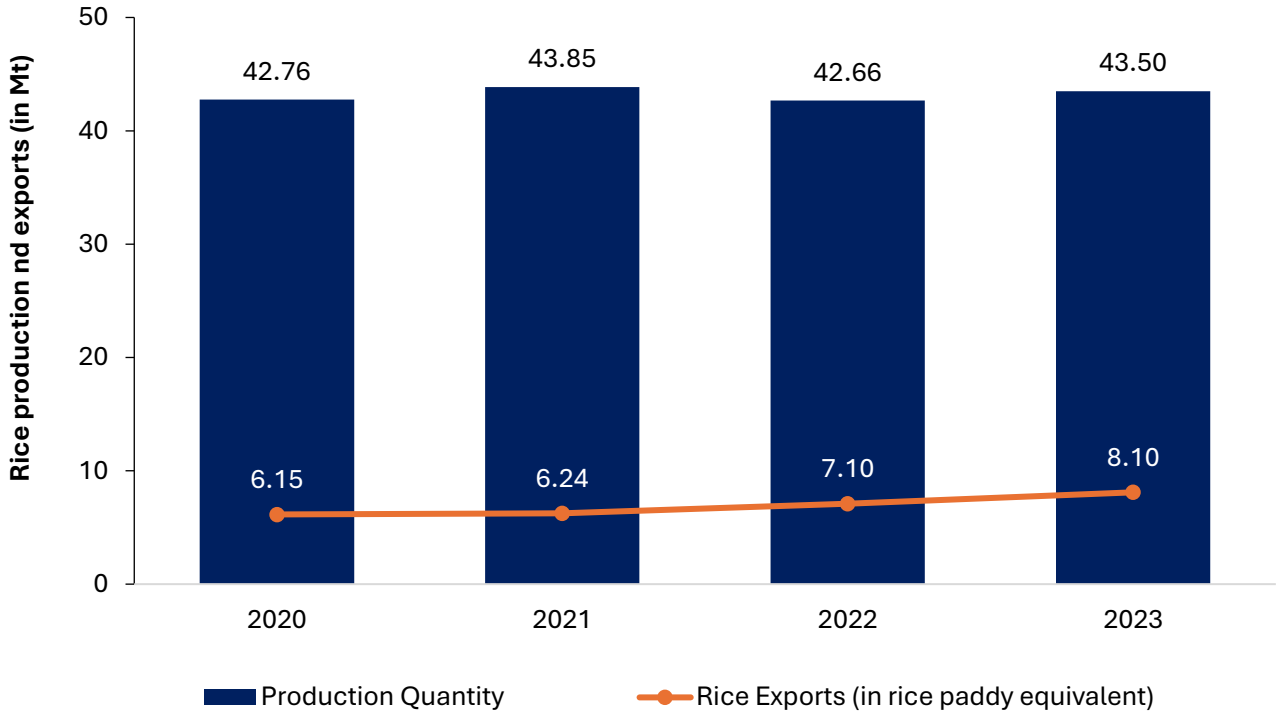
- **Targeting and Outreach Strategies**

To maximize impact, policies should target the right farmers with the right approaches. The study indicates that provinces with lower baseline adoption or awareness (like Thai Binh, Nghe An) will need intensive outreach and possibly higher incentive levels initially, whereas provinces in the Mekong Delta (where partial adoption is already happening) can scale more quickly with moderate incentives and better coordination. Within communities, engage local influencers and women farmers – given 30% of decision-makers are women, women's groups could be powerful channels for dissemination. Younger farmers or those with larger farms might be early adopters; they can be leveraged to lead by example. Conversely, support for older or more traditional farmers might involve extra hand-holding or demonstrating results on others' fields first. Farmer organizations (cooperatives, associations) are crucial partners: the high membership rate (74% overall) means interventions can be deployed through these existing structures, ensuring buy-in and reducing transaction costs for program enrollment. Policymakers should also coordinate across ministries – agricultural extension, water management, and environment agencies – to provide a cohesive package of support (for instance, aligning irrigation service incentives with emission-reduction goals).

1. Introduction

1.1. Background

Vietnam ranks among the world's top five rice producers and top three rice milled exporters (FAO, 2025a). In 2023, Vietnam was able to produce a total of 43.50 million tons (Mt) of rice paddy, as shown in Figure 1, significantly contributing 5.44% to the world's total rice production. To achieve this quantity of production, a yield of 6.11 tons per hectare (t/ha) is achieved by the country (FAO, 2025b). Aside from it, Vietnam also shows a stable rice production dedicated to export. In 2023, a total of 8.10 Mt of rice were exported to various countries, including their top importing countries such as the Philippines, Indonesia, and China.



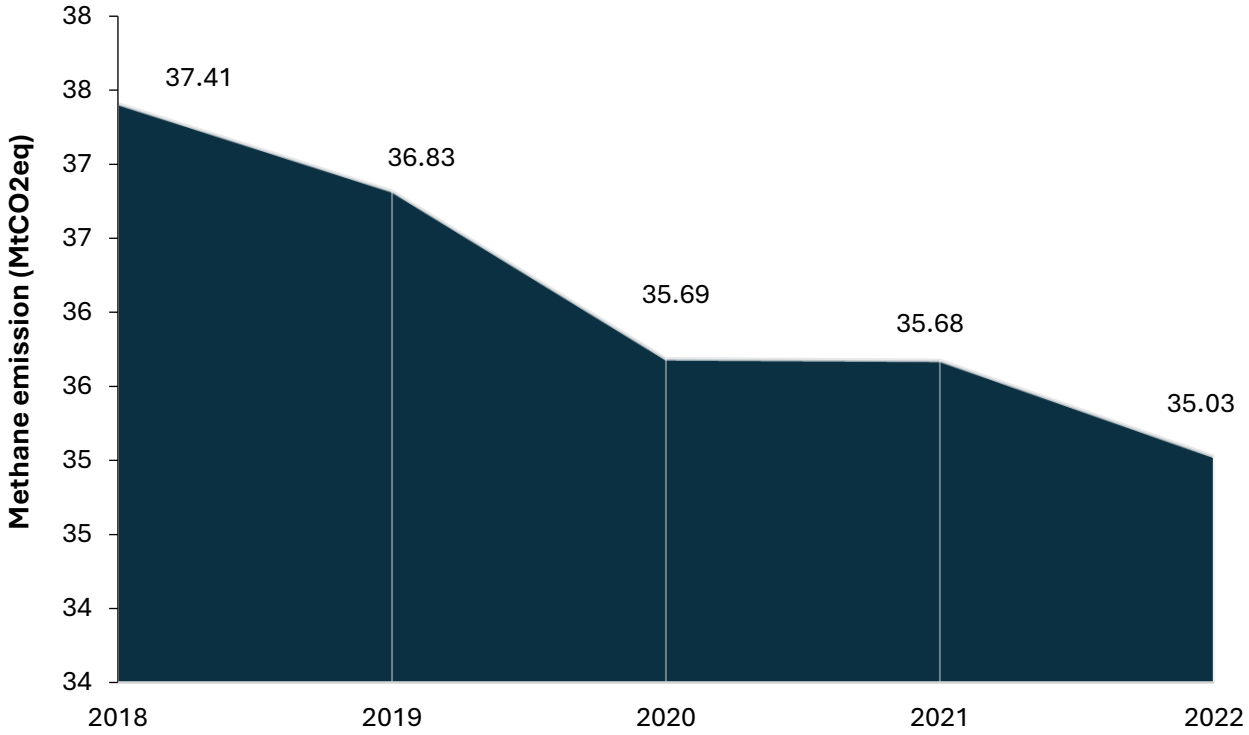
Source: General Statistics Office of Vietnam (2024) and Ministry of Industry and Trade of Vietnam.

Figure 1. Total rice production and exports of Vietnam (in metric tons), 2020-2023.

This intensive rice production of Vietnam, which usually involves two to three cropping seasons in a year, emerges as a significant contributor to the high methane emissions in rice production in the country. The flooding condition during rice cultivation fosters the growth of soil microbes that produce methane. Figure 2 shows the annual methane emission of Vietnam from 2018 to 2022, with a sustained reduction of methane emissions—from 37.41 Mt of CO_2 equivalent in 2018 to 35.03 Mt in 2022.

One of the climate-smart initiatives was the widespread scaling of the Alternate Wetting and Drying (AWD) technique, which aims to regulate the utilization of water in rice farming to reduce methane emissions from fields while maintaining or improving rice productivity. Another is the "One Must Do, Five Reductions" (1M5R) method which entails the process wherein 'One must do'

requires farmers to utilized certified seeds during rice cultivation, while 'Five Reductions' emphasizes the reduction of various inputs during a cropping cycle such as the seed sown, amount of nitrogen-fertilizers used, use of pesticides, the water used in cultivation, as well as the losses from post-harvest activities (World Bank, 2022; Connor et al, 2020). Additionally, the Vietnam Sustainable Agriculture Transformation (VnSAT) project implemented strategies, including the provision of technical training and seminars that help rice farmers in improving their post-harvest processes. Vietnam's 'One million hectares' (1Mha) project[1] aims to encourage farmers in utilizing sustainable rice farming practices while transforming the production of rice from one-million-hectare of rice cultivation towards high-quality, low-carbon rice produce.



Source: FAO, 2025c.

Figure 2. Total greenhouse gas emissions of Vietnam (in million tons CO_2 equivalent), 2018-2022.

[1] Decision 1490/QD-TTg dated November 27, 2023, of the Prime Minister on Approval of the Project Sustainable development of one million hectares of high-quality and low-emission rice cultivation associated with green growth in the Mekong Delta by 2030"

1.2. Objective

This study assesses the current rice cultivation practices of farmers in Vietnam. It evaluates farmers' willingness to adopt methane-reducing practices (e.g., alternate wetting and drying, rice straw management, etc.). Primary data and insights from this study can inform the development of evidence-based policy recommendations for promoting low-emission rice in Vietnam. Data collection was specifically conducted to:

1. describe the socio-demographic characteristics of rice farmers;
2. assess farm characteristics and land utilization;
3. examine water management practices;
4. identify climate risks and corresponding mitigation measures;
5. evaluate farmers' awareness, knowledge, and perceptions of Climate-Smart Agriculture (CSA); and
6. assess awareness of and willingness to participate in the carbon market.

2. Methodology

2.1. Selection of Sites and Sampling Strategy

The survey employed a multi-stage sampling approach. In the first stage, three major rice-growing regions were purposively selected: the Red River Delta (RRD), the Coastal Region, and the Mekong River Delta (MRD). In the second stage, one province was randomly selected from both the RRD and the Coastal Region. In contrast, three provinces were randomly selected from the MRD, reflecting its status as the largest rice-producing region among the three regions. The selection of provinces within each region followed a probability sampling method, specifically using probability proportional to size (PPS) based on the rice cultivation area in each province.

Within each selected province, two districts were randomly chosen, followed by the random selection of two communes per district using the same PPS method. In each commune, two villages were randomly selected. Finally, 15 farmers per village were randomly sampled to participate in the survey.

Although the initial target was 600 respondents, some questionnaires were incomplete or invalid. As a result, the final number of valid responses was 597, as shown in Table 1, while Figure 3 shows the geographical location of the provinces included in the survey.

Table 1. Distribution of samples by region, province, district, and commune, 2024.

Region	Province	District	Commune	Respondent no.
Red River Delta	Thai Binh	Dong Hung	Phu Luong	29
			Dong Son	30
		Thai Thuy	Son Ha	30
			Thai Giang	30
Coastal Region	Nghe An	Do Luong	Dang Son	30
			Thai Son	30
		Nam Dan	Hung Tien	30
			Nam Giang	30
Mekong River Delta	An Giang	Chau Thanh	TT Vinh Binh	30
			Vinh Hanh	30
		Tri Ton	Tan Tuyen	29
			Vinh Phuoc	30
	Kien Giang	Giong Rieng	Hoa Hung	30
			Thach Phuoc	30
		Hon Dat	Nam Thai Son	30
			Binh Giang	30
	Soc Trang	Chau Thanh	Phu Lam	30
			Ho Dac Kien	30
		Long Phu	Long Phu (Commune)	30
			Tan Hung	29
Total				**597**

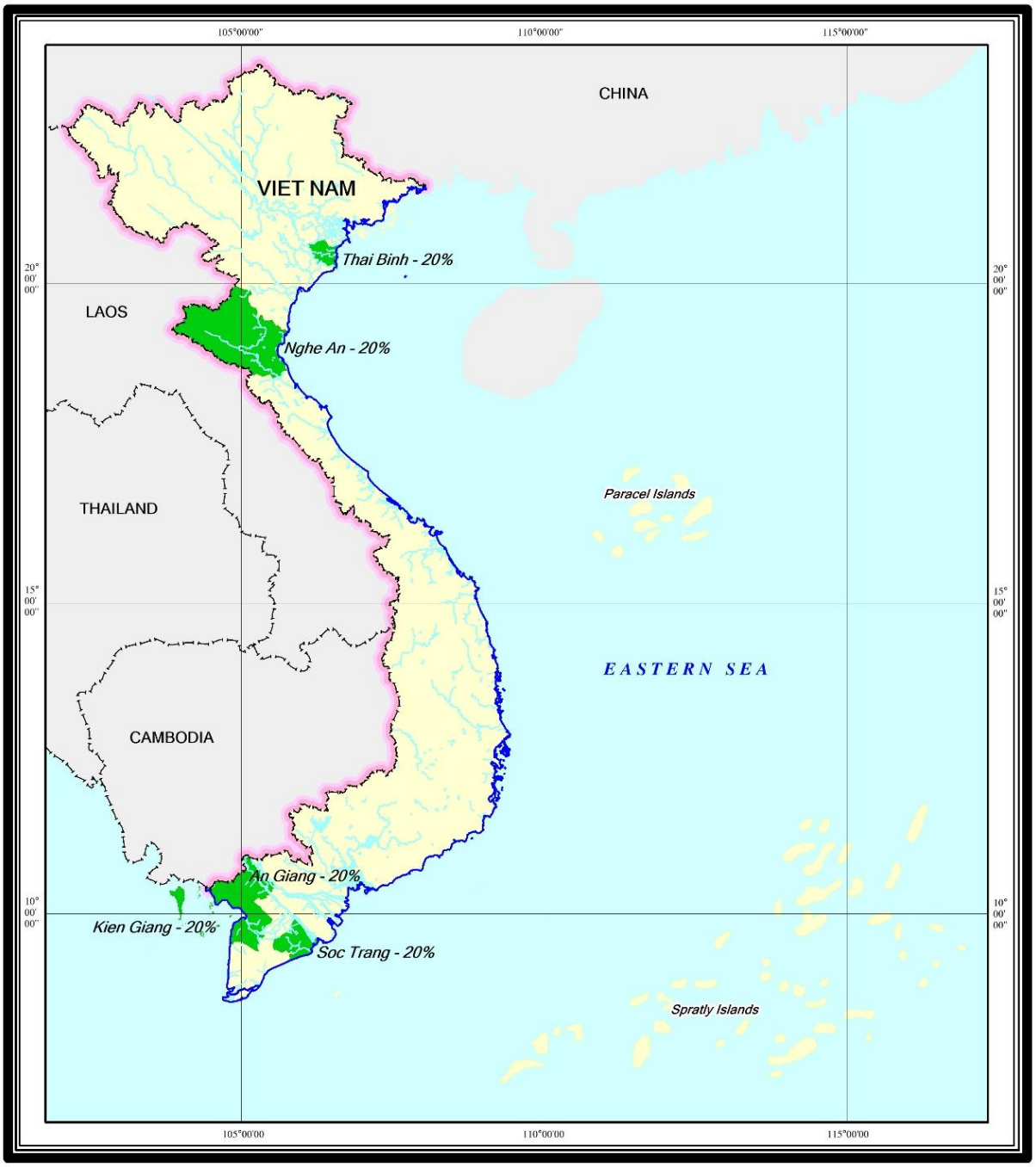


Figure 3. Geographic location of the survey areas and distribution of the respondents, by province, 2024.

2.2. Data Collection Process

For data collection, the study utilized Survey Solutions, a computer-assisted personal interview (CAPI) software developed by the World Bank. Survey Solutions is open-access software designed for creating detailed and complex questionnaires, complete with validation and data quality control features. It also features an offline mode for use during data collection and enables remote monitoring of data collection via a cloud server.

The survey questionnaire, approved by the IRRI Research Ethics Committee (IREC), was developed using the Survey Solutions Designer. Following its completion, the team conducted pre-testing of the survey instrument to ensure that the questions were valid and easily understood by farmers. Feedback from the pre-testing was incorporated into the final version of the questionnaire. The “Interviewer” application was installed on the computer tablets and was used during the data collection.

In Vietnam, seven IPSARD staff members served as enumerators for this survey. On October 7-8, 2024, a training of trainers (ToT) session was conducted in Hanoi, Vietnam, attended by five enumerators. Following the ToT, an internal training session was organized for the remaining two enumerators to ensure they were adequately prepared for the data collection process. IPSARD utilized Survey Solutions as the data collection tool. Data collection commenced on December 2, 2024, and was completed on January 16, 2025.

3. Survey Results and Discussion

3.1. Profile of the Respondents

3.1.1. Household demographic characteristics

As shown in Table 2, the respondents were predominantly (74%) the household heads themselves. This was most evident in An Giang, where 95% of respondents identified as household heads, followed by Kien Giang (88%) and Soc Trang (86%). In contrast, Thai Binh and Nghe An reported relatively lower figures, with only 60% and 44% of respondents being household heads, respectively. Based on Table 3, respondents also had extensive experience in rice farming, as reflected in their average of 32 years in the field. Notably, farmers in Thai Binh and Nghe An had even longer experience, averaging 39 and 37 years, respectively, compared to the other three provinces with 26-29 years.

Table 2. Socio-demographic information of the respondents, by province, 2024-2025.

	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Household head (%)	60	44	95	88	86	74
Female decision-maker (yes=1) (%)	54	70	3	9	13	30
Age, respondent (years)	60	58	51	50	53	55
Married status (yes = 1) (%)	95	94	97	98	95	96
Household size (no. of persons)	4	5	5	5	5	4
Educational attainment, respondent (%)						
Did not attend school	0	0	7	4	3	3
Primary	2	1	45	29	24	20
Junior High School	65	47	28	51	39	46
Senior High School	29	48	15	13	29	27
Technical/Vocational	3	2	2	2	2	2
College/University	3	3	4	2	3	3
Dependency ratio	.67	.63	.50	.51	.73	.61

Table 3. Surveyed farmers' average year of farming experience, by province, 2024-2025.

Province	Years of farming experience
Thai Binh (n=119)	39
Nghe An (n=120)	37
An Giang (n=119)	26
Kien Giang (n=120)	28
Soc Trang (n=119)	29
All five provinces (n=597)	**32**

Regarding decision-making, approximately 70% of households had male decision-makers, although results varied notably by province. In Nghe An (70%) and Thai Binh (54%), the majority of the households reported female decision-makers, suggesting that in Northern Vietnam, the spouse, often the wife, frequently plays a key role in managing farm responsibilities and decision-making. The respondents were generally middle-aged, with a mean age of 55, and mainly were married (96%), a consistent pattern across all five provinces. Levels of educational attainment among farmers varied but were generally low. Most farmers had only a basic education, with 20% having completed primary schooling, 46% reaching junior high school, and 27% attaining senior high school.

However, there were noteworthy provincial differences. In provinces such as Thai Binh, Kien Giang, and Soc Trang, farmers were likely to have completed at least junior high school at significant rates of 65%, 51%, and 39%, respectively. Nghe An had the highest share of farmers who had attained senior high school at 48%. Meanwhile, a large portion of farmers in An Giang had only a primary education, at 45%. All surveyed farmers in Thai Binh and Nghe An reported having received some form of formal education. In contrast, a small percentage of farmers reported having no formal education in the southern provinces: 7% in An Giang, 4% in Kien Giang, and 3% in Soc Trang.

When it comes to household size, on average, a household was composed of four people, with very minimal variations by province. The dependency ratio averaged around 61% overall, which was highest in Soc Trang at 73%, likely due to a higher proportion of children or elderly individuals at home. On the other hand, An Giang and Kien Giang exhibited the lowest dependency ratios, at approximately 50 to 51%, which may indicate a higher proportion of working-age members relative to dependents.

The largest share of the farming population falls within the 50–59 age group, with both males and females notably represented at 22% and 13%, respectively (Figure 4). This is followed by the 60–69 age group, accounting for 17% of males and 10% of females, indicating that older individuals were primarily involved in farming. The 40–49 age range shows a slightly smaller representation, especially among females, indicating that fewer middle-aged individuals are actively engaged in farming. Participation in the 20–29 and 30–39 age brackets was noticeably low, reflecting the underrepresentation of youth and young adults in the farming sector. These age groups were predominantly represented by males, with only 2% of female respondents recorded in the 30–39 bracket. The presence of farmers in the 70–79 and 80–89 age groups, though modest and mainly male, further highlights the aging structure of the farming population.

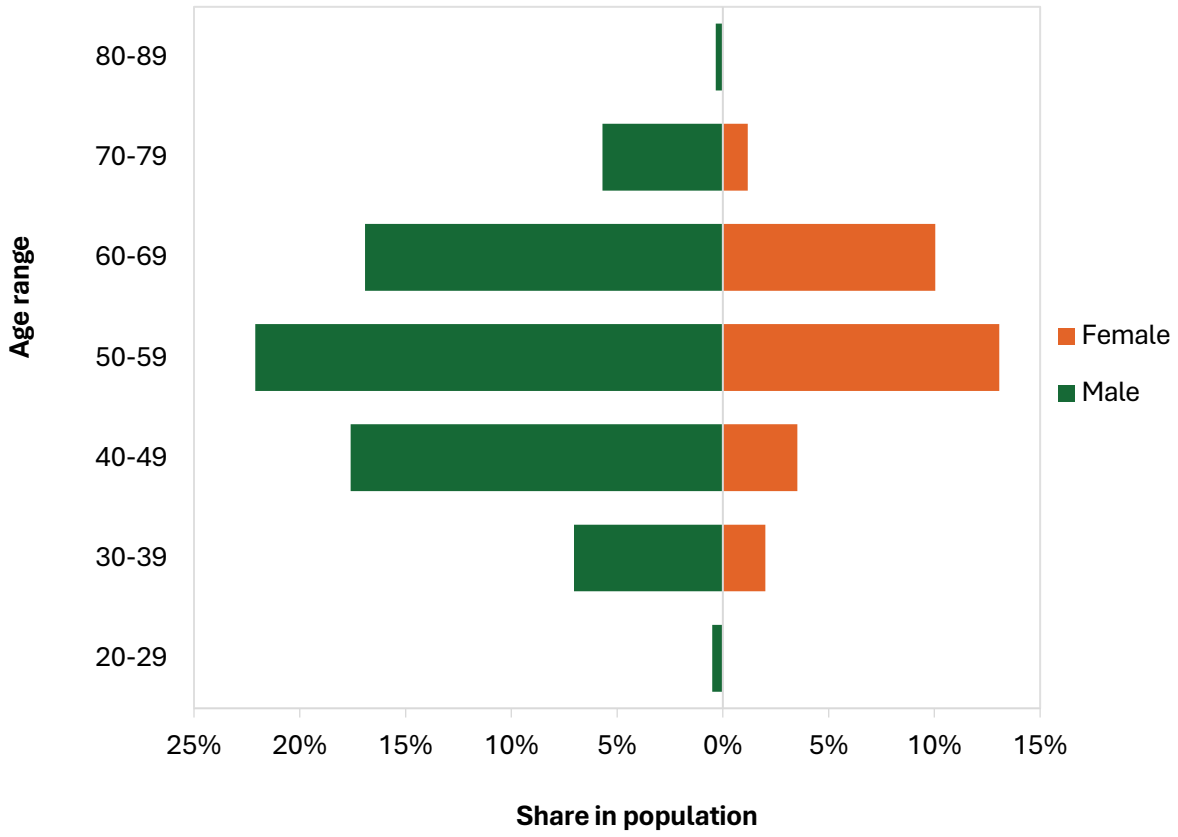
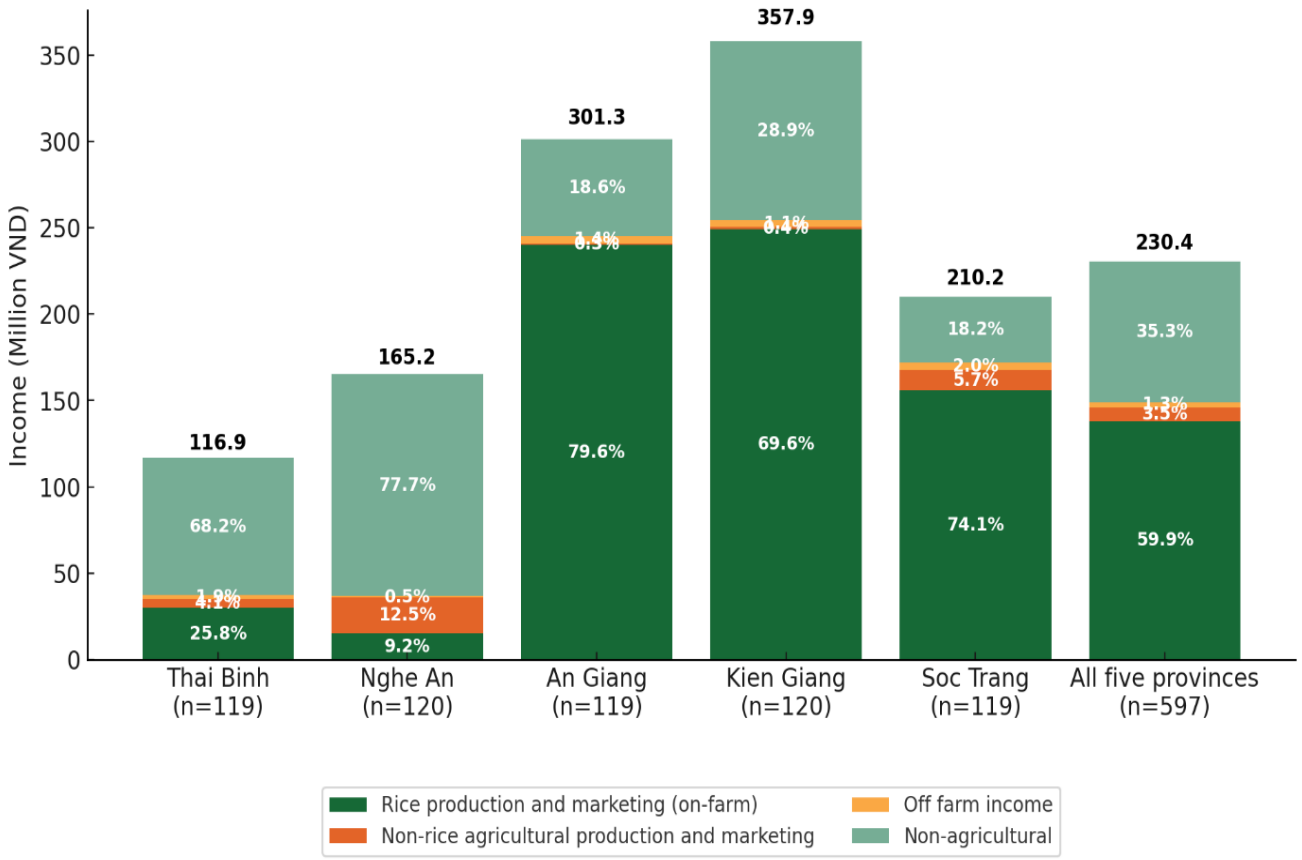


Figure 4. Age pyramid of the respondents, 2024-2025.

3.1.2. Household socioeconomic characteristics

Most households have various income sources contributed by several family members. Overall, rice production and marketing were the dominant household source of income, making up 60% of the total income (Figure 5). It was the primary source of income in An Giang (80%), Soc Trang (74%), and Kien Giang (70%), reflecting a more rice-dependent household in these areas. In contrast, the two other provinces exhibited more diversified income sources and were less specialized in rice farming. In Thai Binh, for instance, rice farming contributed only 26% of its average total income. The dominant share (68%) of total income came from non-agricultural sources, such as salaries and wages from government/private employment, trade, pensions, or remittances, among others. Nghe An demonstrated a similar pattern, with only nine percent of the overall income coming from rice production, while the most significant share was derived from non-agricultural income at 78%. Moreover, non-rice agricultural production and marketing income sources also accounted for a significant 13% in this province. Finally, off-farm sources accounted for a minor share of income, with an overall percentage of only 1%, showing no significant variations across the five provinces.



The values shown above the graph represent the respondents' average household income over the past 12 months, expressed in million dong.
*Non-rice agricultural production and marketing include income from other crops, livestock, and fishery.
** Non-agricultural sources include non-agricultural labor, government/private employment, business and investments, pensions, and social cash transfers, including remittances.

Figure 5. Distribution of household income sources and average income (in million dong), by province, 2024-2025.

3.2. Social Networks

Social networks and organizational memberships are key components that influence farmers' access to agricultural information, resources, and support services. Understanding the extent of their involvement in such networks provides insight into how knowledge and assistance circulate within their communities.

The survey reveals a high overall membership, where 74% of farmers said to belong to at least one community organization, although results varied by province (Figure 6). Nearly all farmers interviewed in Thai Binh were members of some organization at 98%, indicating a strong presence of social institutions in the province. Soc Trang and Nghe An also displayed high organization membership at over 85% each. Conversely, only 38% of farmers in An Giang cited belonging to any community organizations, while almost two-thirds were not formally engaged in any farmer groups. In the case of Kien Giang, the majority of farmers (63%) were affiliated with some farmer organizations. In general, the data reflect variability of organization membership rates across provinces, which could possibly affect the dissemination of knowledge and new practices that often take place through social groups and cooperatives.

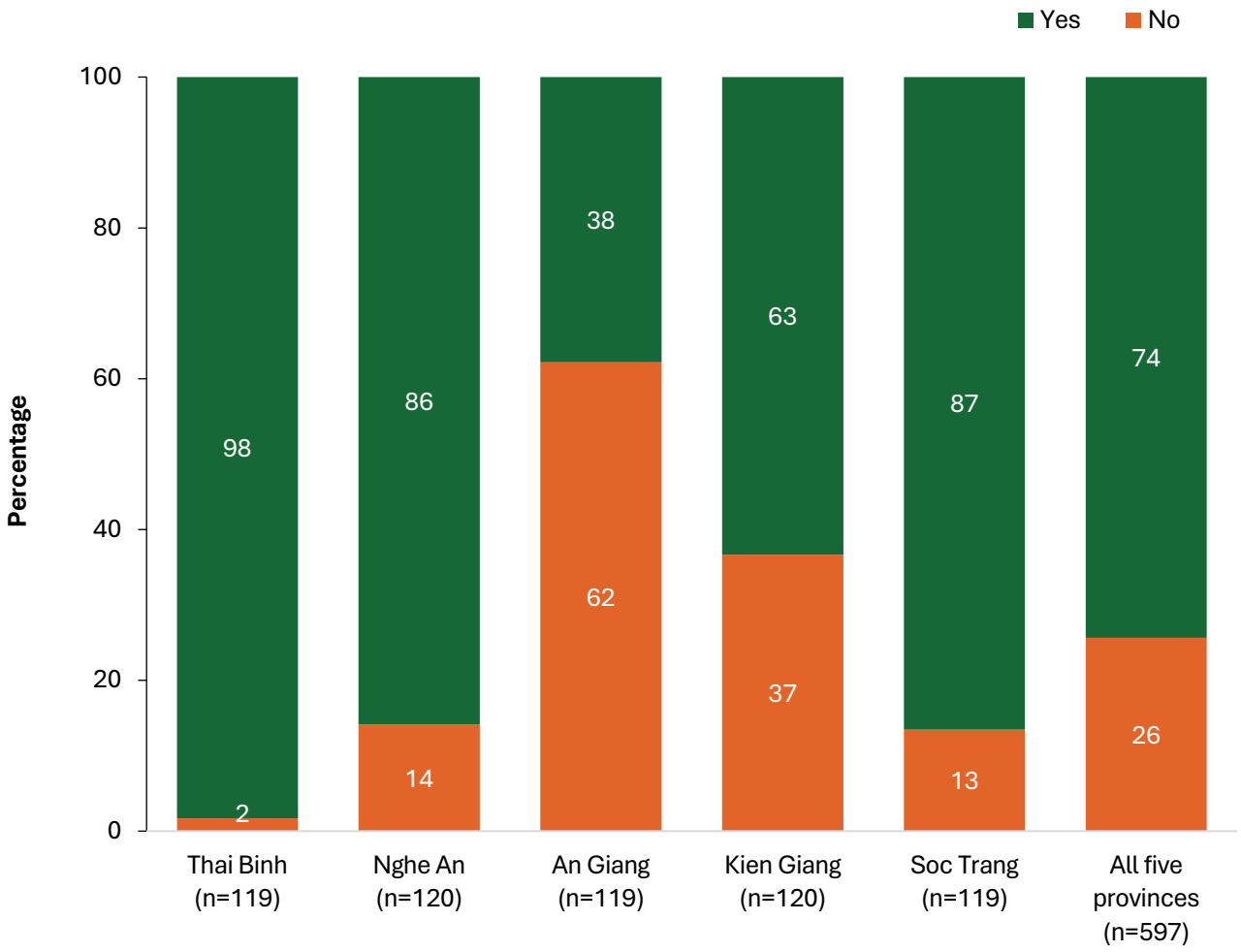


Figure 6. Membership status of the respondents in organizations (in percent), by province, 2024-2025.

Among respondents currently participating in organizations, the types of groups varied by province (Figure 7). However, cooperatives and farmers' associations were the most commonly joined, with participation rates of 54% and 48%, respectively. In Thai Binh and Nghe An, the farmer association was the predominant type of group, with over 70% of farmers reporting membership. This may reflect a longstanding presence of mass organizations like the farmer associations in these areas. Cooperative was the primary organization among farmers in An Giang (56%), Kien Giang (84%), and Soc Trang (94%), while the farmer association was relatively less prevalent, except in An Giang, with 49% participation. This likely reflects the drive for cooperatives focusing on rice production. Other organizations, such as women's group had an overall membership of nine percent, most notable in Nghe An with 18% and followed closely by Thai Binh with 16%. Civic groups had a general membership of 7% and were mostly observed in Nghe An, with a 12% participation rate and six to seven percent each in the remaining four provinces. Social and political groups also exist in a small minority of farmers of seven percent, particularly popular in Nghe An, with 17% membership. Farmer associations and cooperatives are the most widely affiliated groups among farmers; hence, they could serve as key channels for the dissemination and promotion of CSA technologies.

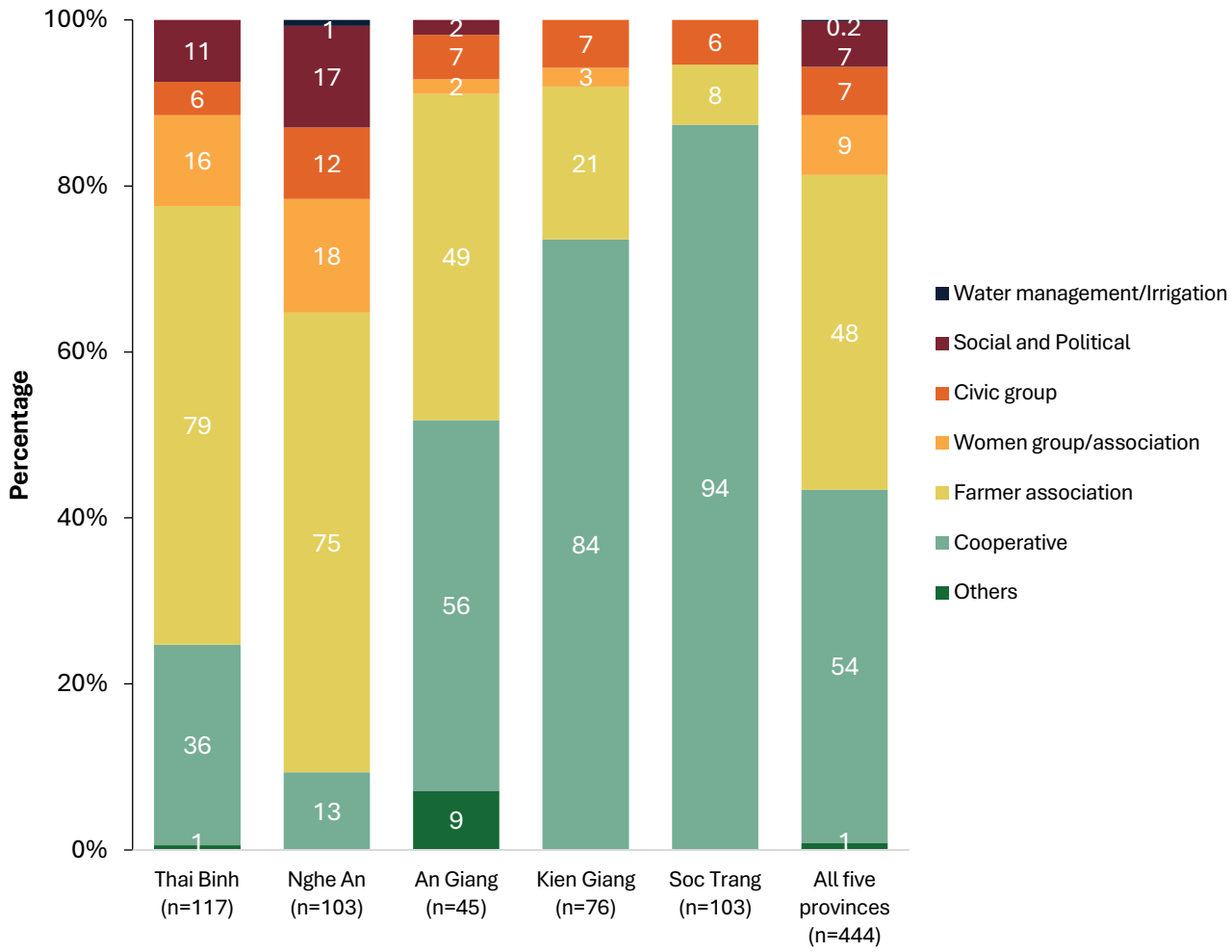


Figure 7. Organizational affiliations of the respondents (in percent), by province, 2024-2025.

Error! Not a valid bookmark self-reference. presents respondents perceived benefits of joining organizations by province. Overall, 75% of farmers reported receiving technical assistance and capacity development as one of the benefits, indicating the importance of such associations to enhance farmers' skills and knowledge continuously. This was consistently high in all provinces except Kien Giang, where less than half (43%) of the farmers reported it. Access to irrigation was also seen as a crucial benefit of being a member of a farmer group by 27% of farmers, although this perception varied significantly across provinces. It was most prominent in Kien Giang (61%) and Thai Binh (41%), while much lower in Soc Trang (6%). Production loans were markedly important in Nghe An and Thai Binh, where 51% and 31% of farmers reported it as a benefit.

Support for agricultural machinery and facilities also emerged as a benefit to 19% of farmers in general, especially in Soc Trang (40%). At the same time, it was almost non-existent in Nghe An at only 1%. Support for input procurement, such as seeds and fertilizers, was received by 15% of farmers through their collective organization, particularly in Soc Trang (22%). Generally, benefits such as marketing support and farm insurance appeared to be limited but were still received by 10% and 7% of farmers across provinces, respectively. Lastly, only 4% indicated that they did not receive any benefits from joining their respective organizations.

Table 4. Benefits of joining an organization (in percent) cited by the respondents, by province, 2024-2025.

Benefits of joining an organization	Thai Binh (n=117)	Nghe An (n=103)	An Giang (n=45)	Kien Giang (n=76)	Soc Trang (n=103)	All five provinces (n=444)
Technical assistance/Capacity development	81	87	73	43	82	75
Access to irrigation/ water services	41	16	11	61	6	27
Livelihood/production loans	31	51	22	12	2	25
Agricultural machineries and facilities	11	1	24	26	40	19
Support to input procurement	16	14	7	9	22	15
Marketing support	2	1	29	13	17	10
Farm insurance	17	4	0	4	4	7
None	7	1	4	5	4	4
Others	4	4	9	5	0	4

3.3. Farm Characteristics

The survey reveals significant provincial variability in land holdings (Figure 8). On average, each household operated a mean farm area of 3.02 hectares in the past 12 months. However, this average mask shows evident differences among provinces.

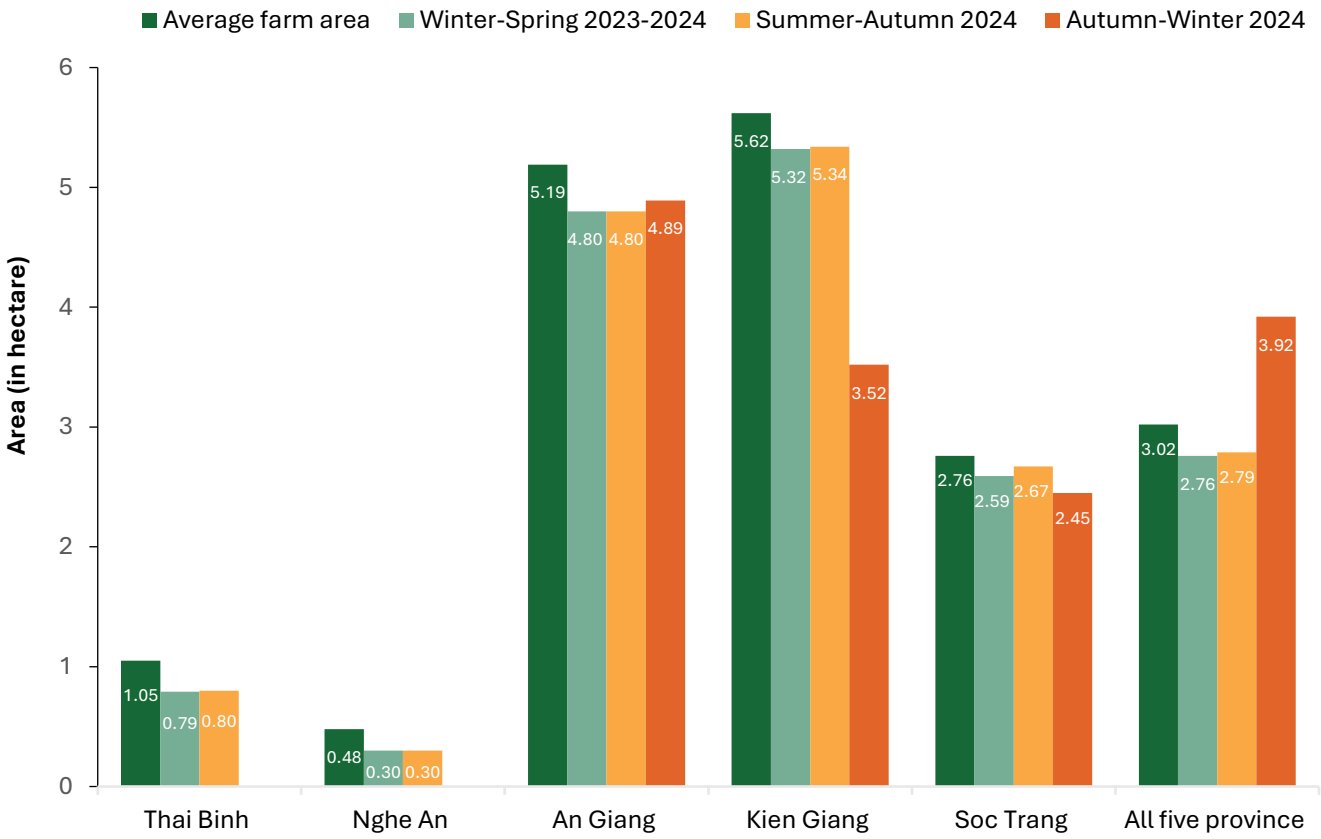


Figure 8. Average farm size cultivated (in hectare) in all three seasons, by province, 2023-2024.

In Kien Giang and An Giang, farm area averaged over 5 hectares, suggesting the prevalence of large-scale farming operations and capacity for mechanization. Then, in Soc Trang and Thai Binh, the land areas were 2.76 ha and 1.05 ha, respectively, indicating relatively modest-scale farming. Nghe An displayed the smallest farm area of only 0.48 ha, highlighting a highly fragmented land structure. Farmers during the Winter-Spring and Summer-Autumn seasons utilize almost the same area for rice farming, unlike in the Autumn-Winter season, where the land utilization for rice farming varies depending on the province.

Land tenure is predominantly owner-cultivated across all provinces (Table 5). In the primary Winter-Spring 2023-2024 season, about 87% of farmers were growing rice on their own land. Renting or contracting land was somewhat more common in the Mekong Delta than in the north, approximately 15% to 19% of farmers in Kien Giang and An Giang rented some land for the winter-spring crop, compared to only 5% in Nghe An. This suggests a nascent land rental market in the delta where enterprising farmers lease additional land to expand production. Sharing tenancy or borrowing land was very rare (<1% of cases). In Thai Binh and Nghe An, over 85% of main plots were owner-operated, with only approximately 5–11% rented. These patterns held similarly for the summer-autumn crop. The key takeaway is that most farmers operate on land they own, with a minority in the south enhancing scale through leases. Secure land tenure generally enables farmers to confidently invest in improvements (such as leveling for AWD or machinery for direct seeding). However, those leases might be more innovative for large-scale farmers.

Table 5. Tenure status of surveyed farmers' main plot (in percent), by season and province, 2023-2024.

Tenure status	Thai Binh	Nghe An	An Giang	Kien Giang	Soc Trang	All five provinces
Winter-Spring 2023-2024	**(n=118)**	**(n=120)**	**(n=119)**	**(n=120)**	**(n=111)**	**(n=588)**
Owner	86	94	78	83	93	87
Contracted/Rented	11	5	19	15	6	11
Share tenant	2	1	0	0	1	1
Leasehold	0	0	3	3	0	1
Borrowed	2	0	0	0	0	0
Summer-Autumn 2024	**(n=116)**	**(n=120)**	**(n=119)**	**(n=119)**	**(n=117)**	**(n=591)**
Owner	88	93	82	85	94	88
Contracted/Rented	10	6	17	13	6	10
Share tenant	0	1	0	0	0	0.2
Leasehold	0	0	2	3	0	1
Borrowed	2	0	0	0	0	0.3
Autumn-Winter 2024	**(n=0)**	**(n=0)**	**(n=114)**	**(n=57)**	**(n=59)**	**(n=230)**
Owner	-	-	80	91	95	87
Contracted/Rented	-	-	18	7	5	12
Leasehold	-	-	2	2	0	1

3.4. Water Management

Water management is a crucial aspect of climate-smart farming, especially given seasonal drought risk and the water-intensive nature of rice cultivation. The survey gathered detailed data on farmers' irrigation management practices. Table 6 to Table 8 show farmers' primary water sources for each season. Natural bodies of water served as the primary water source for 60% to 79% of farmers. This pattern was consistent across all provinces and the three cropping seasons, suggesting that the surveyed areas were situated near rivers, streams, or canals. Irrigation canals also played a significant role, particularly during the Winter-Spring and Summer-Autumn seasons, when 39% and 38% of farmers, respectively, accessed water from these sources. However, only 19% of farmers who cultivated rice during the Autumn-Winter season reported using irrigation canals as their primary source, indicating a broader preference for natural sources like rivers and streams. Meanwhile, groundwater and ponds were reported by less than one to two percent of farmers.

Table 6. Distribution of surveyed farmers (in percent), by water source of the largest plot and province, Winter-Spring 2023-2024.

Water source	Thai Binh (n=118)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=111)	All five provinces (n=588)
Irrigation canal	59	79	13	23	22	39
Ground water	0	0	2	0	0	0.3
River/Stream/Canals	41	21	85	78	78	60

Table 7. Distribution of surveyed farmers (in percent), by water source of the largest plot and province, Summer-Autumn 2024.

Water source	Thai Binh (n=116)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=119)	Soc Trang (n=117)	All provinces (n=591)
Irrigation canal	55	79	13	24	20	38
Ground water	2	0	2	3	4	2
Individual farm pond	0	0	1	0	0	0.2
River/Stream/Natural canal	43	21	85	73	76	60

Table 8. Distribution of surveyed farmers (in percent), by water source of the largest plot and province, Autumn-Winter 2024.

Water source	Thai Binh (n=0)	Nghe An (n=0)	An Giang (n=114)	Kien Giang (n=57)	Soc Trang (n=59)	All three provinces (n=230)
Irrigation canal	0	0	16	23	20	19
Ground water	0	0	2	0	2	1
Individual farm pond	0	0	1	0	0	0.4
River/Stream/Natural canal	0	0	82	77	78	79

Only a few farmers experienced severe water shortages across the three seasons for the past three years (Figure 9 to Figure 11). During the last three Winter-Spring seasons, some farmers (13%) experienced insufficient water for rice cultivation. Out of all the provinces, Thai Binh was the most affected at 25% followed by Soc Trang (15%). Farmers in Nghe An (12%) and An Giang (7%)

reported fewer shortages, while Kien Giang (5%) showed the most stable access to water. The past three Summer-Autumn seasons reported the highest incidence of water shortages, at 15% overall. It is especially pronounced in Nghe An (27%), followed by Thai Binh (19%) and An Giang (16%). In contrast, Kien Giang and Soc Trang reported very low rates of water shortages, at 5% and 7%, respectively. Then, Autumn-Winter, an overall five percent of farmers experienced water shortages, which occurred in An Giang (9%) and Kien Giang (4%).

Figure 9. Distribution of surveyed farmers who experienced water shortages (in percent) during the last three Winter-Spring seasons, by province, 2022-2024.

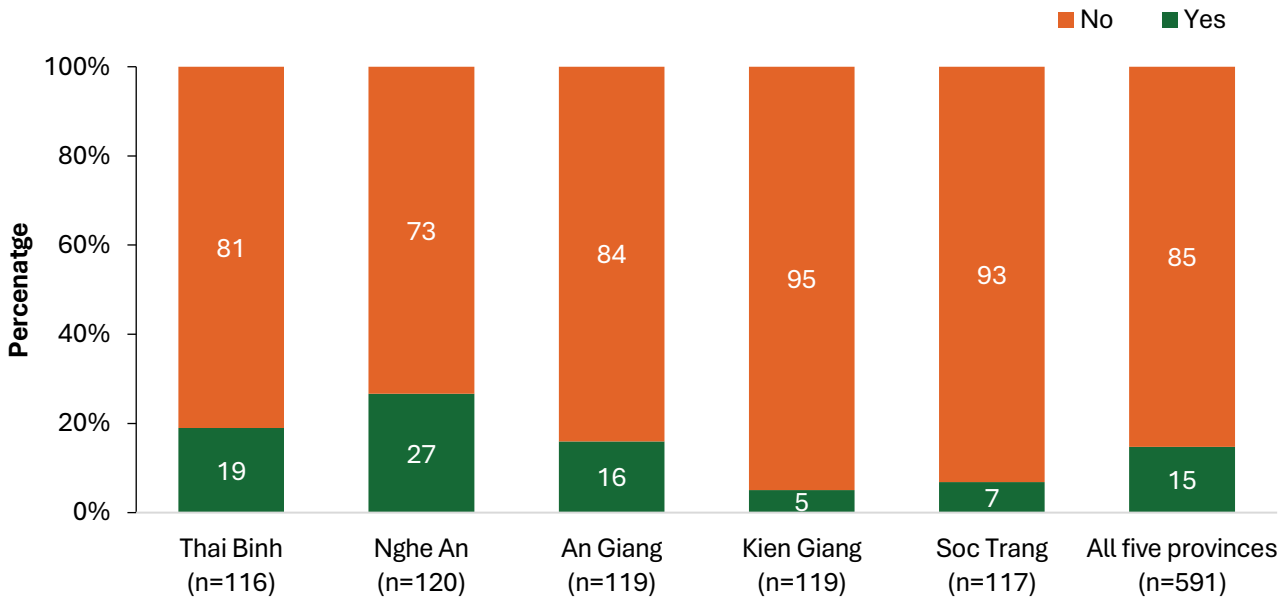


Figure 10. Distribution of surveyed farmers who experienced water shortages (in percent) during the last three Summer-Autumn seasons, by province, 2022-2024.

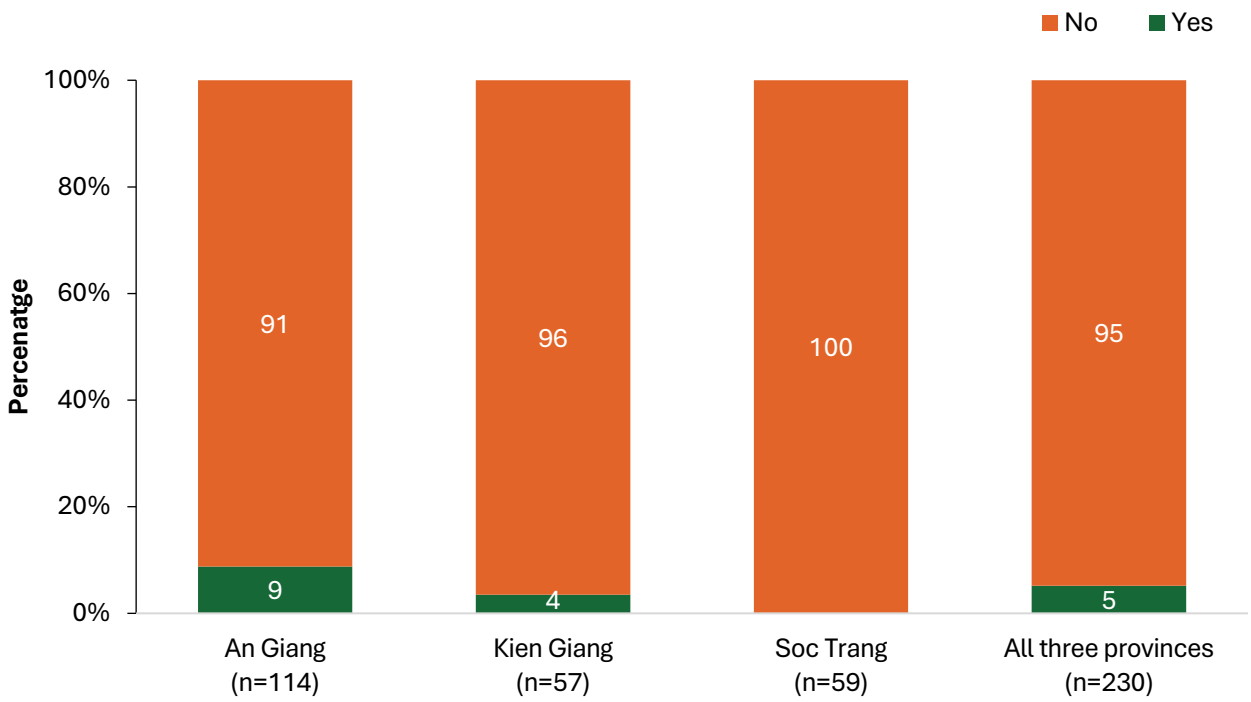


Figure 11. Distribution of surveyed farmers who experienced water shortages (in percent) during the last three Autumn-Winter seasons, by province, 2022-2024.

The survey reveals a mix of traditional fixed schedules and some adaptive cues, as seen per season in Figure 12 to Figure 14. Overall, in all seasons, a substantial majority (ranging from 83% to 85%) reported following a time gap-based irrigation schedule, characterized by irrigating fields at regular intervals (usually 7 to 10 days). Only a minority reported using soil moisture cues as signals to irrigate; specifically, about eight percent waited until the soil surface turned white, and six to nine percent waited until tiny hairline cracks appeared on the soil. During the Winter-Spring and Summer-Autumn seasons, very few farmers (2% each) were observed to irrigate fields when the water drains. Still, the dominant practice across provinces in all seasons was routine scheduling. These results suggest an opportunity to train farmers to adjust irrigation based on field conditions, which could enhance water-use efficiency.

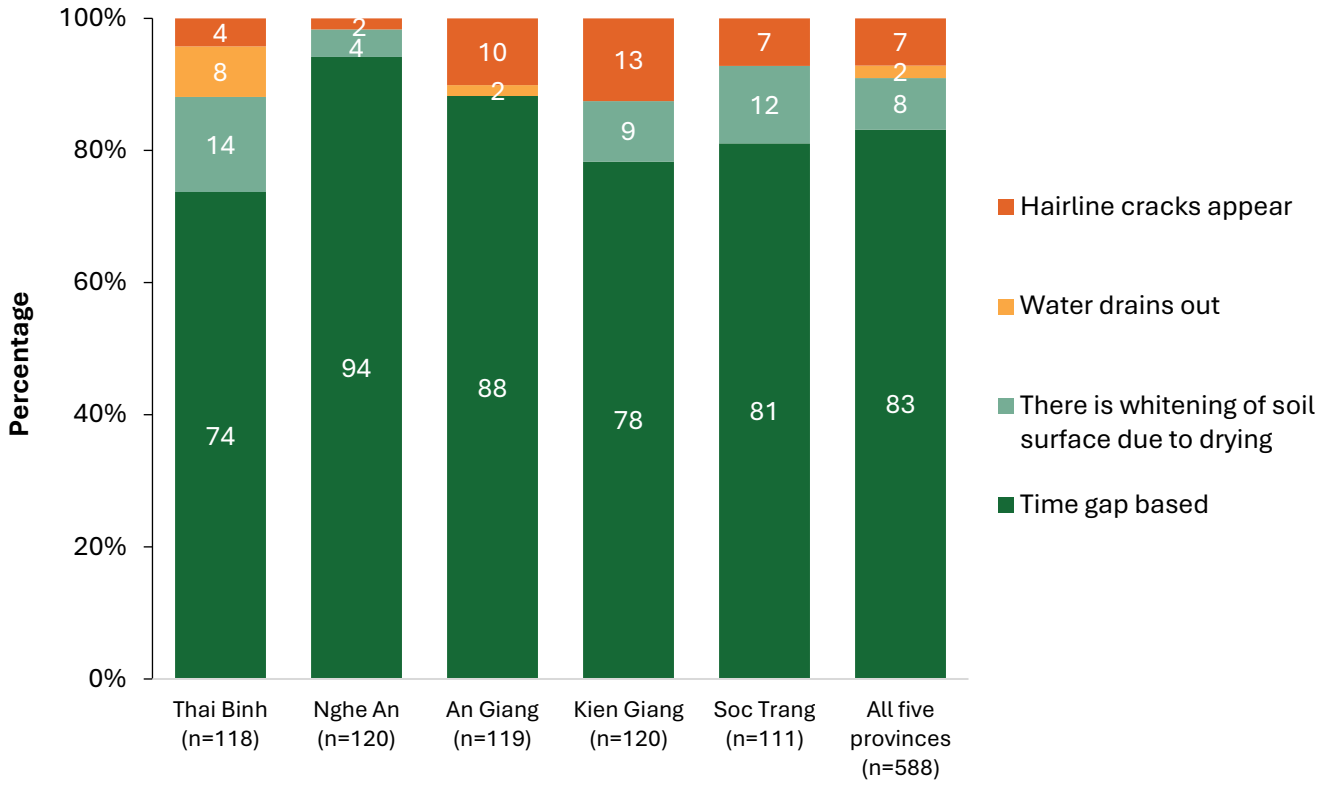


Figure 12. Attributes affecting the decision of surveyed farmers to irrigate (in percent), by province, Winter-Spring 2023-2024.

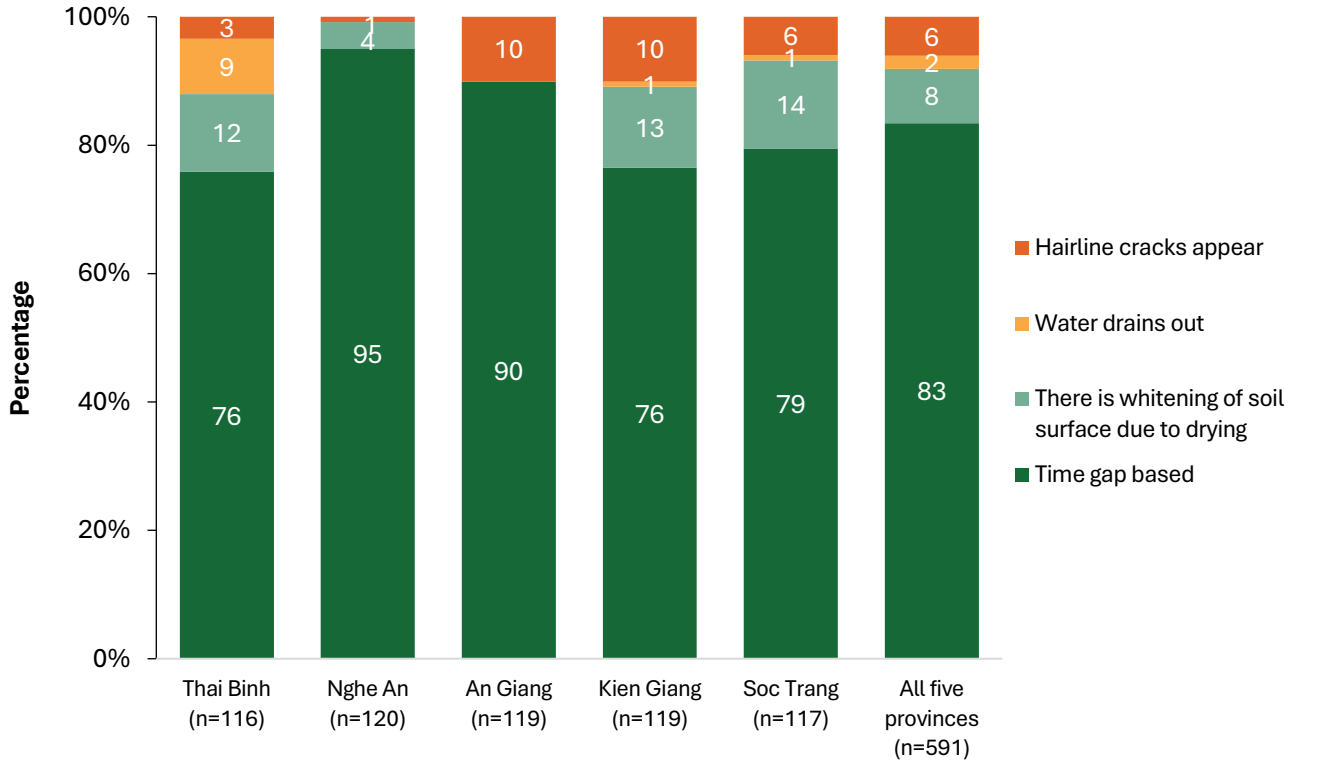


Figure 13. Attributes affecting the decision of surveyed farmers to irrigate (in percent), by province, Summer-Autumn 2024.

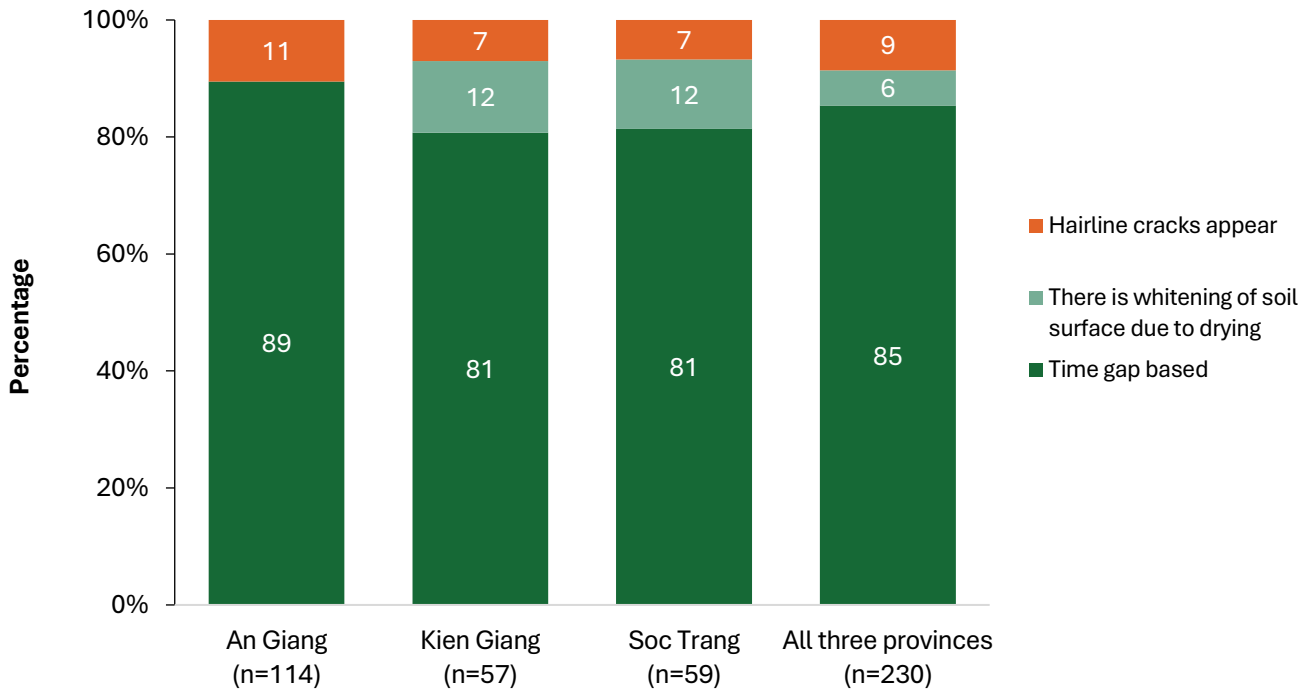


Figure 14. Attributes affecting the decision of surveyed farmers to irrigate (in percent), by province, Autumn-Winter 2024.

Additionally, farmers were asked about the water regime they followed for the last three seasons. The data reveals a widespread application of multiple drainage systems across all five provinces. This pattern indicates a significant shift away from continuous flooding, with substantial implications for water conservation, input cost reduction, and the potential alignment with AWD principles. During the Winter-Spring season, 64% of farmers used multiple drainage, with Kien Giang (87%) and An Giang (72%) showing strong adherence (Figure 15). This season often marks higher water demand due to intensive cropping, yet continuous flooding remains minimal (6%). The repeated drying intervals practiced here strongly resemble AWD.

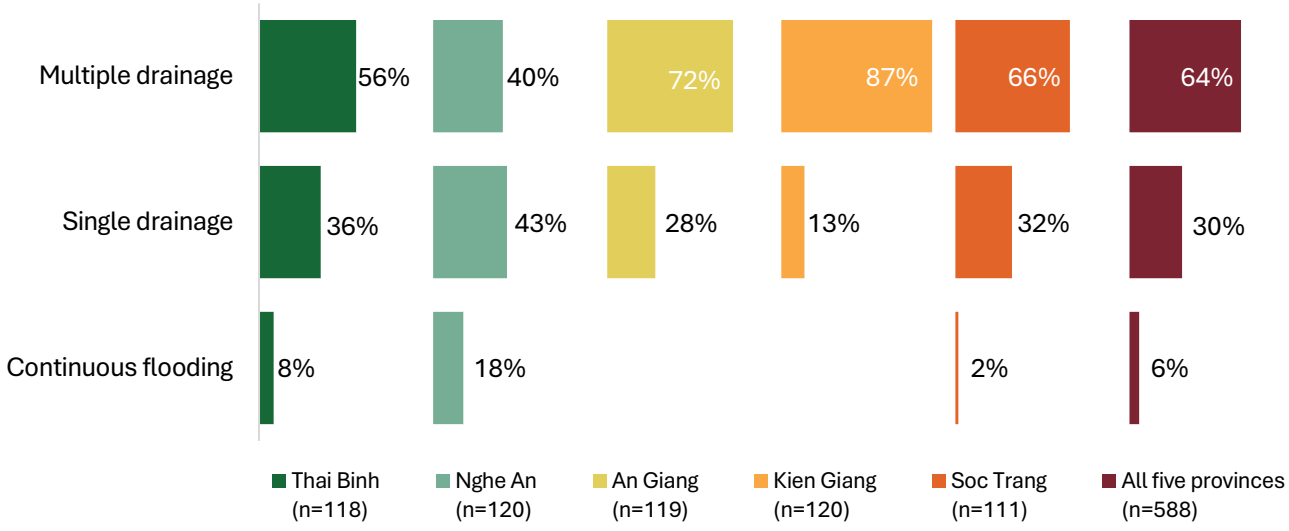


Figure 15. Surveyed farmers' water regime in the past 12 months, by province, Winter-Spring 2023-2024.

This behavior continues in the Summer-Autumn season, where 63% of farmers reported multiple drainage, with particularly high adoption in Kien Giang (90%) and Soc Trang (66%), as shown in Figure 16. The low share of continuous flooding (6%) and only moderate use of single drainage (32%) highlight a further move toward adaptive water regimes.

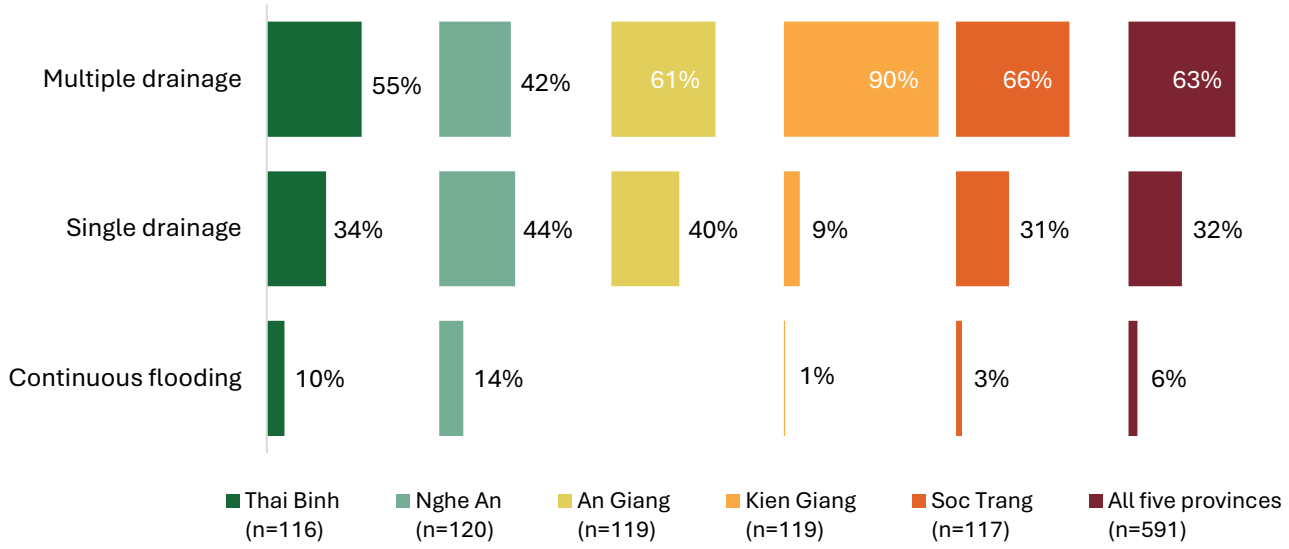


Figure 16. Surveyed farmers' water regime in the past 12 months, by province, Summer- Autumn 2024.

In the Autumn-Winter season, Figure 17 shows that a dominant 77% of farmers reported using multiple drainage practices, especially in Kien Giang (89%) and An Giang (75%). The near absence of continuous flooding (only 0.4% overall) suggests that farmers were already practicing frequent field dry downs, which is a core principle of AWD. By allowing fields to dry multiple times during the cropping period, farmers can reduce water use and potentially lower methane emissions, while maintaining or even improving yields.

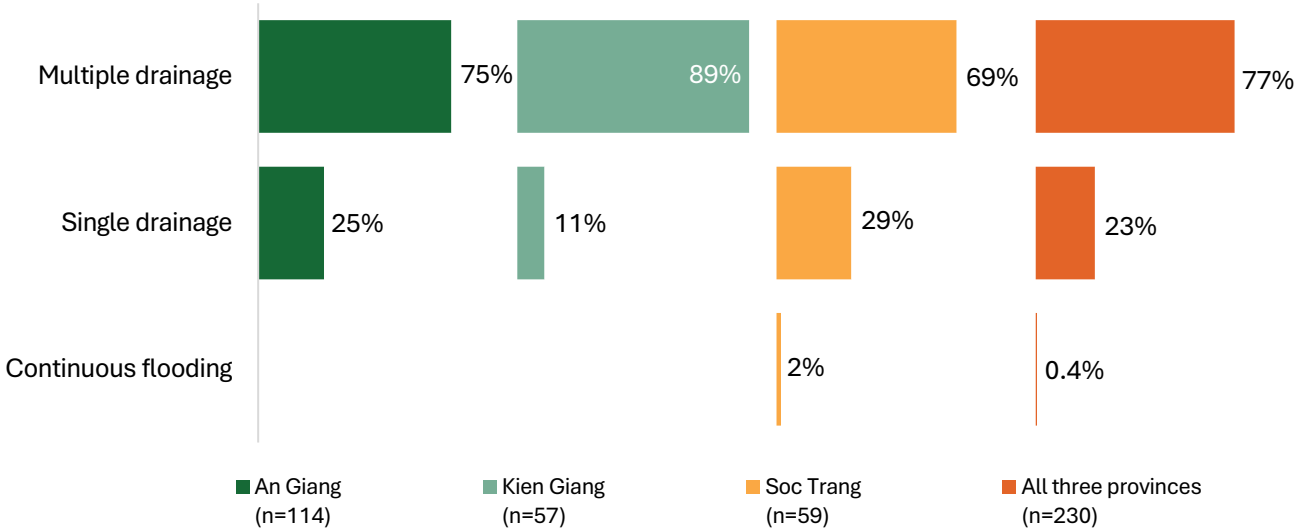


Figure 17. Surveyed farmers' water regime in the past 12 months, by province, Autumn-Winter 2024.

Overall, across all seasons and provinces, the dominant use of multiple drainage confirms that the vast majority of farmers experienced at least one dry-down per cropping season. As water scarcity and climate variability increase, strengthening the link between farmers' current practices and AWD can be a strategic pathway for enhancing water productivity, improving environmental outcomes, and increasing farm profitability in rice-based systems.

Moreover, farmers were asked when they irrigate their fields during critical rice growth stages (Figure 18 to Figure 20). Results showed a consistent pattern across all three seasons, with over 90% of farmers applying water during land preparation (tilling) but none during the seeding stage. This suggests that farmers tend to establish crops in relatively dry fields, which is indicative of using DSR as the crop establishment method. Irrigation activity remained very active during the tillering, panicle initiation, and heading stages for 72 to 94% of farmers. These are crucial growth periods when rice undergoes intense vegetative development and reproductive transitions, making a sufficient water supply essential for optimal yield formation. During the ripening stage, over 60% of farmers ensure that water is still present and will be drained at a later stage. As expected, irrigation was absent during harvesting, as the fields had been drained beforehand. These responses align with standard practice, as farmers keep fields flooded through most of the crop cycle, then drain toward harvest.

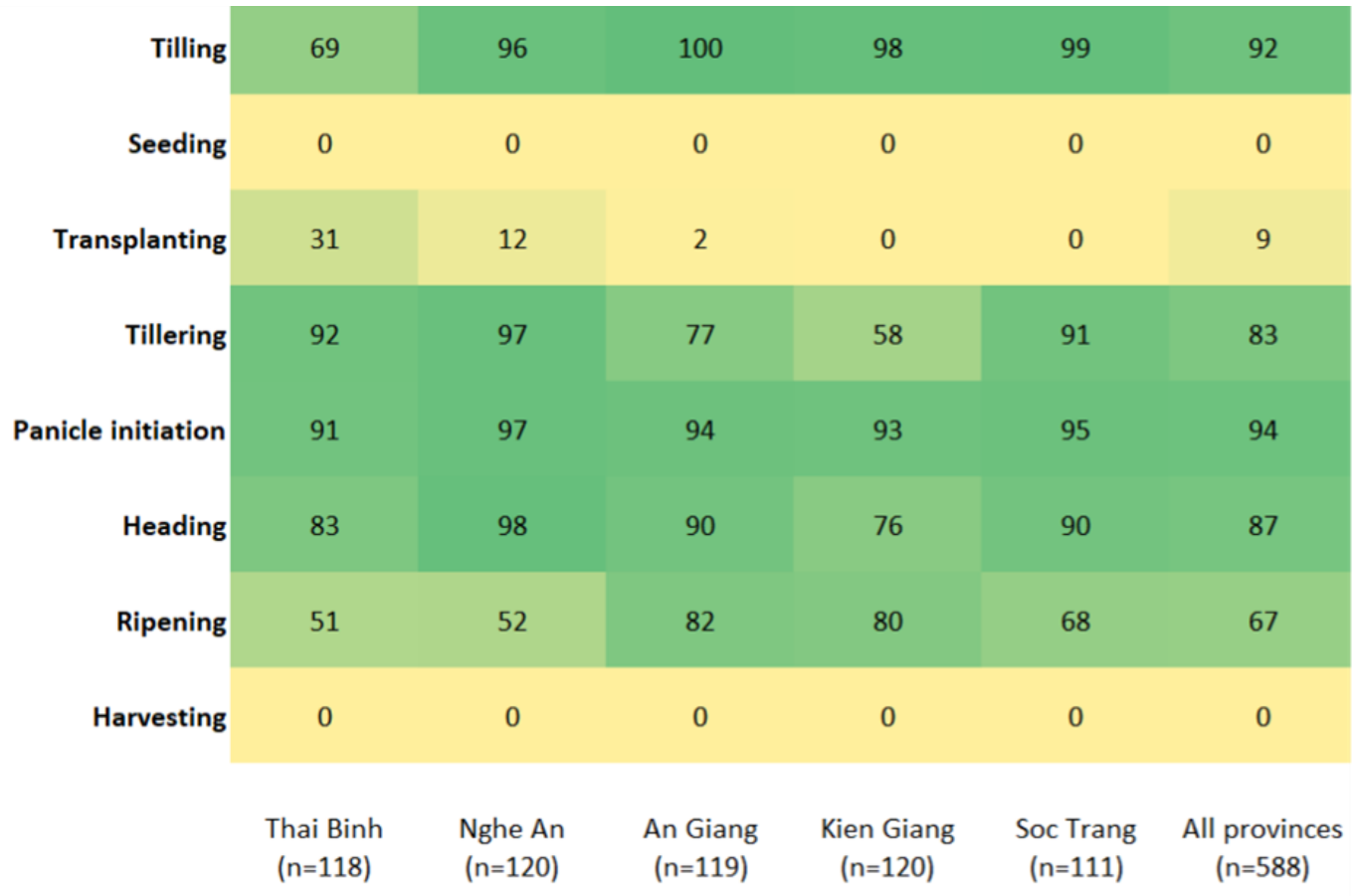


Figure 18. Heat map of surveyed farmers' irrigation timing across rice growth stages (in percent), by province, Winter-Spring 2023-2024.

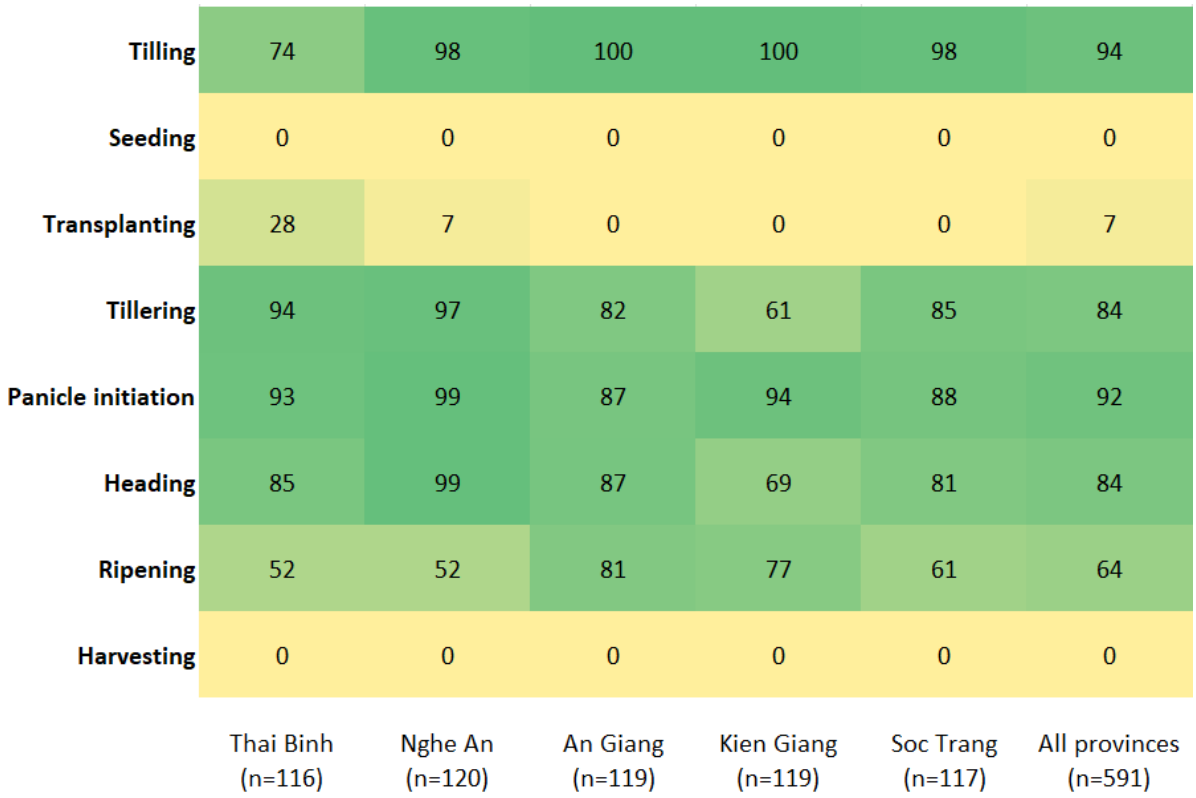


Figure 19. Heat map of surveyed farmers' irrigation timing across rice growth stages (in percent), by province, Summer-Autumn 2024.

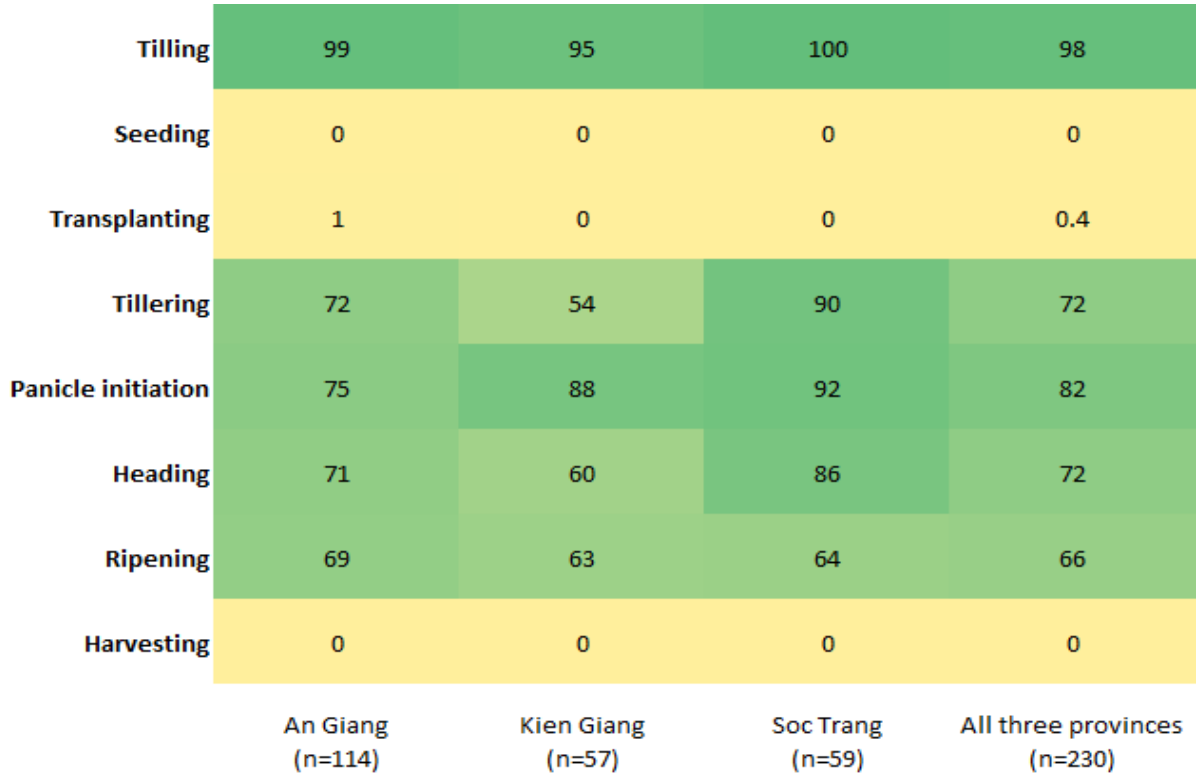


Figure 20. Heat map of surveyed farmers' irrigation timing across rice growth stages (in percent), by province, Autumn-Winter 2024.

The timing of when the water level drops across rice growth stages was also asked in the survey. A comparable trend emerged in Winter-Spring (Figure 21) and Summer-Autumn (Figure 22) seasons. A range of 28% to 58% of farmers overall reported that water levels dropped below the soil level during the tillering, panicle initiation, and ripening stages. Only a small fraction of farmers, five percent during the Winter-Spring season and four percent in the Summer-Autumn season, reported never allowing their fields to dry, suggesting that the vast majority experienced at least one period of field dry-down. In Autumn-Winter, farmers across all three provinces shared similar practices (Figure 23). A notable percentage of farmers reported drying the field at seeding (77%), indicating that DSR is a common practice in crop establishment. Water level drops were also commonly reported during the heading (52%) and tillering stages (78%), both critical growth phases where controlled water management helps balance water use efficiency and crop development. During the ripening stage, an overall 53% of farmers indicated water reduction, while the presence of water in the fields was nonexistent during harvesting to ease the reaping process.

Overall, the data indicate that most farmers strategically manage water levels, particularly by reducing them during later stages of the crop cycle. Although some fields still have water during harvesting, this is usually due to rain that has caused water to accumulate in the fields.

	Thai Binh (n=118)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=111)	All provinces (n=588)
Tilling	19	3	13	28	16	16
Seeding	19	48	72	88	74	60
Transplanting	0	0	0	0	0	0
Tillering	30	35	78	93	50	57
Panicle initiation	9	18	45	38	41	30
Heading	20	9	54	46	38	33
Ripening	35	34	45	60	53	45
Harvesting	69	68	92	90	75	79
Not applicable/Never	15	6	0	0	2	5

Figure 21. Heat map of surveyed farmers' water level drop across rice growth stages (in percent), by province, Winter-Spring 2023-2024.

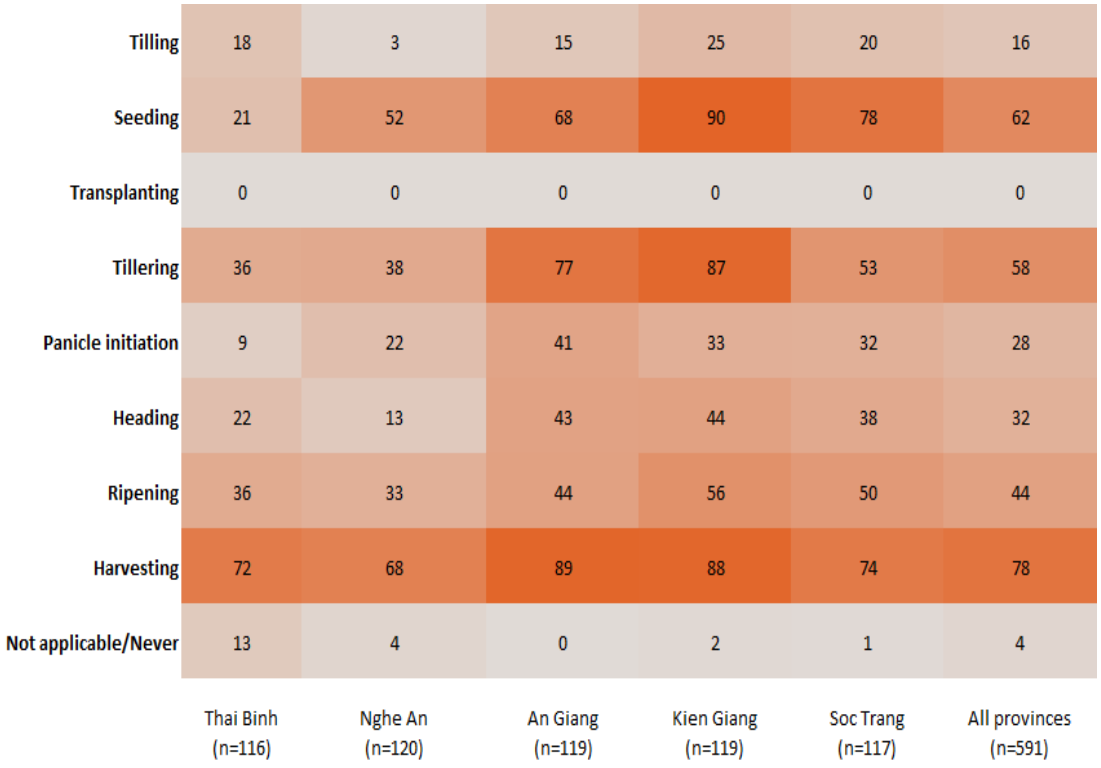


Figure 22. Heat map of surveyed farmers' water level drop across rice growth stages (in percent), by province, Summer-Autumn 2024.

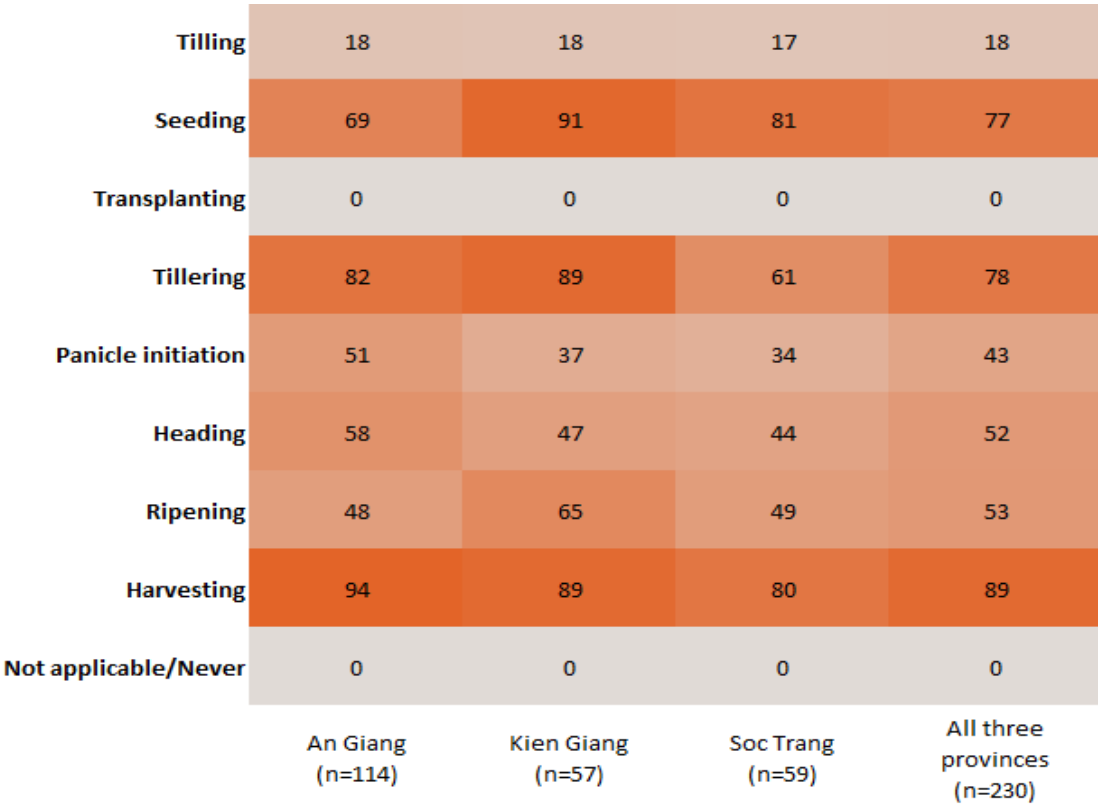


Figure 23. Heat map of surveyed farmers' water level drop across rice growth stages (in percent), by province, Autumn-Winter 2024.

3.5. Climate Risks

Aside from water shortages, surveyed farmers also experienced climate risks that may have affected their rice production over the past three years, as shown in Figure 24. The highest proportion of farmers who were exposed to these risks was in Thai Binh (85%), followed by Nghe An (72%). Additionally, a greater proportion (58%) of respondents in An Giang reported experiencing these risks. In contrast, significantly fewer farmers in Soc Trang (43%) and Kien Giang (36%) reported such experiences.

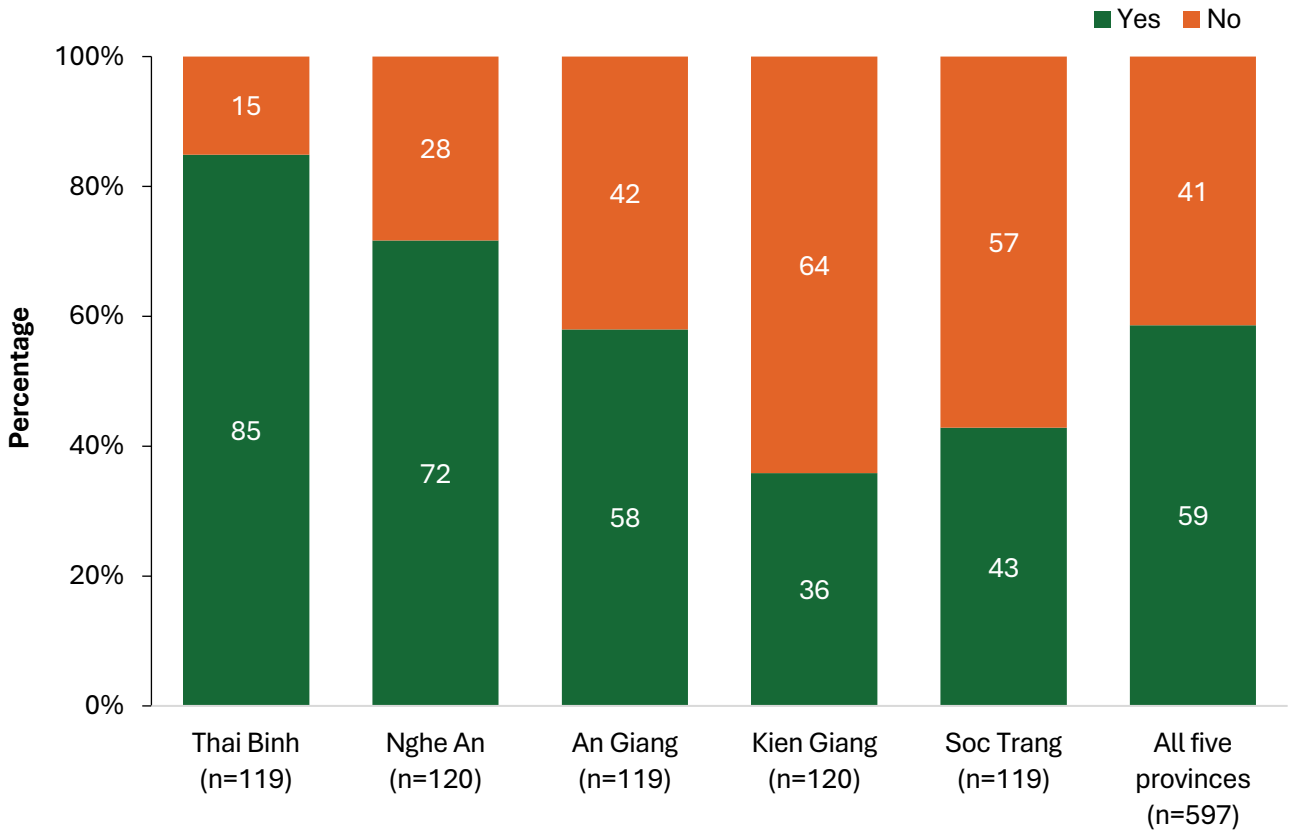


Figure 24. Distribution of respondents who experienced climate risks (in percent), by province, 2022-2024.

Across all provinces, storms (57%) emerged as the most frequent climate risk (Figure 25), with particularly high occurrence rate in Thai Binh (98%) and moderate levels in Kien Giang (60%) and Nghe An (48%), as presented in Table 9. Another concern was flooding, reported by approximately 29% of respondents—particularly in Soc Trang (51%), Kien Giang (37%), and An Giang (29%), all of which are located within the MRD. The region is particularly susceptible to unpredictable flooding, especially during high tides, due to its geographical characteristics, including low-lying plains and extensive estuarine systems. Soc Trang is the most vulnerable, given its location, which faces both the Bassac River and the East Sea (Linh and Huan, 2022).

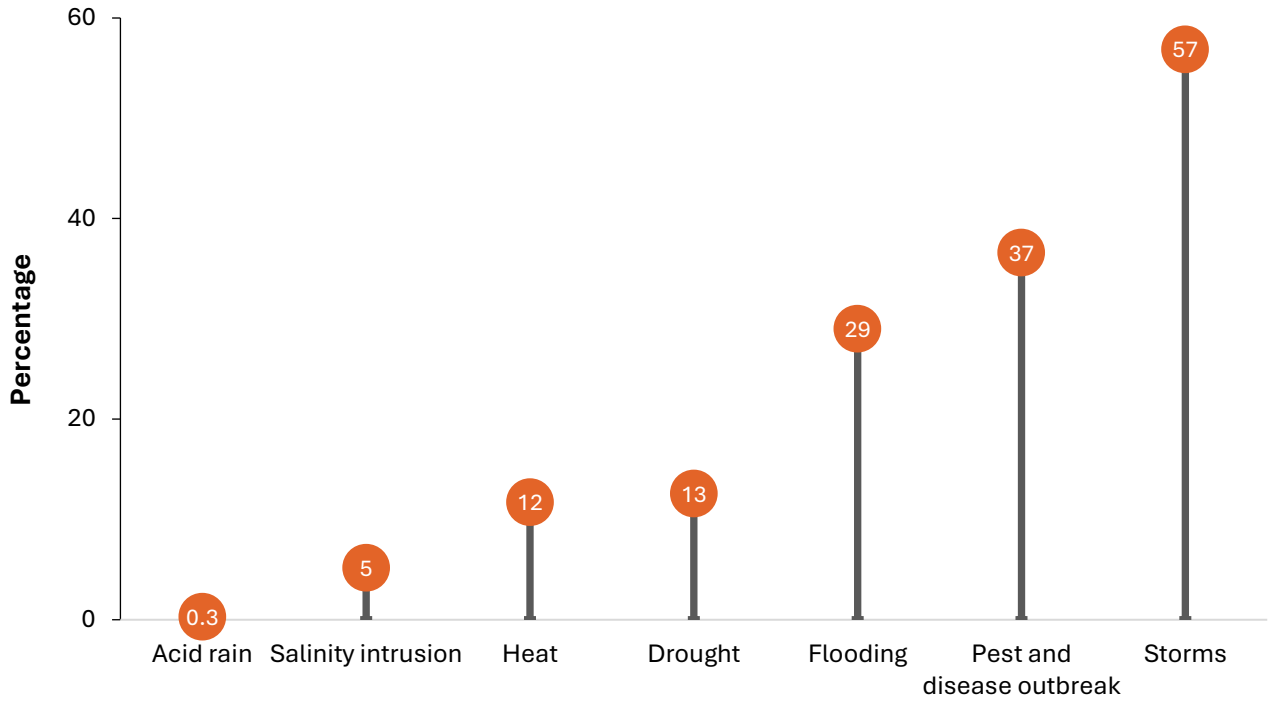


Figure 25. Climate risks experienced by respondents in rice production (in percent), 2022-2024.

Table 9. Climate risks experienced by respondents in rice production (in percent), by province, 2022-2024.

Climate risks	Thai Binh (n=101)	Nghe An (n=86)	An Giang (n=69)	Kien Giang (n=43)	Soc Trang (n=51)
Storms	98	48	26	60	29
Pest and disease outbreak	38	35	62	16	20
Flooding	11	34	29	37	51
Heat	11	23	12	5	0
Drought	3	31	13	7	4
Salinity intrusion	1	0	0	2	31
Acid rain	0	1	0	0	0

Another significant issue cited was the outbreak of pests and diseases (37%), particularly in An Giang (62%), while this risk was lower in Kien Giang and Soc Trang, at 16% and 20%, respectively. Meanwhile, some farmers also mentioned drought (13%) and heat stress (12%), particularly in Nghe An, with rates of 31% and 23%, respectively. The province is one of the three provinces most affected by climate risks and extreme weather events in the North Central Coast (NCC) Region (Tran et al., 2022). In 2020, 5,000 ha of agricultural land were affected by water shortage due to extreme heat events and minimal rainfall occurrences (North Central Regional Hydro-Meteorological Center, as cited in Tran et al., 2022).

In Soc Trang, 31% of respondents reported experiencing salinity intrusion—the highest proportion among the surveyed provinces. This may be attributed to the province's location, where the Hau River flows into the East Vietnam

Sea (also known regionally as the Southeast Sea), making the province susceptible to damage from saline intrusion (Dang et al., 2025). The proximity of the surveyed districts to the coastline further contributes to this issue.

Additionally, the estimated average production losses varied across provinces. Thai Binh reported the highest percentage losses of 40%, highlighting the devastating impact of climate risks, particularly storm events in rice production (Figure 26). To minimize these losses, nearly a quarter (23%) of farmers in Thai Binh adopted stress-tolerant varieties (Table 10). In contrast, farmers in An Giang reported average losses of about 26% only, which may be attributed to the fact that more than half (55%) of them applied pesticides to control the province's high incidence of pests and diseases.

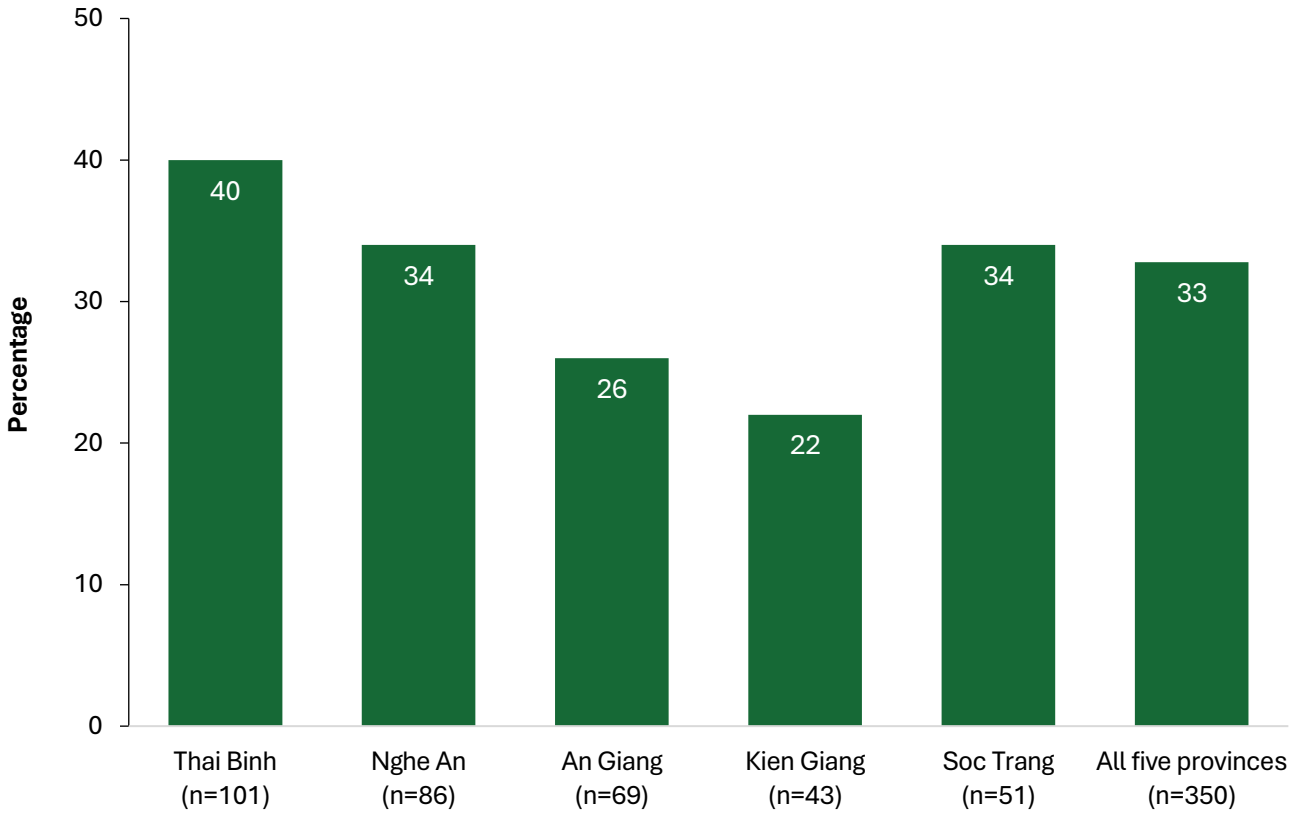


Figure 26. Estimated average production losses when the risks occurred on rice production (in percent), by province, 2022-2024.

Meanwhile, farmers in both Nghe An and Soc Trang reported similar estimated losses of 34%, possibly because nearly half —47% in Nghe An and 53% in Soc Trang—did not implement any mitigation measures. Kien Giang recorded the lowest production loss at 22%, which aligns with the province having the fewest farmers reporting exposure to climate risks. This low level of loss may also be partly due to the actions taken by some farmers—21% applied pesticides and 28% improved their water management. Across all provinces, only a small proportion of farmers (6%) reported using mulching as a mitigation strategy (Figure 27).

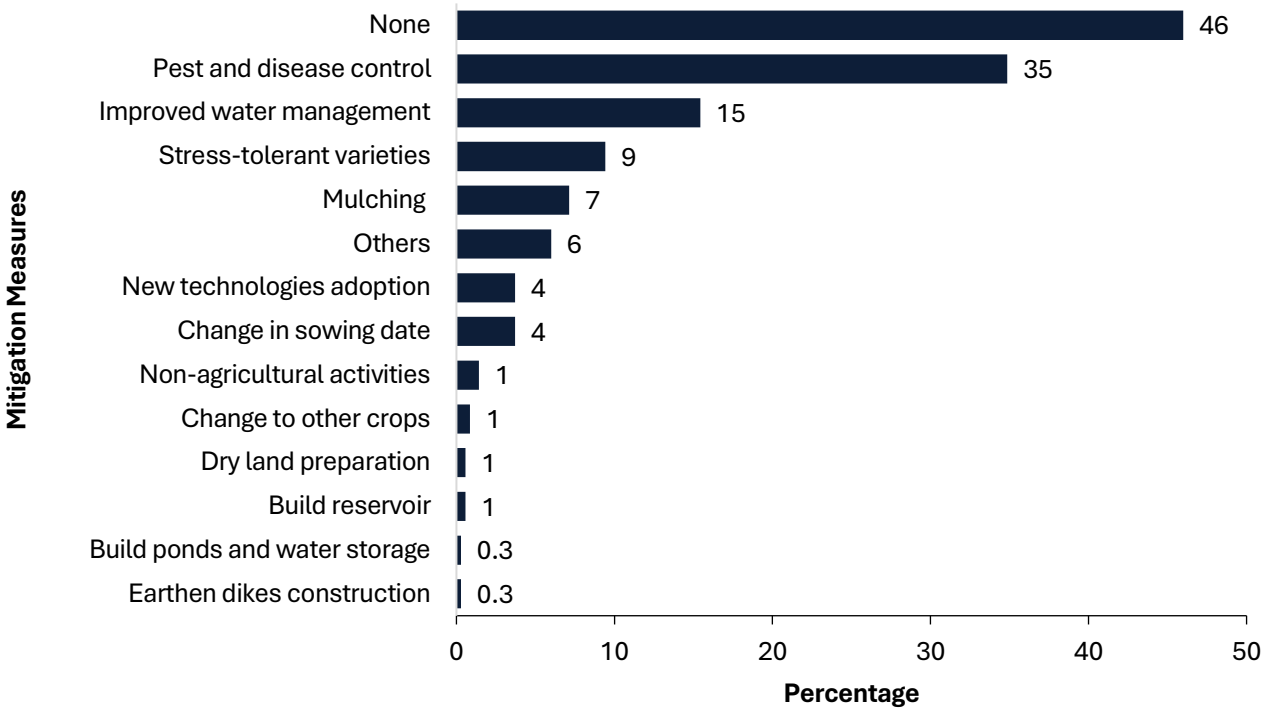


Figure 27. Mitigation measures adopted by respondents in response to climate risks (in percent), 2022-2024.

Table 10. Top 5 mitigation measures adopted by respondents in response to climate risks (in percent) by province, 2022-2024.

Mitigation Measures	Thai Binh (n=101)	Nghe An (n=86)	An Giang (n=69)	Kien Giang (n=43)	Soc Trang (n=51)
None	53	47	29	47	53
Application of pesticides (Pest and disease control)	41	26	55	21	24
Improved water management	3	17	14	28	27
Changes to stress-tolerant varieties	23	7	4	0	2
Mulching	18	3	1	0	6

3.6. Awareness, Knowledge, and Perception of Farmer on Climate-Smart Agriculture

3.6.1. Alternate Wetting and Drying (AWD)

AWD Awareness

The awareness of Alternate Wetting and Drying[2] among rice farmers in Vietnam varied significantly across the five provinces. Based on the data collected, 42% of farmers across provinces had a slight awareness of the overall concept and practice of AWD. In comparison, a significant proportion (38%) were unaware, and only 20% were highly aware. Based on Figure 28, provinces in the MRD reported higher proportions of highly aware farmers – Soc Trang (31%), An Giang (27%), and Kien Giang (23%) compared to Thai Binh (18%) and Nghe An (3%). Moreover, the majority (76%) of farmers in Nghe An were not aware of AWD.

[2] Farmers define AWD closely as multiple drainages during cropping season (≥2 times/cropping season) rather than the AWD defined scientifically.

In addition, as further discussed in Section 3.10.1, results on CSA technology adoption indicate that the MRD provinces had the highest adoption rates across all seasons. In contrast, adoption rates in Thai Binh ranged from 55% to 56%, while Nghe An recorded the lowest rates, at 40% to 42%, depending on the season. These findings suggest a knowledge gap across regions, which may act as a barrier to technology adoption, particularly in areas with low levels of awareness. This highlights the importance of targeted information dissemination, as well as the provision of support and initiatives tailored to the farming conditions and needs in the area, to improve farmers' awareness and facilitate adoption.

The respondents who reported slight to high awareness of the AWD concept were further asked about their awareness of specific indicators, including suitable farm conditions, water management strategies, and implementation tools. Across provinces, the majority of respondents indicated slight awareness of the suitable conditions or conducive environment for AWD, with only 3% to 5% reporting no awareness (Figure 29). Notably, no farmers in Nghe An reported being unaware. Among all provinces, An Giang and Kien Giang had the highest proportion of highly aware farmers, at 41% and 40%, respectively. These findings suggest that while a significant share of farmers demonstrated strong awareness, a larger proportion still possessed limited knowledge. Therefore, there is a continued need to strengthen farmers' understanding of the key conditions required for the successful implementation of AWD.

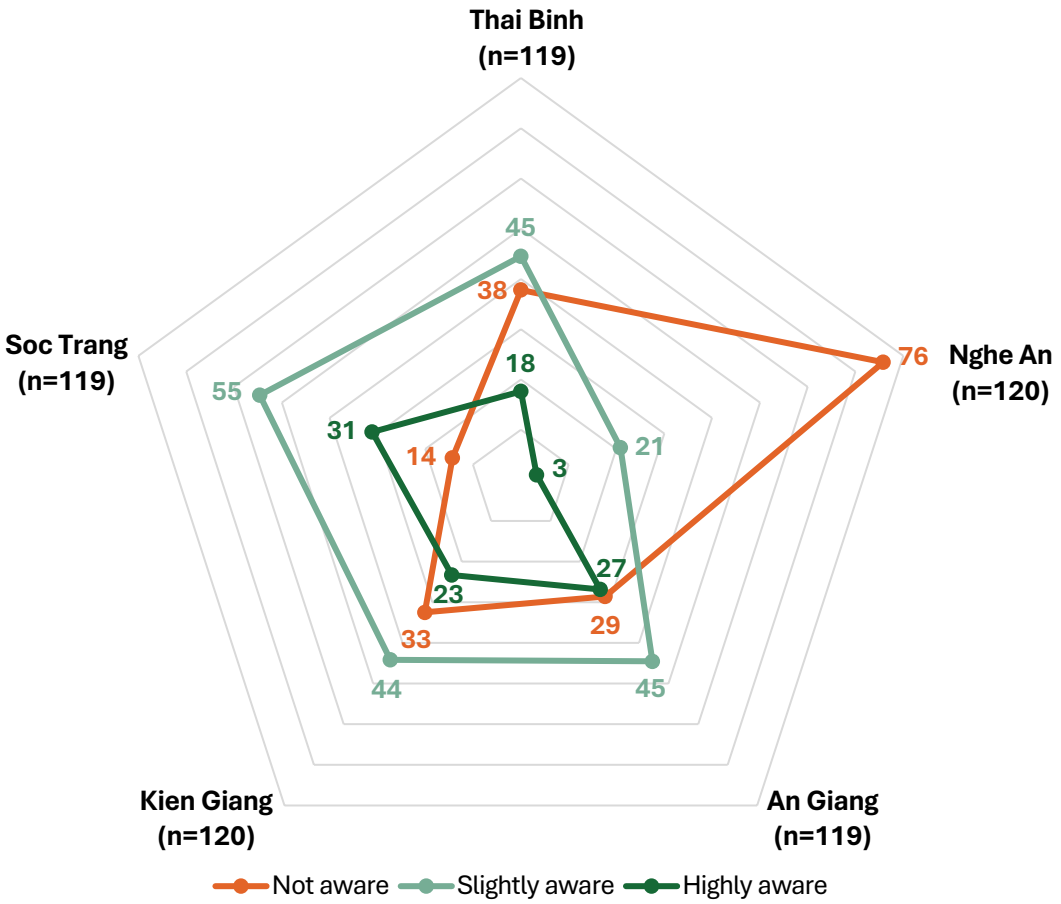


Figure 28. Awareness levels on AWD practices (in percent), by province, 2024-2025.

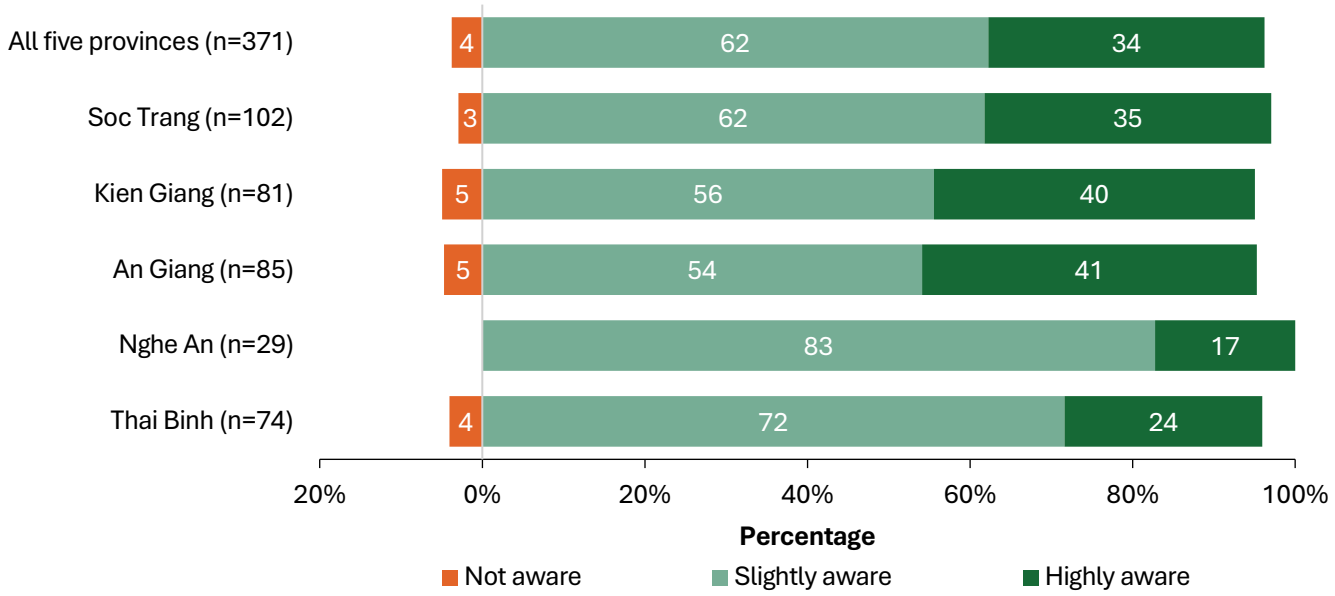


Figure 29. Awareness levels of respondents (in percent) about the conducive farm conditions/environments suitable for AWD, by province, 2024-2025.

On the other hand, about half of the farmers (51%) reported slight awareness of the specific water management strategies required for AWD, while 41% demonstrated a strong understanding of these strategies (Figure 30). This is a crucial finding, as improper water management could hinder the effectiveness of AWD and limit its potential benefits. Hence, initiatives such as capacity development and on-field demonstrations may be necessary to enhance the technical skills and knowledge of farmers. Additionally, the majority still had minimal awareness regarding the tools and strategies to effectively implement AWD, particularly in Nghe An (76%) and Thai Binh (76%) (Figure 31).

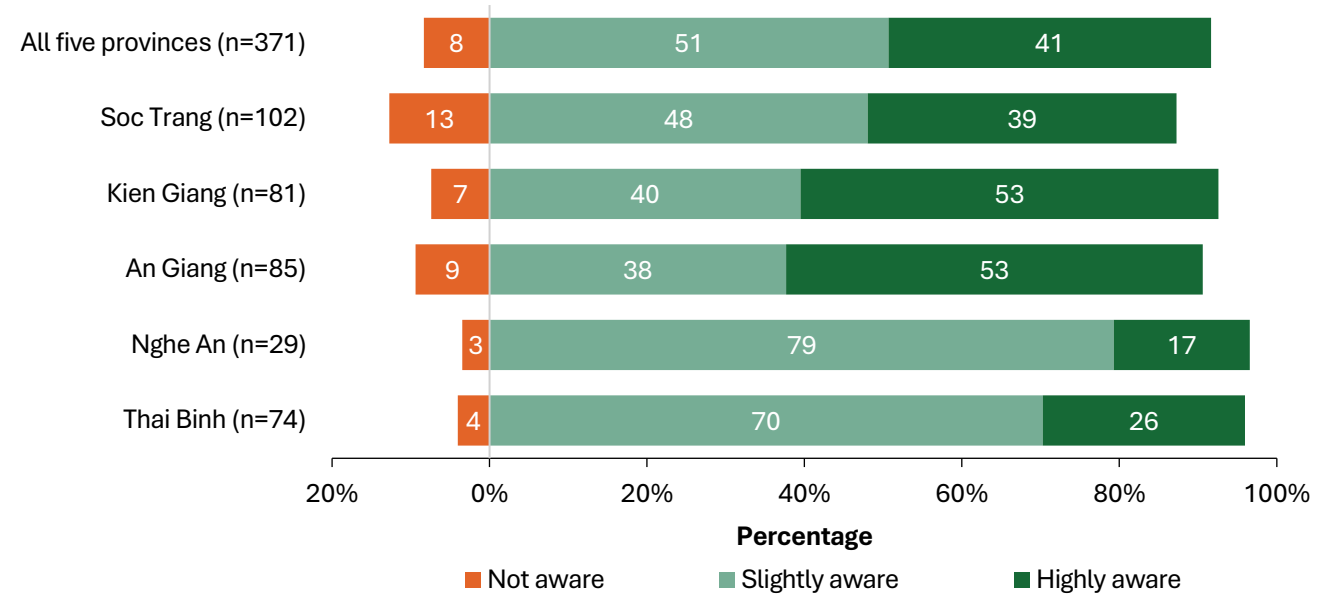


Figure 30. Awareness level of respondents (in percent) about the certain water management strategy for AWD, by province, 2024-2025.

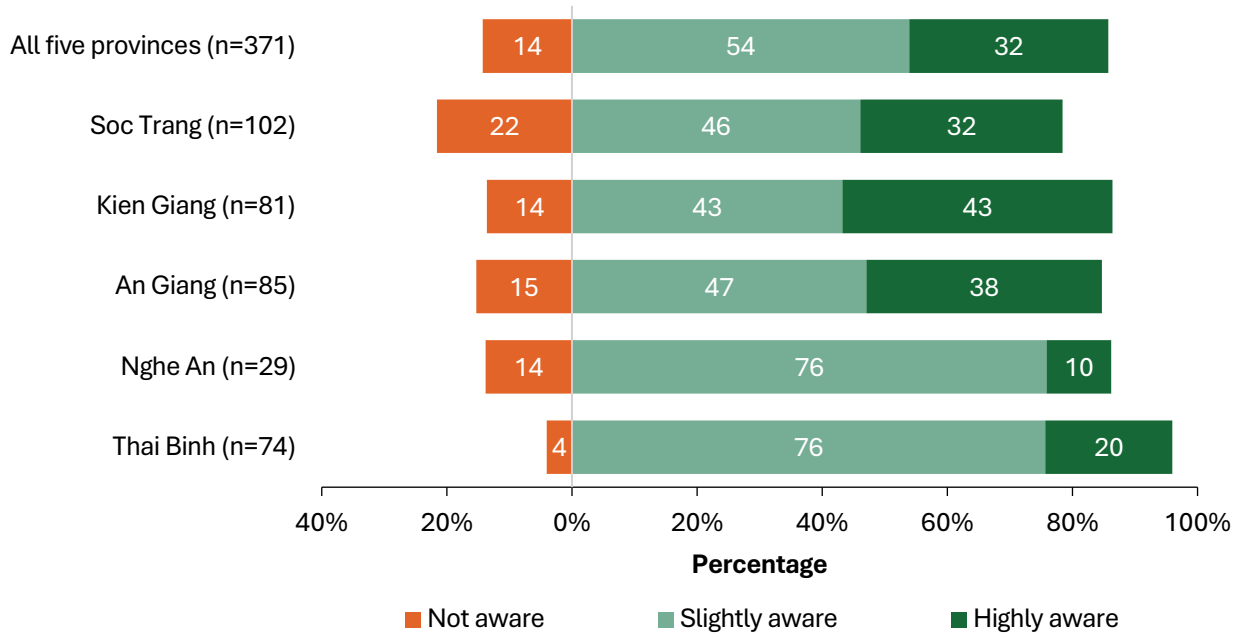


Figure 31. Awareness level of respondents (in percent) about the tools and strategies to effectively implement AWD, by province, 2024-2025.

AWD Perception

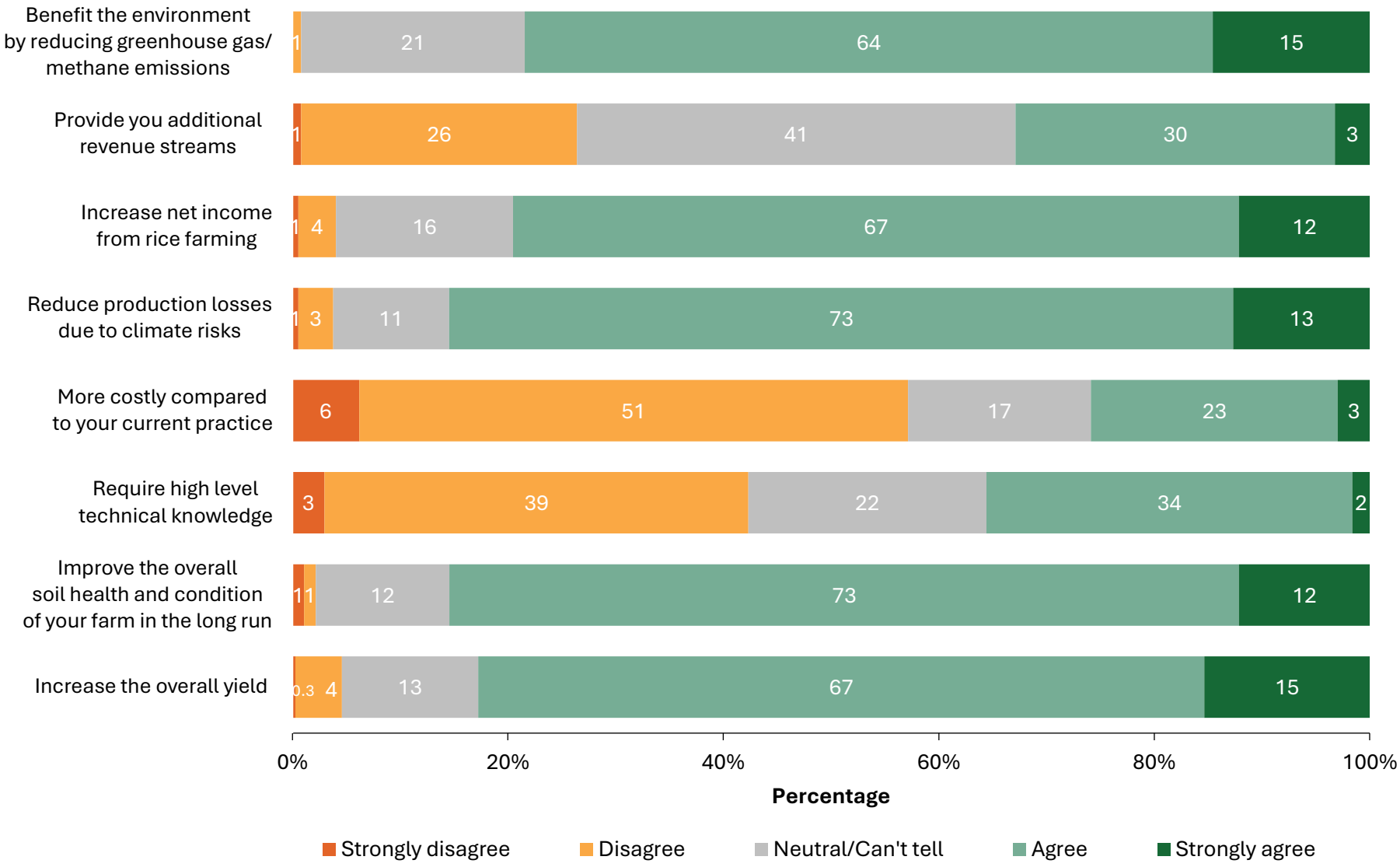
The perceptions of the farmers regarding AWD are illustrated in Figure 32 to Figure 37. Farmers who were aware of AWD technology were further asked about their perceptions regarding the potential agronomic and economic benefits. The majority (82%) of the farmers across provinces agreed or strongly agreed that AWD adoption could increase the rice yield (Figure 32). The perception of increased yield was particularly high in Kien Giang, where 70% of farmers agreed and 27% strongly agreed with this statement. In contrast, a small percentage of farmers remained neutral (13%) or indicated disagreement (4%). The highest proportions of neutral responses were observed in Nghe An (21%) and An Giang (19%).

In general, farmers perceived AWD as beneficial to soil and overall farm health in the long run, with 85% agreeing (73% agreed and 12% strongly agreed). Additionally, 79% of farmers (64% agreed and 15% strongly agreed) acknowledged the environmental benefits of AWD, particularly its role in reducing methane emissions. However, a significant proportion (21%) expressed uncertainty, particularly in Soc Trang (30%) and Kien Giang (23%), possibly due to limited knowledge on this topic. Hence, programs and initiatives that emphasize and disseminate information on the benefits of AWD to methane reduction should be implemented. In addition, a large proportion of farmers (86%) - 73% agreed and 13% strongly agreed - that AWD could reduce production losses caused by climate risks.

Meanwhile, in terms of economic benefits, the majority of farmers (79%) - with 67% agreeing and 12% fully agreed that the increase in yield could outweigh the costs of adopting AWD, thus also contributing to a higher income. This implies that farmers consider this practice as financially viable. Overall, these positive perceptions regarding the environmental and economic benefits of AWD indicate that the farmers in the area regard it as a technology capable of improving yield, income, and environmental outcomes - factors that can serve as strong motivation for adoption.

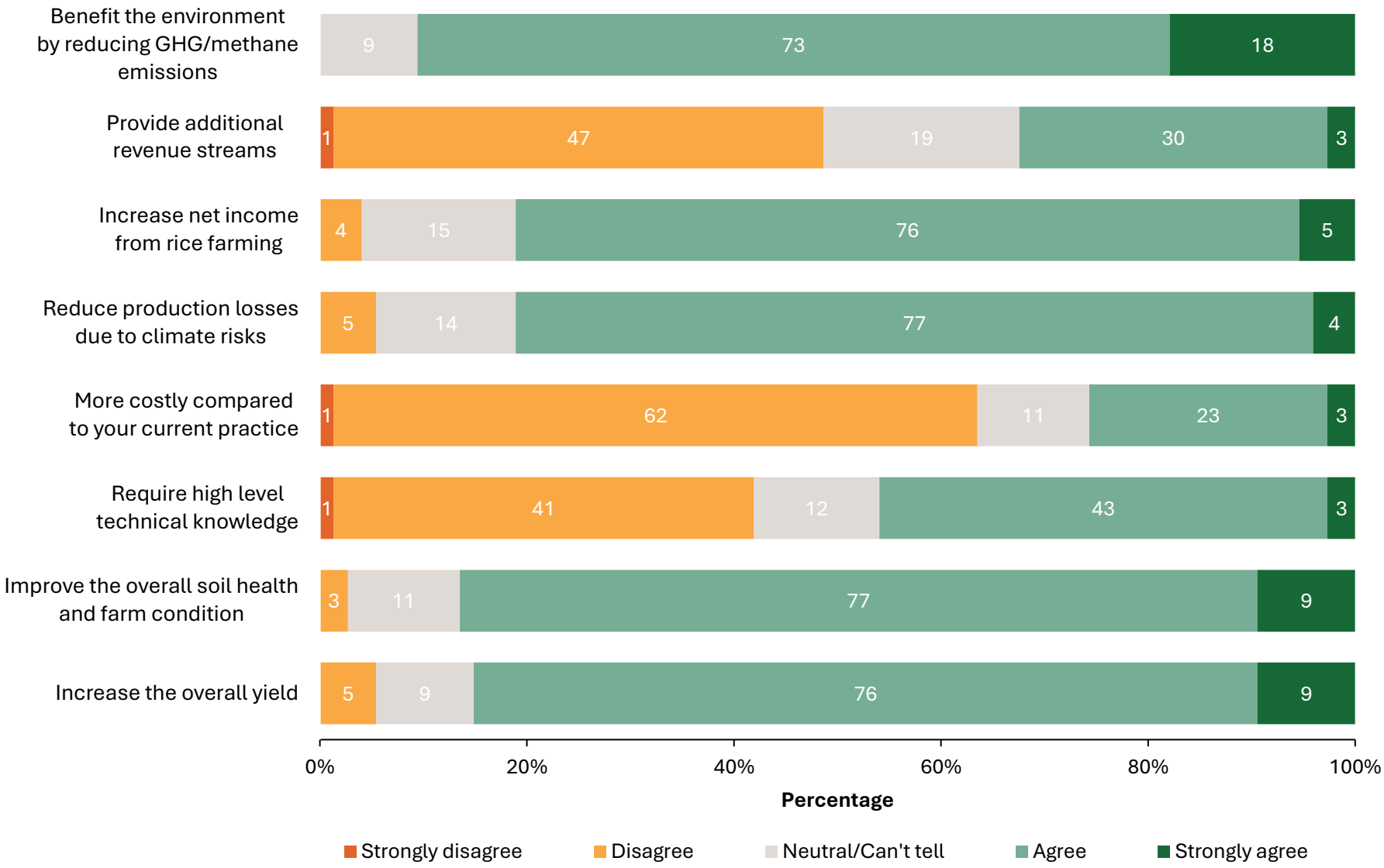
However, there were hesitations about the complexity and the costs of implementation. While 57% of farmers, including 51% who disagreed and 6% who completely disagreed, did not consider AWD as more expensive than their previous practices. Nonetheless, perceptions remained mixed, with 26% agreeing that it was more costly and 17% remaining neutral. This suggests that farmers may be more likely to adopt AWD if financial and technical support is provided to facilitate the transition. It may also be beneficial to present farmers with the expected costs of implementing AWD, allowing them to compare these with their current practices, particularly if the shift could result in savings on irrigation and labor.

Moreover, there was also a divided perception on the level of technical knowledge required to implement AWD effectively. Across the provinces, 39% disagreed while 34% agreed that a high level of technical knowledge was necessary, and 22% neither agreed nor disagreed. This suggests a need for more intensive support and extension services, such as hands-on demonstrations of proper AWD implementation on their farms, as peer learning may help reduce the perceived complexity.



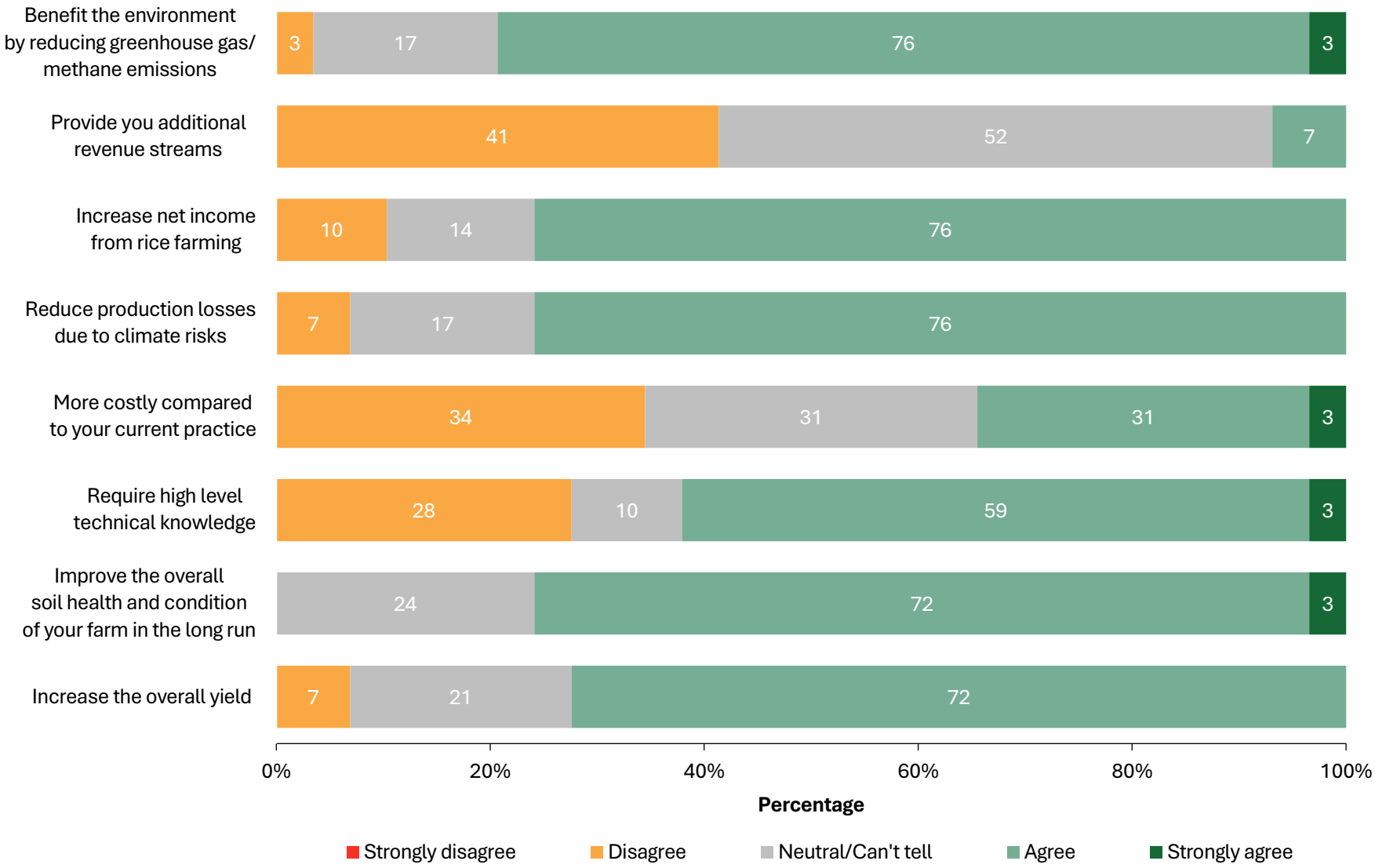
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of AWD (n=371).

Figure 32. Respondents' perceptions of AWD across multiple indicators (in percent), 2024-2025.



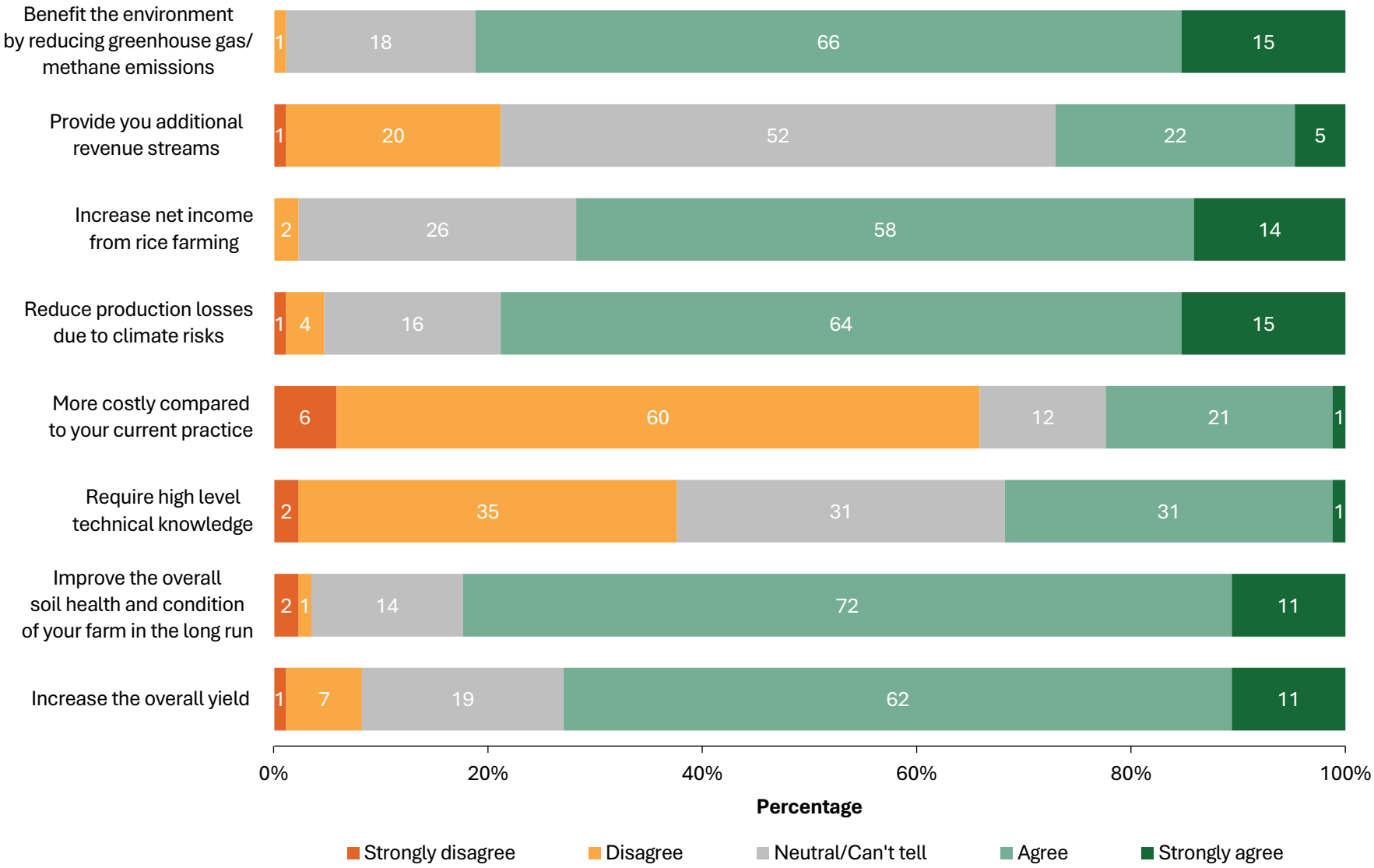
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of AWD (n=74).

Figure 33. Respondents' perceptions of AWD across multiple indicators (in percent) in Thai Binh, 2024-2025.



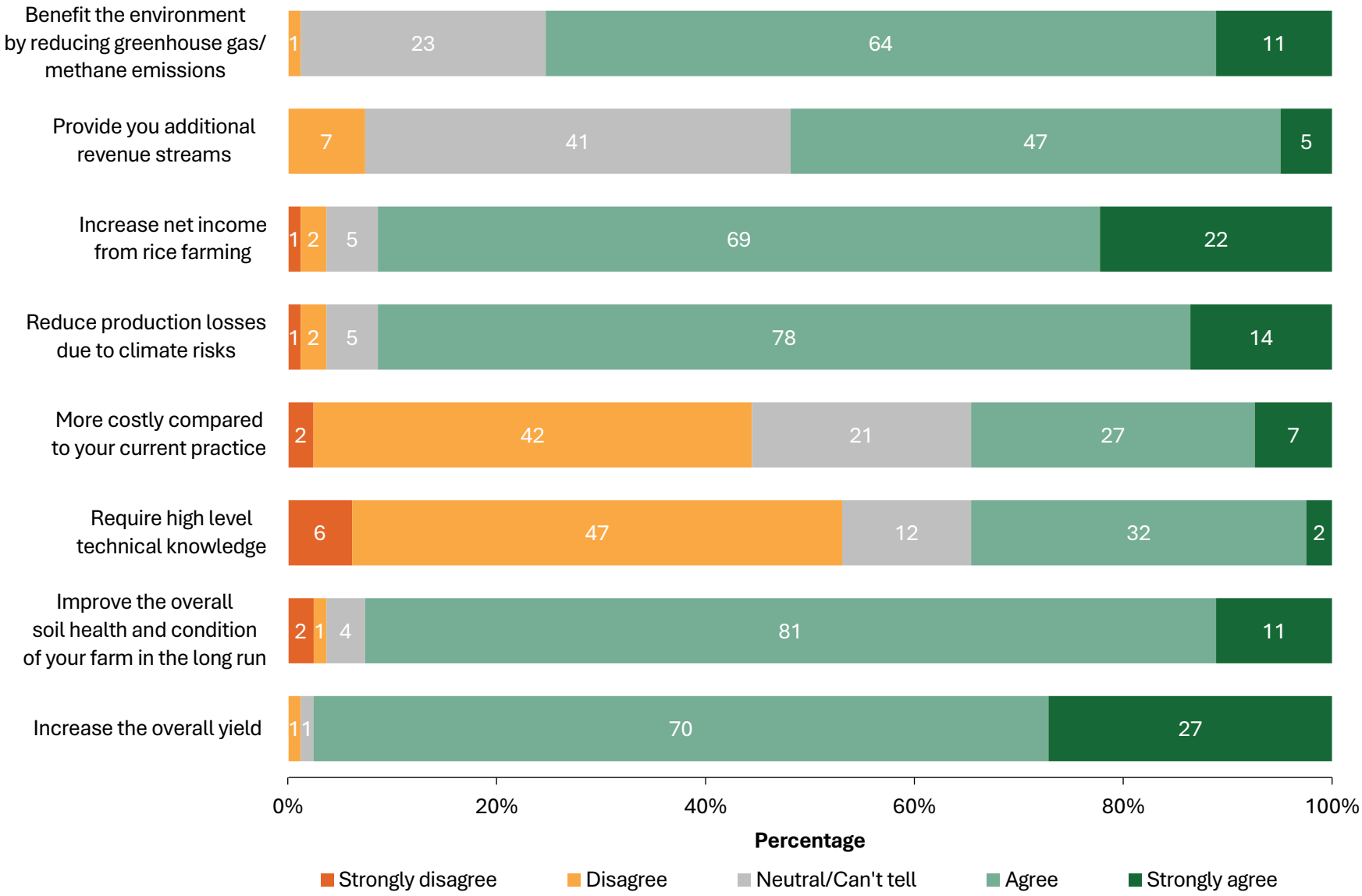
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of AWD (n=29).

Figure 34. Respondents' perceptions of AWD across multiple indicators (in percent) in Nghe An, 2024-2025.



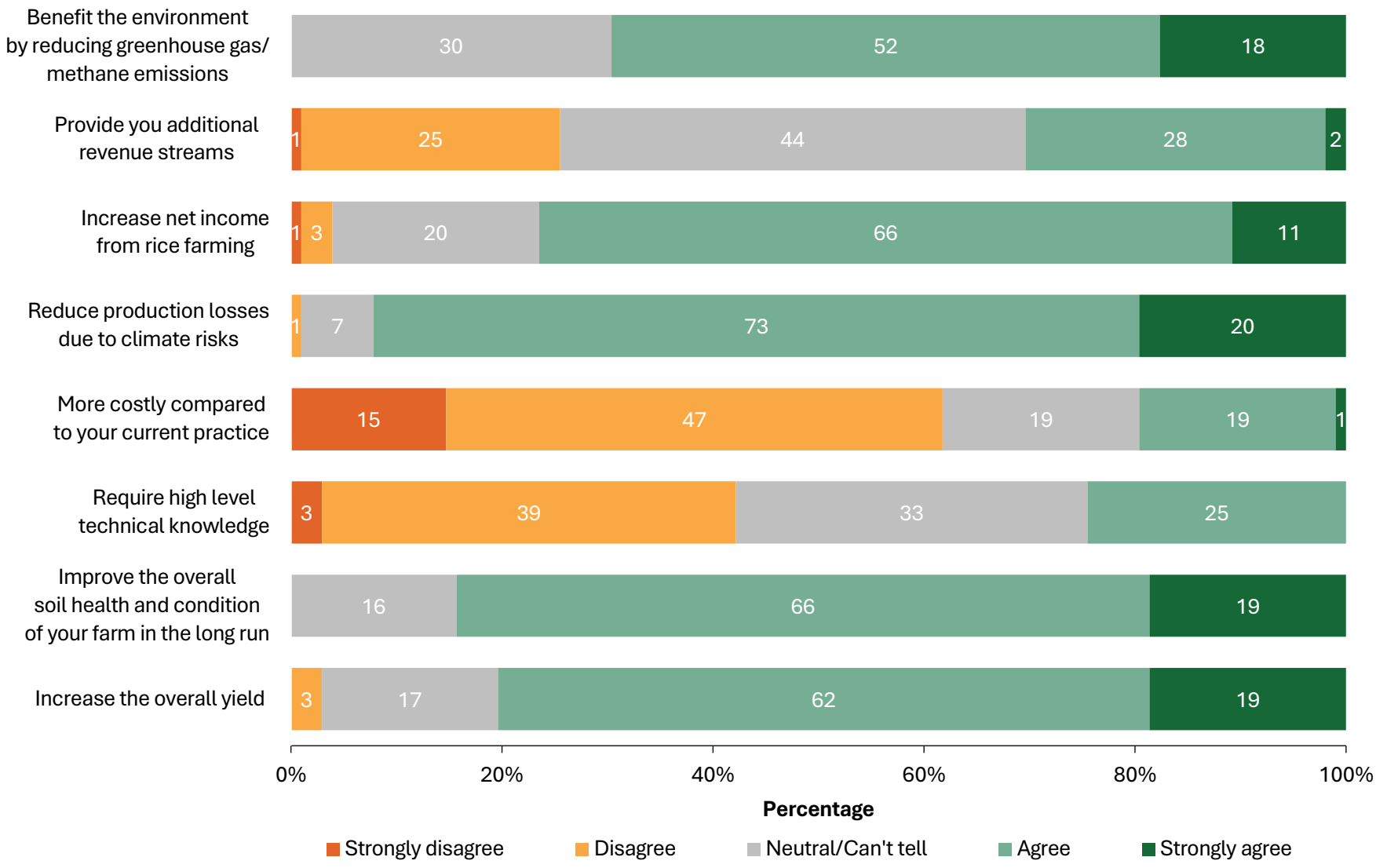
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of AWD (n=85).

Figure 35. Respondents' perceptions of AWD across multiple indicators (in percent) in An Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of AWD (n=81).

Figure 36. Respondents' perceptions of AWD across multiple indicators (in percent) in Kien Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of AWD (n=102).

Figure 37. Respondents' perceptions of AWD across multiple indicators (in percent) in Soc Trang, 2024-2025.

AWD Accessibility

Access to technical support, inputs, and other initiatives is crucial for boosting farmers' confidence in adopting AWD practices. As noted in Table 11, the major source of information across all the provinces was the seminars and farmers' training (57%) conducted by various relevant institutions. This highlights the critical role these institutions play in disseminating information and promoting sustainable farming practices. However, additional outreach efforts may be needed in provinces with lower participation in such programs to encourage greater farmer engagement. In addition, extension workers and agricultural technicians (47%) also served as a key source of information. The relatively low access in Thai Binh (38%) and An Giang (36%) suggests that extension services may be limited in these provinces. Strengthening these services could help bridge the gap, as direct guidance from technical experts is essential for effective AWD implementation.

Table 11. Sources of information of respondents about AWD (in percent), by province, 2024-2025.

Sources of information	Thai Binh (n=74)	Nghe An (n=29)	An Giang (n=85)	Kien Giang (n=81)	Soc Trang (n=102)	All five provinces (n=371)
Seminars/Trainings of relevant institutions	77	69	56	46	50	57
Communication materials (flyers, brochures)	20	3	15	25	14	17
Shared by extension workers/agricultural technicians	38	66	36	51	53	47
Shared by private entities	1	0	4	9	2	4
Shared by government including research/academic institutions	7	10	7	2	3	5
Heard from fellow farmers/groups	18	7	22	64	40	34
Self-taught	12	0	27	65	39	34

Other channels of information mentioned were their fellow farmers (34%) and self-learning (34%), particularly in Kien Giang, a central rice-producing province in MDR. This shows the importance of peer networks and local knowledge exchange among farmers in adopting new practices, as information sharing from those with first-hand experience can support others in making informed decisions. Additionally, this highlights farmers' initiative to actively seek out information, further emphasizing the need for accessible and relevant materials on these practices. Meanwhile, only 17% of the farmers received communication materials such as brochures, suggesting a need to expand the distribution of these resources to reach more farmers across provinces.

In terms of support services received within the past three years, only 29% of farmers reported receiving any form of assistance, with the lowest proportion in An Giang (22%) and the highest in Soc Trang (33%), as shown in Figure 38. This means that about 71% of the farmers across the provinces did not receive support. This suggests that although programs and support services exist, their reach remains limited. Therefore, more extensive efforts are needed to expand these services and ensure broader participation among farmers.

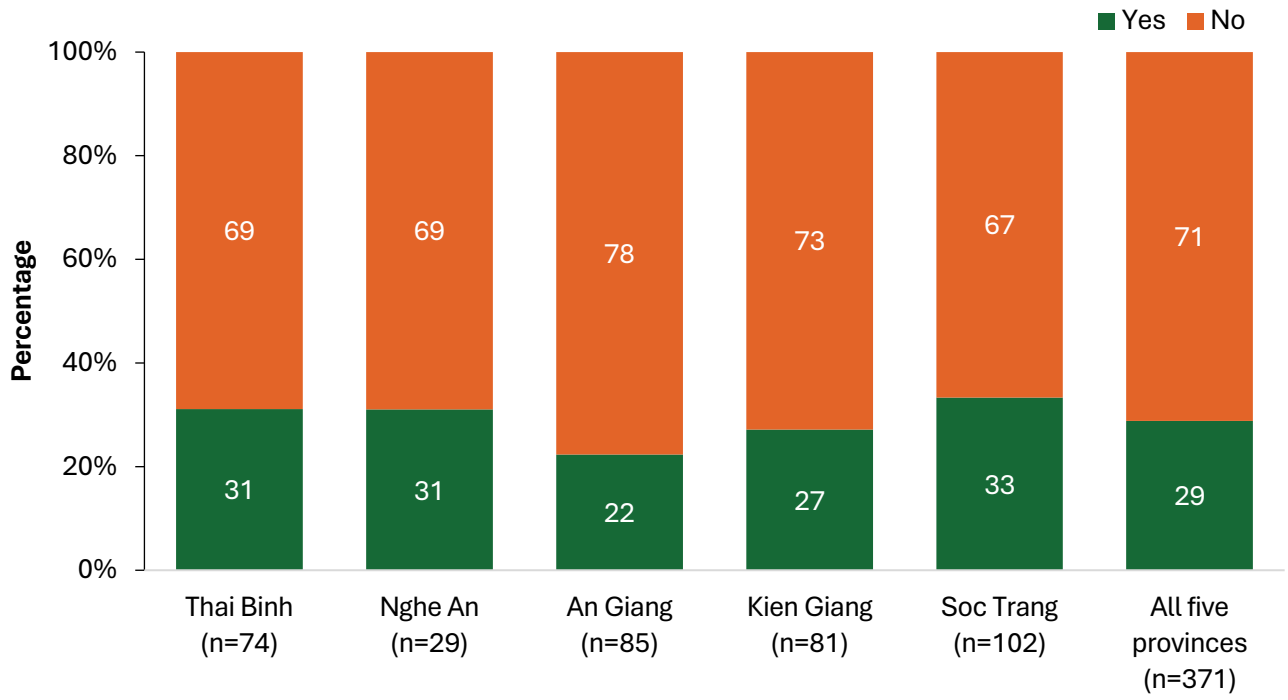


Figure 38. Respondents who received support to adopt AWD (in percent), by province, 2022-2024.

Among the farmers who received support, the most commonly provided form of assistance was training and seminars (81%), reflecting ongoing efforts to build farmers' capacity (Table 12). Some farmers also received material support, such as in-kind grants (34%). A handful (7%) received machinery or tools, while very few received direct cash grants (3%) and price premiums (3%). This indicates that current support efforts have primarily focused on knowledge transfer rather than financial incentives. While nearly all supported farmers received training, very few received monetary assistance. Enhancing farmers' knowledge is crucial, but some farmers face adoption barriers that can be overcome with financial provision and material support.

Table 12. Support provided to respondents for the adoption of AWD technology (in percent), by province, 2024-2025.

Support provider	Thai Binh (n=23)	Nghe An (n=9)	An Giang (n=19)	Kien Giang (n=22)	Soc Trang (n=34)	All five provinces (n=107)
Trainings/Seminars	96	89	100	82	59	81
Capital (in-kind) as grants	26	22	11	55	41	34
Extension service	43	0	0	5	0	10
Machineries, tools and equipment	13	0	0	14	3	7
Networks and markets	9	11	0	14	0	6
Capital (cash) as grants	0	0	11	0	3	3
Price premium	4	0	0	9	0	3

In the provinces of the MRD, the primary source of support came from the National and Local Governments. In contrast, farmers in Thai Binh (91%) and Nghe An (78%) mainly relied on local farmer groups or cooperatives, as shown in Table 13.

Table 13. Provider of support for AWD adoption (in percent) mentioned by the respondents, by province, 2024-2025.

Support provider	Thai Binh (n=23)	Nghe An (n=9)	An Giang (n=19)	Kien Giang (n=22)	Soc Trang (n=34)	All five provinces (n=107)
National/Local Government	0	22	89	91	79	62
Farmer group, cooperative (member)	91	78	26	9	18	38
Private company	0	11	16	18	3	8
Research institutes	22	0	0	5	3	7
Fellow farmers	13	0	0	5	0	4
NGOs/CSOs	4	0	0	0	0	1

3.6.2. Direct-Seeded Rice (DSR)

DSR Awareness

Figure 39 shows the awareness of DSR practices of farmers by province. Across provinces, over half (except in Thai Binh) of the farmers were slightly aware of the overall concept and practice of DSR, while more than 30% (except in Kien Giang) were highly aware. This indicates that, compared to AWD, a greater number of farmers have some level of awareness about DSR—possibly because the majority of farmers across seasons were already practicing this method (See Section 3.10.1). However, the adoption rate was much lower in Thai Binh compared to the other provinces. However, this also highlights that although many farmers were already practicing DSR, their understanding of the technology remained limited. This gap could potentially affect the execution of the method, limit the potential benefits, and, consequently, affect their overall production.

In addition, follow-up questions regarding DSR were administered to the 518 farmers who indicated awareness of the technology. A significant proportion (62%) reported being only slightly familiar with its cultivation practices and implementation requirements (Figure 40). Moreover, although a significant proportion (39%) of the farmers mentioned that they were well-informed regarding the crop establishment methods for DSR, greater than half (55%) of them across provinces were minimally aware of these practices, while 6% were unaware (Figure 41). These results further highlight a gap in DSR implementation and knowledge regarding the practice, which is important to address as it involves specific methods and practices necessary for proper execution. This implies a need for enhanced information dissemination and capacity-building efforts, such as specialized training focused on DSR practices.

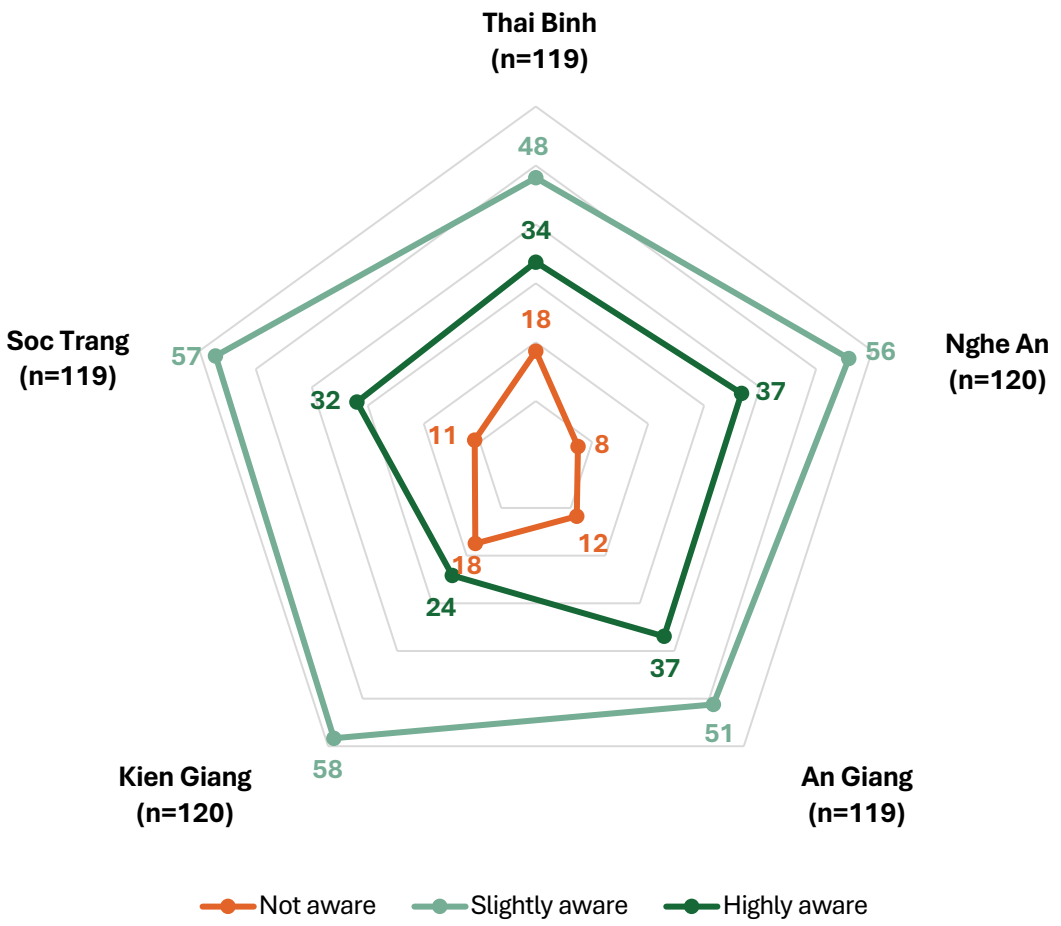


Figure 39. Awareness levels of respondents on DSR practices (in percent), by province, 2024-2025.

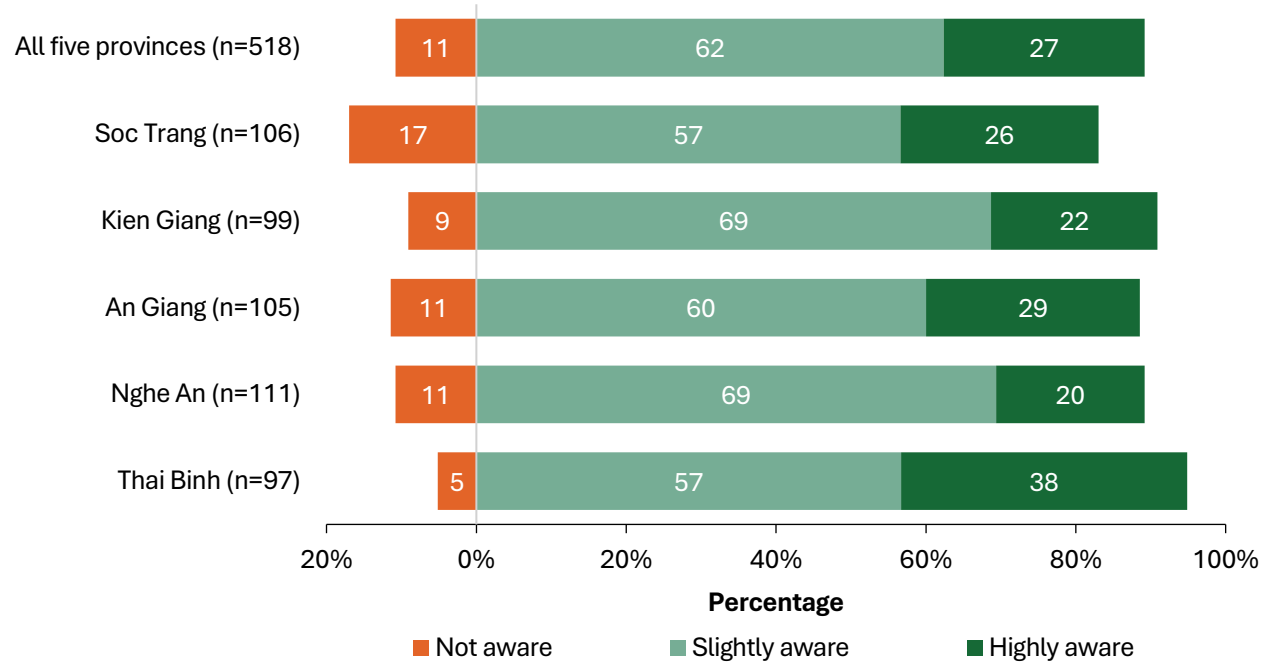


Figure 40. Awareness levels of respondents about the different cultivation practices or ways to implement DSR (in percent), by province, 2024-2025.

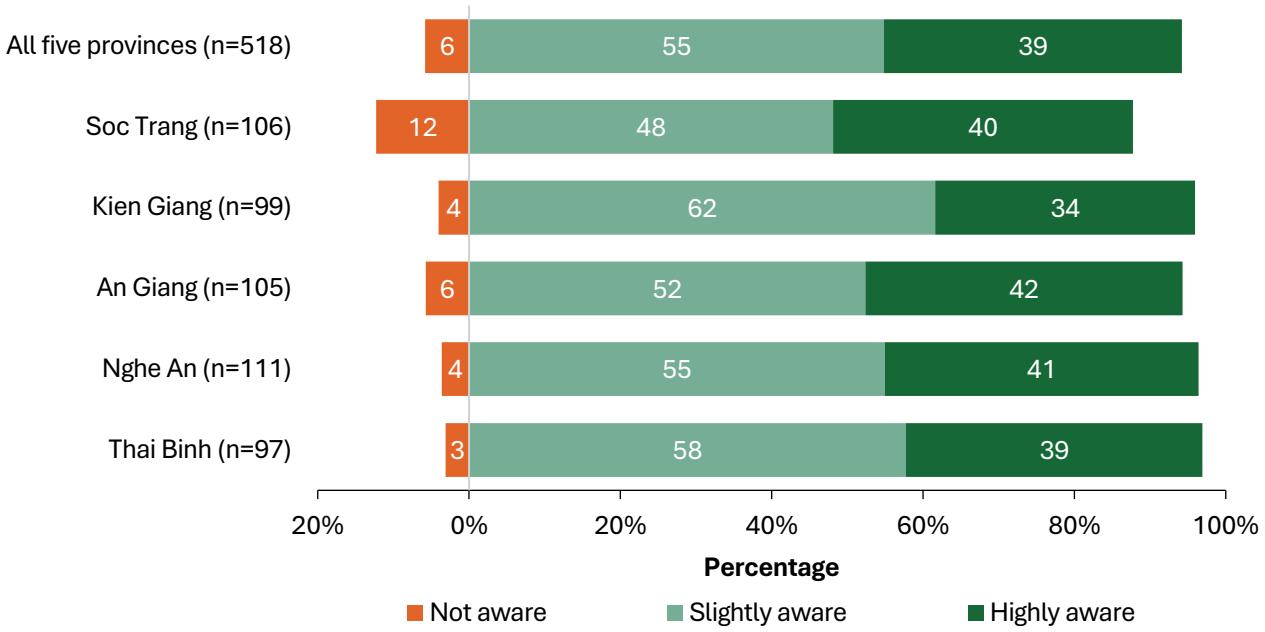


Figure 41. Awareness level of respondents on the different DSR crop establishment methods (in percent), by province, 2024-2025.

Furthermore, 59% of the respondents across all the provinces possessed slight awareness regarding the optimal use of inputs for DSR, while 34% had substantial awareness (Figure 42). This suggests that farmers recognized input management as a crucial aspect of DSR. However, there remains a need for a deeper understanding of how to effectively utilize these inputs to maximize the efficiency of the technology, improve cost-effectiveness, and support sustainable farming practices.

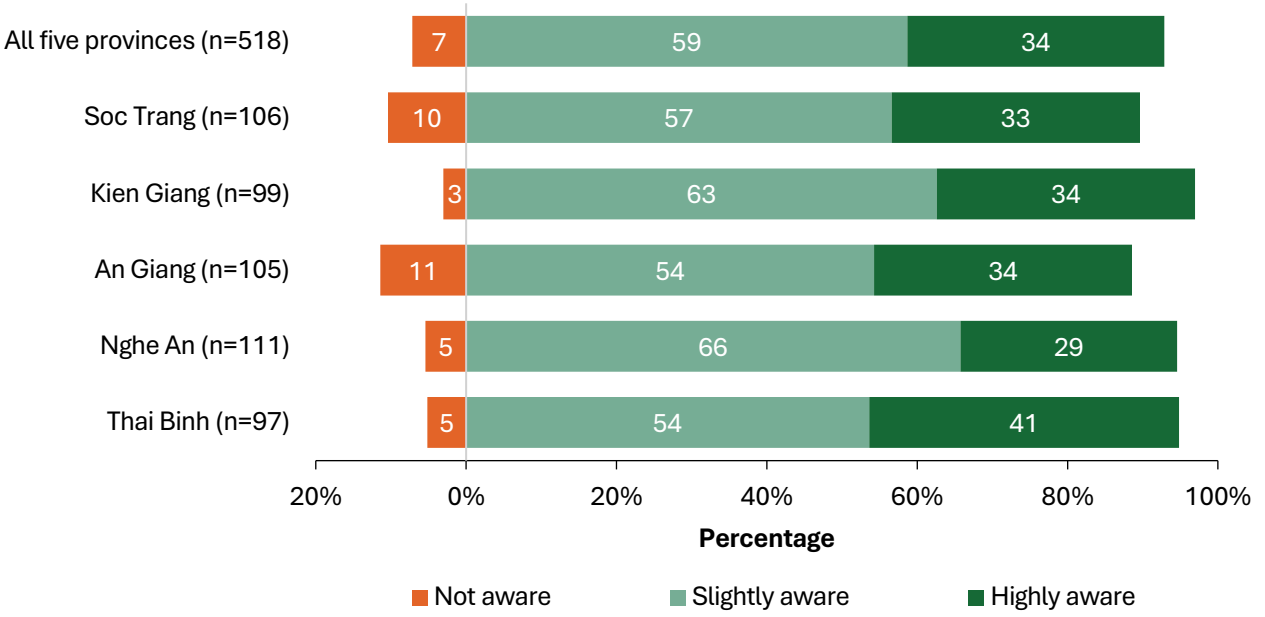


Figure 42. Awareness level of respondents about the optimal use of inputs for DSR (in percent), by province, 2024-2025.

A similar trend was observed in farmers' awareness of the various mechanization options available, with a larger proportion (58%) reporting limited awareness, compared to 31% who had a strong understanding and 11% who were completely unaware (Figure 43). This suggests that the majority of farmers do not fully comprehend the role of machinery in DSR; therefore, efforts should include the dissemination of information about the benefits of using machinery and tools in rice production. Additionally, initiatives are needed to improve the availability and accessibility of such equipment for farmers. Overall, awareness campaigns are necessary to improve the knowledge and technical skills of the farmers. Hands-on demonstrations, pilot projects, and field trials can boost farmers' confidence in implementing technology.

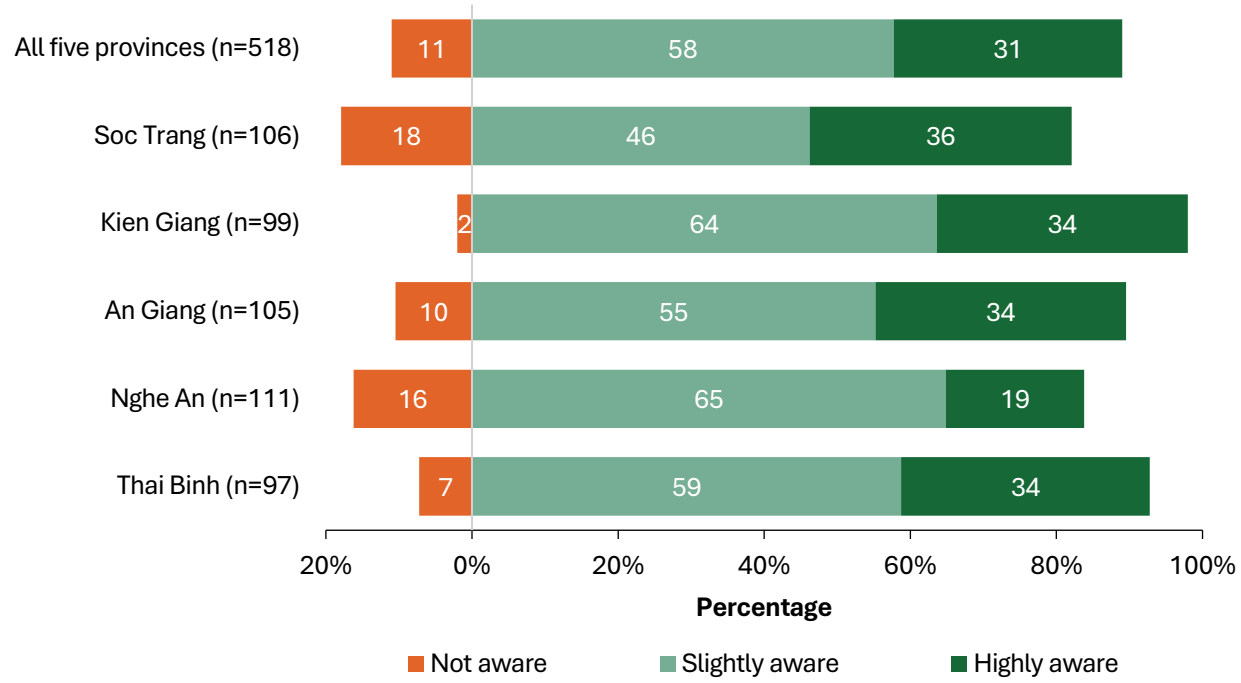


Figure 43. Awareness level of respondents about the different mechanization options that can be adopted for DSR (%).

DSR Perception

Farmers who reported certain levels of DSR awareness were further asked about their perceptions of adopting the practice, as shown in Figure 44 to Figure 49. Only about 62% of farmers – 58% agreed and 4% strongly agreed – believed that DSR could increase overall rice yield, while 21% disagreed with the statement. This result indicates that a significant number of farmers were less convinced of the potential yield benefits of DSR, particularly in Thai Binh, where 29% explicitly disagreed.

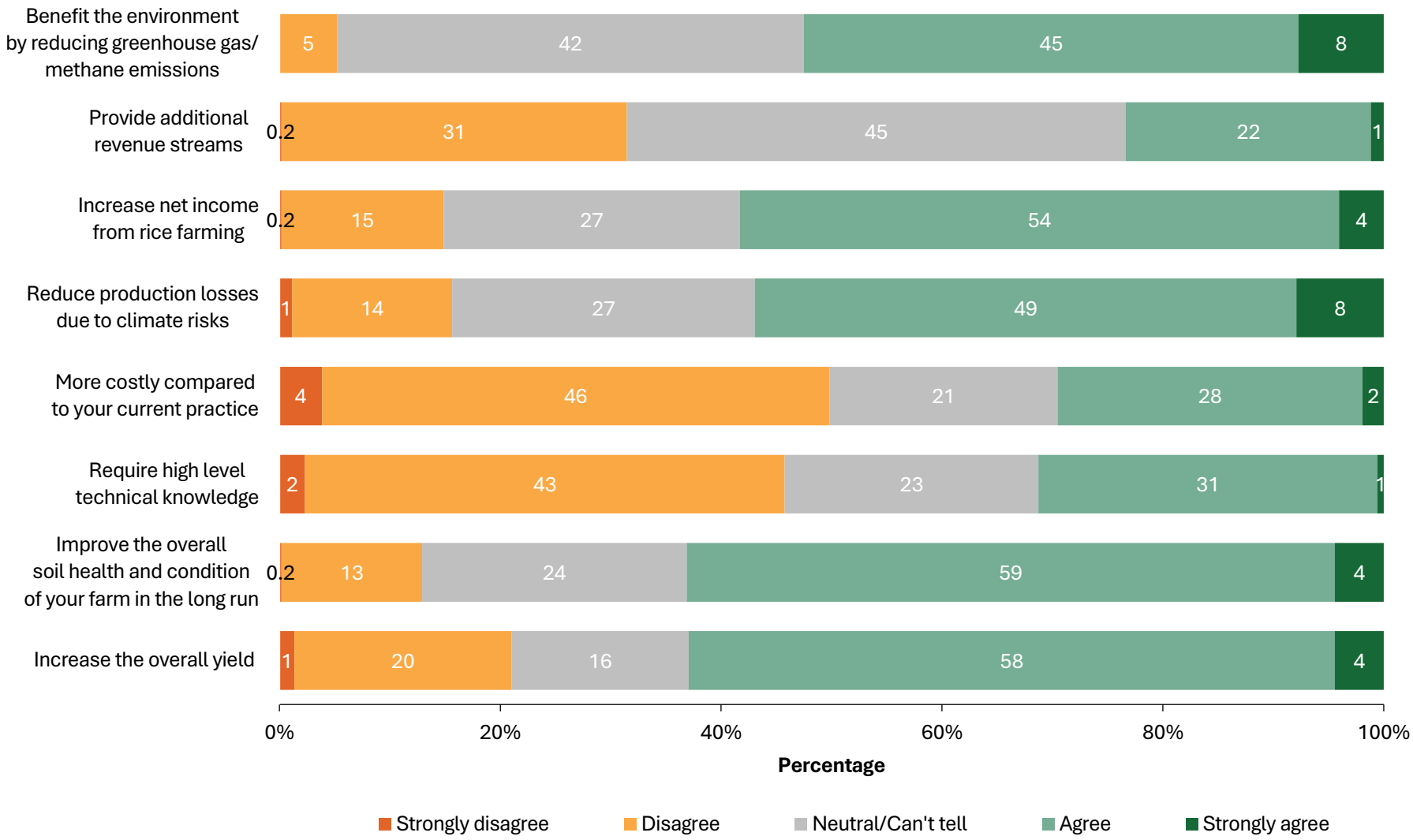
Similarly, 63% of farmers — 59% agreed and 4% strongly agreed — perceived that DSR could improve soil health and overall farm conditions in the long term, while only 13% disagreed. This positive perception was most prominent in Soc Trang, where 79% of farmers either agreed or strongly agreed. In contrast, Nghe An (20%) and Thai Binh (23%) recorded the highest proportions of disagreement. Meanwhile, almost a quarter

(24%) expressed neutrality, suggesting that the long-term effects of DSR on soil and farm health may still be uncertain for some farmers.

In terms of DSR's benefit in mitigating production losses due to climate risks, over half of the farmers (57%) - 49% agreed and 8% strongly agreed — recognized this advantage, particularly in Soc Trang and An Giang. However, only about a quarter (24%) of the respondents agreed in Nghe An, while 41% remained neutral, and the rest disagreed. Overall, 27% of farmers expressed neutrality, suggesting that although many farmers view DSR positively in this regard, a considerable portion still lacks confidence in its effectiveness. A similar trend was observed in farmers' perceptions of DSR's potential to reduce greenhouse gas emissions from rice production. Forty-two percent remained neutral, with the highest levels of neutrality reported in Nghe An (61%) and Kien Giang (51%). This indicates a potential area for promoting DSR adoption by highlighting not only its economic benefits but also its environmental advantages.

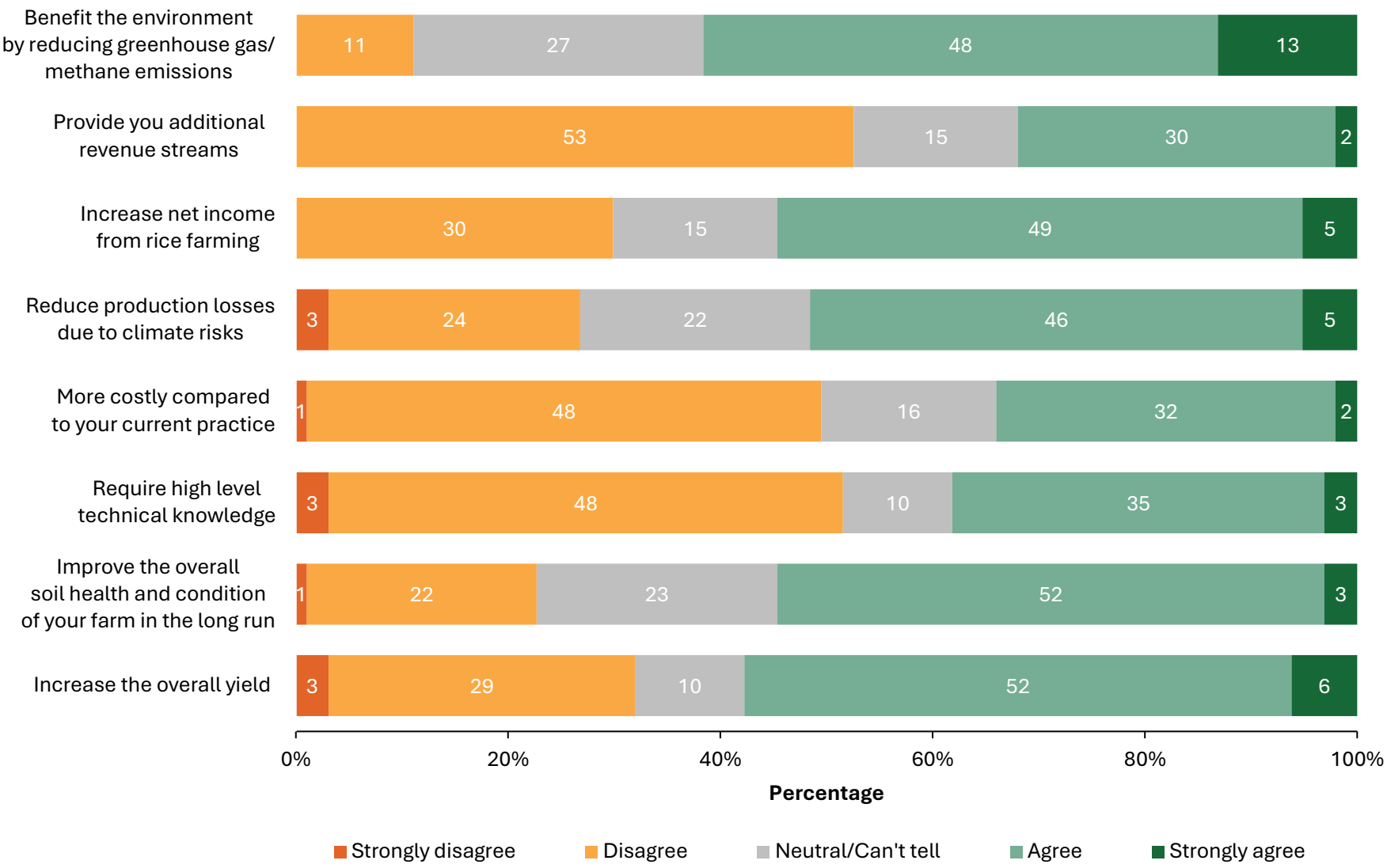
Regarding the economic benefits, 58% perceived that DSR adoption could increase their net income from their production. However, only 23% believed that this method could provide additional revenues. Notably, a significant proportion of respondents remained uncertain—27% regarding income increase and 45% regarding additional revenues. This may be due to the financial concern of the farmers in the cost of shifting to another practice, especially since the majority of them had not received any support (see Figure 50). This also suggests that there is a need to increase farmers' awareness of the potential benefits of DSR.

Meanwhile, farmers had mixed perceptions regarding the level of technical knowledge for its implementation, with 45% disagreeing, 32% agreeing, and 23% neutral. This suggests that, in addition to promoting its benefits, there is a need to enhance technical knowledge through training, demonstrations, and extension support to build farmers' confidence in adopting the technology. Meanwhile, only 30% perceived – 28% agreed and 2% strongly agreed - that DSR was more costly compared to their current practice, with the highest percentage in the province of Nghe An. However, the majority (50%) expressed disagreements – 46% disagreed and 4% strongly disagreed – indicating that many farmers do not view DSR as a more expensive option.



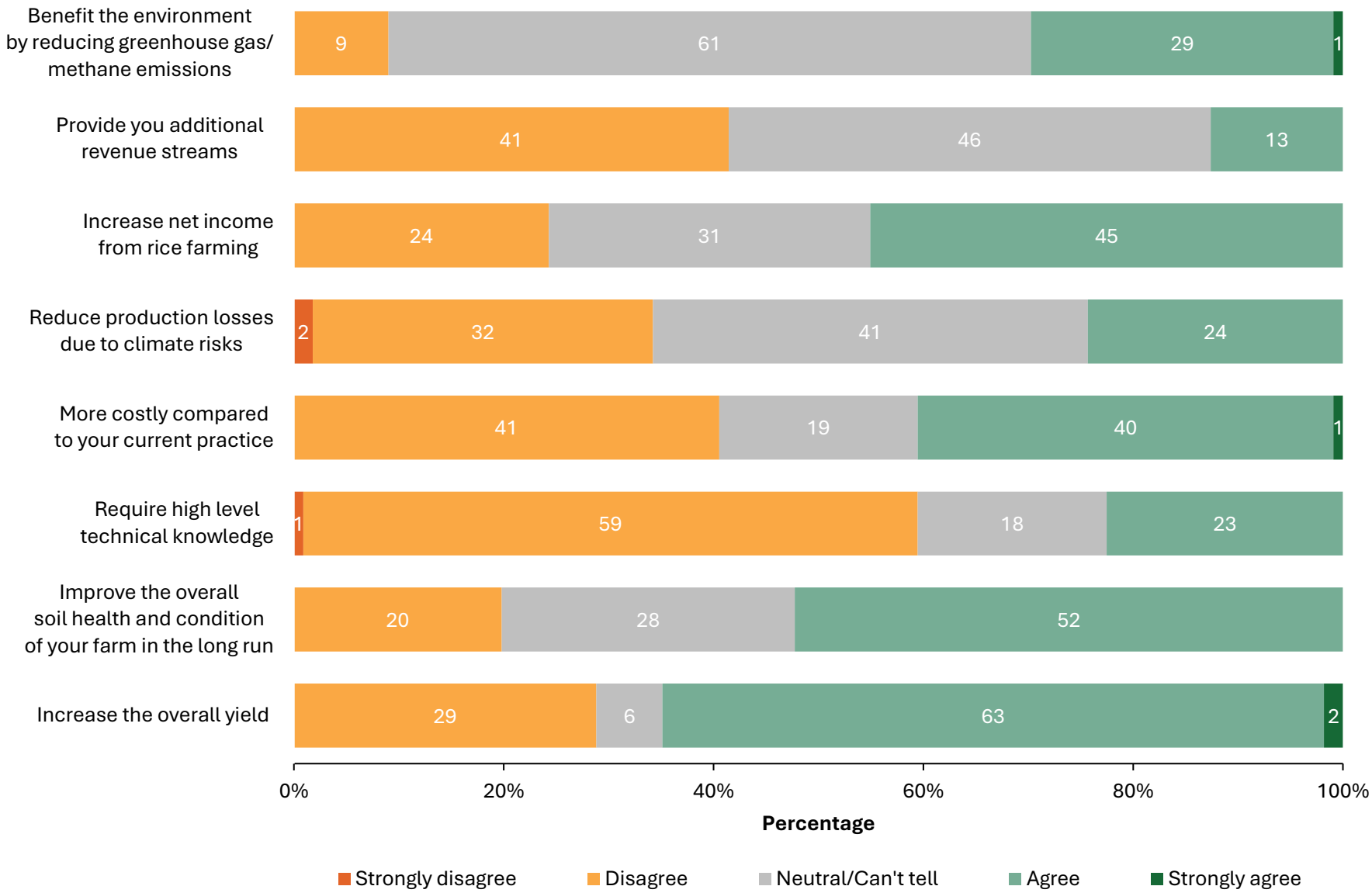
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of DSR (n = 518).

Figure 44. Respondents' perceptions of DSR across multiple indicators (in percent), 2024-2025.



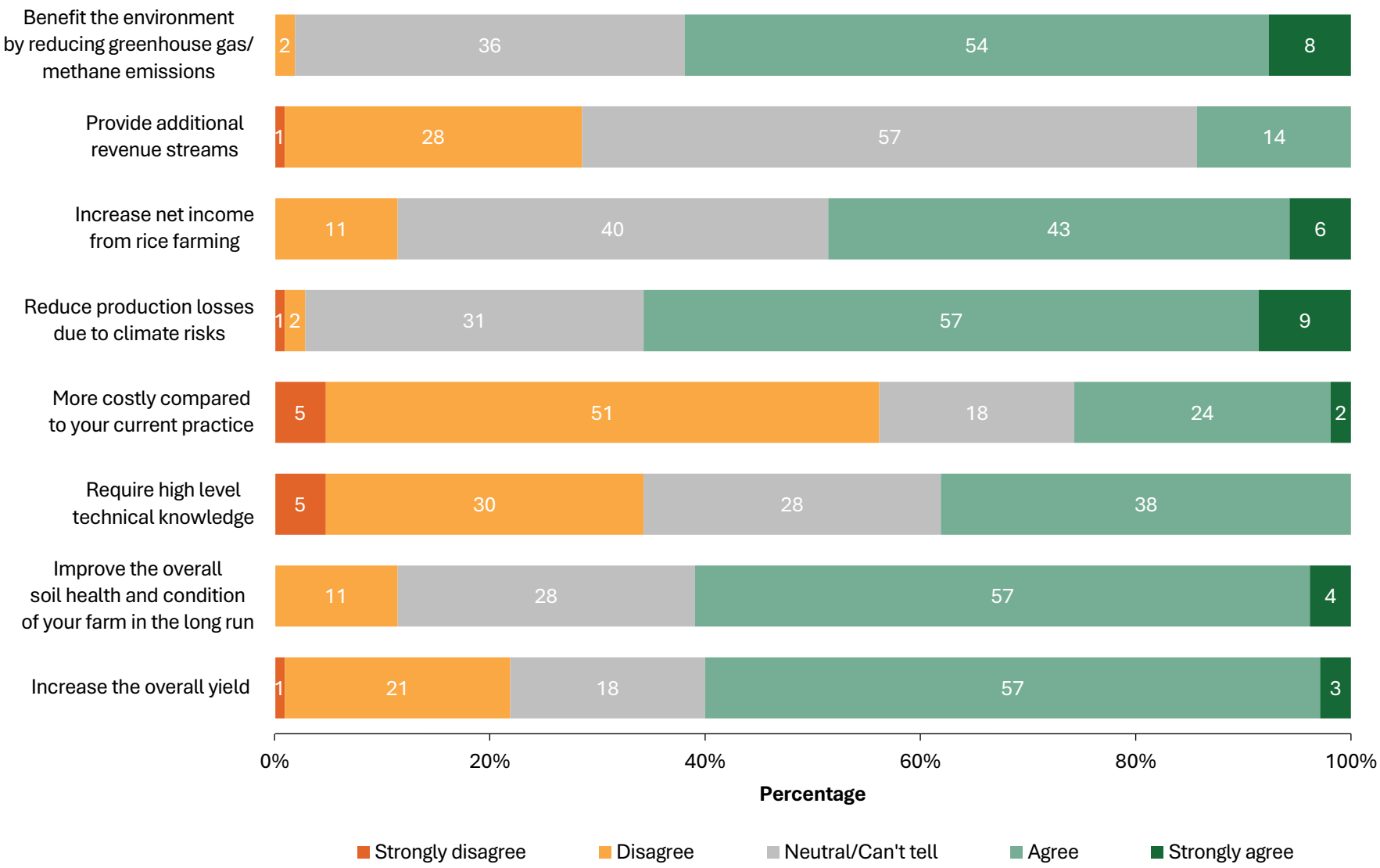
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of DSR (n = 97).

Figure 45. Respondents' perceptions of DSR across multiple indicators (in percent) in Thai Binh, 2024-2025.



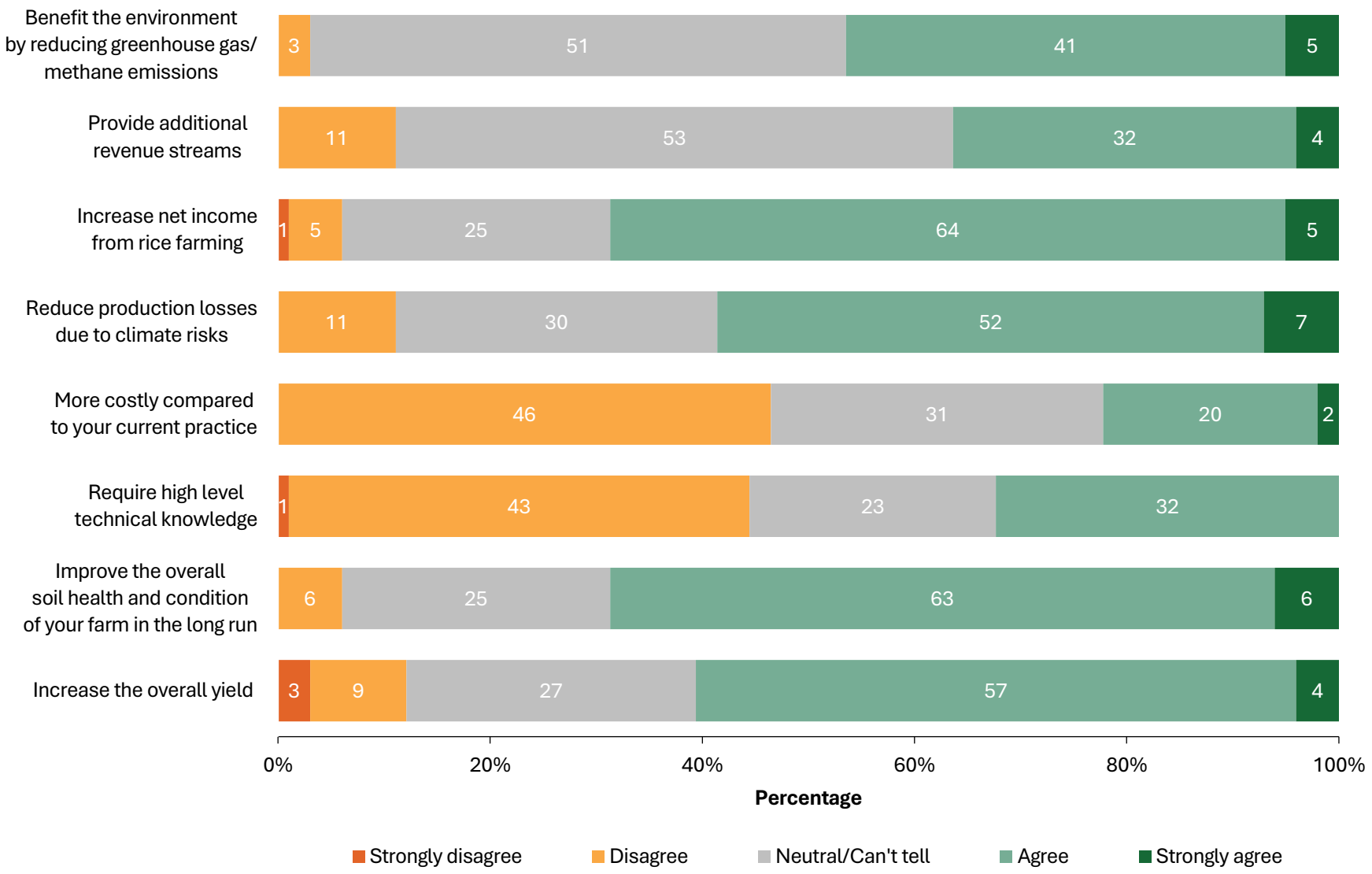
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of DSR (n = 111).

Figure 46. Respondents' perceptions of DSR across multiple indicators (in percent) in Nghe An, 2024-2025.



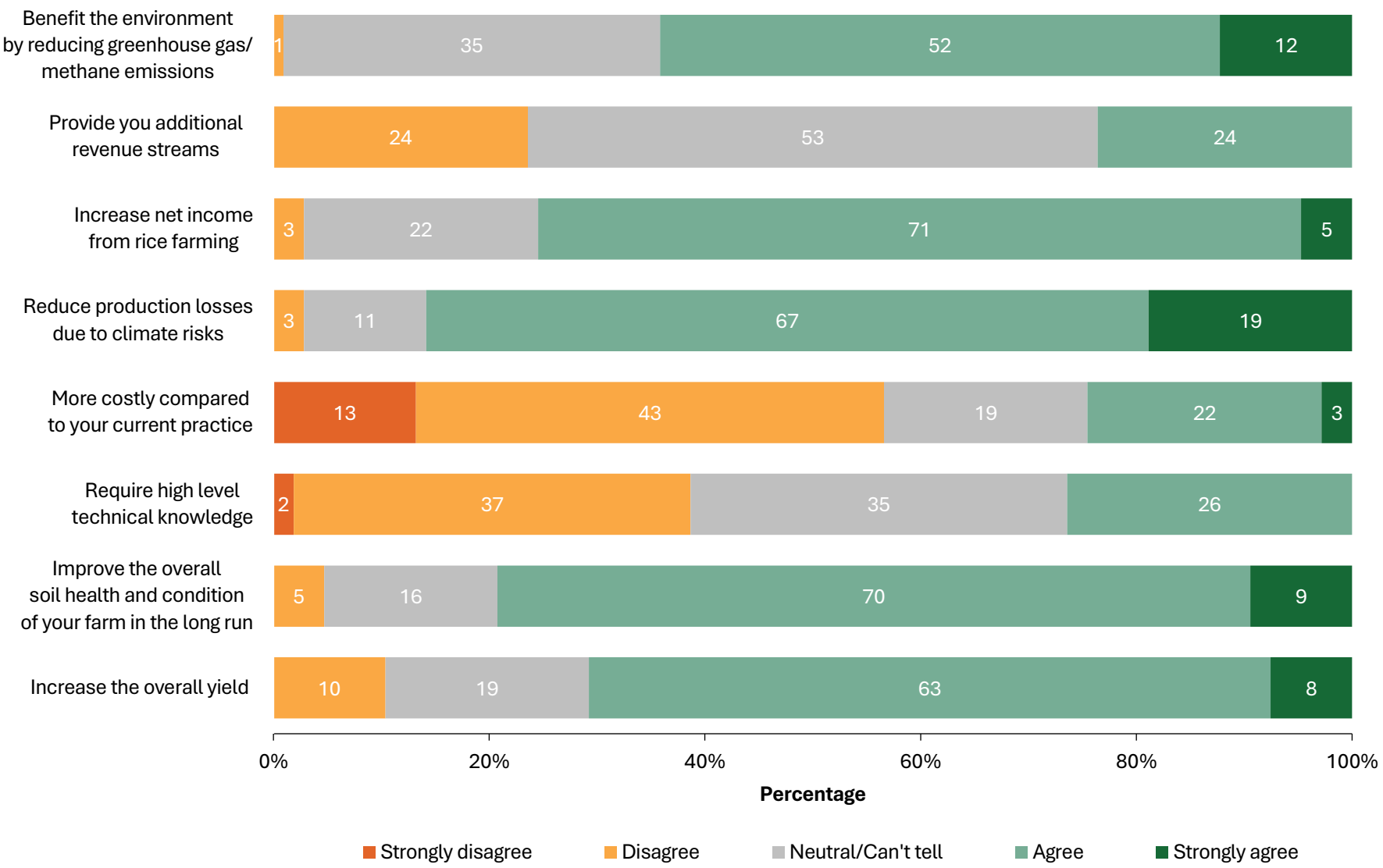
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of DSR (n = 105).

Figure 47. Respondents' perceptions of DSR across multiple indicators (in percent) in An Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of DSR (n = 99).

Figure 48. Respondents' perceptions of DSR across multiple indicators (in percent) in Kien Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of DSR (n = 106).

Figure 49. Respondents' perceptions of DSR across multiple indicators (in percent) in Soc Trang, 2024-2025.

DSR Accessibility

The sources of information on DSR are presented in Table 14. In Thai Binh, more than half of the farmers (52%) reported attending seminars and training sessions conducted by various institutions and agencies. Similarly, 43% of farmers in An Giang had participated in these types of events. In contrast, a majority of farmers in Nghe An (60%) and Kien Giang (61%) indicated that they were self-taught. Meanwhile, nearly half of the farmers in Soc Trang (49%) cited extension workers and agricultural technicians as their primary source of information. This highlights that the sources of information vary across provinces, possibly due to differences in resource accessibility, availability, and the level of engagement of various institutions in rice production within these areas.

Table 14. Source of information of respondents about DSR (in percent), by province, 2024-2025.

Sources of information	Thai Binh (n=97)	Nghe An (n=111)	An Giang (n=105)	Kien Giang (n=99)	Soc Trang (n=106)	All five provinces (n=518)
Seminars/Trainings of relevant institutions	52	15	43	33	42	36
Communication materials (flyers, brochures)	13	5	9	11	13	10
Shared by extension workers/agricultural technicians	32	23	38	33	49	35
Shared by private entities	1	9	6	6	4	5
Shared by government including research/academic institutions	3	1	5	1	3	3
Heard from fellow farmers/groups	44	47	39	74	46	50
Self-taught	19	60	18	61	30	38

Overall, half (50%) of the farmers learned DSR through fellow farmers or farmers' groups. This highlights the significance of local knowledge networks among farmers for adopting new farming methods. Additionally, 38% acquired knowledge through self-learning, indicating the farmers' efforts to adopt new practices or technologies in rice production. This highlights the importance of ensuring that relevant information and resources are readily available and accessible to support their independent learning efforts. Moreover, this suggests that farmers not only relied on their own experiences but also on the knowledge and insights of their peers when determining their farming practices.

Other notable sources of information included seminars or training programs (36%) and agricultural technicians or workers (35%). This suggests that, aside from informal sources of information, formal sources also played an important role in disseminating information about DSR. However, the variation in these sources across provinces points to inconsistencies in the implementation of such initiatives, which could hinder broader adoption. At the same time, this also highlights the opportunities to scale up these programs and expand their reach, as these activities can provide essential support for farmers in successfully adopting DSR.

Additionally, only 21% of the farmers reported receiving support to adopt DSR in the past three years (Figure 50). The highest proportion of farmers who received support was reported in Soc Trang (38%), followed by An Giang (25%) and Thai Binh (24%). In contrast, lower proportions were reported in Kien Giang (17%) and Nghe An (4%). This indicates existing support gaps in these provinces, which could hinder DSR adoption, especially since most farmers reported receiving no assistance. Enhanced extension services and tailored material or financial support might encourage farmers to implement DSR.

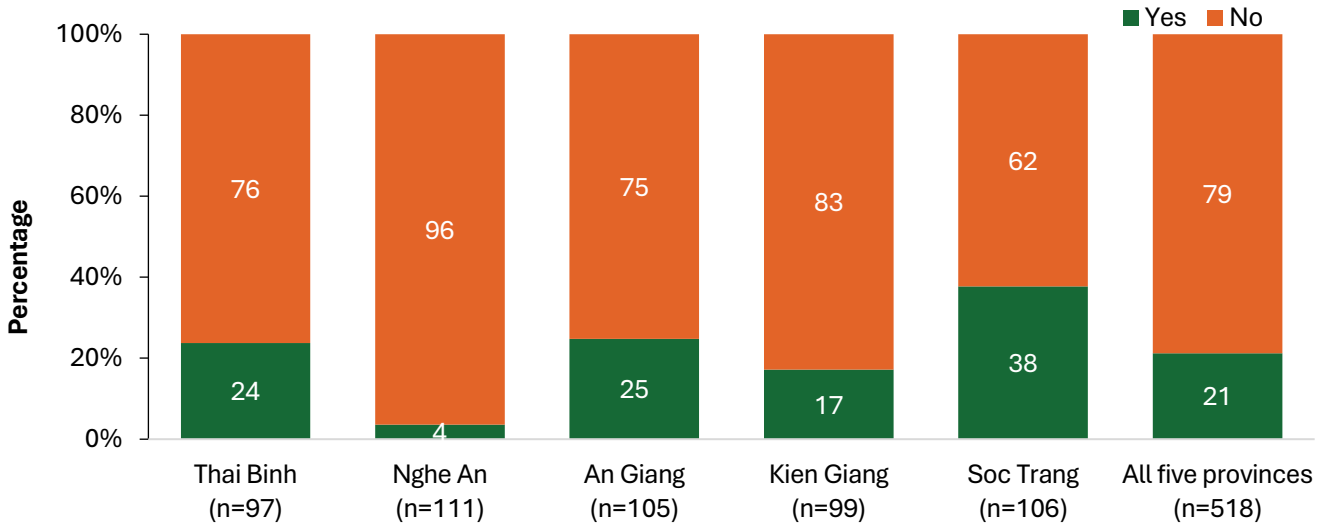


Figure 50. Respondents who received support to adopt DSR (in percent), by province, 2022-2024.

Among those who received support, as shown in Table 15, majority (81%) indicated it was primarily in the form of training or seminars, which aligns with the earlier discussion that these events are a key source of information on DSR. On the other hand, a significant proportion (35%) of farmers received in-kind capital as grants, particularly in Soc Trang (63%). Meanwhile, half (50%) of the farmers in Nghe An received cash capital as grants, while 39% of farmers in Thai Binh reported receiving support for extension services. However, the relatively low provision of machinery, tools, and equipment (6%) suggests that farmers may lack the necessary resources to implement DSR. Therefore, in addition to knowledge dissemination, improving farmers' access to inputs and equipment should be a key focus area to facilitate adoption.

Table 15. Support provided to the respondents for the adoption of DSR technology (in percent), by province, 2024-2025.

Type of Support	Thai Binh (n=23)	Nghe An (n=4)	An Giang (n=26)	Kien Giang (n=17)	Soc Trang (n=40)	All five provinces (n=110)
Training/Seminars	78	100	92	94	68	81
Capital (in-kind) as grants	35	25	12	12	63	35
Extension service	39	0	0	6	0	9
Machineries, tools and equipment	22	0	0	0	5	6
Capital (cash) as grants	0	50	0	0	3	3
Networks and markets	9	0	0	6	0	3
Price premium	0	25	0	6	0	2
Capital (credit)	4	0	0	0	0	1

Meanwhile, the provider of these supports also differed across provinces, as presented in Table 16. In the provinces of MRD—An Giang (85%), Kien Giang (82%), and Soc Trang (75%), the National or Local Government was the primary source of support. In contrast, most support in Thai Binh came from farmers' groups or cooperatives (78%), while all respondents in Nghe reported receiving assistance from private companies (100%). Based on these results, in addition to expanding support services, there is a need to enhance the level of engagement of support providers, particularly the involvement of government agencies in Thai Binh and Nghe An. Another potential approach is to encourage greater involvement from other stakeholders, such as private companies and research institutions, to provide more support and assistance to the farmers.

Table 16. Provider of support for DSR adoption (in percent) mentioned by the respondents, by province, 2024-2025.

Support Provider	Thai Binh (n=23)	Nghe An (n=4)	An Giang (n=26)	Kien Giang (n=17)	Soc Trang (n=40)	All five provinces (n=110)
National/Local Government	22	0	85	82	75	65
Farmer group, cooperative (member)	78	50	15	12	25	33
Private company	13	100	23	29	3	17
Research institutes	22	25	0	0	0	5
Fellow farmers	13	0	4	6	0	5
Farmer group, cooperative (non-member)	9	0	0	0	0	2

3.6.3. Rice Straw Management (RSM)

RSM Awareness

The majority of farmers across surveyed provinces reported some level of awareness about the concept and practices of RSM, with 42% (Nghe An) to 52% (An Giang) indicating awareness, and 18% (An Giang and Kien Giang) to 32% (Nghe An) being intensely aware. This suggests that while many farmers are familiar with RSM, a substantial portion remain either uninformed or only slightly aware of its practices. As shown in Figure 51, the highest proportions of unaware farmers were reported in Kien Giang (36%) and An Giang (30%), indicating a need to strengthen outreach efforts in these provinces to better educate farmers about RSM.

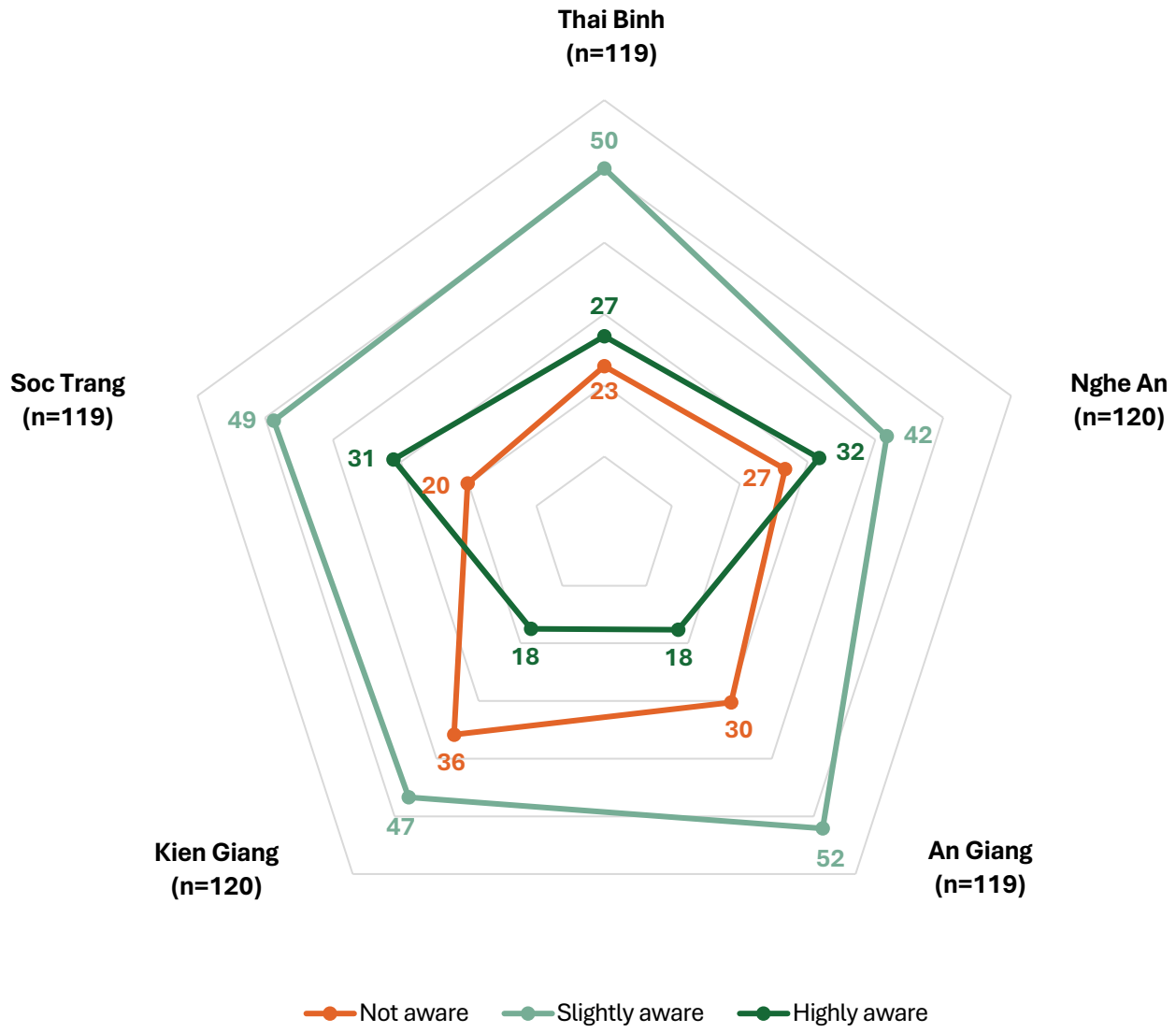


Figure 51. Awareness levels of respondents on RSM practices (in percent), by province, 2024-2025.

Among the 435 farmers who were aware of RSM, the majority of them had some awareness of the different uses of rice straw, with 62% slightly aware and 35% highly aware across all provinces (Figure 52). This indicates that farmers recognize the value of rice straw for various applications. The highest proportion of farmers who had high levels of awareness was reported in Nghe An (44%) and Soc Trang (41%). This suggests that farmers in these areas may have seen rice straw as a resource rather than a waste product. In contrast, the majority of farmers were still only slightly aware, particularly in Kien Giang (78%), indicating that there is still an opportunity to enhance farmers' awareness through various knowledge-sharing initiatives.

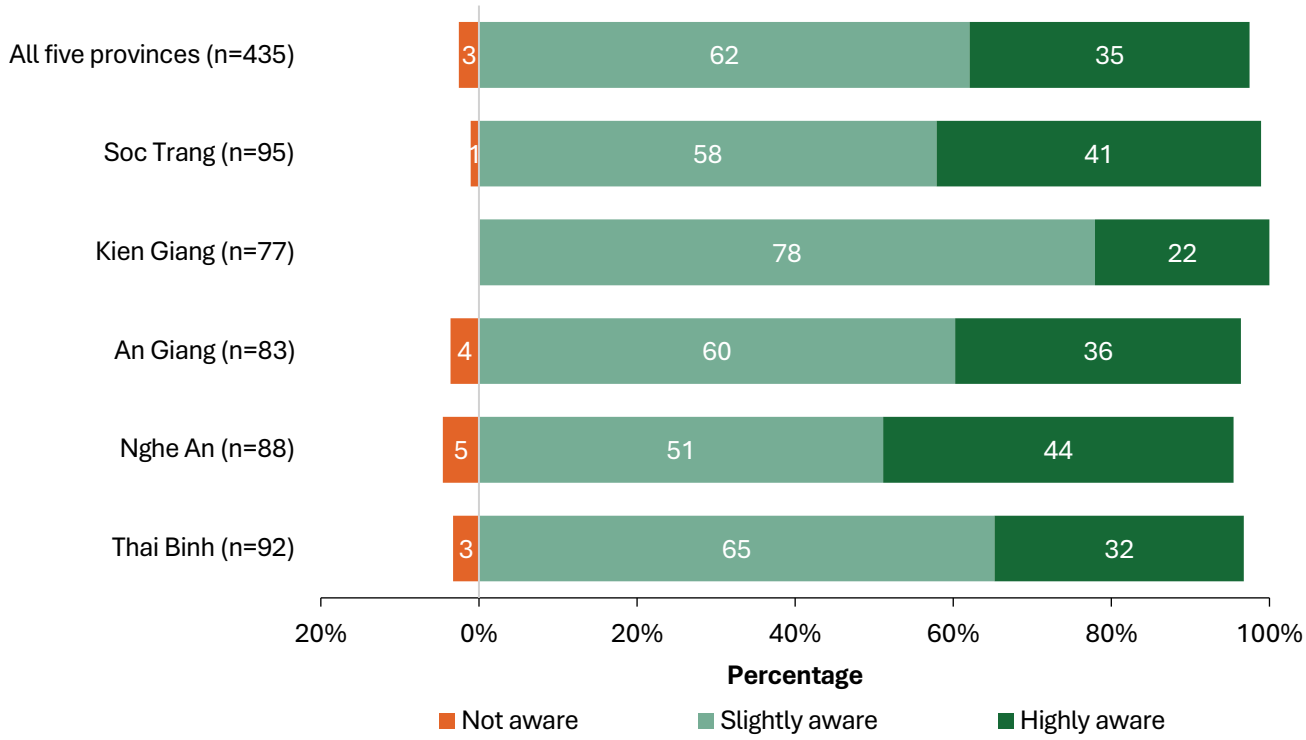


Figure 52. Awareness levels of respondents on the different uses of rice straw in farming and other purposes, by province, 2024-2025.

Meanwhile, 63% of them were moderately aware of the various methods and machinery required to process rice straw, while 29% were highly aware, and the remaining 8% were unaware. Similarly, Kien Giang (17%) stood out with the highest unaware farmers (Figure 53), suggesting that farmers in this province may lack access to appropriate machinery or to resources and training on efficient rice straw processing techniques. Additionally, the high proportion of slightly aware farmers across provinces highlights the need to disseminate information on available machinery that farmers can access and utilize, as well as the necessary processing methods. On the other hand, awareness of the adverse effects of burning rice straw on the soil and environment was relatively high, with 50% of respondents being highly aware and 47% slightly aware (Figure 54). The level of awareness was relatively consistent across provinces, with 47% of farmers in Thai Binh and up to 53% in Kien Giang and Soc Trang reporting high awareness. This implies that farmers acknowledge the harmful effects of rice straw burning.

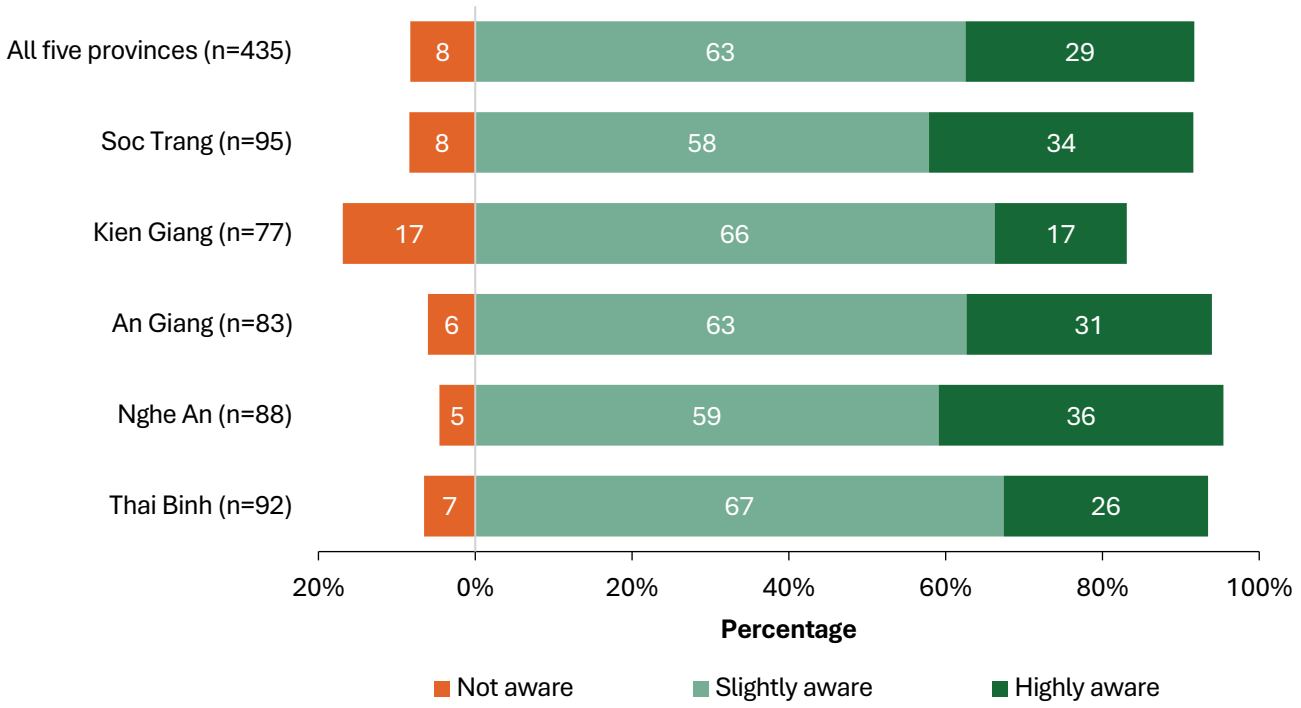


Figure 53. Awareness levels of respondents about the different ways and the machinery needed to process rice straw as a reusable product (in percent), by province, 2024-2025.

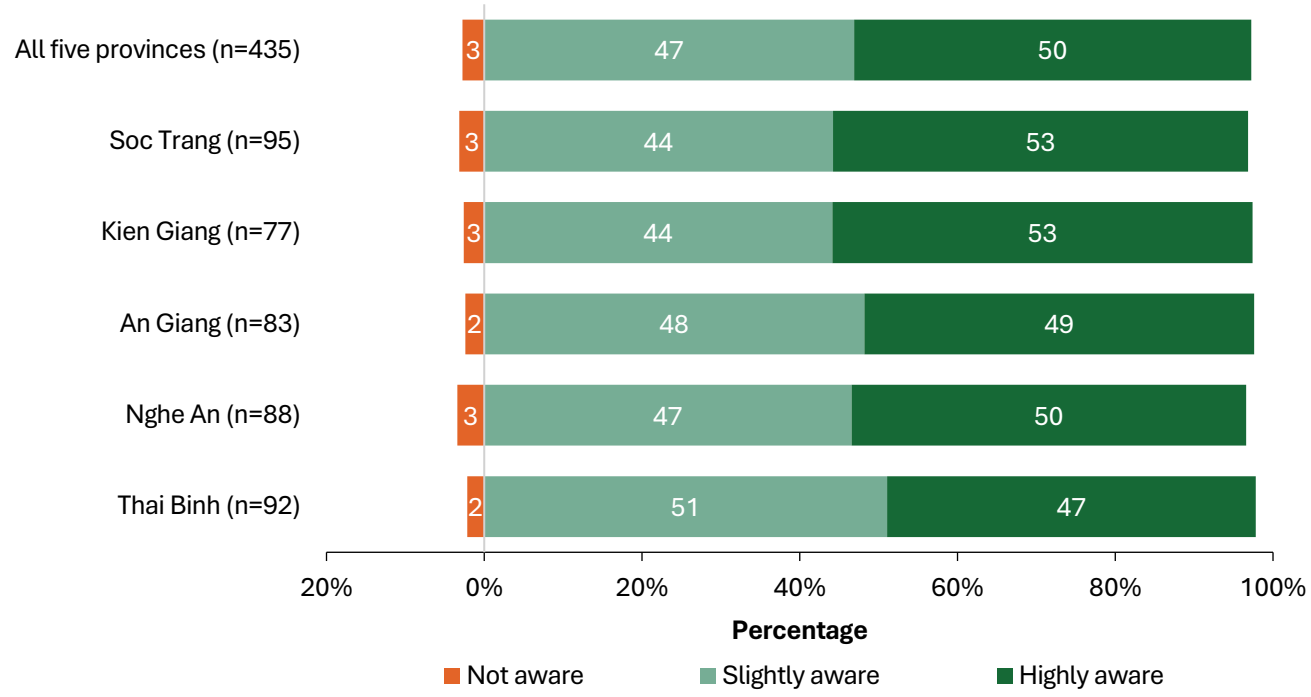


Figure 54. Awareness levels of respondents about the negative effects of burning rice straw on the soil and environment (in percent), by province, 2024-2025.

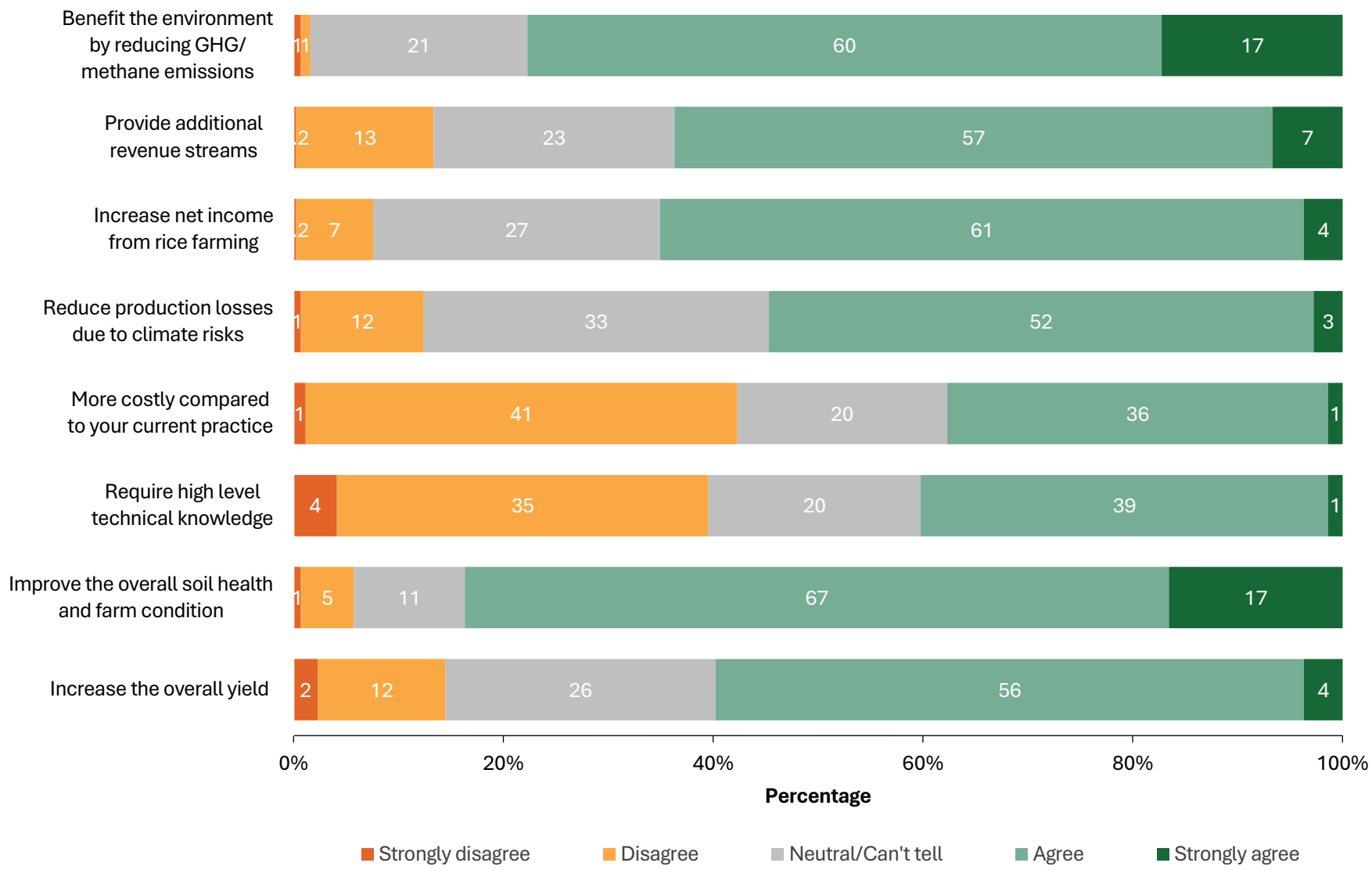
RSM Perception

The perceptions of farmers with varying levels of awareness of RSM were also assessed, particularly regarding its potential benefits, implementation costs, and required technical knowledge, among other factors (Figure 55 to Figure 60). Sixty percent (56% agreed and 4% strongly agreed) believed that RSM could increase the overall yield of their rice production. The combined proportion of respondents who either agreed or strongly agreed varied notably across provinces. The highest level of agreement was recorded in Thai Binh (88%), whereas An Giang reported the lowest at only 34%. In the other three provinces, the proportion of farmers who agreed or strongly agreed ranged from 57% to 60%. These variations may reflect differences in the adoption of RSM practices and the experiences of farmers across provinces.

Meanwhile, the majority of farmers (84%) agreed that RSM provides benefits to soil quality and overall farm conditions. Furthermore, more than three-fourths of the farmers agreed that RSM contributes to the reduction of methane emissions from rice farming, ranging from 76% to 95% across four provinces, with Nghe An (58%) being an exception. These findings suggest that farmers recognize both the environmental and agronomic benefits of the practice, which could be leveraged to encourage and motivate wider adoption. However, there remains a need for efforts, supported by scientific evidence, to raise farmers' awareness and understanding of how this practice can lead to such benefits. Accordingly, campaigns and demonstration activities should be conducted to explain to farmers the specific mechanisms through which RSM can improve farm conditions and contribute to environmental sustainability.

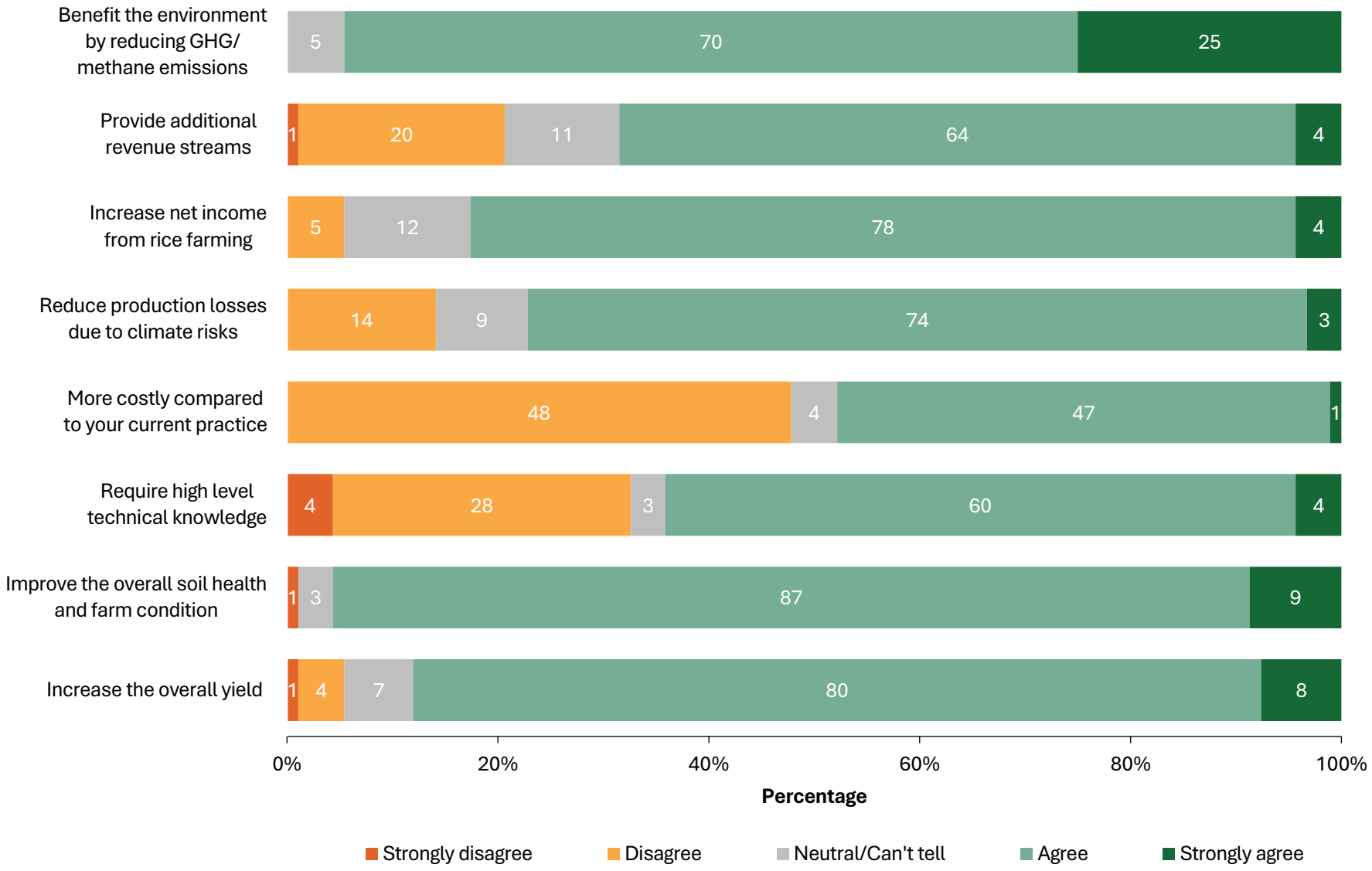
On the other hand, more than half of the farmers (55%) believed that RSM practices could reduce losses associated with climate risks. A notable proportion (33%) remained neutral on this matter, with particularly high neutrality observed in Nghe An (45%) and An Giang (42%). Furthermore, perceptions were mixed regarding the technical knowledge required to implement RSM, with 40% agreeing that high technical skills are necessary, while 39% disagreed. This further highlights the importance of conducting practical demonstrations and providing technical guidance to assist farmers, especially those with limited technical knowledge. Additionally, peer-to-peer learning and community-based programs could enhance farmers' confidence in adopting this practice.

Perceptions regarding the cost of implementation also varied, with 37% of farmers perceiving RSM as more expensive compared to their current practices, while 42% disagreed with this statement. This variation may be attributed to factors related to RSM implementation, such as the availability of resources and labor, which can influence the overall costs. In contrast, the majority agreed that RSM could increase their net income (65%) and provide additional revenue streams (64%), suggesting that aside from environmental benefits, the farmers also recognized the economic benefits of RSM.



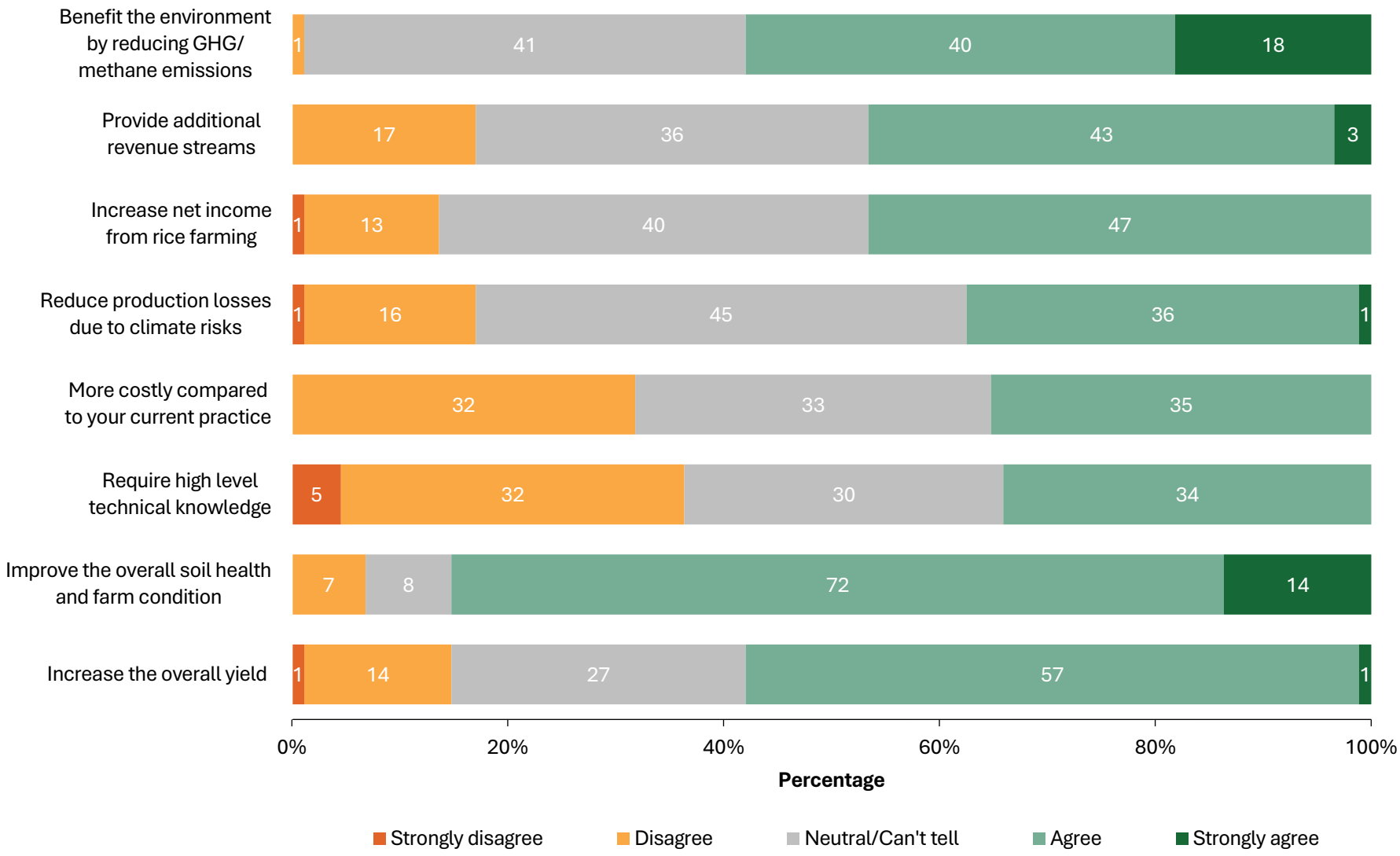
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of RSM (n=435).

Figure 55. Respondents' perceptions of RSM across multiple indicators (in percent), 2024-2025.



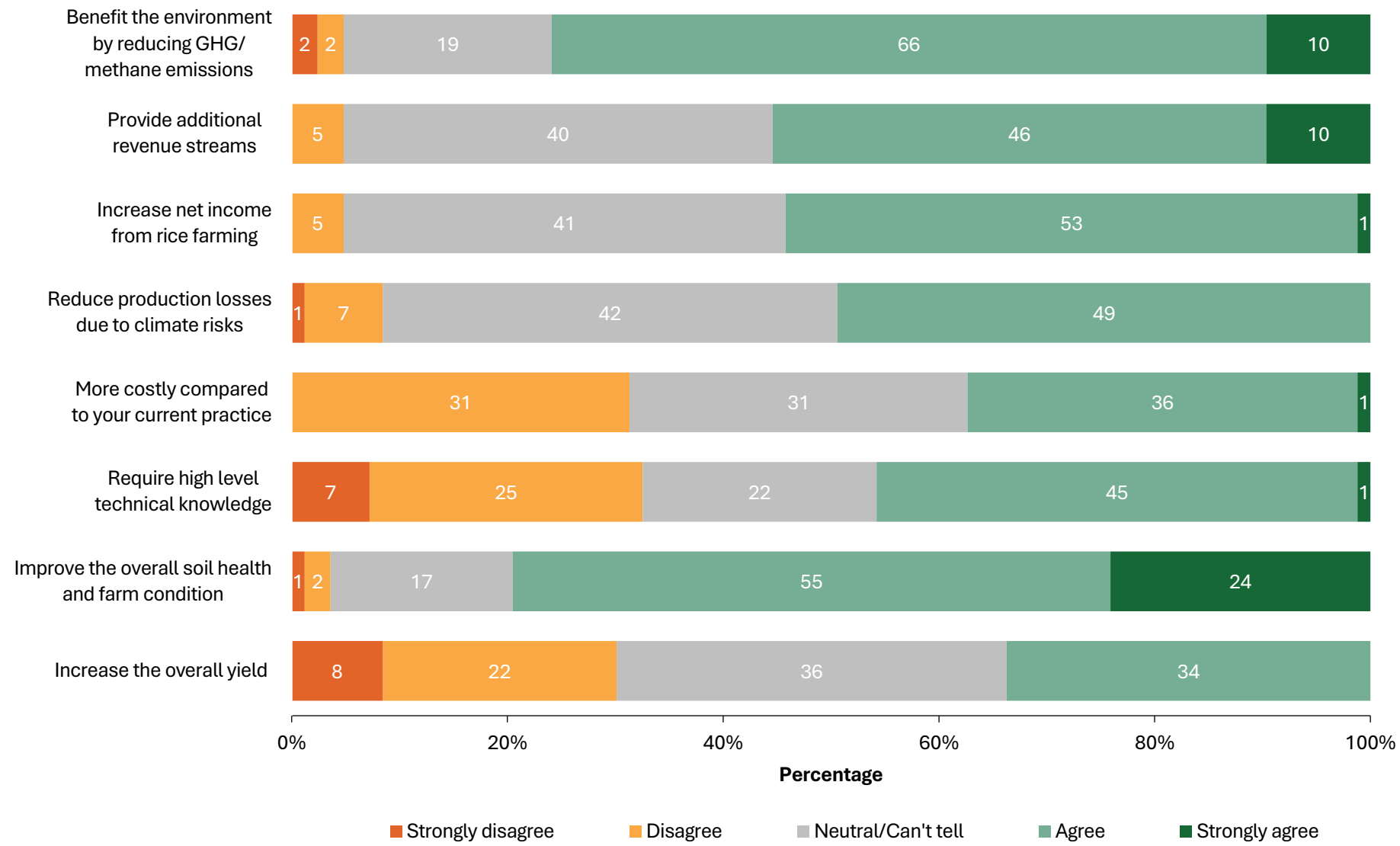
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of RSM (n=92).

Figure 56. Respondents' perceptions of RSM across multiple indicators (in percent) in Thai Binh, 2024-2025.



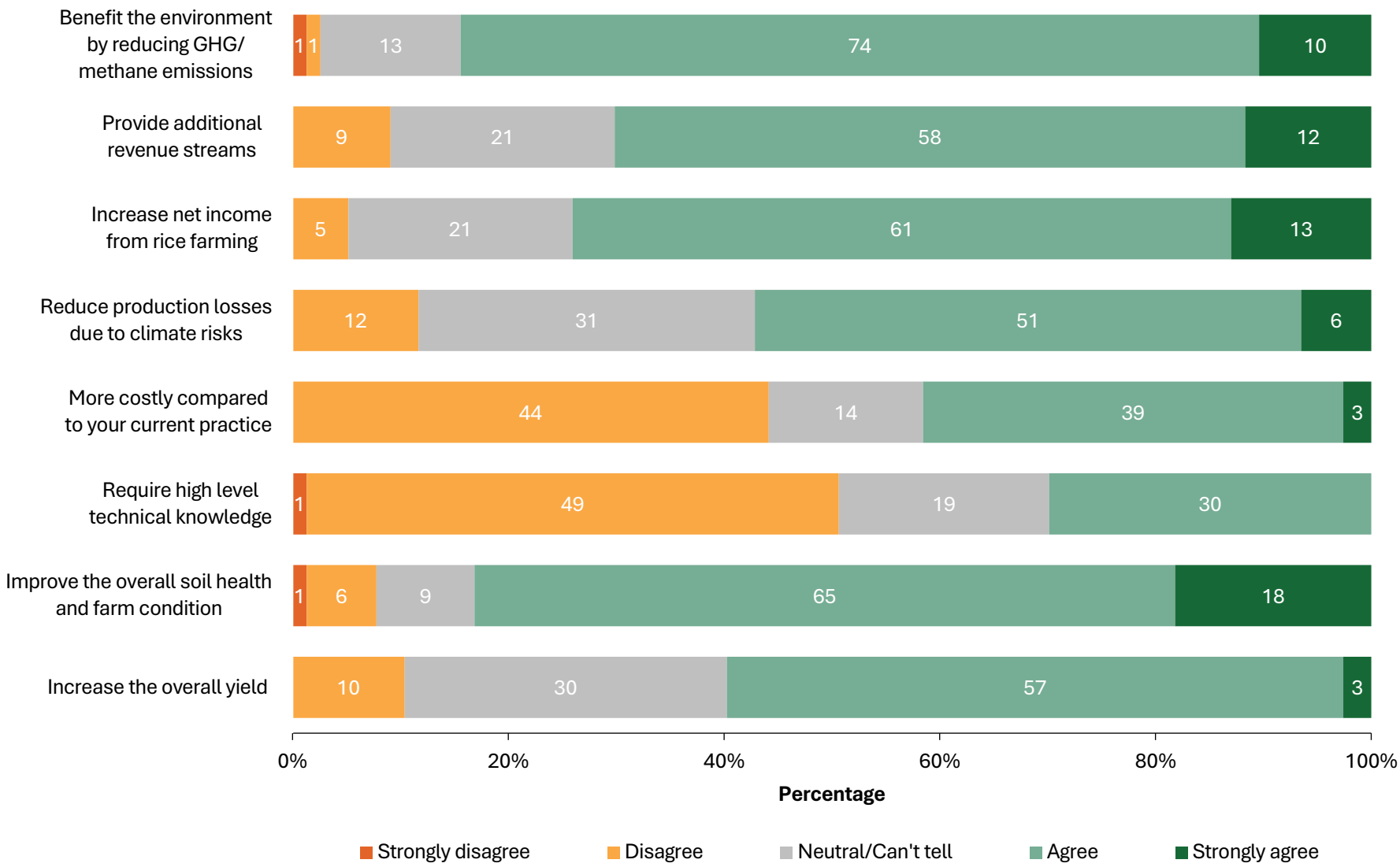
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of RSM (n=88).

Figure 57. Respondents' perceptions of RSM across multiple indicators (in percent) in Nghe An, 2024-2025.



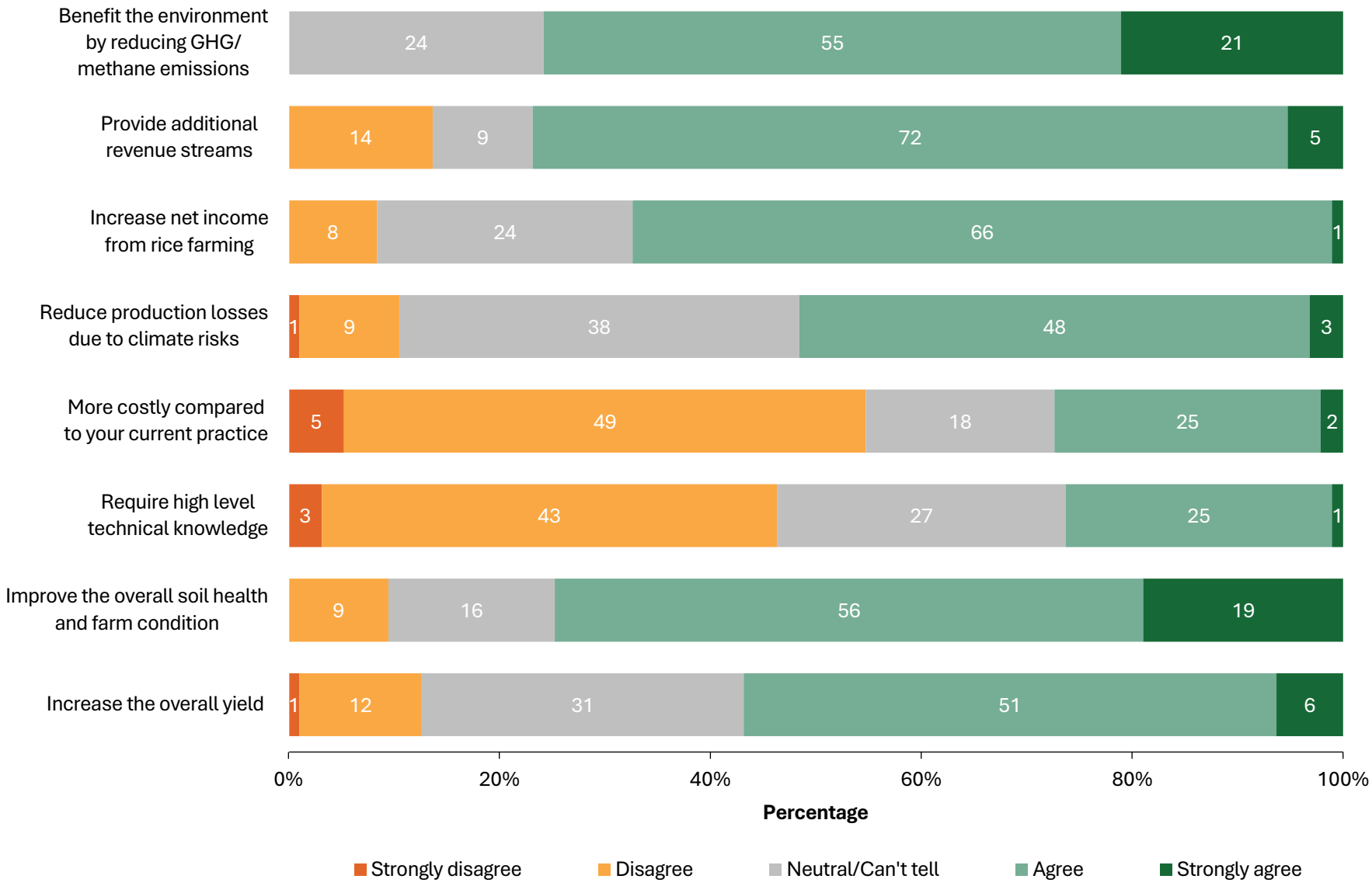
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of RSM (n=83).

Figure 58. Respondents' perceptions of RSM across multiple indicators (in percent) in An Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of RSM (n=77).

Figure 59. Respondents' perceptions of RSM across multiple indicators (in percent) in Kien Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of RSM (n=95).

Figure 60. Respondents' perceptions of RSM across multiple indicators (in percent) in Soc Trang, 2024-2025.

RSM Accessibility

The primary sources of information on RSM varied across provinces, as presented in Table 17. In Thai Binh (85%) and An Giang (57%), the most commonly reported sources were seminars and training programs. In contrast, extension workers or agricultural technicians were the primary sources in Nghe An (45%) and Soc Trang (53%). Notably, more than half (58%) of farmers in Kien Giang reported being self-taught, indicating a reliance on their own efforts and experience. These differences may be attributed to the varying availability of support services and initiatives across localities.

Table 17. Source of information of respondents about RSM (in percent), by province, 2024-2025.

Sources of information	Thai Binh (n=92)	Nghe An (n=88)	An Giang (n=83)	Kien Giang (n=77)	Soc Trang (n=95)	All five provinces (n=435)
Seminars/Trainings of relevant institutions	85	32	57	38	49	53
Communication materials (flyers, brochures)	17	8	7	25	20	15
Shared by extension workers/agricultural technicians	29	45	41	42	53	42
Shared by private entities	7	11	8	3	3	6
Shared by government including research/academic institutions	3	5	5	0	2	3
Heard from fellow farmers/groups	18	31	17	53	33	30
Self-taught	10	43	23	58	32	32

Nonetheless, these results highlight the need for a more uniform distribution of support services, such as training opportunities, to enhance farmers' understanding of RSM concepts and practices, thereby enabling more effective and efficient implementation. Aside from this, support from extension workers should also be available to more farmers, providing practical and localized assistance suited to the specific conditions of each province. Moreover, a significant proportion of farmers reported being self-taught (32%) or having learned from their fellow farmers (30%), highlighting the importance of accessible resources and technical guides. Also, it is essential to enhance the development and effective distribution of communication materials to better support farmers in adopting RSM practices.

Similar to the previous discussions, the majority of the farmers did not receive support to adopt or implement RSM in the past three years. The highest proportion of farmers who received support was in Thai Binh (46%), followed by Soc Trang (38%) as shown in Figure 61. This further highlight that support programs are not reaching all the farmers, which may contribute to increased barriers to adoption. Therefore, expanding these services, particularly in provinces with low levels of support, may be crucial to encourage adoption of practices.

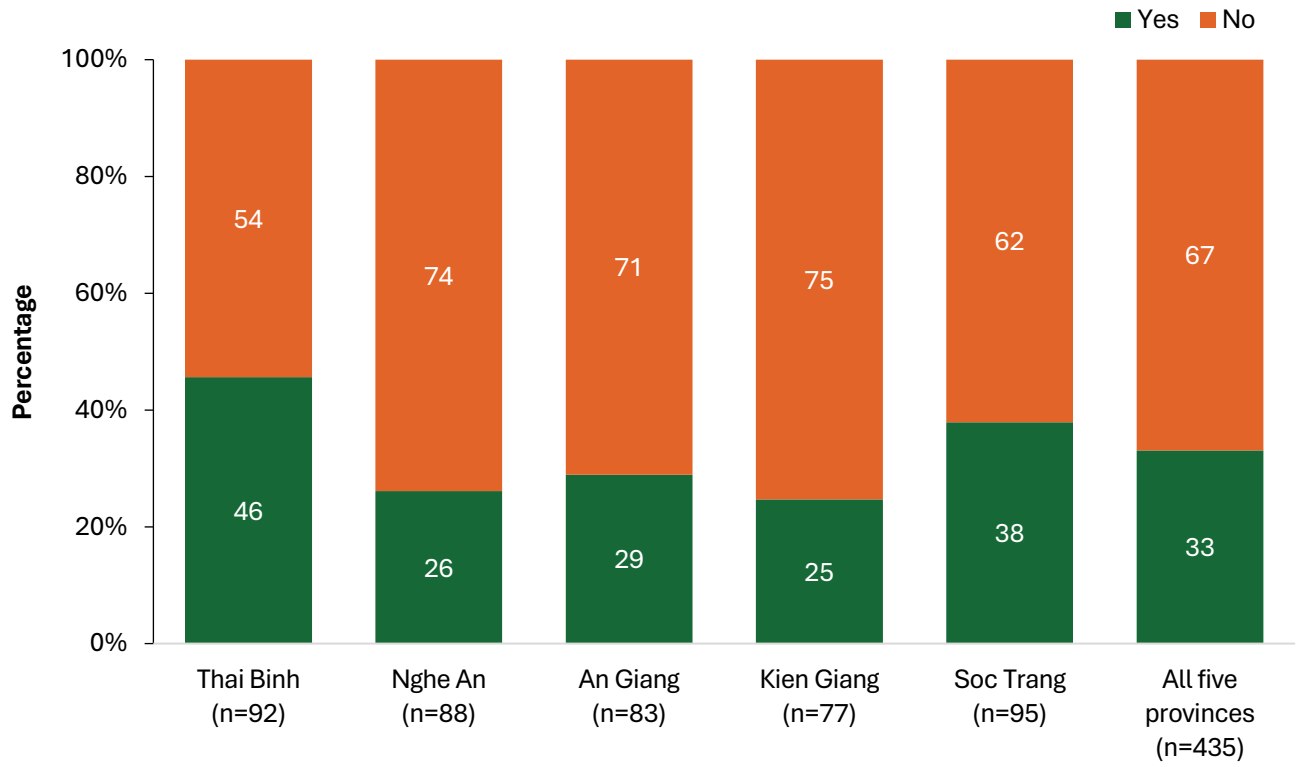


Figure 61. Respondents who received support to adopt RSM (in percent), by province, 2022-2024.

Among those who received support, the majority (81%) indicated that it was provided in the form of training and seminars, particularly in the provinces within the MRD (Table 18). A notable proportion (33%) also received in-kind grants, with Nghe An reporting the highest share at 74%. In contrast, only a small percentage of farmers received machinery, tools, and equipment (3%) or cash grants (3%). These findings suggest that support and efforts should also prioritize the provision of material and financial assistance, as these could help address key barriers to the adoption of RSM practices.

Table 18. Support provided to the respondents for the adoption of RSM technology (in percent), 2024-2025.

Type of support	Thai Binh (n=42)	Nghe An (n=23)	An Giang (n=24)	Kien Giang (n=19)	Soc Trang (n=36)	All five provinces (n=144)
Training/Seminars	79	57	96	95	83	81
Capital (in-kind) as grants	48	74	4	11	22	33
Extension service	21	0	0	0	0	6
Machineries, tools and equipment	10	0	0	5	0	3
Capital (cash) as grants	2	9	0	0	3	3
Networks and markets	2	0	4	0	3	2
Capital (credit)	2	0	0	0	0	1

Meanwhile, the providers of support also varied across provinces (Table 19). In Thai Binh (60%) and Nghe An (70%), farmer groups and cooperatives served as the primary sources of assistance, whereas in MRD provinces, support was provided by national and local government agencies. In line with earlier discussions, there is a need to strengthen partnerships among various stakeholders to enhance their engagement. Such collaboration could lead to the development of more comprehensive support packages for farmers, integrating knowledge dissemination, access to technical and financial resources, and the promotion of technological innovations.

Table 19. Provider of support for RSM adoption (in percent) mentioned by the respondents, by province, 2024-2025.

Support provider	Thai Binh (n=42)	Nghe An (n=23)	An Giang (n=24)	Kien Giang (n=19)	Soc Trang (n=36)	All five provinces (n=144)
Farmer group, cooperative (member)	60	70	17	21	44	45
National/Local Government	21	9	79	74	53	44
Private company	19	17	13	11	6	13
Research institutes	10	0	0	5	0	3
Farmer group, cooperative (non-member)	7	4	4	0	0	3
Fellow farmers	10	0	0	5	0	3
NGOs/CSOs	5	0	0	0	0	1
Others	0	4	4	0	0	1

3.6.4. Sustainable Rice Platform (SRP) Standard

SRP Standard Awareness

Overall, most of the respondents were not aware of the SRP standard across the provinces (Figure 62). Only 23% to 28% of farmers (except in Nghe An) reported being slightly aware of the SRP Standard, while fewer than 10% were highly aware. The SRP standard was most known in Thai Binh, with 37% of the respondents showing awareness of the technology. Soc Trang followed as the second most aware region, with 32% of respondents being highly aware, 28% slightly aware, and 4% highly aware of SRP. An Giang and Kien Giang followed close to the average rate, though 70% and 76% of farmers in these provinces were unaware of SRP. Finally, 91% of farmers in Nghe An were unaware of the SRP standard.

Respondents who had heard about the SRP standard only had moderate awareness of different aspects of the technology, as shown in Figure 63 to Figure 65. The respondents had an idea of the conducive farm conditions required to follow practices of the SRP standard – 75% slightly aware and 18% highly aware. Similarly, the respondents were moderately aware of the water management strategy that needs to be followed with the SRP Standard – 71% slightly aware and 21% highly aware. Finally, the respondents had an idea about the tools needed to effectively implement SRP Standard practices – 71% slightly aware, and 16% highly aware. Farmers in Nghe An, the province with the lowest awareness of the technology, consistently answered that they were slightly aware of these aspects of SRP 82% of the time, showing that no farmer in the province feels well-equipped with an understanding of the SRP Standard.

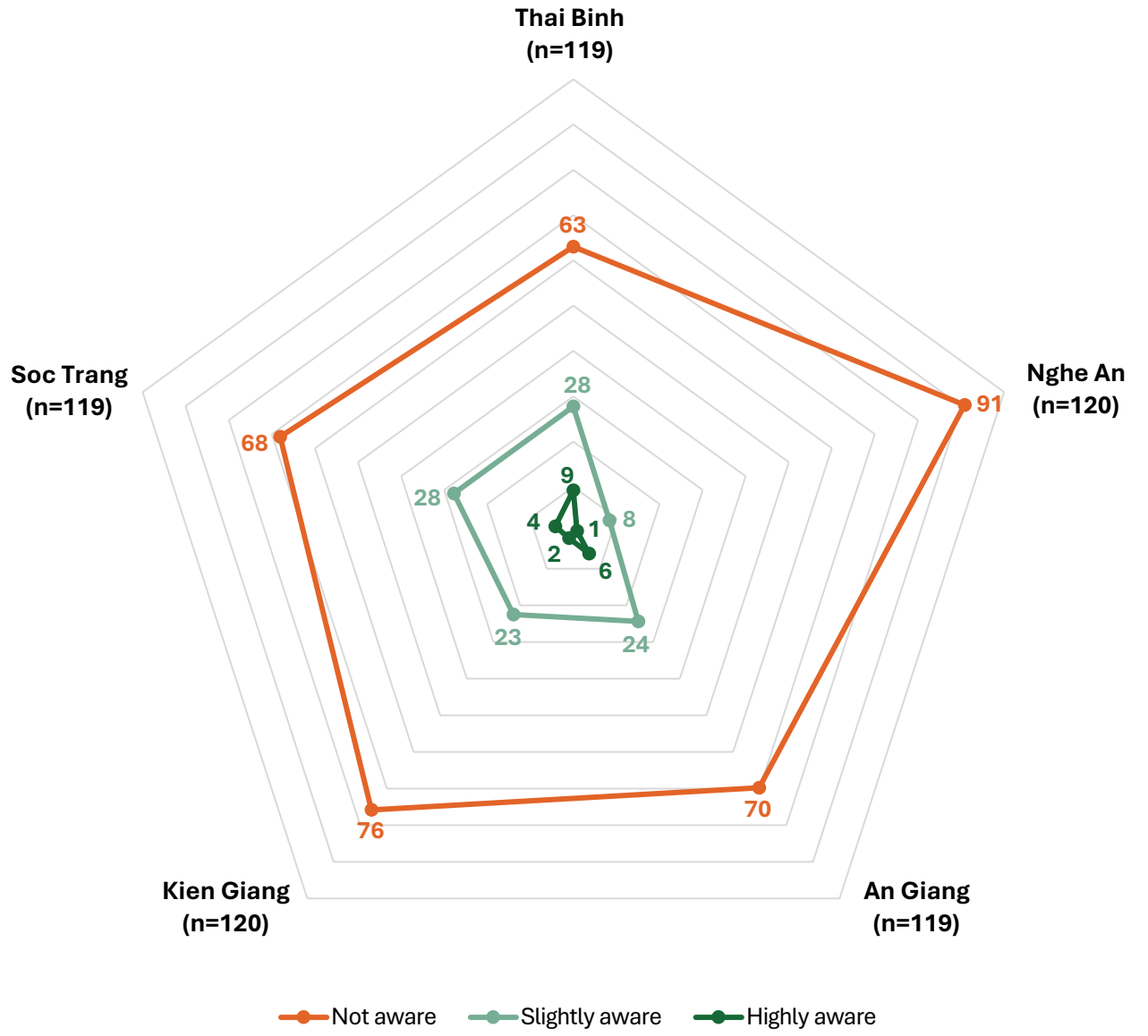


Figure 62. Awareness levels of respondents on the overall concept of the SRP Standard (in percent), by province, 2024-2025.

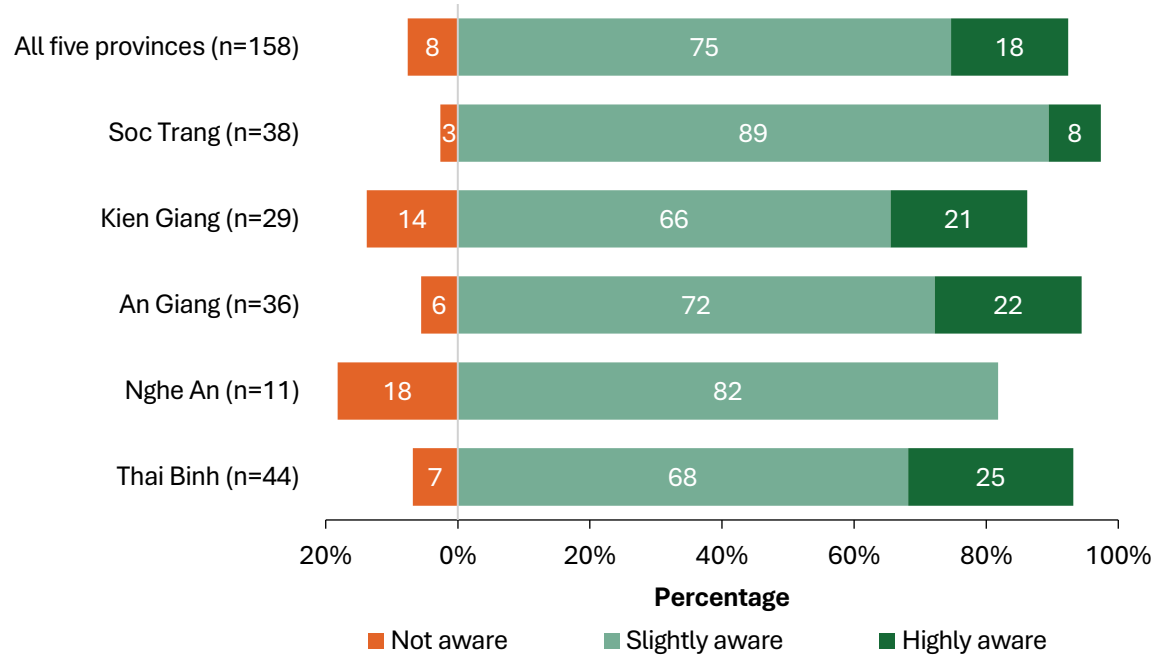


Figure 63. Awareness levels of respondents on the conducive farm conditions where SRP is applicable (in percent), by province, 2024-2025.

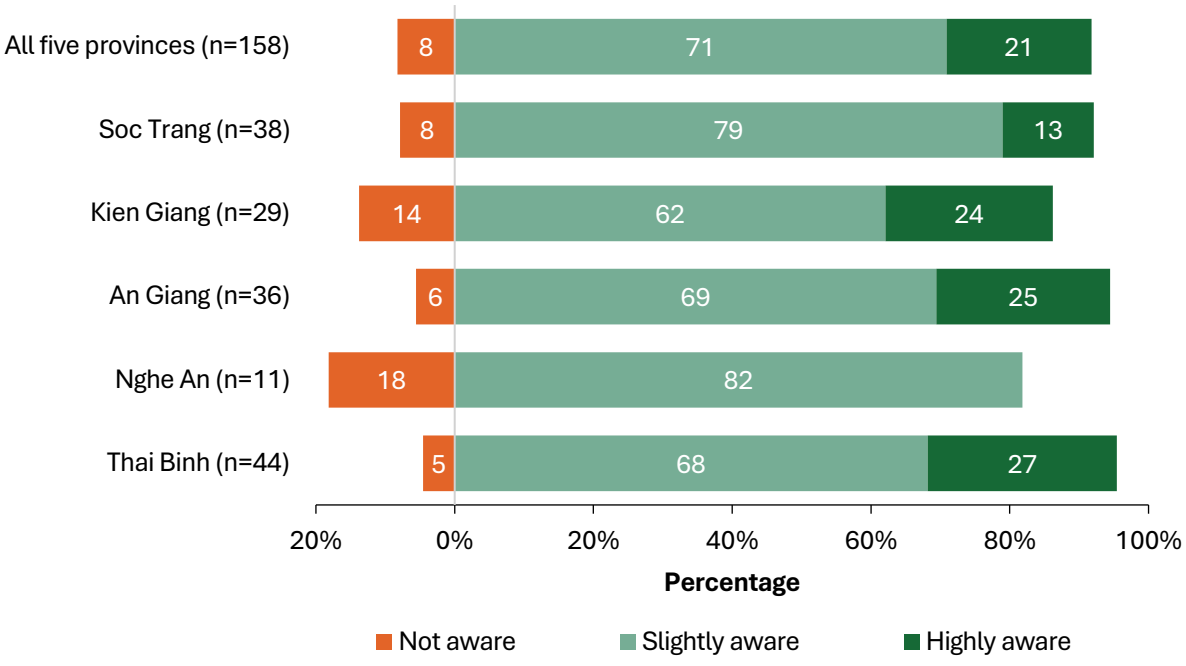


Figure 64. Awareness levels of respondents on the certain water management strategy that needs to be followed (in percent), by province, 2024-2025.

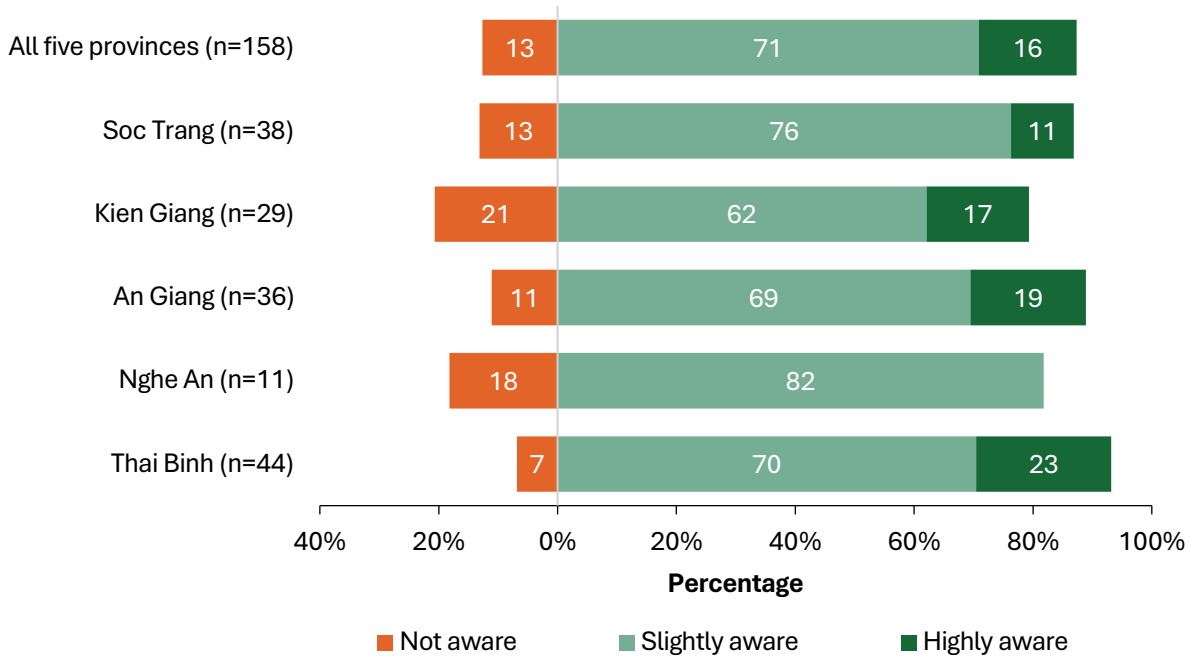


Figure 65. Awareness levels of respondents on the tools and strategies to effectively implement SRP (in percent), by province, 2024-2025.

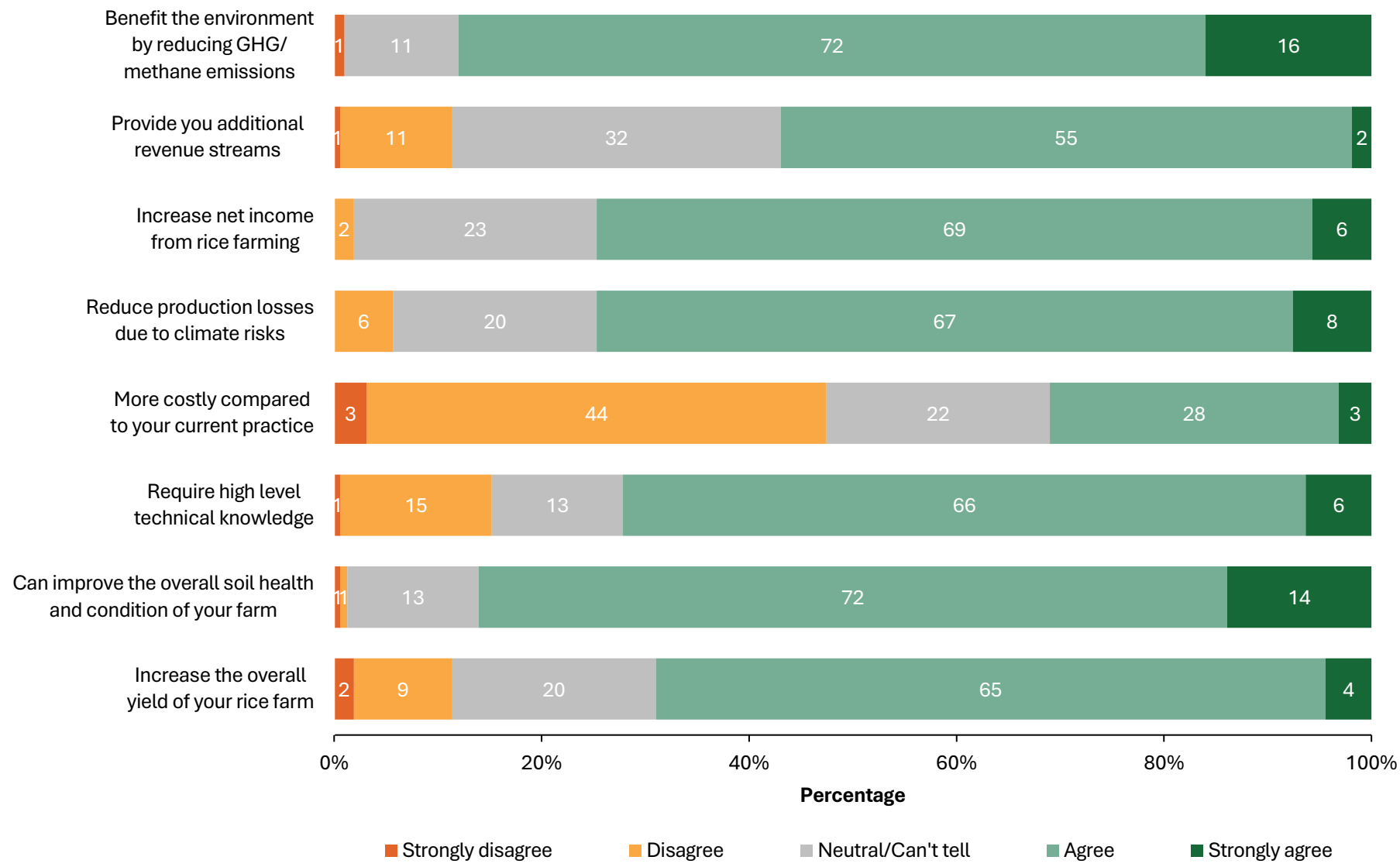
SRP Standard Perception

The 158 farmers in the five provinces generally considered adopting the SRP standard as beneficial to their farm (Figure 66 to Figure 71). On the productivity aspect, more than half (69%) of the farmers believed that adopting the SRP standard practices could increase the overall yield of their rice farm – 65% agreed and 4% strongly agreed. A significant portion in An Giang (28%) disagreed that SRP could increase their yield. In all other provinces except for Kien Giang, those who were neutral ranged between 11% to 36%. Farmers in Kien Giang were more optimistic about SRP in terms of productivity, with 97% of them agreeing with the statement.

Overall, three-fourths of respondents believed that adopting the SRP standard could reduce losses from climate risks – 67% agreed, and 8% strongly agreed. Similarly, there was high uncertainty in Nghe An, with 64% unsure of the impact of the SRP standard on production losses.

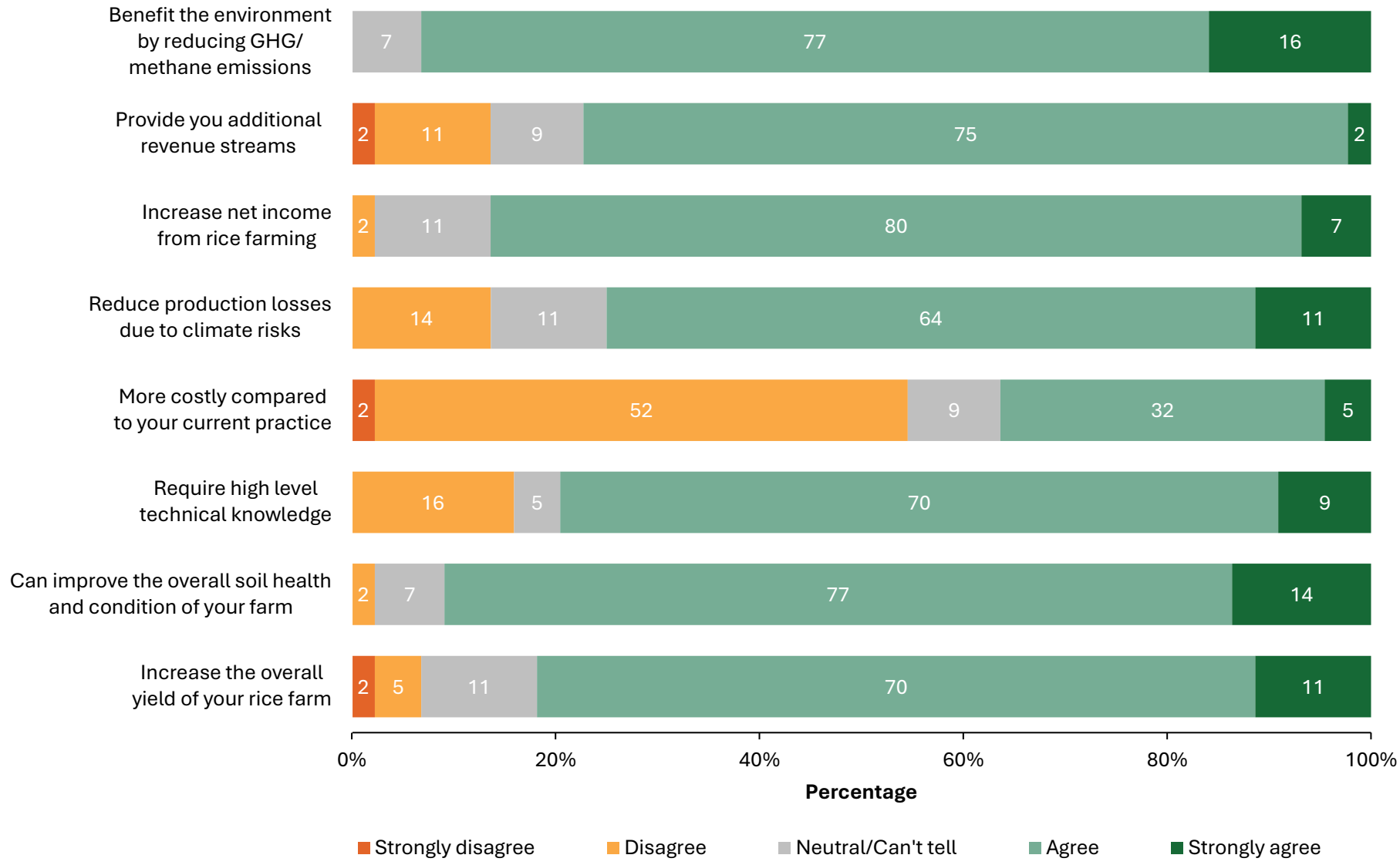
Additionally, 47% believed that adopting the SRP standard would not be more costly than current practice, while 44% disagreed and 3% strongly disagreed. In Nghe An, however, 45% thought that the SRP standard would increase their production costs (45%). There is also a high need for training, as 72% of the respondents in all five provinces felt that it requires high technical knowledge to implement SRP Standard practices. This number reached as high as 91% in Nghe An. Establishing model farms and encouraging farmers to adopt the SRP standard as a community may make farmers less intimidated to learn about the SRP Standard.

Finally, the farmers generally believed that adopting the SRP standard could provide benefits to their farm soil (86%) and the environment (87%). In Nghe An, 36% were uncertain about the benefits of adopting the SRP standard for their soil health, and 27% were uncertain about the environmental effects of the SRP standard.



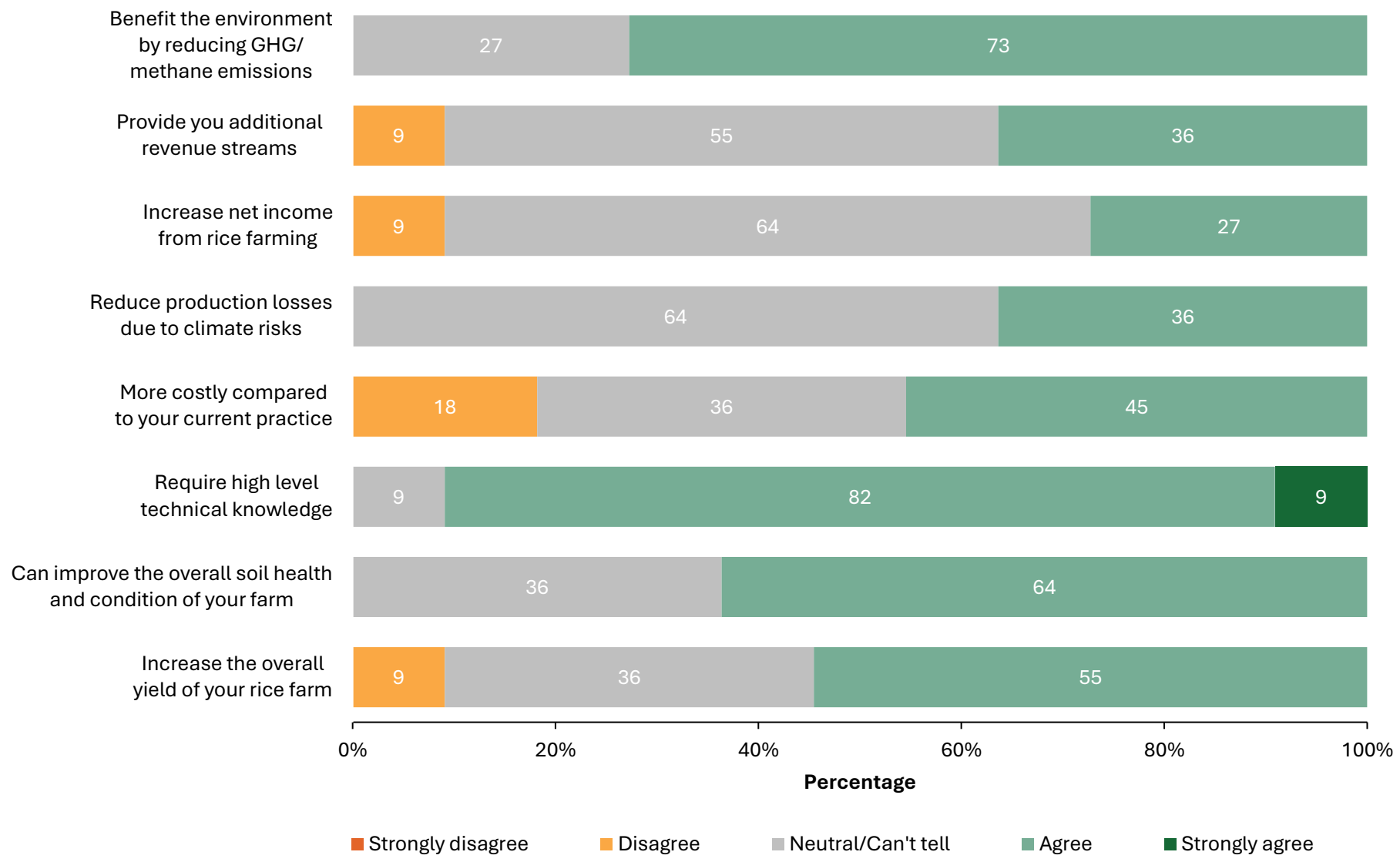
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of SRP Standard (n=158).

Figure 66. Respondents' perceptions of SRP Standard across multiple indicators (in percent), 2024-2025.



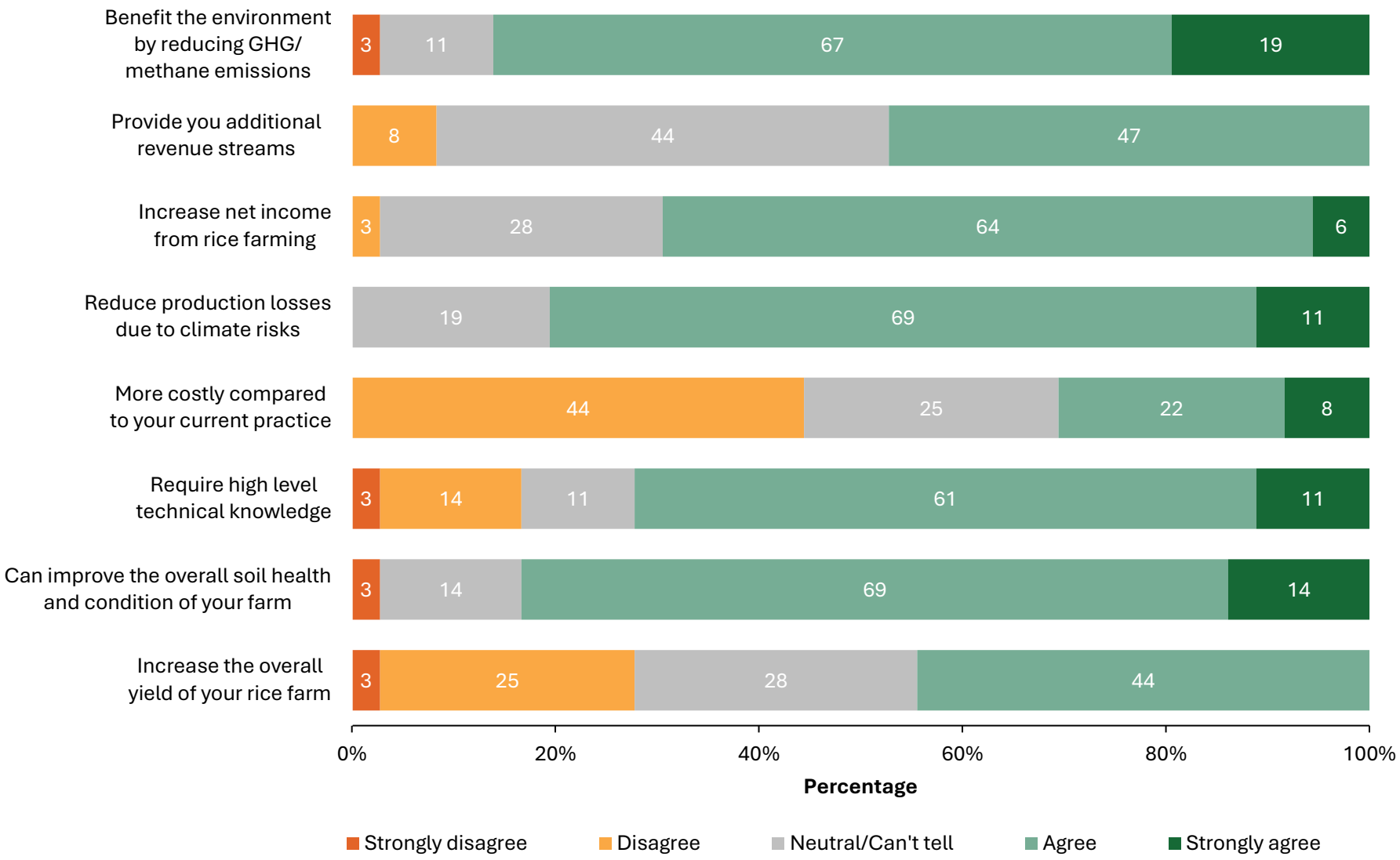
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of SRP Standard (n=44).

Figure 67. Respondents' perceptions of SRP Standard across multiple indicators (in percent) in Thai Binh, 2024-2025.



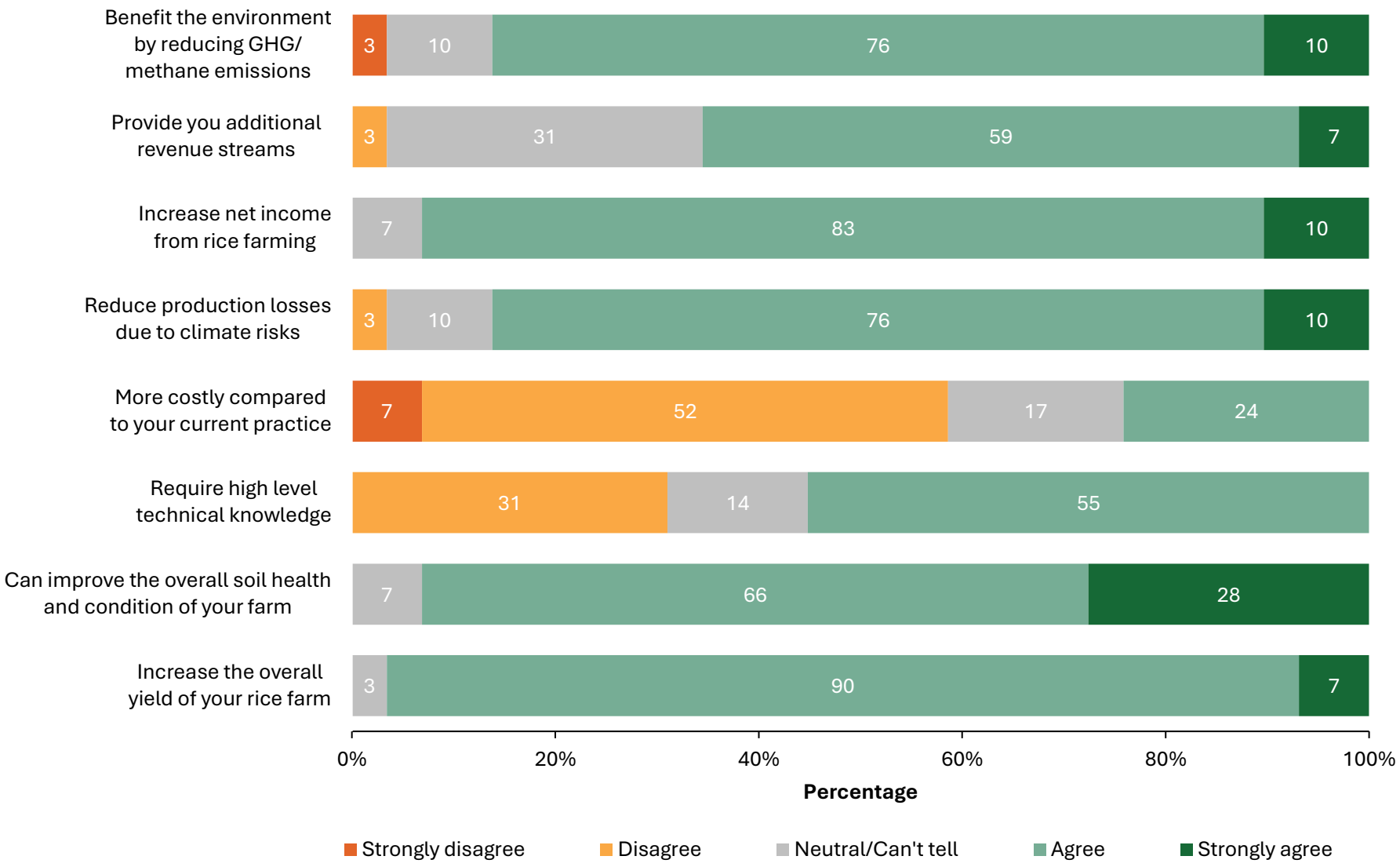
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of SRP Standard (n=11).

Figure 68. Respondents' perceptions of SRP Standard across multiple indicators (in percent) in Nghe An, 2024-2025.



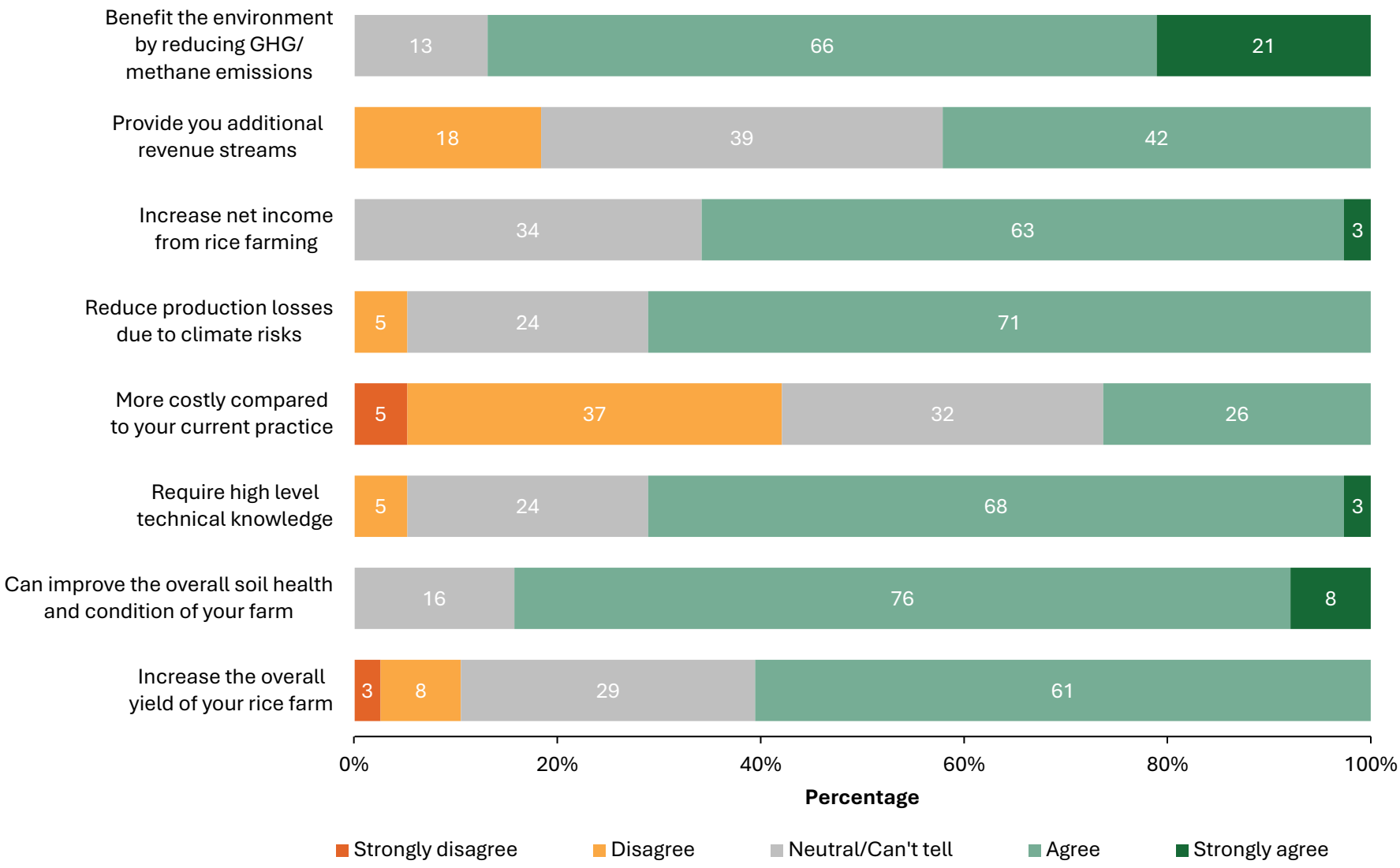
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of SRP Standard (n=36).

Figure 69. Respondents' perceptions of SRP Standard across multiple indicators (in percent) in An Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of SRP Standard (n=29).

Figure 70. Respondents' perceptions of SRP Standard across multiple indicators (in percent) in Kien Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of SRP Standard (n=38).

Figure 71. Respondents' perceptions of SRP Standard across multiple indicators (in percent) in Soc Trang, 2024-2025.

SRP Accessibility

The different sources of information where farmers learn about SRP are summarized in Table 20. Information about the SRP standard was primarily disseminated through trainings by relevant institutions[3], or agricultural extension workers. For over one-half of the respondents (59%), they learned about the SRP standard from seminars; significant rates of the respondents in Thai Binh (84%) and An Giang (61%) were able to participate in such trainings. Respondents from Nghe An (73%) and Soc Trang (79%), on the other hand, learned about SRP from agricultural extension workers. In addition to attending trainings, farmers in Kien Giang learned about SRP from communication materials (41%). Kien Giang also exhibited the highest rate of self-taught farmers (45%), indicating a natural interest in the province regarding the technology.

When asked if they received support to adopt practices that would allow them to qualify for the SRP standard, a significant 69% of respondents indicated that they had not received any form of support (Figure 72). In the province of Nghe An, none of the farmers had received any form of support to adopt the SRP Standard. Only a small group (31%) reported receiving some form of support.

Table 20. Source of information of respondents about SRP (in percent), by province, 2024-2025.

Sources of Information	Thai Binh (n=44)	Nghe An (n=11)	An Giang (n=36)	Kien Giang (n=29)	Soc Trang (n=38)	All five provinces (n=158)
Seminars/Trainings of relevant institutions	84	55	61	52	37	59
Communication materials (flyers, brochures) handed to the community	20	0	8	41	13	18
Shared by extension workers/agricultural technicians	32	73	42	14	79	45
Shared by private entities	0	9	14	14	0	6
Shared by government including research/academic institutions	2	9	11	0	3	4
Heard from fellow farmers/groups	16	18	8	17	13	14
Self-taught	5	9	8	45	21	17
Others: I cannot recall	2	0	0	3	0	1

[3] There are only three members of SRP in Vietnam: Loc Troi Group (in MDR), IPSARD, and MARD.

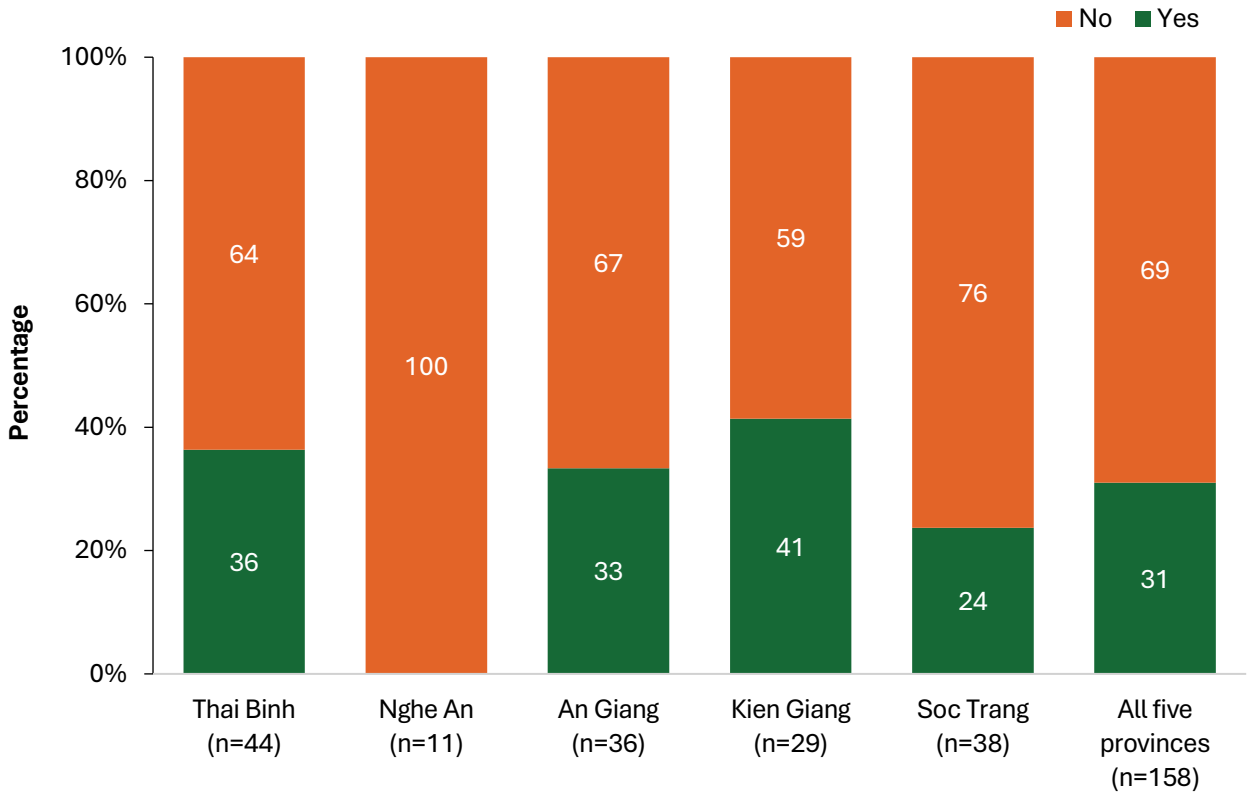


Figure 72. Respondents who received support to adopt SRP (in percent), by province, 2022-2024.

Table 21 shows that 86% of farmers attended seminars about SRP. A small percentage of those beneficiaries received in-kind grant-based capital (35%). Farmers from Thai Binh and Kien Giang received extension services (12%) and equipment (8%). In contrast, farmers in An Giang and Kien Giang benefited from market networks (4%) and price premiums (4%). The leading providers of these support services were the national and local government (61%), farmer cooperatives (33%), research institutions (8%), and private companies (8%), as shown in Table 22.

Table 21. Support provided to the respondents for the adoption of SRP technology (in percent), 2024-2025.

Kind of support	Thai Binh (n=16)	Nghe An (n=0)	An Giang (n=12)	Kien Giang (n=12)	Soc Trang (n=9)	All five provinces (n=49)
Trainings/Seminars	94	0	75	100	67	86
Capital (in-kind) as grants	44	0	25	8	67	35
Extension service	31	0	0	8	0	12
Machineries, tools and equipment	19	0	0	8	0	8
Networks and markets	0	0	8	8	0	4
Price premium	0	0	8	8	0	4

Table 22. Provider of support for SRP adoption (in percent) mentioned by the respondents, by province, 2024-2025.

Provider of Support	Thai Binh (n=16)	Nghe An (n=0)	An Giang (n=12)	Kien Giang (n=12)	Soc Trang (n=9)	All five provinces (n=49)
National/Local Government	6	0	83	83	100	61
Research institutes	25	0	0	0	0	8
Farmer group, cooperative (member)	94	0	0	8	0	33
Farmer group, cooperative (non-member)	6	0	0	0	0	2
Private company	6	0	17	8	0	8
NGOs/CSOs	0	0	0	0	0	0
Fellow farmers	6	0	0	0	0	2

3.6.5. 1 Must Do, 5 Reductions (1M5R)

1M5R Awareness

Respondents were generally slightly aware of the 1M5R[4] program of Vietnam as shown in Figure 73. The majority of residents in An Giang demonstrated higher awareness rates, with 61% indicating they had some knowledge of the program. Nghe An and Thai Binh exhibited high percentages of unaware respondents at 80% and 55%, suggesting a considerable lack of understanding of the 1M5R concept in the two regions. Conversely, An Giang and Soc Trang demonstrated higher proportions of individuals who were slightly aware and highly aware. This demonstrates the need for extension campaigns in Nghe An and Thai Binh. Among those who had heard about the 1M5Rs, respondents generally had a slight idea about the concept, water management, a conducive environment, and the necessary tools needed to implement the practice successfully.

[4] 1 Must do (M): use the verfified rice seed; 5 Reductions (Rs): reductions of the quantity of seed, fertilizer, water, pesticide usages and postharvest loss.

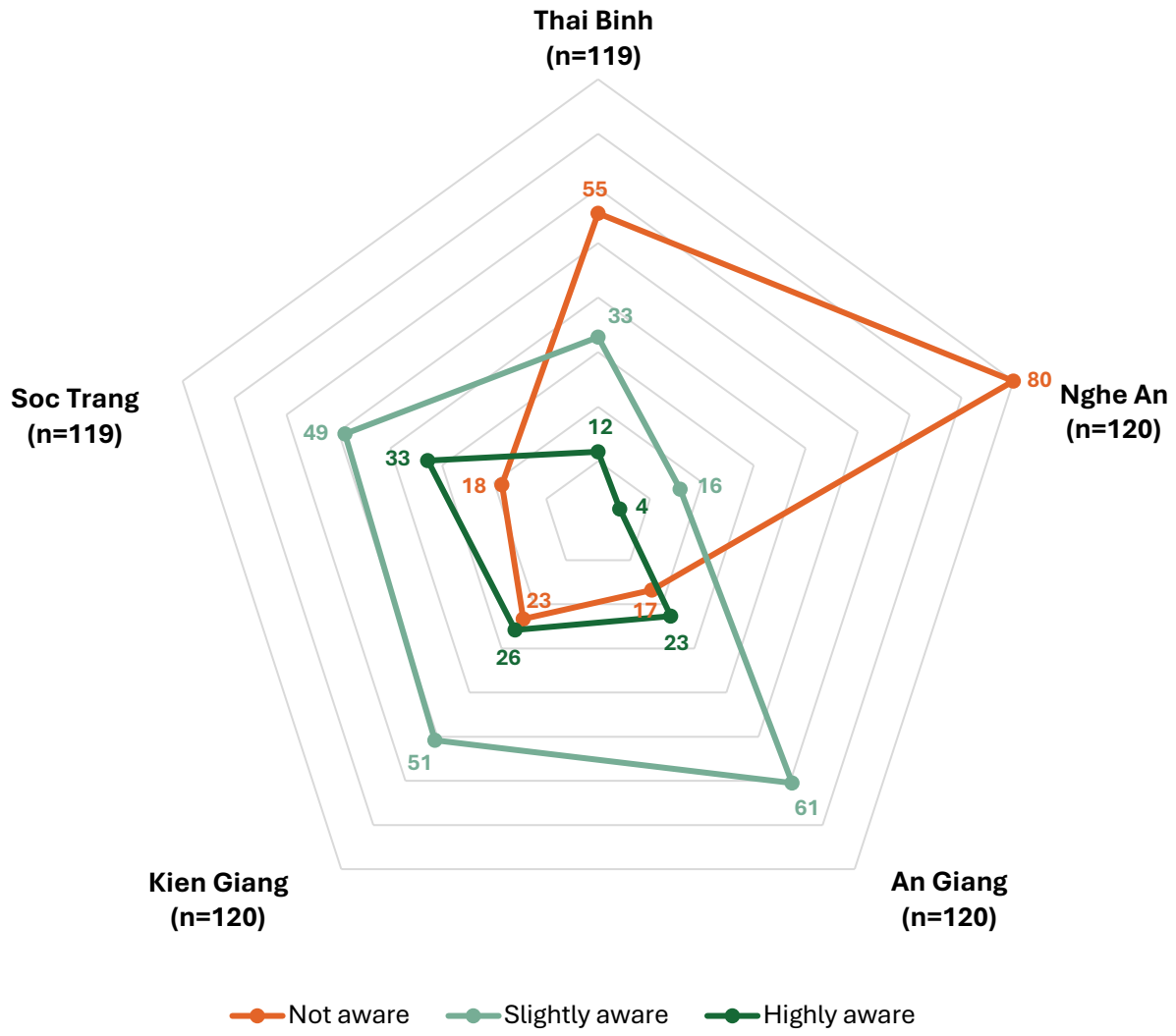


Figure 73. Awareness levels of respondents on the overall concept of the 1 must do, 5 reductions (1M5R) (in percent), by province, 2024-2025.

The respondents were generally aware of the different aspects of 1M5R. Among those who had heard about the technology, around 94% of them had an idea of the conducive farm conditions where 1M5R is applicable – 62% were slightly aware, and 32% were highly aware (Figure 74). This number dropped to 91% when asked about a particular water management strategy used under the 1M5R – 59% were slightly aware, and 32% were highly aware (Figure 75). Finally, the general awareness rate dropped to 85% when asked about the specific tools and strategies needed to implement the 1M5R – 58% were slightly aware, and 27% were highly aware (Figure 76). Consistently, one-third of the respondents had high awareness of the 1M5Rs, indicating that while access to extension programs, seminars, and other support services may be limited, these are effective in communicating information about the 1M5R to 30% of the population.

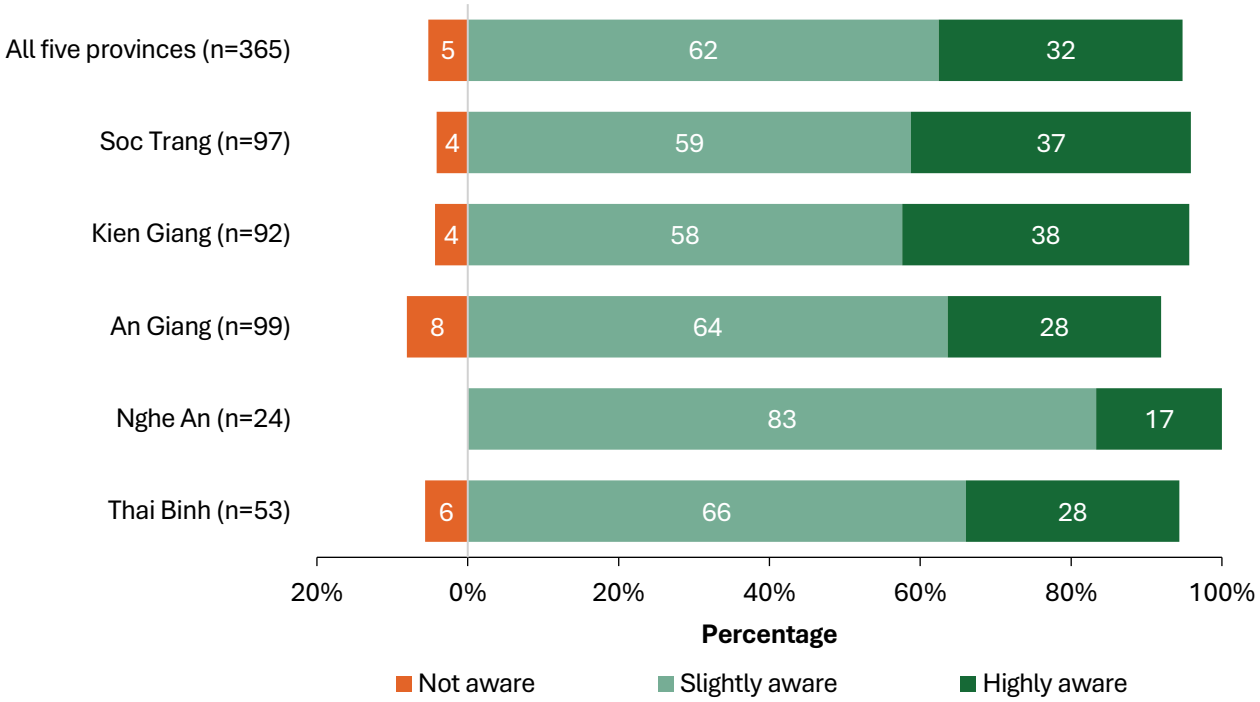


Figure 74. Awareness levels of respondents on the conducive farm conditions where 1M5R is applicable (in percent), by province, 2024-2025.

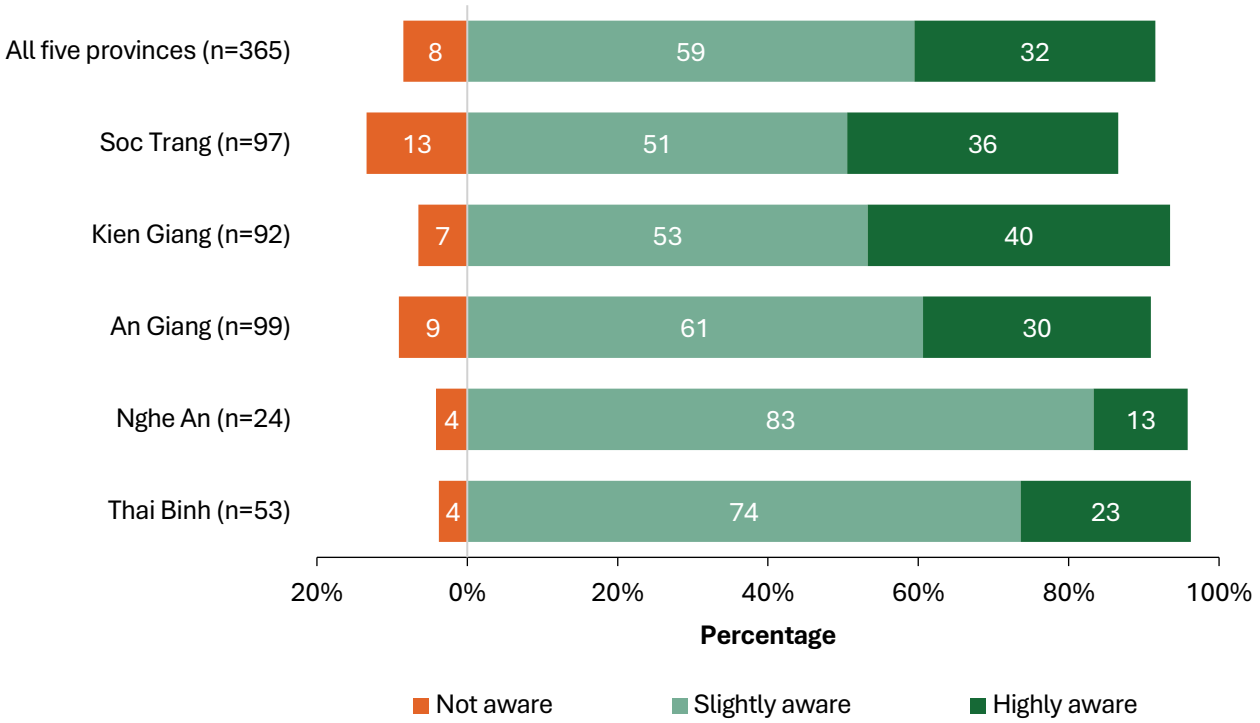


Figure 75. Awareness levels of respondents on the certain water management strategy that needs to be implemented to implement 1M5R (in percent), by province, 2024-2025.

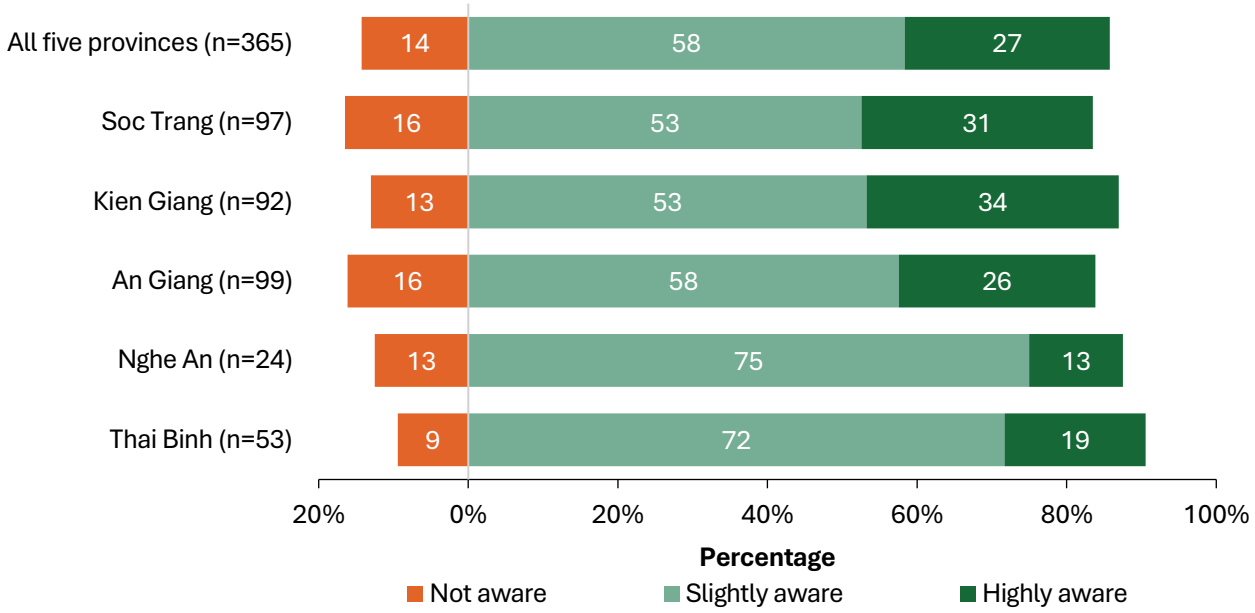


Figure 76. Awareness levels of respondents on the tools and strategies to effectively implement 1M5R (in percent), by province, 2024-2025.

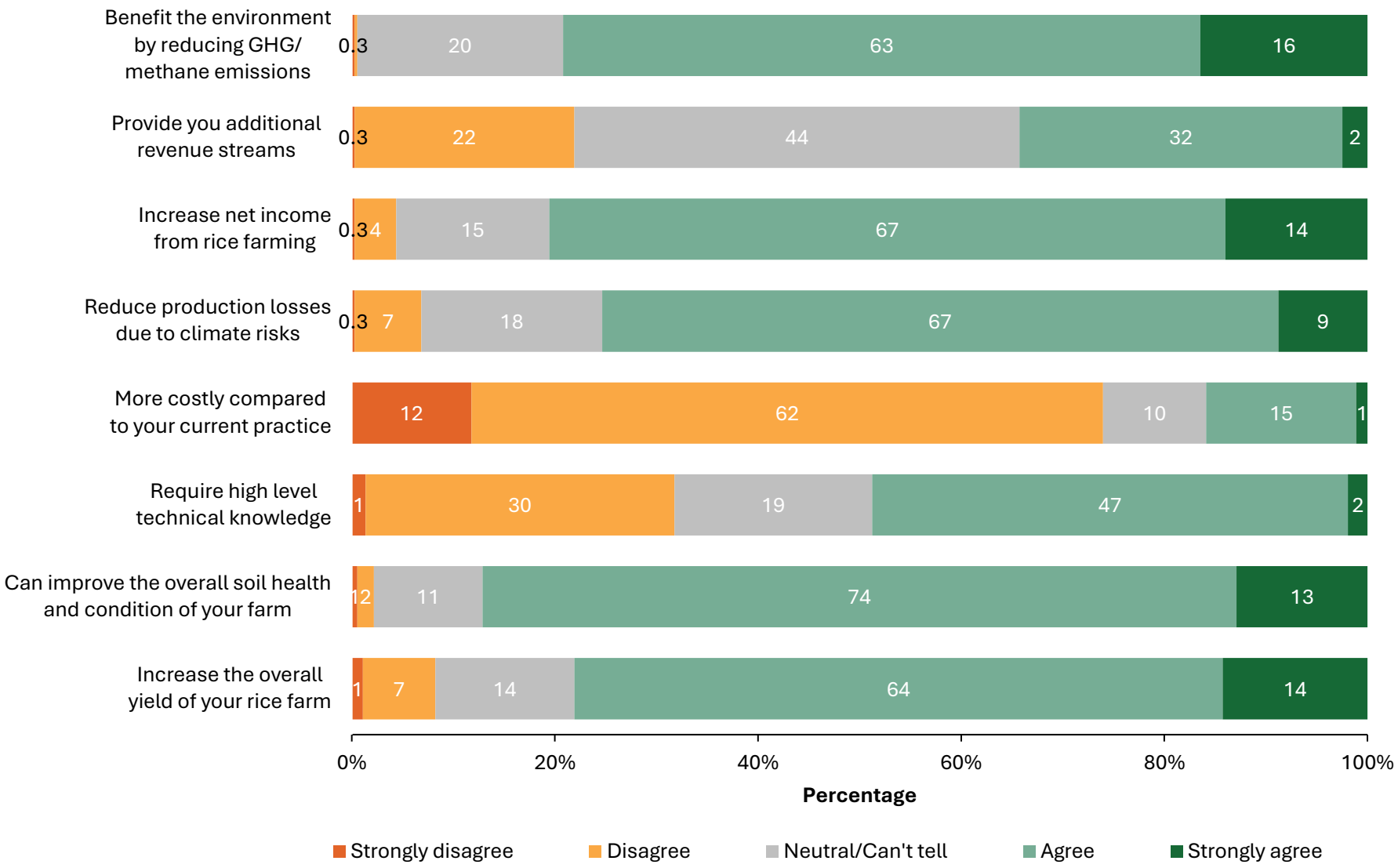
1M5R Perception

Farmers' perception of various statements regarding the 1M5R is illustrated in Figure 77 to Figure 82. Regarding yield improvement, the majority of farmers perceived that 1M5R could increase their farm's overall yield – 64% agreed and 14% strongly agreed with the statement.

Regarding environmental benefits, there was a strong confidence that adopting 1M5R could improve farm soil health and condition (74% agreed and 13% strongly agreed) and reduce methane emissions (63% agreed and 16% strongly agreed). Confidence was also high in Thai Binh, Kien Giang, and Soc Trang, with more than 90% of respondents agreeing or strongly agreeing with the statements. However, respondents from Kien Giang felt more uncertain about these benefits, with 20% answered neutrally, indicating a need to clarify the environmental impact of rice farming in the province.

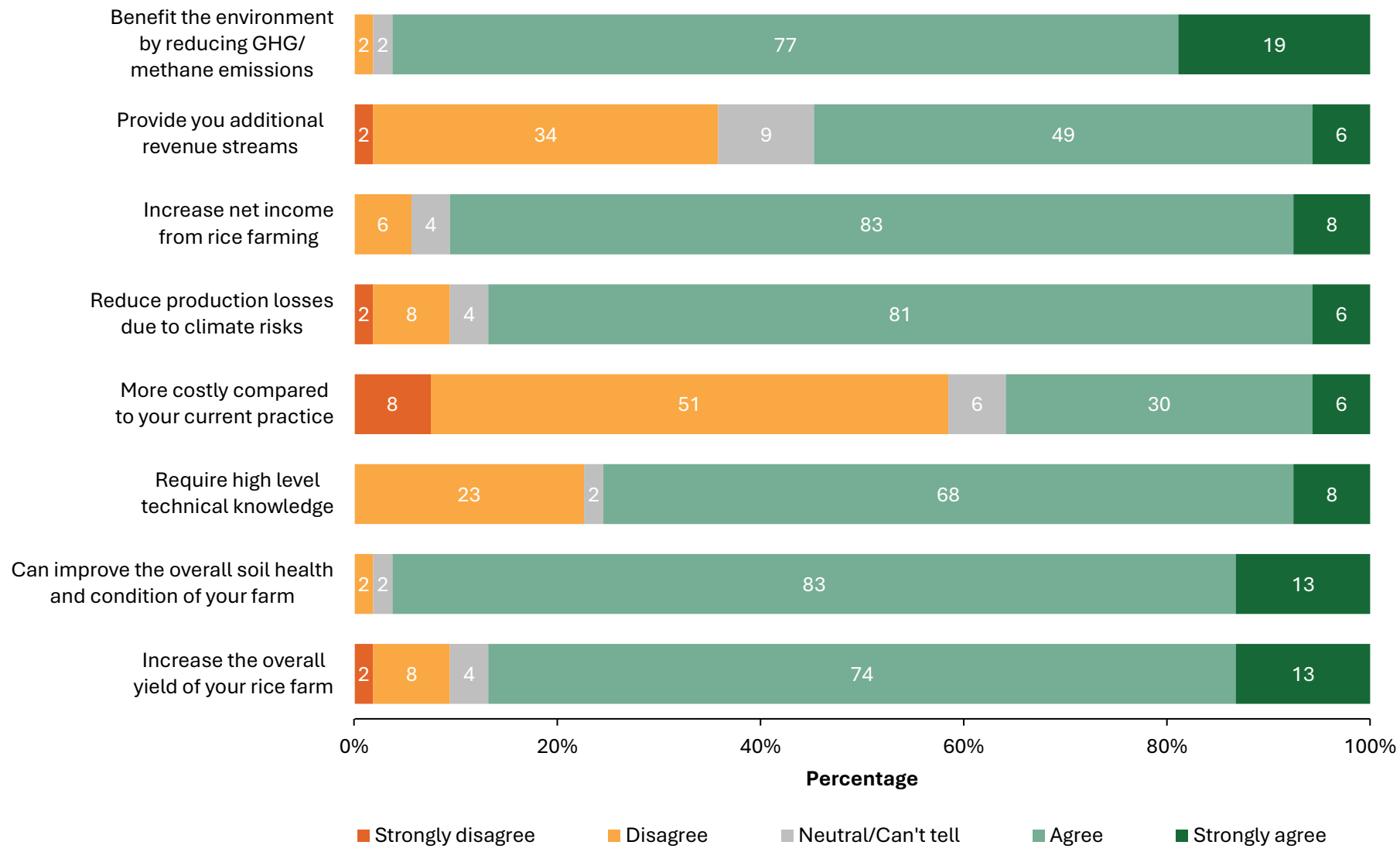
Meanwhile, more than half of the farmers disagreed (62% disagreed and 12% strongly disagreed) that the 1M5R would be more costly compared to their current practice. This was especially evident in An Giang (74%), Kien Giang (86%), and Soc Trang (76%), wherein farmers perceived that the transaction costs associated with shifting behavior would be lower. In terms of the training requirements, 76% of farmers in Thai Binh and 67% in Nghe An perceived that 1M5R adoption would require a high level of technical knowledge, marking a significant barrier to adoption in these two provinces. Interestingly, in terms of 1M5R awareness, Thai Binh had the highest rates, while Nghe An had the lowest rates.

Farmers generally perceived that adopting the 1M5R could also lead to economic benefits such as a reduction in production losses and an increase in net income. More than half of the respondents (76%) believed that 1M5R could reduce production losses associated with climate risks. This was especially high in Thai Binh (87%), but lower in Nghe An (54%). Lastly, farmers in the five provinces generally cannot tell if the 1M5R could provide additional revenue streams to their practice, as 44% of them answered neutrally. In Nghe An, more farmers disagreed that 1M5R could bring in additional revenue. This further indicates a lack of understanding of the benefits of the 1M5R in the region.



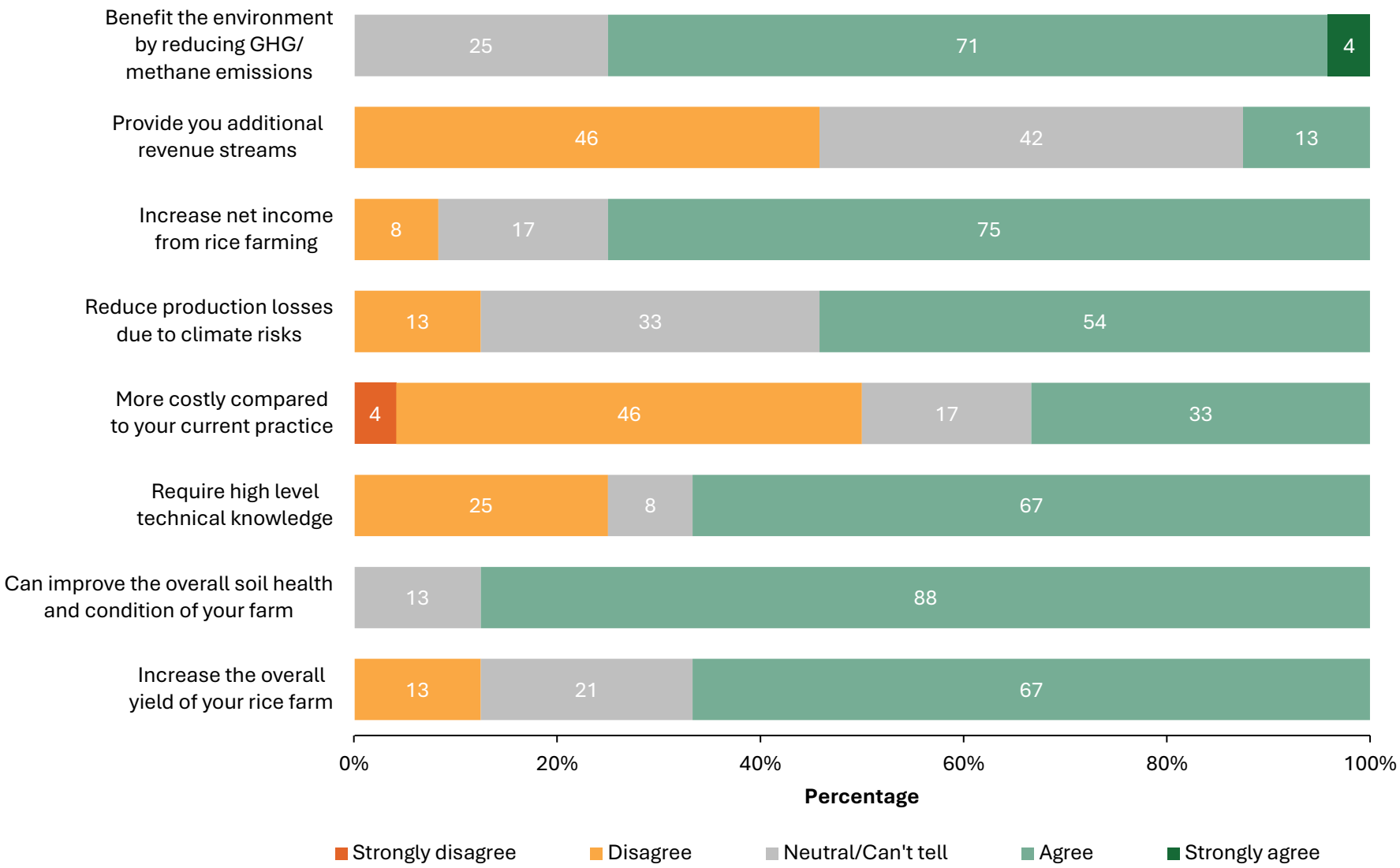
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of 1M5R (n=365).

Figure 77. Respondents' perceptions of 1M5R across multiple indicators (in percent), 2024-2025.



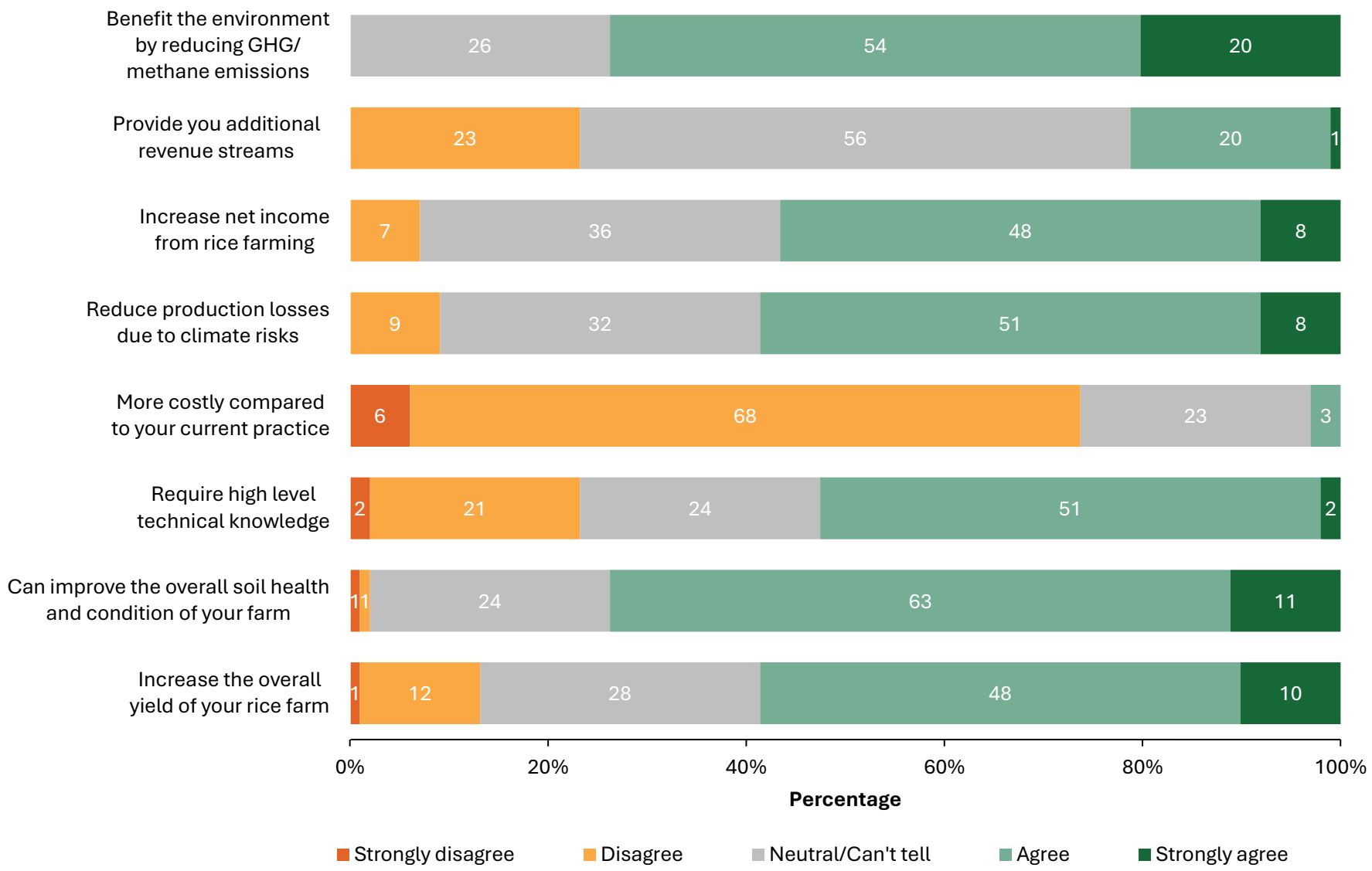
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of 1M5R (n=53).

Figure 78. Respondents' perceptions of 1M5R across multiple indicators (in percent) in Thai Binh, 2024-2025.



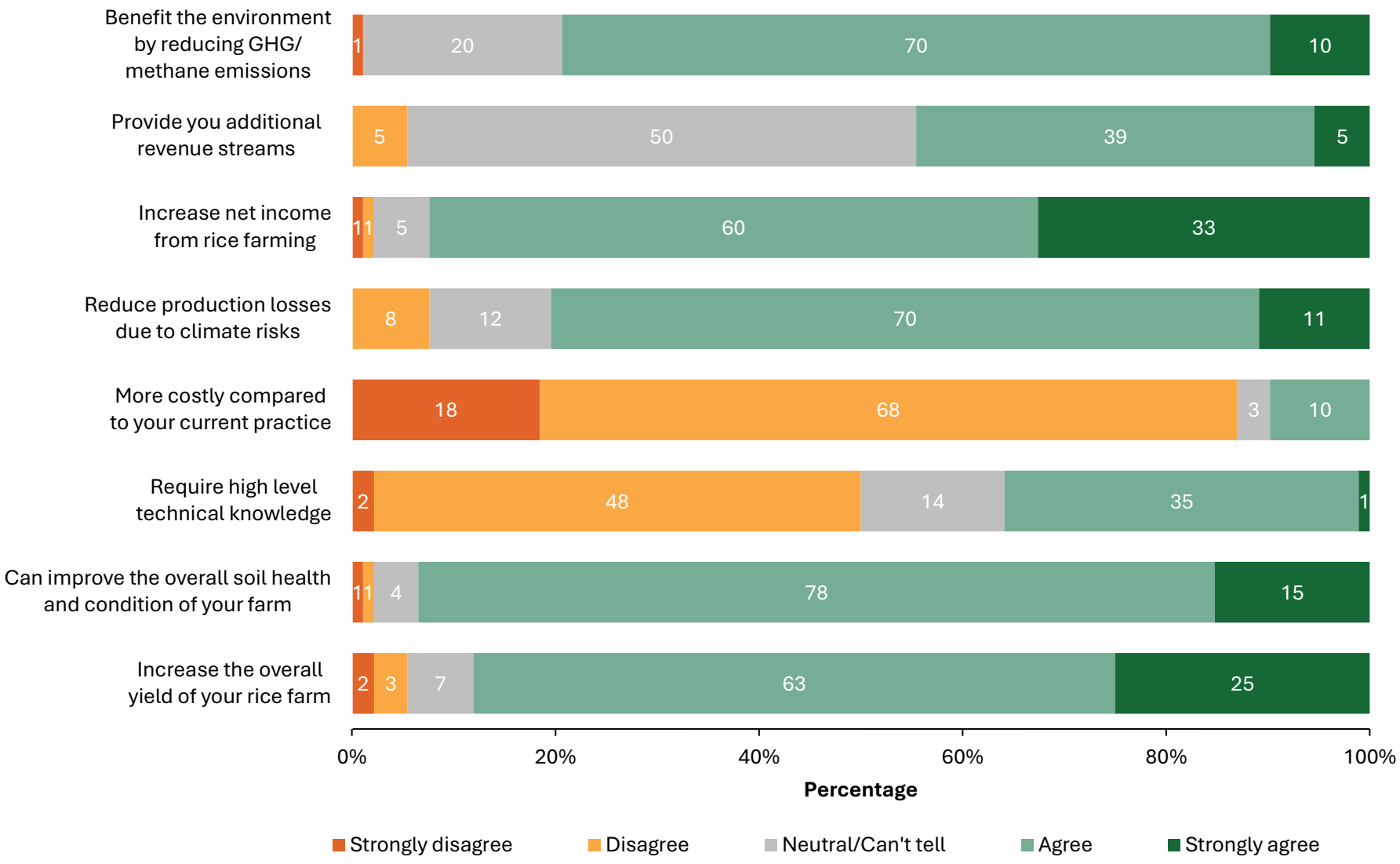
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of 1M5R (n=24).

Figure 79. Respondents' perceptions of 1M5R across multiple indicators (in percent) in Nghe An, 2024-2025.



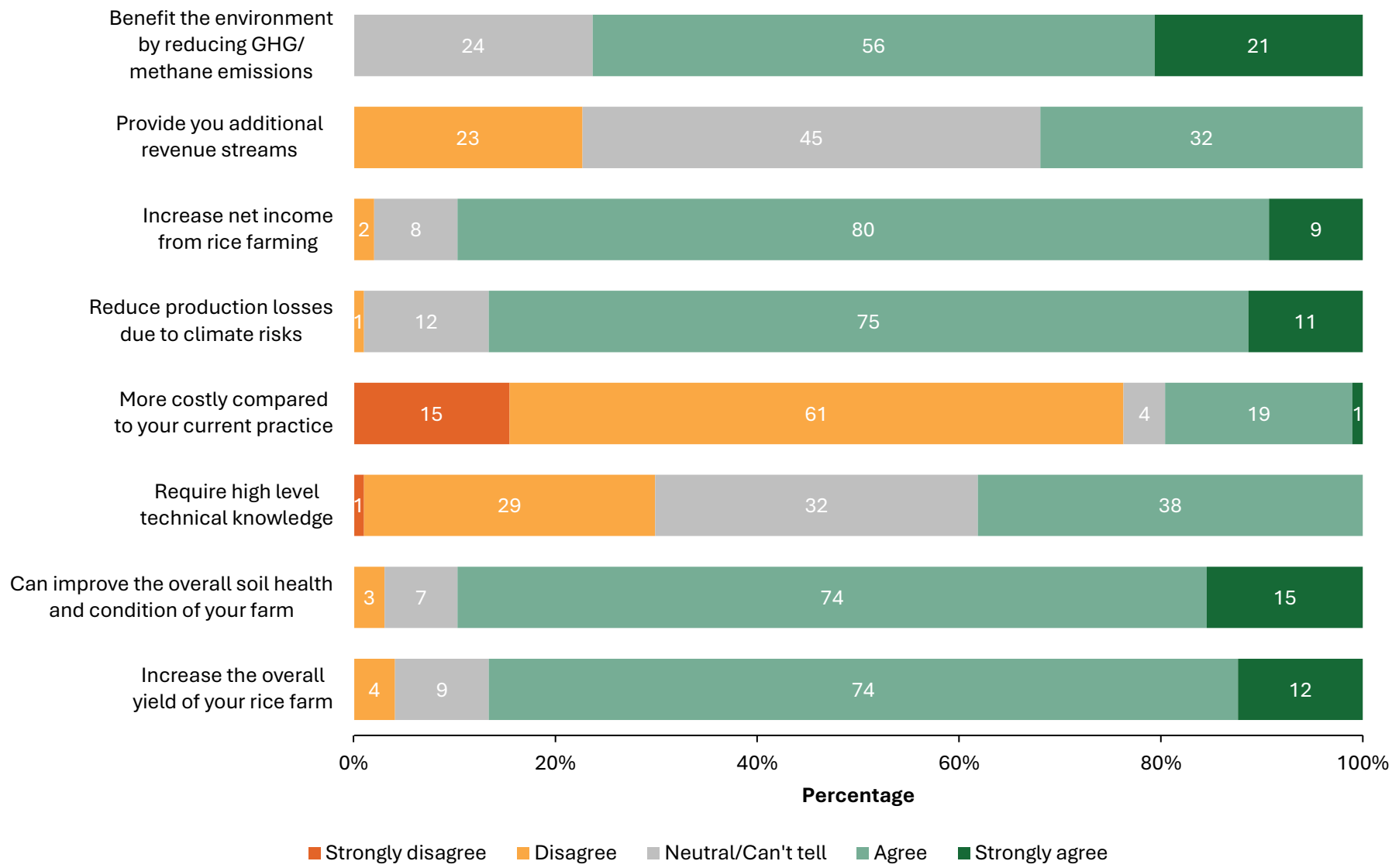
Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of 1M5R (n=99).

Figure 80. Respondents' perceptions of 1M5R across multiple indicators (in percent) in An Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of 1M5R (n=92).

Figure 81. Respondents' perceptions of 1M5R across multiple indicators (in percent) in Kien Giang, 2024-2025.



Note: Sample size was based on the number of respondents who are aware of the overall concept and practice of 1M5R (n=97).

Figure 82. Respondents' perceptions of 1M5R across multiple indicators (in percent) in Soc Trang, 2024-2025.

1M5R Accessibility

As shown in Table 23, information about the 1 Must Do, 5 Reductions (1M5R) was generally disseminated through seminars by relevant institutions (67%) or by agricultural extension workers (50%). Farmers also learned from fellow farmer groups (30%) or self-taught (24%). Particularly in Kien Giang, with 51-60% of the respondents from the province learning about the 1M5R independently. This reveals an opportunity for institutional intervention in the area to promote the 1M5Rs and other technologies.

Only 39% of farmers from all five provinces received support to adopt 1M5R in the last 3 years (Figure 83). Soc Trang (49%) and Thai Binh (40%) have the highest percentages of farmers receiving support among the five provinces, while An Giang (31%) reports the lowest percentage of support access. Conversely, that is 69% of the farmers not receiving support to adopt 1M5R. Overall, more than half of the farmers from each province received insufficient support in implementing the program, indicating a clear support gap in the provinces.

Table 23. Source of information of respondents about 1M5R (in percent), by province, 2024-2025.

Sources of Information	Thai Binh (n=53)	Nghe An (n=24)	An Giang (n=99)	Kien Giang (n=92)	Soc Trang (n=97)	All five provinces (n=365)
Seminars/Trainings of relevant institutions	92	63	64	63	62	67
Extension workers/agricultural technicians	32	67	42	51	64	50
Fellow farmers/groups	11	8	18	60	30	30
Self-taught	6	0	13	51	25	24
Communication materials (flyers, brochures)	28	21	18	24	20	22
Private entities	0	8	11	15	4	8
Government including research/academic institutions	4	8	3	4	4	4
Others: None and not practicing	0	0	2	0	0	1

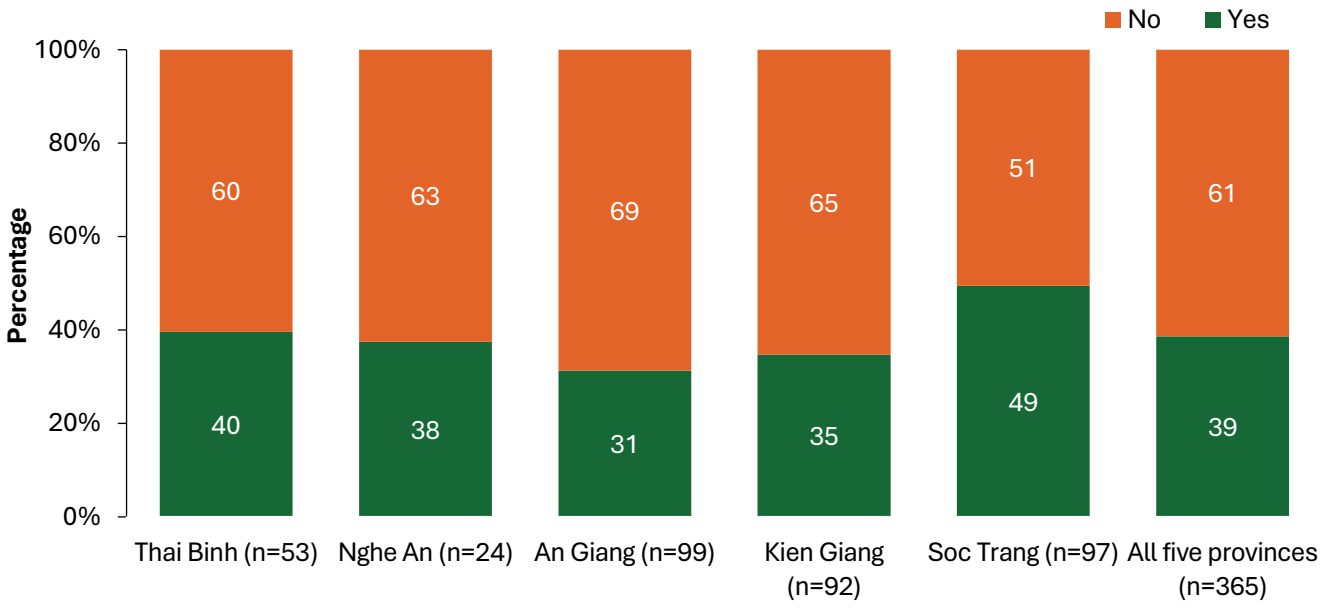


Figure 83. Respondents who received support to adopt 1M5R (in percent), by province, 2022-2024.

Among those farmers who received support for the adoption of 1M5R, 85 % reported having it in the form of training/seminar (Table 24) which conforms with the earlier discussion that most of the farmers became aware of the 1M5R technology through seminars/trainings of relevant institutions. Furthermore, a high percentage of farmers in Thai Binh (95%), An Giang (94%), and Kien Giang (100%) received training/seminars to adopt the technology. Meanwhile, Soc Trang farmers (65%) received capital (in-kind) as a grant. In comparison, only 35% of farmers across the five provinces received this type of support, suggesting that providing physical inputs was also given importance in Soc Trang. Overall, the 1M5R support programs have significantly focused on training/seminars in the last 3 years. As shown in Table 25, the leading provider of these supports across the regions is the national/local government (65%), followed by farmer group/cooperative (member) (33%).

Table 24. Support provided to the respondents for the adoption of 1M5R technology (in percent), 2024-2025.

Kind of support	Thai Binh (n=21)	Nghe An (n=9)	An Giang (n=31)	Kien Giang (n=32)	Soc Trang (n=48)	All five provinces (n=141)
Trainings/Seminars	95	78	94	100	67	85
Capital (in-kind) as grants	33	44	3	22	65	35
Extension service	38	0	0	0	0	6
Machineries, tools and equipment	14	0	0	3	0	3
Networks and markets	5	11	0	3	0	2
Capital (cash) as grants	0	0	3	0	2	1
Capital (credit)	5	0	0	0	0	1
Price premium	0	0	3	0	0	1

Table 25. Provider of support for 1M5R adoption (in percent) mentioned by the respondents, by province, 2024-2025.

Support provider	Thai Binh (n=21)	Nghe An (n=9)	An Giang (n=31)	Kien Giang (n=32)	Soc Trang (n=48)	All five provinces (n=141)
National/Local Government	19	33	87	81	65	65
Research institutes	19	0	0	6	0	4
Farmer group, cooperative (member)	90	22	16	19	31	33
Farmer group, cooperative (non-member)	5	11	3	3	2	4
Private company	0	22	26	28	2	14
NGOs/CSOs	5	11	0	0	2	2
Fellow farmers	0	0	0	6	0	1

3.7. Awareness on and Willingness to Adopt CSA Practices

3.7.1. Willingness to adopt CSA practice

Alternate Wetting and Drying (AWD) Method

Across all provinces, a large majority (81%) of respondents indicated a willingness to adopt or improve AWD practices (Figure 84). This reflects a generally favorable perception among farmers toward AWD adoption, which may be attributed to the fact that a majority of them believed the practice offers both economic and environmental benefits, as discussed in Section 3.6.1. The provinces in the Mekong Delta River – Soc Trang (92%), Kien Giang (91%), and An Giang (87%) – demonstrated the highest willingness to adopt the technique (Figure 85). Notably, the primary providers of support in these provinces were national and local government agencies. In contrast, Nghe An (53%) and Thai Binh (83%) showed relatively lower levels of willingness, with Nghe An having the highest proportion of undecided farmers (20%).

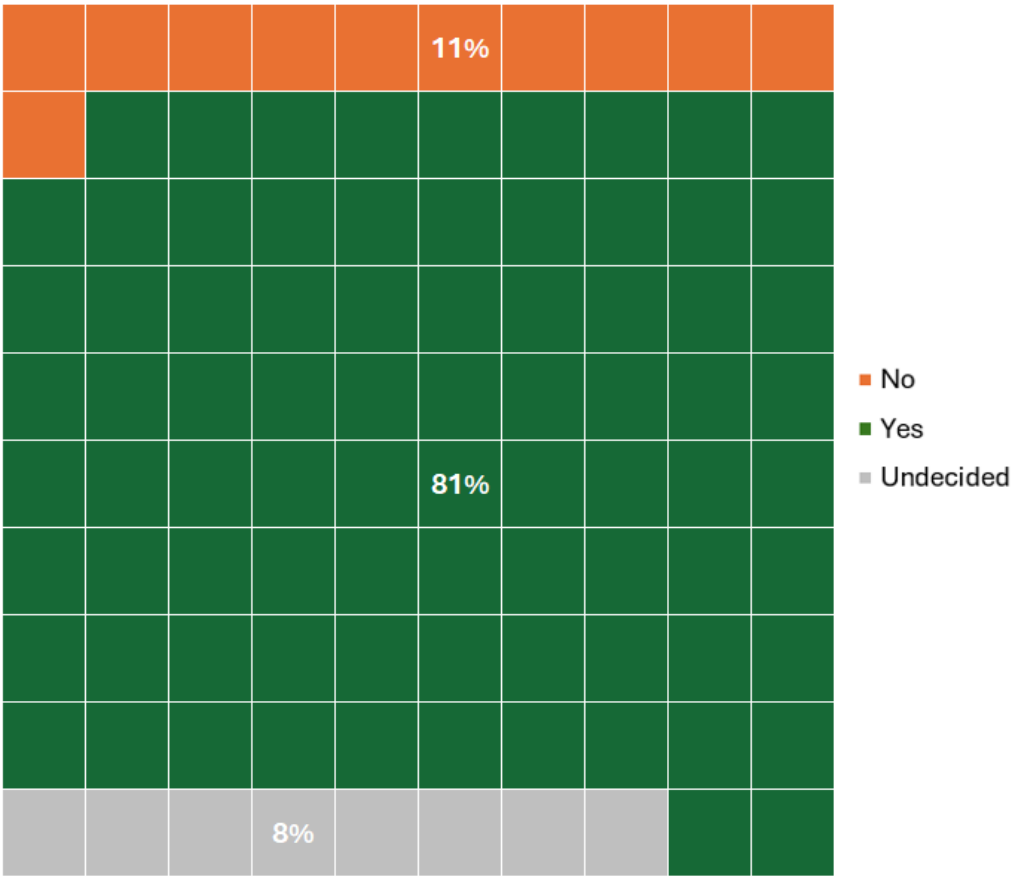


Figure 84. Distribution of the respondents based on their willingness to adopt AWD or improve their practice to align with the CSA technique (in percent), 2024-2025.

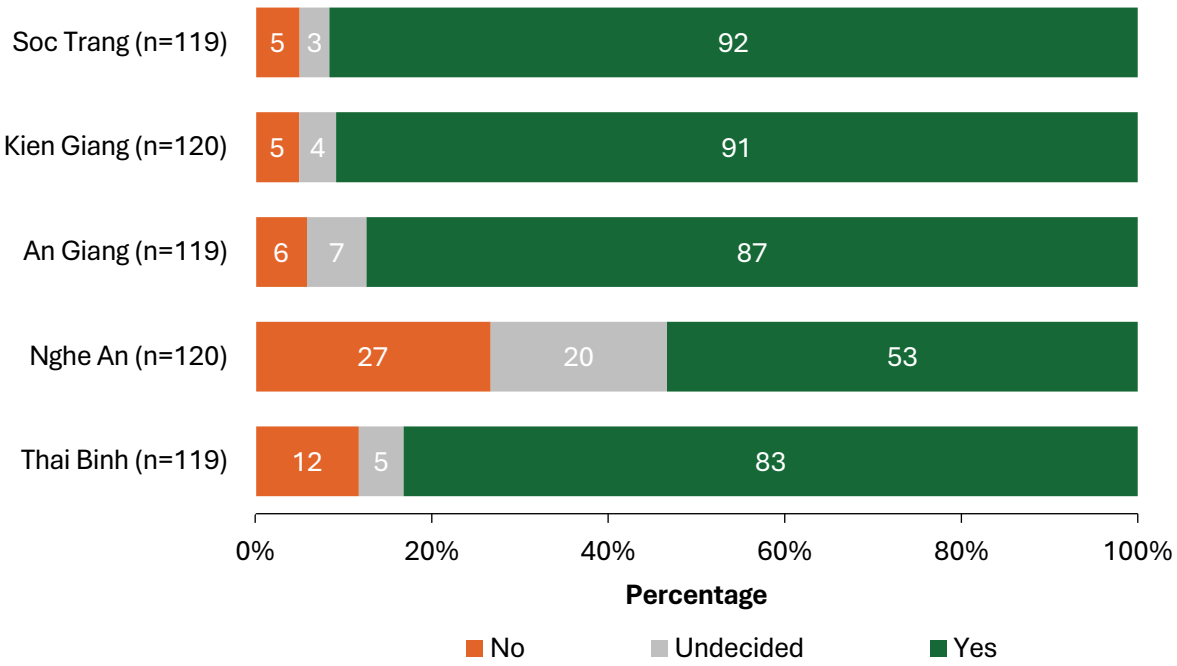


Figure 85. Distribution of the respondents based on their willingness to adopt AWD or improve their practice to align with the CSA technique (in percent), by province, 2024-2025.

The potential increases in yield (64%) and income (61%) were the most cited motivator for adopting AWD (Table 26). This highlights that economic incentives are essential drivers for behavioral change in agricultural practices. The high percentages observed in Kien Giang and Soc Trang align with the findings on farmers' perception levels, where the majority agreed or strongly agreed that AWD could lead to these benefits. This further implies the confidence of the farmers in this technology.

Table 26. Cited reasons of the respondents to adopt AWD (in percent), by province, 2024-2025.

Reason	Thai Binh (n=99)	Nghe An (n=64)	An Giang (n=104)	Kien Giang (n=109)	Soc Trang (n=109)	All five provinces (n=485)
To increase yield	60	55	48	79	74	64
To increase income	58	53	47	72	71	61
To reduce losses due to climate risks	48	56	56	57	66	57
To improve soil and farm conditions	51	48	29	50	67	49
To help environment/reduce agricultural pollution	0	0	1	0	0	0.2
To cut costs and lower expenses	2	0	2	4	0	2
Others	2	0	9	4	0	3

Another significant motivator was the potential of AWD to mitigate climate-related losses (57%) in rice production. The percentage of farmers who cited this reason varied moderately across provinces, with 48% in Thai Binh to 66% in Soc Trang. This suggests that farmers are becoming increasingly aware of climate-related issues that impact their production, such as flooding and drought. Hence, they are willing to adopt practices that can help reduce their vulnerability and enhance resilience to these challenges. Another significant reason was the benefits of the technology to the soil and farm condition (49%) – although only 29% of farmers in An Giang mentioned this reason. This highlights that, aside from the economic benefits, the farmers were now also considering the environmental and agronomic benefits of a practice.

On the other hand, as shown in Table 27, the primary barriers cited by farmers were limited technical knowledge (36%) and dissatisfaction with their current practices (31%). Hence, one of the leading solutions was the consistent provision of technical guidance and training (42%) (Table 28). In addition, another significant barrier was the farmers' hesitancy to adopt alone (15%); thus, they mentioned a need for widespread information dissemination to encourage their fellow farmers (36%) and the establishment of experimental sites (28%). Also, 13% reported a lack of available machinery and equipment, as well as the additional costs to be incurred, as barriers to adoption. The farmers cited a need for available machinery and equipment (19%) and compensation for the additional costs incurred in adoption (19%).

Table 27. Reasons for the respondents' hesitation to adopt AWD (in percent), by province, 2024-2025.

Adoption Barriers	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Limited technical know-how	29	57	24	33	35	36
Satisfied with the current rice farming technology/practice being adopted	33	26	40	30	24	31
Not practiced by fellow farmers in the community	24	14	18	4	13	15
Lack of available machinery/equipment required	6	12	12	18	20	13
Additional costs to be incurred	13	12	14	11	13	13
Lack of appropriate available and affordable inputs (other than fertilizers)	8	12	5	18	8	10

Table 28. Solutions to the barriers cited by farmers in adopting or continuing the adoption of AWD (in percent), by province, 2024-2025.

Solutions	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Consistent provision of technical guidance and trainings	35	60	24	45	45	42
Wide information dissemination to encourage fellow farmers	40	30	28	39	43	36
Experiment sites established in the community for learning	32	33	21	29	24	28
Access to required machineries/equipment	5	22	13	24	30	19
Compensation for additional costs to be incurred	21	23	23	12	15	19
Discounts/subsidies for fertilizers	14	11	8	23	31	18
Discounts/subsidies for seeds and pesticides	11	8	10	21	34	17
None	20	15	17	12	2	13

Direct Seeded Rice (DSR)

A significant proportion (79%) of the farmers expressed willingness to adopt DSR, suggesting that, similar to AWD, farmers also have positive views on this technology (Figure 86). However, there were notable differences in the willingness of farmers across provinces. Nghe An (90%), Kien Giang (85%), and Soc Trang (83%) reported a higher proportion of willing farmers compared to the other two provinces (Figure 87). Whereas the highest percentage of unwilling farmers was in Thai Binh (34%), possibly due to their relatively low perception of the practice's potential benefits.

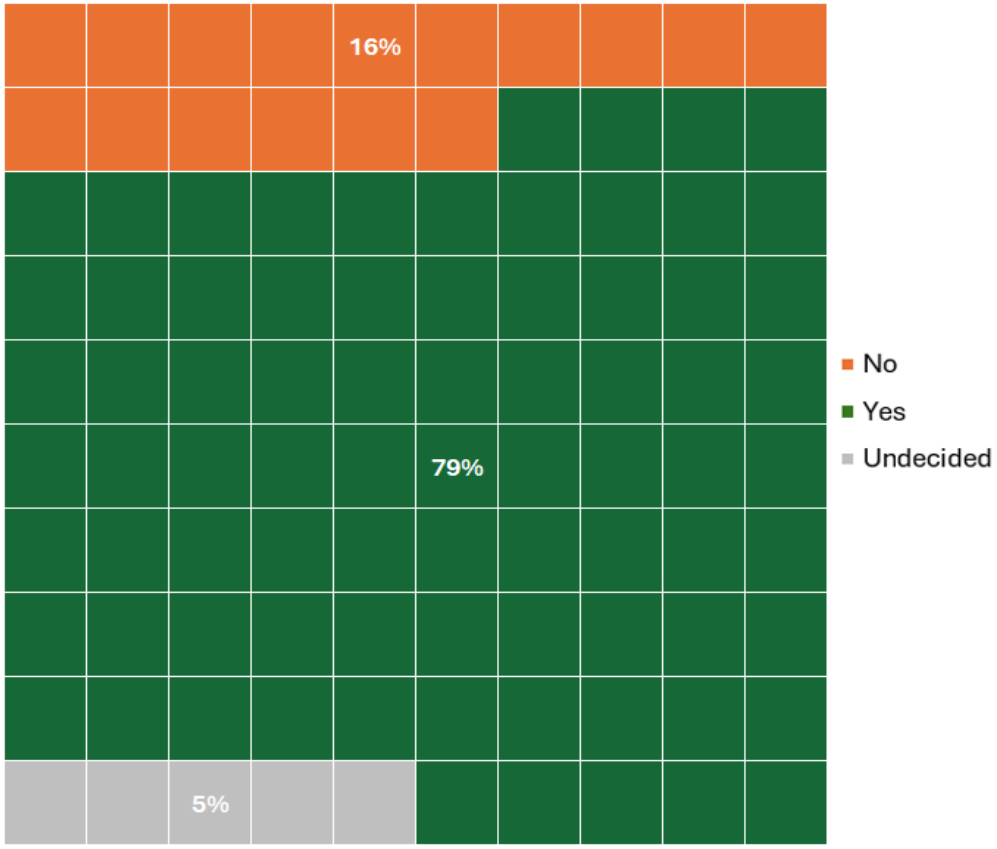


Figure 86. Distribution of the respondents based on their willingness to adopt DSR or improve their practice to align with the CSA technique (in percent), 2024-2025.

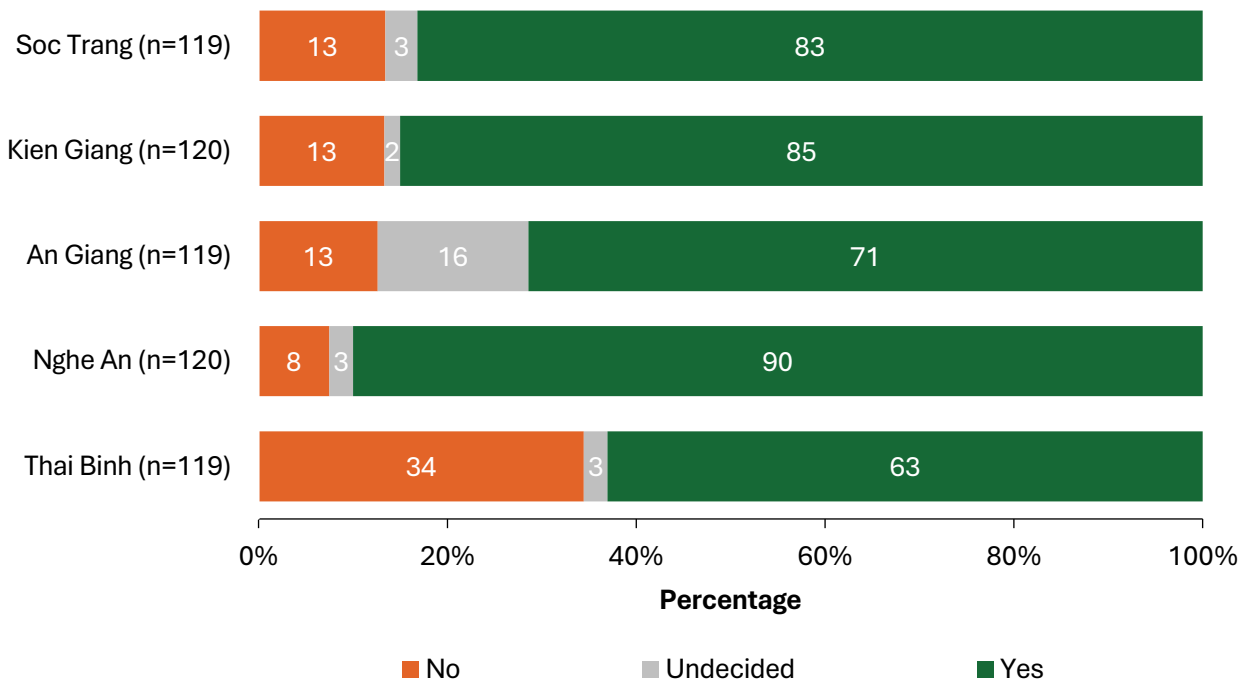


Figure 87. Distribution of the respondents based on their willingness to adopt DSR or improve their practice to align with the CSA technique (in percent), by province, 2024-2025.

Based in Table 29, among the farmers willing to adopt, the two main reasons were consistent with those cited for AWD adoption — to increase yield (68%) and to increase income (68%). This suggests that farmers also perceive DSR as a practice with the potential to deliver economic benefits. Other significant motivators cited included the potential to reduce climate-related losses (39%), particularly in Soc Trang (68%), and the improvement of soil health and overall farm sustainability (39%), with Soc Trang again reporting the highest proportion at 69%. Furthermore, highlighting the potential environmental benefits could also encourage adoption among farmers.

Table 29. Cited reasons of the respondents to adopt DSR (in percent), by province, 2024-2025.

Reasons to adopt	Thai Binh (n=75)	Nghe An (n=108)	An Giang (n=85)	Kien Giang (n=102)	Soc Trang (n=99)	All five provinces (n=469)
To increase yield	71	73	47	65	83	68
To increase income	67	57	49	71	92	68
To reduce losses due to climate risks	25	29	34	35	68	39
To improve soil and farm conditions	29	34	14	42	69	39
To help environment/reduce agricultural pollution	0	0	1	0	0	0.2
To cut costs and lower expenses	4	13	2	5	2	6
Others	1	1	1	13	1	4

On the other hand, the farmers were also asked about the key barriers to DSR adoption and the proposed solutions. Similar to the AWD adoption, the main barrier cited was still the limited technical knowledge (31%) of the farmers (Table 30). This suggests that farmers lacked the confidence to implement the technology effectively. Hence, regular delivery of technical assistance and training sessions (39%) and the expansion of information dissemination (34%) were the top solutions mentioned (Table 31). In addition, since the availability of the necessary machinery and equipment (26%) was also considered a challenge, 30% of the farmers emphasized the importance of having access to such resources. Other barriers included financial constraints or the incurred costs of adoption (19%) and the lack of appropriate, available, and affordable inputs (13%). In response to these challenges, farmers proposed support mechanisms such as discounts or subsidies for inputs like seeds and pesticides (21%), as well as compensation to help them cover the additional costs incurred (20%).

Table 30. Top barriers cited by respondents in adopting or continuing the adoption of DSR (in percent), by province, 2024-2025.

Barriers	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Limited technical know-how	22	40	18	33	44	31
Lack of available machinery/equipment required	9	40	20	20	41	26
Satisfied with the current rice farming technology/practice being adopted	13	27	23	32	14	22
Additional costs to be incurred	19	27	23	13	12	19
Not practiced by fellow farmers in the community	34	8	13	8	13	15
Lack of appropriate available and affordable inputs (other than fertilizers)	6	18	5	14	24	13

Table 31. Top solutions to the barriers cited by respondents in adopting or continuing the adoption of DSR (in percent), by province, 2024-2025.

Solutions	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Consistent provision of technical guidance and trainings	29	48	19	44	53	39
Wide information dissemination to encourage fellow farmers	38	24	28	38	41	34
Access to required machinery/equipment	13	46	23	26	42	30
Experiment sites established in the community for learning	29	28	25	28	29	28
Discounts/subsidies for fertilizers	14	20	6	23	44	21
Discounts/subsidies for seeds and pesticides	10	24	9	21	42	21
Compensation for additional costs to be incurred	25	28	22	14	12	20

Rice Straw Management (RSM)

The data from Figure 88, reveals a strong overall willingness among farmers across all five provinces to adopt or improve their rice straw management (RSM) practices in alignment with climate-smart agriculture (CSA) techniques. The majority (82%) of them indicated willingness, which was higher than that observed for AWD and DSR. Moreover, unlike the previous CSA technologies, there was relatively slight variation in the proportion of willing farmers across provinces, ranging from 76% in An Giang to 93% in Soc Trang (Figure 89). This indicates the farmers' openness to adopting RSM in their rice production.

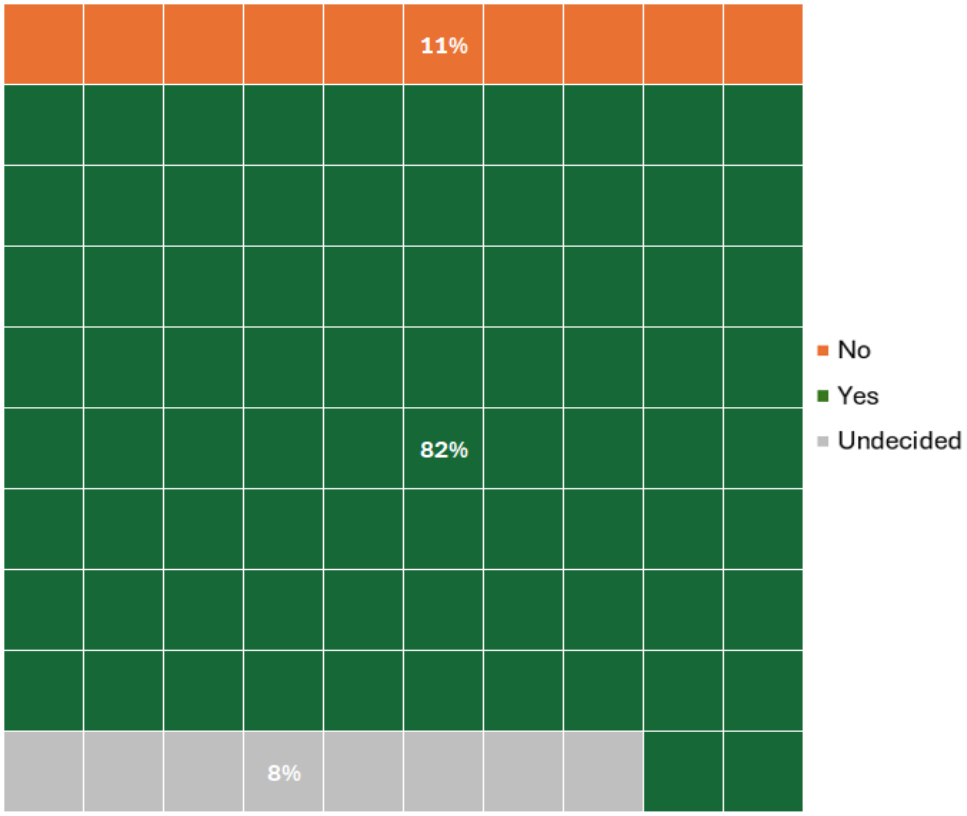


Figure 88. Distribution of the respondents based on their willingness to adopt RSM or improve their practice to align with the CSA technique (in percent), 2024-2025.

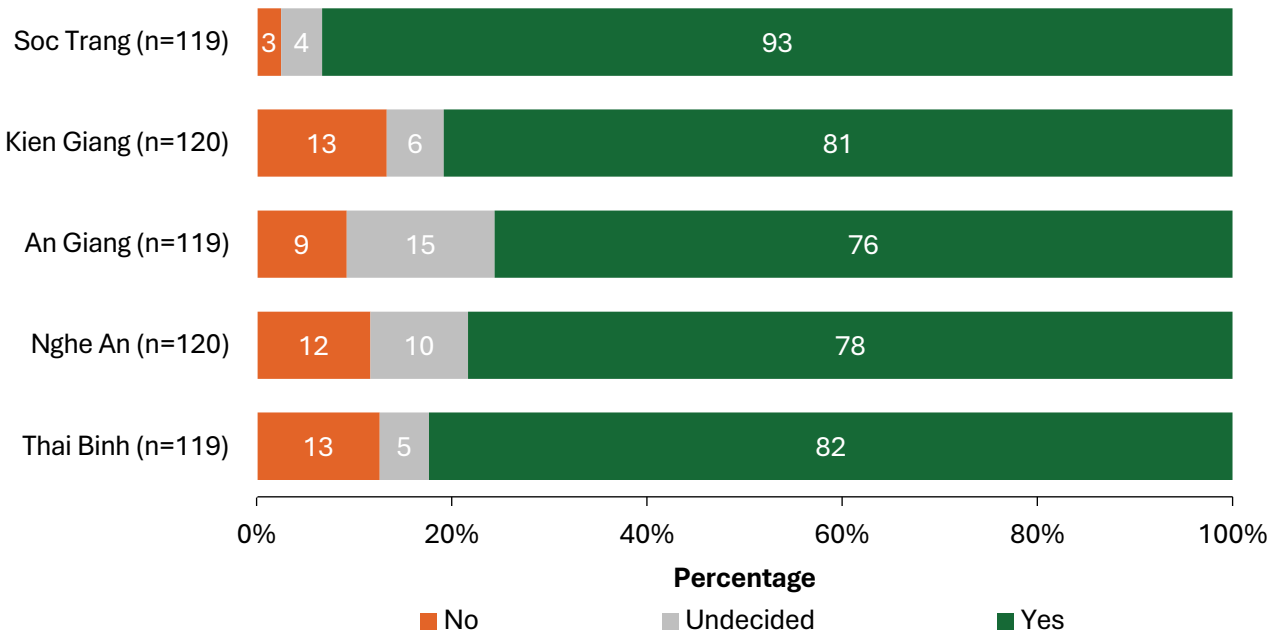


Figure 89. Distribution of the respondents based on their willingness to adopt RSM or improve their practice to align with the CSA technique (in percent), by province, 2024-2025.

Moreover, improvement of the soil and their farm (71%) was the predominant reason for the farmers' willingness to adopt (Table 32). This implies that the farmers perceived the agronomic benefits of rice straw management, with the majority being aware or strongly aware of these benefits. Additionally, 59% of the farmers cited an increase in income and yield (37%) as their primary motivation for adoption. Another significant reason was the potential of RSM to reduce production losses due to climate risks (29%).

Table 32. Cited reasons of the respondents to adopt RSM (in percent), by province, 2024-2025.

Reasons to adopt	Thai Binh (n=98)	Nghe An (n=94)	An Giang (n=90)	Kien Giang (n=97)	Soc Trang (n=111)	All five (n=490) provinces
To increase yield	48	39	22	26	49	37
To increase income	49	50	48	67	76	59
To reduce losses due to climate risks	23	28	39	23	33	29
To improve soil and farm conditions	73	65	72	78	68	71
To help environment/reduce agricultural pollution	2	0	0	2	0	1
To cut costs and lower expenses	5	0	0	0	0	1

Meanwhile, the reported barriers for adoption were similar to the other CSA practices as shown in Table 33. Hence, to encourage farmers and strengthen their confidence in adopting these CSA practices, awareness campaigns should be expanded, and information dissemination efforts must be extended to reach areas with low awareness and limited technical skills. Partnership among stakeholders must be strengthened to provide farmers with the necessary support which includes technical knowledge, material and financial incentives.

Table 33. Reasons for the hesitation of the respondents in adopting or continuing the adoption of RSM (in percent), by province, 2024-2025.

Barriers	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Limited technical know-how	26	45	18	33	47	34
Lack of available machinery/equipment required	3	11	21	63	51	30
Additional costs to be incurred	28	23	39	18	19	25
Not practiced by fellow farmers in the community	34	20	27	12	17	22
Satisfied with the current rice farming technology/practice being adopted	29	24	18	13	11	19

Specifically, 38% and 36% of farmers cited that wider information dissemination and continuous training programs are needed to promote rice straw management (Table 34). Farmers also suggested that they would need access to the machinery needed to implement RSM (33%). In addition, 27% of farmers indicated that they would need compensation for the additional costs for collecting, and processing rice straw, and that experiment sites should be established to demonstrate proof of RSM's feasibility and economic benefits.

Table 34. Top solutions to the barriers cited by respondents in adopting or continuing the adoption of RSM (in percent), by province, 2024-2025.

Solutions	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Wide information dissemination to encourage fellow farmers	39	39	37	32	44	38
Consistent provision of technical guidance and trainings	27	47	18	41	48	36
Access to required machinery/equipment	7	19	24	59	55	33
Compensation for additional costs to be incurred	35	34	33	13	20	27
Experiment sites established in the community for learning	28	23	13	33	36	27

Sustainable Rice Platform (SRP) Standard

Figure 90 presents the willingness of farmers to adopt the Sustainable Rice Platform (SRP) standard. Around half (51%) expressed their willingness to align their practices to the SRP standard. Meanwhile, about one-third (32%) indicated lack of interest, while 17% remained undecided. Across provinces, Thai Binh farmers showed the highest inclination (72%) towards adopting SRP standards, followed by Soc Trang (55%) and Kien Giang (53%) (Figure 91). In An Giang, the majority of farmers were split between being uncertain (40%) and willing to adopt the standards (43%). Notably, in Nghe An, there was no predominant viewpoint, with the responses equally (33%) among willingness, disinterest, and indecision.

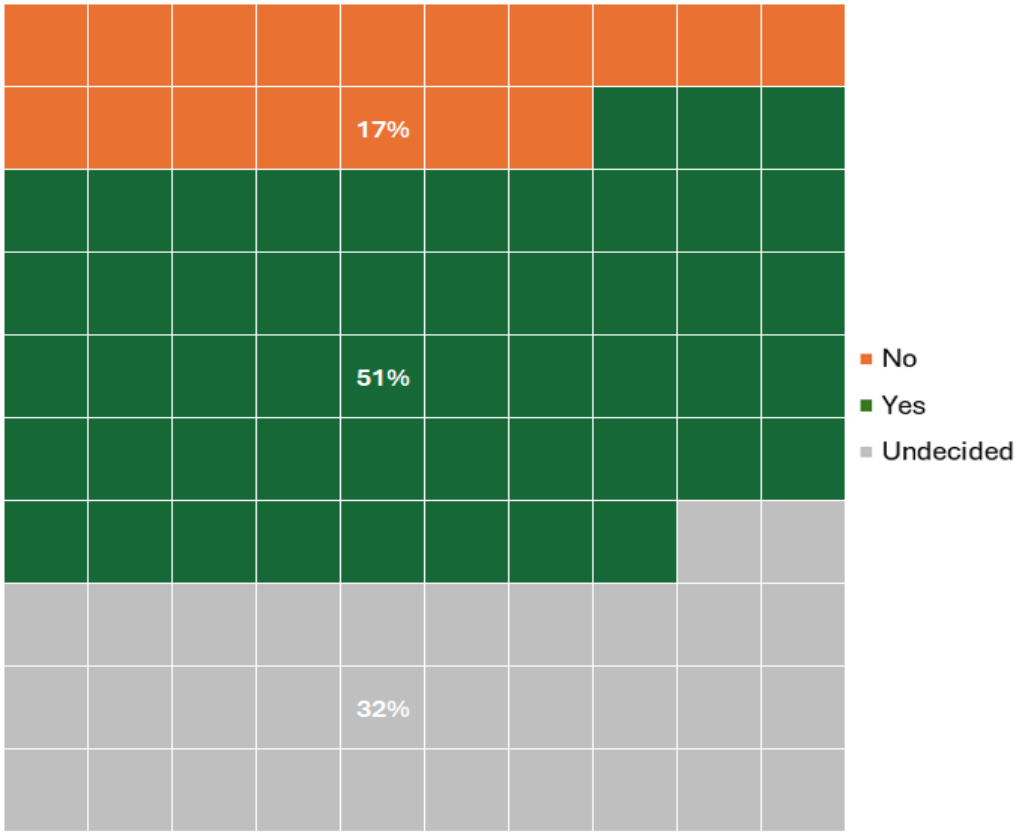


Figure 90. Distribution of respondents based on their willingness to adopt the Sustainable Rice Platform (SRP) Standard or improve their practice to better align with the CSA technique (in percent), 2024-2025.

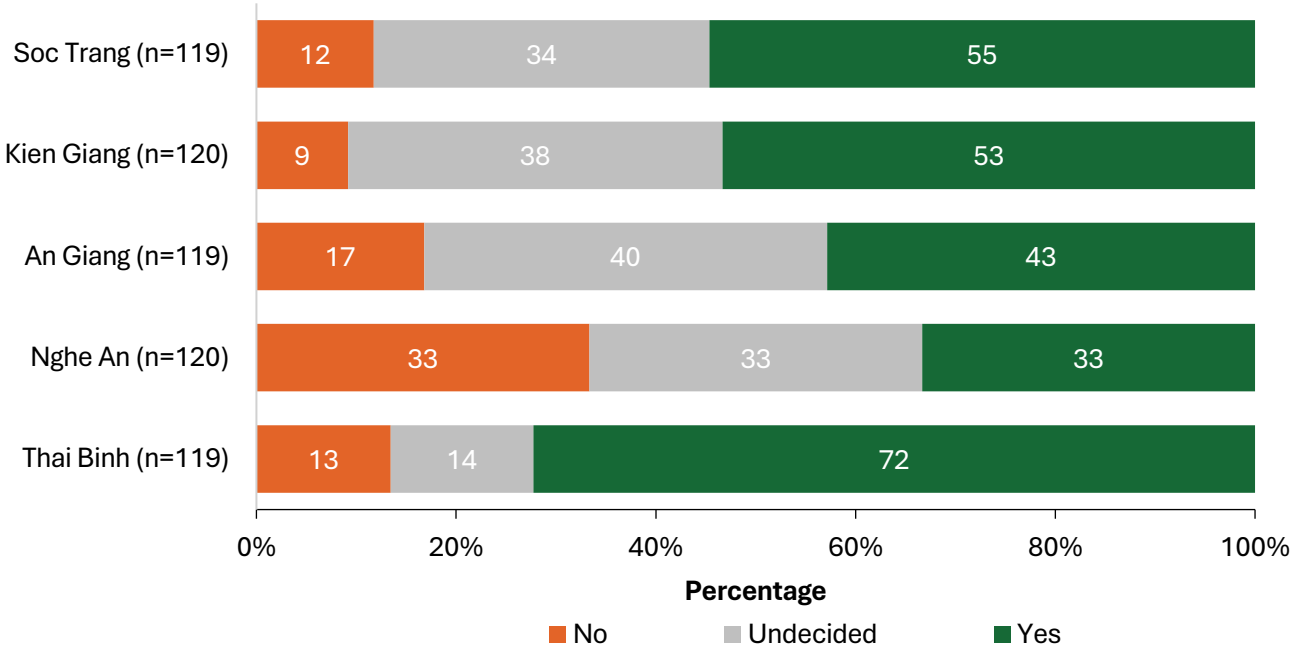


Figure 91. Distribution of respondents based on their willingness to adopt the Sustainable Rice Platform (SRP) Standard or improve their practice to better align with the CSA technique (in percent), by province, 2024-2025.

For the farmers who were willing to adopt SRP standards, their reasons are summarized in Table 35. The majority of farmers mentioned that improving income from rice cultivation (79%) and increasing rice yield (76%) as their primary motivation. Many farmers (65%) also indicated that the adoption of SRP standards could enhance their soil and overall farm conditions, a reason particularly evident in An Giang, where the majority of farmers (63%) cited this reason. Additionally, 47% of farmers acknowledged that SRP standards could contribute to reducing losses from climate risks.

Table 35. Cited reasons of the respondents to adopt SRP (in percent), by province, 2024-2025.

Reasons	Thai Binh (n=86)	Nghe An (n=40)	An Giang (n=51)	Kien Giang (n=64)	Soc Trang (n=65)	All five provinces (n=306)
To increase yield	72	90	49	88	83	76
To increase income	78	88	61	88	80	79
To reduce losses due to climate risks	35	25	55	56	63	47
To improve soil and farm conditions	56	70	63	66	74	65
To help environment/reduce agricultural pollution	0	3	0	0	0	0.3
To cut costs and lower expenses	2	0	0	2	0	1
Others	0	0	2	2	0	1

The farmers' perceptions that SRP standards may potentially increase income and yield suggest that the majority's motivations are driven by economic returns. Also, the perception that SRP standards can improve soil health and farm conditions indicate that the farmers may have awareness on SRP's long-term benefits, Moreover, the recognition of SRP in mitigating climate risks highlights the importance of promoting these standards as a strategy to climate mitigation. These highlight the need for targeted support and education to maximize the adoption and benefits of SRP standards, ultimately contributing to more sustainable and resilient rice farming practices.

For the farmers who were hesitant to adopt SRP standards, their reasons are provided in Table 36. Across provinces, the majority (64%) cited limited technical knowledge and skills as a barrier to adoption. In Thai Binh, 45% of farmers mentioned that their reluctance was due to the lack of other farmers practicing SRP standard in their community. In An Giang, 30% of farmers expressed reservations due to the unguaranteed benefits in terms of yield and income. These reasons for hesitation in adopting SRP standards underscore the need for comprehensive capacity building programs. The reluctance in Thai Binh, came from the lack of community practices, suggests the importance of peer learning and demonstration projects to build confidence and showcase successful implementations. In An Giang, the reservations about unguaranteed benefits highlight the necessity for clear communication of the potential economic advantages and risk mitigation strategies associated with SRP standards.

Table 36. Reasons for the hesitation of the respondents to adopt SRP Standard (in percent), by province, 2024-2025.

Reason	Thai Binh (n=33)	Nghe An (n=80)	An Giang (n=68)	Kien Giang (n=56)	Soc Trang (n=54)	All five provinces (n=291)
Limited technical know-how	43	83	54	73	68	64
Not practiced by fellow farmers in the community	45	22	29	16	13	25
Yield and income advantage not guaranteed	16	22	30	15	13	19
Additional costs to be incurred	24	22	12	18	18	19
Satisfied with the current rice farming technology/practice being adopted	24	21	11	11	18	17

Table 37 presents the suggested solutions by farmers to address the barriers to adopting SRP standards. The majority of farmers (65%) emphasized the need for consistent provision of technical guidance and training. Nearly half of the farmers suggested that the establishment of community-level experiment sites (48%) and wide information dissemination (47%) could encourage fellow farmers to adopt SRP standards. Notably, in Nghe An, economic incentives appear to be a significant factor, with farmers citing compensation for additional incurred costs (37%), discounts or subsidies for seeds and pesticides (37%), and fertilizers (34%).

Table 37. Top cited solutions to overcome barriers for adopting the SRP Standard (in percent), by province, 2024-2025.

Solutions	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Consistent provision of technical guidance and trainings	44	89	47	73	71	65
Experiment sites established in the community for learning	41	53	39	58	50	48
Wide information dissemination to encourage fellow farmers	55	53	42	38	45	47
Compensation for additional costs to be incurred	31	37	15	21	24	25
Discounts/subsidies for seeds and pesticides	15	37	9	22	35	24
Discounts/subsidies for fertilizers	18	34	8	20	34	23

The suggested solutions highlight the role of technical support and community engagement in promoting SRP standards. Consistent guidance and training can bridge the knowledge gap and build farmers' confidence. Establishing experiment sites and disseminating information can create a supportive environment for peer learning and demonstration of successful implementations. The emphasis on economic incentives in Nghe An underscores the need for financial support mechanisms to offset additional costs and make adoption more feasible. These insights suggest that various approaches, combining technical, community, and economic support, are essential for overcoming barriers and fostering widespread adoption of SRP standards.

1 Must do, 5 Reductions (1M5R)

For 1M5R (1 Must Do, 5 Reductions), which is a package of practices, 78% expressed willingness to adopt (Figure 89). Nghe An was lowest at 50% probably due to lack of exposure (Figure 90). Meanwhile, Mekong provinces, where 1M5R has been promoted, showed strong interest — 85% in Kien Giang and 94% in Soc Trang. Thai Binh also showed a high willingness to adopt at 82%, indicating that if informed, they would be open to a comprehensive, improved practice approach. The results suggest that targeted strategies are crucial for provinces like Nghe An to address specific concerns, provide more information, and understanding among the hesitant and resistant populations.

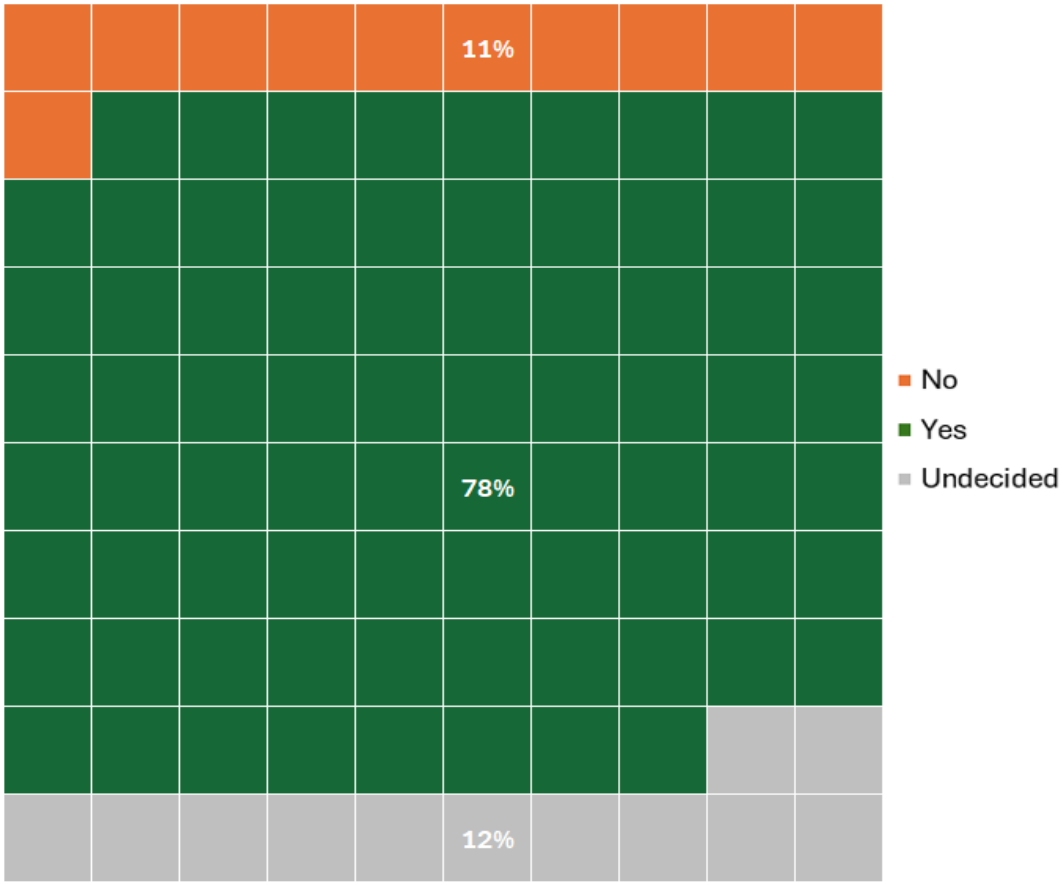


Figure 92. Distribution of the respondents based on their willingness to adopt 1M5R or improve their practice to align with the CSA technique (in percent), 2024-2025.

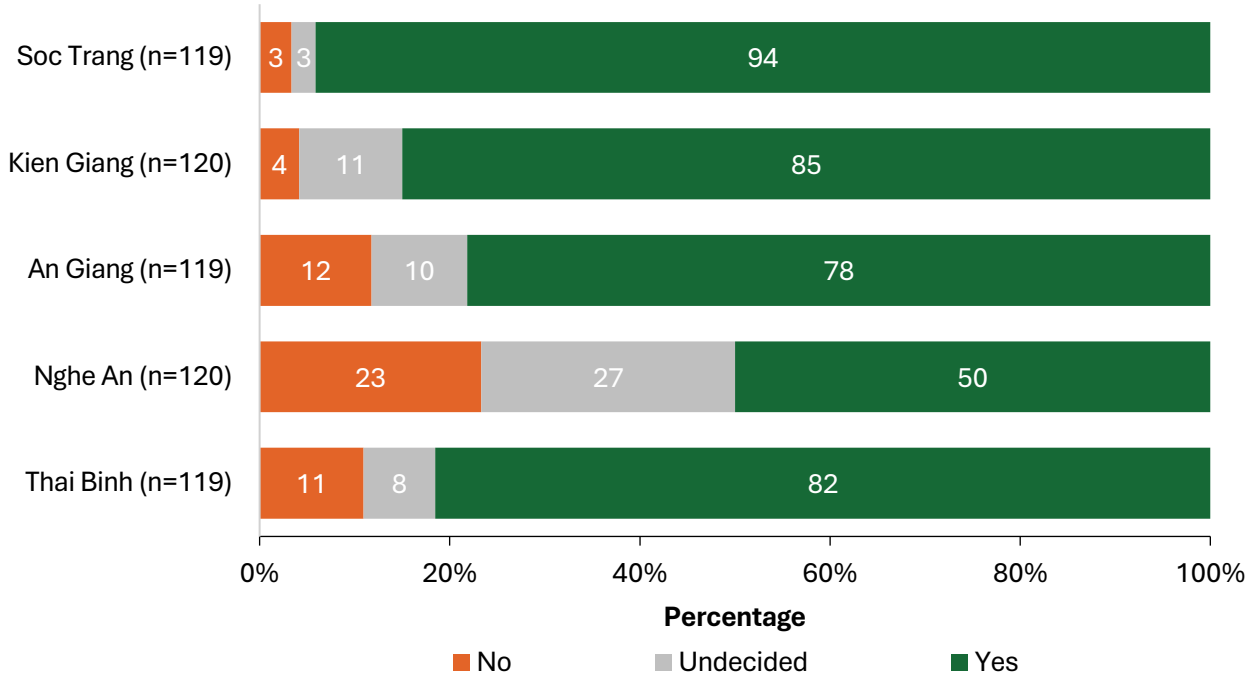


Figure 93. Distribution of the respondents based on their willingness to adopt 1M5R or improve their practice to align with the CSA technique, by province (in percent), 2024-2025.

The reasons farmers cited for their willingness to adopt 1M5R, as detailed in Table 38, predominantly revolve around economic gains and environmental improvements. The most frequently cited reason, according to the surveyed farmers, was to increase income (82%). This was particularly evident in Soc Trang, where most farmers (96%) identified this as a key benefit.

Table 38. Cited reasons of the respondents to adopt 1M5R (in percent), by province, 2024-2025.

Reasons	**Thai Binh** (n=97)	**Nghe An** (n=60)	**An Giang** (n=93)	**Kien Giang** (n=102)	**Soc Trang** (n=112)	**All five provinces** (n=464)
To increase income	77	75	70	87	96	82
To increase yield	71	85	49	84	82	74
To improve soil and farm conditions	64	80	51	67	81	68
To reduce losses due to climate risks	35	38	41	59	71	51
To cut costs and lower expenses	5	0	5	5	1	3
Others	0	0	0	1	0	0

This was followed by the potential increase in yield, with 74% of respondents across the five provinces indicating it as a reason for their willingness to adopt. Improving soil and farm conditions emerged as the third most popular reason (68%). This environmental benefit was particularly recognized in Soc Trang and Nghe An, with rates of 81% and 80%, respectively, emphasizing its importance. Furthermore, half (51%) of the respondents believed that adopting

this technology could effectively reduce losses due to climate risks, highlighting an apparent concern for climate resilience. In contrast to these widely cited reasons, the prospect of cutting costs and lowering expenses (3%) held very little influence, suggesting that farmers prioritize revenue generation, improved production, and environmental sustainability over immediate cost savings.

Table 39 reveals that while farmers across provinces in Vietnam were willing primarily to adopt 1M5R, several barriers hinder its adoption or continued practice. The most frequently cited barrier was the limited technical know-how, particularly in Nghe An, where 80% of farmers reported this as a problem. They must be concerned that they lack the necessary skills to implement the technology effectively. Other factors affecting adoption included farmers being satisfied with their current practices (24%) and observing that fellow farmers in their community were not adopting it either (22%). Issues with inputs may also affect farmers, with 19% mentioning a lack of affordable and readily available agricultural inputs, excluding fertilizers. Another 19% cited the unavailability and high cost of suitable fertilizers. These barriers suggest that targeted solutions are necessary, including enhanced training, increased community involvement, and improved access to and affordability of agricultural resources.

Table 39. Reasons for the hesitation of the respondents in adopting or continuing the adoption of 1M5R (in percent), by province, 2024-2025.

Reasons	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Limited technical know-how	40	80	37	41	52	50
Satisfied with the current rice farming technology/practice being adopted	26	21	26	26	19	24
Not practiced by fellow farmers in the community	38	20	23	12	16	22
Lack of appropriate available and affordable inputs (other than fertilizers)	6	17	16	27	32	19
Lack of appropriate available and affordable fertilizers	10	11	16	22	38	19

The solutions farmers proposed to overcome barriers in adopting or continuing 1M5R, as detailed in Table 40, largely align with the identified challenges. The most cited solution, mentioned by 51% of all respondents, was the consistent provision of technical guidance and training. This directly addresses the central issue of limited technical know-how previously identified in the analysis. Following this, 42% of farmers believed that widespread information dissemination to encourage fellow farmers was considered a key solution, directly tackling one of the barriers to 1M5R not being practiced by fellow farmers in the community. Further supporting knowledge acquisition, establishing experiment sites in the community for learning was another solution for 35% of the farmers. Financial incentives also emerged as crucial, specifically, 29% of farmers favored discounts or subsidies on seeds and pesticides, while 28% sought similar support for fertilizers. These directly address the barriers concerning the lack of appropriate, available, and affordable inputs. Additionally, 21% of farmers expressed a need for compensation for additional costs incurred when adopting 1M5R. Collectively, these solutions

underscore that reducing both direct and indirect financial outlays for farmers is a key component in encouraging and sustaining the adoption of 1M5R.

Table 40. Top solutions to the barriers cited by farmers in adopting or continuing the adoption of 1M5R (in percent), by province, 2024-2025.

Solutions	Thai Binh (n=119)	Nghe An (n=120)	An Giang (n=119)	Kien Giang (n=120)	Soc Trang (n=119)	All five provinces (n=597)
Consistent provision of technical guidance and trainings	39	78	29	50	57	51
Wide information dissemination to encourage fellow farmers	45	47	40	39	40	42
Experiment sites established in the community for learning	38	50	37	30	18	35
Discounts/subsidies for seeds and pesticides	13	24	18	37	52	29
Discounts/subsidies for fertilizers	16	16	19	34	53	28
Compensation for additional costs to be incurred	32	36	17	14	6	21

3.7.2. Awareness on Carbon Market

Rice farmers in the five provinces of Vietnam generally demonstrated low awareness of carbon markets and their underlying concepts (Figure 94). More than one-half (44% and 8%) of farmers had slight or high awareness that shifting to the CSA practices can reduce carbon emissions in rice farming. However, almost two-thirds (68-69%) of farmers are unaware that these emission reductions can be measured and verified, and that they can receive support for adopting technologies that reduce their emissions. This indicates that there is a need to raise awareness not only of the environmental benefits of adopting CSA technologies, but also of the economic benefits that farmers can gain from reducing their emissions and how they can access these benefits.

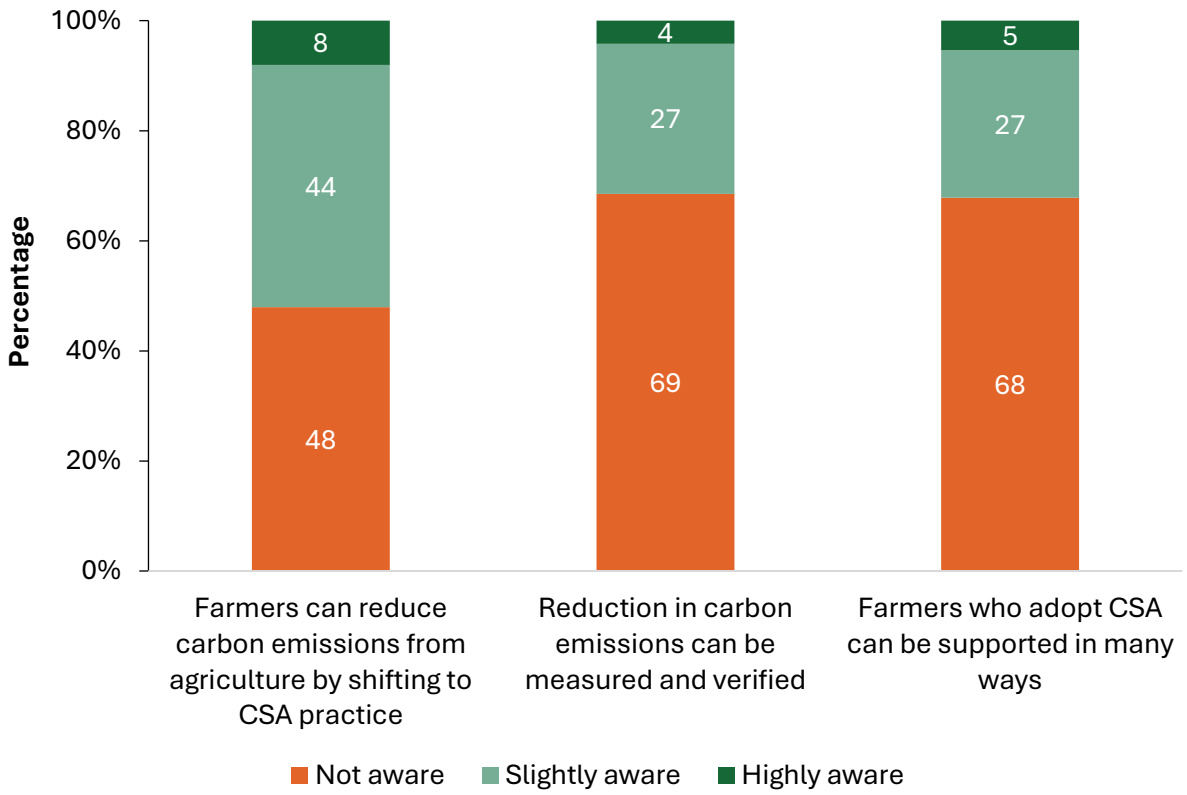


Figure 94. Respondents' awareness of carbon market across multiple indicators (in percent), 2024-2025.

3.8. Choice Experiment on CSA Adoption

A choice experiment presents respondents with hypothetical situations, each with a given set of attributes. For this study, farmers were given three contract bundles that incentivized them to adopt a CSA practice through support services, compensation for additional costs of adoption, the price premium added to the produce, and access to training. By stating their preferred option from the three scenarios, farmers revealed which incentives had a significant influence on their adoption. Farmers still had the option not to participate in the program (Option 4).

3.8.1. Choice Set 1

In the first choice set, respondents generally preferred the first option, as shown in Figure 92. This means that they preferred the incentives offered in this option (Table 41). Across the four provinces, more than half (54-65%) of the respondents preferred to adopt DSR in return for fertilizer discount vouchers, 1-20% compensation for the additional cost per hectare, an 11%-15% premium on the produce, and access to training for implementation. Uniquely, respondents in Kien Giang preferred the third option (47%) over the other two – adopting DSR in return for a marketing agreement, higher compensation (21-40%), lower premium (1%-5%), and a training component. Alternatively, option three was the 2nd most frequently chosen option, being chosen 29% of the time, while option two, which requires the participant to adopt AWD, was the least preferred (14%).

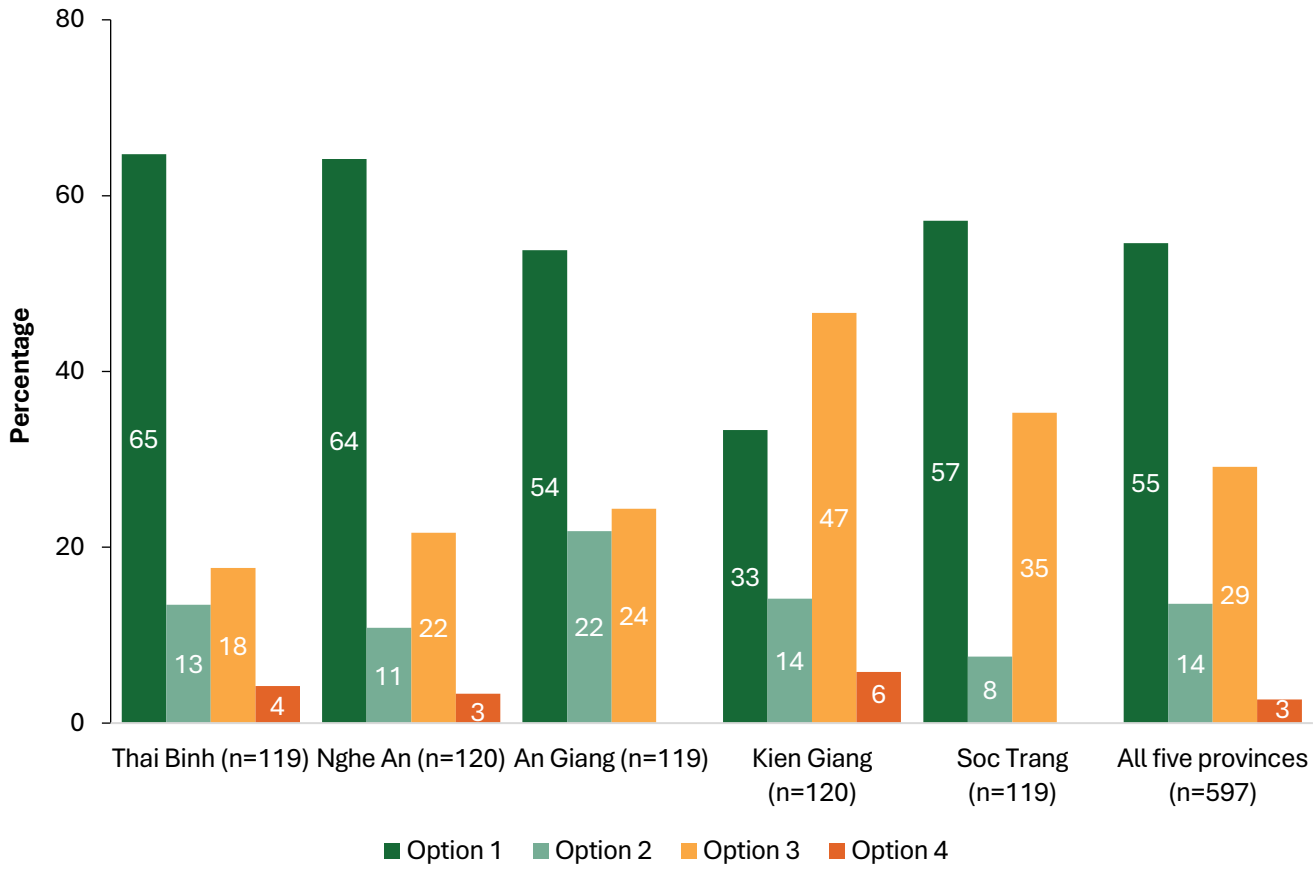


Figure 95. Surveyed farmers' program preferences based on different attributes in choice set 1 (in percent), by province.

Table 41. Attributes and corresponding options in choice set 1.

Attribute	Option 1 (Adopt DSR)	Option 2 (Adopt AWD)	Option 3 (Adopt DSR)
Support services per hectare of adoption per season	Fertilizer discount/ vouchers	Access to machineries/ equipment	Marketing agreement with rice dealers/traders
Compensation for additional cost per hectare of adoption per season	1% - 20% compensation	1% - 20% compensation	21% - 40% compensation
Price premium for produce	11% - 15% premium	6% - 10% premium	1% - 5% premium
Access to training	With training	With training	With training

When asked for the reason they chose the option, the top reason was that farmers preferred the support services provided (49%); specifically, the leading option was the provision of fertilizer discounts. Additionally, 27% of the farmers considered the level of price premium, showing that farmers were interested in the impact of adopting new technology on their net profits. The third most prominent reason influencing their selection was the compensation provided in the package (11%), which was especially significant among farmers in Nghe An (23%). This suggests that farmers are cautious about the risks and additional costs associated with adopting new technology and would prefer to mitigate these risks through financial support. Lastly, 5% of the farmers preferred the option that had a training component.

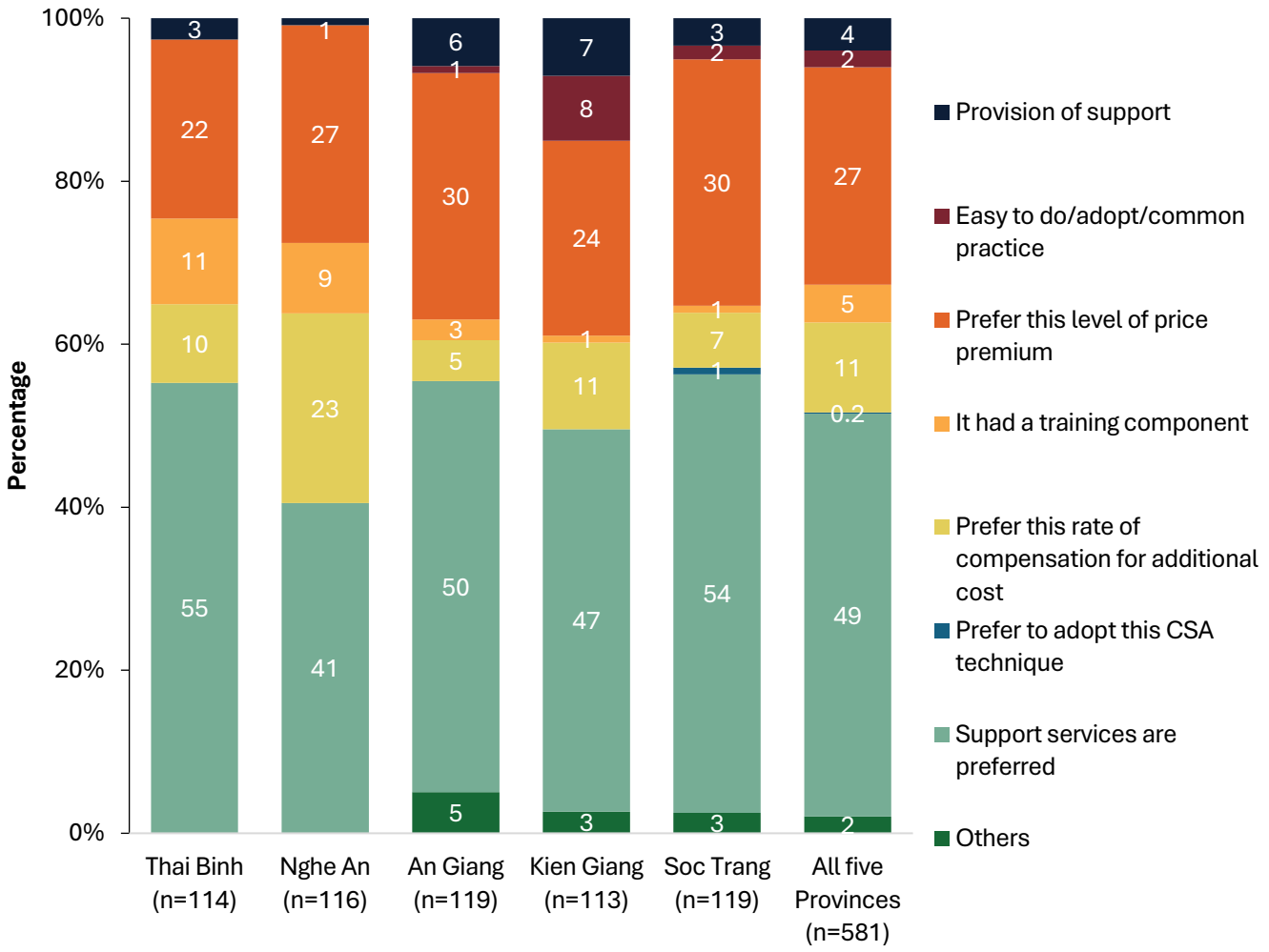


Figure 96. Surveyed farmers' reasons for selecting option 1,2, or 3 in choice set 1 (in percent), by province.

Those who opted to abstain from participating had varying reasons. Farmers in Nghe An were mainly constrained by their age (75%), while farmers in Thai Binh primarily preferred that neighboring farmers also adopt the technology. These findings suggest that community-based projects may attract more farmers to participate in CSA programs, while training younger farmers may encourage the adoption of CSA Technology. Other respondents preferred their traditional method of farming (13%) or were already practicing DSR or AWD (6%). Interestingly, no farmers in An Giang and Soc Trang abstained from the choice set, indicating that economic incentives are sufficient to encourage them to adopt CSA practices.

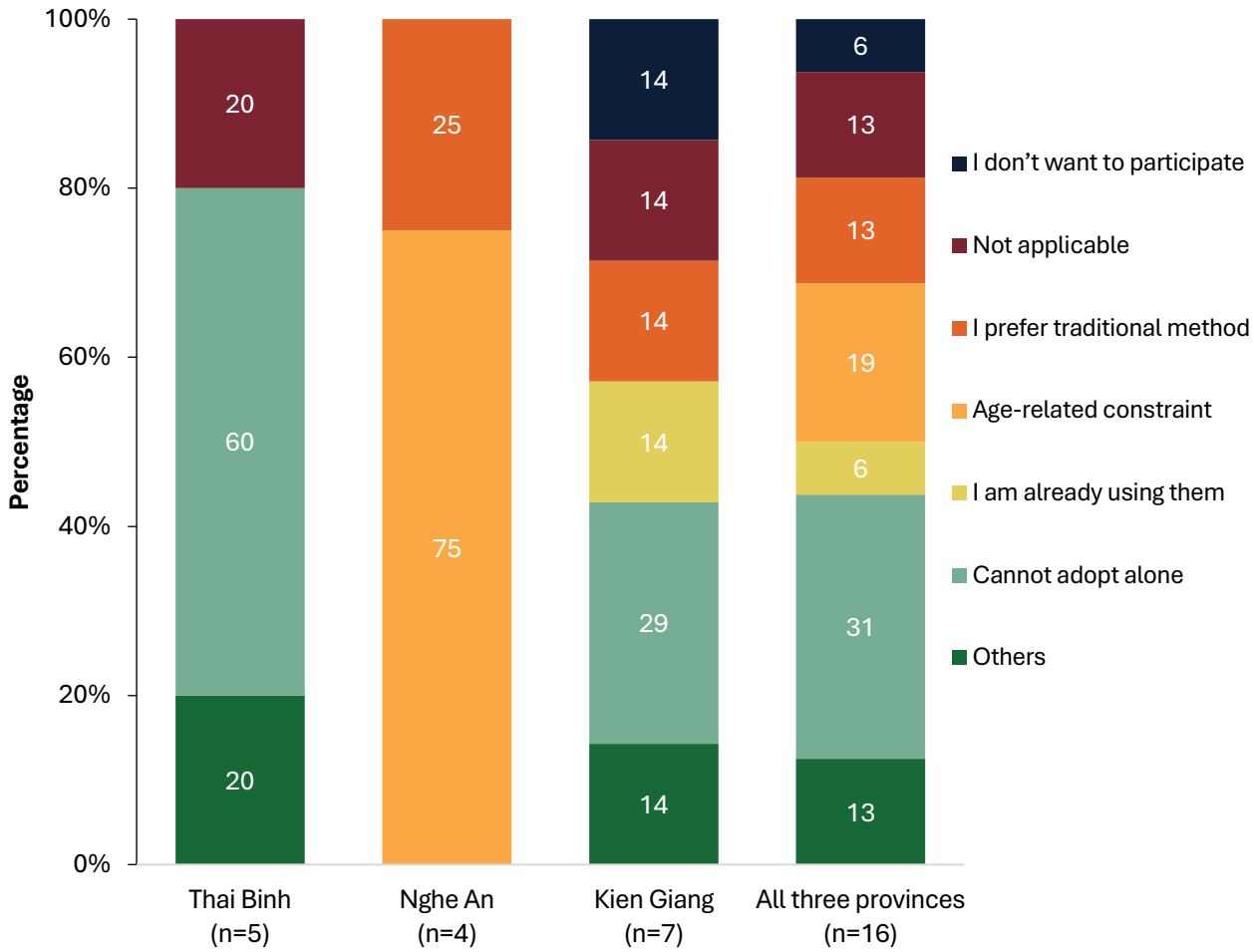


Figure 97. Reasons for not participating among surveyed farmers who selected option 4 in choice set 1 (in percent), by province.

Meanwhile, Table 42 shows the preferred DSR method of farmers who either selected option 2 or 3 in the first choice set. There was almost equal preference for each of the DSR methods across all five provinces, with manual wet DSR being preferred by the fewest participants (16%). In Kien Giang, there was a heavy preference for mechanized wet DSR (93%); in contrast, this was the least preferred mode in Thai Binh – farmers from the province highly preferred manual dry DSR among other options. This may be due to the differences in standard and traditional DSR practices in the regions.

Table 42. The type of DSR method indicated by surveyed farmers who selected option 2 or 3 in choice set 1 (in percent), by province.

DSR Method	Thai Binh (n=98)	Nghe An (n=103)	An Giang (n=93)	Kien Giang (n=96)	Soc Trang (n=110)	All five Provinces (n=500)
Wet DSR (Manual)	13	33	10	3	18	16
Wet DSR (Mechanized)	2	9	38	93	22	32
Dry DSR (Manual)	79	30	11	0	28	30
Dry DSR (Mechanized)	6	28	42	4	32	23

3.8.2. Choice Set 2

In the second choice set, the majority of the respondents opted for the third option (Figure 98) which requires them to adopt AWD and DSR in return for fertilizer discount vouchers, 41-60% compensation on the additional cost to adopt, an 11% to 15% premium on certified produce, and a training component (Table 43). Interestingly, abstain votes in Thai Binh and Nghe An remained the same, but decreased by one person in Kien Giang, indicating that choice set 2 provided more compelling incentives than the first.

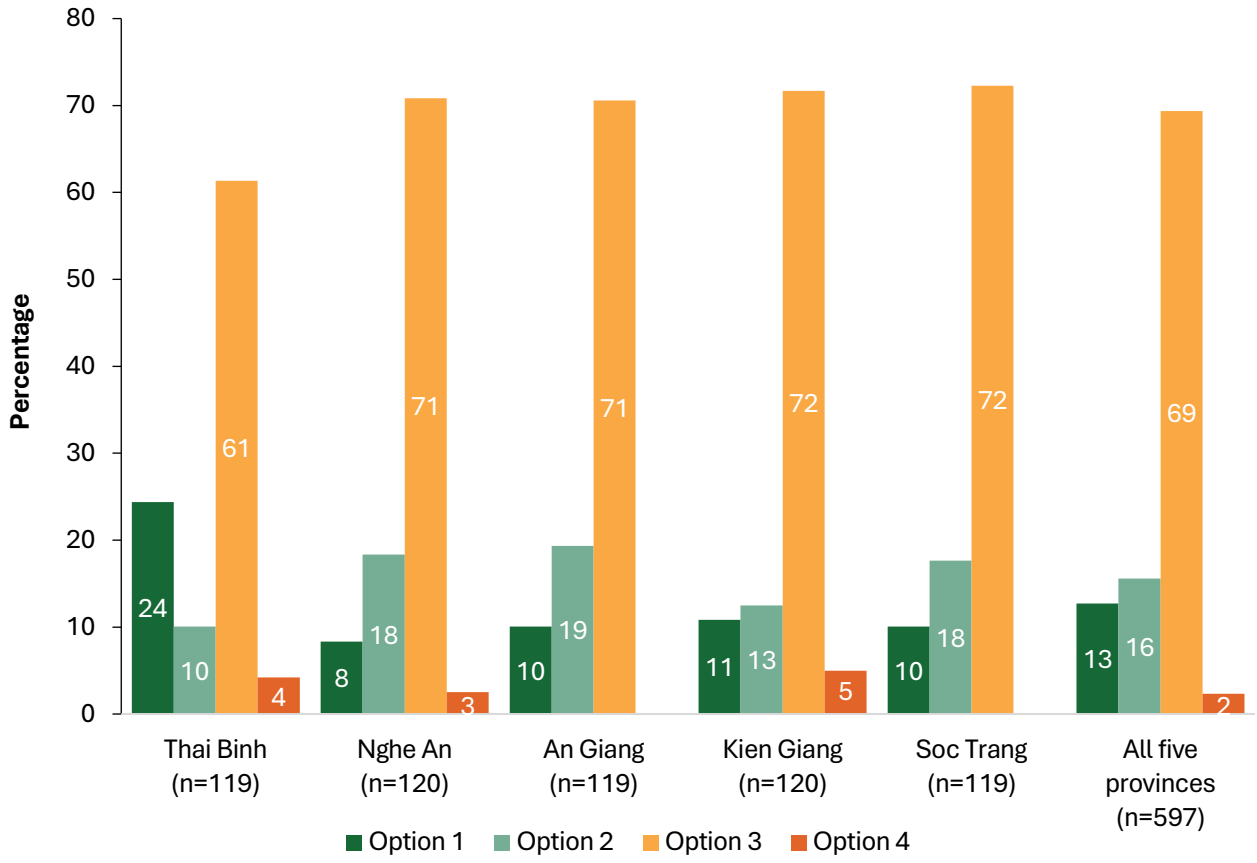


Figure 98. Surveyed farmers' program preferences based on different attributes in choice set 2 (in percent), by province.

Table 43. Attributes and corresponding options in choice set 2.

Attribute	Option 1 (Adopt AWD)	Option 2 (Adopt DSR)	Option 3 (Adopt AWD + DSR)
Support services per hectare of adoption per season	Access to machineries/ equipment	Marketing agreement with rice dealers/traders	Fertilizer discount/ vouchers
Compensation for additional cost per hectare of adoption per season	21% - 40% compensation	41% - 60% compensation	41% - 60% compensation
Price premium for produce	1% - 5% premium	6% - 10% premium	11% - 15% premium
Access to training	Without training	Without training	With training

When asked about the attributes influencing their decisions, 44% of farmers in the five provinces indicated that they preferred the support services of their choice over the other two, with option three leading in this choice set. This may refer to fertilizer discount vouchers, which are consistent with the leading support services in the first-choice set. In Thai Binh, more than half of the farmers (61%) were influenced by the support services provided. Furthermore, 26% of respondents made their decision based on the price premium offered, making it the second leading attribute in the choice set. In Nghe An, however, there was a larger preference (27%) for receiving compensation for the added costs of adopting the technology. Meanwhile, twelve percent of the farmers preferred the option that had a training component.

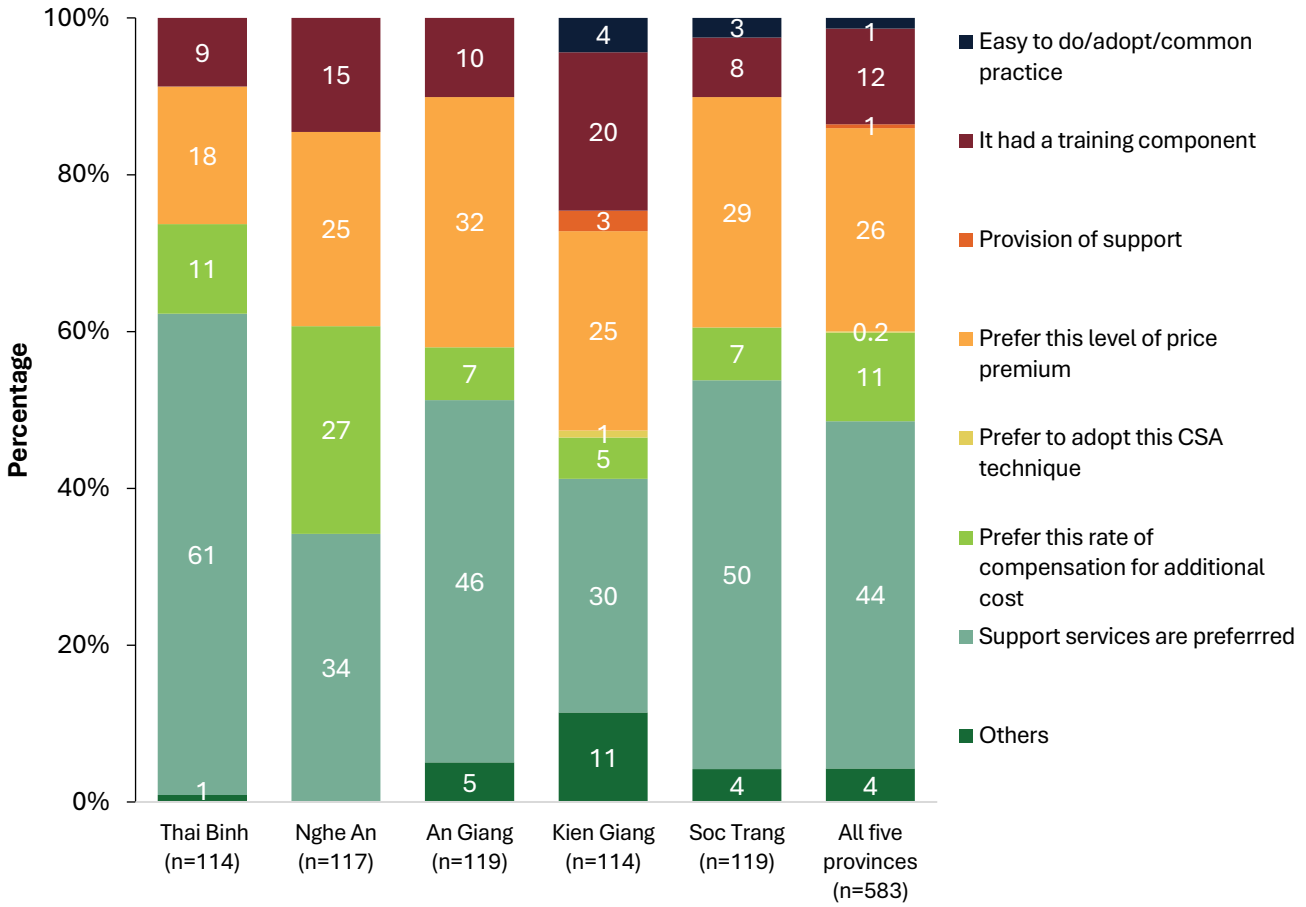


Figure 99. Surveyed farmers' reasons for selecting option 1,2, or 3 in choice set 2 (in percent), by province.

In terms of the preferred method for direct-seeded rice in choice set 2, farmers generally chose the same answer compared to the former choice set. Farmers in Nghe An preferred manual wet DSR (31%) followed by manual dry DSR (28%), and mechanical dry DSR (29%). In contrast, farmers in An Giang preferred the mechanized versions of DSR, whether it was wet DSR (42%) or dry DSR (36%). This may reveal a pattern of distinct differences in how farmers in the two provinces balance the utility of more convenient methods against saving on costs.

Table 44. The type of DSR method indicated by surveyed farmers who selected option 2 or 3 in choice set 2 (in percent), by province.

DSR Method	Thai Binh (n=85)	Nghe An (n=107)	An Giang (n=107)	Kien Giang (n=101)	Soc Trang (n=107)	All five provinces (n=507)
Wet DSR (Manual)	13	31	10	3	17	15
Wet DSR (Mechanized)	2	12	42	91	24	35
Dry DSR (Manual)	79	28	12	0	26	27
Dry DSR (Mechanized)	6	29	36	6	33	23

In Kien Giang, half (50%) of the time, farmers abstained simply because they did not want to participate. Farmers in Nghe An consistently answered that their old age made it impractical for them to explore new technology. A small portion of farmers (7%) preferred traditional methods. Meanwhile, 21% of the respondents who abstained indicated that they would only adopt the technology if farmers in their neighborhood also adopted it.

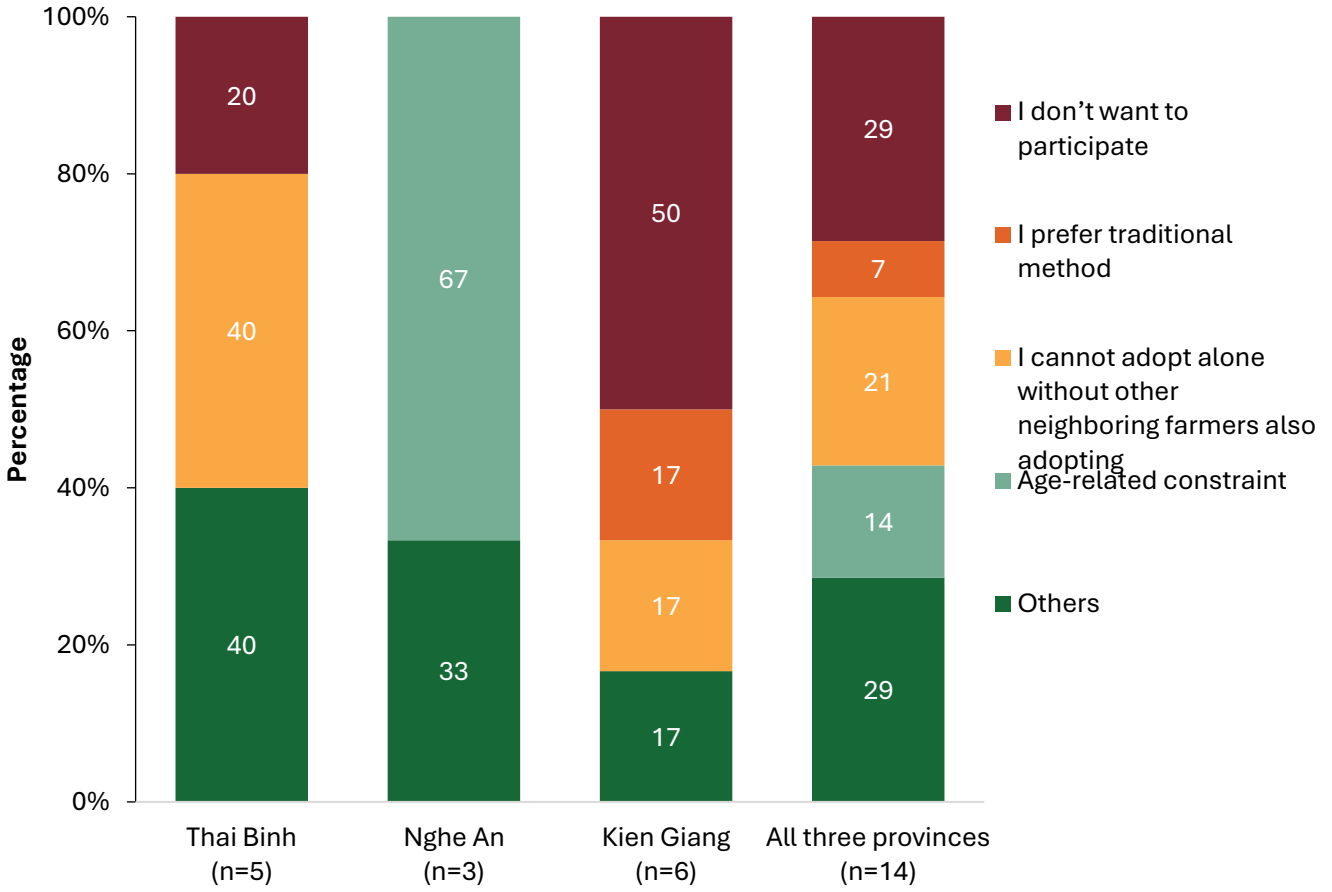


Figure 100. Reasons for not participating among surveyed farmers who selected option 4 in choice set 2 (in percent), by province.

3.8.3. Choice Set 3

In the third choice set, the majority of farmers chose option 3 (Figure 101) which required them to adopt both AWD and DSR in return for fertilizer support, 21-40% compensation, an 11%-15% price premium for sustainably produced rice, and a training component (Table 45). The fertilizer discount vouchers were once again included as a support service in the leading option, indicating that farmers may have a strong preference for this support service over the others. Additionally, option three provided the highest price premium. Alternatively, the second most preferred option was option 1, where the participant will adopt AWD in return for marketing agreements, higher compensation (41%-60%), a lower price premium (6%-10%), and a training component. This may suggest that for 21% of farmers, higher compensation for the cost of adoption, along with assurance of sales, may be more valuable than a potential increase in revenue from price premiums and input subsidies.

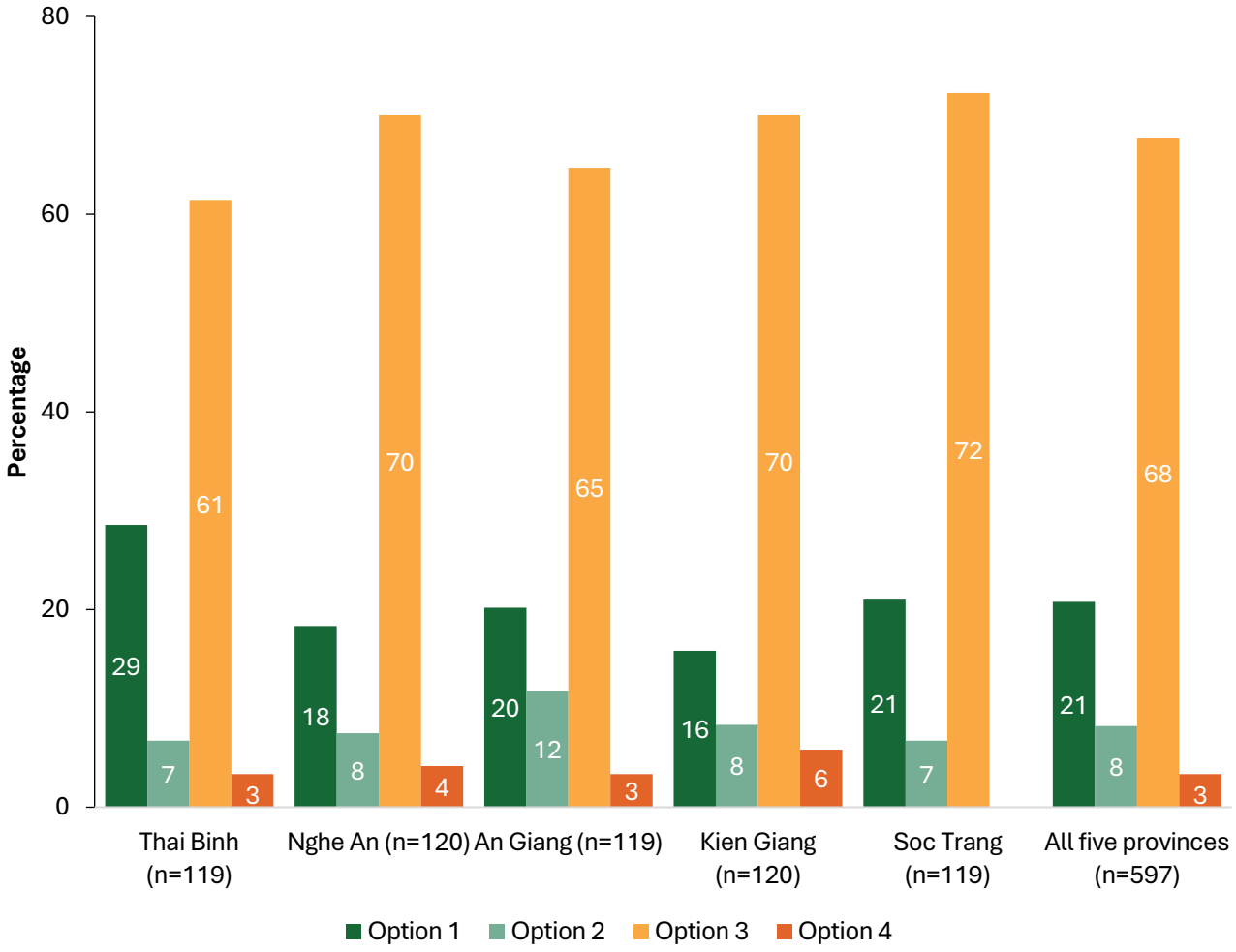


Figure 101. Surveyed farmers' program preferences based on different attributes in choice set 3 (in percent), by province.

Table 45. Attributes and corresponding options in choice set 3.

Attribute	Option 1 (Adopt AWD)	Option 2 (Adopt AWD + DSR)	Option 3 (Adopt AWD + DSR)
Support services per hectare of adoption per season	Marketing agreement with rice dealers/traders	Access to machineries/ equipment	Fertilizer discount/ vouchers
Compensation for additional cost per hectare of adoption per season	41% - 60% compensation	1% - 20% compensation	21% - 40% compensation
Price premium for produce	6% - 10% premium	1% - 5% premium	11% - 15% premium
Access to training	With training	Without training	With training

Consistent with former choice sets, 49% of farmers from all five provinces were heavily influenced by the support services provided – fertilizer discount vouchers. This was especially evident in An Giang (51%), Soc Trang (52%), and Thai Binh (62%), which were selected by more than half of the respondents. This suggests that fertilizer support services have the potential to be an effective incentive for CSA adoption. Additionally, the level of price premium was the second leading reason (29%) influencing the respondents' choice. This suggests that farmers may be enticed to shift to CSA practices by establishing price premiums and generating demand for sustainably produced rice. Compensation for the added cost of adoption was the third leading attribute, influencing 10% of farmers overall, and 23% in Nghe An. Lastly, the training component was considered important by only 7% of the respondents.

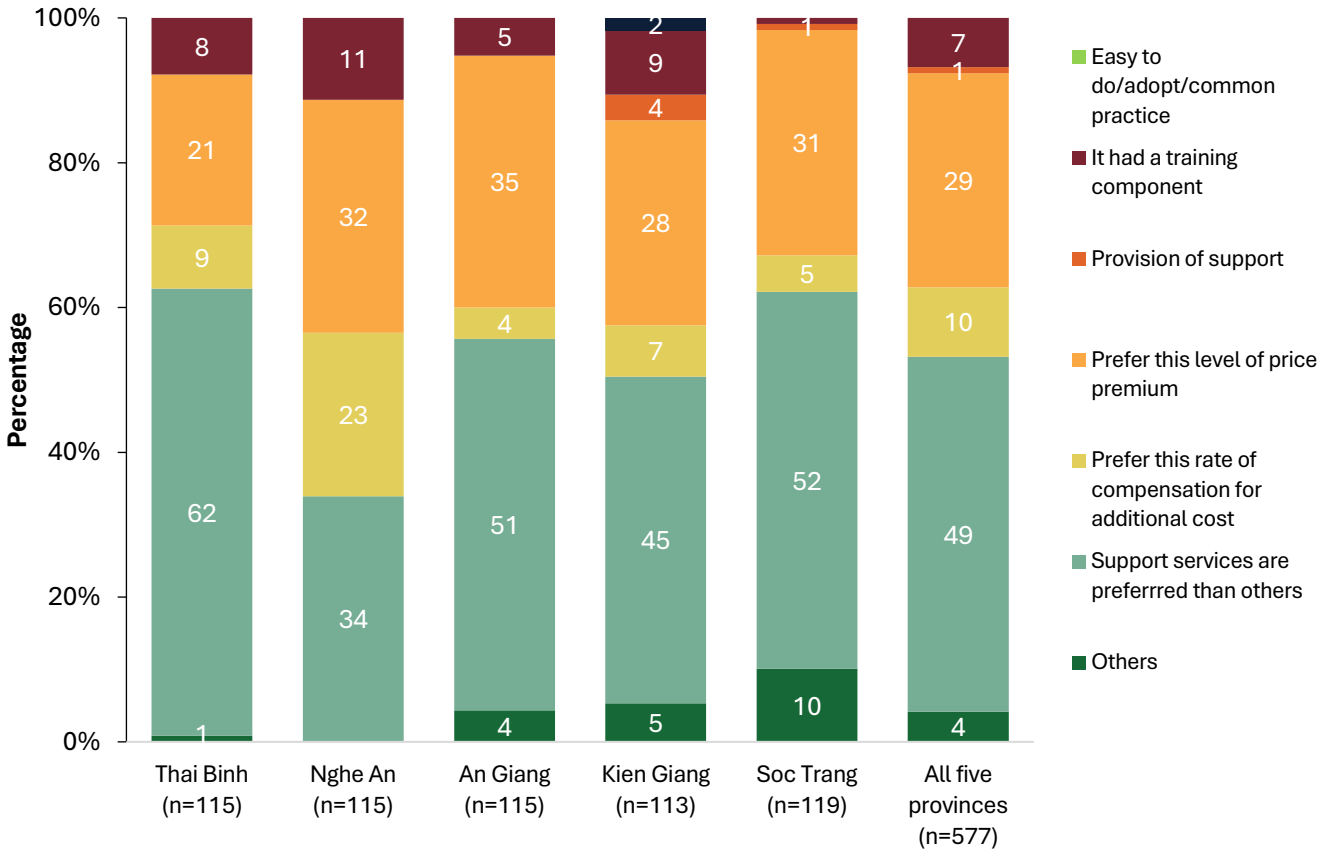


Figure 102. Surveyed farmers' reasons for selecting options 1,2, or 3 in choice set 3 (in percent), by province.

Only 20 respondents across the four provinces did not participate in choice set 3. These farmers were generally reluctant to participate due to old age (15%), lack of adoption by neighbouring farmers (20%), and preference for traditional methods (10%). Some farmers did not find the need to participate (20%) or did not prefer the support services offered (15%).

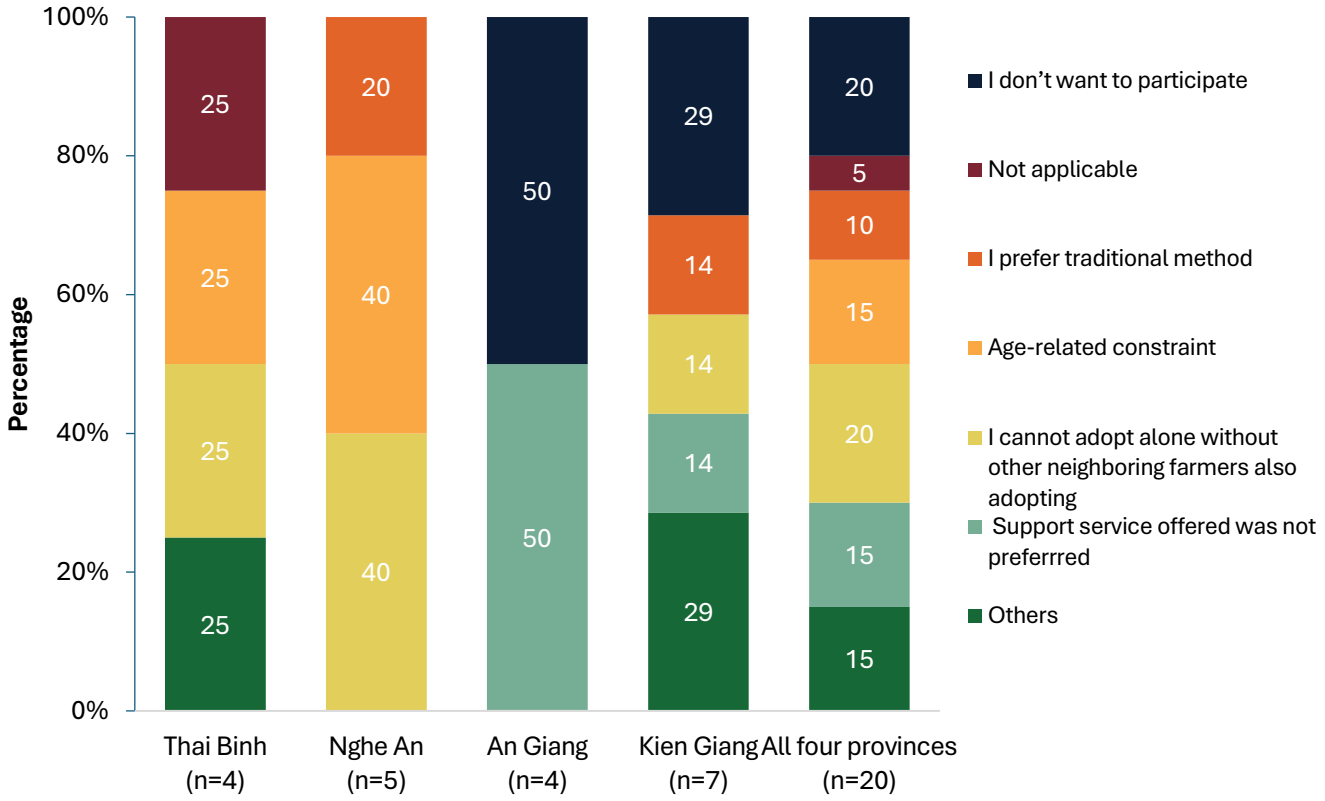


Figure 103. Surveyed farmers' reasons for not participating among farmers who selected option 4 in choice set 3 (in percent), by province.

When asked for the DSR method they would prefer to adopt in option 2 or 3, different provinces had distinct preferences (Table 46). The most preferred method was wet mechanized DSR, with 34% of farmers indicating a preference for this technology. A large majority of farmers in Kien Giang (91%) prefer mechanized wet DSR over all other options. Meanwhile, the dry manual DSR method was the most preferred method among farmers in Thai Binh (83%), and the second most preferred across the five provinces (27%). Dry mechanized DSR was preferred by a multiplicity of farmers in Soc Trang (34%), and only 22% of all farmers. In contrast, manual wet DSR was the least preferred across all five provinces, but was preferred by 37% of farmers in Nghe An. This can guide technology extension programs, which may find more success in promoting specific DSR technologies in each province.

Table 46. The type of DSR method indicated by surveyed farmers who selected option 2 or 3 in choice set 3 (in percent), by province.

DSR Method	Thai Binh (n=81)	Nghe An (n=93)	An Giang (n=91)	Kien Giang (n=94)	Soc Trang (n=94)	All five provinces (n=453)
Wet DSR (Manual)	11	37	12	3	21	17
Wet DSR (Mechanized)	1	11	42	91	19	34
Dry DSR (Manual)	83	28	8	0	26	27
Dry DSR (Mechanized)	5	25	38	5	34	22

3.8.4. Choice Set Conclusions

The choice experiment provides multiple insights into how farmers in the five provinces of Vietnam perceive alternate wetting and drying (AWD), direct-seeded rice (DSR), their associated benefits, and the trade-offs that accompany them. By stating their preference among three options, farmers reveal the attributes that heavily influence their decision-making and willingness to adopt DSR or AWD. Given that only 2-3% of the respondents abstained from at least one of the choice sets, almost all (97-98%) are willing to adopt AWD and DSR in return for a given set of benefits, such as support services, compensation for any cost of adoption, rice price premiums, and training.

In all three choice sets, farmers opted for the option that included the support service they preferred. Fertilizer discount vouchers were the leading variation of this attribute. This reveals the potential for fertilizer support to be a sufficient incentive to drive farmers' adoption of CSA practices, and that policymakers should consider repurposing fertilizer provision to promote CSA practices in the provinces.

There is also a high preference for rice price premiums, as it has consistently been the second leading attribute influencing farmers' decisions to adopt both AWD and DSR in one package. Farmers generally accepted the option with an 11%-15% premium on the price of sustainably produced rice as an ample incentive to adopt AWD and DSR.

Additionally, the rate of compensation given in the choice set was only considered by 10-11% of farmers in all provinces. Farmers preferred a higher rate of compensation for adopting the technology. This may be due to the perception of the perceived costs of shifting practices. Farmers aim to mitigate potential losses by adopting new technology. Based on the answers from Choice sets 2 and 3, 68-69% of farmers are willing to adopt a combination of AWD and DSR for a minimum compensation of 21-40%, provided they gain access to fertilizer vouchers, an 11-15% price premium, and training.

The training component had a minimal influence compared to the other attributes, as only 5% to 12% of farmers indicated that training was a significant consideration in their decision to adopt AWD and DSR. It is worth noting that in choice set 2, one-third of the respondents opted for the option with no training, likely due to their preference for support services, which included marketing agreements with rice dealers and access to machinery. However, the results from the previous section show that training and continued guidance are the top solutions for overcoming barriers to adoption. Therefore, policymakers should still include the training component in future programs.

The most common hindrances for farmers who abstain from adopting AWD and DSR are the lack of neighboring farmers who are also willing to adopt the technology, old age, and a preference for traditional methods. Policy makers should consider widespread information dissemination

to encourage farmers to adopt CSA practices as a community. Experiment sites can also provide proof of concept to farmers who are skeptical of the technology.

3.9. Production Practices

3.9.1. Land Preparation

Land preparation is a labor-intensive activity that aims to prepare fields before planting. Typically, this involves several steps such as clearing, ploughing, puddling, and rotavating, which break down soil clumps to control weed growth and allow better absorption of nutrients essential for crop development. In accordance, land preparation practices vary significantly depending on several factors such as available resources, labor costs, and farming objectives. The findings of the survey conducted in selected rice-growing provinces in Vietnam reveal that farmers heavily rely on machinery as a source of power for land preparation activities. Most farmers, particularly those with larger landholdings, utilized 4-wheel tractors, 2-wheel tractors, and rotary tillers to prepare their fields before crop establishment. However, it is notable that there were variations in the machines employed per season and province. Figure 104 to Figure 106 show the utilization of machines during each season by province.

Most farmers during the Winter-Spring and Summer-Autumn seasons operated 4-wheel tractors for land preparation, while 71% of the farmers across three provinces during the Autumn-Winter season utilized 2-wheel tractors. The difference in the machine used may stem from the need to accommodate intensive operations in wet field conditions, especially during May to October (Summer-Autumn season), which coincides with the period of high annual rainfall in Northern and Southern Vietnam (Van et al., 2015; Huang et al., 2025).

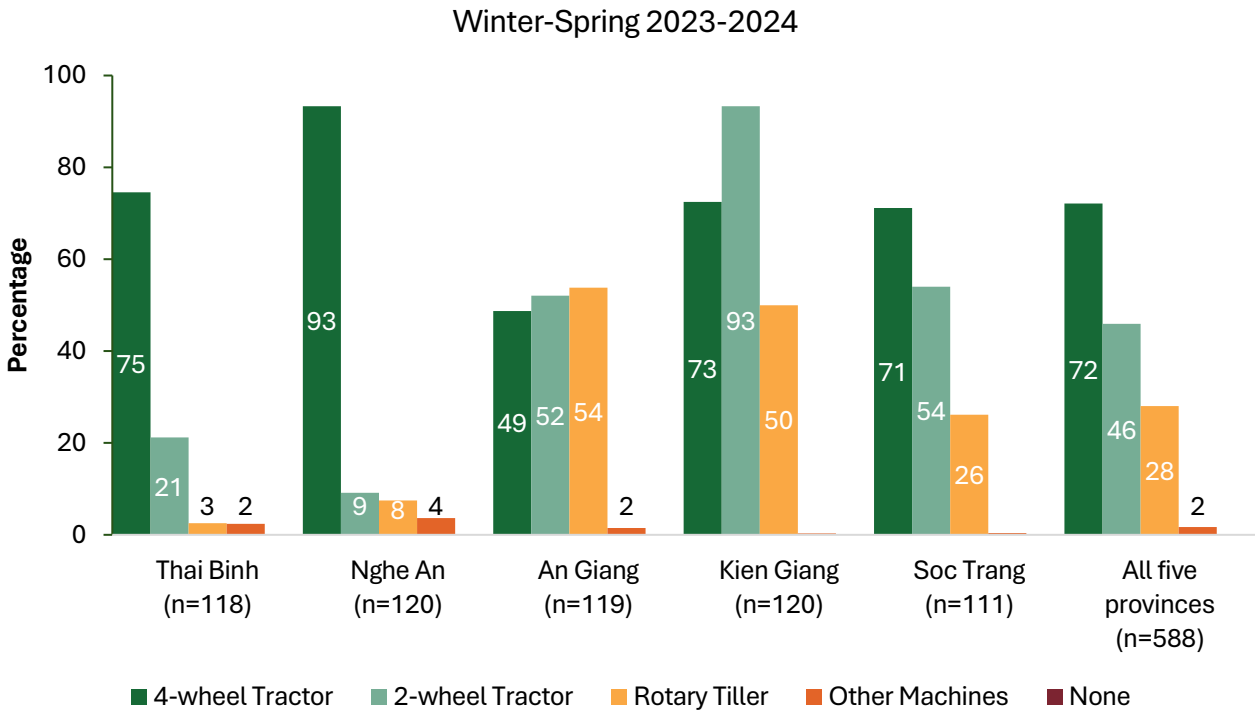


Figure 104. Source of power of surveyed farmers for land preparation (in percent), by province, Winter-Spring 2023-2024.

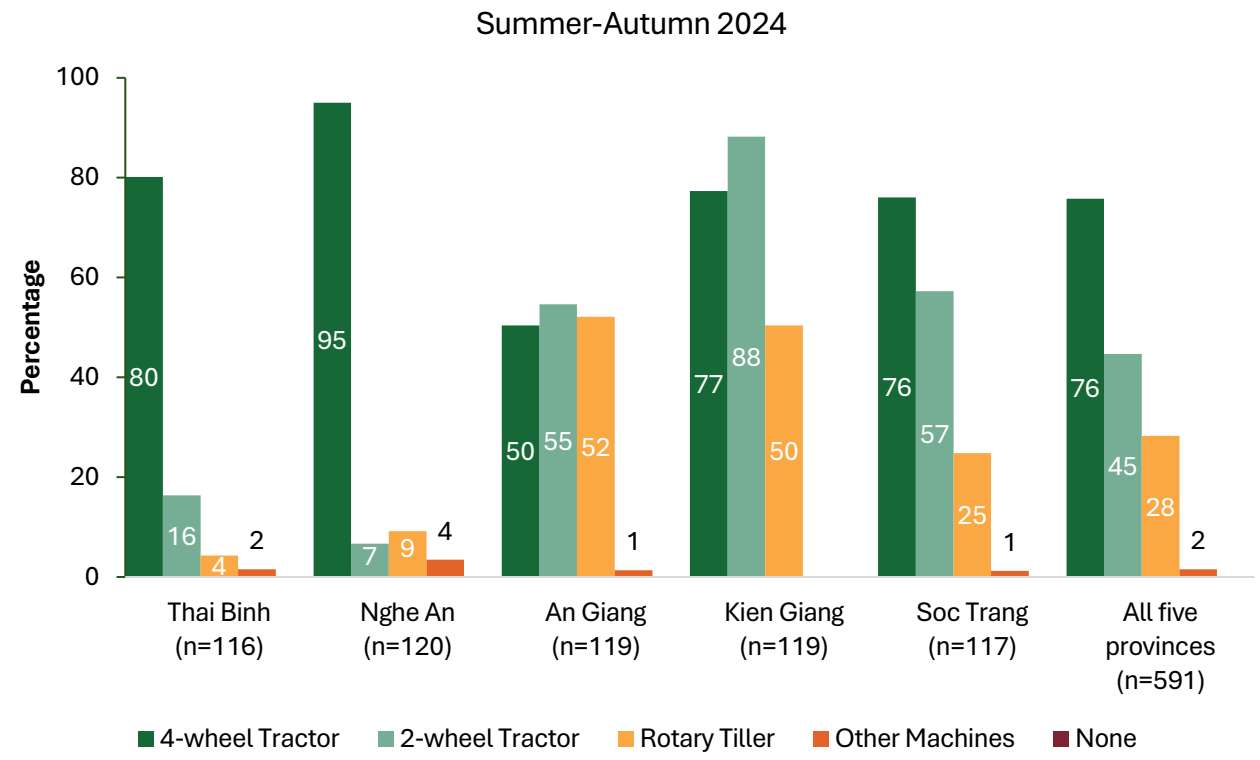


Figure 105. Source of power of surveyed farmers for land preparation (in percent), by province, Summer-Autumn 2024.

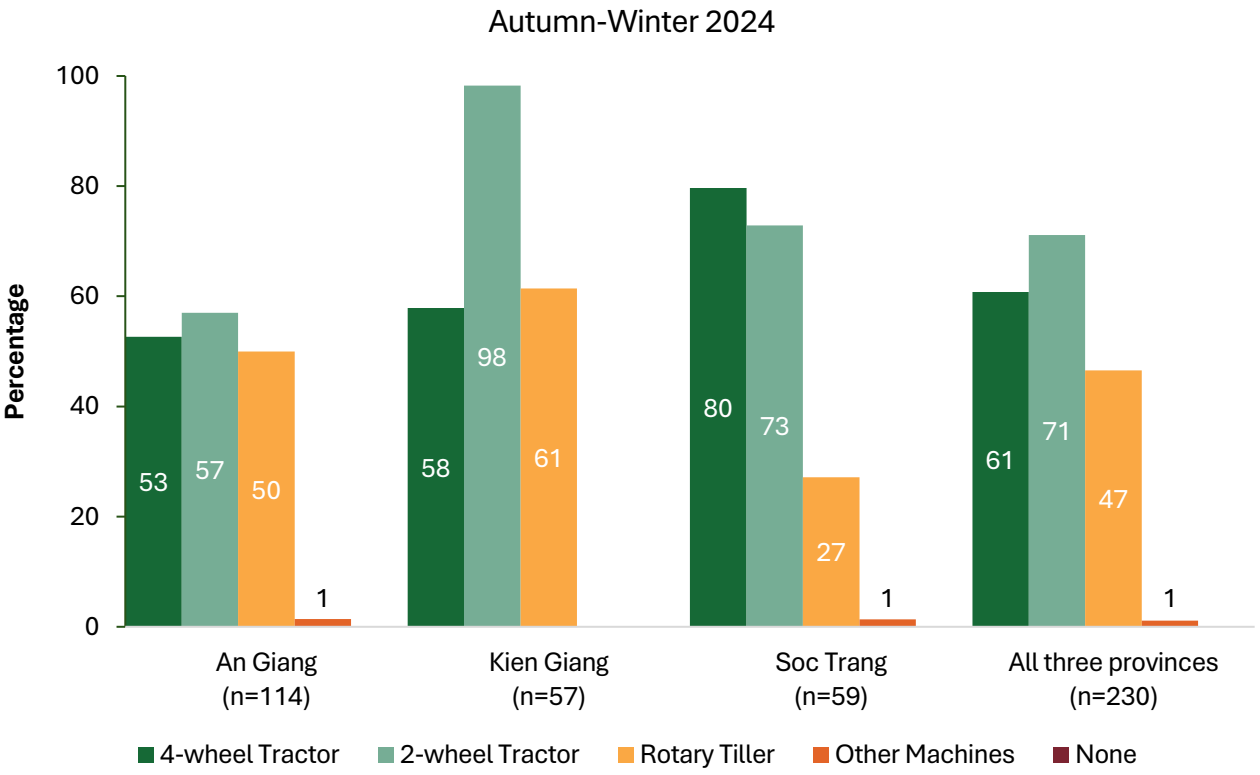


Figure 106. Source of power of surveyed farmers for land preparation (in percent), by province, Autumn-Winter 2024.

Correspondingly, the high usage of 4-wheel tractors during the two seasons was prominent in Nghe An, where adoption rates reached 93% during the Winter-Spring season, and 95% during the Summer-Autumn season. This was followed by Thai Bihn with 75% and 80% adoption rates within the respective seasons. Additionally, rotary tillers were also equipped across seasons (28%, 28%, and 47%, respectively). This machine may have been used by farmers to enhance soil breakdown, making the field more suitable for crop establishment.

Overall, the high degree of mechanization during land preparation in the selected provinces of Vietnam could be attributed to the persistent challenge of agricultural labor shortages. According to a study by Sakata (2020), this shortage began in the early 2000s, when Vietnam entered a phase of rapid economic growth, leading to a shift in labor from agriculture to the industrial and service sectors. Considering this challenge, mechanization appears to be the vital solution to maintaining the country's rice productivity.

3.9.2. Crop Calendar

During the Winter-Spring season, it can be inferred based on Figure 107 that across all provinces, crop establishment was usually done by farmers between November and January. This was dominantly evident in Kien Giang, where 94% of the farmers reported sowing seeds in November. Similarly, 60% of respondents from An Giang also conducted crop establishment in November. Meanwhile, harvesting of produce was typically done between January and May. Farmers from Kien Giang and Soc Trang typically harvested their rice crops in January (100% and 46%, respectively), while 58% and 86% of the farmers from Thai Binh and Nghe An conducted harvesting in May.

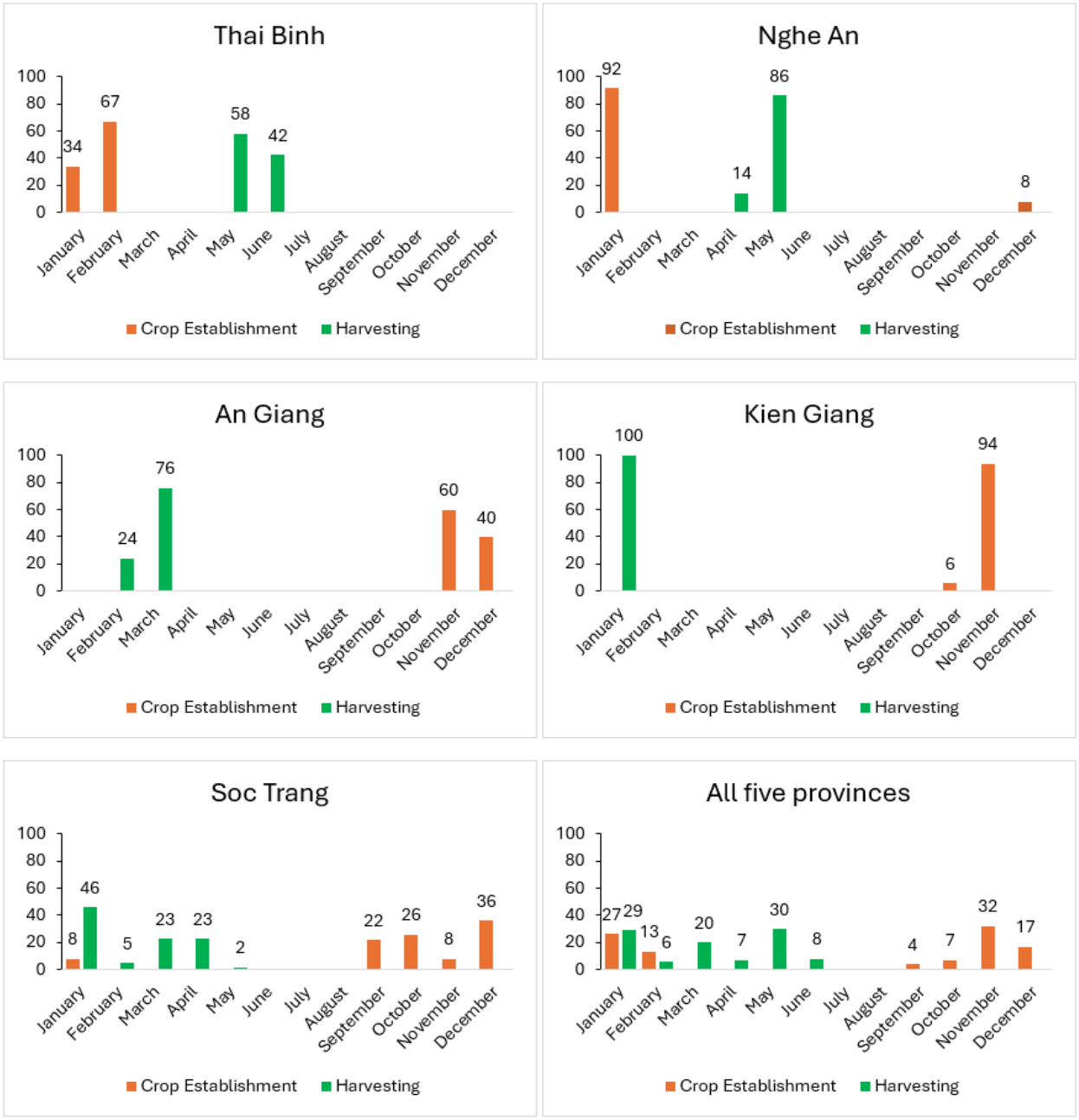


Figure 107 . Monthly distribution of surveyed farmers' rice planting and harvesting activities (in percent), by province, Winter-Spring 2023-2024.

Figure 108 reveals variations in crop establishment and harvesting activities during the Summer-Autumn season (2024). Across all provinces, it can be observed that crop establishment peaked in June, with 25% of farmers initiating planting in this month. This was followed by 23% of farmers who began crop establishment in March. Similarly, this data was highly evident in Nghe An, where the majority of farmers (56%) began sowing seeds in June. In Soc Trang, 68% of the farmers conducted crop establishment during May.

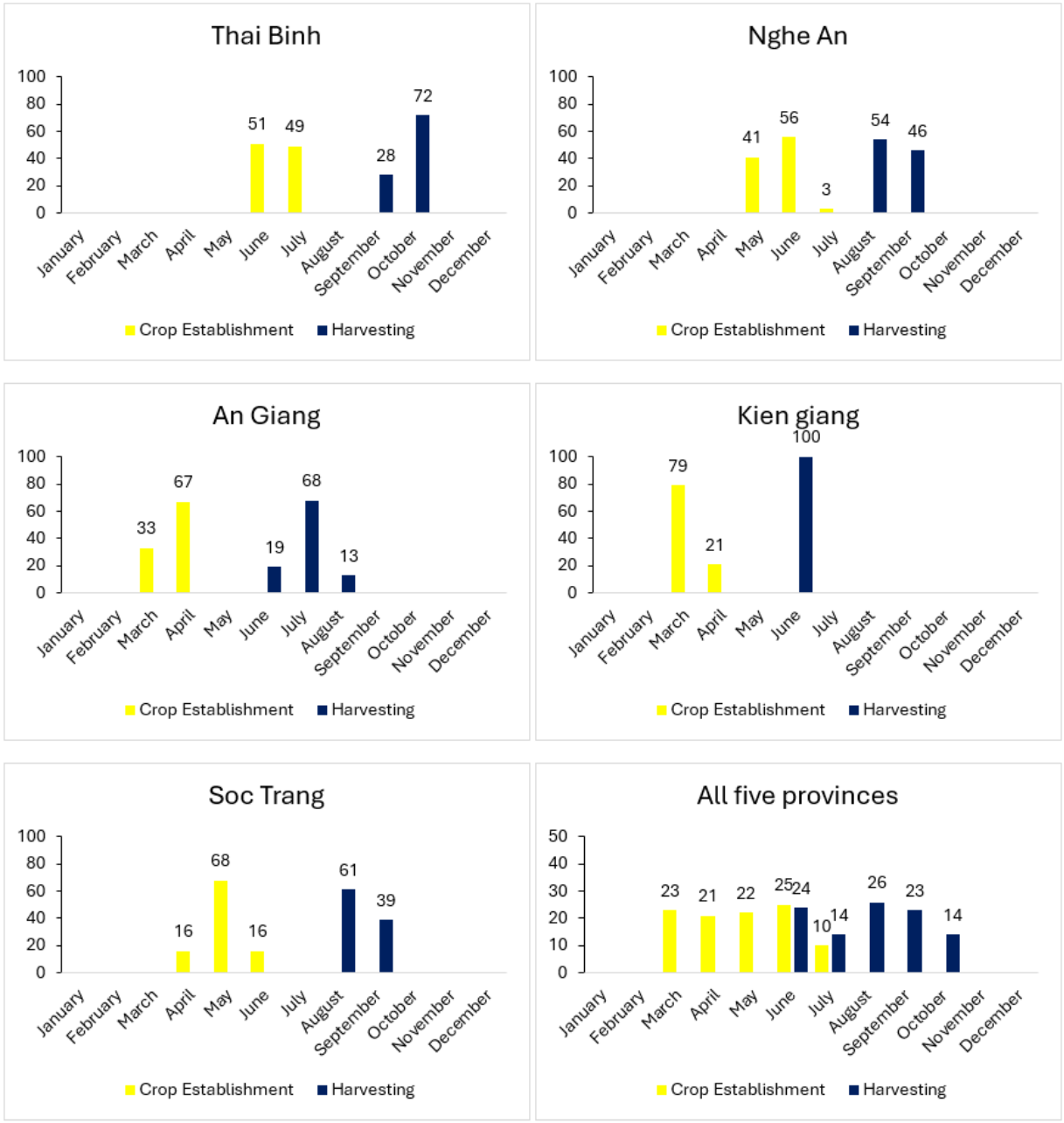


Figure 108. Monthly distribution of surveyed farmers' rice planting and harvesting activities (in percent), by province, Summer-Autumn 2024.

On the other hand, the peak for harvesting rice crops occurred during August and September, with 26% and 23% of farmers participating in this activity, respectively. In accordance, August emerged as the primary harvesting month in both Nghe An (54%) and Soc Trang (61%). Overall, the presented data indicate that the majority of farmers across provinces typically follow a 90-120-day cropping duration for the Summer-Autumn season.

Figure 109 depicts that during the Autumn-Winter season (2024), crop establishment across all provinces took place between June and September. For Kien Giang province, 86% of respondents conducted crop establishment activities during June. In contrast, farmers from An Giang (56%) employed the practice during August, and 68% of Soc Trang rice farmers sowed rice seeds during September.

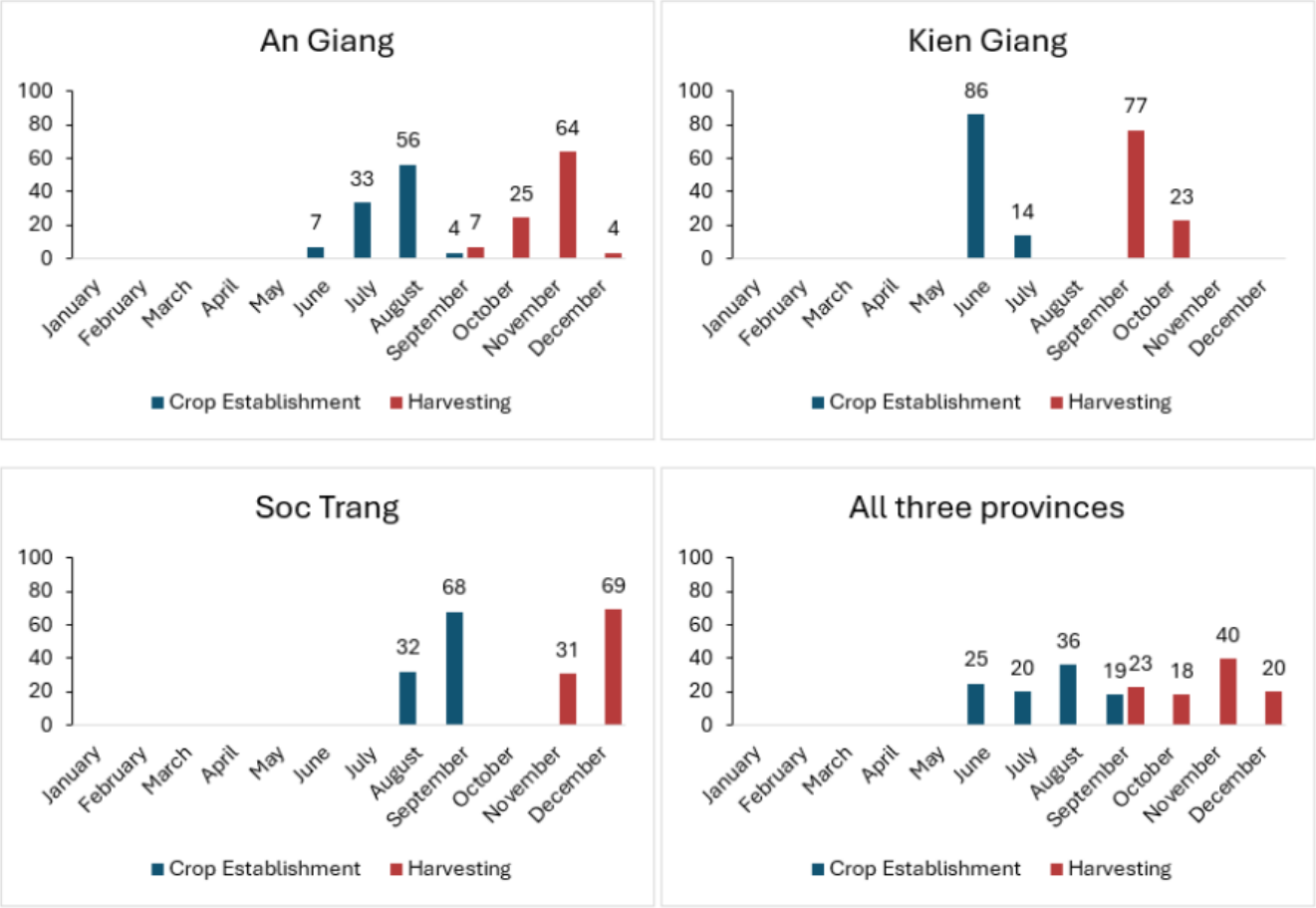


Figure 109. Monthly distribution of surveyed farmers' rice planting and harvesting activities (in percent), by province, Autumn-Winter 2024.

In relation to this, the harvesting activity of the interviewed rice farmers typically occurred between September and December. In Kien Giang, 77% of respondents reported harvesting during September, while 64% of farmers from An Giang conducted this activity in November. Lastly, 69% of farmers from Soc Trang harvested rice crops during December.

3.9.3. Crop Establishment

Crop establishment is a method used by farmers to establish rice plants in the fields. It is a crucial stage in rice cultivation as it sets the foundation for a rice cropping cycle by significantly influencing productivity and rice quality. In relation, crop establishment can be conducted in various ways, including transplanting and direct seeding of rice (DSR) (Kashenge-Killenga et al., 2017).

As shown in Table 47, direct seeding appeared to be the dominant crop establishment method among the six provinces in Vietnam. During the Winter–Spring and Summer–Autumn seasons, the majority of farmers used DSR, at 86 percent and 89 percent, respectively. While in the Autumn-Winter season, almost all (98%) of the farmers across all provinces utilized DSR in planting. Notably, this was emphasized in Kieng Giang and Soc Trang, where 100% adoption rates were achieved among farmers. In accordance, this high adoption rate of DSR in the mentioned provinces could probably highlight the effective transfer of knowledge and techniques from institutions and fellow farmers (based on Table 16).

Table 47. Crop establishment method employed by surveyed farmers (in percent), by season and province, 2023-2024.

Crop Establishment Method	Thai Binh	Nghe An	An Giang	Kien Giang	Soc Trang	All provinces
Winter-Spring (2023-2024)	**(n=118)**	**(n=120)**	**(n=119)**	**(n=120)**	**(n=111)**	**(n=588)**
Transplanting	45	19	4	0	0	14
Direct-seeding	55	81	96	100	100	86
Summer-Autumn (2024)	**(n=116)**	**(n=120)**	**(n=119)**	**(n=119)**	**(n=117)**	**(n=591)**
Transplanting	43	11	3	0	0	11
Direct-seeding	57	89	97	100	100	89
Autumn-Winter (-2024)	**(n=0)**	**(n=0)**	**(n=114)**	**(n=57)**	**(n=59)**	**(n=230)**
Transplanting	-	-	4	0	0	2
Direct-seeding	-	-	96	100	100	98

During the Winter-Spring and Summer-Autumn seasons, only 55% and 57% of farmers employed DSR as a crop establishment method in Thai Binh. This may stem from the small support that farmers received in the province in order for them to fully adopt or implement DSR during rice cultivation cycles (see Figure 50).

The selection of cultivated rice varieties is crucial in achieving a successful crop cycle, as this substantially affects yields, rice quality, and the incomes of farmers. Thus, various factors such as soil type, environmental conditions, weather conditions, water availability, and market demands must be considered to enhance productivity, meet demand, and increase the economic benefits received by rice farmers (IRRI, n.d.; Rangga et al., 2022).

Considering this, Figure 110 reveals the significant distribution of rice varieties cultivated during the Winter-Spring season. In the northern provinces of Vietnam, such as Thai Binh and Nghe An, TBR225 was widely cultivated, accounting for 54% and 32% of farmers. This could be due to its impressive yield potential and good grain quality, making it appealing and popular among farmers within the region (Bao, 2016; Nguyen et al., 2025).

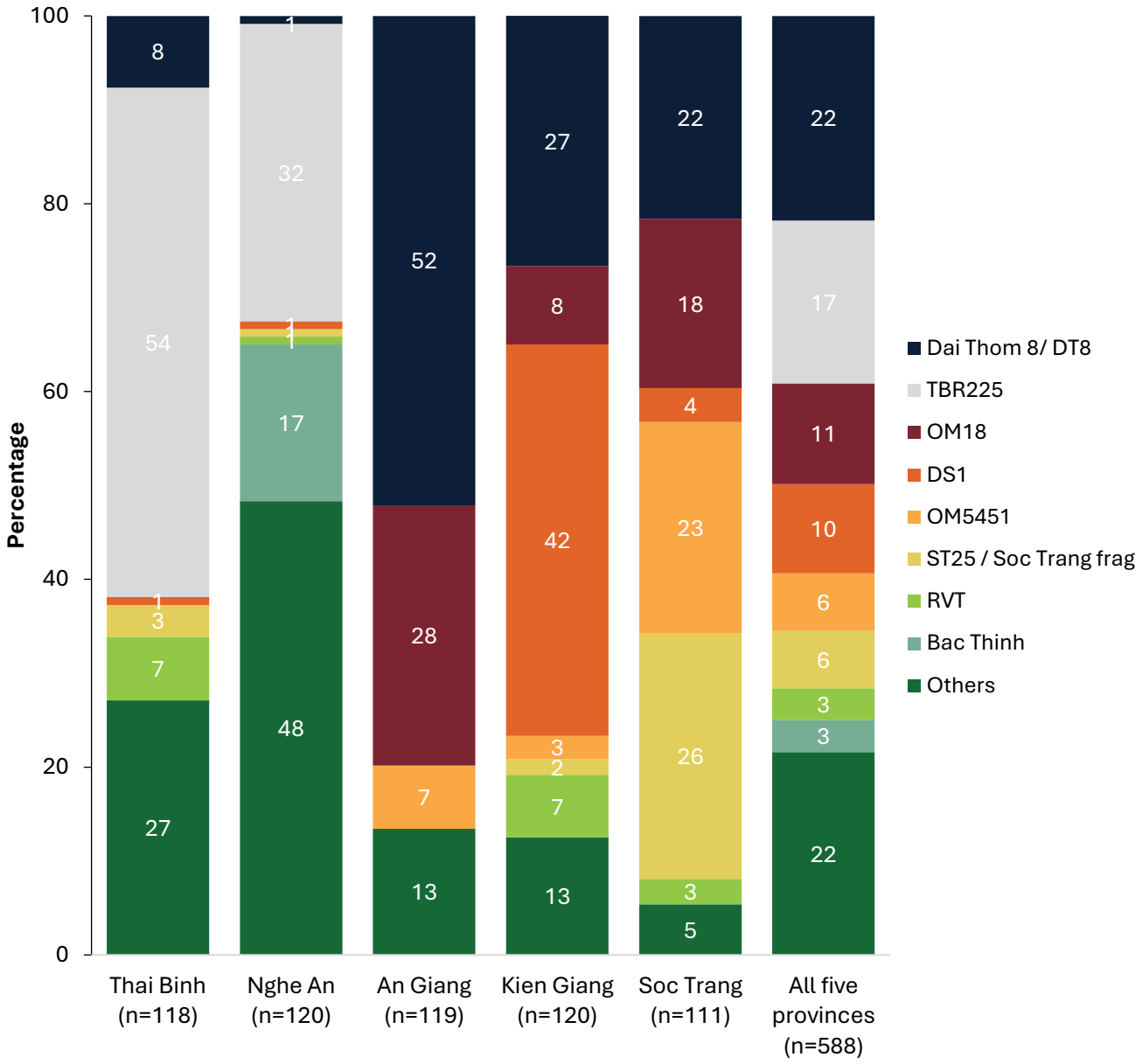


Figure 110. Surveyed farmers' rice variety distribution (in percent), by province, Winter-Spring 2023-2024.

Meanwhile, it can also be observed that Dai Thom 8 (DT8) was popularly cultivated in Mekong Delta provinces such as An Giang (52%) and Kien Giang (27%). Accordingly, the widespread use of this variety may be attributed to its strong aroma and good grain and eating quality. Figure 110 also presents that the ST25 rice variety was highly concentrated in Soc Trang province. Accordingly, the extensive adoption of this rice variety may stem from its exceptional aroma and flavor, allowing it to establish a presence in local and international markets (Bui et al., 2023). Lastly, the figure also reveals "Other" rice varieties that were minor or local varieties, such as ST24, BC15, and IR50404. Generally, the data appears to exhibit an important pattern of aligning rice varieties with factors such as environmental conditions and consumer preferences to enhance crop productivity while ensuring market competitiveness.

For the Summer-Autumn season, variations of cultivated rice varieties were also evident. Similar to the Winter-Spring season, the TBR225 rice variety maintained its prominence in Thai Binh during the Summer-Autumn season, accounting for 39% of the adoption by rice farmers within the province. Additionally, the cultivation of OM5451 was also widespread in An Giang and Soc Trang, accounting for 46% and 36% of the farmers, respectively. Meanwhile, DS1 was commonly adopted by the majority (40%) of rice farmers from Kien Giang. The extensive utilization of this rice variety may stem from its tolerance to salinity and export potential (Bui et al., 2019). Lastly, 59% of the farmers from Nghe An utilized Khang Dan rice variety during the Summer-Autumn season. The majority of farmers valued this variety due to its stable yield and tolerance to abiotic stresses and diseases. Moreover, the figure also exhibits the "Other" category, which encompasses the minor rice varieties, including TBR97 and DB6.

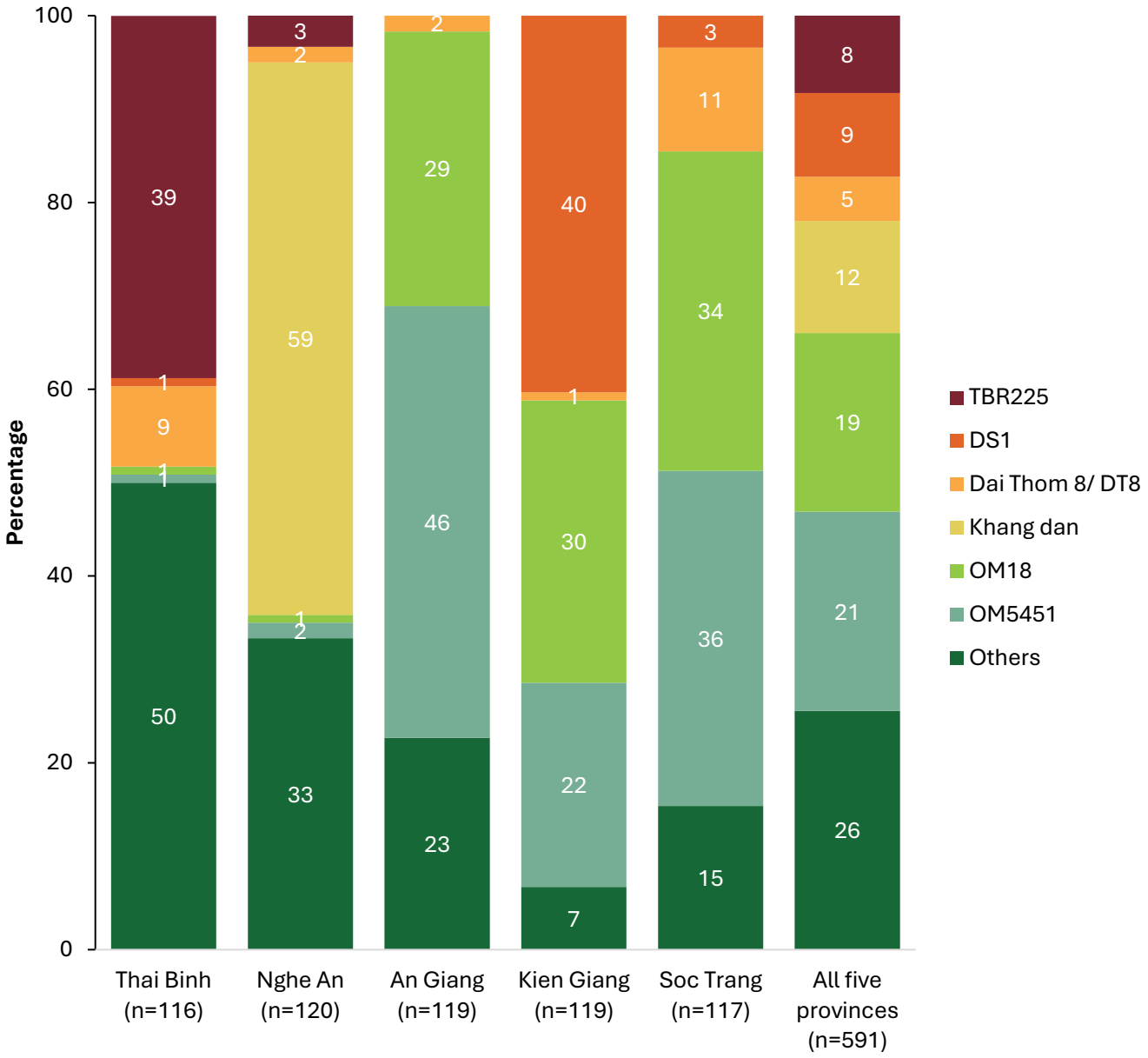


Figure 111. Surveyed farmers' rice variety distribution (in percent), by season, Summer-Autumn 2024.

Furthermore, Figure 112 depicts the different rice varieties utilized by farmers during the Autumn-Winter season. OM5451 and OM18 appeared to be the most common rice varieties, wherein 51% and 24% of farmers across provinces used these seeds during crop establishment. Accordingly, these varieties were particularly dominant in the provinces of An Giang and Kien Giang, with farmers who used OM5451 reaching 42% and 67%, respectively. While 32% and 25% of the farmers from the same provinces utilized OM18. According to the study by Nguyen et al. (2025), farmers switch to utilizing these varieties due to their manageable characteristics, high adaptability to various weather conditions, high pest resistance, and short cropping cycles, allowing rice farmers to reduce expenses associated with pest control while achieving increased productivity.

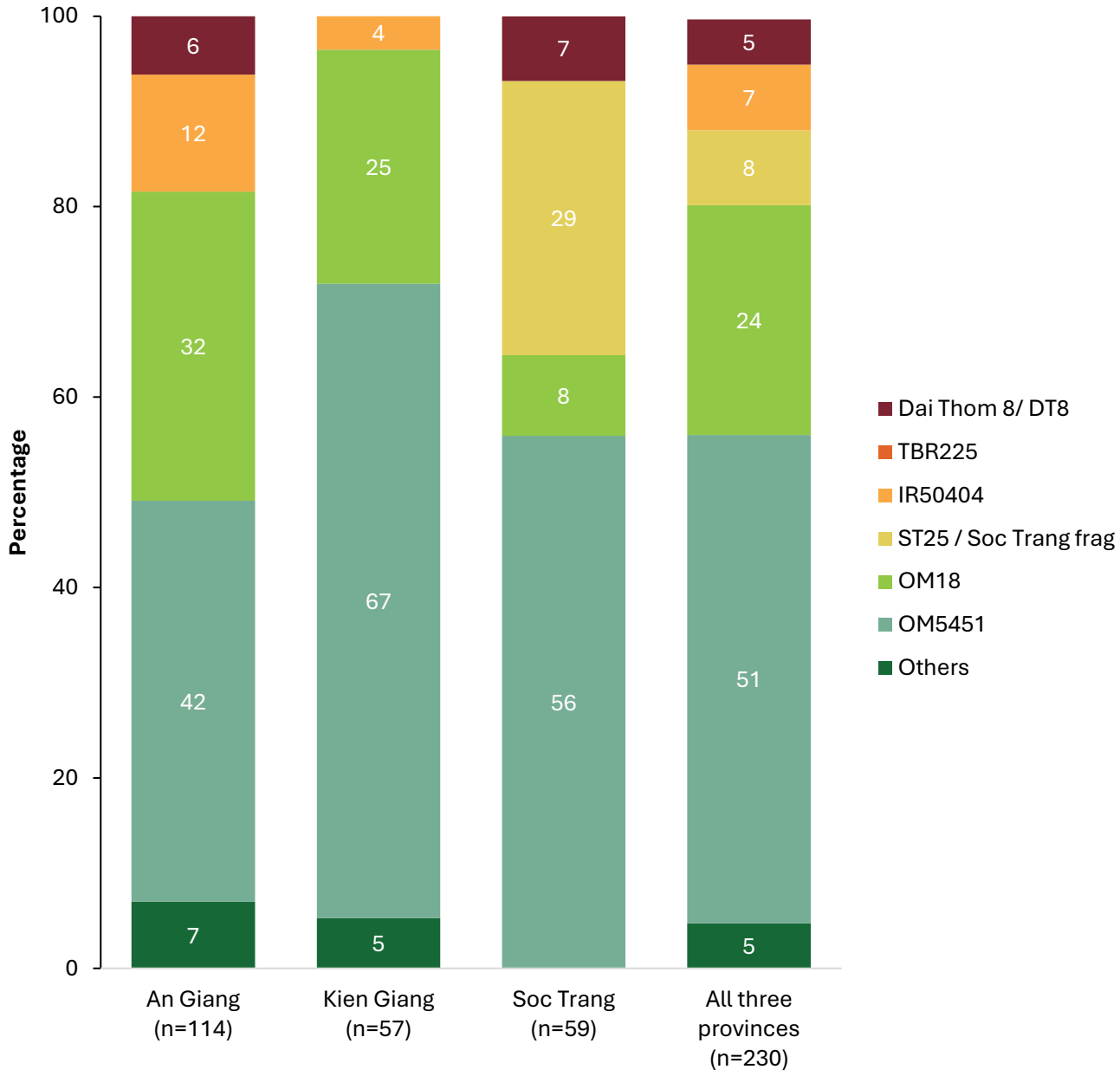


Figure 112. Surveyed farmers' rice variety distribution (in percent), by province, Autumn-Winter 2024.

Seed rate is defined as the number of seeds sown in an area, which is typically measured in kilograms per hectare. Accordingly, it is regarded as an essential measurement to ensure good standing of rice crops, optimal crop density in an area, and adequate intake of nutrients from inputs such as fertilizers (Runsick and Wilson, 2009). Recommended seed rates vary depending on the type of seeds used and the method of crop establishment.

Figure 113 highlights a significant relationship between seed rate and method of crop establishment. In provinces with higher adoption of DSR, seed rates were also comparatively high. This pattern was particularly evident in the province of An Giang, where the DSR adoption ranges from 96% to 97% and an average seed rate of 131kg/ha in all three seasons. This was followed by farmers from Soc Trang, who had a 100% adoption rate of DSR as a crop establishment method, reporting average seed rates of 95 kg/ha, 96 kg/ha, and 88 kg/ha, respectively, for the three seasons. In contrast, farmers from Thai Binh, who had comparatively lower DSR adoption rates among the provinces (55% and 57% in two seasons), recorded the lowest seed rates across all provinces, at 49 kg/ha and 50 kg/ha in each season.

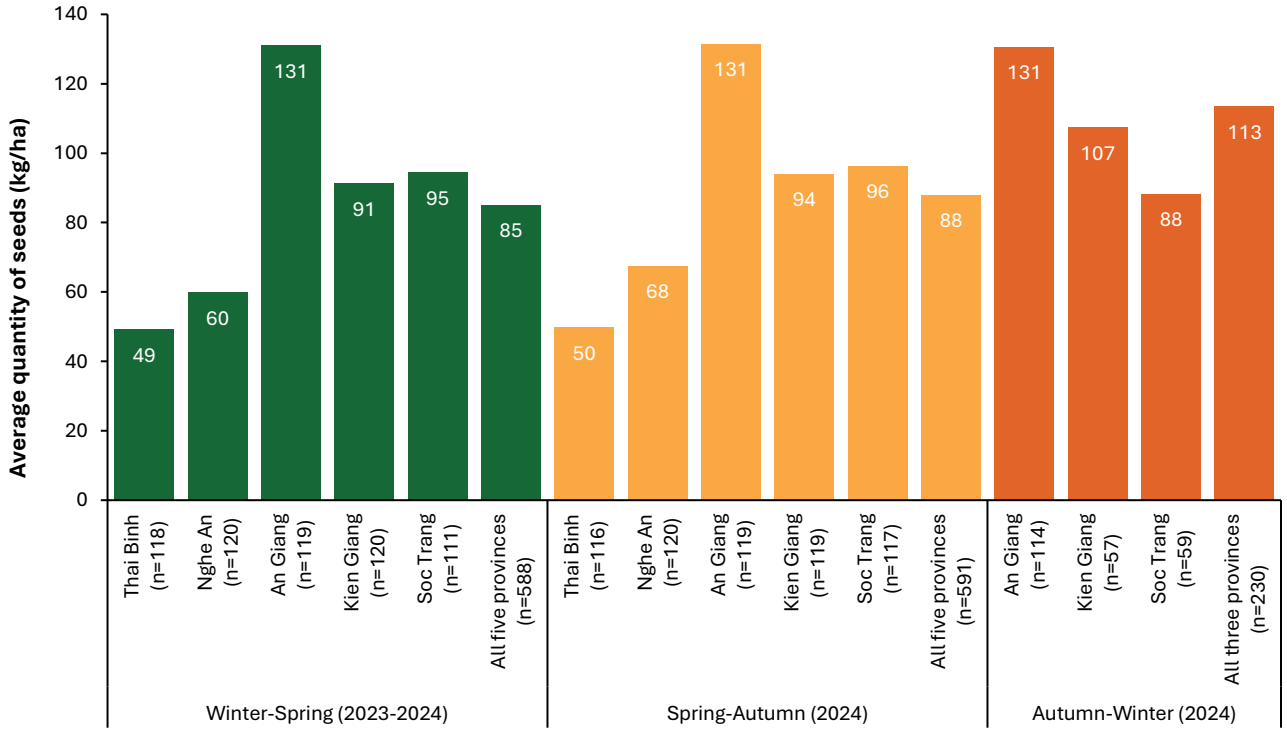


Figure 113. Average quantity of seeds used (kg/ha) by the surveyed farmers, by season and province, 2023-2024.

In terms of flooding, before the actual sowing of seeds in the field, as shown in Figure 114 to Figure 116, the majority of farmers across provinces and seasons appeared to practice flooding of fields, accounting for 83% to 84% of the respondents. In general, farmers reported maintaining the flooded field condition for 30 days or less before sowing. The extensive use of this practice among farmers can be attributed to the advantages it brings, such as controlling weed growth and enhancing root establishment, which aids in nutrient absorption essential for crop development (Ismail, 2012).

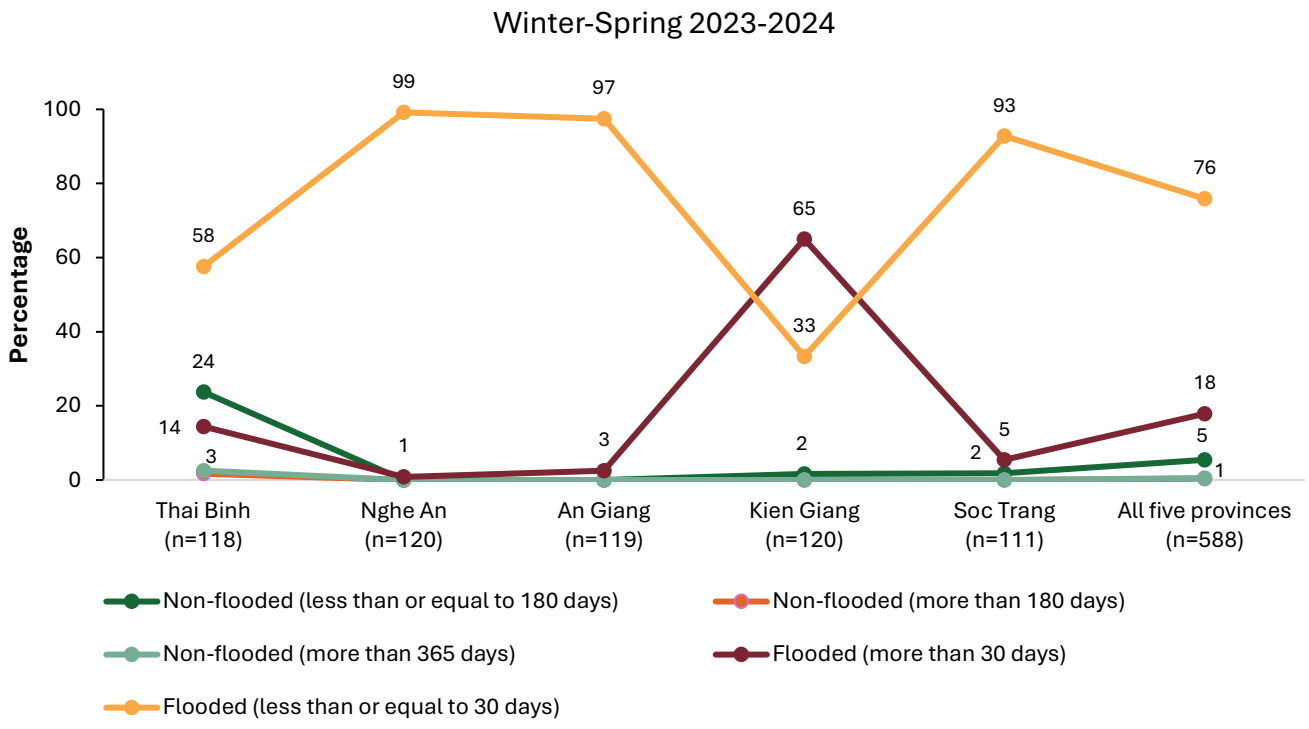


Figure 114. Number of days (in percent) the plot was submerged in water before crop establishment, as reported by surveyed farmers, by province, Winter-Spring 2023-2024.

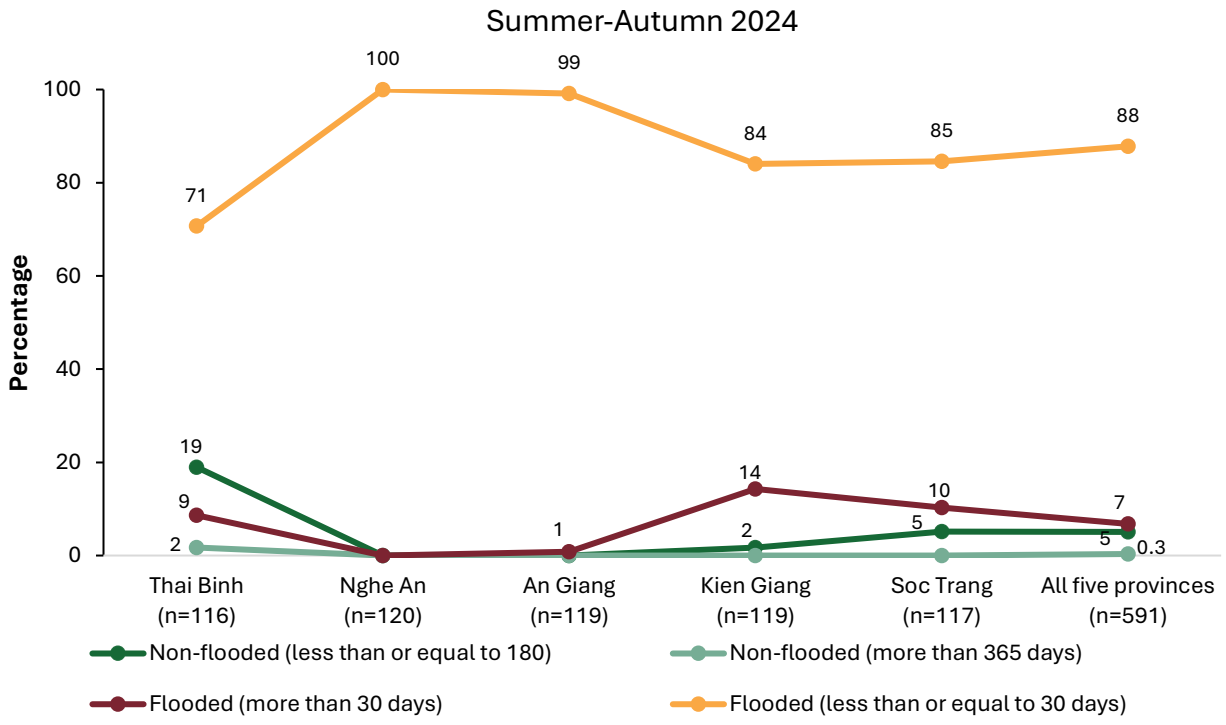


Figure 115. Number of days (in percent) the plot was submerged in water before crop establishment, as reported by surveyed farmers, by province, Summer-Autumn 2024.

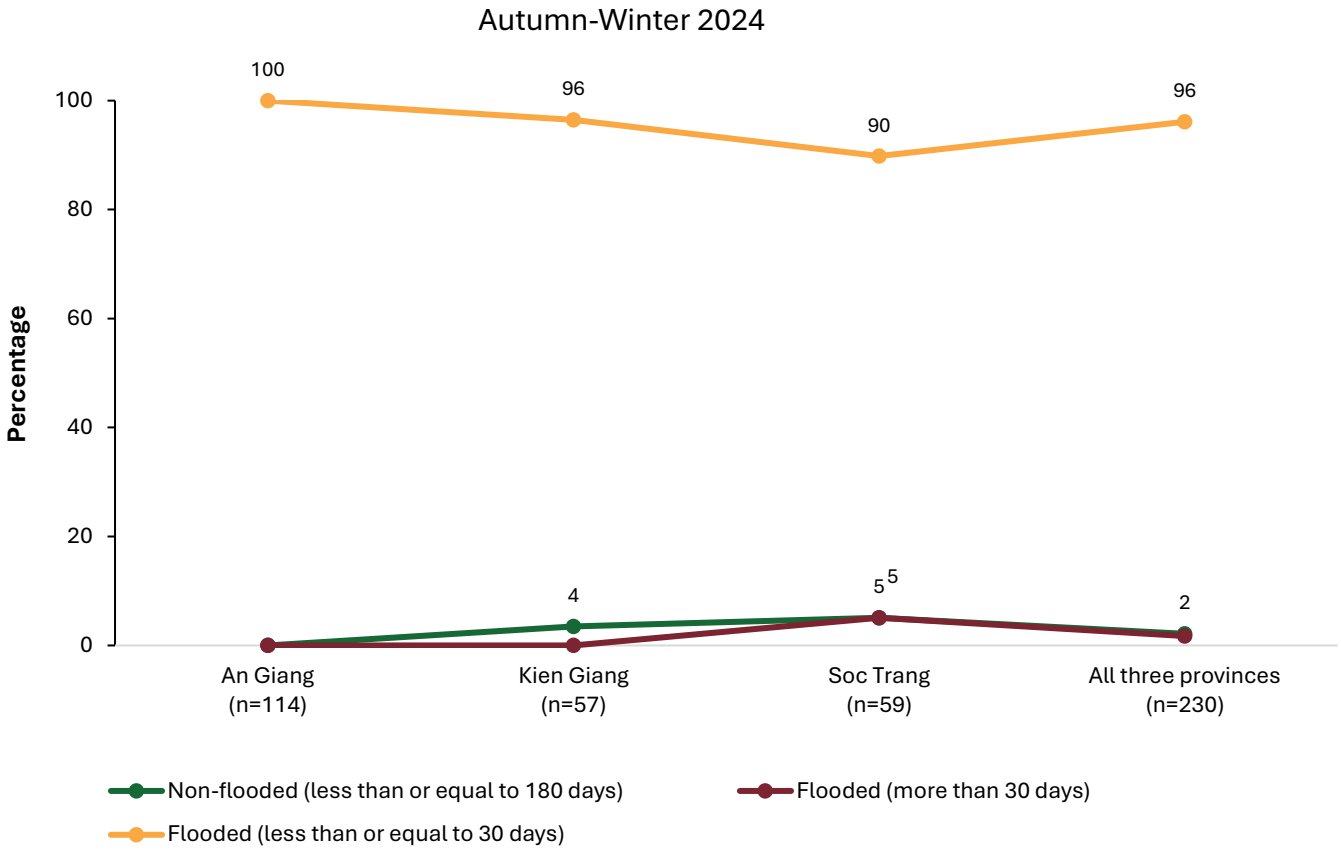


Figure 116. Number of days (in percent) the plot was submerged in water before crop establishment, as reported by surveyed farmers, by province, Autumn-Winter 2024.

While this practice provides substantial benefits, it also poses environmental drawbacks such as the increased emission of GHG–particularly methane (CH_4), due to the anaerobic condition of soil when it is submerged in water for an extended period. Considering this, despite the favorable results offered by this technique, it also contributes to the ongoing challenge posed by climate change; thus, emphasizing the need for the broader dissemination of knowledge and skills related to sustainable water management practices, as well as assistance that would encourage farmers to adopt climate-smart agriculture techniques.

3.9.4. Fertilizer Application

The results of fertilizer application patterns observed in the five surveyed provinces in Vietnam during the Winter-Spring 2024 rice season, urea was the most applied fertilizer among farmers, with 82% utilizing it at an average rate of 146 kg/ha (Table 48). MOP was also widely adopted, used by 67% of farmers at a rate of 102 kg/ha, followed by DAP at 147 kg/ha, used by 51% of farmers. Among complete fertilizers, notable rates were observed with 32% of farmers applied a 16-16-08 at 325 kg/ha, and 20% used a 20-20-15 fertilizer at 201 kg/ha.

Table 48. Average quantity of fertilizer applied (kg/ha) by surveyed farmers, by province, during Winter-Spring 2023-2024.

Fertilizer Type	Thai Binh (n=118)		Nghe An (n=120)		An Giang (n=119)		Kien Giang (n=120)		Soc Trang (n=111)		All five provinces (n=588)	
	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty
Urea (46-0-0)	53	88	77	156	98	173	92	149	90	136	82	146
Complete (15-15-15)	11	224	12	243	1	100	0	0	0	0	5	229
DAP (18-46-0)	3	247	1	435	84	144	88	169	84	118	51	147
Muriate of Potash (0-0-60)	34	103	73	113	80	100	82	103	64	87	67	102
TSP (0-46-0)	1	547	3	246	4	144	1	333	9	170	3	202
NPK 08-10-03	0	0	16	258	0	0	0	0	0	0	3	258
NPK 08-10-13	0	0	9	400	0	0	0	0	0	0	2	400
NPK 16-13-6	2	314	10	408	0	0	0	0	0	0	2	394
NPK 16-16-08	47	366	57	462	27	142	22	159	6	131	32	325
NPK 20-20-15	3	300	3	324	34	175	22	183	41	217	20	201
NPK 25-25-05	0	0	0	0	0	0	0	0	5	152	1	152
Compost	3	255	2	1500	0	0	1	500	2	234	2	554
Green manure	0	0	4	2872	0	0	0	0	0	0	1	2872
Organic manure	3	2074	40	4254	1	200	9	179	23	249	15	2487
Other fertilizers	36	360	9	415	7	129	10	288	14	228	15	314

Surprisingly, the amount of organic fertilizers applied during Winter-Spring 2023-2024 was significantly high, as shown in Figure 117. Organic green manure was applied the most, with an average amount of 2,872 kg/ha, although only 1% of farmers incorporated it. Organic manure was applied at an average of 2,487 kg/ha by 15% of farmers across five provinces, with 40% of farmers in Nghe An applying at an exceptional average of 4,254 kg/ha. Overall, it appears that farmers in Nghe An applied various types of fertilizers at higher rates compared to other regions, suggesting a more intensive and potentially integrated approach to nutrient management, which may have been aimed at enhancing soil health and optimizing crop nutrition in that province.

Meanwhile, as shown in Figure 114, nitrogen was the most applied nutrient, at an average rate of 117 kg/ha, across the five provinces. Nghe An demonstrated the highest rate of nitrogen application at 176 kg/ha, more than double that of Thai Binh (78 kg/ha). The difference in nitrogen application is likely attributable to Nghe An applying a higher amount of urea compared to Thai Binh. Furthermore, Nghe An applied the highest rate of potassium at 90 kg/ha, which can be linked to farmers in this province utilizing a higher quantity of MOP, a fertilizer rich in potassium.

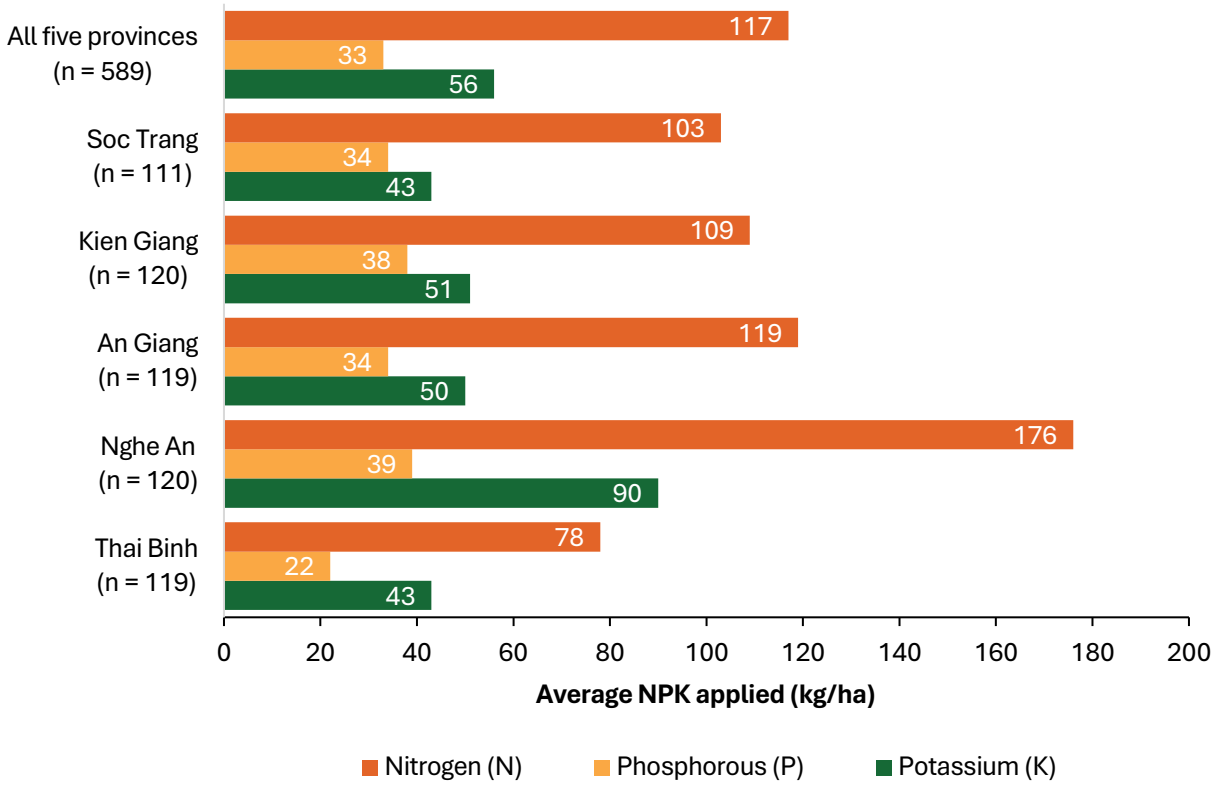


Figure 117. Average NPK quantity applied (kg/ha) by surveyed farmers, by province, Winter-Spring 2023-2024.

The various fertilizer types applied by farmers during the Summer-Autumn season (2024) are displayed in Table 49. Urea was the most common choice among 83% of the surveyed farmers, reflecting a strong preference for fertilizers with high nitrogen content. Nghe An notably exhibited very high urea usage (169 kg/ha) and stood out for its significant application of most fertilizers (80%), including MOP and other complete (NPK) formulations. On the other hand, among the organic fertilizers used, manure was the most widely applied, at an average of 2,405 kg/ha, followed by green manure at 1,547 kg/ha and compost at 555 kg/ha. This trend was particularly evident in Nghe An, where high usage of compost and green manure was observed, and in Thai Binh, where significant application of organic manure was noted. In contrast, provinces such as An Giang, Kien Giang, and Soc Trang demonstrated a stronger preference for DAP, specifically 18-46-0. An Giang and Kien Giang also favored high MOP use, while Soc Trang leaned towards NPK 20-20-15. These diverse fertilizations across provinces highlight distinct approaches to nutrient management, likely tailored to local environmental conditions, specific crop requirements, and varying soil nutrient profiles.

Table 49. Average quantity of fertilizer applied (kg/ha) by surveyed farmers, by surveyed farmers, by province, Summer – Autumn 2024.

Fertilizer Type	Thai Binh (n=116)		Nghe An (n=120)		An Giang (n=119)		Kien Giang (n=119)		Soc Trang (n=117)		All five provinces (n=591)	
	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty
Urea (46-0-0)	52	89	80	169	98	167	92	155	90	125	83	146
Complete (15-15-15)	11	251	13	221	1	100	0	0	1	160	5	228
DAP (18-46-0)	3	247	0	0	85	142	87	172	82	114	51	144
Muriate of Potash (0-0-60)	34	108	72	117	79	97	81	104	63	84	66	102
TSP (0-46-0)	1	547	1	100	5	150	0	0	9	197	3	195
NPK 08-10-03	0	0	14	231	0	0	0	0	0	0	3	231
NPK 08-10-13	0	0	8	439	0	0	0	0	0	0	2	439
NPK 16-13-6	2	314	10	412	0	0	0	0	0	0	2	398
NPK 16-16-08	48	369	58	448	26	145	20	179	6	184	32	330
NPK 20-20-15	3	314	3	388	31	170	23	186	41	198	20	195
NPK 25-25-05	0	0	0	0	0	0	0	0	6	150	1	150
Compost	3	255	1	3000	0	0	2	253	2	234	2	555
Green manure	0	0	2	1547	0	0	0	0	0	0	0.3	1547
Organic manure	3	1618	34	4175	1	200	8	236	19	334	13	2405
Other fertilizers	33	364	6	335	8	147	10	276	15	208	14	294

The NPK uptake patterns during the Summer–Autumn season generally mirrored fertilizer application trends across the five provinces, as shown in Figure 118. Specifically, provinces exhibiting high nitrogen uptake, such as Nghe An and An Giang, correlated strongly with their extensive use of nitrogen-rich fertilizers like urea, DAP, and other NPK fertilizers (e.g., 20-20-15). Similarly, high phosphorus uptake, particularly in An Giang, Kien Giang, and Soc Trang, directly reflected their substantial application of DAP, a fertilizer commonly used by a high percentage of farmers in these provinces. For potassium, Nghe An farmers applied the most at an average rate of 85 kg/ha. This was consistent with their significant usage of MOP. These distinct NPK uptake profiles across provinces highlight how local farming practices are adapted to meet the specific nutrient demands of crops and prevailing soil conditions.

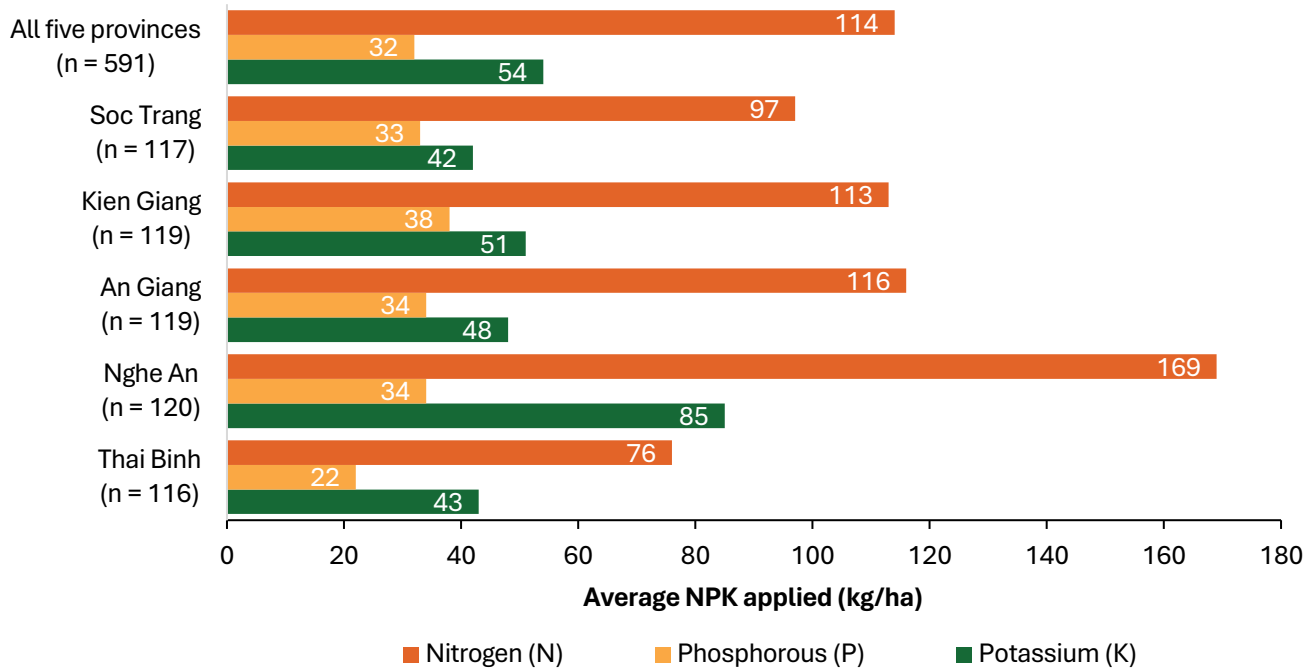


Figure 118. Average NPK quantity applied (kg/ha) by surveyed farmers, by province, Summer-Autumn 2024.

During the Autumn-Winter 2024 rice season, Table 50 reveals a firm reliance on synthetic nutrient inputs. Urea (46-0-0) was the predominant nitrogenous fertilizer, applied by almost all farmers (96%) at an average amount of 141 kg/ha, highlighting its important role in meeting the crop's nitrogen demands. This was closely followed by Diammonium Phosphate (DAP, 18-46-0), which was utilized by 87% of farmers at a rate of 133 kg/ha, indicating a significant emphasis on phosphorus supplementation alongside nitrogen. Furthermore, Muriate of Potash (MOP, 0-0-60), essential for potassium supply, was applied by 79% of farmers at a rate of 90 kg/ha.

Table 50. Average quantity of fertilizer applied (kg/ha) by surveyed farmers, by province, Autumn–Winter 2024.

Fertilizer Type	An Giang (n = 114)		Kien Giang (n = 57)		Soc Trang (n = 59)		All three provinces (n = 230)	
	%	Qty	%	Qty	%	Qty	%	Qty
Urea (46-0-0)	97	160	98	110	92	133	96	141
Complete (15-15-15)	1	100	0	0	2	183	1	194
DAP (18-46-0)	84	139	96	138	86	117	87	133
Muriate of Potash (MOP)	81	95	91	82	66	89	79	90
TSP (0-46-0)	4	123	0	0	12	179	5	159
NPK 16-16-08	28	135	12	95	2	154	17	128
NPK 20-20-15	32	166	19	154	34	204	29	176
NPK 25-25-05	0	0	0	0	5	105	1	105
Compost	0	0	2	500	0	0	0.4	500
Organic manure	1	200	16	215	19	203	9	208
Other fertilizers	8	157	5	139	22	242	11	199

Beyond these primary nutrient sources, the use of complete or NPK fertilizers was also evident. Specifically, 29% of farmers applied NPK 20-20-15 at an average rate of 176 kg/ha, while 17% utilized NPK 16-16-08 at 128 kg/ha. This suggests a preference for balanced nutrient formulations to support overall crop development. While less prevalent, farmers also integrated organic fertilizers, such as compost at an average of 500 kg/ha (applied by 0.4% of farmers) and organic manure at 208 kg/ha by 9% of farmers.

Among the macronutrients, such as Nitrogen (N), Phosphorus (P), and Potassium (K) used during the Autumn-Winter season, nitrogen was applied at the highest rate, averaging 102 kg/ha across the surveyed provinces (Figure 119). Next, Potassium was applied at 46 kg/ha, while Phosphorus was applied at the lowest rate among the macronutrients, at 33 kg/ha. At the provincial level, An Giang had the highest average application rates for all macronutrients—Nitrogen (112 kg/ha), Phosphorus (32 kg/ha), and Potassium (48 kg/ha). Conversely, Kien Giang exhibited the lowest application rates, with 84 kg/ha of N, 31 kg/ha of P, and 43 kg/ha of K. These findings could indicate differences in soil nutrient status, fertilizer availability, or farmer practices compared to those in other provinces.

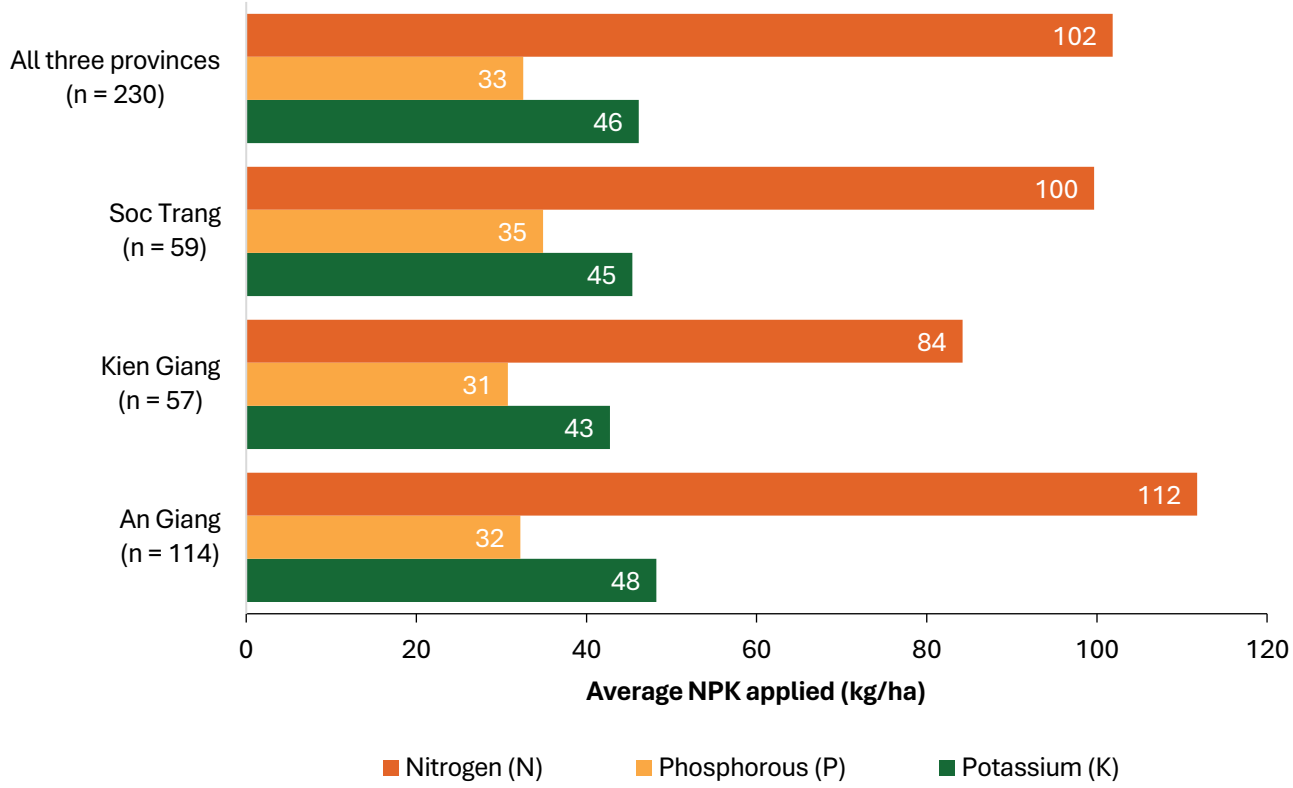


Figure 119. Average NPK quantity applied (kg/ha) by surveyed farmers, by province, Autumn-Winter 2024.

Based on the previous results showing the average application rates (kg/ha) for specific fertilizer types across the seasons, the Winter-Spring 2023-2024 season appeared to have the highest overall application of synthetic fertilizers. This may be because it is considered the dry season in Vietnam, wherein farmers often experience more stable weather conditions with less rainfall. According to Wang et al. (2024), rainfall can have a significant impact on the crop's absorption of nutrients from fertilizers. Hence, prolonged or frequent rainfall can lead to nutrient

loss through runoff and leaching. As such, farmers tend to invest more heavily in fertilizer input during the dry season, particularly synthetic ones, for effective utilization and to maximize yields.

While synthetic fertilizers, particularly Urea, DAP, and MOP, were widely used across all three seasons, the Winter-Spring and Summer-Autumn seasons showed a more pronounced integration of organic fertilizers at higher application rates compared to the Autumn-Winter season. This highlights a significant approach to nutrient management, where farmers likely adapt their fertilization strategies based on seasonal crop demands, soil conditions, and the availability or preference for organic amendments. However, it is important to note that one contributing factor to the limited use of organic fertilizers among farmers may be the limited availability. Trinh (2023) mentioned that livestock production has declined significantly due to urbanization and industrialization. As a result, there is no space allocated for household livestock production or waste storage, which contributes to the insufficient supply of organic fertilizers, specifically animal manure.

Furthermore, the results on the application rates of macronutrients (nitrogen, phosphorus, and potassium) in all three seasons showed that N was applied in larger quantities compared to all other nutrients. This may be because it is a key nutrient for optimal rice growth. Although phosphorus and potassium were applied in lower amounts, they are still essential for the overall health and productivity of the rice crop. These nutrients contribute significantly to improving root development and strengthening the rice plant's stalks, which helps prevent lodging (the bending or breaking of stems) and enhances the plant's natural resistance to diseases (IRRI, n.d.). Overall, the farmers consistently relied on the use of inorganic or synthetic fertilizers as the primary nutrient source across all three seasons. Their fertilization strategies and practices vary according to seasonal conditions and crop nutrient requirements.

3.9.5. Harvesting and Threshing

The surveyed farmers across all five provinces in Vietnam heavily relied on mechanized harvesting for rice crops, primarily utilizing combine harvester (Table 51). Throughout the Winter-Spring and Autumn-Winter seasons, combine harvesters were universally adopted by all farmers for harvesting, indicating widespread and complete mechanization for this farm activity. For the Summer-Autumn season, the use of combine harvesters remained dominant at 99.7% overall. The only notable difference was in Thai Binh province, where a minimal 2% of the farmers recorded either manual harvesting or that no machine was used. Although it is important to note that one farmer was unable to harvest due to floods and other climate-related risks, this underscores the vulnerability of even mechanized systems to adverse weather conditions. Another farmer in this group conducted manual harvesting and used a mechanical thresher for grain separation. The near-universal adoption of mechanized harvesting could contribute to increased efficiency and reduced labor intensity in rice production.

Table 51. Surveyed farmers' main source of power for harvesting (in percent), by province,2023-2024.

Winter-Spring 2024	Thai Binh (n = 118)	Nghe An (n = 120)	An Giang (n = 119)	Kien Giang (n = 120)	Soc Trang (n = 111)	All five provinces (n = 588)
Combine harvester	100	100	100	100	100	100
Summer-Autumn 2024	**Thai Binh (n = 116)**	**Nghe An (n = 120)**	**An Giang (n = 119)**	**Kien Giang (n = 119)**	**Soc Trang (n = 117)**	**All five provinces (n = 591)**
Combine harvester	98	100	100	100	100	99.7
None/Manually harvested	2	0	0	0	0	0.3
Autumn-Winter 2023 - 2024	**Thai Binh (n = 0)**	**Nghe An (n = 0)**	**An Giang (n = 114)**	**Kien Giang (n = 57)**	**Soc Trang (n = 59)**	**All five provinces (n = 230)**
Combine harvester	0	0	100	100	100	100

3.9.6. Rice Straw Management

The survey results show the average height of cut/stubble removed after the harvest process across all seasons. Based on Figure 120, the minimum stubble height recorded was 32 centimeters (cm), which was dominantly evident in the province of An Giang throughout all seasons. On the other hand, the highest stubble length, at 38 cm, was observed in Kien Giang and Nghe An during the Winter-Spring and Summer-Autumn seasons, respectively. Meanwhile, Soc Trang reported 36 cm during the Autumn-Winter season.

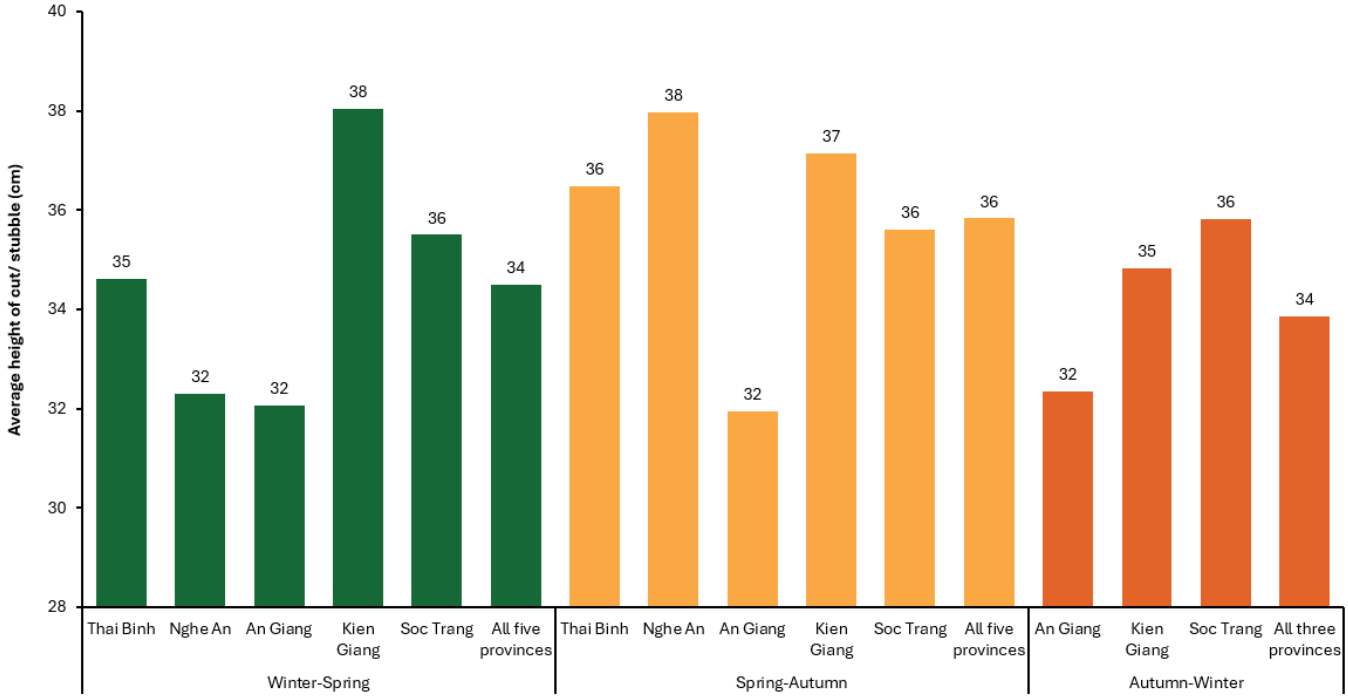


Figure 120. Average height of rice straw cut/stubble (cm) done by the surveyed farmer, by season and province, 2023-2024.

Across all the provinces and seasons, burning rice straws or stubble in the field appeared to be the usual practice done by rice farmers, as shown in Figure 121 to Figure 123. Specifically, 45% of farmers reported burning rice straws during the Winter-Spring season, 34% during the Summer-Autumn season, and 37% during the Autumn-Winter season. The high adoption of this practice may be rooted in its convenience and fast clearing of fields in preparation for the next cropping cycle. Similarly, during the Summer-Autumn season, leaving and incorporating stubbles before land preparation was also the top method used by 34% of respondents across provinces, alongside burning.

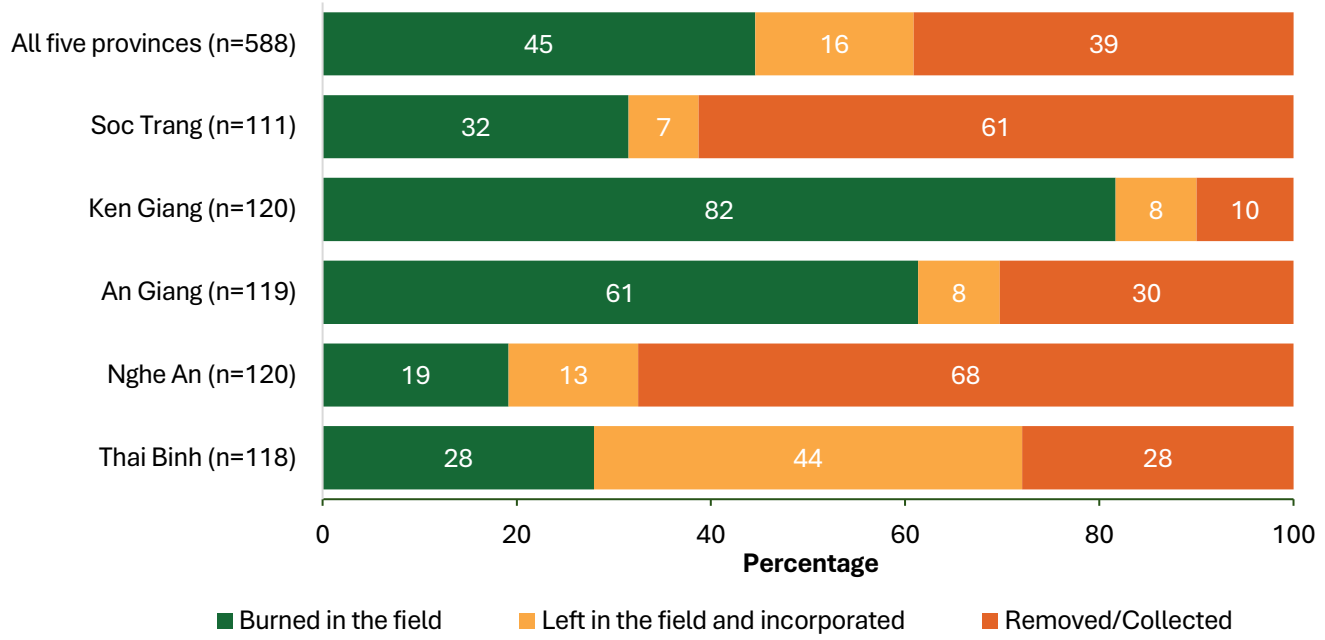


Figure 121. Surveyed farmers' rice straw management after harvesting/threshing (in percent), by province, Winter-Spring 2023-2024.

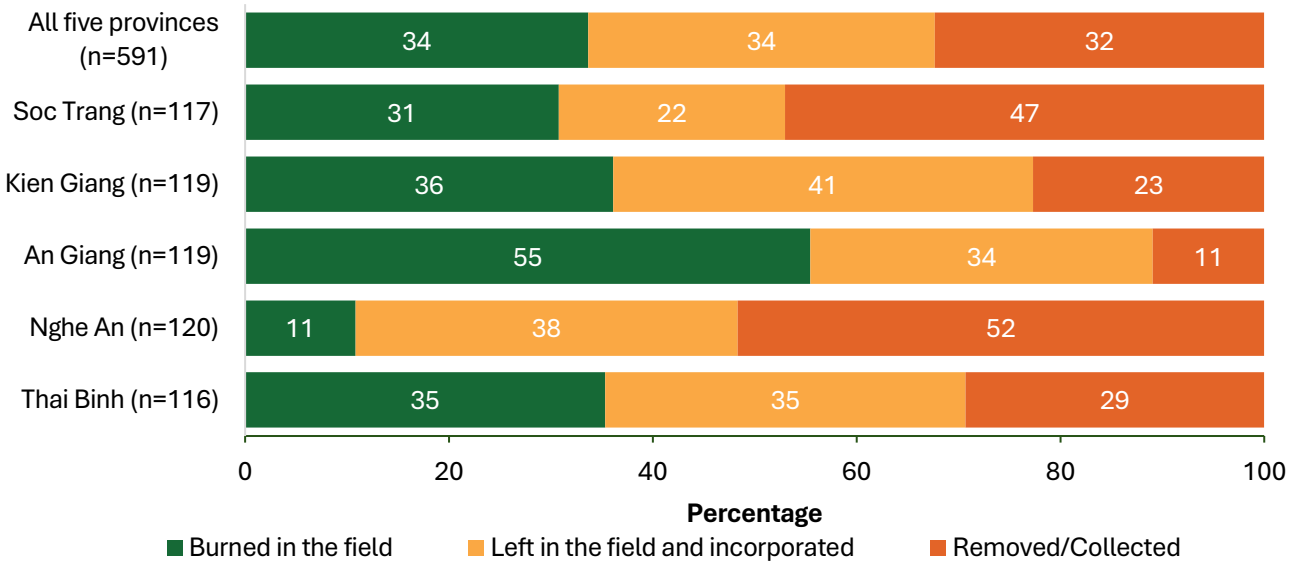


Figure 122. Surveyed farmers' rice straw management after harvesting/threshing (in percent), by province, Summer-Autumn 2024.

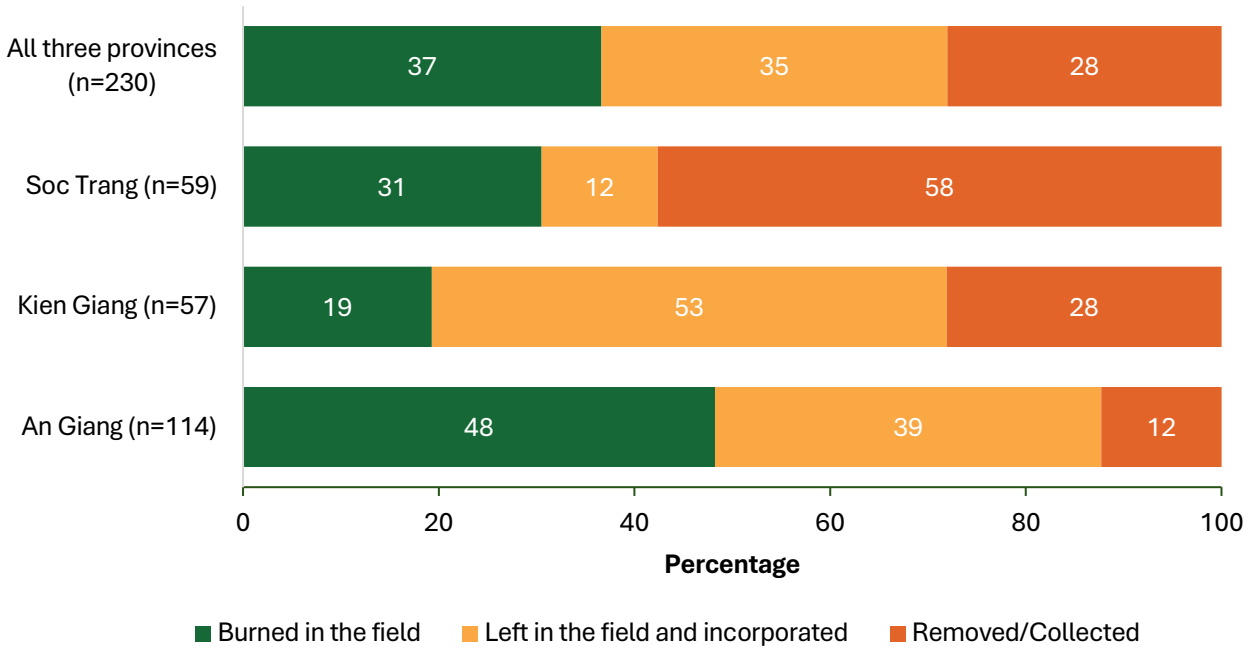


Figure 123. Surveyed farmers' rice straw management after harvesting/threshing (in percent), by province, Autumn-Winter 2024.

Meanwhile, removing and collecting stubble after harvesting was the second most common practice utilized by farmers during the Winter-Spring season, accounting for 39% of total farmers across provinces. In contrast, this practice was only third in the Autumn-Winter season, practiced by only 28% of the interviewed farmers. The lower adoption rate of this practice may stem from the shortage of agricultural laborers who can perform it.

Consequently, the widespread burning of rice stubble among farmers poses a threat to the environment as the continuous burning of rice straw increases the emission of GHGs, particularly methane (CH4), which contributes to the challenges brought by climate change. In relation, the information gathered through the AMR survey could help different institutions identify gaps and develop strategies to fully promote sustainable rice straw management within the country's rice farming systems.

Among the farmers who left rice straws in the field, the majority reported that they incorporated the rice straws into the soil before the subsequent rice cultivation, with 81%, 70%, and 89% of the farmers. As seen in Table 52, An Giang had the highest rate of conducting the incorporation, ranging from 93-100% of the farmers practicing it across seasons. In accordance, this practice may be highly preferred by farmers as it reduces labor demand, and the decomposed rice straw may act as an organic fertilizer, which may enhance soil fertility. However, when this mixed rice straw was submerged in water during the process of flooding the fields, methane emissions may increase due to the limited oxygen conditions.

In relation to the data presented in Table 52, farmers provided several reasons for incorporating rice straw in the soil before land preparation, as illustrated in Figures 124 to 126. The top reason was improving the soil quality of the field where rice cultivation takes place. Considering that rice straws are an organic material, incorporating them into the soil may enhance soil structure by adding or recycling soil nutrients.

Table 52. Surveyed farmers' method of rice straw incorporation (in percent), by province and season, 2023-2024.

Method of Incorporation	Thai Binh	Nghe An	An Giang	Kien Giang	Soc Trang	All five provinces
Winter- Spring	**(n=52)**	**(n=16)**	**(n=10)**	**(n=10)**	**(n=8)**	**(n=96)**
Left in the field (nothing was done)	12	50	0	20	25	19
Mixed in the soil before land preparation	88	50	100	80	75	81
Summer-Autumn	**(n=41)**	**(n=45)**	**(n=40)**	**(n=49)**	**(n=26)**	**(n=201)**
Left in the field (nothing was done)	17	62	5	33	31	30
Mixed in the soil before land preparation	83	38	95	67	69	70
Autumn-Winter	**(n=0)**	**(n=0)**	**(n=45)**	**(n=30)**	**(n=7)**	**(n=82)**
Left in the field (nothing was done)	0	0	7	20	0	11
Mixed in the soil before land preparation	0	0	93	80	100	89

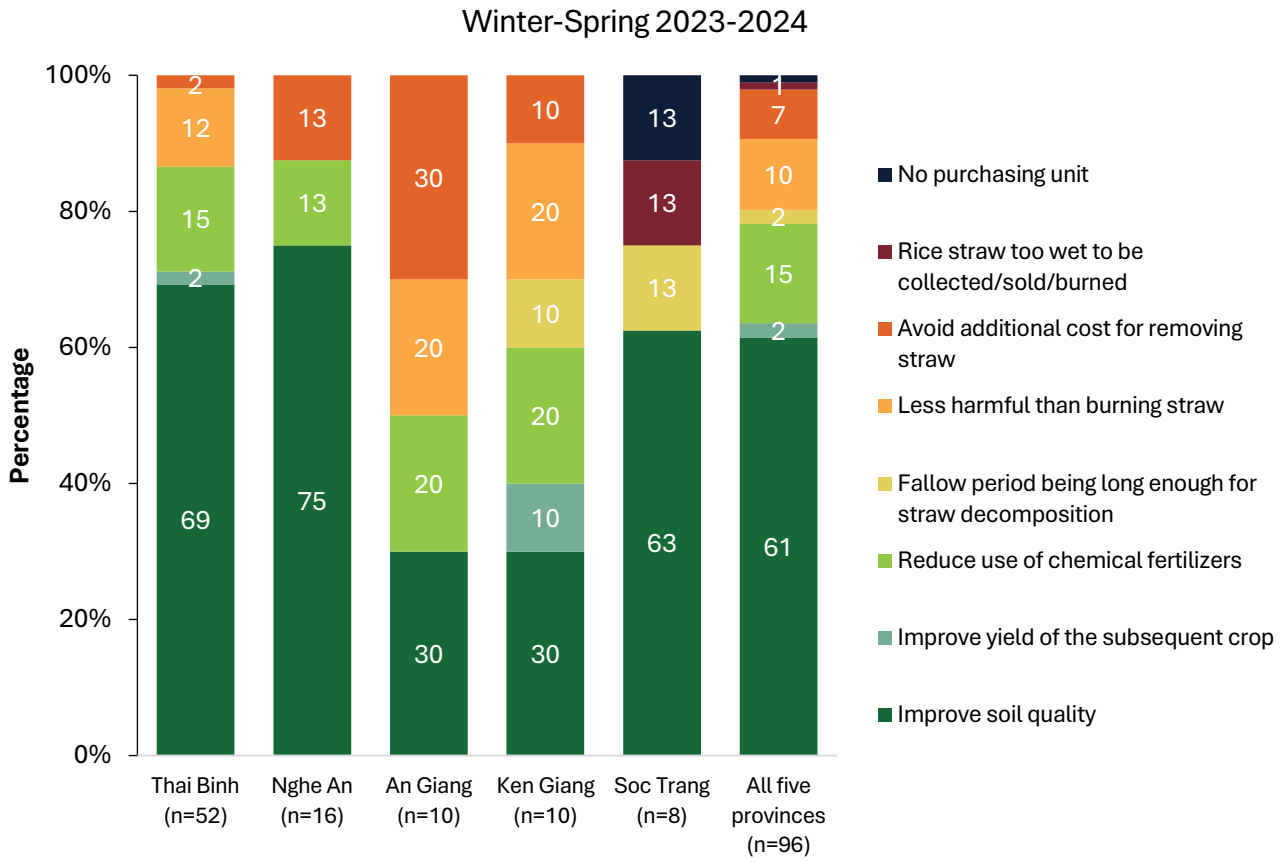


Figure 124. Surveyed farmers' reasons for straw incorporation (in percent), by province, during Winter-Spring 2024.

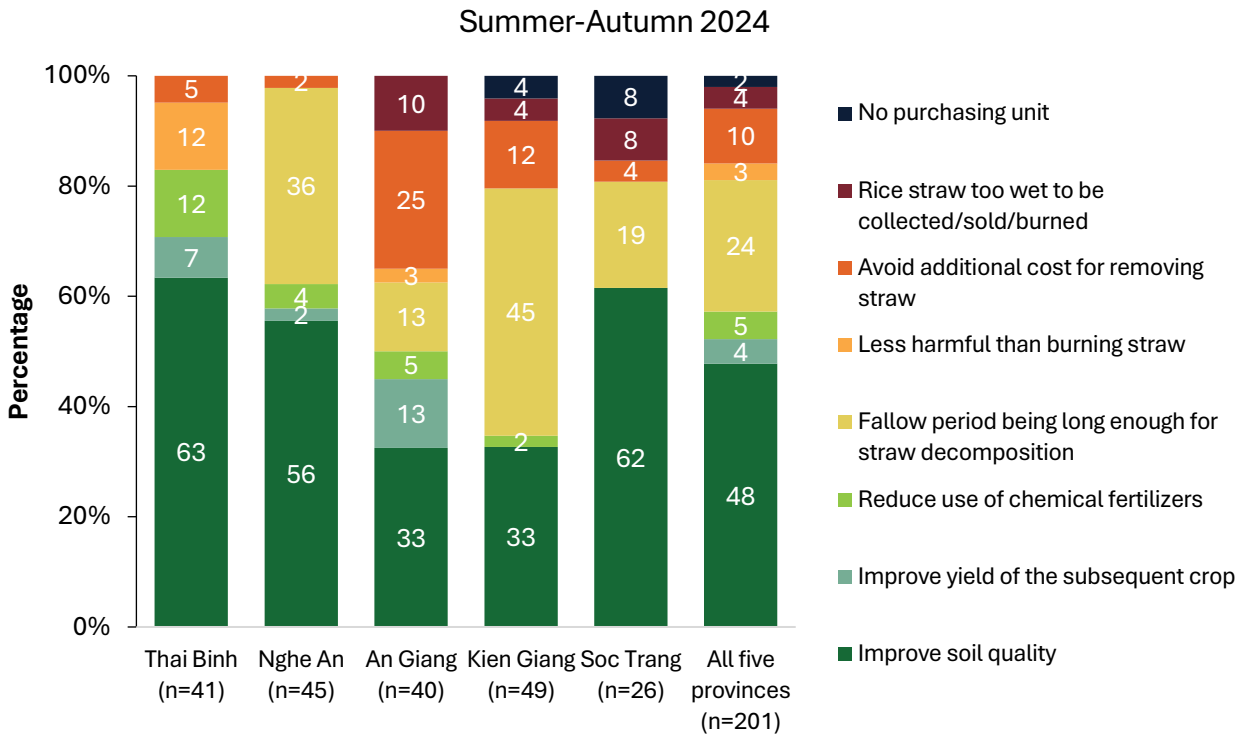


Figure 125. Surveyed farmers' reasons for straw incorporation (in percent), by province, Summer-Autumn 2024.

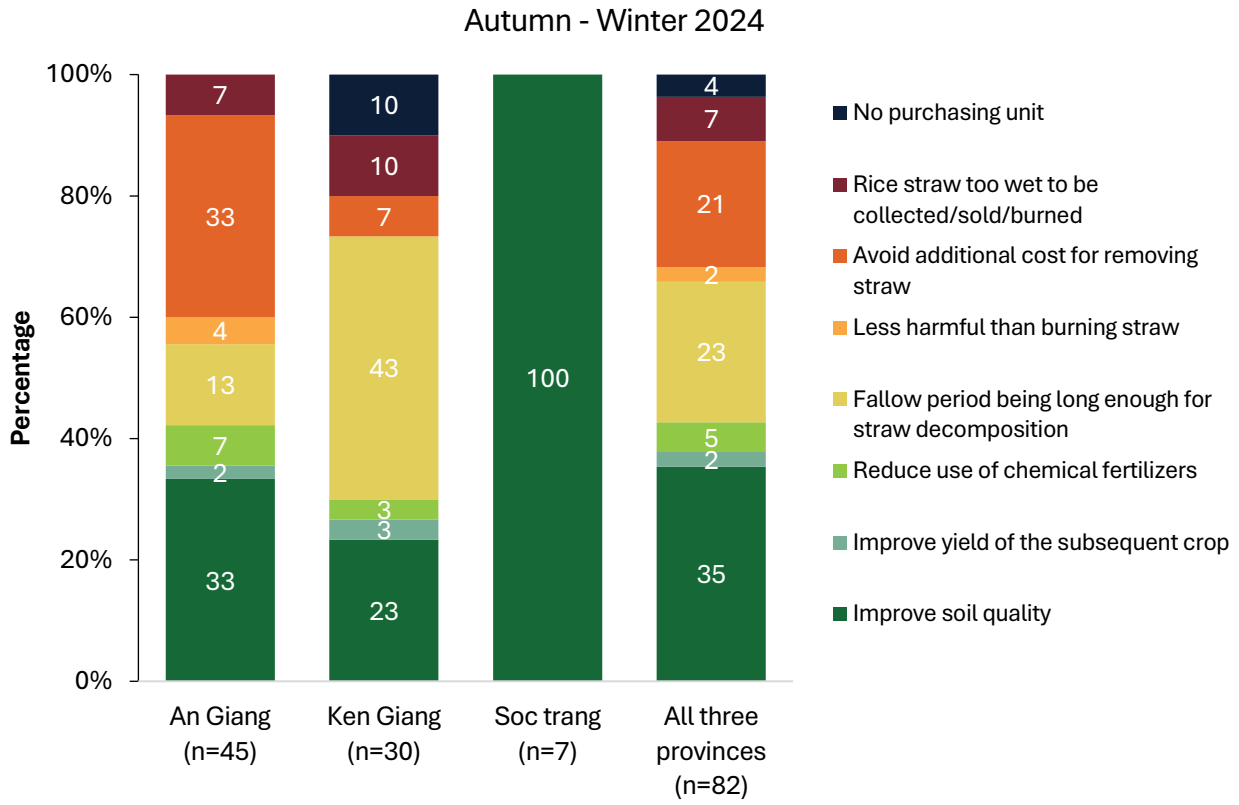


Figure 126. Surveyed farmers' reasons for straw incorporation (in percent), by province, Autumn-Winter 2024.

In addition to soil improvement, farmers in the Summer-Autumn and Autumn-Winter seasons also cited an extended fallow period, as it provides ample time for rice straws to decompose. In contrast, another reason emerged during the Winter-Spring season, wherein 15% of the farmers across provinces expressed a desire to switch to using decomposed rice straw as a nutrient source for the soil. This intention may arise from the aspiration to reduce costs brought by using chemical fertilizers in rice cultivation.

3.10. Rice Production

3.10.1. Adoption of CSA Practices

This section provides insights into the CSA adoption practices across five provinces in Vietnam during the three seasons – Winter-Spring, Summer-Autumn, and Autumn-Winter. The practices under focus are AWD and DSR, both of which are sustainable rice cultivation practices that aim to improve water efficiency and reduce methane emissions. The results highlight that adoption varied across provinces, possibly due to differences in local conditions, resource availability and accessibility, and farmers' awareness.

In terms of AWD adoption, two sets of criteria were used. The first definition assessed adoption based solely on farmers' reported water management practices over the past 12 months, specifically whether they implemented multiple drainage events. The other definition is stricter with three different criteria: (1) the practice of multiple drainage events, (2) the use of field-based indicators (e.g., hairline cracks, soil whitening, and visible water drainage) to guide irrigation decisions, and (3) awareness of the overall concept and application of AWD. The adoption rate declined significantly.

Based on the first definition of AWD adoption, the highest adoption rates were observed in Kien Giang, increasing from 87% in the Winter-Spring season to 90% in the Summer-Autumn season, as presented in Table 53. High adoption rates can also be observed in An Giang, particularly during the Winter-Spring period (72%) and the Autumn-Winter period (75%). AWD technology was introduced in the province of An Giang as a part of their 'one must do five reductions (1M5R)' initiative (Flor et al., 2021). In addition, most farmers in these provinces do not experience water shortages, which means they are not hesitant to let their fields drain, as they are confident in the reliability of their water sources. During the Autumn-Winter season, no farmers in Thai Binh and Nghe An reported cultivating rice.

Table 53. AWD adoption by surveyed farmers based on various criteria (in percent), by province and season 2023-2024.

AWD Adoption	Thai Binh	Nghe An	An Giang	Kien Giang	Soc Trang	All five provinces
Winter Spring	**(n=118)**	**(n=120)**	**(n=119)**	**(n=120)**	**(n=111)**	**(n=588)**
Based on water regime only	56	40	72	87	66	64
Based on three variables	10	0	5	9	10	7
Summer-Autumn	**(n=116)**	**(n=120)**	**(n=119)**	**(n=119)**	**(n=117)**	**(n=591)**
Based on water regime only	55	42	61	90	66	63
Based on three variables	10	0	1	13	14	7
Autumn-Winter	**(n=0)**	**(n=0)**	**(n=114)**	**(n=57)**	**(n=59)**	**(n=230)**
Based on water regime only	-	-	75	89	69	77
Based on three variables	-	-	4	11	14	8

Additionally, Soc Trang also showed a relatively high adoption rate of 66% to 69%, highlighting that the practice of multiple drainage was more prevalent in the Mekong Delta Region compared to the other regions. Moreover, to promote the adoption of CSA technologies in the region, there were programs implemented, such as the One-Million-Hectare High-Quality and Low-Emission Rice Program (1mHa Program) and the Vietnam Sustainable Agriculture Transformation Project (VnSAT).

Results of the adoption based on the water regime suggest that relying solely on this indicator yielded high reported adoption rates, with 63% to 77% of farmers experiencing at least one period of dry soil. These figures suggest a strong potential for formalizing AWD adoption among farmers who already practice field drying informally. With appropriate support, these farmers could be encouraged to transition to more rigorous implementation of AWD. On the other hand, Thai Binh and Nghe An reported significantly lower rates across seasons. However, under more comprehensive and stricter criteria, the adoption rate decreases significantly to about 7% to 8% per season. This is primarily because most farmers relied on fixed time intervals for irrigation, rather than observing field conditions to determine timing.

These results suggest that, although the majority of farmers had some level of awareness of AWD and did not face water supply issues, there may still be gaps in their knowledge or access to support. This is particularly evident given that, as previously discussed, only 29% of farmers reported receiving support for the implementation or adoption of the technology. In addition, one of the top barriers to AWD adoption identified by farmers was the limited technical knowledge, cited by 36% of respondents (34% agreed and 2% strongly agreed), who believed that AWD implementation requires a high level of technical expertise. Moreover, a significant proportion (22%) remained neutral. Hence, there is a need for targeted training and initiatives to raise the awareness of farmers to promote and encourage widespread adoption of this technology, particularly in provinces with low levels of partial adoption.

Meanwhile, the adoption of DSR is very high, specifically in the Mekong Delta Region, and significant in the Northern Region, as reported in Table 54. In Autumn-Winter, the adoption rate was 98%, which was the highest among the seasons, although it had a smaller proportion of respondents. The number of farmers who adopted DSR in each province was almost comparable across seasons. During the Winter-Spring and Summer-Autumn seasons, the type of DSR technology adopted varied across provinces. In Thai Binh and Nghe An, farmers predominantly preferred the manual dry DSR method, while in Soc Trang, a significant proportion of farmers also preferred this method. In An Giang, mechanized dry DSR was more common, whereas in Kien Giang, mechanized wet DSR was the preferred method. Overall, farmers' preferences during these seasons were divided between mechanized wet DSR and manual dry DSR, wherein some even used drones. Meanwhile, it is notable that during the Autumn-Winter season, 43% of farmers practiced mechanized wet direct-seeded rice (DSR), with particularly high adoption in Kien Giang (96%). In contrast, 51% of farmers in Soc Trang preferred manual dry DSR, possibly due to limited access to machinery and other necessary resources, or because this method is perceived as more efficient in saving water.

The high adoption of DSR across most provinces in Vietnam highlights the opportunity to scale up these practices. For provinces with high current adoption, the promotion of DSR should focus on improving outcomes rather than encouraging farmers. Meanwhile, provinces with lower adoption rates should enhance farmers' awareness and knowledge of the technology.

There should be available support and initiatives to make resources accessible to farmers. Programs and training, such as on-farm demonstrations and farmers' field schools, could play a key role in achieving broader adoption of these CSA practices.

Table 54. DSR adoption based on various criteria (in percent), by province, during the Autumn-Winter 2023-2024 season.

DSR Adoption	Thai Binh	Nghe An	An Giang	Kien Giang	Soc Trang	All five provinces
Winter Spring	**(n=118)**	**(n=120)**	**(n=119)**	**(n=120)**	**(n=111)**	**(n=588)**
DSR Adoption	**55**	**81**	**96**	**100**	**100**	**86**
Wet DSR (Manual)	11	32	9	5	23	16
Wet DSR (Mechanized)	2	8	33	94	24	37
Dry DSR (Manual)	86	60	17	1	39	35
Dry DSR (Mechanized)	2	0	41	0	14	12
Summer-Autumn	**(n=116)**	**(n=120)**	**(n=119)**	**(n=119)**	**(n=117)**	**(n=591)**
DSR Adoption	**57**	**89**	**97**	**100**	**100**	**89**
Wet DSR (Manual)	11	33	10	5	26	17
Wet DSR (Mechanized)	2	8	30	95	21	35
Dry DSR (Manual)	85	59	17	0	41	36
Dry DSR (Mechanized)	3	0	42	0	13	13
Autum-Winter	**(n=0)**	**(n=0)**	**(n=114)**	**(n=57)**	**(n=59)**	**(n=230)**
DSR Adoption	**-**	**-**	**96**	**100**	**100**	**98**
Wet DSR (Manual)	-	-	10	2	19	10
Wet DSR (Mechanized)	-	-	28	96	20	43
Dry DSR (Manual)	-	-	16	0	51	22
Dry DSR (Mechanized)	-	-	47	2	10	26

3.10.2. Yield

Figure 127 illustrates the yield performances of each province by season. The Winter-Spring 2023-2024 season saw the highest overall productivity, with a general mean yield of 7.31 tons/ha, likely due to favorable farming conditions. Additionally, this might be due to lower rainfall at critical stages of plant growth during the season, which reduces plant grain separation and lodging (Nguyen, 2021). At the provincial level, Kien Giang had the best productivity, peaking at 8.75 tons/ha, followed by 7.65 tons/ha in An Giang. Thai Binh (6.48 tons/ha), Nghe An (6.82 tons/ha), and Soc Trang (6.81 tons/ha) also manifested high yields. This suggests that the Winter-Spring season was generally the most productive period for rice cultivation.

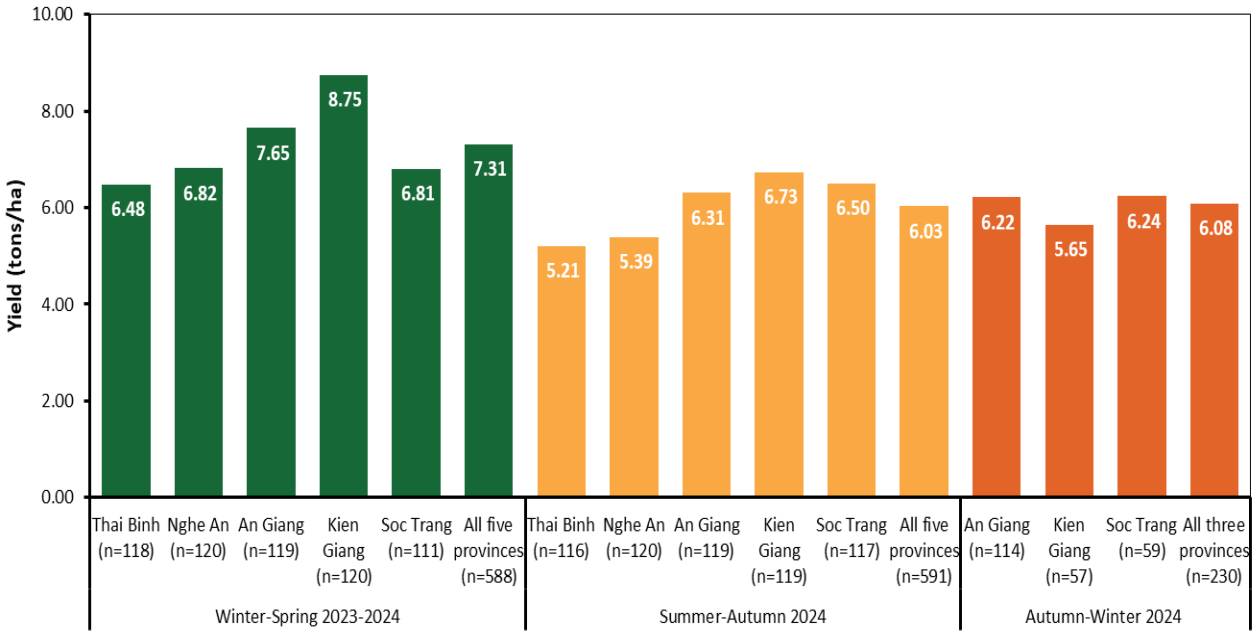


Figure 127. Rice yield (tons/ha) of surveyed farmers, by province and season, 2023-2024.

During the Summer-Autumn season, yields declined across all provinces, likely due to the effects of prolonged heat and drought during this period (Lavane, 2023), which were further exacerbated by pest and disease outbreaks, such as planthoppers. Despite these challenges, all five provinces displayed a good mean yield of 6.03 tons/ha. Kien Giang (6.73 tons/ha) and Soc Trang (6.50 tons/ha) posted the highest outputs, while the lowest yields were recorded in Thai Binh (5.21 tons/ha) and Nghe An (5.39 tons/ha). An Giang performed above the average at 6.31 tons/ha.

During the Autumn-Winter season, yields averaged 6.08 tons/ha with minimal variations across provinces. An Giang and Soc Trang had relatively comparable yields at 6.22 tons/ha and 6.24 tons/ha, respectively. Despite Kien Giang showing the lowest productivity in this season, it was still considerably high at 5.65 tons/ha. It can be observed that no farmers in Thai Binh and Nghe An cultivated rice for this season.

Productivity was also analyzed by each water regime practice by season (Figure 128). Farmers were grouped based on their water regime: (1) continuous flooding, (2) single drainage, and (3) multiple drainage. The data from the Winter-Spring and Summer-Autumn seasons revealed similar patterns. Specifically, the practice of multiple drainage yielded the highest yields of 7.55 and 6.13 tons/ha, respectively. Whereas, during the Autumn-Winter season, the yields of single drainage and multiple drainage were comparable. This suggests that improving water efficiency by draining the field at least once may yield productivity benefits.

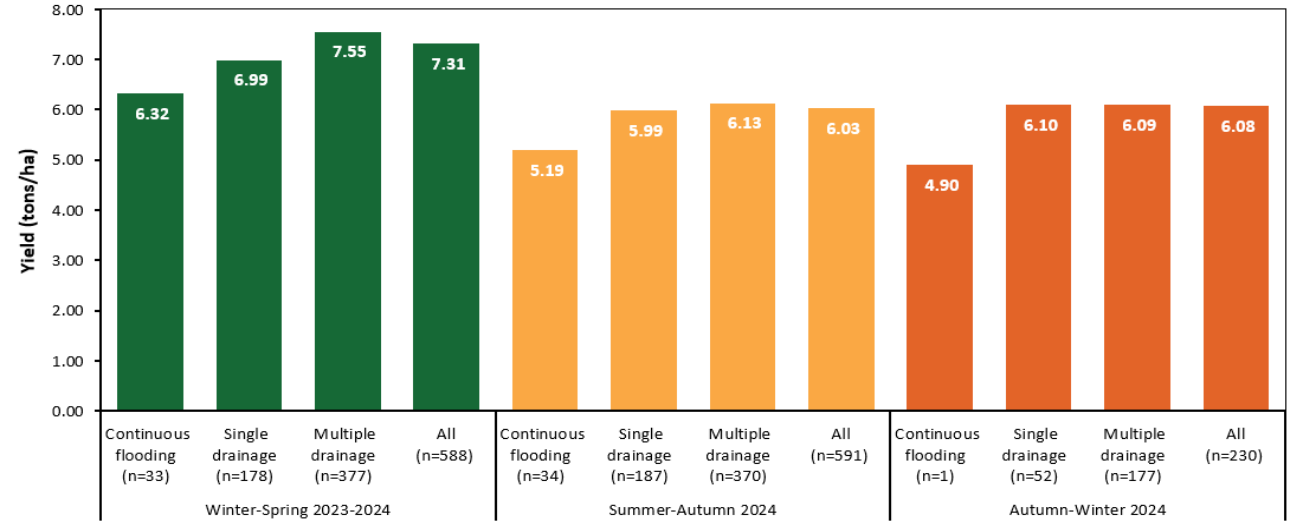


Figure 128. Rice yield (tons/ha) of surveyed farmers, by water regime and season, 2023-2024.

Yields were also analyzed based on crop establishment method (Figure 129). Farmers who practiced DSR during the Winter-Spring and Summer-Autumn had the highest yield of 7.37 t/ha and 6.14 t/ha, respectively. In contrast, transplanted rice achieved a greater yield of 6.41 t/ha during the Autumn-Winter season. However, this classification was underrepresented since only five respondents were categorized into this group. In addition, farmers who implemented DSR still achieved a yield of 6.08 t/ha, indicating the potential benefits of this CSA technique and the opportunity to improve it further.

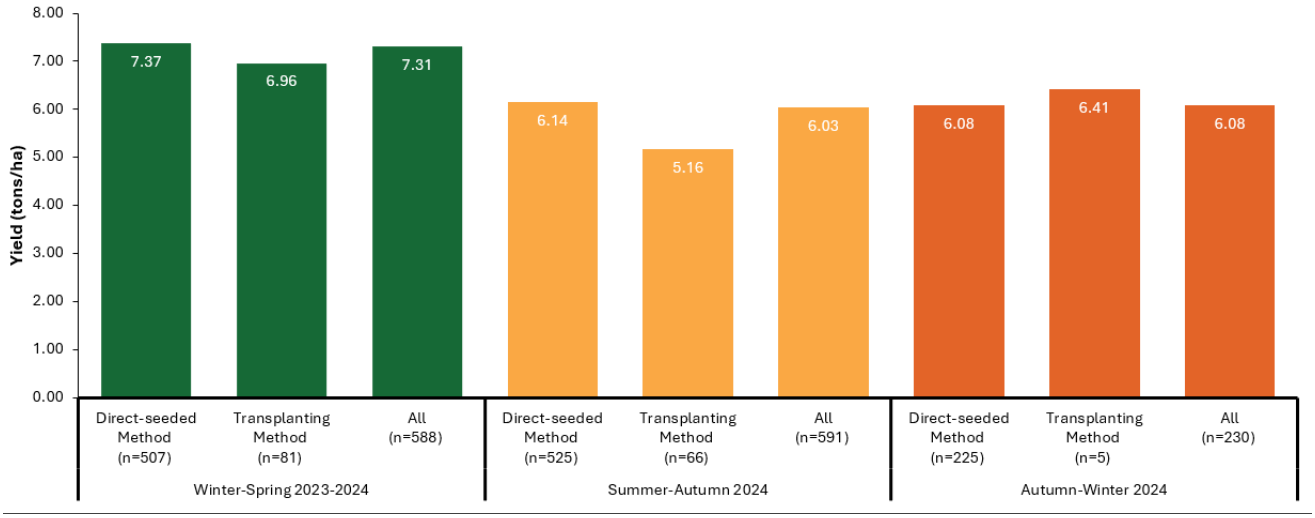


Figure 129. Rice yield (tons/ha) of surveyed farmers by crop establishment practice and season, 2023-2024.

Overall, farmers who practiced continuous flooding reported the lowest yields across seasons, whereas those who employed intermittent irrigation reported the highest yields. Additionally, DSR achieved higher yields in two consecutive seasons. These imply the potential benefits of CSA techniques to productivity. Additionally, aside from the water regime and crop establishment method, yields were affected by seasonal variability, with the highest yields reported during the Winter-Spring season.

3.10.3. Production Use

Paddy use methods are shaped by factors like local consumption demands and market-based production. Based on the survey, the allocation of harvested paddy varies by province and season. Production allocation showed greater variation during the Winter-Spring season, as presented in Table 55. In Thai Binh, most of the harvest was sold, but through a range of channels—such as fresh paddy (33.32%), seed sales (16.19%), dried paddy for milling (7.44%), and milled rice (0.71%). Notably, a substantial portion was also allocated for home consumption (42.20%). This suggests that, alongside their engagement in commercial activities, farmers in Thai Binh continued to prioritize food security through significant household consumption.

Table 55. Surveyed farmers' rice production and disposal (in percent) during the Winter-Spring 2023-2024 season.

Production Use	Thai Binh	Nghe An	An Giang	Kien Giang	Soc Trang	All five provinces
Sold (Fresh)	33.32	0.02	99.82	99.32	97.38	68.40
Consumed at home	42.20	76.21	0.18	0.53	2.62	22.66
Sold (Dried for seeds)	16.19	18.91	-	-	-	6.49
Sold (Dried for milling)	7.44	3.95	-	-	-	2.08
Reserved (Seeds/Planting materials)	0.13	0.42	-	0.16	-	0.14
Sold (Milled)	0.71	0.01	-	-	-	0.13
Given away	-	0.24	-	-	-	0.05
In-kind payments	-	0.24	-	-	-	0.05

In Nghe An, farmers primarily cultivated rice for sustenance, with the majority allocated for home consumption (76.21%). An additional 18.91% was sold as dried paddy for seeds, while other sales methods, such as dried paddy for milling (3.95%), milled rice (0.01%), and fresh paddy (0.02%), were minimal to almost nonexistent. A small portion of the harvest was also used for other purposes, such as giveaways (0.24%) and in-kind payments (0.24%). In contrast, farmers in the remaining three provinces —An Giang, Kien Giang, and Soc Trang—focused heavily on commercial production, allocating the majority of their yield to fresh paddy sales, ranging from 97.38% to 99.82%, with home consumption remaining very minimal. These results highlight the subsistence orientation in Thai Binh and Nghe An, in contrast to market-driven practices in the Mekong Delta provinces.

A comparable trend was also observed during the Summer-Autumn, shown in Table 56. The production disposal methods varied significantly across the five provinces, reflecting different farming strategies and levels of market integration. In Thai Binh, farmers demonstrated a balanced approach between commercial and subsistence farming, allocating almost equal amounts of rice to fresh paddy sales (39.27%) and home consumption (38.80%). In contrast, Nghe An showed a stronger inclination toward subsistence farming, with the highest level of home consumption (60.95%) among the provinces. While commercial seed sales (29.91%) were notable, other market sales allocations were minimal, implying a focus on household food security. On the other hand, An Giang, Kien Giang, and Soc Trang were strikingly commercial in orientation, with over 98% of fresh paddy sold directly in each province. These provinces

allocated negligible portions for home use or other disposal methods, highlighting a dependence on the market. The near absence of post-harvest losses across all regions reflects effective post-harvest practices, although it may also be due to less representation. Overall, Northern provinces appeared to maintain more diversified and resilient production systems. In contrast, Mekong Delta provinces exhibited high market dependency, which can boost income but may increase vulnerability to market fluctuations.

Table 56. Surveyed farmers' rice production and disposal (in percent) during the Summer-Autumn 2024 season.

Production Disposal	Thai Binh	Nghe An	An Giang	Kien Giang	Soc Trang	All five provinces
Sold (Fresh)	39.27	3.05	99.98	98.50	98.35	71.41
Consumed at home	38.80	60.95	0.02	0.27	1.65	18.06
Sold (Dried for seeds)	14.75	29.91	-	1.04	-	8.16
Sold (Dried for milling)	6.91	4.95	-	-	-	2.07
Sold (Milled)	0.27	0.81	-	-	-	0.19
Reserved (Seeds/Planting materials)	-	0.15	-	0.18	-	0.07
In-kind payments	-	0.15	-	-	-	0.03
Given away	-	0.02	-	-	-	0.004

During the Autumn-Winter season, farmers across the four provinces demonstrated distinct patterns in allocating their harvests (Table 57). In An Giang, farmers sold nearly all of their paddy as fresh (99.98%), with only a negligible portion retained for home consumption (0.02%), reflecting a strong market-oriented approach. A similar pattern was observed in Soc Trang, where most of the harvest (99%) was allocated for fresh paddy sales, and only a small amount was kept for home use (1%). Meanwhile, Kien Giang exhibited the most diversified allocation strategy. The bulk of the harvest was sold as fresh paddy (99.65%), portions were also set aside for planting materials and seeds (0.06%), and household consumption (0.29%).

Table 57. Surveyed farmers' rice production and disposal (in percent) during the Autumn-Winter 2024 season.

Production Disposal	An Giang	Kien Giang	Soc Trang	All three provinces
Sold (Fresh)	99.98	99.65	99.00	99.65
Consumed at home	0.02	0.29	1.00	0.34
Reserved (Seeds/Planting materials)	-	0.06	-	0.01

3.10.4. Costs and Returns Analysis

The economic viability of rice production across Vietnam's three regions—Red River Delta (Thai Binh), Coastal Region (Nghe An), and Mekong River Delta (An Giang, Kien Giang, and Soc Trang) was assessed through cost and returns analysis. The gross income was calculated from the value of fresh paddy rice and rice straw sold. Total production costs were categorized into three main components: material inputs (including seeds, fertilizers, herbicides, and pesticides), labor (encompassing both family and hired labor), and other operational expenses (such as irrigation payments, machinery costs, and miscellaneous farm expenditures). These costs were calculated by averaging the expenses for each farm activity, which were then divided into the main plot area to standardize the values on a per-hectare basis (VND/ha). To account for the economic value of family labor, the costs were imputed by multiplying the person-days per hectare by the daily wage rate. The average wage rate used for this report was 250,000 VND (9.60 USD per day), as reported in various literature and the standard wage rate across the survey areas. According to Thi (2021), wage rates in Vietnam range from 8.7 to 10.8 USD/day for rice production. Finally, the net income was derived from subtracting the overall production costs from the gross income.

The cost and return analysis were presented in three main sets of tables. The first set (Table 58 to Table 60) shows the data at the provincial level for each season. Conversely, the second set (Table 62 to Table 70) and last set (Table 71 to Table 79) specifically analyzes the costs and returns associated with each water regime and crop establishment method, respectively. It is important to note that this analysis focused solely on fresh paddy production, meaning all costs related to post-harvest activities were excluded from the calculations. Additionally, two respondents were omitted from the cost and return computations because they were identified as outliers.

By Region

As shown in Table 58, the costs and returns of rice production across the three regions in Vietnam during the Winter-Spring 2023-2024 season. Yields vary considerably, with MRD achieving the highest at 7,761 kg/ha, significantly surpassing the other regions. In addition, some farmers in this region generated a minor income from rice straw, highlighting the potential for utilizing agricultural by-products. In contrast, the yields in RRD and Coastal Region were comparable at 6,480 kg/ha and 6,838 kg/ha, respectively. Moreover, no sales of rice straw were recorded in these two regions.

Table 58. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by region, Winter–Spring, 2023-2024.

	Red River Delta (n=118)	Coastal Region (n=118)	Mekong River Delta (n=350)	All three regions (n=586)
Yield (kg/ha)	6,480	6,838	7,761	7,316
Sold price (VND/kg)	8.25	8.94	7.90	8.18
Gross income	**53,463**	**61,129**	**61,394**	**59,892**
Paddy	53,463	61,129	61,315	59,845
Rice straw	-	-	80	47
Production costs				
Material inputs	**11,429**	**12,736**	**14,015**	**13,234**
Seeds	1,807	2,332	1,900	1,968
Fertilizer	5,197	7,039	6,855	6,556
Herbicides	810	981	652	750
Pesticides	3,615	2,384	4,608	3,959
Labor	**13,465**	**16,475**	**5,309**	**9,207**
Family	11,510	13,378	3,078	6,858
Hired	1,955	3,098	2,232	2,350
Other costs	**10,462**	**8,606**	**6,761**	**7,882**
Irrigation payment	846	369	344	451
Machine	8,295	7,312	4,389	5,769
Others	1,321	925	2,027	1,663
Total costs	**35,356**	**37,818**	**26,086**	**30,323**
Net return	**18,107**	**23,311**	**35,309**	**29,569**
Total costs ('000 VND/ton)	5,456	5,531	3,361	4,145
Net return ('000 VND/ton)	2,794	3,409	4,549	4,042

* Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

* Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e., food, transportation, oil/fuel).

In terms of production costs, Coastal Region incurred the highest total cost at 37,818 thousand VND/ha, mostly driven by high labor expenses (13,378 thousand VND/ha for family and 3,098 thousand VND/ha for hired). In contrast, MRD obtained the lowest total costs, partly due to the lower labor costs. Other key cost components include material inputs like seeds, fertilizers, herbicides, and pesticides, with significant variations across provinces. The Coastal Region also had the highest seed cost of 2,332 thousand VND/ha, while machine cost was highest in RRD, amounting to 8,295 thousand VND/ha. The net income across all regions also showed significant variations, with MRD leading with 35,309 thousand VND/ha, primarily attributable to its high yield. Coastal Region, on the other hand, had a high production expense, which resulted in a lower net return at 23,311 thousand VND/ha. Likewise, RRD had the lowest net income of 18,107 thousand VND/ha due to low yield and high production cost compared to the other two regions. Meanwhile, the estimated costs and returns during the Summer-Autumn 2024 season was summarized in Table 59. The average gross income across the three regions for this season was 47,162 thousand VND/ha. Similar with the previous season, MRD achieved the highest gross

income of 50,594 thousand VND/ha among all regions. This was due to high average yield of 6,514 kg/ha, hence despite the lower selling price compared to RRD it still generated a higher gross income. Meanwhile, the Coastal Region recorded the lowest gross income (39,716 thousand VND/ha), since its yield (5,404 kg/ha) and selling price (PhP 7.35/kg) were also the lowest. Income from rice straw remains a minor component, with Coastal Region showing no income from this source, while MRD had an average rice straw income of 42 thousand VND/ha.

Table 59. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by region, Summer-Autumn 2024.

	Red River Delta (n=116)	Coastal Region (n=118)	Mekong River Delta (n=355)	All three regions (n=589)
Yield (kg/ha)	5,208	5,404	6,514	6,035
Sold price (VND/kg)	8.45	7.35	7.76	7.81
Gross income	**44,040**	**39,716**	**50,594**	**47,162**
Paddy	44,007	39,716	50,552	47,130
Rice straw	33	-	42	32
Production costs				
Material inputs	**11,442**	**11,968**	**13,733**	**12,928**
Seeds	1,753	1,991	1,846	1,857
Fertilizer	5,172	6,794	6,752	6,450
Herbicides	824	1,026	656	763
Pesticides	3,693	2,156	4,478	3,858
Labor	**13,222**	**15,980**	**5,172**	**8,923**
Family	11,441	13,661	3,080	6,847
Hired	1,781	2,319	2,091	2,076
Other costs	**10,305**	**8,306**	**6,398**	**7,550**
Irrigation payment	867	347	283	411
Machine	8,206	7,063	4,488	5,736
Others	1,231	896	1,627	1,403
Total costs	**34,969**	**36,254**	**25,302**	**29,400**
Net return	**9,071**	**3,462**	**25,292**	**17,762**
Total costs ('000 VND/ton)	6,715	6,709	3,884	4,872
Net return ('000 VND/ton)	1,742	641	3,882	2,943

* Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

* Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e., food, transportation, oil/fuel).

The production costs of each region differ significantly from one another. RRD and Coastal Region incurred the highest total costs, reaching 34,969 thousand VND/ha and 36,254 thousand VND/ha, respectively. The high costs in both provinces came mainly from family labor expenses. The main reason for this was the small and fragmented average farm sizes (see Figure 9) in these regions. Among the material inputs, fertilizer costs were notably high at an average of 6,450 thousand VND/ha, with RRD recording the lowest spending at 5,172 thousand VND/ha. Machine rent constituted the third largest expense, averaging 5,736 thousand VND/ha, with

RRD incurring the highest cost at 8,206 thousand VND/ha. Additionally, surveyed farmers in the MRD had the largest farm areas cultivated, and they achieved the highest yields and net returns. This might suggest that operating on a larger scale allows for more efficient resource utilization, which may lead to higher productivity, lower per-unit costs, and higher net returns. Moreover, the provincial differences in production costs had a direct impact on net returns. Particularly, Coastal Region reported a net return of 3,462 thousand VND/ha which was significantly lower compared to 25,292 thousand VND/ha of those in the MRD.

Lastly, as shown in Table 60, the average gross income from rice production in the MRD for the Autumn-Winter 2024 season was 49,626 thousand VND/ha, with the majority coming from paddy sales of 49,575 thousand VND/ha, while only 51 thousand VND/ha came from rice straw production. RRD and Coastal Region do not have data as none of the surveyed farmers cultivated during this season. Among the farmers who sold rice straw during the season, a small portion of them only had an income from selling rice straw at an average of 15%.

Table 60. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by region, Autumn–Winter 2024.

	Red River Delta (n=0)	Coastal Region (n=0)	Mekong River Delta (n=230)	All three regions (n=230)
Yield (kg/ha)	-	-	6,083	6,083
Sold price (VND/kg)	-	-	8.15	8.15
Gross income	-	-	**49,626**	**49,626**
Paddy	-	-	49,575	49,575
Rice straw	-	-	51	51
Production costs				
Material inputs			**12,754**	**12,754**
Seeds	-	-	1,856	1,856
Fertilizer	-	-	6,230	6,230
Herbicides	-	-	559	559
Pesticides	-	-	4,109	4,109
Labor			**4,722**	**4,722**
Family	-	-	2,744	2,744
Hired	-	-	1,978	1,978
Other costs			**6,566**	**6,566**
Irrigation payment	-	-	623	623
Machine	-	-	4,413	4,413
Others	-	-	1,530	1,530
Total costs	-	-	**24,041**	**24,041**
Net return	-	-	**25,584**	**25,584**
Total costs ('000 VND/ton)	-	-	3,952	3,952
Net return ('000 VND/ton)	-	-	4,206	4,206

* Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

* Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e., food, transportation, oil/fuel).

Among the costs in rice production, fertilizer accounted for the largest expense at 6,230 thousand VND/ha. This was followed by machine costs of 4,413 thousand VND/ha, since all the surveyed farmers in the region used machines, such as combine harvesters, during the harvesting activity. Pesticide costs accounted for an average of 4,109 thousand VND/ha. This is most probably because pest and disease outbreaks have been the main problem experienced by the majority (62%) of farmers for the past three years in the province of An Giang. Labor costs were also significant, wherein the cost for hired labor was 1,978 thousand VND/ha, and the cost for family labor was 2,744 thousand VND/ha. Overall, the surveyed rice farmers in the MRD reported an average net return of 25,584 thousand VND/ha. This suggests that rice farms in the study sites were profitable during the Autumn–Winter season.

As shown in Table 61, rice production in Vietnam varies significantly across seasons. It was found that the Winter-Spring season consistently stood out as the most favorable time for rice cultivation, as it generated the highest average net returns. This is primarily due to the dry conditions during this period, which could promote optimal growth and profitability. However, the Summer-Autumn season generally exhibited lower net returns, indicating that this might be the more challenging period for rice cultivation.

Table 61. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production by region and season, 2023-2024

Winter-Spring 2023-2024	**Red River Delta (n=118)**	**Coastal Region (n=118)**	**Mekong River Delta (n=350)**	**All three regions (n=586)**
Total costs	35,356	37,818	26,086	30,323
Net return	18,107	23,311	35,309	29,569
Summer-Autumn 2024	**Red River Delta (n=116)**	**Coastal Region (n=118)**	**Mekong River Delta (n=355)**	**All three regions (n=589)**
Total costs	34,969	36,254	25,302	29,400
Net return	9,071	3,462	25,292	17,762
Autumn-Winter 2024	**Red River Delta (n=0)**	**Coastal Region (n=0)**	**Mekong River Delta (n=230)**	**All three regions (n=230)**
Total costs	-	-	24,041	24,041
Net return	-	-	25,584	25,584

The result indicates that while the average total costs during the Summer-Autumn season were lower than those in Winter-Spring, inefficiencies in RRD and Coastal Region led to significantly lower net returns. High production costs, especially labor expenses, have led to lower net returns, particularly during the Summer-Autumn season. Additionally, it is considered as the rainy season in Vietnam, where excessive rainfall, flooding, or typhoons are often experienced, which can damage crops, reduce yields, or limit market access, further affecting farmers' net returns. Although it is important to consider that there may be other underlying factors influencing the net return of farmers in these regions.

By Water Regime

Winter-Spring 2023-2024

The profitability of rice production across all three regions in Vietnam was also determined by their water regime. Table 62 shows the results of the cost and return analysis during the Winter-Spring season 2023-2024. Farmers who continuously flooded their fields were either underrepresented or few in numbers across the regions. Surveyed farmers who practiced intermittent irrigation had the highest gross income, mainly due to a higher average yield. In contrast, their selling price was lower compared to the other two regimes.

Table 62. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by water regime, Winter – Spring 2023 - 2024.

	Continuous Flooding (n=33)	Single Drainage (n=176)	Multiple drainage (n=377)	All (n=586)
Yield (kg/ha)	6,315	7,010	7,546	7,316
Sold price (VND/kg)	8.77	8.27	8.09	8.18
Gross income	**55,386**	**58,018**	**61,098**	**59,892**
Paddy	55,386	57,969	61,047	59,845
Rice straw	-	49	51	47
Production costs				
Material inputs	**11,706**	**13,473**	**13,256**	**13,234**
Seeds	2,241	2,073	1,895	1,968
Fertilizer	6,325	6,814	6,456	6,556
Herbicides	866	821	707	750
Pesticides	2,274	3,765	4,197	3,959
Labor	**14,834**	**10,903**	**7,927**	**9,207**
Family	12,839	8,070	5,771	6,858
Hired	1,995	2,832	2,156	2,350
Other costs	**10,377**	**7,810**	**7,698**	**7,882**
Irrigation payment	598	460	434	451
Machine	7,999	6,209	5,369	5,769
Others	1,780	1,141	1,895	1,663
Total costs	**36,917**	**32,186**	**28,880**	**30,323**
Net return	**18,469**	**25,833**	**32,218**	**29,569**
Total costs ('000 VND/ton)	5,846	4,592	3,827	4,145
Net return ('000 VND/ton)	2,924	3,685	4,269	4,042

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

In terms of the costs of production, the material input costs were higher for the single aeration (13,473 thousand VND/ha) and multiple drainage (13,256 thousand VND/ha) compared to continuous flooding (11,706 thousand VND/ha). Conversely, the latter incurred higher labor costs - particularly from family labor - at 14,834 thousand VND/ha, whereas the lowest reported was 7,927 thousand VND/ha (multiple drainage). In addition, continuously flooding the field resulted in marginally higher irrigation costs. Hence, those who belong to this group reported the highest total costs, at 36,917 thousand VND/ha and the lowest net return (18,469 thousand VND/ha). Meanwhile, since the production costs of those who drained once was higher (32,186 thousand VND/ha) with a lower gross income (58,018 thousand VND/ha), the net return was lower than that of multiple drainage, at 25,883 thousand VND/ha and 32,218 thousand VND/ha, respectively. This means that overall, across the regions, draining the field at least once is beneficial to rice productivity with intermittent drainage as the most profitable water regime practice. Hence, in promoting the adoption of water conservation practices, it may be useful to

highlight the potential economic benefits of shifting to these practices. Showcasing success stories or farmer champions could also help encourage wider adoption.

Meanwhile, Table 63 to Table 65 present the costs and returns based on the water regime for each region. In RRD and MRD, farmers who practiced multiple drainage reported higher yields compared to the other two water regimes, which consequently resulted in higher gross incomes. In contrast, in the Coastal Region single drainage had the highest total revenue due to its higher yield. In terms of rice straw sales, some of the farmers in MRD reported income from rice straw at 80 thousand VND.

Table 63. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production in Red River Delta, by water regime, Winter-Spring 2023 - 2024.

	Continuous Flooding (n=10)	**Single Drainage (n=42)**	**Multiple drainage (n=66)**	**All (n=118)**
Yield (kg/ha)	6,002	6,443	6,575	6,480
Sold price (VND/kg)	8.32	8.18	8.29	8.25
Gross income	**49,933**	**52,701**	**54,510**	**53,463**
Paddy	49,933	52,701	54,510	53,463
Rice straw	-	-	-	-
Production costs				
Material inputs	**11,153**	**12,382**	**10,872**	**11,429**
Seeds	1,842	1,752	1,836	1,807
Fertilizer	5,879	5,713	4,772	5,197
Herbicides	891	879	755	810
Pesticides	2,541	4,038	3,509	3,615
Labor	**10,349**	**13,831**	**13,701**	**13,465**
Family	10,267	11,492	11,706	11,510
Hired	82	2,339	1,994	1,955
Other costs	**10,895**	**11,013**	**10,051**	**10,462**
Irrigation payment	841	768	895	846
Machine	8,751	8,959	7,810	8,295
Others	1,303	1,286	1,346	1,321
Total costs	**32,397**	**37,227**	**34,624**	**35,356**
Net return	**17,535**	**15,474**	**19,887**	**18,107**
Total costs ('000 VND/ton)	5,398	5,778	5,266	5,456
Net return ('000 VND/ton)	2,922	2,402	3,024	2,794

Note: Conversion unit (1 USD =24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Table 64. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production in the Coastal Region, by water regime, Winter-Spring 2023 - 2024.

	Continuous Flooding (n=21)	Single Drainage (n=49)	Multiple drainage (n=48)	All (n=118)
Yield (kg/ha)	6,462	6,996	6,840	6,838
Sold price (VND/kg)	9.05	8.99	8.83	8.94
Gross income	**58,480**	**62,897**	**60,398**	**61,129**
Paddy	58,480	62,897	60,398	61,129
Rice straw	-	-	-	-
Production costs				
Material inputs	**11,911**	**13,866**	**11,943**	**12,736**
Seeds	2,487	2,311	2,285	2,332
Fertilizer	6,475	7,950	6,357	7,039
Herbicides	871	1,046	964	981
Pesticides	2,078	2,560	2,338	2,384
Labor	**17,782**	**17,579**	**14,777**	**16,475**
Family	14,728	13,571	12,589	13,378
Hired	3,054	4,008	2,187	3,098
Other costs	**10,285**	**8,507**	**7,973**	**8,606**
Irrigation payment	539	394	268	369
Machine	8,029	7,143	7,171	7,312
Others	1,717	970	534	925
Total costs	**39,978**	**39,953**	**34,693**	**37,818**
Net return	**18,502**	**22,944**	**25,706**	**23,311**
Total costs ('000 VND/ton)	6,187	5,711	5,072	5,531
Net return ('000 VND/ton)	2,863	3,279	3,758	3,409

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Table 65. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production in Mekong River Delta, by water regime, Winter – Spring 2023 - 2024.

	Continuous Flooding (n=2)	Single Drainage (n=85)	Multiple drainage (n=263)	All (n=350)
Yield (kg/ha)	6,346	7,297	7,922	7,761
Sold price (VND/kg)	8.05	7.90	7.90	7.90
Gross income	**51,087**	**57,751**	**62,657**	**61,394**
Paddy	51,087	57,649	62,585	61,315
Rice straw	-	102	73	80
Production costs				
Material inputs	**12,313**	**13,786**	**14,102**	**14,015**
Seeds	1,653	2,095	1,839	1,900
Fertilizer	6,977	6,703	6,904	6,855
Herbicides	692	662	648	652
Pesticides	2,990	4,326	4,711	4,608
Labor	**6,303**	**5,606**	**5,206**	**5,309**
Family	5,855	3,208	3,014	3,078
Hired	448	2,398	2,191	2,232
Other costs	**8,758**	**5,825**	**7,048**	**6,761**
Irrigation payment	-	345	347	344
Machine	3,931	4,313	4,418	4,389
Others	4,827	1,167	2,284	2,027
Total costs	**27,373**	**25,217**	**26,356**	**26,086**
Net return	**23,713**	**32,534**	**36,301**	**35,309**
Total costs ('000 VND/ton)	4,313	3,456	3,327	3,361
Net return ('000 VND/ton)	3,737	4,458	4,582	4,549

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Across the three regions, there were marginal differences in the material input costs among the water regimes, with fertilizers contributing the largest share followed by pesticides. In RRD, those who flooded their fields continuously reported the lowest labor cost at 10,349 thousand VND, whereas those practicing single and multiple drainage had comparable labor costs of 13,831 thousand VND and 13,701 thousand VND, respectively. In comparison, in Coastal Region and MRD, intermittent drainage had the lowest labor costs. Though, similar with RRD, in MRD the costs for single and multiple aeration did not differ substantially at 5,606 thousand VND and 5,206 thousand VND. Whereas, for Coastal Region, it's the continuous flooding and single drainage that were nearly equivalent. For the other costs, no significant differences were observed in RRD, whereas in the Coastal Region and MRD, continuous flooding incurred higher expenses.

Overall, across all three regions, the multiple drainage reported the highest net returns compared to the other two water regimes. In the Coastal Region and MRD, the differences in net returns between multiple and single aeration were relatively small, amounting to less than 3,000 and 4,000 thousand VND, respectively. This highlights the economic benefit of draining the field even once. Although, there are other main factors that affect the rice productivity, these results can still be used to promote the adoption of AWD practices or water saving techniques to the farmers.

Summer-Autumn 2024

The costs and returns of the rice production across the regions were also analyzed during the Summer-Autumn season, as shown in Table 66. Compared to the previous season, the yields reported were lower at an average of 6,035 kg/ha. Although, similarly, the farmers who practiced multiple drainage recorded the highest yield at 6,127 kg/ha. These farmers also sold their harvested produced at the highest price of 7.83 thousand VND/kg, which consequently led to the highest gross income (48,002 thousand VND) among the water regimes.

Table 66. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by water regime, Summer-Autumn 2024.

	Continuous Flooding (n=34)	Single Drainage (n=185)	Multiple drainage (n=370)	All (n=589)
Yield (kg/ha)	5,194	6,005	6,127	6,035
Sold price (VND/kg)	7.61	7.81	7.83	7.81
Gross income	**39,525**	**46,938**	**48,002**	**47,162**
Paddy	39,525	46,900	47,971	47,130
Rice straw	-	38	32	32
Production costs				
Material inputs	**11,238**	**12,705**	**13,195**	**12,928**
Seeds	1,763	1,898	1,845	1,857
Fertilizer	6,343	6,258	6,555	6,450
Herbicides	801	803	740	763
Pesticides	2,332	3,746	4,055	3,858
Labor	**12,893**	**10,063**	**7,988**	**8,923**
Family	11,529	7,826	5,927	6,847
Hired	1,364	2,237	2,061	2,076
Other costs	**9,240**	**7,222**	**7,558**	**7,550**
Irrigation payment	552	439	384	411
Machine	7,539	5,862	5,507	5,736
Others	1,149	921	1,667	1,403
Total costs	**33,371**	**29,990**	**28,740**	**29,400**
Net return	**6,154**	**16,948**	**19,262**	**17,762**
Total costs ('000 VND/ton)	6,425	4,994	4,691	4,872
Net return ('000 VND/ton)	1,185	2,822	3,144	2,943

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

As for the production costs, those who practiced multiple drainage had the highest material inputs costs (13,195 thousand VND), wherein across the water regimes, fertilizers and pesticides accounted for the greatest shares of the expenses. In contrast, intermittent drainage resulted to a lower labor cost (7,988 thousand VND), whereas continuous flooding had the highest labor expense at 12,893 thousand VND.

Overall, the total production costs of single and multiple aeration were almost comparable at 29,990 thousand VND and 28,740 thousand VND, respectively. On the other hand, continuous flooding incurred the highest total cost of 33,371 thousand VND and produced the lowest yield of 5,194 kg/ha, leading to the lowest net return of 6,154 thousand VND among the water regimes. In comparison, multiple drainage with the highest yield and lowest input costs generated a significantly higher net return of 19,262 thousand VND, which is also about 2,300 thousand VND higher compared to single drainage.

The costs and returns comparison of the water regime practiced in each region were shown in Table 67 to Table 69. Similar with the previous season, in RRD (5,231 kg/ha) and MRD (6,540 kg/ha) the yields were highest for farmers who employed periodic drainage during their production. Meanwhile, the highest yield in the Coastal Region was reported by those who drained their fields once at 5,776 kg/ha. Additionally, the gross incomes across the water regimes were nearly the same in the MRD region, while in RRD, the values for single and multiple aeration were closely comparable. In contrast, in the Coastal Region, single drainage farmers reported the highest gross income (42,398 thousand VND), followed by multiple drainage (38,344 thousand VND) with continuous flooding yielding the lowest gross income (35,844 thousand VND).

Table 67. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production in Red River Delta, by water regime, Summer-Autumn 2024.

	Continuous Flooding (n=12)	Single Drainage (n=40)	Multiple drainage (n=64)	All (n=116)
Yield (kg/ha)	4,927	5,255	5,231	5,208
Sold price (VND/kg)	8.13	8.44	8.51	8.45
Gross income	**40,059**	**44,393**	**44,551**	**44,040**
Paddy	40,059	44,352	44,517	44,007
Rice straw	-	42	33	33
Production costs				
Material inputs	**11,153**	**11,124**	**11,696**	**11,442**
Seeds	1,448	1,675	1,859	1,753
Fertilizer	6,151	4,979	5,109	5,172
Herbicides	778	760	873	824
Pesticides	2,777	3,709	3,855	3,693
Labor	**9,594**	**13,822**	**13,527**	**13,222**
Family	9,185	11,520	11,815	11,441
Hired	409	2,302	1,712	1,781
Other costs	**11,097**	**10,169**	**10,241**	**10,305**
Irrigation payment	767	924	851	867
Machine	9,015	8,176	8,073	8,206
Others	1,316	1,070	1,316	1,231
Total costs	**31,844**	**35,115**	**35,464**	**34,969**
Net return	**8,214**	**9,278**	**9,087**	**9,071**
Total costs ('000 VND/ton)	6,463	6,682	6,779	6,715
Net return ('000 VND/ton)	1,667	1,766	1,737	1,742

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Table 68. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production in the Coastal Region, by water regime, Summer-Autumn 2024.

	Continuous Flooding (n=17)	Single Drainage (n=51)	Multiple drainage (n=50)	All (n=118)
Yield (kg/ha)	5,020	5,776	5,154	5,404
Sold price (VND/kg)	7.14	7.34	7.44	7.35
Gross income	**35,844**	**42,398**	**38,344**	**39,716**
Paddy	35,844	42,398	38,344	39,716
Rice straw	-	-	-	-
Production costs				
Material inputs	**11,053**	**12,984**	**11,242**	**11,968**
Seeds	1,941	1,977	2,023	1,991
Fertilizer	6,426	7,435	6,266	6,794
Herbicides	840	1,102	1,011	1,026
Pesticides	1,846	2,471	1,942	2,156
Labor	**17,366**	**16,823**	**14,650**	**15,980**
Family	15,553	14,107	12,563	13,661
Hired	1,813	2,716	2,086	2,319
Other costs	**9,176**	**8,477**	**7,835**	**8,306**
Irrigation payment	562	384	237	347
Machine	7,504	6,896	7,082	7,063
Others	1,111	1,197	516	896
Total costs	**37,595**	**38,285**	**33,727**	**36,254**
Net return	**-1,751**	**4,113**	**4,617**	**3,462**
Total costs ('000 VND/ton)	7,489	6,628	6,544	6,709
Net return ('000 VND/ton)	-349	712	896	641

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Table 69. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production in Mekong River Delta, by water regime, Summer-Autumn 2024.

	Continuous Flooding (n=5)	Single Drainage (n=94)	Multiple drainage (n=256)	All (n=355)
Yield (kg/ha)	6,424	6,449	6,540	6,514
Sold price (VND/kg)	7.97	7.79	7.74	7.76
Gross income	**51,197**	**50,292**	**50,660**	**50,594**
Paddy	51,197	50,234	50,622	50,552
Rice straw	-	58	37	42
Production costs				
Material inputs	**12,074**	**13,227**	**13,951**	**13,733**
Seeds	1,914	1,950	1,806	1,846
Fertilizer	6,519	6,164	6,973	6,752
Herbicides	721	659	653	656
Pesticides	2,921	4,454	4,518	4,478
Labor	**5,602**	**4,795**	**5,302**	**5,172**
Family	3,473	2,845	3,159	3,080
Hired	2,128	1,950	2,143	2,091
Other costs	**4,997**	**5,287**	**6,834**	**6,398**
Irrigation payment	-	262	296	283
Machine	4,117	4,317	4,558	4,488
Others	880	708	1,980	1,627
Total costs	**22,673**	**23,309**	**26,086**	**25,302**
Net return	**28,525**	**26,983**	**24,574**	**25,292**
Total costs ('000 VND/ton)	3,530	3,615	3,988	3,884
Net return ('000 VND/ton)	4,440	4,184	3,757	3,882

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Meanwhile, the costs of material inputs were closely similar across the water regimes in all regions. Regarding labor costs, in RRD, farmers who drained their fields either once or multiple times reported higher labor costs compared to those who kept their fields continuously submerged. In the Coastal Region, farmers practicing multiple drainage incurred the lowest labor costs, while in the MRD, the estimated values were comparable. Collectively, in RRD and MRD, drainage at intervals resulted in the highest production costs compared to the other water regimes. In addition, unlike the results during the Winter-Spring season, periodic drainage of the rice farms did not result in a significantly higher net return. In the RRD and Coastal Region, the net revenues from single and multiple drainage were nearly the same. At the same time, continuous flooding resulted in the lowest estimates, with some areas even showing a negative value in the Coastal Region. In comparison, in MRD, the practice of non-drainage irrigation resulted in the highest net profit (28,525 thousand VND), approximately 4,000 thousand VND higher than multiple drainage (24,525 thousand VND). This implies that aside from the water regime, other key factors affect rice productivity. Hence, it is also important to optimize production to achieve efficiency.

Autumn-Winter 2024

Meanwhile, during the Autumn-Winter 2024 season, the continuous flooding group in MRD was underrepresented, with only one respondent reporting this practice. In terms of yield, the average of those who practiced single drainage and multiple aeration were comparable at 6,095 kg/ha and 6,086 kg/ha, respectively (Table 70). However, the latter had a higher gross income due to a slightly higher selling price. There was also no significant difference in production costs, consequently, the net income was likewise similar, with multiple drainage having a net income of 25,740 thousand VND/ha, which is 600 thousand VND/ha higher than that of single drainage.

Table 70. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by water regime, Autumn-Winter 2024.

	Continuous Flooding (n=1)	Single Drainage (n=52)	Multiple drainage (n=177)	All (n=230)
Yield (kg/ha)	4,904	6,095	6,086	6,083
Sold price (VND/kg)	8.80	7.95	8.21	8.15
Gross income	**43,154**	**48,521**	**50,012**	**49,626**
Paddy	43,154	48,458	49,964	49,575
Rice straw	-	63	47	51
Production costs				
Material inputs	**9,544**	**13,286**	**12,616**	**12,754**
Seeds	1,640	2,108	1,783	1,856
Fertilizer	5,308	6,337	6,204	6,230
Herbicides	769	696	517	559
Pesticides	1,827	4,145	4,111	4,109
Labor	**5,011**	**4,263**	**4,855**	**4,722**
Family	4,576	2,720	2,741	2,744
Hired	435	1,543	2,114	1,978
Other costs	**4,404**	**5,807**	**6,801**	**6,566**
Irrigation payment	-	398	693	623
Machine	4,308	4,384	4,422	4,413
Others	96	1,025	1,687	1,530
Total costs	**18,959**	**23,356**	**24,271**	**24,041**
Net return	**24,195**	**25,165**	**25,740**	**25,584**
Total costs ('000 VND/ton)	3,866	3,832	3,988	3,952
Net return ('000 VND/ton)	4,934	4,129	4,230	4,206

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Meanwhile, based on Figure 130 to Figure 132, there was no linear correlation between the net income and total costs across regions and seasons. The scatterplots indicate that an increase in production costs does not correspond to a reduction in net income, since higher yields generate greater gross income that offsets the additional costs and ultimately raises net income. In addition, results from the Analysis of Variance (ANOVA) test showed that the differences in yield and net income across irrigation regimes were not statistically significant for the RRD and Coastal Region, but were marginally significant in the MRD during the Winter-Spring Season as also shown in Figure 133 and Figure 134, respectively. In contrast, for the subsequent seasons, the differences in both yields and net incomes across irrigation regimes were not statistically significant in any of the regions.

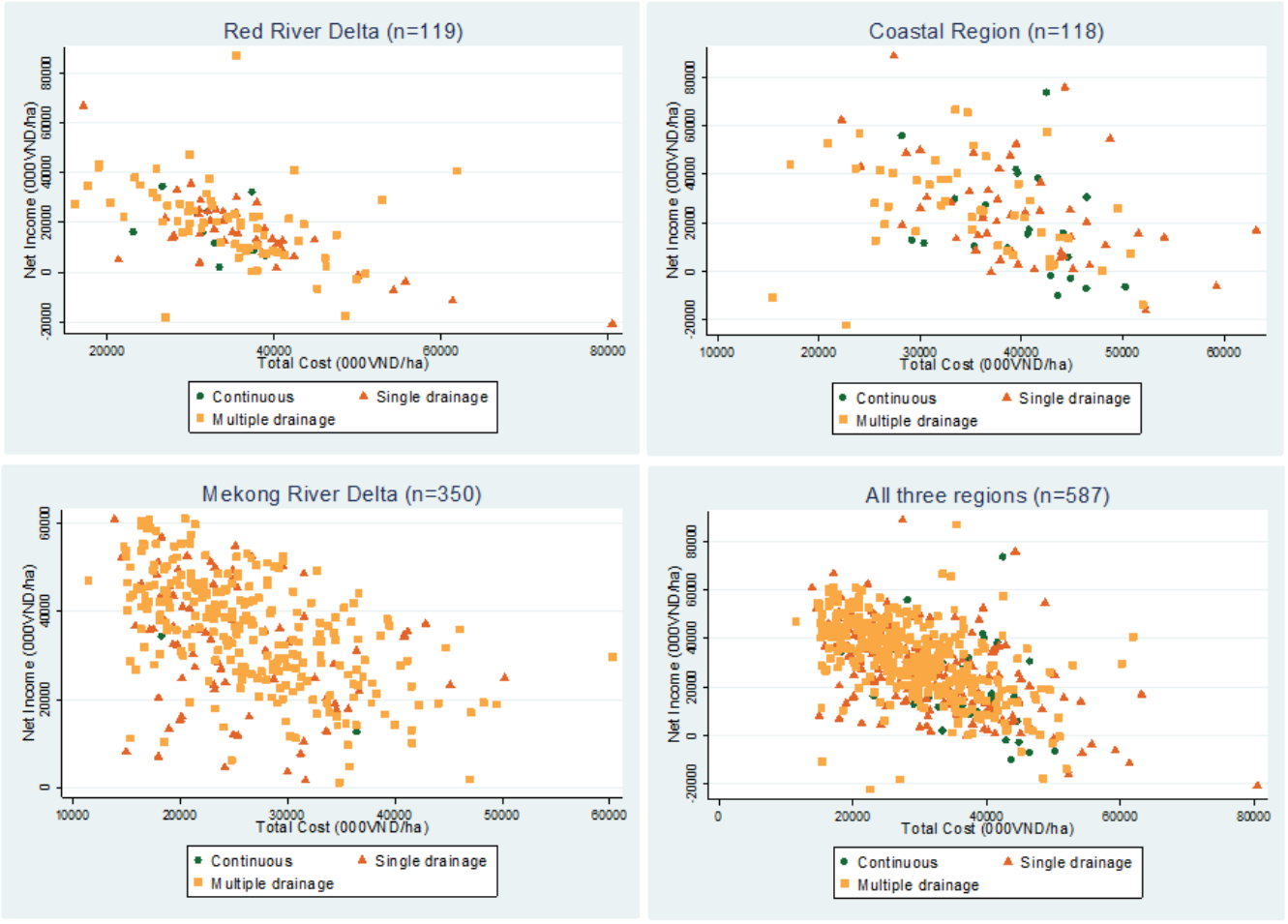


Figure 130. Scatterplot of net income and total cost (000 VND/ha) among surveyed rice farmers, by region and water regime, Winter-Spring 2023-2024.

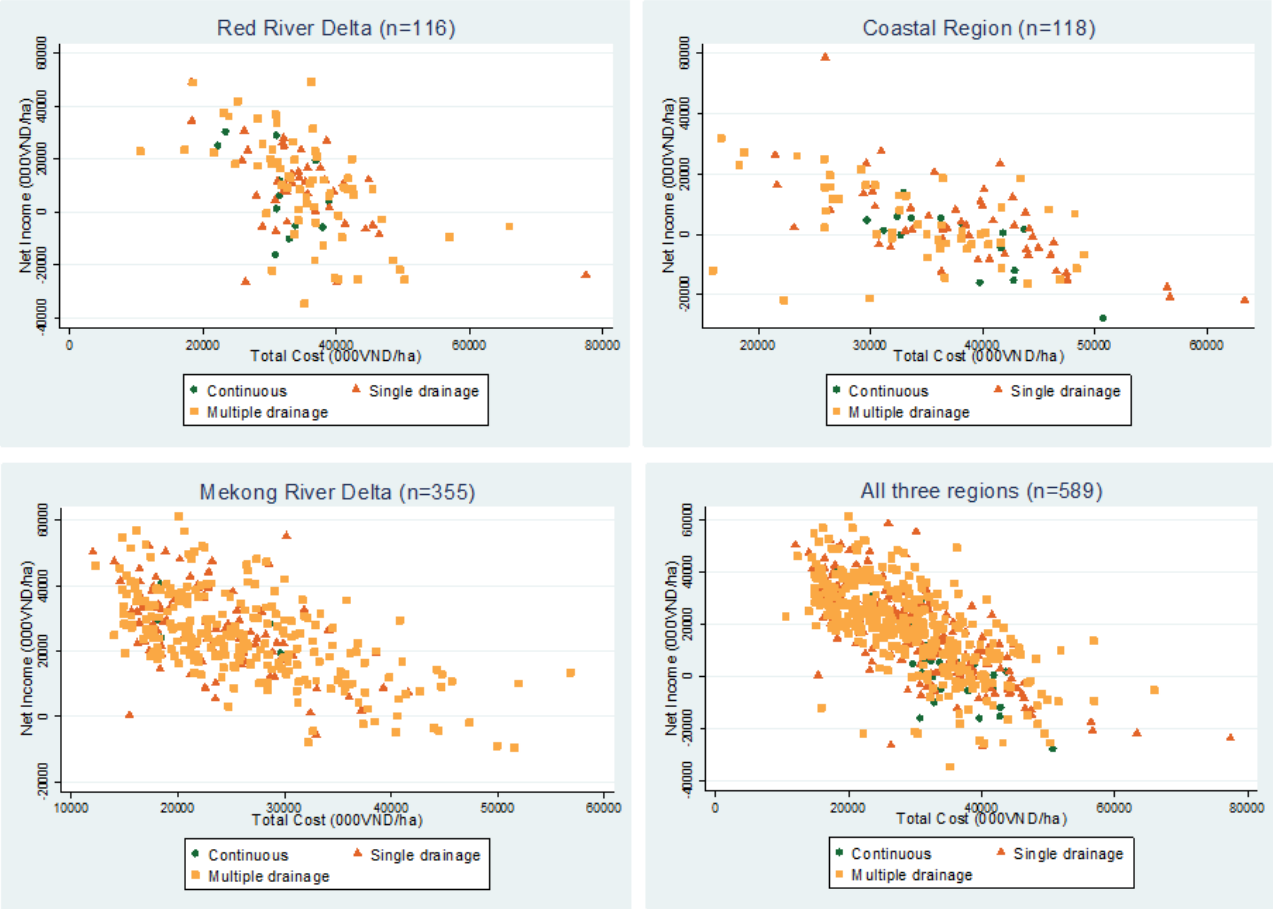


Figure 131. Scatterplot of net income and total cost (000 VND/ha) among surveyed rice farmers, by region and water regime, Summer-Autumn 2024.

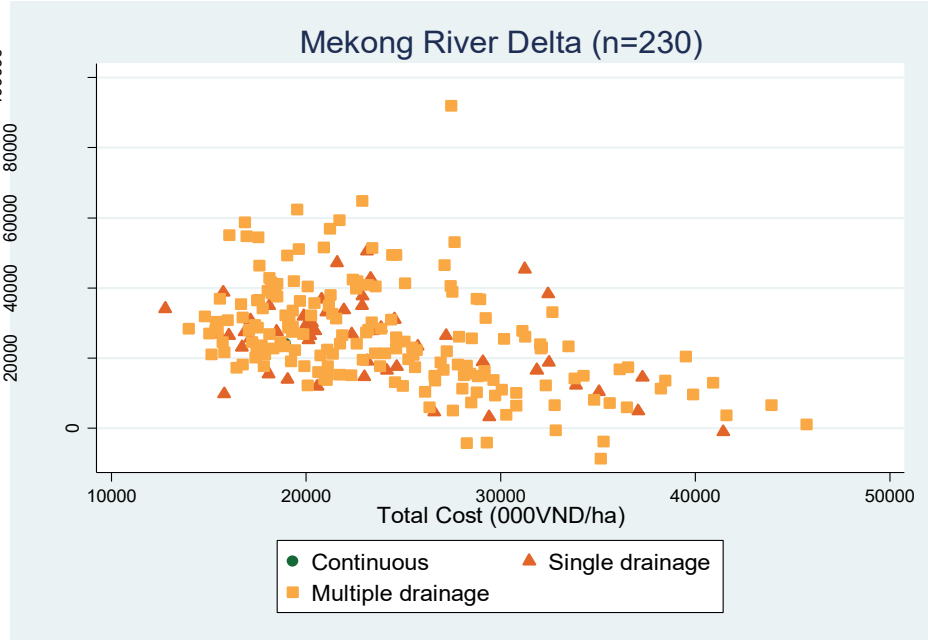


Figure 132. Scatterplot of net income and total cost (000 VND/ha) among surveyed rice farmers, by water regime, Autumn-Winter 2024.

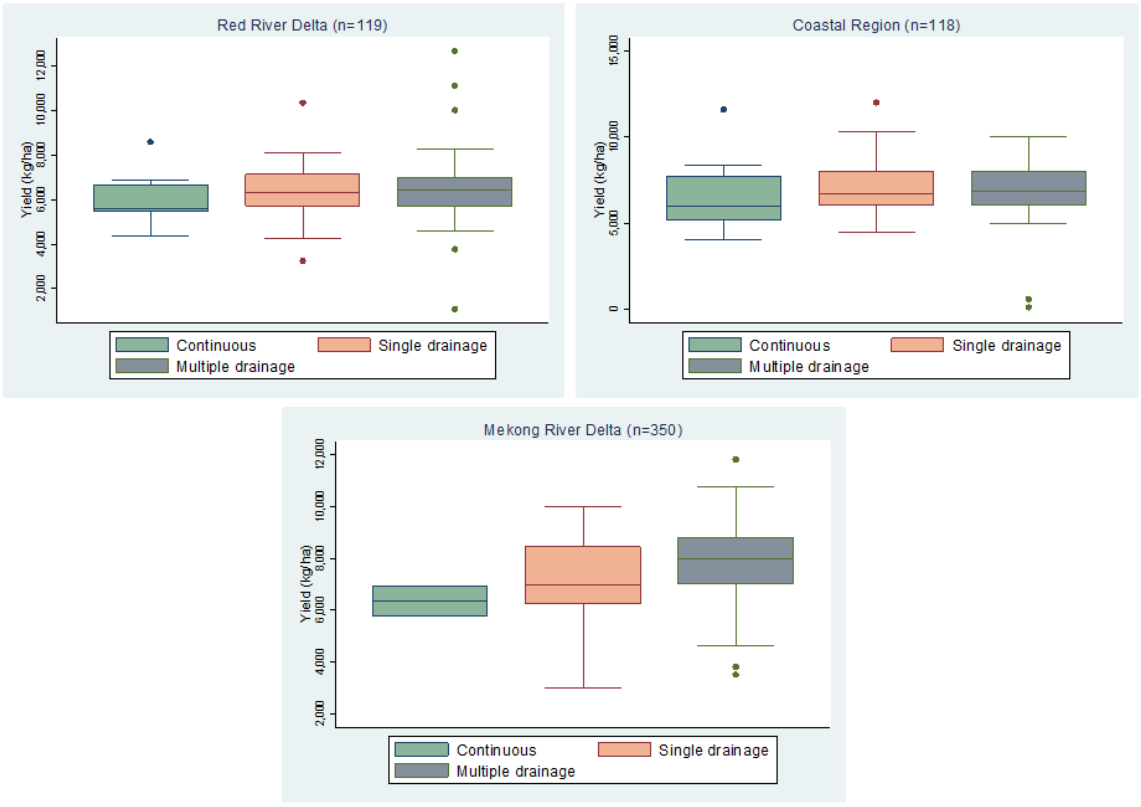


Figure 133. Comparison of rice yield (kg/ha) among surveyed farmers, by region and water regime, Winter - Spring 2023-2024.

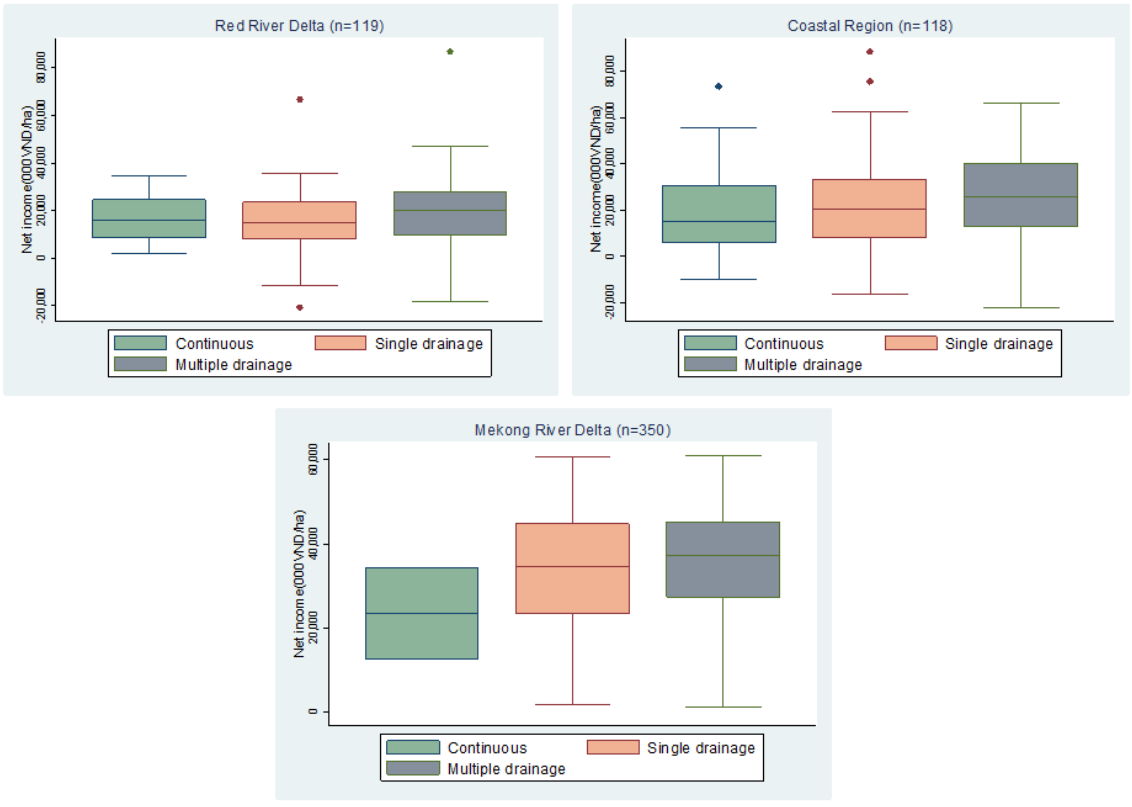


Figure 134. Comparison of net income (000 VND/ha) among surveyed farmers, by region and water regime, Winter-Spring 2023-2024.

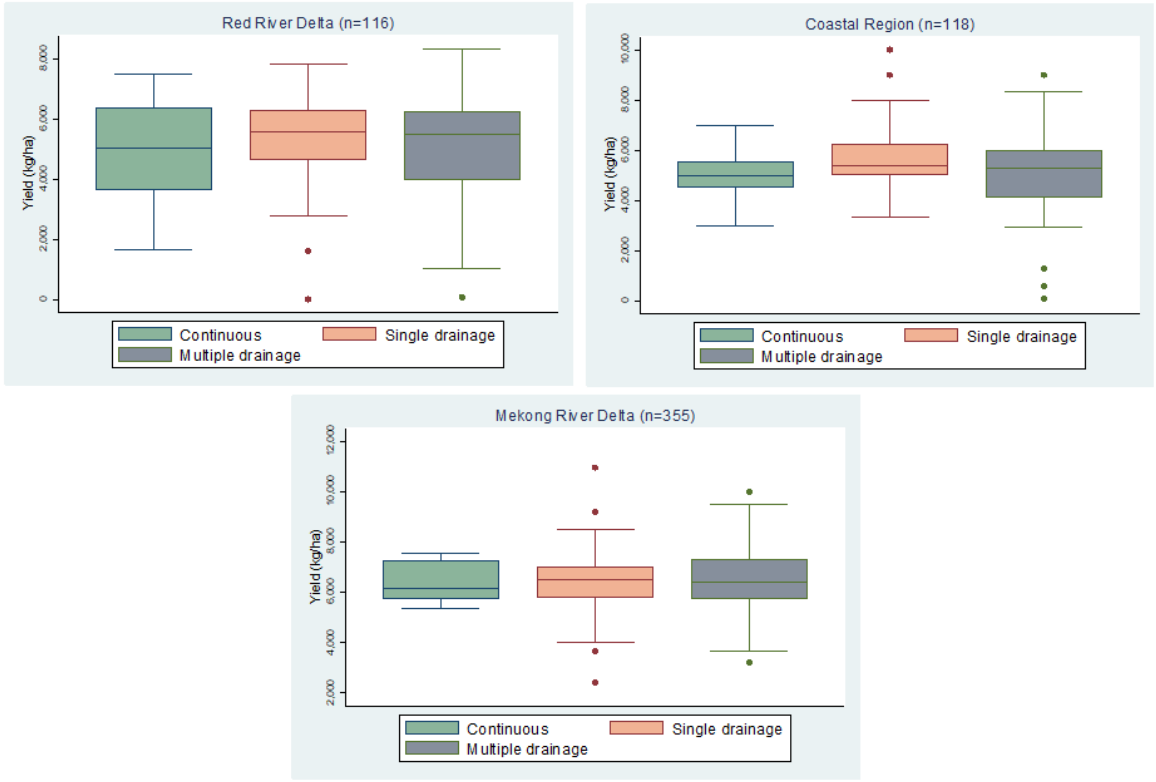


Figure 135. Comparison of rice yield (kg/ha) among surveyed farmers, by region and water regime, Summer-Autumn season 2024.

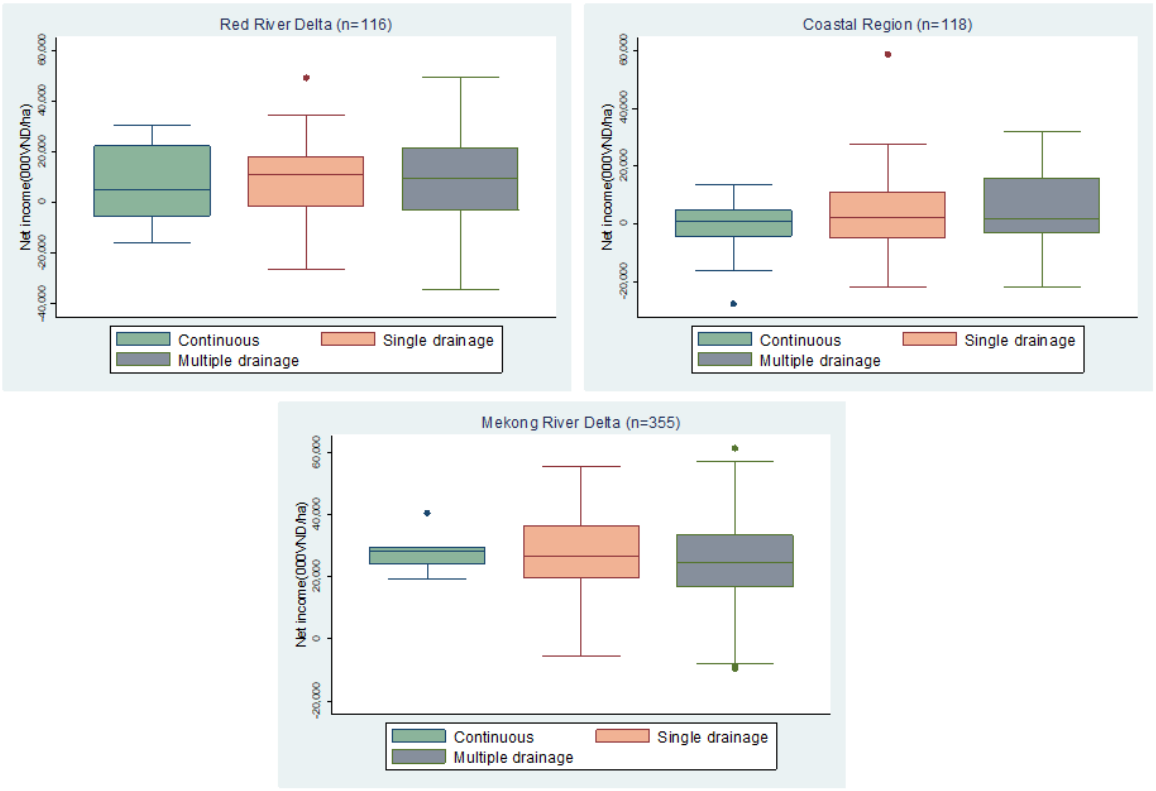


Figure 136. Comparison of net income (000 VND/ha) among surveyed farmers, by region and water regime, Summer-Autumn season 2023-2024.

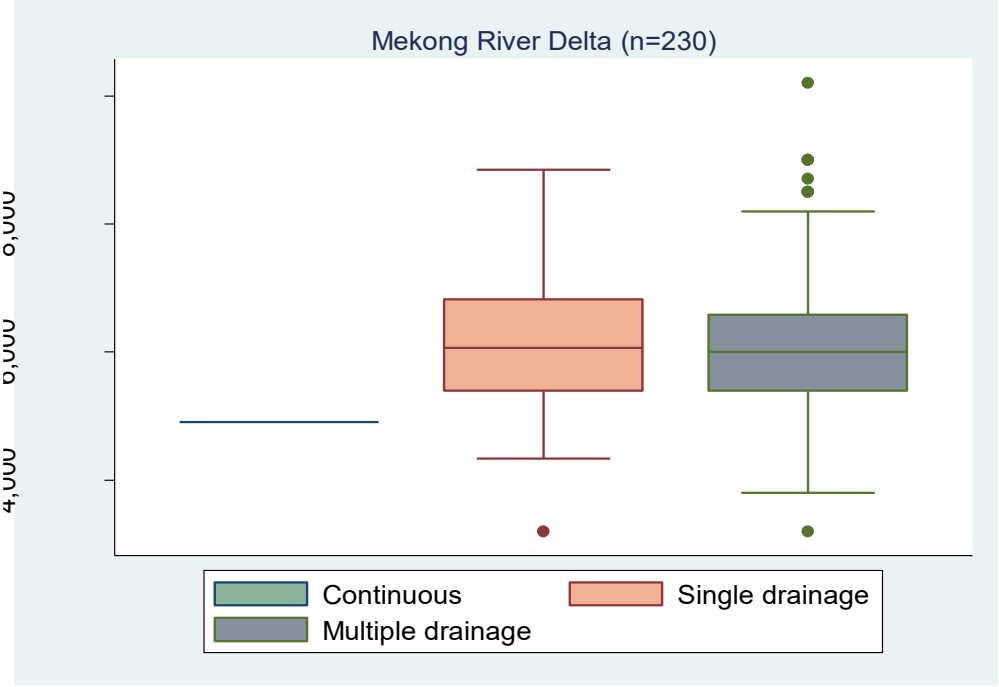


Figure 137. Comparison of rice yield (kg/ha) among surveyed farmers in the Mekong River Delta, by water regime, Autumn-Winter season 2024.

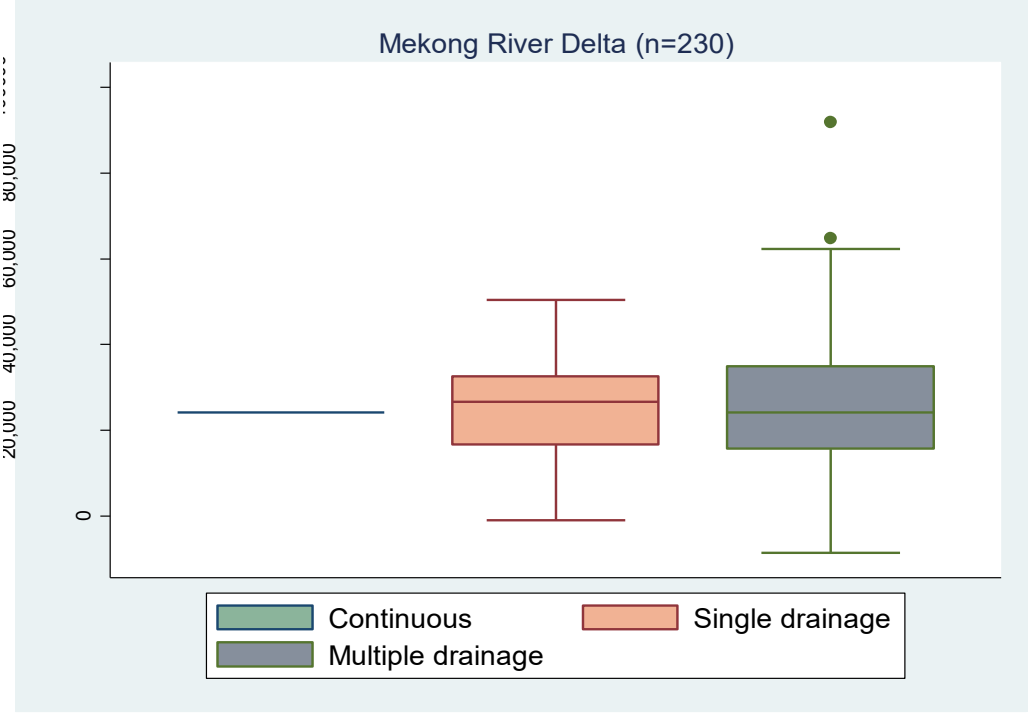


Figure 138. Comparison of net income (000 VND/ha) among surveyed farmers in the Mekong River Delta, by water regime, Autumn-Winter season 2024.

By Crop Establishment Method

Winter-Spring 2023-2024

The costs and returns by crop establishment were also analyzed in this report. During the Winter-Spring 2024 season, 86% of the farmers practiced DSR across the regions. Farmers who employed the DSR method as their crop establishment practice reported a higher yield at 7,373 kg/ha compared to 6,962 kg/ha of those who transplanted rice (Table 71). However, the latter reported a higher gross income of 60,081 thousand VND due to a higher selling price at 8.63 thousand VND/kg.

Table 71. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by crop establishment method, Winter – Spring 2023 - 2024.

	Direct-Seeded Rice (n=505)	Transplanted Rice (n=81)	All (n=586)
Yield (kg/ha)	7,373	6,962	7,316
Sold price (VND/kg)	8.11	8.63	8.18
Gross income	**59,847**	**60,081**	**59,892**
Paddy	59,793	60,081	59,845
Rice straw	55	-	47
Production costs			
Material inputs	**13,541**	**11,313**	**13,234**
Seeds	1,992	1,818	1,968
Fertilizer	6,694	5,697	6,556
Herbicides	781	559	750
Pesticides	4,075	3,239	3,959
Labor	**8,341**	**14,621**	**9,207**
Family	6,137	11,360	6,858
Hired	2,204	3,260	2,350
Other costs	**7,674**	**9,184**	**7,882**
Irrigation payment	421	635	451
Machine	5,546	7,159	5,769
Others	1,706	1,390	1,663
Total costs	**29,556**	**35,118**	**30,323**
Net return	**30,292**	**24,962**	**29,569**
Total costs ('000 VND/ton)	4,009	5,044	4,145
Net return ('000 VND/ton)	4,109	3,586	4,042

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

In terms of the costs, DSR farmers incurred higher material inputs costs (13,541 thousand VND) compared to transplanted farmers (11,313 thousand VND), but significantly lower labor costs (8,341 thousand VND). The total labor cost for transplanted rice was 14,621 thousand VND, mainly from family labor. They also reported higher costs of irrigation and machine, which consequently led to a higher total production cost at 35,118 thousand VND which is approximately 5,000 thousand VND higher than the total input cost of those who practiced DSR (29,556 thousand VND). These led to DSR farmers generating a higher net return of 30,292 thousand VND. This highlights the economic potential of DSR due to its lower production costs and comparable yield to transplanted rice.

Meanwhile, Table 72 to Table 74 shows the costs and returns of DSR and transplanted rice for each region. In RRD and MRD, the yields were higher for DSR while in the Coastal Region transplanted rice was higher. The difference in yield was most prominent in the Coastal Region, wherein the yield of transplanted rice was 8,219 kg/ha which was 1,716 kg/ha higher than the yield achieved using DSR method (6,503 kg/ha). In addition, the transplanted rice was also sold in a higher price, hence, there is a significant difference in the gross income – 80,468 thousand VND compared to the DSR gross income of 56,773 thousand VND. In RRD, there were not much difference in the yield and selling price, thus the gross incomes were comparable. Whereas, in MRD, the yield of DSR was slightly higher thus, despite the higher selling price of transplanted rice, DSR still generated a higher gross income.

Table 72. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production in Red River Delta, by crop establishment method, Winter-Spring 2023 - 2024.

	Direct-Seeded Rice (n=65)	Transplanted Rice (n=53)	All (n=118)
Yield (kg/ha)	6,508	6,446	6,480
Sold price (VND/kg)	8.32	8.17	8.25
Gross income	**54,148**	**52,661**	**53,463**
Paddy	54,148	52,661	53,463
Rice straw	-	-	-
Production costs			
Material inputs	**11,656**	**11,146**	**11,429**
Seeds	1,772	1,851	1,807
Fertilizer	5,238	5,147	5,197
Herbicides	998	576	810
Pesticides	3,648	3,573	3,615
Labor	**14,156**	**12,605**	**13,465**
Family	12,424	10,372	11,510
Hired	1,732	2,233	1,955
Other costs	**11,051**	**9,727**	**10,462**
Irrigation payment	856	832	846
Machine	9,022	7,389	8,295
Others	1,172	1,507	1,321
Total costs	**36,863**	**33,479**	**35,356**
Net return	**17,285**	**19,182**	**18,107**
Total costs ('000 VND/ton)	5,664	5,194	5,456
Net return ('000 VND/ton)	2,656	2,976	2,794

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Table 73. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production in the Coastal Region, by crop establishment method, Winter-Spring 2023 - 2024.

	Direct-Seeded Rice (n=95)	Transplanted Rice (n=23)	All (n=118)
Yield (kg/ha)	6,503	8,219	6,838
Sold price (VND/kg)	8.73	9.79	8.94
Gross income	**56,773**	**80,468**	**61,129**
Paddy	56,773	80,468	61,129
Rice straw	-	-	-
Production costs			
Material inputs	**13,326**	**10,298**	**12,736**
Seeds	2,451	1,841	2,332
Fertilizer	7,277	6,059	7,039
Herbicides	1,092	523	981
Pesticides	2,507	1,875	2,384
Labor	**15,358**	**21,090**	**16,475**
Family	12,830	15,640	13,378
Hired	2,528	5,450	3,098
Other costs	**8,522**	**8,953**	**8,606**
Irrigation payment	412	192	369
Machine	7,282	7,437	7,312
Others	829	1,324	925
Total costs	**37,207**	**40,341**	**37,818**
Net return	**19,566**	**40,127**	**23,311**
Total costs ('000 VND/ton)	5,721	4,908	5,531
Net return ('000 VND/ton)	3,009	4,882	3,409

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Table 74. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production in Mekong River Delta, by crop establishment method, Winter – Spring 2023 - 2024.

	Direct-Seeded Rice (n=345)	Transplanted Rice (n=5)	All (n=350)
Yield (kg/ha)	7,778	6,648	7,761
Sold price (VND/kg)	7.90	8.22	7.90
Gross income	**61,523**	**54,649**	**61,394**
Paddy	61,442	54,649	61,315
Rice straw	81	-	80
Production costs			
Material inputs	**13,961**	**17,758**	**14,015**
Seeds	1,908	1,362	1,900
Fertilizer	6,812	9,873	6,855
Herbicides	653	545	652
Pesticides	4,588	5,978	4,608
Labor	**5,296**	**6,227**	**5,309**
Family	3,091	2,151	3,078
Hired	2,205	4,076	2,232
Other costs	**6,794**	**4,489**	**6,761**
Irrigation payment	341	587	344
Machine	4,403	3,451	4,389
Others	2,050	450	2,027
Total costs	**26,051**	**28,474**	**26,086**
Net return	**35,472**	**26,175**	**35,309**
Total costs ('000 VND/ton)	3,350	4,283	3,361
Net return ('000 VND/ton)	4,561	3,937	4,549

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

In terms of material input costs, in RRD, the estimated total costs for the various farm inputs were around 11,000 thousand VND, both for DSR (11,656 thousand VND) and transplanted (11,146 thousand VND). Meanwhile, in the Coastal Region, the DSR method incurred higher input costs, which was the opposite of MRD, where the transplanted method generated higher costs. Similar to the previous discussions, the majority of these costs were largely attributable to fertilizers and pesticides. For the labor costs, results showed that in both the Coastal and MRD regions, the transplanting method generated higher expenses. This was particularly evident in the Coastal Region, where transplanted rice incurred labor costs of 21,090 thousand VND compared to 15,358 thousand VND for DSR. In contrast, in RRD, the total labor cost for the DSR method was greater than that for transplanted. In addition, the machine rental/costs for DSR were higher in RRD and MRD, whereas in the Coastal Region, the values were comparable.

Overall, the differences in the total production costs between DSR and transplanted were around 2,400 to 3,300 thousand VND across regions. The costs of rice production were lower for farmers

who implemented the DSR method in both the Coastal Region and the MRD. Furthermore, in MRD, the net return was higher for DSR (35,472 thousand VND) than for transplanted (26,175 thousand VND). In comparison, in RRD, transplanted recorded a marginally higher net profit (19,182 thousand VND) than DSR (17,285 thousand VND). Meanwhile, the difference in farm profit was more evident in the Coastal Region, since transplanted rice had a higher yield and selling price, it achieved a net income of 40,127 thousand VND, which is much higher than the 19,566 thousand VND of DSR.

Summer-Autumn 2024

During the Summer-Autumn season, DSR achieved a higher yield of 6,145 kg/ha, which resulted in a greater gross income estimate of 47,842 thousand VND (Table 75). In addition, it reported a lower production cost (28,837 thousand VND) compared to transplanting (33,859 thousand VND). Although the material costs were higher for DSR, transplanting incurred greater labor and other expenses. Consequently, due to its higher yield and lower production cost, DSR achieved greater profitability at 19,005 thousand VND compared to 7,791 thousand VND for transplanted rice.

Table 75. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by crop establishment method, Summer-Autumn 2024.

	Direct-Seeded Rice (n=523)	Transplanted Rice (n=66)	All (n=589)
Yield (kg/ha)	6,145	5,161	6,035
Sold price (VND/kg)	7.78	8.07	7.81
Gross income	**47,842**	**41,650**	**47,162**
Paddy	47,806	41,650	47,130
Rice straw	36	-	32
Production costs			
Material inputs	**13,124**	**11,376**	**12,928**
Seeds	1,881	1,665	1,857
Fertilizer	6,564	5,543	6,450
Herbicides	780	632	763
Pesticides	3,899	3,536	3,858
Labor	**8,324**	**13,667**	**8,923**
Family	6,339	10,868	6,847
Hired	1,984	2,799	2,076
Other costs	**7,390**	**8,816**	**7,550**
Irrigation payment	378	673	411
Machine	5,585	6,928	5,736
Others	1,427	1,215	1,403
Total costs	**28,837**	**33,859**	**29,400**
Net return	**19,005**	**7,791**	**17,762**
Total costs ('000 VND/ton)	4,693	6,560	4,872
Net return ('000 VND/ton)	3,093	1,510	2,943

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Similar to the discussion from the previous season, farmers who adopted DSR in RRD and MRD reported higher yields, while in the Coastal Region, transplanted rice still had an advantage as shown in Table 76 to Table 78. These patterns were also reflected in the estimated gross income values. Meanwhile, in RRD, there was little difference in the calculated material costs between the crop establishment methods. In contrast, in the Coastal Region, DSR entailed higher input costs, whereas in MRD, it was the transplanted method that generated greater farm input costs. For labor costs, in the Coastal Region and MRD, transplanting generated higher costs with a difference of approximately 4,000 thousand VND compared to the DSR method.

Table 76. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by crop establishment method in Red River Delta, Summer-Autumn 2024.

	Direct-Seeded Rice (n=66)	Transplanted Rice (n=50)	All (n=116)
Yield (kg/ha)	5,544	4,764	5,208
Sold price (VND/kg)	8.43	8.47	8.45
Gross income	**46,797**	**40,349**	**44,040**
Paddy	46,740	40,349	44,007
Rice straw	58	-	33
Production costs			
Material inputs	**11,390**	**11,512**	**11,442**
Seeds	1,788	1,707	1,753
Fertilizer	5,096	5,272	5,172
Herbicides	948	661	824
Pesticides	3,557	3,873	3,693
Labor	**13,863**	**12,376**	**13,222**
Family	12,355	10,236	11,441
Hired	1,508	2,140	1,781
Other costs	**10,874**	**9,553**	**10,305**
Irrigation payment	900	824	867
Machine	8,849	7,358	8,206
Others	1,125	1,371	1,231
Total costs	**36,126**	**33,441**	**34,969**
Net return	**10,671**	**6,908**	**9,071**
Total costs ('000 VND/ton)	6,516	7,020	6,715
Net return ('000 VND/ton)	1,925	1,450	1,742

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Table 77. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by crop establishment method in Coastal Region, Summer-Autumn 2024.

	Direct-Seeded Rice (n=105)	Transplanted Rice (n=13)	All (n=118)
Yield (kg/ha)	5,269	6,487	5,404
Sold price (VND/kg)	7.45	6.59	7.35
Gross income	**39,257**	**42,748**	**39,716**
Paddy	39,257	42,748	39,716
Rice straw	-	-	-
Production costs			
Material inputs	**12,271**	**9,519**	**11,968**
Seeds	2,038	1,609	1,991
Fertilizer	6,924	5,744	6,794
Herbicides	1,090	508	1,026
Pesticides	2,218	1,658	2,156
Labor	**15,519**	**19,702**	**15,980**
Family	13,478	15,141	13,661
Hired	2,041	4,561	2,319
Other costs	**8,483**	**6,875**	**8,306**
Irrigation payment	372	145	347
Machine	7,197	5,978	7,063
Others	914	753	896
Total costs	**36,274**	**36,097**	**36,254**
Net return	**2,984**	**6,652**	**3,462**
Total costs ('000 VND/ton)	6,884	5,565	6,709
Net return ('000 VND/ton)	566	1,025	641

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Table 78. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by crop establishment method in Mekong River Delta, Summer-Autumn 2024.

	Direct-Seeded Rice (n=352)	Transplanted Rice (n=3)	All (n=355)
Yield (kg/ha)	6,518	6,038	6,514
Sold price (VND/kg)	7.76	7.97	7.76
Gross income	**50,626**	**48,126**	**50,594**
Paddy	50,583	48,126	50,552
Rice straw	43	-	42
Production costs			
Material inputs	**13,703**	**17,155**	**13,733**
Seeds	1,851	1,213	1,846
Fertilizer	6,732	9,187	6,752
Herbicides	655	693	656
Pesticides	4,465	6,063	4,478
Labor	**5,139**	**9,030**	**5,172**
Family	3,082	2,882	3,080
Hired	2,057	6,147	2,091
Other costs	**6,410**	**4,948**	**6,398**
Irrigation payment	281	444	283
Machine	4,493	3,894	4,488
Others	1,636	610	1,627
Total costs	**25,253**	**31,133**	**25,302**
Net return	**25,373**	**16,993**	**25,292**
Total costs ('000 VND/ton)	3,874	5,156	3,884
Net return ('000 VND/ton)	3,893	2,814	3,882

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

Overall, in MRD, farmers who employed the DSR method generated a higher net income (25,373 thousand VND) due to a higher yield and lower production cost. Similarly, in RRD, DSR farmers achieved a higher net profit, despite incurring greater costs, as the higher yield offset these expenses. Lastly, it was the opposite in the Coastal Region, wherein the farmers who practiced transplanting had higher profitability.

Autumn-Winter 2024

Lastly, during the Autumn-Winter season only the farmers in MRD cultivated rice. The results showed that transplanted rice achieved a higher gross income due to a higher yield and selling price compared to DSR (Table 79). However, transplanted rice incurred higher production expenses since it generated more material inputs and labor costs. Hence, the resulting net income for the crop establishment methods showed little no difference between transplanting (26,492 thousand VND) and DSR (25,581 thousand VND).

Table 79. Costs and returns analysis ('000 VND/ha) of surveyed farmers' rice production, by CSA technology, Autumn-Winter 2024.

	Direct-Seeded Rice (n=225)	Transplanted Rice (n=5)	All (n=230)
Yield (kg/ha)	6,075	6,414	6,083
Sold price (VND/kg)	8.13	9.12	8.15
Gross income	**49,445**	**58,495**	**49,626**
Paddy	49,394	58,495	49,575
Rice straw	52	-	51
Production costs			
Material inputs	**12,681**	**16,030**	**12,754**
Seeds	1,866	1,398	1,856
Fertilizer	6,186	8,209	6,230
Herbicides	549	1,020	559
Pesticides	4,080	5,403	4,109
Labor	**4,616**	**9,464**	**4,722**
Family	2,748	2,537	2,744
Hired	1,868	6,927	1,978
Other costs	**6,567**	**6,508**	**6,566**
Irrigation payment	602	1,593	623
Machine	4,415	4,294	4,413
Others	1,550	621	1,530
Total costs	**23,864**	**32,003**	**24,041**
Net return	**25,581**	**26,492**	**25,584**
Total costs ('000 VND/ton)	3,928	4,990	3,952
Net return ('000 VND/ton)	4,210	4,130	4,206

Note: Conversion unit (1 USD = 24,100 VND)

* With imputed data on material inputs and labor

Note: The other costs consist of land rent/land tax, other materials used and other costs from each farm activity (i.e. food, transportation, oil/fuel)

A comparative analysis across the three seasons reveals clear trends regarding the profitability of rice production and the impact of CSA practices. The Winter-Spring season consistently emerged as the most profitable, marked by higher average yields, gross incomes, and net returns, highlighting its advantage as a prime growing season. Furthermore, the adoption of CSA technologies, particularly multiple drainage and DSR method, is linked with better financial performance across all seasons. Farmers

implementing these practices constantly achieved the highest or near-highest net returns.

In general, the findings across these three seasons promote the widespread adoption of CSA technologies, particularly the integrated use of AWD and DSR. These practices not only contribute to potentially higher yields but also help deal with the rising production costs, particularly labor costs. This significantly enhances the economic resilience and profitability of rice farming across diverse seasonal contexts.

Based on the Figure 139 to Figure 141, similar to the discussions on the water regime, there is no linear correlation between the net incomes and the total costs. As shown in the figures, as the total costs increase, the net income decreases. This implies the importance of determining the optimal allocation of inputs to maximize production efficiency. Beyond a certain point, adding more inputs can lead to cost inefficiencies, as additional inputs do not necessarily translate into higher productivity. Meanwhile, results of ANOVA tests showed that the differences in yields and net incomes across crop establishment methods were not statistically significant.

Figure 139. Scatterplot of net income and total cost (000 VND/ha) among surveyed rice farmers, by region and crop establishment method, Winter-Spring 2023-2024.

Figure 140. Scatterplot of net income and total cost (000 VND/ha) among surveyed rice farmers, by region and crop establishment method, Summer-Autumn 2024.

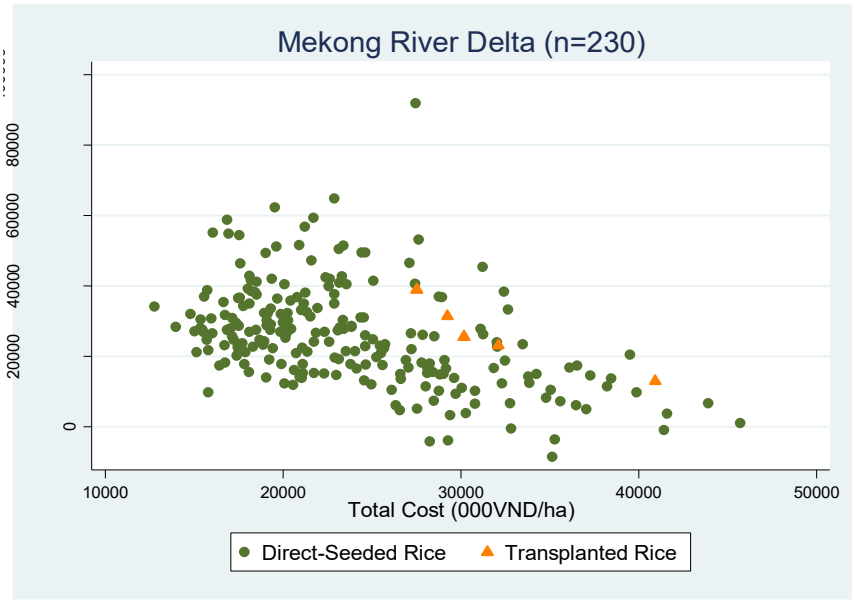


Figure 141. Scatterplot of net income and total cost (000 VND/ha) among surveyed rice farmers in the Mekong River Delta, by crop establishment method, Autumn-Winter 2024.

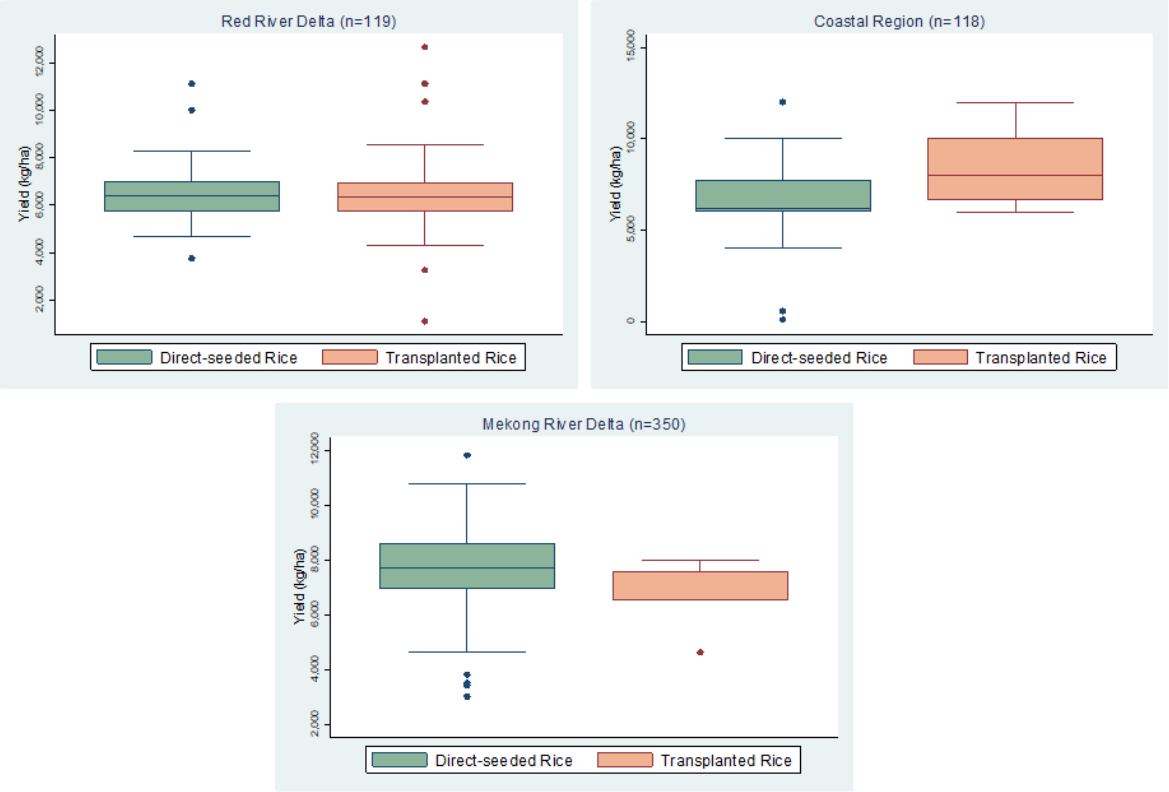


Figure 142. Comparison of rice yield (kg/ha) among surveyed farmers, by region and crop establishment method, Winter - Spring 2023-2024.

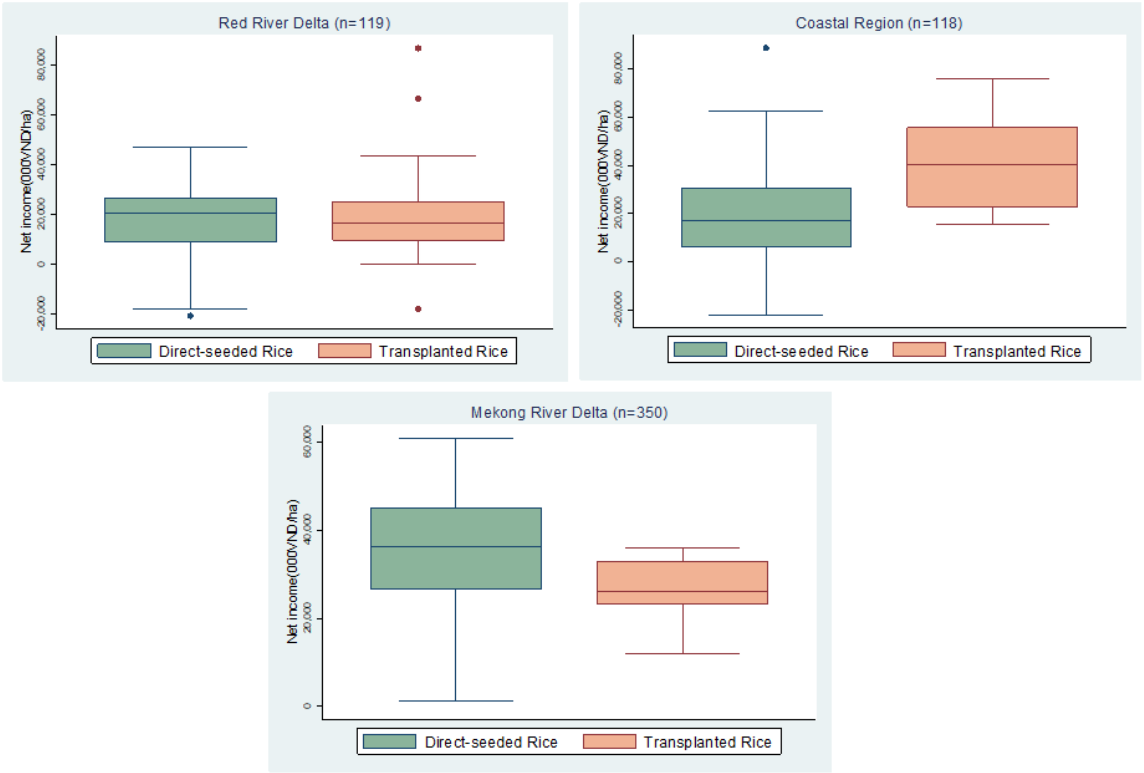


Figure 143. Comparison of net income (000 VND/ha) among surveyed farmers, by region and crop establishment method, Winter-Spring 2023-2024.

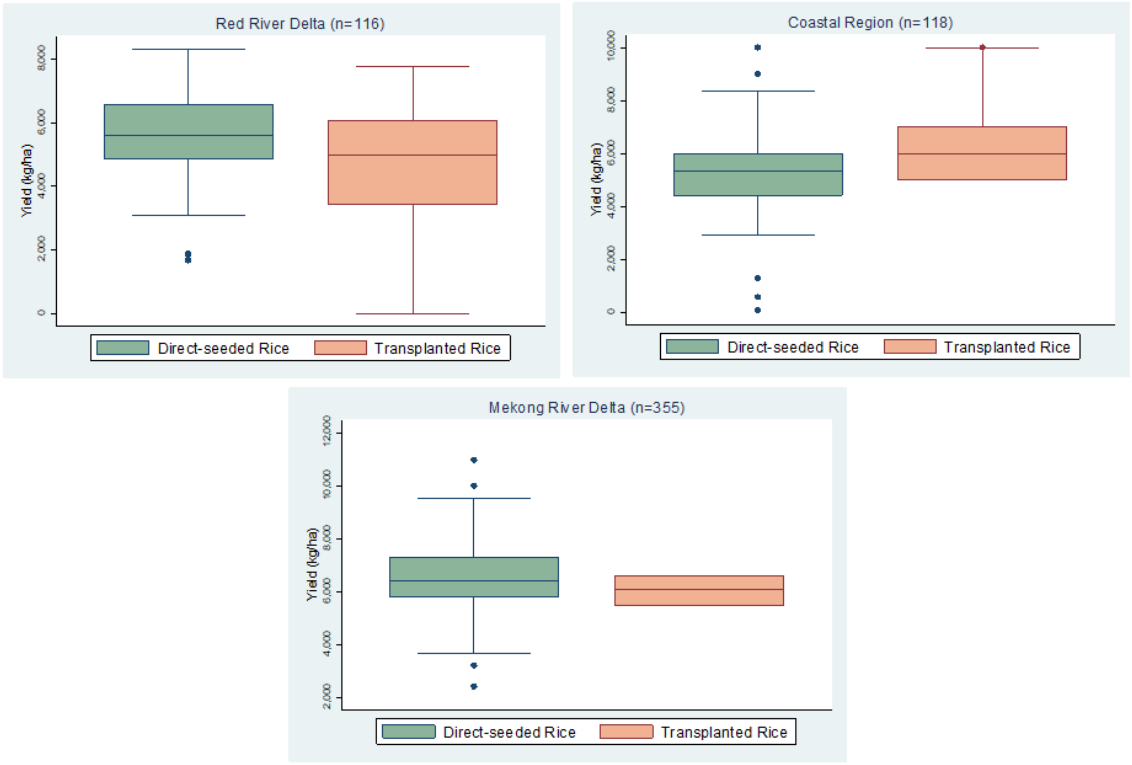


Figure 144. Comparison of rice yield (kg/ha) among surveyed farmers, by region and by crop establishment method, Summer-Autumn 2024.

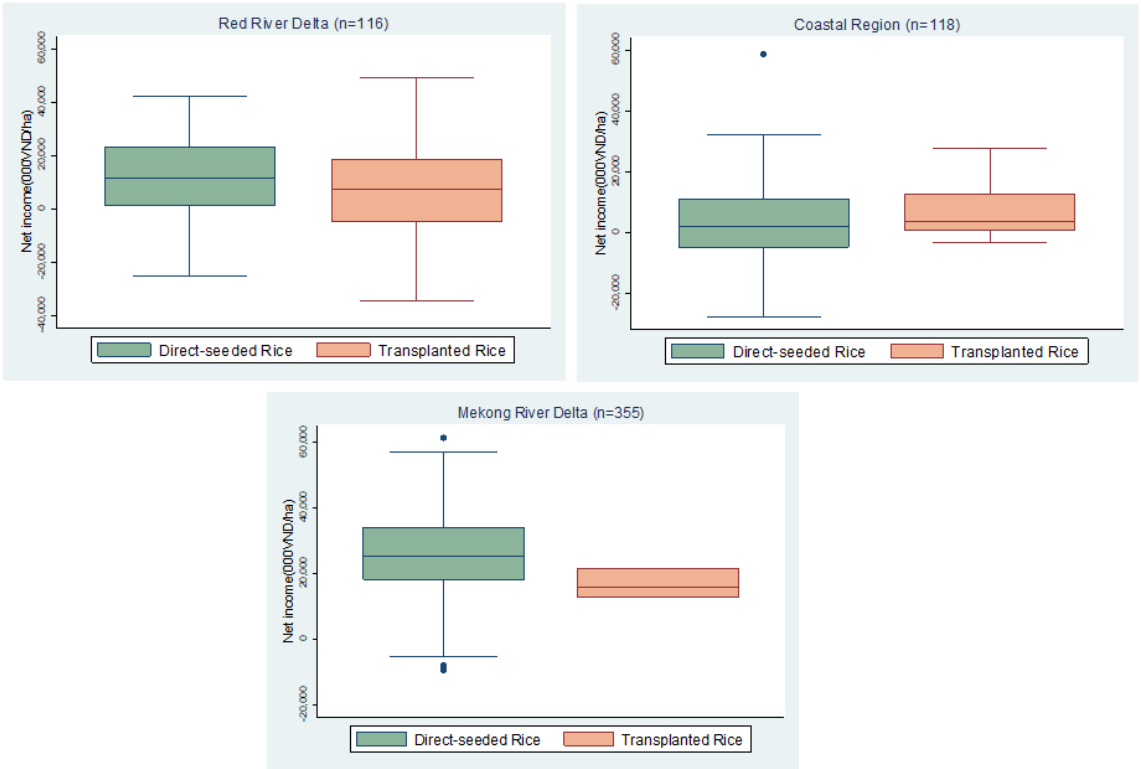


Figure 145. Comparison of net income (000 VND/ha) among surveyed farmers, by region and crop establishment method, Summer-Autumn 2024.

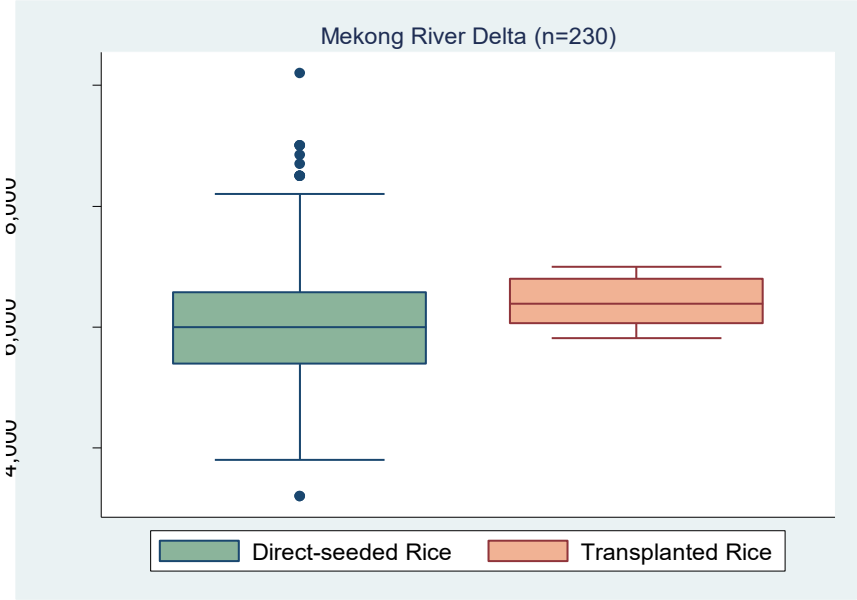


Figure 146. Comparison of rice yield (kg/ha) among surveyed farmers in the Mekong River Delta, by crop establishment method, Autumn-Winter 2024.

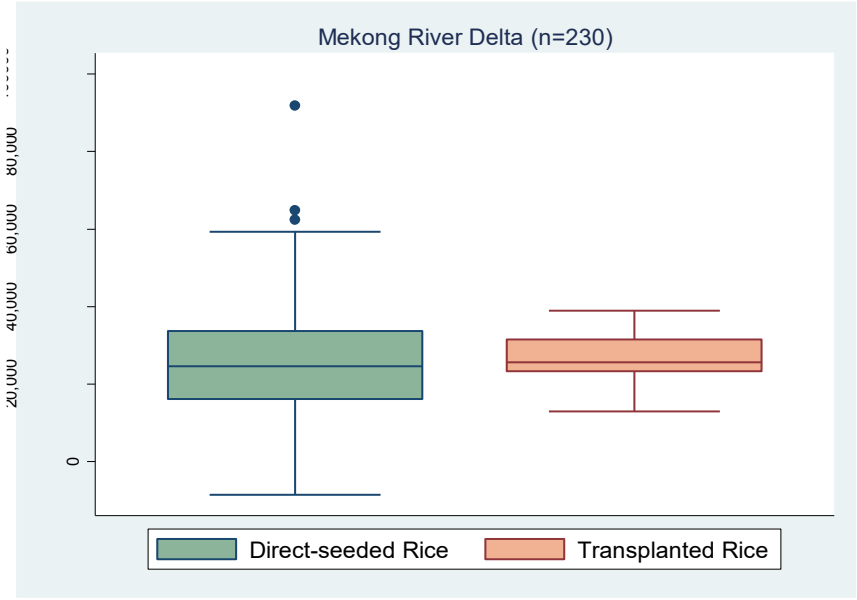


Figure 147. Comparison of net income (000 VND/ha) among surveyed farmers in the Mekong River Delta, by crop establishment method, Summer-Autumn 2024.

4. Summary and Conclusions

Vietnam remains one of the world's leading rice producers and exporters, but its rice-based systems also contribute significantly to methane emissions. This study, conducted by IRRI and IPSARD, surveyed 597 rice farmers across five provinces—Thai Binh, Nghe An, An Giang, Kien Giang, and Soc Trang—to assess current production practices, awareness, and willingness to adopt low-emission climate-smart agriculture (CSA) technologies. The primary objective was to generate evidence to support the design of policies and investments that promote CSA adoption, enhance resilience to climate risks, and sustain rice productivity and profitability while contributing to national emission reduction goals.

A multi-stage sampling approach was used to select representative rice farmers from major rice-growing regions in northern, central, and southern Vietnam. Data collection involved structured interviews using standardized survey instruments that covered household demographics, farming practices, awareness of CSA technologies, perceptions, and economic outcomes. The analysis integrated descriptive statistics, cross-tabulations, and inferential tests to examine relationships between CSA adoption, yield, and profitability. The study also employed a choice experiment to assess farmers' preferences for CSA attributes, including training, financial incentives, and market access.

Results revealed that farmers were experienced (with an average of 32 years in rice farming) but aging (with an average age of 55), and had varying farm sizes—larger in the Mekong Delta and smaller in the northern provinces. About 30% of decision-makers were women, emphasizing the importance of gender-responsive extension efforts. Climate-related hazards were common, particularly floods and pest outbreaks, yet nearly half of farmers had not implemented adaptive measures, indicating a need for greater institutional support and awareness.

Awareness and adoption of CSA practices were uneven. While many farmers were familiar with direct-seeded rice (DSR) and rice straw management (RSM), fewer knew about alternate wetting and drying (AWD), 1 Must Do, 5 Reductions (1M5R), or the Sustainable Rice Platform (SRP) standards. Nonetheless, a majority expressed willingness to adopt AWD and DSR, driven mainly by expectations of higher yield and income. Choice experiment results showed that fertilizer discount vouchers and price premiums were the most substantial incentives for CSA adoption, followed by compensation for additional costs. These findings suggest that linking support services with market-based rewards could significantly enhance CSA uptake.

Production and profitability analyses across the three seasons (Winter-Spring, Summer-Autumn, and Autumn-Winter) showed that the Winter-Spring season consistently yielded the highest productivity and net income. The use of multiple drainage and DSR methods correlated with higher profitability, reinforcing the benefits of integrated CSA technologies. However, scatterplot and ANOVA analyses indicated no linear correlation between total production costs and net income, suggesting diminishing returns from excessive input use. This highlights the importance of optimizing input allocation and adopting efficiency-enhancing practices, such as AWD and 1M5R, to sustain profitability in the face of rising production costs.

The survey underscores that climate-smart agriculture in Vietnam offers dual benefits—economic gains and environmental sustainability. Farmers' positive attitudes toward AWD and DSR present strong entry points for scaling CSA technologies. Policymakers should prioritize extension training, input and credit support, and market-based incentives such as price premiums for low-emission rice. Strengthening linkages

between cooperatives, government programs, and private sector actors will be key to accelerating adoption. Continued investment in farmer education and evidence-based policy frameworks will help Vietnam achieve its climate goals while safeguarding the livelihoods of rice farmers.

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