Masculinization of Agriculture in the Vietnamese Mekong River Delta: The Power of Migration and Remittance Investment on Adoption of Sustainable Production Practice

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Abstract

The story of Vietnam’s agrarian transition is increasingly a tale of gendered migration. Vietnam emerged as a rice production giant in the 1990s due to policy and infrastructural change. Meanwhile, female farmers began migrating from the delta to the city due to the lack of local wage labor jobs and a largely patriarchal land tenure system. In this way, Vietnam shows an opposing trend to the “feminization of agriculture” seen across Southeast Asia and parts of Latin America by showing an increasingly male-managed farm. Today, men are increasingly double- burdened with managing the farm and the family, while women work wage labor jobs in the city to send remittances back home. This article is a gender disaggregated plot-level study exploring on-farm practices to determine if gender is a driver of sustainable or intensification practices. The study uses plot-level data to understand sustainable practice adoption by gender. Results indicate that access to extension training, education, and credit constraints have an impact on sustainable practice adoption. Male- and jointly-managed plots are significantly more likely to adopt less popular sustainable practices such as intercropping, using mulch, composting, and integrated pest management. Similar studies from other Provinces in the Mekong River Delta could build a robust case for understanding gendered impacts on sustainable practices across southern Vietnam, helping the Plant Protection Department (PPD) of the Ministry of Agriculture and Rural Development (MARD) target effective extension trainings to improve sustainable practice adoption.
Introduction

The story of Vietnam’s agrarian transition is still unfolding. Beginning in the 1980s, a cascade of physical and social changes rippled across the Vietnamese Mekong River Delta. The country spent 25 years mired in conflict, freeing themselves of colonial ties, only to start a new battle: the “irrigation front” (Ehlert 2012). The canal and sluice gate system tamed the Mekong and the surrounding delta, shifting the flow of the river and the systems of water governance. These paved veins of modernization, combined with Green Revolution philosophies of input-dependent production, allowed Vietnam to emerge as a rice production giant (Pingali and Xuan 1992).

Between 1990 and 2010 Vietnam became one of the region’s leading rice producers. The gross domestic product (GDP) per capita rose from $98 in 1990 to $2,052 in 2014 (World Bank 2016). However, this economic explosion resulted in pockets of wealth and power in the rice production industry, producing a stratified peasant class system: a rich peasant class with larger land holdings, technological and input advancements, hired labor, and higher yields; small landholder peasants who use more labor-intensive cultivation methods and maintain lower yields; and the landless peasant class who eventually end up selling their labor to survive (Akram-Lodhi 2005). The majority of farms in Vietnam fall into the second class with small plots of land. These farmers must keep pace with an increasing demand for rice.

The triple rice crop requires nutrient and water inputs far beyond the soil and precipitation limits of the environment. Over many years, the prolonged soil wetness required for triple rice production can cause decreases in soil organic matter content and composition, which decreases indigenous nitrogen supply and has been linked to long term rice yield declines (Dawe et al. 2000). Indigenous phosphorus and potassium can also decline if correct applications of inputs are not maintained, which is common among resource-poor farmers. Ecological or sustainable- intensification methods, such as non-rice crop rotations, alternate wetting and drying, and sustainable rice intensification (SRI) have been proposed as alternatives to a strict input- dependent triple-rice cropping system (Doberman
However, the gendered adoption of these practices is not well understood. To meet the increasing rice production pressures, growers may intensify production, diversify cropping systems, or abandon their farming operations to seek wage labor (Tscharntke et al. 2012, Munroe et al. 2013).

Men and women tend to use different strategies to deal with poor soil quality and increasing demands for productivity. Women’s “triple burden” of child bearing, domestic care, and on-farm duties limit their ability to toil in the fields. Women are more likely to intensify farming practices, such as mechanization and investment in tree crops, to reduce labor demands (Zimmerer 2014, Radel and Schmook 2008). Men, on the other hand, tend to perform more labor-intensive activities on the farm, or simply abandon their own land to sell their labor for money. Vietnam’s female migration pattern complicates these new theories of gendered production practices, creating a deviant case of what I would phrase the masculinization of agriculture.

Structural reformations in the late 1980s pushed female farmers from the delta to the city due to the lack of local wage labor jobs and a largely patriarchal land tenure system (Tacoli and Mabala 2010, Dang et al. 1997, Thao 2013). In this way, Vietnam shows an opposing trend to the “feminization of agriculture” seen across Southeast Asia and parts of Latin America (Kelkar 2007). Rather than an increasingly female-managed farm, the Mekong River Delta shows an increasingly male-managed farm. Female migration forces men to take on “social reproduction work,” such as caring for children and performing traditionally female tasks. Today, men are increasingly double-burdened with managing the farm and the family, while women work wage labor jobs in the city to send remittances back home.

Decisions to diversify cropping systems and livelihoods are based on access to resources and information, which is unequal between men and women. Women are more likely to live in poverty and less likely to own land or resources, have control over production, obtain secondary school education, have institutional support, access information, maintain freedom of association, or gain positions in decision-making bodies (Alston 2013). Case studies in South America
demonstrate that women are more likely to intensify farming practices, such as mechanization and investment in tree crops, to reduce labor demands (Zimmerer 2014, Radel and Schmook 2008). However, the influence of gender on sustainable practice adoption is poorly understood in general, let alone in Vietnam. A case study in Kenya demonstrated a promising approach to evaluating gender differences in SI adoption using a livelihood survey approach (Ndiritu et al. 2014). However, the study did not account for remittances from migrant family members.

The purpose of my research is to evaluate the gendered dimensions of on-farm practices that contribute to larger patterns of rice intensification. Vietnam’s history of rapid infrastructural expansion, economic growth, and mass migration of women presents the ideal landscape to study the process and drivers of modern agrarian change. This paper fits into the broad “land-sparing versus land-sharing” debate between natural and social science circles, specifically within the “sustainable intensification” (SI) debate in Agro-ecology. This gender disaggregated plot-level study explores on-farm practices to determine if gender is a driver of sustainable practices. Specifically, I hope to learn how gendered remittance investments influence intensification practices by asking the questions:

- How does gender influence sustainable or unsustainable agricultural practice adoption?
- How do gendered patterns of remittance investment relate to agricultural intensification?

**Study Area and Sampling Strategy**

As other similar farm practice adoption studies have done, I employed a multi-stage sampling protocol for choosing study farms, using purposive sampling at the Province-, District-, and hamlet-level; and proportionate random sampling at the and sub-hamlet-level (Kassie et al. 2015, Ndiritu et al. 2014). Tien Giang was chosen because it is within the Mekong River floodplain and therefore has the highest water availability, making the lands most suitable for the triple cropping
system (Figure 1). Historically, they have a high proportion of triple rice cropping (Sakamoto 2009) and a pattern of seasonal and permanent out-migration (Anh 1999).

I sampled two hamlets in the Cai Be District of the Tien Giang Province. We chose Mỹ Quốc and My Phú, which are in the heart of triple rice cropping territory (Sakamoto 2009). Based on the advice of experts in the People’s Committee of Mỹ Quốc and My Phú, we chose sub-hamlets purposively to include the largest proportion of households that were likely to farm. We then chose eight sub-hamlets in each hamlet and surveyed households using a random proportionate approach. If a household did not participate in farming activities, the next household on the list provided by each hamlet was chosen. Trained extension agents deployed approximately 20 surveys in each sub-hamlet, totaling 160 household surveys.

**Survey Design**

The survey included gender-disaggregated plot-level management questions to understand production practice adoption. The survey is a structured questionnaire designed to understand how men and women manage household resources differently, including remittance connections with household members that have migrated to urban areas. It also includes planned crop diversity, or number and abundance of species, gathered through observation and structured questionnaire, as is common in similar studies (Pacini et al. 2014). Each survey was given to the adult head of household, if available, or their spouse if not.

The surveys were eight pages, with over 350 questions, including a detailed map of the Lower Mekong Delta extending from Phnom Penh in Cambodia to the South Sea on the eastern edge of Vietnam’s Macau Peninsula. The Cai Be District is located in the westernmost portion of Tien Giang Province, shown in orange.
farm to illustrate resources and access to transportation infrastructure. The preliminary survey was pilot-tested on October 25, 2015, and heavily edited and altered according to feedback from two households in the Tien Giang Province. The revised surveys were used to train extension agents from the Tien Giang Province on November 9, 2015. The extension agents advised the research team of several additional edits during their survey training. The final survey was pilot tested on several additional households on November 9. An additional 160 household surveys were conducted between November 10 and 13, 2015.

Upon completion, the survey data was checked for errors and missing values. The majority of the questions included fixed responses, while a few open-ended questions were included to build information about types of pesticides and fertilizers, crop choices, and other such items. Staff at Nong Lam University in Ho Chi Minh City translated the open-ended responses.

**Methodology for Analysis**

This study examines how gender influences production patterns using plot-level data. Plot-level dependent and independent variables were divided into three categories: male-managed plots, female-managed plots, and jointly-managed plots. Differences between these categories were analyzed using a one-way analysis of variance (ANOVA). To determine whether adoption of sustainable practices ovaries, the Pearson’s correlation coefficient was calculated for each pair of practices, such as intercropping and using mulch. Finally, to understand how remittance investment influenced adoption of sustainable practices, the magnitude of Vietnamese Dong (VND) was regressed against

**Dependent Variables**

Sustainable intensification (SI), or ecological intensification, is a philosophy based on reducing environmental damage of agricultural production, while increasing yield from areas already under production. There are many SI practices gaining popularity in the Mekong River Delta, including intercropping or mixed cropping systems, minimum tillage, water-saving practices, rice straw and plastic mulch, and integrated pest management. Many of these practices are linked to the “3 reductions 3 gains” and “1 Must Do, 5 Reductions” campaigns in Southern Vietnam. The SI approach runs
contrary to the Green Revolution tactics of improved seeds; fertilizer and pesticides use; and heavy use of machinery to reduce labor demands.

**Mixed Cropping/Intercropping**

Diversity in cropping systems is closely linked to resilience because it reduces sensitivity to environmental shocks (Di Falco and Chavas 2006). Diverse cropping systems, such as crop-livestock and agroforestry, create emergent properties that naturally support soil fertility, sustained and increased yields, and pest regulation (Altieri et al. 2015). Case studies in Vietnam have shown outstanding results for combined rice-fish culture systems, fruit tree intercropping, and vegetable strips on bunded fields (Dey and Prein 2005, Pretty et al. 2003). However, the majority of the time, powerful non-government and government organizations push “diversification” practices that include purchasing more drought- or flood-resistant cultivars of rice.

**Minimum Tillage**

Reduced-tillage, minimum tillage, and no-tillage are newly popularized approaches to lessening disturbance of soil. The practice aims to maintain soil porosity and structure by reducing or eliminating the number of times machinery is used to disc, plow, or otherwise disturb the field. Documented benefits of reduced tillage include reducing labor and fuel costs, improving or maintaining soil chemical and physical health such as reduced compaction, and reducing erosion (Chauhan et al. 2006). Non-conventional tillage practices tend to increase weed and volunteer species emergence (Chauhan and Johnson 2009). Because of this effect, there is often an increased use of pesticides on reduced-tillage plots.

**Water Saving Irrigation Practices**

Alternate Wetting and Drying (AWD) is an irrigation technique in which water is applied to the field a number of days after the disappearance of ponded water. This is in contrast to the traditional irrigation practice of continuous flooding, in which farmers do not allow the ponded water to disappear. This means that rice fields are not kept continuously submerged but are allowed to dry intermittently during the rice growing stage. The number of days in which the field is allowed
to be “non-flooded” before irrigation is applied can vary from 1 day to more than 10 days, depending on the soil type and climate (Bouman and Tuong 2001). The underlying premise behind this irrigation technique is that the roots of the rice plant are still adequately supplied with water even if there is currently no observable ponded water in the field. To assist farmers in the practical implementation of AWD, a simple tool (a 25-cm-long perforated field water tube) was introduced (Bouman et al. 2007). The field water tube can be made of plastic pipe or bamboo or any cheap material, and is embedded in the paddy field to a depth of 15 cm, with the soil removed from inside the tube, to reveal the perched water-table level (Lampayan et al 2015). During AWD implementation, the field is irrigated to a depth of around 5 cm whenever the ponded water level has dropped to about 15 cm below the surface.

**Mulch/Soil Surface Cover**

Two types of mulch are popular in the Vietnamese Mekong River Delta, including rice straw mulch and plastic mulch. Covering the soils surface, regardless of the material, reduces water losses, increases soil temperature at the surface, and reduces emergence of weed species (Ramakrishna et al. 2006). If rice straw is used, it has also been shown to reduce loss of soil organic matter, increase yields, and reduce air pollution due to straw-burning practices (Humphreys et al. 2011). Because of its ability to improve soil quality, rice straw mulch can be used in highly degraded soils of the Mekong to allow for post-rice legume crops that would otherwise not be possible (Bunna et al. 2011). Use of plastic or rice straw mulch does, however, prohibit use of many pieces of machinery during the growth cycle.

**Compost/Organic Fertilizer**

Compost and organic fertilizer from animal manure are viable alternatives to inorganic fertilizers, especially for resource-poor farmers who cannot afford to purchase fertilizer. Benefits of compost include increased soil organic matter, reduced compaction, more available nitrogen and phosphorus, percentage base saturation, soil respiration, soil aggregate stability (Guong et al. 2010). Compost also increases yield in nutrient-poor soils.
To reduce costs and application rates of inorganic fertilizer, plowing the rice straw back into the field can be a good source of immobilized nitrogen that can be mineralized. Thus, a sustained, slow release of nitrogen through crop residues is a viable option, and has proved successful as an alternative nitrogen supply (Kramer et al. 2002). One cautionary factor is that the rice straw be given enough time prior to planting to decompose, preventing abnormally high rates of anaerobia that can impair root growth for rice plants. This accelerated rate of decomposition of the rice straw is yet another source of greenhouse gas emissions (Batjes 1997).

**Integrated Pest Management**

Green Revolution pesticide policies pushed farmers to overuse pesticides in the Vietnamese Mekong Delta, particularly in early growth stages. There are environmental and human health impacts from pesticide use, such as harm to fish populations in the MRD (Klemick and Lichtenberg 2008). Many farmers believed that a leaf-feeding larvae, the leaf folder (*Cnaphalocrocis medinalis*), would reduce yield if found on rice crops during the vegetative stages of growth (Huan et al. 1999). However, not only are there no yield impacts from the pest during early growth stages, but also pesticide application early in the growth cycle can lead to secondary infestations of pests such as the brown plant hopper (*Nilaparvata lugens*). In an effort to reduce pesticide and fertilizer subsidies, Vietnam’s PPA and MARD promoted integrated pest management (IPM) through Farmer Field Schools (FFS) as a holistic approach to pest management (Tuyen 1997). The main focus of the approach is to reduce the frequency and potency of pesticide, herbicide, and fungicide use by taking advantage of natural predators and growth cycle characteristics of paddy rice. In the Mekong Delta of Vietnam, non-IPM farmers use twice as many pesticides as IPM farmers, including the active ingredient amount and frequency of application (Berg 2001).

**Independent Variables**

**Plot Characteristics (Natural Capital)**

Biophysical characteristics often influence what types of farming practices are applied to a particular plot or crop. Plot characteristics in this study include soil
quality, whether or not there are major soil problems, depth to the clay pan, and the size of the plot in hectares.

**Household Characteristics (Human Capital)**

Socioeconomic drivers have a large influence on farming practices. Household characteristics in this study include the age and education of the respondent, the number of individuals in the household, whether the household is credit-constrained, and whether or not members of the households have off-farm work.

**Kinship and Institutional Support (Social Capital)**

Social capital is a Social capital in this study refers to whether the respondent is a member of an agricultural group, if the household has a relative or friend in a leadership position in the village, and how many family members live in the village.

**Household Resources (Financial and Physical Capital)**

The household resource section of this study was designed to understand the assets and land tenure situation of each household. Variables include the size in hectares of the entire farm; the household and farm asset scores, devised by author by giving points for owned items and subtracting points for rented items; livestock production; whether the household rents or owns their land; and how much income the farm brought in last year.

**Access to Information and Markets (Capabilities)**

Access to information and opportunity is a gendered phenomenon, creating inequality and uneven uptake of sustainable practices between the sexes. Extension training and access to the market are included in this study as additional independent variables.

**Results and Discussion**

Socioeconomic characteristics illustrate results in line with what is expected across gender lines in the Vietnamese Mekong River Delta. The average age of female-headed households is 13 years older than men, indicating that women lead
households must content with the challenges of physical aging in addition to the challenges already facing women in smallholder agriculture (Table 1).

Educational inequality is perhaps the most stark and telling driver of the unequal adoption of sustainable practices between men and women. The average education of women is only 3.8 years, while for men it is 6.7 years. With twice as much education, men are better candidates for extension trainings, are more likely to adopt practices they are trained on, and are more able to utilize training effectively (Tuyen 1997). To add to this educational inequality, only 21% of women receive extension training, while 50% of men receive it. Extension trainings are crucial for shifting farming practices in the delta. This is the most policy-relevant finding of this study, indicating that intense targeting of women would yield a much higher adoption rate of sustainable practices among female farmers.

Results also show that women are at a disadvantage in financial and land tenure positioning. Financially speaking, 24% of women are credit constrained, while only 9% of men face obstacles to borrowing money for farm and household needs. This has a huge impact on farm practice choice, as it comes down to being able to purchase high quality inputs on credit for the upcoming season. Finally, women’s farms are 0.5 hectare on average, while men’s farms are 0.69 hectare. This 0.2 hectare difference can have a huge impact on production of a farm.

Table 1. Socioeconomic Characteristics of Sampled Households

<table>
<thead>
<tr>
<th>Household Characteristics</th>
<th>Female HH</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>66.03</td>
<td>53.66</td>
</tr>
<tr>
<td>Education (number of years)</td>
<td>3.79</td>
<td>6.71</td>
</tr>
<tr>
<td>Household Size (number of individuals)</td>
<td>4.76</td>
<td>4.77</td>
</tr>
<tr>
<td>Credit Constrained (trouble getting loans)</td>
<td>0.24</td>
<td>0.09</td>
</tr>
<tr>
<td>Household member works at local farm</td>
<td>0.14</td>
<td>0.18</td>
</tr>
<tr>
<td>Household member has local non-farm work</td>
<td>0.38</td>
<td>0.50</td>
</tr>
<tr>
<td>Social Capital</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Interestingly, the only noticeable biophysical difference between the plot characteristics of male-, female-, and jointly-managed plots is that of having “major problems” with plot productivity (Table 2). This illustrates an interesting avenue for further research, as the source and nature of these major problems is not clear from this particular survey.

Table 2. Characteristics of Plots Managed by Household Members (Mean)

<table>
<thead>
<tr>
<th></th>
<th>Female Managed Plots</th>
<th>Male Managed Plots</th>
<th>Jointly Managed Plots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group membership (1=yes, 0=no)</td>
<td>0.00 0.03</td>
<td>0.97 0.98</td>
<td>4.52 4.49</td>
</tr>
<tr>
<td>Relative/friend in leadership position (1=yes, 0=no)</td>
<td>5.00 5.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relatives that live in village (number of)</td>
<td>0.50 0.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household Resource Size in Hectares of whole farm (hectares)</td>
<td>8.97 9.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household Asset Score (items owned minus items rented)</td>
<td>5.00 5.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm Asset Score (items owned minus items rented)</td>
<td>0.50 5.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Produce small livestock, large livestock, or products (0=no, 1=yes, 2=more than 1)</td>
<td>0.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Or you rent your land (1=own, 0=rent)</td>
<td>5 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income from plots last year (percentage)</td>
<td>56.28 58.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to Services</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Received extension training (1=yes, 0=no)</td>
<td>0.50 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to nearest market (kilometers)</td>
<td>1.70 8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A snapshot of sustainable practice adoption illustrates that some are much more popular than others, regardless of gender (Figure 2). First, it is clear that reduced tillage and water-saving practices are widely adopted by the majority of farmers, with adoption rates of 62-87% and 83-94%, respectively. IPM and composting or applying organic fertilizer are less popular, with adoption rates between 38-70% and 22-44%, respectively. Finally, intercropping and using mulch are not widely adopted, with rates of between 2-13% and 2-10%, respectively.

There are very distinct differences in technological adoption between plots that are influenced by men and those that are not. Within each sustainable practice category, male-managed or jointly-managed plots consistently adopt sustainable practices more often than female-managed plots by a margin of between 8 and 28%. The exception is water-saving practices, where we see the highest adoption rate of any practice (94%) on jointly-managed plots and the second-highest rate (87%) on female-managed plots. Statistically significant categories in adoption included minimum tillage, water management practices, composting, and IPM (p=.016, p<.000, p=.024, p=.030, respectively) (ANOVA results).
Sustainable Practice Adopted

Regarding covariance of sustainable practices, there are many correlations between the practices. Positive correlations indicate that the practices are complementary, while a negative correlation indicates that one practice may replace the other (Nditiru et al. 2014), summarized below (Table 3). These correlations make sense, given the outcomes and inputs of each sustainable practice. What is interesting is that the more popular practices are highly correlated, as are the less popular practices.
Table 3. Correlations and Covariance of Sustainable Practices

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>TIL</th>
<th>WA</th>
<th>MU</th>
<th>CO</th>
<th>IPM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intercropping</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0.11</td>
<td>.174</td>
<td>0.046</td>
</tr>
<tr>
<td>Correlation</td>
<td>0.09</td>
<td>0.02</td>
<td>6</td>
<td></td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>Covariance</td>
<td>5</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Reduced Tillage**

|                     |     |     |     |     |     |     |
| Pearson             | -   | 1   | .250| 0.07| -   | .405**|
| Correlation         |     |     | **  | 4   | 0.03|     |
| Covariance          |     | 0.19| 0.03| 0.00| -   | 0.087|

**Water-saving Practices**

|                     |     |     |     |     |     |     |
| Pearson             | -   | .250| 1   | -   | -   | .322**|
| Correlation         |     |     | **  | 0.02| 0.06|     |
| Covariance          |     | 0.03| 0.00| -   |     | 0.055|

**Mulch**

|                     |     |     |     |     |     |     |
| Pearson             | 0   | 0.07| -   | 1   | .254| 0.108|
| Correlation         | 4   | 0.02| -   |     | **  |     |
| Covariance          | 0.00| -   | 0.06| 0.03| 0.014|

**Compost/Organic Fertilizer**

|                     |     |     |     |     |     |     |
| Pearson             | -   | -   | .254| 1   |     | .099|
| Correlation         | 0.03| 0.06| **  |     |     |     |
| Covariance          |     |     | 0.03| 0.22| 0.023|

*Correlations marked with ** are significant at the 0.01 level.*
The less popular practices illustrated in Table 2 include intercropping, using compost or organic fertilizer, and using mulch. Intercropping (INT) is significantly positively correlated with composting and organic fertilizer (COM) use ($r = .174$). Composting or using organic fertilizer (COM) is significantly positively correlated with using mulch (MUL) ($r = .254$). These practices focus primarily on soil quality and diversification. Because their correlation represents a complimentary relationship, this study supports a possible avenue for further promoting use of these less-popular practices. For example, if composting methods can be integrated into mulching practices, perhaps farmers in the MRD would be more likely to utilize these approaches for fertility management. Similarly, if intercropping with legumes can be promoted as another form of organic fertilization, farmers may be able to adopt both practices while adding cash crops and diversification to their crop portfolio.

The more frequently adopted practices include reduced tillage, water-saving efforts, and IPM. Reduced tillage (TIL) adoption is significantly positively correlated with water-saving practices (WAT) ($r = .250$) and integrated pest management (IPM) ($r = .405$). Because reduced tillage often requires pesticides to control for volunteer and weed species, IPM would be an avenue to reduce required pesticides and, thus, additional reduce financial resources. WAT is also positively correlated with using IPM ($r = .322$). This is an interesting result, as the two practices are not necessarily a natural compliment. It should be noted that the PPD and MARD intensely promote
water-saving practices and IPM under the “1 Must Do, 5 Reductions” program, which could perhaps explain the common use of both practices together.

The migration and remittance data shows a similar trend to the male-dominated adoption data above. Table 4 illustrates the average remittances received for male-, female-, and jointly- managed plots. Consistent with the sustainable practice adoption, male- and jointly-managed plots are much more likely to receive remittances from family members who have seasonally or permanently migrated away from the home. In addition, results show that 19 out of 39 men who migrate for work still make decisions on the plots when they are away, while zero out of 9 women who migrate for work still make decisions on plots back home. Additional, regionally representative studies in other Districts and Provinces in the MRD are warranted to further understand the significance of these data.
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