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# Identifying early adopters, enhancing learning, and the diffusion of agricultural technology

**by**


**Kyle Emerick, Tufts University**

**Alain de Janvry, University of California at Berkeley**

**Elisabeth Sadoulet, University of California at Berkeley**

**Manzoor H. Dar, International Rice Research Institute**

# Identifying early adopters, enhancing learning, and the diffusion of agricultural technology

Kyle Emerick, Alain de Janvry, Elisabeth Sadoulet, and Manzoor H. Dar*

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**Abstract**

We introduced a new seed variety to a subset of farmers across 100 rural Indian villages. Initial adopters were either identified by participatory meetings or by consultation with a local political figure. In addition, we randomly allocated half of the villages to receive a traditional form of agricultural extension where the variety is explained in a village meeting and villagers are taken to the field to observe the crop. We find that allowing villagers to participate in the selection of early adopters reduces patronage, but has no effect on future uptake. In contrast, the farmer field days had a strong positive effect on demand. This result indicates that traditional methods of agricultural extension can be effective at enhancing learning and speeding up the diffusion of agricultural technology.

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*Emerick: Tufts University, 8 Upper Campus Road, Medford, MA 02155-6722 (e-mail: kyle.emerick@tufts.edu); de Janvry: University of California at Berkeley, 207 Giannini Hall, Berkeley, CA 94720-3310 (e-mail:alain@berkeley.edu); Sadoulet: University of California at Berkeley, 207 Giannini Hall, Berkeley, CA 94720-3310 (e-mail:esadoulet@berkeley.edu). Dar: International Rice Research Institute, New Delhi India (e-mail:m.dar@irri.org). We acknowledge financial support from the Agricultural Technology Adoption Initiative of the Bill and Melinda Gates Foundation. We are grateful to Ritadhi Chakravarti, Manaswini Rao, and Xinxin Lyu for excellent research assistance.

# 1 Introduction

The adoption of improved technologies is an important engine of growth for smallholder farmers in developing countries. Yet, levels of technology adoption often remain disappointingly low and information constraints are considered to be an important barrier to adoption (Jack, 2011). Focusing on learning, there is a long list of studies showing that peers serve as important sources of information (Foster and Rosenzweig, 1995; Bandiera and Rasul, 2006; Conley and Udry, 2010). Building on these findings, recent work has turned to methods for identifying initial adopters in order to maximize the spread of information across individuals (Banerjee et al., 2014; Beaman et al., 2015). At the same time, there are few studies that rigorously test alternative approaches to facilitating information diffusion once this group of peer adopters has been identified.

In this paper we combine these two ideas by considering two related questions. First, we ask whether allowing villagers to jointly determine the early adopters of an improved seed variety results in increased future demand for that variety. Second, we ask whether information diffusion can be further facilitated by adding a farmer field day — a traditional method of agricultural extension where a short village meeting is followed by a visit to the field where the new seed variety is being grown. The first question tests an alternative method to identifying early adopters with the objective of maximizing technological diffusion.[1] The second question steps back and asks whether a more traditional — but untested — method of agricultural extension can be effective.

Understanding the efficacy of learning-related interventions such as these is important for policy. Low productivity in the agricultural sector is tightly associated with low levels of aggregate productivity (Restuccia, Yang, and Zhu, 2008). At the same time, modernizing agricultural technology is an important driver of structural transformation and hence long-term growth (Yang and Zhu, 2013; Bustos, Caprettini, and Ponticelli, 2016). The policy challenge that arises is how to make proven agricultural technologies diffuse faster in developing countries? Our work tests a new method for identifying early adopters and a different method for encouraging learning once these adopters are identified.

We find that setting up village meetings to identify early adopters had small and statistically insignificant effects on future demand. In contrast, simple farmer field days increased adoption of the improved seed variety by approximately 40 percent. These findings were generated by a two-step randomized experiment in the Indian state of Odisha. In the first

[1] Beaman et al. (2015) show that a network model of diffusion can reliably identify injection points and increase adoption of pit planting for Maize in Malawi. BenYishay and Mobarak (2015) show that adoption the same technique is larger when both more representative "peer farmers" are selected and compensated for diffusing information.

step we introduced 25 kilograms of a new high-yielding and flood-tolerant rice variety called Swarna-Sub1 in 100 villages. Importantly, the technology has been shown to dominate existing technology, indicating that it should diffuse rapidly in the absence of barriers to adoption.[2] Each village was randomly allocated to one of three different methods for introducing the variety. In one third of the villages we used the status-quo approach of delivering the seeds to locally-elected village officials — ward members in the Gram Panchayat — who then chose how to further distribute the seeds amongst villagers.[3] In another third of the villages we used a participatory meeting where villagers were invited to jointly determine how the seeds should be allocated. Finally, we used village meetings with local women's groups (Self Help Groups or SHG's) in the remaining villages.

In the second level of randomization our partner NGO carried out farmer field days in 50 villages. These field days occurred approximately four months after the seeds were introduced and while the crops of the initial beneficiaries were approaching time for harvest. The field days were simple two hour events where the variety was described, initial beneficiaries spoke about their experience, questions were answered, and then attendees were taken to the fields of initial beneficiaries if possible.

We then offered the new variety for sale after harvest and immediately prior to planting for the next growing season. Our survey teams went door-to-door and asked a random sample of 15 households per village whether they were interested in buying seeds. Importantly, we fixed the price to be near the prevailing market price of the variety.[4] Therefore, offering seeds directly to farmers in this way allows us to measure demand in an environment without either supply constraints or high subsidies.

This design allows us to measure three parameters. First, we measure whether identifying early adopters in consultation with villagers leads to greater future diffusion. This approach could dominate the use of locally-elected officials if villagers as a whole are better able to compile information on who is most suitable to demonstrate the new variety.[5] Second, we

[2]The variety was released in 2009. It offers flood tolerance without reducing yield during non-flood years (Dar et al., 2013). The technology also leads to significant welfare gains by inducing farmers to modernize production (Emerick et al., 2016)

[3]The minikit is a popular seed dissemination approach in South Asia. India's National Food Security Mission program uses minikits and relies on members of the Gram Panchayat to help identify beneficiaries.

[4]The new variety was not yet available at the government block offices where most farmers purchase subsidized seeds. One other large NGO in the area was selling seeds of this variety at prices higher than government subsidized prices.

[5]Participatory community meetings have been shown to improve targeting of anti-poverty program in Indonesia (Alatas et al., 2012). One possible explanation of this finding is that community meetings aggregate more information on who is poor relative to other approaches. Other studies have considered an opposite approach where welfare programs are targeted using local elites (Basurto, Dupas, and Robinson, 2015). This approach could be superior if local elites possess better information. Our use of meetings to identify injection points is based on a similar idea that villagers may be able to better aggregate information on the

measure the efficacy of farmer field days under the status quo environment where farmers can only learn from early adopters identified by local political figures. Third, we measure whether farmer field days are any more or less effective under the alternative mechanism where early adopters are identified with village meetings.

We have four main results. First, we show that both forms of village meetings reduce patronage. The initial recipients of the technology are 31 percent and 62 percent less likely to be close family or friends of the ward member in village meeting and SHG meeting villages, respectively. In addition, 11 percent of recipients in ward member villages are elected representatives (including the ward member him or herself). These percentages fall to 5 percent and 3.2 percent in village meeting and SHG meeting villages, respectively. Thus, the first intervention of changing the method of identifying initial adopters of new seed varieties did succeed in reducing patronage and increasing adoption by farmers less connected to political figures.

Second, we show that despite reducing patronage, identifying early adopters with meetings does not lead to increases in future demand. Differences in adoption between ward member, SHG meeting, and village meeting villages are small and statistically insignificant. Our estimated standard errors allow us to reject increases in adoption of around 33 percent. The data therefore indicate that using village meetings to identify the first generation of adopters of a new technology does not strongly increase future demand. In addition, the results suggest that the consequences of patronage in terms of future technological diffusion are minimal in this context.

Third, we estimate strong effects of farmer field days on demand. Adoption increased by around 12 percentage points from 30 to 42 percent in villages where farmer field days took place. This effect is concentrated more heavily on adoption of a single seed package. We find that purchases of one 5 kilogram packet rose by 59 percent, while purchases of two or more packages rose by only 25 percent.[6] In addition, we show that the effect of field days on demand is the largest for the poorer farmers in the village. More specifically, the effects of farmer field days on buying a single package of seeds is significantly larger for farmers that are in lower caste groups and farmers that are below the poverty line (BPL) as defined by the government's well-known entitlement program.

Fourth, we show that the effects of field days on demand are no larger in villages where initial adopters were selected with meetings. If anything, the effects of farmer field days on demand are largest in ward member villages. However, the differences in the effect of

best farmers to demonstrate a new technology.

[6] Almost all farmers that purchased seeds bought only one or two packages. This amount of seeds is enough to cultivate around 10-30 percent of their land.

field days across the three methods of introducing the seeds are not statistically significant. Nonetheless, we can rule out that field days are more effective when meetings are used to determine the first adopters in the village. In other words, the field day is effective regardless of the identities of the farmers cultivating the new variety.

One immediate possible explanation of our finding is that farmer field days are effective because they simply generate demand by farmers that do not interact with early adopters and thus otherwise would not have had the opportunity to learn about the variety.[7] The data are generally inconsistent with this explanation. Using either common surnames or geographic distance as measures of connectedness, we show that the effect of field days is no larger for farmers that are less connected to the first-year recipients. Focusing on the SHG villages only, we find that if anything, field days only have an effect on demand for SHG member households and households that are friends or family of the president of the SHG. These results suggest that field days either convey additional information or re-enforce existing knowledge about the variety.

Taken together, our results imply that relying on early adopters to automatically transmit information on new technologies may not maximize short-term adoption. Further, allowing the village as a whole to aggregate information for identifying injection points does not change this finding. Instead, further intervention can make learning via networks more effective. In our context, adding a traditional approach of agricultural extension appears to be a cost effective way of increasing technology adoption by smallholder farmers. In addition, the approach leads to a more equitable distribution of improved technology by inducing adoption by the poorest farmers.

Our paper is most closely related to the literature on learning in developing country agriculture. Numerous studies have established the importance of peers as a source of information about new agricultural technology.[8] Building on this, recent work has sought to improve methods of selecting entry points of new technology (Beaman et al., 2015). However, farmers may not transmit information automatically if it is costly to do so. In this context, BenYishay and Mobarak (2015) show that compensating early adopters for transmitting information can be effective at increasing future adoption. Our work tests both a different and scalable method for identifying injection points as well as another approach to improving learning outcomes conditional on the identities of these injection points. Thus,

[7] As shown by Golub and Jackson (2012), diffusion of information between individuals is limited by certain network structures where individuals only interact with people that have similar characteristics. Alatas et al. (2015) show empirically that community-based targeting of anti-poverty programs in Indonesia is more effective when network structures are more dense.

[8] Conley and Udry (2010) is the leading example where peers are shown to be an important source of information about pineapple cultivation in Ghana.

we consider our experiment to be more of a hybrid approach where local farmers are relied upon for peer influence and demonstration, but a traditional extension technique is also used to further enhance learning.

There is a widespread view that the traditional system of agricultural extension is massive in scale, but underperforming (Anderson and Feder, 2007). However, we possess less information about whether this is due to various competing explanations such as inadequate incentives for extension workers, ineffective methods, or lack of accountability. We focus on method and show that a traditional extension method can be effective when combined with demonstration of new technology by varying types of farmers.

The most recent literature on information-sharing in agriculture has focused on the importance of mobile phones for spreading information about farming (Aker, 2011; Fafchamps and Minten, 2012; Cole and Fernando, 2014). While these studies tend to find positive impacts of mobile-phone-based extension, we are not aware of a rigorous evaluation of engaging adopters with non-adopters via field days. The closest empirical studies focus on field schools which are distinct because they are usually carried out over multiple days, provide general information about agriculture rather than details about a specific technology, and don't engage peer adopters as a source of learning. In addition, these studies have relied on observational data and non-experimental methods such as matching (Godtland et al., 2004; Davis et al., 2012). Our paper instead uses an experiment to address whether a relatively simpler approach to diffusing information can increase the adoption rate of a profitable agricultural technology.

The rest of this paper is organized as follows. In section 2 we give further background on the technology that we use in the study. We focus on why the particular technology is suitable for our study. We also walk through the conceptual motivation for our experiment. Section 3 discusses the experimental design and some basic characteristics of the population we study. Section 4 discusses our main results. Finally, section 5 offers concluding remarks.

# 2 Background and conceptual framework

In this section we start by giving more details on the specific technology used in the experiment. We focus on its key benefits and how they make it a worthwhile technology for studying diffusion. We then discuss the conceptual reasoning behind the interventions that we chose for the experiment.

## 2.1 Details about technology

Swarna-Sub1 — the rice variety introduced as part of the experiment — offers flood tolerance as its key benefit. Swarna-Sub1 is otherwise similar to Swarna, which is a popular type of rice cultivated throughout eastern India and Bangladesh. The technology was developed by moving a group of flood tolerance genes from a traditional rice landrace to the popular variety Swarna.[9] Plant breeders were able to rely on modern breeding techniques to create the improved variety without introducing other undesirable characteristics (Xu et al., 2006). This is important because it guarantees that the technology offers added benefit without any obvious disadvantages such as lower yields during normal years.

Previous randomized experiments have conferred two channels through which this new variety improves farmer welfare. First, the variety does improve output under flooding without compromising output when there is no flooding (Dar et al., 2013). Second, Swarna-Sub1 induces farmers to invest more in inputs such as planting methodology and fertilizer at planting. These effects likely arise due to the risk-reducing property of the technology (Emerick et al., 2016). As a result, the new variety improves outcomes even in years when flooding does not occur.

The technology is appropriate for our purposes because it offers benefits in one state without affecting outcomes in the other state. The technology therefore dominates existing technology and should diffuse rapidly in a perfect environment with no information barriers or supply constraints. This dominance makes it a worthwhile technology for studying different mechanisms to encourage diffusion. Most importantly, we can be confident that adoption is the appropriate outcome variable because there are no groups in the population for which adoption is strictly unprofitable.

## 2.2 Conceptual motivation

The first arm of our experiment considers a new alternative for identifying early adopters of agricultural technology. We consider a planner who has the objective of maximizing the adoption rate of a profitable new technology. The initial supply of seed is scarce and therefore the planner must allocate the initial supply in a way that facilitates the spread of information and maximizes future demand once additional supply becomes available. This setup is similar to the way new seeds are often introduced in practice. The Indian government uses a system of demonstrations and minikits and has to choose the initial beneficiaries as part of this process. Locally elected members of the gram panchayat are the main source

[9]The biological mechanism is that Swarna-Sub1 suppresses the plant's natural response of elongation during flooding. This allows the plant to retain the necessary carbohydrates for regeneration after the flooding is over (Voesenek and Bailey-Serres, 2009).

of information for identifying these beneficiaries. Using local elites may offer advantages. Basurto, Dupas, and Robinson (2015) show that chiefs in Malawi account for productivity differences when allocating subsidized inputs to villagers. If the batch of recipients identified by local elites is more productive, then this could have positive effects for future diffusion.

Beaman et al. (2015) assume that the planner knows the structure of the social network and therefore can identify the most suitable entry points based on a network model of information diffusion. Their main finding is that using the theory in this way can identify injection points that lead to increased diffusion relative to those identified by government extension workers or geospatial data alone. Thus, the planner can make diffusion more rapid if her information set includes these detailed network data.

Banerjee et al. (2014) propose a different method of simply asking villagers the identity of the best person for spreading information in the village. They show a strong correlation between the individuals identified and their diffusion centrality — a theoretical measure of importance for diffusion outlined in Banerjee et al. (2013). This work suggests that the planner may be able to rely on villagers themselves to identify the best entry points.

We borrow from the literature on targeting of poverty programs to pose village meetings as an alternative for identifying suitable entry points of new technology. The basic reasoning underlying this approach is that villagers possess private information that is unobservable to the planner on who are the best farmers for demonstrating a new technology. The literature on targeting of anti-poverty programs has found that villagers possess information on poverty status that is otherwise unobservable to a principal (Alatas et al., 2012). In addition, village meetings showed to be a reliable way of getting villagers to reveal this information. Turning back to agricultural technology, peers are a common source of information about new seeds and there is likely variation across farmers in not only network centrality but in quality of demonstrating new varieties. As an example, a small farmer with limited access to fertilizer would not be suitable for demonstrating a new seed variety requiring large amounts of fertilizer. We investigate whether village meetings can identify the most suitable farmers for demonstration and diffusion of information in order to maximize future adoption.

From a policy perspective, scalability is an additional benefit of testing this approach. The advantage of using a village meeting is that it eliminates the need to survey households to either directly identify entry points or to collect data on their network connections. If the approach works then it would offer a more scalable alternative to other potentially more costly methods.

We chose not to stop at investigating these alternative injection mechanisms because it is unclear whether information will diffuse alone or whether further intervention can enhance social learning. BenYishay and Mobarak (2015) show that spreading information may be costly and thus incentivizing farmers to disseminate information has positive impacts on future adoption. In our context the initial seed recipients do not have direct incentives to spread information to other farmers regarding Swarna-Sub1. However, seed systems in rural India are generally based on informal networks and farmers will provide information — or seeds directly — if approached by other farmers. The more relevant cost in our context is likely to be a cost of obtaining information rather than a cost of providing it.

Farmer field days were built into our experimental design as a way of reducing some of these barriers to information flow. There are two mechanisms through which this could be achieved. First, field days could overcome the deficiencies that arise in network-based learning due to network structure alone. Put differently, some farmers may not have the opportunity to learn about a new technology because would otherwise never talk to early adopters. In this case field days would increase adoption by allowing information to flow to these least connected individuals. Certain network structures where connections are sparse or concentrated between similar individuals have been shown to prohibit learning (Golub and Jackson, 2012; Alatas et al., 2015). Second, field days could provide additional information that would not spread in networks. Or, field days could make existing knowledge more precise by aggregating the experiences of several adopters, rather than just a single adopter sharing a connection with a given non-adopting farmer. One example would be a farmer that learns about the new variety from a peer and thus possesses some signal of its effectiveness on her land. In this case the field day would aggregate the experiences of other adopters that this farmer would not have otherwise interacted with. This additional information gives more data to the farmer for deciding whether the adopt the technology herself. We attempt to decompose these two explanations at the end of our analysis that follows.

# 3 Details of the experimental design

In this section we give specific details on the experimental design. We give more information on how the treatments were carried out and the timing of data collection. We also describe some basic summary statistics as well as randomization balance.

Our experiment took place in 100 villages in Balasore — the northernmost district in the state of Odisha. The experimental villages are located in three blocks — an administrative unit two levels above villages — where our partner NGO frequently works. We randomly selected these villages from the subset of villages that were affected by flooding for at least 2 days in 2011 or 2013. We used satellite images of flooding during these years to classify which villages were affected. Our sample is focused on flood-prone areas to ensure that adoption of Swarna-Sub1 is a profitable outcome and therefore diffusion is important to study. We next describe the timing of events, which we also display graphically in Figure 1.

We administered a baseline survey to 10 farmers in each village prior to carrying out any activities in the village.[10] Enumerators first visited a local village leader and identified the names of 10 villagers that cultivate land in flood-affected areas. These farmers were then administered with a short survey. The baseline included basic demographics, information on assets, and detailed information on rice production — including usage of rice varieties and production at the plot level. Swarna-Sub1 was entirely new at the time of the baseline survey: only two farmers that were surveyed at baseline had cultivated Swarna-Sub1 during the previous season in 2013.

Shortly after completion of the baseline in May 2014, enumerators from our partner NGO returned to each village to distribute seeds of the new rice variety. Each village was provided with 25 kilograms of seed. This amount of seed is sufficient to cultivate one to two acres in total. But more importantly, the seeds were already packaged into five kilogram packages to encourage that at least five farmers be selected as adopters. A five kilogram package contains enough seed for sowing around 0.3 acres, or around 10 percent of the average farmer's landholdings.

Villages were randomly assigned to one of three methods for identifying beneficiaries. The seeds were delivered to the locally elected village ward member in 33 villages. The ward member is elected to represent the village in the local Gram Panchayat, or the next administrative unit above villages. A representative from our partner NGO delivered the seeds directly to the ward member and informed them that the NGO was giving the seeds to the village. The enumerator then asked the ward member to identify the most suitable cultivators of the new seeds. In all cases the seeds were left to the ward member and she independently decided about their further distribution, including whether to keep some for herself. This approach simulates the common approach of both government and NGO's of using local political figures to distribute seed minikits, as in Bardhan and Mookherjee (2006, 2011).

We used two types of village meetings to identify recipients in the remaining villages. In 34 meeting villages NGO staff first visited the village and informed as many villagers as possible that they were carrying out a short meeting to describe a new flood-tolerant rice variety. Enumerators were specifically instructed to put the seed minikits at the front of the meeting and describe the benefits of the new variety relative to Swarna — the parent variety that is familiar to all farmers. Importantly, enumerators instructed villagers to jointly decide on who would be best to cultivate the variety. In all cases villagers were able to come to an agreement and all 25 kilograms of seed were distributed to farmers that were willing to

[10]Enumerators were unable to carry out the baseline survey in one of the 100 villages.

plant. We used a process that was nearly identical to this in the remaining 33 villages. The only difference was that only Self Help Group (SHG) members were invited to the meeting. This approach makes the meeting inclusive of entirely women.

Enumerators returned to all villages in September 2014 to survey all of the minikit recipients, whom we refer to as early adopters. This short survey had two main purposes. First, the survey allows us to compare characteristics of early adopters across the three different treatment arms. These characteristics include household assets or wealth, landholdings, and most importantly the relationship between the seed recipient and the ward member. Second, we collected information on how much area was planted with Swarna-Sub1, the current status of the crop, and the GPS boundaries for the plots of farmers that actually transplanted the seedlings.[11] Overall, we have plot locations for 452 (67 percent) of the farmers that received seeds.

Farmer field days were then carried out in 50 randomly selected villages during the month of November 2014. The field days were purposefully timed to take place slightly before harvest when the adopters had built some experience with the technology but while the crop was still in the ground for demonstration. The field days were short. Staff from our partner NGO again described Swarna-Sub1 and its properties, spoke about seed quality and how to distinguish quality seeds, and then gave the first-year adopters an opportunity to discuss their experience with the technology. The meetings were fairly well attended: an average of 41 farmers — or 59 percent of rice-farming households — attended the field days. Table A1 shows that basic household characteristics in general do not strongly predict attendance of the field days. The meetings appear to have been attended by a broad group of villagers and not just the wealthiest or most elite farmers.

We then carried out a survey with approximately 15 farmers in each village in order to measure knowledge about Swarna-Sub1. We refer to this group as the non-adopting farmers, i.e. those that were not in the group of early adopters. The surveys took place during February to March 2015. We used the list of households from the 2002 Below the Poverty Line (BPL) census to randomly select households.[12] We removed the early adopters before randomly selecting the households. Each respondent was asked several questions to measure their knowledge of Swarna-Sub1. These included whether they knew about it at all, knowledge of its main benefit, which areas are suitable for cultivation, the duration (time from planting to harvest), and a question on how the current adopters received seeds. We use these information to estimate the degree to which knowledge of these basic characteristics

[11]Some farmers were affected by flooding during the nursery stage before seedlings had been transplanted in the main field. No rice variety is tolerant to submergence at this stage. As a result, 29 percent of farmers lost their seedlings and were unable to plant the crop in the main field.

[12]We selected all households in the villages where there were fewer than 15 non-adopting households.

was affected by the different treatment arms in our experiment.

Our NGO sent a new team of staff members to each village in May 2015. Each farmer that was surveyed in February-March was visited and given the opportunity to purchase Swarna-Sub1 seeds. There was only one other NGO selling Swarna-Sub1 to farmers for a price of around 20 rupees. Our price was set to 20 rupees in order to mimic this market price. Thus, farmers benefitted mostly from free delivery when given this purchasing opportunity. Most of the farmers in our sample did not know how to obtain Swarna-Sub1.[13] The door-to-door sales were used to eliminate these barriers and allow us to reveal demand at the market price and in the absence of supply barriers. We observed a strong demand for the technology in the door-to-door sales: 36 percent of farmers bought at least one package of seeds.

The inability to record adoption from other sources — largely other farmers in the village — is the disadvantage of measuring adoption with the door-to-door sales. Swarna-Sub1 is an inbred rice variety that can be multiplied, reused, and traded with other farmers. Many estimates indicate that this informal seed system of either reusing one's own seed or obtaining from neighbors accounts for a large portion of seed use in South Asia. It is possible that the different methods of identifying early adopters could generate variation in the propensity for these early adopters to sell or trade seeds. We would miss this source of adoption with our door-to-door sales.

We remedied this issue by carrying out a door-to-door adoption census starting in July 2015. Survey teams went door-to-door in each village and asked each household a small set of questions, including whether they were currently cultivating Swarna-Sub1. A total of 6,511 households were surveyed during these door-to-door visits. The data do show the importance of supply barriers. Only 14 percent of all households adopted Swarna-Sub1.[14] This compares to a 36 percent adoption rate in the sample of farmers that received door-to-door visits. We use this additional dataset for investigating whether different entry points were any more (or less) effective at physically transferring seed to other farmers.

Table 1 shows summary statistics from the baseline sample. The sample consists of mainly small farmers practicing rainfed cultivation. Average cultivated area is about 2.8 acres and only 40 percent of farmers report any access to irrigation. Importantly, Swarna is a popular variety in the sample: 74 percent of farmers cultivated Swarna at baseline. In other words, a majority of the sample already had experience with the variety that is otherwise identical to Swarna-Sub1. This experience makes learning less complex than if the

[13]One of the main questions that came up during the field days was how to obtain the seed. Private seed dealers do not operate in this area and the seeds were generally not available at the local block office where most farmers buy their seeds. There was only one other NGO with access to seeds and most farmers were unaware of this NGO.

[14]This figure includes the households that were endowed with seed the previous year.

new technology was entirely different.

Table 1 also considers covariate balance by regressing each baseline characteristic on indicator variables for SHG meeting, village meeting, and farmer field day villages. This is the same form of regression used in the main analysis that follows. A handful of characteristics are not well-balanced across the different arms of the experiment. We show that our results are unchanged by controlling for these and various other household characteristics.

Another methodological concern is that our primary sample of households consists of the farmers that were not selected as early adopters during the first year. Part of the reason we introduced only 25 kilograms was to sharpen selection of the first-year adopters. As a consequence, this limits the selection of the group of non-adopters because the early adopters represent a small share of the village. More concretely, around 6 to 8 farmers were selected as early adopters across the three treatment arms. This represents about 10 percent of the rice farmers in the average village of our sample. Table A2 shows balance of household characteristics for the random sample of non-adopter households. The treatment variables are jointly significant at the 10 percent level in 2 of the 17 regressions. Thus, our sample of non-adopting households appears to be similar across the different treatment arms. We also show similar effects on adoption for the entire village, which effectively shuts down the possibility that selection into the group of non-adopting farmers drives the results.

# 4 Results

We divide this section into separate components for our different groups of results. We first outline the empirical framework, which is simple given the experimental design. We start the analysis by documenting the differences in characteristics of early adopters across the village meeting, SHG meeting, and ward member villages. We then show how various measures of production varied across the different injection points — including the number of adopters, area planted, and the number of successful adopters. We then show effects of the different treatments on knowledge diffusion and revealed demand. We conclude the analysis by showing suggestive evidence on whether farmer field days can be characterized as a source of information for only those that are less likely to communicate with early adopters.

## 4.1 Regression framework

Our experimental design affords us a simple estimating equation. In most specifications we estimate the regression

$$y_{ivb} = \beta_0 + \beta_1 Meet_{vb} + \beta_2 SHG_{vb} + \beta_3 FieldDay_{vb} + \beta_4 X_{ivb} + \alpha_b + \varepsilon_{ivb}, \quad (1)$$

where $y_{ivb}$ is some outcome (usually seed adoption) for household $i$ located in village $v$ and block $b$. We include indicator variables for village meeting and SHG meeting villages, denoted as $Meet_{vb}$ and $SHG_{vb}$, respectively. In our main specification we pool the effect of farmer field days across the different entry points by including a single indicator variable for field day villages. In some specifications we verify that our results are unaffected when including household covariates $X_{ivb}$. The villages in the experiment were spread across three blocks (an administrative unit which was a stratification variable) and therefore we include fixed effects for blocks, i.e. the $\alpha_b$ terms. Finally $\varepsilon_{ivb}$ is a random error term which we allow to be correlated within villages but assume to be uncorrelated across villages.

## 4.2 Characteristics of early adopters

Table 2 shows estimates of equation (1) where we focus our estimation on the chosen early adopters and only include the indicator variables for village meeting and SHG meeting villages.[15] We show these coefficient estimates for various characteristics that were collected when our survey teams returned to villages after seed distribution to gather additional information from early adopters.

Our first main result is that patronage exists when seeds are distributed via ward members. The first row in column 1 shows that 30.5 percent of early adopters are either the ward member, or family / close friends with the ward member. 20.9 percent of early adopters fell under the same category in meeting villages and this number fell to 11.7 percent in SHG meeting villages. The second row shows that part of this effect is the ward member keeping seeds for him or herself. 11 percent of early adopter households had an elected panchayat representative in ward member villages. The share of households having an elected panchayat representative was significantly lower in village meeting and SHG meeting households.[16]

[15] These regressions are meant to measure selection. The block fixed effects are dropped from the regression to avoid absorbing any selection effects.

[16] We removed the ward member households from the data and re-estimated the regression in the first row. The coefficient for village meeting villages decreases and becomes statistically insignificant, but the coefficient for SHG meeting villages remains negative and statistically significant. In addition, both variables jointly explain the likelihood that the adopter is connected to the ward member (p-value of F statistic = 0.05). This helps ensure that this effect is not entirely driven by the ward member keeping seeds for their

One possible outcome at the onset of the experiment was that local political elites would be able to capture village meetings and ensure that early adopters were there closest family members or friends. The pattern of results suggest that this is not the case. Table 1 showed that around 21 percent of villagers report being family or close friends with the ward member. The share of early adopters in the two types of meeting villages that report the same thing are either near or below this value, suggesting that the meetings were not dominated by political figures.

In addition to closeness with elected officials, there are several other differences between entry points across the treatments. Not surprisingly, early adopters in SHG meeting villages come from entirely SHG households. This is a consequence of using SHG meetings which consist entirely of women. The fourth row shows that early adopters in SHG villages are significantly more likely to be family or close friends with the SHG president — relative to village meeting villages. Focusing on the other rows, adopters in SHG villages are more likely to be part of agricultural cooperatives, are younger, and are less likely to come from disadvantaged castes. Differences in livestock ownership appear to be the only wealth differences across the treatments.

In sum, there are some differences in observable characteristics of early adopters across the different mechanisms for injecting the new seed variety. What remains unclear is whether changing the pool of adopters in this way has any positive consequences for learning and ultimately diffusion of the technology.

### 4.3 Differences in production and information diffusion to non-adopters

This in-season visit also included various questions about the production of early adopters. Table 3 shows results where we aggregate these outcomes to the village level in order to study how production varies across the three different methods of introducing the seed. Starting with column 1, almost all 25 kilograms were distributed and planted in the nursery.[17] This varies little across the three treatments. Columns 2 and 3 show somewhat weak evidence that village meetings gave access to a larger number of farmers. The average number of recipients in meeting villages increases by 28 percent, however this effect is not statistically significant (p=0.12). The difference between SHG and village meeting villages is however

own household.

[17] At this stage we define planting as accepting the seeds and planting them in a nursery bed. The common planting technique in our sample is then to uproot these seedlings after three weeks and transplant them in the larger field where the crop is to be grown. These two things are distinct because some farmers experienced flooding in the nursery and thus were unable to transplant the variety in the main field.

statistically significant. Column 3 shows this is driven by the increased likelihood of dividing the five packages into smaller packages; only 22 percent of ward member villages had more than five adopters, while there was more than five adopters in just over 50 percent of meeting villages. Column 4 shows that relative to SHG meeting villages, the number of farmers not losing the crop during the nursery phase — and thus actually transplanting Swarna-Sub1 — is highest in village meeting villages. A similar result is found in column 5 with total acreage transplanted.

These results are useful for first understanding how demonstration varied across the different arms of the experiment. If farmers learn only from peers and the size of the cultivated field is irrelevant, then dividing the seeds into small packages and distributing to different pockets of the village network would be optimal for diffusion. The data show moderate evidence that village meetings are the most effective at generating the largest pool of early adopters.

A final useful question before turning to demand effects is did information flows to non-recipient households vary across the different arms of the experiment? Before selling seeds we surveyed 15 households in each village to assess their knowledge of Swarna-Sub1. We asked respondents several questions, starting with whether they had ever heard of Swarna-Sub1 and how many farmers they had spoken to about the variety. We then asked several multiple choice questions such as the two differences between Swarna-Sub1 and Swarna[18], the length of flooding that Swarna-Sub1 can tolerate, and the duration of Swarna-Sub1 (days from planting to harvesting).

Table 4 indicates that selecting early adopters with village or SHG meetings does little to increase the spread of information to non-adopting households. Across all seven measures in the table, the only statistically significant difference between the different injection strategies is a moderate increase in the probability that non-adopting households in SHG meeting villages had ever heard of Swarna-Sub1. In contrast, farmer field day villages show moderately higher levels of knowledge about Swarna-Sub1. Non-adopting farmers are 5.6 percentage points more likely to have ever heard of Swarna-Sub1 in field day villages. Column 2 shows that a non-adopting farmer in field day villages reports talking to an additional 0.12 adopting farmers. We also estimate positive effects on knowledge of maximum survival length and duration of the growth cycle in farmer field day villages. Thus, farmer field days appear to have succeeded at improving information diffusion, while using village meetings to select early adopters did not.

We used SHG meetings to explicitly ensure that women were involved in the selection of early adopters. One of the disadvantages of this is that concentrating early adopters

[18] In addition to flood tolerance, Swarna-Sub1 has a white husk, making it distinguishable from Swarna.

amongst SHG households may limit the flow of information to non-SHG households. Table A3 shows evidence consistent with this. In short, SHG households possess more knowledge in villages where SHG meetings were used. As a result, one disadvantage of introducing a new technology through an existing organization is the lack of knowledge dissemination to households outside of that organization. This is important because NGO's in South Asia often partner with established groups such as village farmers clubs when introducing new technologies or farming practices. This common approach limits diffusion of information outside of these groups.

### 4.4 Main results: Effects on revealed demand

The experiment was designed with the policy objective of increasing the diffusion of a new agricultural technology that has been proven as beneficial to farmers. Adoption is therefore the most important measure of efficacy in our experiment. We measure adoption directly with our door-to-door sales experiment that was carried out approximately one year after seeds were originally introduced in each village. We measure adoption in an environment where free delivery — in contrast to heavy subsidies — is the main benefit introduced by our experiment.

We first show in Table 5 our two main results: identifying early adopters with participation from villagers does not increase future adoption and that learning opportunities created by farmer field days translate into greater future adoption. As seen in the first two rows, we estimate small and statistically insignificant effects of both SHG meetings and more broad village meetings. In column 1, adoption decreases in village meeting villages by 1.8 percentage points. This effect is statistically insignificant. The 95 percent confidence interval on this point estimate allows us to reject increases in adoption of larger than 9.6 percentage points. Put differently, the data allow us to reject that using village meetings to identify early adopters increases adoption by any more than 26.9 percent. Similar results are obtained with SHG meetings. The point estimate for SHG villages is effectively zero. In terms of precision, we are able to reject increases in adoption of 11.8 percentage points or higher. Given that 35.7 percent of farmers in ward member villages adopt, we have the power to reject that SHG meetings cause increases in adoption of 32.7 percent or higher. We of course lose some statistical precision by estimating separate effects of village and SHG meetings. The online appendix shows that we obtain slightly more precise null results when pooling both types of villages together and estimating a single effect of meetings.[19]

[19]Table A4 shows that the marginal impact of meetings on adoption is a negative 0.5 percentage point decline in adoption. The upper bound on the 95 percent confidence interval is 8.8 percentage points — meaning that we can reject that meetings in general led to increases in adoption of 24.7 percent or higher.

In addition to measuring overall adoption, we separate our adoption measure into different indicators for farmers that purchased one or two five kilogram packages of seeds. We estimate null effects of both types of meetings on adoption of five and ten kilogram packages (columns 2 and 3). In other words, there is no evidence that selection of early adopters via meetings did anything to induce farmers to even "try" a small amount of seed. We further add several household control variables to the same specifications in columns 4 through 6. The main conclusion that both types of meetings have little effect on adoption is unchanged — an effect that is expected since the sample of non-adopting households is largely similar on observable characteristics across the different methods of identifying early adopters.

In combination, we don't find any evidence that engaging villagers to participate in selection of early adopters drives future technology diffusion. These estimated null effects are only interesting alongside the result that meetings reduce patronage by generating a pool of early adopters that are on average less connected to local political officials. In practice the result means that although relying on elected officials to identify early program beneficiaries does induce favoritism, this favoritism has no consequences on the rate at which the new technology diffuses to other villagers. In our context allowing for a more participatory method of identifying beneficiaries does no better at inducing faster diffusion. Importantly, this is not due to the early adopters being any less productive farmers. If anything, the early adopters in village meeting villages are the the largest in number and the most likely to successfully cultivate the new technology. Given that village meetings involve a time cost of farmers, our results indicate that relying on the knowledge of the locally elected officials is a more cost effective approach to identifying early adopters.

In contrast to the null effects of our selection treatments, farmer field days led to significant gains in adoption. We estimate that field days led to a 12.2 percentage point increase in adoption In the main specification without household controls. The rate of adoption in villages without field days was 29.7 percent. Our point estimate therefore indicates that this relatively simple method of bringing farmers together to discuss a new technology leads to a 41 percent gain in adoption. Interestingly, column 2 shows that the effect appears larger on adoption of a single package of seeds. Adoption of a single package of seeds increases by 8.6 percentage points — or 59 percent. On the other hand, adoption of two packages increases by only 3.7 percentage points and this effect is statistically insignificant. Our data do not allow us to pinpoint an exact reason for this difference. Nonetheless, one possible reason is that the field days provided additional information to farmers that were near the threshold of simply trying the new seed. But field days were less impactful for farmers that had already decided to plant the variety on a larger share of their land.

Similarly to the other estimates, incorporating several household control variables does not change this result (columns 4 through 6). The point estimates are almost identical to those that only use the variation created by the experiment.

Figure 2 helps understand this effect by showing the distribution of the village-level adoption rates for the two types of villages. Two things stand out from the figure. First, the field days decreased the frequency of little or no adoption at the village level. 35 percent of villages without field days had adoption rates lower than 10 percent. In contrast, only 12 percent of field day villages had adoption rates lower than 10 percent. Second, the distribution for field day villages puts much more mass on adoption rates greater than 50 percent. 38 percent of field day villages had adoption rates of 50 percent or higher, while only 19 percent of the remaining villages had at least half of the farmers adopt.

A back-of-the envelope calculation suggests that field days are likely cost effective. The average village in our sample has 69 rice-farming households. Thus, a field day would be expected to generate around 8.3 additional adopters of Swarna-Sub1. In Emerick et al. (2016) we find that this technology leads to revenue gains of 10 percent or around 2,969 rupees. This effect arises largely due to the crowd-in effect of inducing farmers to use more inputs. Thus, field days generate one-year revenue gains of around 24,643 rupees, or around 410 dollars. Our partner NGO required only approximately 200 dollars per village to execute the farmer field days. Therefore, farmer field days appear to pay for themselves after just a single growing season. One the one hand this calculation is very encouraging because the one-year benefits are an extreme lower bound on the flow of benefits that farmers will receive from continued adoption. On the other hand, the calculation has to be interpreted with caution for two reasons. First, it is unclear whether there would be dis-economies of scale with wider implementation. There would likely be additional costs of incorporating a larger number of villages outside of the coverage area where our partner NGO operates. Second, our estimated adoption effects are conditional on the absence of other supply barriers. We can only think of field days as being cost effective when seeds are delivered to farmers at market prices.

It does not appear that the field days were any more effective when early adopters were identified with meetings. Table 6 shows the complete specification where the field day indicator is interacted with the indicators for village and SHG meetings. The second two rows of the table show that if anything, the field days were less effective when early adopters were selected by meetings. The coefficient on the interaction term between field days and SHG meetings is negative, somewhat large, but statistically insignificant. The coefficient on the interaction between field days and village meetings is also negative and equally imprecise. Nonetheless, our findings are not compatible with the idea that managing the learning process with field days is more effective when the adopters are more representative of the village and less likely to be connected to local political figures. Farmers appear to learn just as well — if not better — from the experiences of the early adopters that are identified by locally elected officials.

Finally, Table 7 considers which types of farmers benefitted the most from the added learning opportunities afforded by field days. More succinctly, we show suggestive evidence that the field days were more effective for poorer farmers. We use two indicators which are readily available in our data. 33 percent of our sample belongs to the scheduled castes or tribes, the most disadvantaged castes in the country. Column 1 shows that the marginal impact of field days on adoption for higher caste farmers is 8.1 percentage points. This impact increases to 20.4 percentage points for farmers belonging to the scheduled castes and tribes — however the large differential effect is not statistically significant (p=0.13). Column 2 shows that this differential effect is largely driven by inducing scheduled caste and tribe farmers to purchase a single package of seeds. The effect of field days on adoption of a single package is only 4.7 percentage points for higher caste farmers. In contrast, the effect is over three times larger for scheduled castes and tribes and the differential effect is statistically significant at the 10 percent level. Column 3 shows that there is virtually no differential effect for scheduled castes and tribes on the probability of purchasing two packages.

In addition to caste status, we also use possession of a "below the poverty line" card, which is meant to deliver various social assistance benefits to poor households. About 62 percent of our sample holds one of these cards. We observe a similar pattern where field days are more likely to induce BPL households to purchase a single package of seeds. In particular, column 5 shows that the effect of field days on adoption of five kilograms is larger by 10.1 percentage points for BPL households. Overall, the results suggest that field days may increase equity by causing the largest adoption gains for the poorest farmers.

In addition to purchasing seeds from us, farmers could have obtained seeds directly from early adopters. Adoption from our door-to-door sales would present an inaccurate picture if either of the two meeting types were more successful at identifying early adopters that are better seed distributors. We surveyed every farming household in each village to test this more explicitly.

There is no evidence that meetings induced more adoption at the village level. Column 1 in Table 8 shows our main specification for all villagers — including the first-year adopters. The coefficients for both village and SHG meetings remain small and statistically insignificant. However, we continue to estimate large positive effects of field days on seed demand at the village level. Field days caused in increase in adoption of 6.2 percentage points, or around 60 percent.[20] Column 2 shows that we still fail to detect significant interaction effects

[20]The much lower adoption rate at the village level is indicative of supply constraints. 35 percent of our

between meetings and field days in this larger sample.

Measuring adoption for the entire village eliminates any concern that selection into the non-adopting sample is responsible for the results. The relatively small number of early adopters — relative to village size — seems to limit this particular type of sample selection.

### 4.5 Do field days only spread information to farmers that don't interact with early adopters?

One interpretation of our findings is that field days simply transmit information to farmers that do not regularly communicate with early adopters. Put differently, learning from peers is imperfect and slow because some people simply do not communicate with each other. If this explanation drives our findings, then field days should be most effective for farmers that otherwise would not have interacted with early adopters. We test this idea using several different measures of how likely non-adopting farmers are to communicate with early adopters.

This additional heterogeneity is in general not compatible with field days only being effective for farmers that are unlikely to communicate with early adopters. Starting with column 1 in Table 9, we interact the field days indicator with the number of early adopters sharing the same surname.[21] We would expect the interaction effect to be negative if field days are most effective for the unconnected farmers. The point estimate on the interaction term is effectively zero. Columns 2 and 3 use the GIS data we collected on the plot locations of early adopters and the houses of non-adopting farmers. We calculate for each farmer the number of Swarna-Sub1 plots of early adopters within a given radius from their household. We allow this radius to vary from 250 to 500 meters.[22] We again find that the field days do not appear to be more effective for farmers that lived the furthest from the places where the new technology was being cultivated. Therefore these additional tests do not favor the idea that field days simply substitute for peer-to-peer learning for farmers that have less of an opportunity to learn from peers.

We next show additional analysis suggesting that if anything, the field days were complementary with having an opportunity to learn from peers. More specifically, we focus

sample that received door-to-door sales adopted, but this falls to around 15 percent when considering the entire village.

[21]Surnames are a common marker of social connection in rural India, largely because of their tight association with caste. The average farmer in the sample of non-adopters shares the same surname with one early adopter. Figure A1 shows the distribution of this measure. 60 percent of farmers have a surname that is common with zero early adopters. At the maximum, one farmer in the sample has the same surname as 11 early adopters.

[22]Figure A2 shows the distribution of the two measures across the sample of non-adopting households.

our estimation on the SHG villages and test whether the field days were less effective for households having an SHG member. Essentially all of the early adopters were SHG member households in SHG meeting villages. Therefore, we would expect field days (with the whole village) to be the least effective for SHG households if field days substitute for peer learning. The interaction effect between field days and the SHG household indicator in column 4 is large and positive, but not statistically significant (p=0.22). Column 5 estimates a larger — and marginally significant — interaction effect when we use an indicator for households that report being a friend or family member of the SHG president. In short, the field days were only effective for households that are close friends or family of the SHG president. We interpret these findings to suggest that the field days enhanced the learning ability of people that were already familiar with early adopters — rater than substituted for peer-to-peer learning for people that are less familiar with early adopters.

As a final piece of evidence, we show in Table A5 that these two interaction effects increase in size and significance with the addition of household controls. More importantly, we also estimate the same two models for the ward member and village meeting villages. The field days had no differential effect for SHG households in these villages. Thus, the differential effects observed in SHG villages are unlikely to result from unobserved correlates of SHG membership that cause these households to more generally gain more from field days.

# 5 Concluding Remarks

This paper shows that there is room for further interventions to increase the efficacy of peer-to-peer learning in agriculture. We tested two such interventions. First, we considered whether ex-ante the selection of the first generation of adopters can be improved by seeking the input of various farmers through village meetings. We found that these meetings do change the composition of the group of early adopters. More specifically, using meetings shifts the pool of early adopters away from friends and family of the locally elected political figures. However, we find that this has no meaningful effect on technology adoption one season later. This result does not undermine the importance of careful selection of early adopters for maximizing technological diffusion. The result instead indicates that relying on villagers to jointly decide this in meetings is unlikely to improve selection in a way that speeds diffusion. Thus, we conclude that further research is required to uncover alternative and cost-effective ways to identify the early adopters that maximize diffusion.

Second, we have shown that ex post — once the early adopters have already been identified — learning outcomes can be improved by nudging farmers to learn from each other. We found that organizing a simple farmer field day where a local NGO discussed the new technology and allowed early adopters to directly share their experiences causes adoption to increase significantly a few months later right before planting. These field days are likely cost effective. Finally, we find limited evidence that field days simply substitute for peer-to-peer learning for farmers that otherwise were unlikely to interact with early adopters. We found that if anything, the field days enhanced the learning ability of those that were the most likely to interact with early adopters. More concretely, the field days appear to be a complement to learning from peers rather than a substitute.

Despite a large number of papers on social learning and technology adoption, there have been few studies that test alternative policy instruments for improving peer-to-peer learning and making technology diffuse faster. Our results suggest that diffusion can be improved when a new technology is injected into a village and farmers are brought together explicitly to improve learning. Organizing meetings in this way is a fairly traditional technique in agricultural extension. However, we found no rigorous evidence on the efficacy of these meetings at driving technology adoption. At the same time, traditional agricultural extension is often considered to be ineffective. In our case this conclusion does not appear to result from solely the methods of traditional extension.

More generally, our results indicate that despite the firm establishment of peer influence by the literature, there is room to build on this by finding ways to make social learning more effective. Simply relying on farmers to share information without any further intervention will damper adoption of improved agricultural technology.

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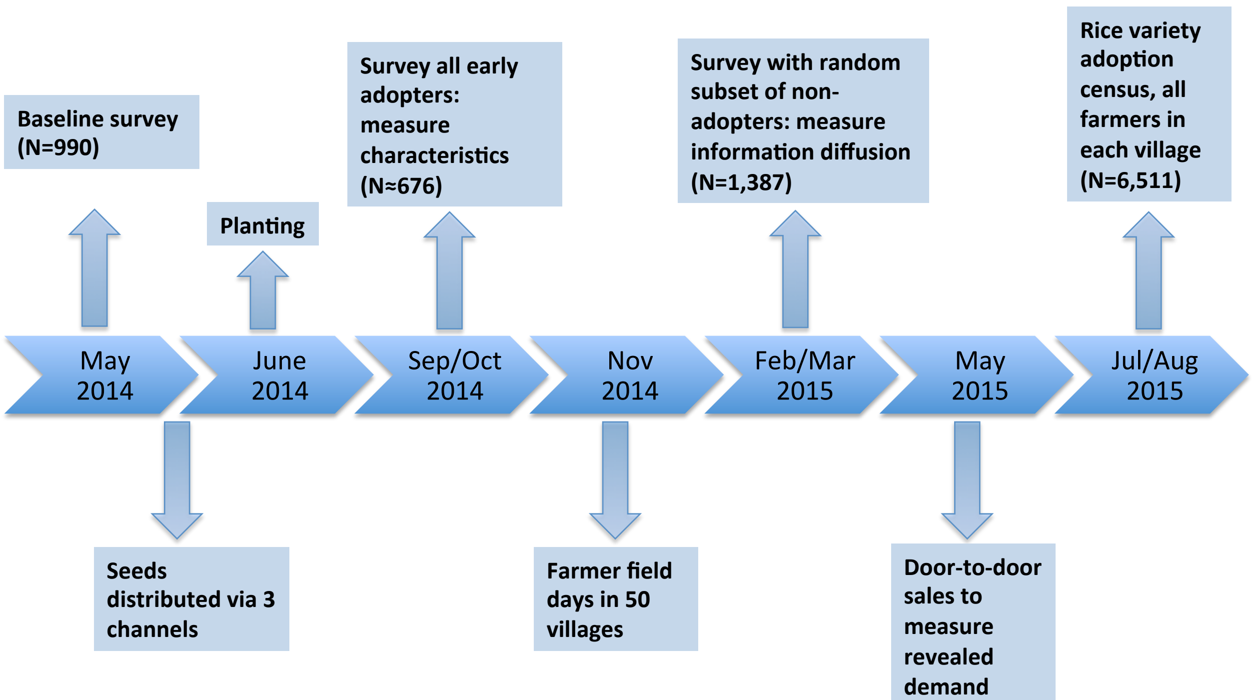
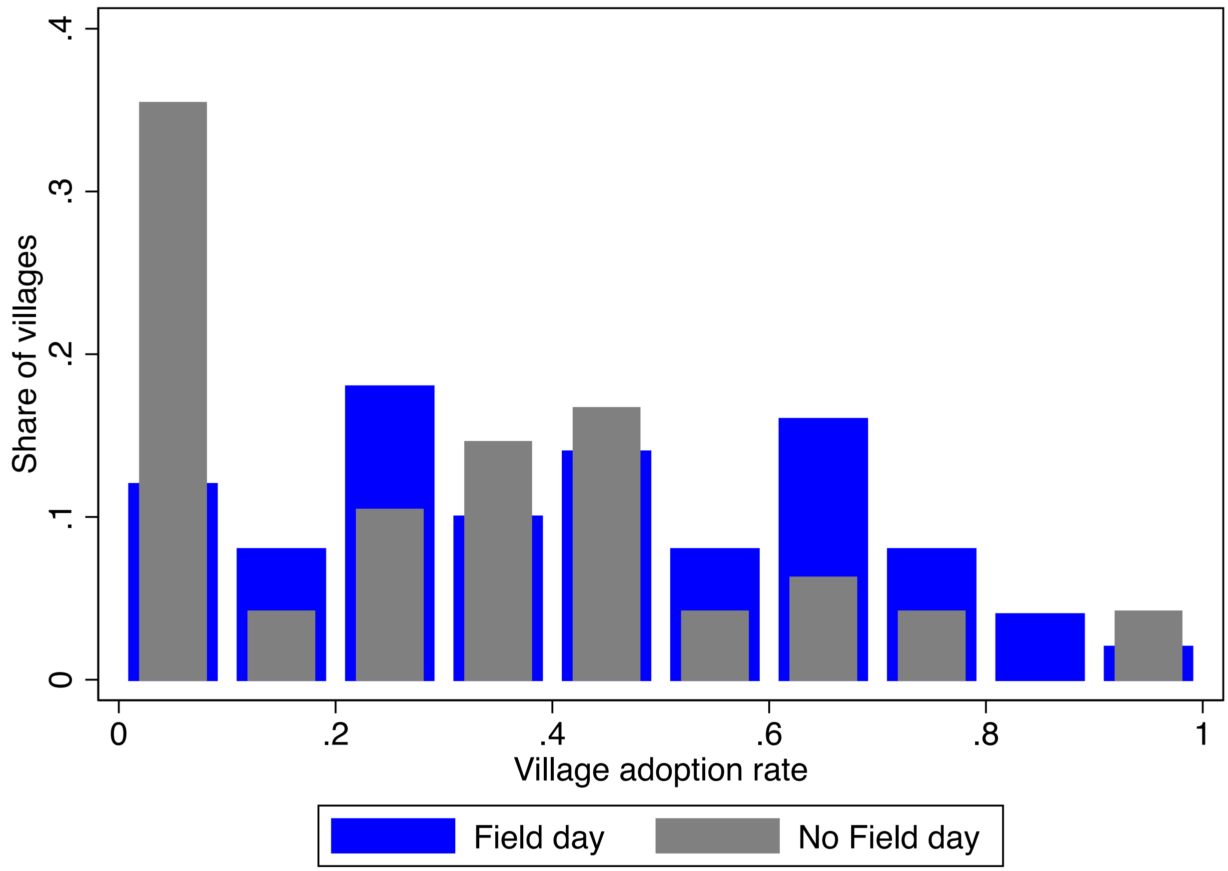
# Figures

Figure 1: Timeline of the experimental design




Notes: The figure shows the timing of the activities that were carried out as part of the experiment. Planting for each season occurs in June and harvesting generally occurs in late November to December.

Figure 2: Distribution of village-level adoption rates separately for field day and non-field day villages




Notes: The figure shows the distribution of the village-level adoption rate for field day and non-field day villages separately. The distributions are based on the adoption data for the approximately 15 farmers per village that received door-to-door sales.

# Tables

Table 1: Baseline summary statistics and balance tests

| | | Coefficients: | | | |
|---|---|---|---|---|---|
| | (1) Mean | (2) Meeting | (3) SHG | (4) Field Day | (5) Joint p-value |
| Household size | 6.137 | 0.171 | 0.119 | 0.231 | 0.775 |
| Access to electricity | 0.894 | 0.040 | 0.034 | 0.007 | 0.810 |
| Mud walls | 0.618 | 0.071 | 0.062 | 0.067 | 0.365 |
| Thatched roof | 0.462 | 0.064 | 0.166*** | 0.074 | 0.042 |
| Number rooms in house | 2.406 | -0.032 | -0.077 | -0.039 | 0.918 |
| Years education | 5.583 | -0.812* | -0.145 | -0.076 | 0.362 |
| Area cultivated in wet season (acres) | 2.847 | 0.106 | 0.193 | -0.003 | 0.821 |
| Private tubewells in house | 0.352 | -0.166** | -0.146** | 0.046 | 0.035 |
| Number of cows owned | 1.573 | 0.002 | -0.196 | -0.043 | 0.652 |
| Some irrigated area | 0.402 | -0.098 | -0.094 | -0.009 | 0.345 |
| Swarna user | 0.744 | 0.048 | -0.009 | 0.064 | 0.320 |
| HH operates business other than farming | 0.081 | 0.003 | -0.025 | -0.022 | 0.544 |
| Sharecrops land | 0.573 | -0.055 | -0.109* | -0.042 | 0.247 |
| HH has member of SHG | 0.516 | 0.070 | 0.189*** | 0.016 | 0.020 |
| Family or close friend of ward member | 0.212 | -0.008 | -0.003 | 0.036 | 0.876 |
| Owns mobile phone | 0.840 | -0.011 | 0.008 | 0.006 | 0.979 |
| BPL card holder | 0.571 | 0.068 | 0.003 | 0.049 | 0.470 |
| NREGS job card holder | 0.668 | 0.023 | 0.045 | 0.118** | 0.044 |
| Scheduled Caste or Tribe | 0.357 | 0.123 | -0.088 | 0.069 | 0.039 |
| Cognitive ability | 3.201 | -0.218 | -0.270 | -0.002 | 0.294 |

The table shows summary statistics and balance tests using the baseline survey of 990 farmers. Column 1 displays the mean value of each characteristic across the entire sample. Columns 2-4 show the coefficients from regressing each characteristic on indicator variables for village meeting, SHG meeting, and field day villages. Each regression includes fixed effects for the three blocks which were randomization strata. Column 5 shows the p-value of the joint test of all three treatment variables. BPL card holders are families eligible for the national government's below the poverty line scheme. NREGS job card holders are those with access to the employment guarantee scheme. The measure of cognitive ability is the score on a reverse digit span test. The standard errors in each regression are clustered at the village level. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Table 2: Characteristics of early adopters across treatments

| | | Coefficients and SE: | | |
|---|---|---|---|---|
| | (1) Ward Mean | (2) Village meeting | (3) SHG meeting | (4) p-value (2)-(3) |
| Ward member, family, or close friend | 0.305*** | -0.096* | -0.188*** | 0.074 |
| | (0.040) | (0.054) | (0.054) | |
| HH has elected panchayat representative | 0.114*** | -0.064** | -0.082*** | 0.319 |
| | (0.023) | (0.026) | (0.026) | |
| HH has member of SHG | 0.476*** | 0.056 | 0.508*** | 0.000 |
| | (0.071) | (0.092) | (0.071) | |
| Family or close friend with an SHG president | 0.138*** | -0.030 | 0.064 | 0.039 |
| | (0.033) | (0.041) | (0.050) | |
| Self reported village leader | 0.257*** | -0.023 | -0.028 | 0.922 |
| | (0.033) | (0.044) | (0.054) | |
| Cooperative member | 0.210*** | -0.001 | 0.179** | 0.035 |
| | (0.051) | (0.068) | (0.088) | |
| Scheduled Caste or Tribe | 0.462*** | -0.034 | -0.196* | 0.066 |
| | (0.088) | (0.111) | (0.104) | |
| Education | 5.652*** | -0.293 | 0.092 | 0.497 |
| | (0.599) | (0.710) | (0.729) | |
| Age | 49.010*** | 1.526 | -7.646*** | 0.000 |
| | (0.992) | (1.344) | (1.337) | |
| Area cultivated | 2.232*** | -0.096 | -0.305 | 0.312 |
| | (0.212) | (0.279) | (0.234) | |
| Mud walls | 0.533*** | 0.053 | 0.041 | 0.881 |
| | (0.059) | (0.073) | (0.088) | |
| BPL card holder | 0.610*** | 0.026 | 0.023 | 0.973 |
| | (0.062) | (0.078) | (0.081) | |
| Cows owned | 2.790*** | -0.509* | -0.806*** | 0.247 |
| | (0.234) | (0.296) | (0.296) | |
| Sharecrops land | 0.452*** | -0.024 | -0.037 | 0.856 |
| | (0.067) | (0.079) | (0.088) | |
| Cognitive ability | 3.015*** | -0.033 | -0.119 | 0.552 |
| | (0.086) | (0.130) | (0.136) | |

The data are from the first survey with all 676 early adopters of Swarna-Sub1. Each row shows regression coefficients of the listed characteristic on indicators for village meeting and SHG meeting villages. The omitted category is the ward member villages and thus the coefficient reported in column 1 is the constant for each regression. Column 4 reports the p-value for the test of equality of the village meeting and SHG meeting villages. Standard errors that are clustered in the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Table 3: Village-level production characteristics of early adopters across treatments

| | (1) KG planted | (2) Number adopters | (3) More than 5 adopters | (4) Share successful adopters | (5) Acres transplanted |
|---|---|---|---|---|---|
| Village meeting | 0.112 | 1.862 | 0.236** | -0.011 | 0.052 |
| | (0.597) | (1.200) | (0.115) | (0.085) | (0.126) |
| SHG meeting | -0.339 | -0.498 | 0.104 | -0.153 | -0.197 |
| | (0.991) | (0.936) | (0.113) | (0.094) | (0.133) |
| p-value Village=SHG | 0.63 | 0.03 | 0.28 | 0.13 | 0.07 |
| Mean in Ward member villages | 24.31 | 6.56 | 0.22 | 5.09 | 0.86 |
| Number of Observations | 96 | 96 | 96 | 96 | 96 |
| R squared | 0.003 | 0.054 | 0.043 | 0.036 | 0.040 |

The data are from the first survey with all 676 early adopters of Swarna-Sub1 and are collapsed to the village level. The dependent variables are the total amount of kilograms planted in the nursery bed in the village (column 1), the total number of farmers that received any seed during year 1 (column 2), an indicator variable if there were more than 5 recipients in the village (column 3), the number of recipients that did not lose the crop during nursery-stage flooding (column 4), and the total acres transplanted in the main field (column 5). Heteroskedasticity robust standard errors are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Table 4: Effects on knowledge diffusion

| | (1) Ever heard of | (2) Number adopters talked to | (3) Difference w/ Swarna | (4) Maximum survival when flooded | (5) Most suitable land type | (6) How variety was distributed | (7) Duration in days |
|---|---|---|---|---|---|---|---|
| Village meeting | 0.050 | -0.045 | 0.033 | 0.079 | 0.020 | -0.016 | 0.020 |
| | (0.038) | (0.079) | (0.054) | (0.059) | (0.044) | (0.090) | (0.043) |
| SHG meeting | 0.062* | 0.034 | 0.013 | 0.051 | -0.022 | 0.113 | 0.025 |
| | (0.035) | (0.079) | (0.046) | (0.054) | (0.048) | (0.079) | (0.043) |
| Field day | 0.056* | 0.116* | -0.038 | 0.130*** | 0.057 | -0.013 | 0.068** |
| | (0.029) | (0.064) | (0.042) | (0.045) | (0.039) | (0.069) | (0.034) |
| p-value Village=SHG | 0.66 | 0.34 | 0.70 | 0.59 | 0.39 | 0.12 | 0.90 |
| Mean in Ward villages | 0.795 | 0.627 | 0.384 | 0.263 | 0.747 | 0.656 | 0.832 |
| Number of Observations | 1385 | 1369 | 1387 | 1387 | 1387 | 1387 | 1387 |
| R squared | 0.076 | 0.027 | 0.110 | 0.138 | 0.083 | 0.122 | 0.128 |

Data are for 1,387 non-adopting households that were surveyed in between harvesting during the first season and planting for the second season. The dependent variables are as follows: Column 1 is an indicator for whether the respondent has ever heard of Swarna-Sub1 prior to the interview. Column 2 is the number of other farmers in the village talked to about Swarna-Sub1. Column 3 is an indicator for selecting both flood tolerance and husk color as the main differences between Swarna and Swarna-Sub1. Column 4 is an indicator for knowledge that Swarna-Sub1 can survive up to 2 weeks when the field is flooded during the vegetative stage of the growing season. Column 5 is an indicator for knowledge that Swarna-Sub1 is most appropriate for medium land where flash flooding occurs. Column 6 is an indicator for knowledge of how Swarna-Sub1 was distributed in the village (either SHG meeting, village meeting, or via ward member). Column 7 is an indicator for knowledge that the duration (time from planting to harvest) of Swarna-Sub1 is approximately 140 days. All regressions include block fixed effects. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * level

Table 5: Effects on revealed demand

| | (1) Buy | (2) Buy 5 KG | (3) Buy 10 KG | (4) Buy | (5) Buy 5 KG | (6) Buy 10 KG |
|---|---|---|---|---|---|---|
| Village meeting | -0.018 | 0.009 | -0.027 | -0.014 | 0.014 | -0.029 |
| | (0.057) | (0.049) | (0.038) | (0.057) | (0.049) | (0.038) |
| SHG meeting | 0.008 | 0.004 | 0.004 | 0.006 | 0.010 | -0.004 |
| | (0.055) | (0.051) | (0.038) | (0.053) | (0.050) | (0.038) |
| Field day | 0.122** | 0.086** | 0.037 | 0.122*** | 0.084** | 0.039 |
| | (0.047) | (0.043) | (0.032) | (0.046) | (0.042) | (0.032) |
| HH Controls | No | No | No | Yes | Yes | Yes |
| Strata FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Mean in non-field day villages | 0.297 | 0.147 | 0.150 | 0.297 | 0.147 | 0.150 |
| Mean in Ward villages | 0.357 | 0.185 | 0.172 | 0.357 | 0.185 | 0.172 |
| Number of Observations | 1384 | 1384 | 1384 | 1384 | 1384 | 1384 |
| R squared | 0.043 | 0.028 | 0.014 | 0.063 | 0.043 | 0.029 |

The dependent variable in columns 1 and 4 is an indicator for whether the farmer purchased Swarna-Sub1 when given a sales offer. The dependent variable in columns 2 and 5 is an indicator for purchase of 1 seed package (5 kg). The dependent variable in columns 3 and 6 is an indicator for purchase of 2 seed packages (10 kg). Household controls are indicator for ST or SC, indicator for BPL card, indicator for NREGS job card, cultivated area, indicator for thatched roof, indicator for mud walls, education of the farmer, age of the farmer, indicator for SHG membership, indicator for private tubewell ownership, and elevation of the household. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Table 6: Interaction effects between farmer field days and meetings

| | (1) Buy | (2) Buy 5 KG | (3) Buy 10 KG | (4) Buy | (5) Buy 5 KG | (6) Buy 10 KG |
|---|---|---|---|---|---|---|
| Field day | 0.184** | 0.139** | 0.045 | 0.188*** | 0.143** | 0.045 |
| | (0.070) | (0.058) | (0.044) | (0.068) | (0.057) | (0.043) |
| Field day * SHG meeting | -0.125 | -0.148 | 0.023 | -0.136 | -0.156 | 0.021 |
| | (0.108) | (0.100) | (0.071) | (0.105) | (0.099) | (0.069) |
| Field day * Village meeting | -0.066 | -0.020 | -0.047 | -0.066 | -0.027 | -0.039 |
| | (0.113) | (0.098) | (0.075) | (0.111) | (0.096) | (0.073) |
| SHG meeting | 0.073 | 0.082 | -0.009 | 0.071 | 0.087 | -0.016 |
| | (0.082) | (0.073) | (0.042) | (0.082) | (0.073) | (0.042) |
| Village meeting | 0.015 | 0.017 | -0.002 | 0.008 | 0.017 | -0.009 |
| | (0.078) | (0.055) | (0.058) | (0.075) | (0.055) | (0.057) |
| HH Controls | No | No | No | Yes | Yes | Yes |
| Strata FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Mean in non-field day villages | 0.297 | 0.147 | 0.150 | 0.297 | 0.147 | 0.150 |
| Mean in Ward villages | 0.357 | 0.185 | 0.172 | 0.357 | 0.185 | 0.172 |
| Number of Observations | 1384 | 1384 | 1384 | 1384 | 1384 | 1384 |
| R squared | 0.046 | 0.035 | 0.015 | 0.057 | 0.039 | 0.030 |

The dependent variable in columns 1 and 4 is an indicator for whether the farmer purchased Swarna-Sub1 when given a sales offer. The dependent variable in columns 2 and 5 is an indicator for purchase of 1 seed package (5 kg). The dependent variable in columns 3 and 6 is an indicator for purchase of 2 seed packages (10 kg). Household controls are indicator for ST or SC, indicator for BPL card, indicator for NREGS job card, cultivated area, indicator for thatched roof, indicator for mud walls, education of the farmer, age of the farmer, indicator for SHG membership, indicator for private tubewell ownership, and elevation of the household. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Table 7: Heterogeneity of effect of farmer field day

| | (1) Buy | (2) Buy 5 KG | (3) Buy 10 KG | (4) Buy | (5) Buy 5 KG | (6) Buy 10 KG |
|---|---|---|---|---|---|---|
| Field day | 0.083* | 0.047 | 0.037 | 0.074 | 0.021 | 0.052 |
| | (0.050) | (0.048) | (0.038) | (0.061) | (0.056) | (0.039) |
| Field day * ST or SC | 0.121 | 0.114* | 0.007 | | | |
| | (0.079) | (0.065) | (0.055) | | | |
| Field day * BPL card | | | | 0.079 | 0.101* | -0.022 |
| | | | | (0.060) | (0.055) | (0.043) |
| SHG meeting | 0.006 | 0.009 | -0.004 | 0.006 | 0.009 | -0.003 |
| | (0.053) | (0.050) | (0.038) | (0.053) | (0.050) | (0.038) |
| Village meeting | -0.017 | 0.012 | -0.029 | -0.014 | 0.015 | -0.029 |
| | (0.056) | (0.049) | (0.038) | (0.056) | (0.048) | (0.038) |
| HH Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Strata FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Mean in non-field day villages | 0.297 | 0.147 | 0.150 | 0.297 | 0.147 | 0.150 |
| Mean in Ward villages | 0.357 | 0.185 | 0.172 | 0.357 | 0.185 | 0.172 |
| Number of Observations | 1384 | 1384 | 1384 | 1384 | 1384 | 1384 |
| R squared | 0.066 | 0.047 | 0.029 | 0.064 | 0.047 | 0.029 |

The dependent variable in columns 1 and 4 is an indicator for whether the farmer purchased Swarna-Sub1 when given a sales offer. The dependent variable in columns 2 and 5 is an indicator for purchase of 1 seed package (5 kg). The dependent variable in columns 3 and 6 is an indicator for purchase of 2 seed packages (10 kg). Household controls are indicator for ST or SC, indicator for BPL card, indicator for NREGS job card, cultivated area, indicator for thatched roof, indicator for mud walls, education of the farmer, age of the farmer, and elevation of the household. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Table 8: Effects on adoption for the entire village

| | (1) | (2) |
|---|---|---|
| Village meeting | -0.008 | -0.003 |
| | (0.028) | (0.031) |
| SHG meeting | 0.016 | 0.040 |
| | (0.025) | (0.029) |
| Field day | 0.062*** | 0.079** |
| | (0.022) | (0.033) |
| Field day * SHG meeting | | -0.044 |
| | | (0.046) |
| Field day * Village meeting | | -0.007 |
| | | (0.056) |
| Strata FE | Yes | Yes |
| Mean in non-field day villages | 0.103 | 0.103 |
| Mean in Ward villages | 0.147 | 0.147 |
| Number of Observations | 6511 | 6511 |
| R squared | 0.054 | 0.055 |

The dependent variable in both columns is an indicator for whether the farmer adopted Swarna-Sub1 for the 2015 season. The data are from a census of varietal adoption that was carried out with all households in each village shortly after planting decisions were made for the 2015 season. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Table 9: Differential effects of farmer field days as a function of connectedness to first year adopters

| | All villages | | | SHG villages | |
|---|---|---|---|---|---|
| | (1)<br>Adopters w/ same surname | (2)<br>Adopter fields within 250 M | (3)<br>Adopter fields within 500 M | (4)<br>SHG member household | (5)<br>Friend / family of SHG president |
| Field day | 0.130** | 0.111** | 0.090 | -0.025 | -0.023 |
| | (0.052) | (0.052) | (0.061) | (0.116) | (0.099) |
| Interaction with Field day | -0.001 | 0.008 | 0.009 | 0.147 | 0.204* |
| | (0.025) | (0.024) | (0.013) | (0.118) | (0.101) |
| Level term | 0.022 | 0.001 | -0.000 | 0.032 | -0.074 |
| | (0.018) | (0.017) | (0.010) | (0.083) | (0.082) |
| Strata FE | Yes | Yes | Yes | Yes | Yes |
| Mean in non-field day villages | 0.303 | 0.296 | 0.296 | 0.350 | 0.350 |
| Number of Observations | 1354 | 1332 | 1332 | 445 | 445 |
| R squared | 0.048 | 0.044 | 0.046 | 0.057 | 0.052 |

The dependent variable in all columns is an indicator for whether the farmer purchased Swarna-Sub1 when given a door-to-door sales offer. Columns 1-3 contain all observations and columns 4-5 only includes SHG villages. The second row reports the coefficient on the interaction between the field day indicator and the variable corresponding to the column title. The third row reports the coefficient on the variable corresponding to the column title. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

# Appendix - For Online Publication

Table A1: Correlates of farmer field day attendance

| | (1) | (2) |
|---|---|---|
| SHG meeting | 0.015 | 0.014 |
| | (0.097) | (0.094) |
| Village meeting | 0.025 | 0.024 |
| | (0.089) | (0.088) |
| ST or SC | | 0.056 |
| | | (0.046) |
| Age | | 0.001 |
| | | (0.001) |
| Educ. in years | | 0.011* |
| | | (0.006) |
| HH has Below Poverty | | -0.025 |
| Line Card | | (0.044) |
| Rice area | | -0.009 |
| | | (0.014) |
| Strata FE | Yes | Yes |
| p-value Village=SHG | 0.88 | 0.88 |
| Mean in Ward villages | 0.671 | 0.671 |
| Number of Observations | 724 | 722 |
| R squared | 0.130 | 0.142 |

The dependent variable in both regressions is an indicator for attending the farmer field day. The data are for the 50 villages where field days took place. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Table A2: Balance of household characteristics for sample of non-adopting farmers

| | | Coefficients: | | | |
|---|---|---|---|---|---|
| | Mean | Meeting | SHG | Field Day | Joint p-value |
| Access to electricity | 0.765 | 0.008 | -0.055 | -0.027 | 0.475 |
| Mud walls | 0.570 | 0.002 | 0.042 | -0.028 | 0.592 |
| Thatched roof | 0.337 | -0.021 | 0.068 | -0.006 | 0.300 |
| Number rooms in house | 2.122 | 0.009 | 0.068 | 0.146 | 0.500 |
| Years education | 5.983 | -0.084 | 0.289 | 0.038 | 0.860 |
| Area cultivated in wet season (acres) | 2.197 | 0.225 | 0.783 | -0.243 | 0.521 |
| Private tubewells in house | 0.342 | -0.055 | -0.037 | -0.002 | 0.842 |
| Number of cows owned | 1.835 | 0.041 | 0.004 | 0.079 | 0.969 |
| Swarna user | 0.570 | -0.022 | -0.099 | 0.094* | 0.100 |
| HH has member of SHG | 0.642 | -0.068 | -0.021 | 0.026 | 0.490 |
| Owns mobile phone | 0.815 | -0.066* | -0.043 | 0.050* | 0.127 |
| BPL card holder | 0.616 | 0.092** | 0.093** | 0.032 | 0.093 |
| NREGS job card holder | 0.656 | 0.056 | 0.067 | -0.034 | 0.502 |
| Scheduled Caste or Tribe | 0.325 | 0.041 | -0.134** | 0.021 | 0.048 |
| Owns television | 0.536 | 0.012 | -0.062 | 0.021 | 0.494 |
| Owns motorbike | 0.186 | 0.016 | -0.014 | 0.025 | 0.636 |
| Owns refrigerator | 0.052 | 0.017 | 0.001 | 0.019 | 0.244 |

The table shows summary statistics and balance tests using the sample of 1,387 non-adopting farmers. Column 1 displays the mean value of each characteristic across the entire sample. Columns 2-4 show the coefficients from regressing each characteristic on indicator variables for village meeting, SHG meeting, and field day villages. Each regression includes fixed effects for the three blocks which were randomization strata. Column 5 shows the p-value of the joint test of all three treatment variables. BPL card holders are families eligible for the national government's below the poverty line scheme. NREGS job card holders are those with access to the employment guarantee scheme. The measure of cognitive ability is the score on a reverse digit span test. The standard errors in each regression are clustered at the village level. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Table A3: Heterogeneity in the spread of information according to SHG membership

| | (1) Ever heard of | (2) Number adopters talked to | (3) Difference w/ Swarna | (4) Maximum survival when flooded | (5) Most suitable land type | (6) How variety was distributed | (7) Duration in days |
|---|---|---|---|---|---|---|---|
| Village meeting | 0.041 | -0.053 | 0.022 | 0.073 | 0.021 | -0.021 | 0.022 |
| | (0.038) | (0.080) | (0.057) | (0.060) | (0.043) | (0.089) | (0.042) |
| Field day | 0.061** | 0.121* | -0.032 | 0.133*** | 0.058 | -0.008 | 0.068** |
| | (0.029) | (0.065) | (0.044) | (0.046) | (0.039) | (0.068) | (0.034) |
| SHG meeting | -0.024 | -0.080 | -0.099 | -0.029 | -0.048 | -0.034 | 0.010 |
| | (0.047) | (0.098) | (0.067) | (0.069) | (0.064) | (0.100) | (0.064) |
| SHG meeting*SHG | 0.128** | 0.172 | 0.167** | 0.120* | 0.041 | 0.223** | 0.023 |
| household | (0.053) | (0.111) | (0.072) | (0.067) | (0.066) | (0.089) | (0.057) |
| SHG household | -0.130*** | -0.112* | -0.151*** | -0.084 | 0.014 | -0.068 | 0.027 |
| | (0.030) | (0.067) | (0.044) | (0.052) | (0.040) | (0.048) | (0.030) |
| p-value Village=SHG | 0.12 | 0.79 | 0.07 | 0.12 | 0.29 | 0.90 | 0.84 |
| Mean in Ward villages | 0.795 | 0.627 | 0.384 | 0.263 | 0.747 | 0.656 | 0.832 |
| Number of Observations | 1385 | 1369 | 1387 | 1387 | 1387 | 1387 | 1387 |
| R squared | 0.094 | 0.030 | 0.124 | 0.143 | 0.084 | 0.134 | 0.130 |

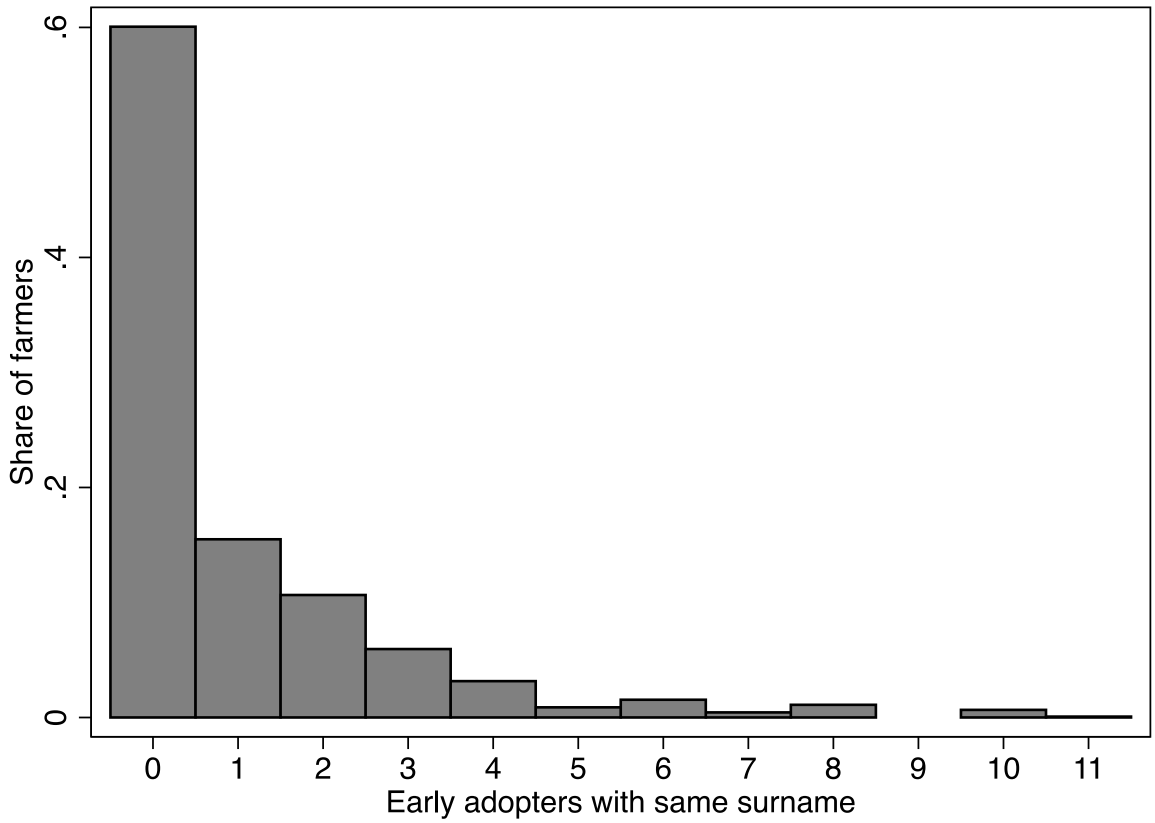
Data are for 1,387 non-adopting households that were surveyed in between harvesting during the first season and planting for the second season. The dependent variables are as follows: Column 1 is an indicator for whether the respondent has ever heard of Swarna-Sub1 prior to the interview. Column 2 is the number of other farmers in the village talked to about Swarna-Sub1. Column 3 is an indicator for selecting both flood tolerance and husk color as the main differences between Swarna and Swarna-Sub1. Column 4 is an indicator for knowledge that Swarna-Sub1 can survive up to 2 weeks when the field is flooded during the vegetative stage of the growing season. Column 5 is an indicator for knowledge that Swarna-Sub1 is most appropriate for medium land where flash flooding occurs. Column 6 is an indicator for knowledge of how Swarna-Sub1 was distributed in the village (either SHG meeting, village meeting, or via ward member). Column 7 is an indicator for knowledge that the duration (time from planting to harvest) of Swarna-Sub1 is approximately 140 days. All regressions include block fixed effects. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * level

Table A4: Effects on revealed demand when pooling village and SHG meeting villages together

| | (1) Buy | (2) Buy 5 KG | (3) Buy 10 KG | (4) Buy | (5) Buy 5 KG | (6) Buy 10 KG |
|---|---|---|---|---|---|---|
| Village or SHG meeting | -0.005 | 0.007 | -0.012 | -0.005 | 0.012 | -0.017 |
| | (0.047) | (0.041) | (0.031) | (0.046) | (0.040) | (0.031) |
| Field day | 0.123** | 0.086** | 0.037 | 0.123*** | 0.084** | 0.039 |
| | (0.047) | (0.042) | (0.032) | (0.046) | (0.041) | (0.032) |
| HH Controls | No | No | No | Yes | Yes | Yes |
| Strata FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Mean in non-field day villages | 0.297 | 0.147 | 0.150 | 0.297 | 0.147 | 0.150 |
| Mean in Ward villages | 0.357 | 0.185 | 0.172 | 0.357 | 0.185 | 0.172 |
| Number of Observations | 1384 | 1384 | 1384 | 1384 | 1384 | 1384 |
| R squared | 0.043 | 0.028 | 0.013 | 0.062 | 0.043 | 0.029 |

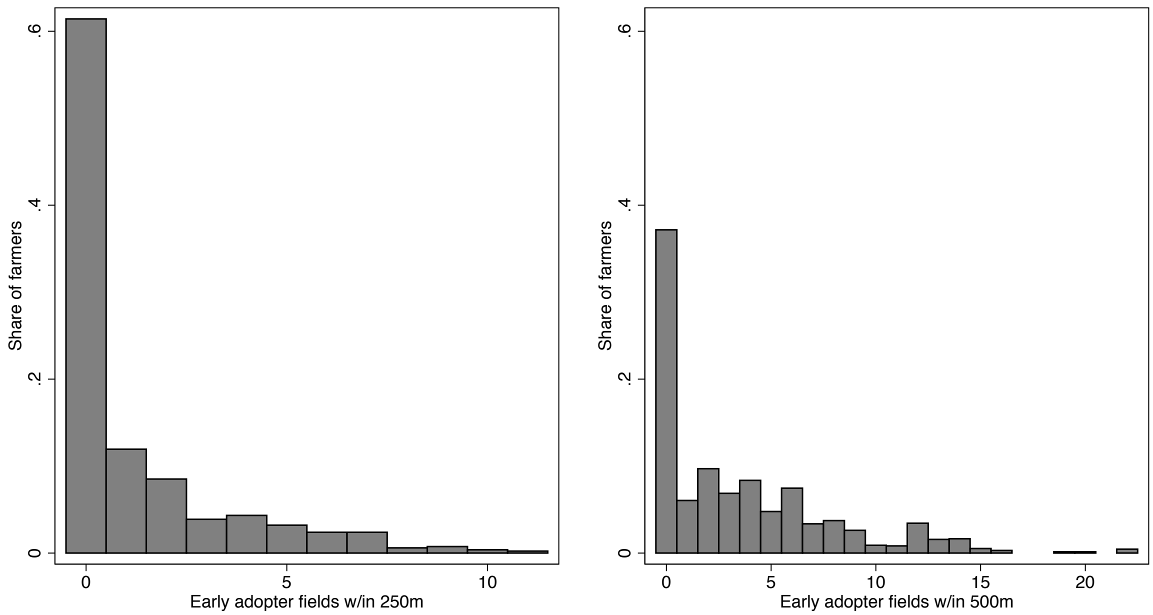
The dependent variable in columns 1 and 4 is an indicator for whether the farmer purchased Swarna-Sub1 when given a sales offer. The dependent variable in columns 2 and 5 is an indicator for purchase of 1 seed package (5 kg). The dependent variable in columns 3 and 6 is an indicator for purchase of 2 seed packages (10 kg). Household controls are indicator for ST or SC, indicator for BPL card, indicator for NREGS job card, cultivated area, indicator for thatched roof, indicator for mud walls, education of the farmer, age of the farmer, indicator for SHG membership, indicator for private tubewell ownership, and elevation of the household. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.

Figure A1: Distribution of surname connections for sample of non-adopting farmers




Notes: The figure uses the data for 1,387 non-adopting farmers to plot the histogram of the number of early adopters with the same surname. The average farmer in the sample shares a surname with one early adopter.

Figure A2: Distribution of number of early adopter plots within 250 and 500 meters of the household




Notes: The figure uses the data for the sample of 1,340 non-adopting farmers to plot the histogram of the number of early adopter fields within 250 meters (the left panel) and 500 meters (the right panel) of the household. There are 47 households for which we did not have GIS coordinates.

Table A5: Effects of farmer field days in SHG villages with household controls

| | (1)<br>SHG villages | (2)<br>SHG villages | (3)<br>Other villages | (4)<br>Other villages |
|---|---|---|---|---|
| Field day | -0.093 | -0.080 | 0.148* | 0.144* |
| | (0.119) | (0.097) | (0.088) | (0.073) |
| Field day * HH has SHG member | 0.208* | | 0.006 | |
| | (0.120) | | (0.091) | |
| HH has SHG member | -0.009 | | 0.065 | |
| | (0.089) | | (0.054) | |
| Field day * Friend/family of SHG president | | 0.276** | | 0.024 |
| | | (0.106) | | (0.082) |
| Friend/family of SHG president | | -0.120 | | 0.078 |
| | | (0.096) | | (0.059) |
| Strata FE | Yes | Yes | Yes | Yes |
| HH Controls | Yes | Yes | Yes | Yes |
| Mean in non-field day villages | 0.350 | 0.350 | 0.273 | 0.273 |
| Number of Observations | 445 | 445 | 939 | 937 |
| R squared | 0.113 | 0.112 | 0.064 | 0.068 |

The dependent variable in all columns is an indicator for whether the farmer purchased Swarna-Sub1 when given a door-to-door sales offer. The data are for SHG villages only in columns 1 and 2 and for ward member and village meeting villages in columns 3 and 4. Household controls are indicator for ST or SC, indicator for BPL card, indicator for NREGS job card, cultivated area, indicator for thatched roof, indicator for mud walls, education of the farmer, age of the farmer, elevation of the household, and an indicator for ownership of a private tubewell. Standard errors that are clustered at the village level are in parentheses. Asterisks indicate that coefficient is statistically significant at the 1% ***, 5% **, and 10% * levels.