Focus Group Discussion with farmers in Chhattisgarh

Improving Farmer Comprehension of Soil Health Cards

In 2019, IDinsight worked with the Government of India's Ministry of Agriculture to improve farmer comprehension of fertiliser best-practices by redesigning the country's Soil Health Card.

HIGHLIGHTS

- An impact evaluation showed that the redesigned Soil Health Card (SHC) improved farmers' comprehension of fertiliser recommendations 65 times, from **0.5%** to **33%**.

- For every ₹1,000 spent on printing cards, **1** farmer is able to understand the recommendations on the old card, while **71** farmers are able to understand the recommendations on the new card[1].

- The new Soil Health Card contains major changes to the macronutrient and micronutrient tables, with recommended quantities and crop names.

- Potential reasons the old card wasn't effective include: farmers were previously confused about the land unit conversion, were not literate, and/or had a lack of awareness of the Soil Health Card scheme.

- Peer learning and improved awareness of the scheme can increase farmers' comprehension, indicating that the long-term effects of the redesigned card may be greater than those currently estimated.

- Automated voice calls and text messages explaining the cards did not affect farmer comprehension.

WHAT IS THE SOIL HEALTH CARD SCHEME?

The SHC scheme has distributed more than 170 million cards targeting 120 million[2] farmers throughout India since February 2015. Over a two-year cycle, soil samples[3] from farmers' plots are tested across 12 parameters to identify nutrient deficiencies of the soil and generate crop-specific fertiliser dosage recommendations. The expectation is that by providing farmers with this information, the scheme will encourage judicious use of fertiliser to improve soil health and ultimately boost agricultural productivity.

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WHY REDESIGN THE SOIL HEALTH CARD?

Between April and September 2018, under the guidance of NITI Aayog, the agriculture team at IDinsight's AMAL unit[4] conducted a process evaluation and diagnostic study of the SHC scheme spanning eight districts in eight Indian states. Details of the process evaluation and diagnostic study can be found here.

The team identified one[5] pressing issue: farmers' inability to understand their card's fertiliser recommendations. Their lack of comprehension was a result of a poorly designed card: it contained small font sizes, scientific terminology, and illegible formatting that made it difficult for even literate farmers to understand. This challenge was most apparent in Rajasthan where farmers responded positively to a simpler, more legible design.

Our primary recommendation was to redesign the card to make it easier for farmers to comprehend. We were asked to assist the Ministry to redesign the card for future phases of the scheme.

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HOW DID WE REDESIGN THE SOIL HEALTH CARD?

To redesign the card, we employed elements of Human Centred Design (HCD). We adopted this approach following a review of the learning-aid design literature and extensive conversations with sector experts.

We used our study's findings to develop an initial set of card design options, along with learnings from other organisations that had worked in this area, such as IFPRI[6]. We also sought the advice of the Ministry of Agriculture and the National Informatics Centre (NIC), which hosts the Soil Health Card portal that is used to print the cards. This ensured that our design options accommodated the logistical and operational constraints associated with the implementation of the scheme.

Once the initial design options were finalised, we conducted user-testing exercises with farmers to improve the designs.

How we collected evidence

We organised focus-group discussions and in-depth interviews with ~150 farmers across three districts in two states. Farmers were asked to provide feedback on different card designs along five factors: usefulness, attractiveness, clarity, relevance, and persuasiveness. We used this feedback to develop our design options. This was an iterative process, where farmers' feedback was analysed at the end of every focus-group discussion and design changes were incorporated before the next discussion.

Where we collected evidence

We conducted this study in two states and three districts that were agronomically and demographically diverse. We visited a total of 15 villages across 7 blocks.

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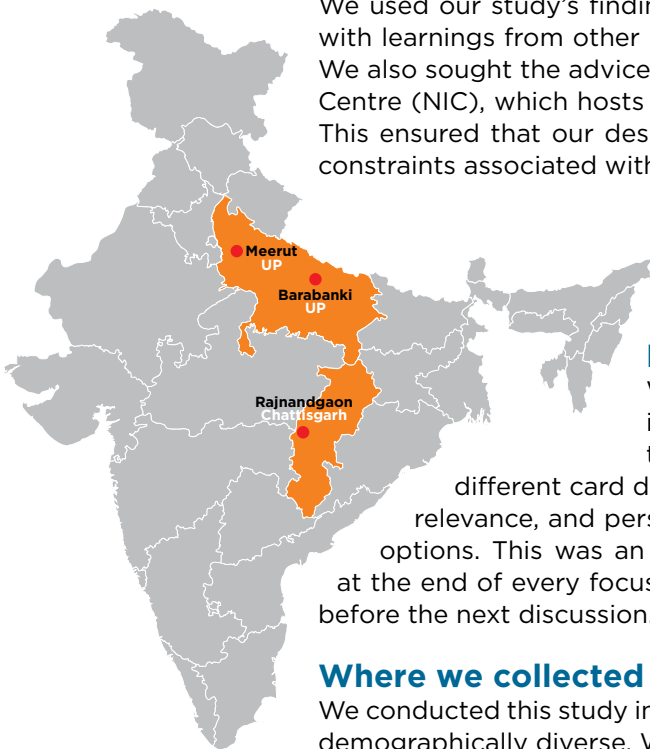
CHALLENGES WITH THE OLD CARD & HOW THESE WERE RESOLVED

Our findings and recommendations were centred around five key themes:

1. Recommendations for major fertilisers are presented in a confusing manner

Farmers were often confused by the two sets of fertiliser recommendations that were provided for each crop, especially since the card often recommended different quantities of the same fertiliser.

02

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Thus, we proposed the following changes to the table:

• **Clearly splitting apart the different tables side-by-side.**

• **Using different colors for different tables.** These design elements emphasise the distinction between the two tables, so farmers are primed to understand that they are different.

• **Explicitly giving instructions on how to interpret the different options.** This enables farmers to interpret the differences as intended, instead of thinking they represent different dosage amounts, or different crop varieties (as they are commonly thought to).

• **Clearly providing contact details for extension services.** Since farmers rarely receive instruction from extension workers on understanding the Soil Health Card, providing the Kisan Call Centre number in the table lets them easily access a support service that can help explain the card.

A farmer in Meerut tests different iterations of the Soil Health Card

2. Using scientific names for fertilisers adds to farmers' confusion

The cards previously used technical names for fertilisers and crops, including scientific terminology like chemical formulae, compound names etc. This confused farmers and made the information entirely inaccessible for illiterate farmers.

Thus, we proposed providing images and using locally-understood terms for crops and fertilisers, without sacrificing the scientific precision of recommendations. For example, using the acronym "DAP," which is more widely known, instead of "Diammonium Phosphate."

3. The recommended quantities of fertiliser are in units rarely used by farmers and are not presented clearly

Previously, the recommended quantities did not clearly reference the land or mass units they corresponded to, nor do they include land units most commonly used by farmers.

We proposed the following changes:

• **Using local land units.** While the Soil Health Card Portal enables districts to print cards in their local land units, the default land unit in the portal is 'hectares,' and districts rarely deviate from this default. Farmers are then forced to convert recommendations from hectares to their local land units, which can be challenging.

  We proposed eliminating the default option of Hectares from the portal, which would encourage districts to select their local land unit when printing cards.

• **Providing numerals and units in each table cell.**

• **Rearranging columns to enable farmers to link crops, fertilisers, and recommended values together.** Farmers were often unable to link the recommended quantities to the fertiliser or crop units they represent because these units only existed in a box that was disconnected from the quantities. Improving these design features made the format more intuitive and easier for farmers to grasp how to apply the recommendations.

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03

4. Difficult to understand recommendations for micronutrients

Farmers struggled to understand the multiple options presented in the micronutrient table, similar to those discussed above. Thus, we recommended the same set of changes as the macronutrient table:

• **Clearly splitting apart the different tables side-by-side.**

• **Explicitly giving instructions for how to interpret the different options.** One key difference in the macronutrient table is that the two options represent different methods of application: spraying crops with chemicals versus applying micronutrients directly in the soil. The old design only mentioned the concentration of solution (e.g: "0.5% sulphur dioxide"), information that is difficult for farmers to understand.

  We updated the design to feature explicit instructions (e.g. "Add 5 ml of sulphur dioxide to 1 litre. of water") which farmers were easily able to understand.

• **Using local land units.**

5. Soil test results are inherently difficult to explain and are rarely understood, but do improve farmers' trust in recommendations

While farmers are neither required nor able to understand the soil test results table that is printed on their soil health cards, we found that including the table in the card increases farmers' trust in the card. It assured them the recommendations were based on genuine test results. Thus, we recommended including this table with the following improvements:
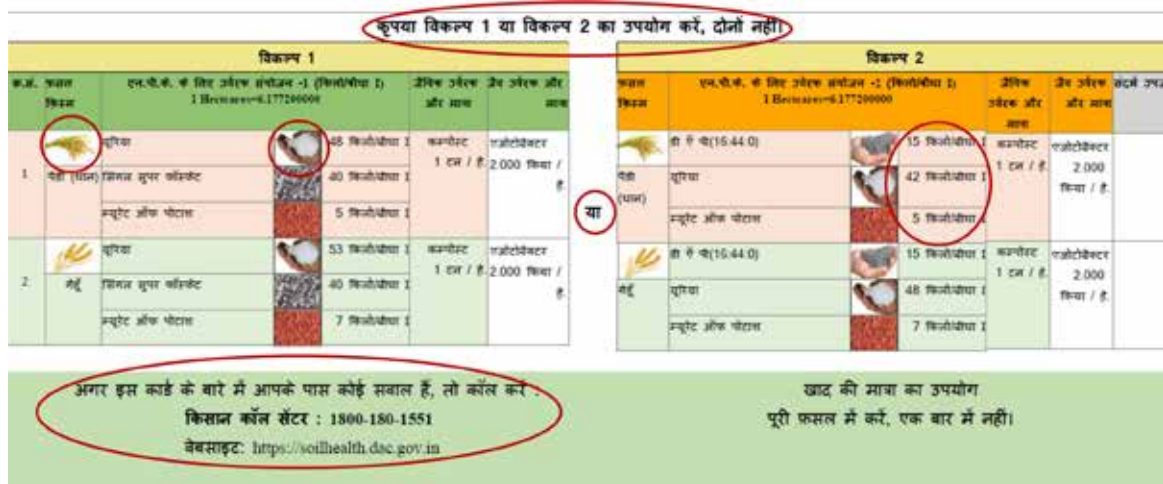
• **Rearranging rows to move more identifiable nutrients higher up.**

• **Using colours to denote sufficiency and insufficiency of nutrients.**

These changes marginally improve the comprehensibility of the table, as farmers are more likely to interpret deficiency and sufficiency through visual cues (like traffic signals) than through written instructions, and are also more likely to understand the implications of deficiencies for known nutrients (like nitrogen or phosphorus) than unknown parameters (like pH or electrical conductivity).

The final design of the Soil Health Card was uploaded to the Ministry's portal in April 2019

Figure 1: The old Soil Health Card accessed through the portal

04

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Figure 2: The new Soil Health Card (page 2) from the portal, with some major changes highlighted

Major changes in the card included clearly separating different fertiliser options, using photos and common names for fertilisers and including the phone number of the Kisan Call Centre

IMPACT OF THE REDESIGNED CARD

Evaluation design

We conducted a randomised control trial with 1,534 farmers in 68 villages across 4 districts of Uttar Pradesh.

In order to assess whether the new design led to improved farmer understanding of the card, we conducted a randomised controlled trial with 1,534 farmers in 68 villages across four districts of Uttar Pradesh.
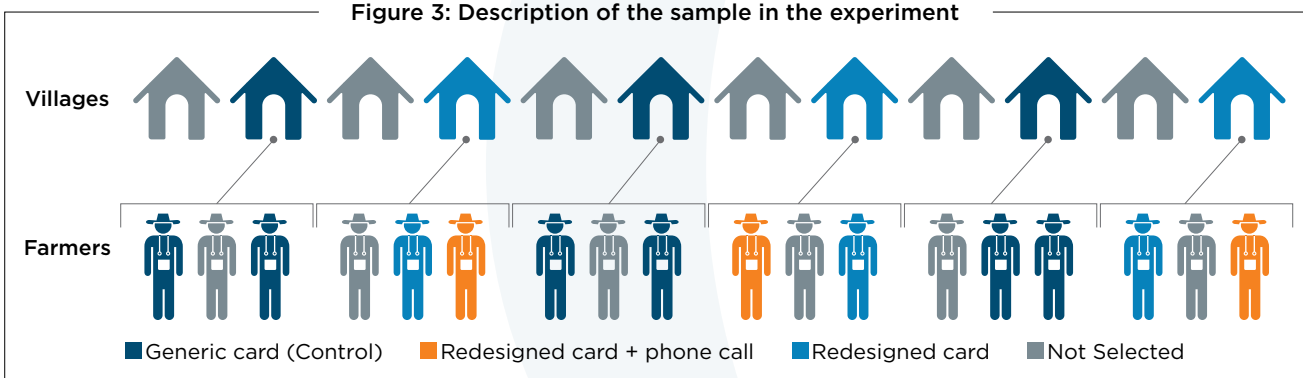
As a part of this trial, farmers in half the villages were given an old version of the Soil Health Card, while farmers in the other half were given cards with the new design. Of the farmers receiving the new card, half of them also received an automated phone call that informed them about its benefits and provided instructions to help them read the card. Thus, we had three intervention groups– one receiving the old cards, one receiving just the new cards, and one receiving both new cards and an automated voice call.

By comparing farmers who received the old card to the farmers who received only the new card, we can estimate the impact of the new card on their understanding.

By comparing farmers who receive the new card to those who receive both a new card and a phone call, we can estimate the impact of the phone call on their understanding.

Bahraich
Mathura
Uttar Pradesh
Ambedkar Nagar
Chitrakoot

Figure 3: Description of the sample in the experiment

Villages

Farmers

■ Generic card (Control) ■ Redesigned card + phone call ■ Redesigned card ■ Not Selected

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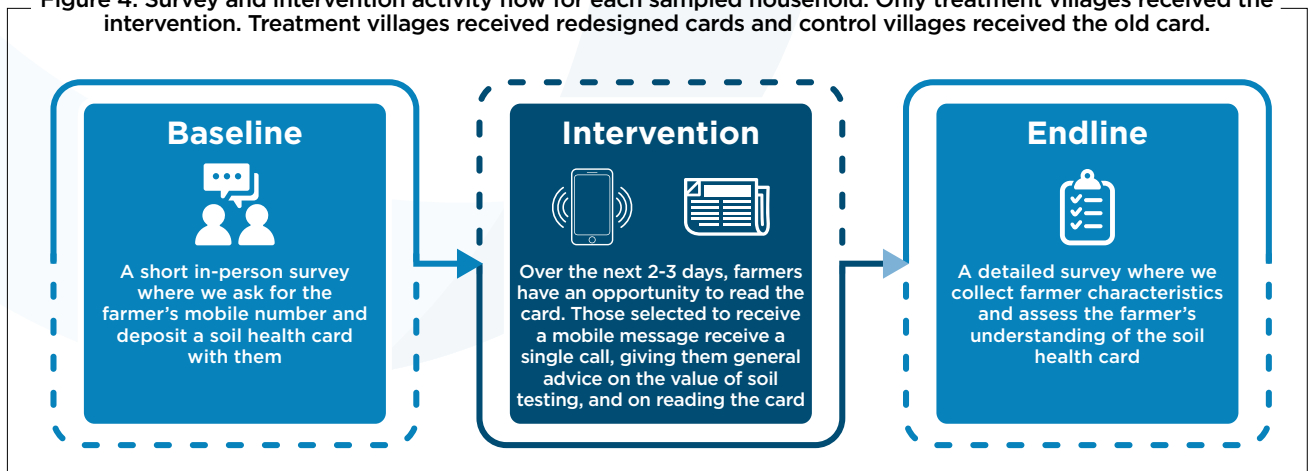twitter.com/IDinsight | facebook.com/IDinsight

05

The sampled villages and farmers were first randomly selected, and then randomly assigned to receive one of the three types of interventions. This helped us ensure that our overall sample was representative of the population of Uttar Pradesh as a whole and that each of the three groups had similar demographic and agronomic characteristics, which might affect their understanding of the card (such as literacy, numeracy, age, landholding, etc).

Data collection

Farmers received their assigned treatment, and their card understanding was gauged 2-5 days later by asking them to calculate their total recommended quantity of urea.

Figure 4: Survey and intervention activity flow for each sampled household. Only treatment villages received the intervention. Treatment villages received redesigned cards and control villages received the old card.

Baseline
A short in-person survey where we ask for the farmer's mobile number and deposit a soil health card with them

Intervention
Over the next 2-3 days, farmers have an opportunity to read the card. Those selected to receive a mobile message receive a single call, giving them general advice on the value of soil testing, and on reading the card

Endline
A detailed survey where we collect farmer characteristics and assess the farmer's understanding of the soil health card
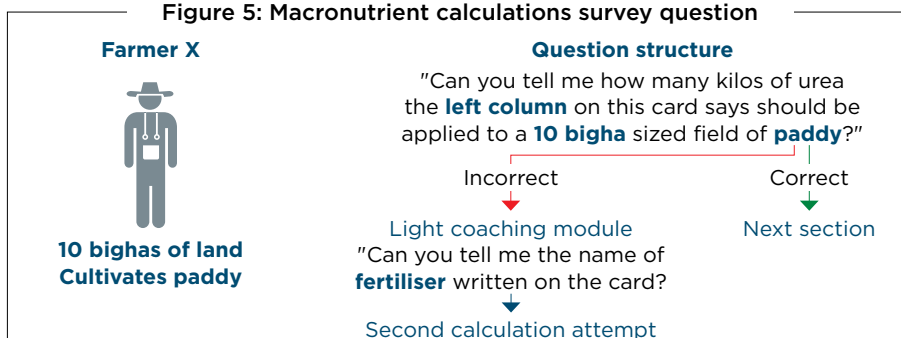
Prior to the survey, we collected data on the actual costs of implementation for each of the three interventions. This allowed us to assess whether the prospective improvement in understanding associated with the new card and the phone call might justify the increased investment to implement these measures.

In order to assess understanding, we conducted two rounds of surveys. In the first round, we collected basic contact details of the farmers and left a copy of a Soil Health Card with them. The type of card they received depended on the intervention group they were randomly assigned. We then left the card with them for 24-72 hours, during which time farmers who were assigned to receive automated phone calls and text messages were contacted. After this, we revisited the farmers and conducted an extensive survey where their understanding of the card was tested.

As a part of the test, farmers were asked to calculate the quantity of fertiliser the card recommended they apply for a particular crop on their respective land size : e.g. a paddy farmer with 10 bigha of land was asked to calculate how much urea the card recommended he apply on a 10 bigha plot of paddy. In the event that farmers miscalculated the quantity, we would provide them with some light coaching by asking them to identify the different crops and fertilisers mentioned on the card. After this exercise, they were asked to once again calculate the recommended quantity.

Figure 5: Macronutrient calculations survey question

Farmer X
10 bighas of land
Cultivates paddy

Question structure
"Can you tell me how many kilos of urea the **left column** on this card says should be applied to a **10 bigha** sized field of **paddy**?"

Incorrect — Correct

Light coaching module
"Can you tell me the name of **fertiliser** written on the card?

Second calculation attempt

Next section

We also collected data on a number of characteristics that we believed might affect a farmer's ability to understand the card, such as their level of literacy, their socio-economic and agronomic background, their prior awareness of soil health cards, their access to extension workers etc.

06
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Main findings

The new card was 65x more effective at conveying fertiliser recommendations than the old card.

Our primary outcome was the proportion of farmers who were able to correctly calculate the quantity of fertiliser the card recommended they apply on their fields. We undertook two comparisons:

• Between farmers that received the old card and farmers that received only the new card

• Between farmers that received the new card and farmers that received both a new card and an automated phone call and text messages

In the first comparison, we found that about **33%** of farmers receiving the new card accurately calculated the recommended quantity in their first attempt, compared to about **0.5%** of farmers receiving the old card, irrespective of the level of a farmer's age, their literacy or numeracy.

Regarding cost-effectiveness, our data suggests that while the fixed costs associated with distributing both cards is the same, the marginal cost of printing is ₹4 for the old card and ₹4.5 for the new card.[7]

Thus, for every ₹1,000 spent on printing; 1 farmer is able to understand the recommendations on the old card, while about 71 farmers are able to understand the recommendations on the new card.

In the second comparison, we find that farmers who received just the new card were as likely to understand the recommendations as farmers who received both the new card and an automated voice call and text message.

Figure 6: New card-old card comparison

y-axis: % of farmers able to undersatnd recommendations

Old card (3/512): 0.5%
New card only (166/509) ***: 33.2%

Controlling for literacy, numeracy and age
Error bar denotes 95% confidence interval of treatment effect
P-value is indicated using stars *<.1, **<.05, ***<.01

Figure 7: New card-combined intervention comparison

y-axis: % of farmers able to understatnd recommendations

New card only (166/509) ***: 30.3%
New card + ICT (166/513): 30.1%

Error bar denotes 95% confidence interval of treatment effect
P-value is indicated using stars *<.1, **<.05, ***<.01

Secondary findings

The new card improved farmer comprehension of micronutrient recommendations and increased Kisan Call Centre phone number recall, but the size of these effects was less than that of the primary outcome.

Apart from farmers' comprehension of the major fertiliser recommendations, we were also interested in the impact the new card might have on some ancillary elements of their understanding:

1. Farmers' understanding of multiple options: As many of our design changes revolved around emphasising the value and purpose of the two different sets of recommendations, we examined if farmers were more likely to correctly interpret these tables when provided with a new card. Thus, farmers were asked to explain why two different quantities of a particular fertiliser were provided for the same crop on the card.

We found that about 30% of farmers receiving the new card correctly interpreted that the different quantities represented two different, independent sets of options, either of which could be adopted, compared to about 21% of farmers receiving the old card.
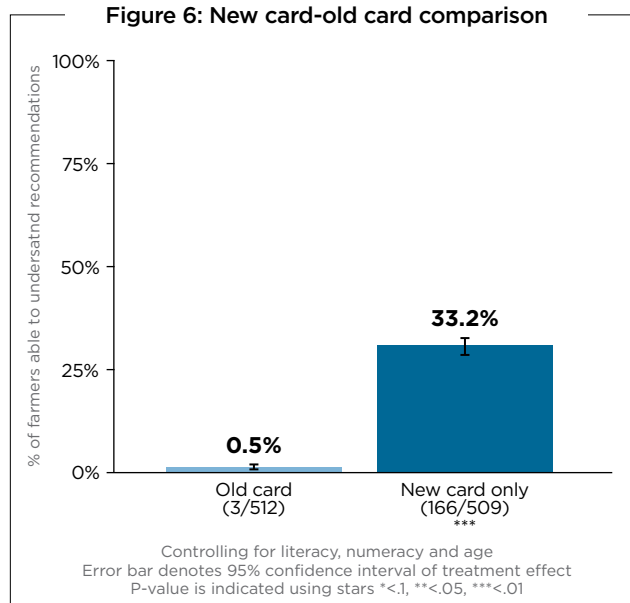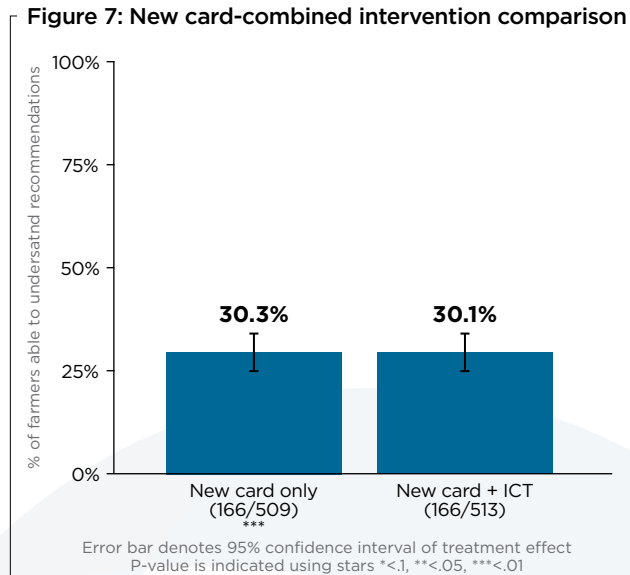
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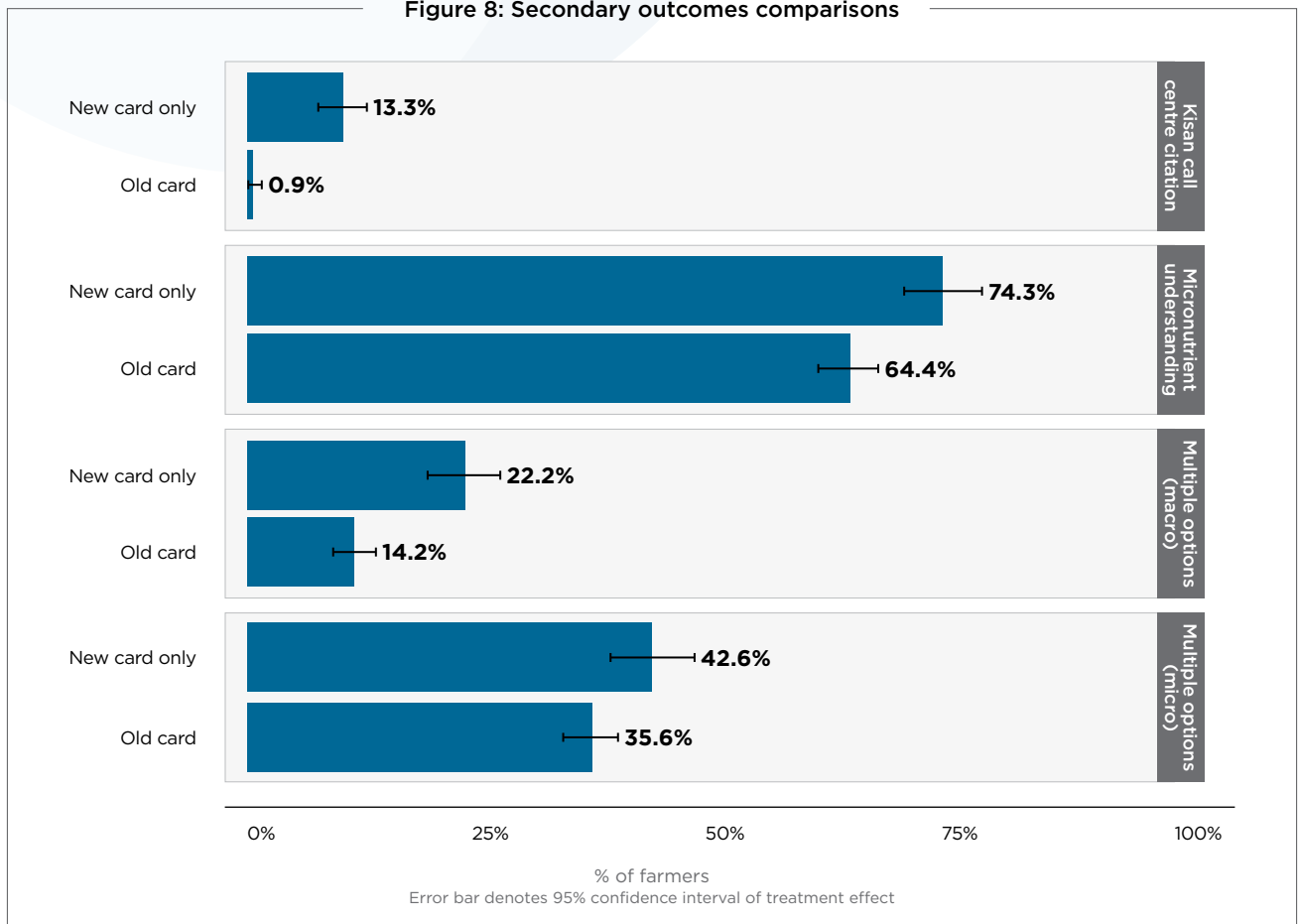twitter.com/IDinsight | facebook.com/IDinsight

07

2. Farmer's understanding of micronutrient recommendations: Since our redesign also affected the format of micronutrient recommendations, we examined the effect of the redesign on farmers' understanding of this dimension.

We found that about 76% of farmers receiving the new card accurately calculated the recommended micronutrient quantity for their crops in their first attempt, compared to about 64% of farmers receiving the old card. We believe their high level of understanding is largely due to the fact that the micronutrient recommendations are presented along a 15 kg range, unlike macronutrient recommendations, which are more precise and specific.

Additionally, we find that about 44% of farmers receiving the new card correctly interpreted that the different micronutrient quantities represented two different, independent sets of options, either of which could be adopted, compared to about 35% of farmers receiving the old card. We believe this is because the different options in micronutrients reflect different methods of application, a fact that is clearly stated and easily inferred from the content of the recommendations.

Figure 8: Secondary outcomes comparisons

- Kisan call centre citation
  - New card only: 13.3%
  - Old card: 0.9%
- Micronutrient understanding
  - New card only: 74.3%
  - Old card: 64.4%
- Multiple options (macro)
  - New card only: 22.2%
  - Old card: 14.2%
- Multiple options (micro)
  - New card only: 42.6%
  - Old card: 35.6%

% of farmers
Error bar denotes 95% confidence interval of treatment effect

3. Kisan Call Centre citation: Finally, a key feature of the redesign was the inclusion of Kisan Call Centre contact details, enabling farmers to use the government's on-call extension service to better understand the card.

We found that about 14% of farmers receiving the new card accurately remembered the KCC phone number, compared to about 1% of farmers receiving the old card.

08
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Farmers who still do not understand the card

Many farmers lack the literacy, knowledge of unit conversion, and general awareness of the scheme to accurately comprehend their fertiliser recommendations.

While the new card represents an improvement over the status quo, a significant proportion of farmers still do not understand the fertiliser recommendations. To better grasp why the remaining farmers don't understand the card, and to help the Ministry identify farmers who require more sustained support, we examined if there were any meaningful differences in how different groups interacted with the card.

Figure 9: Farmers divided into six comprehension groups
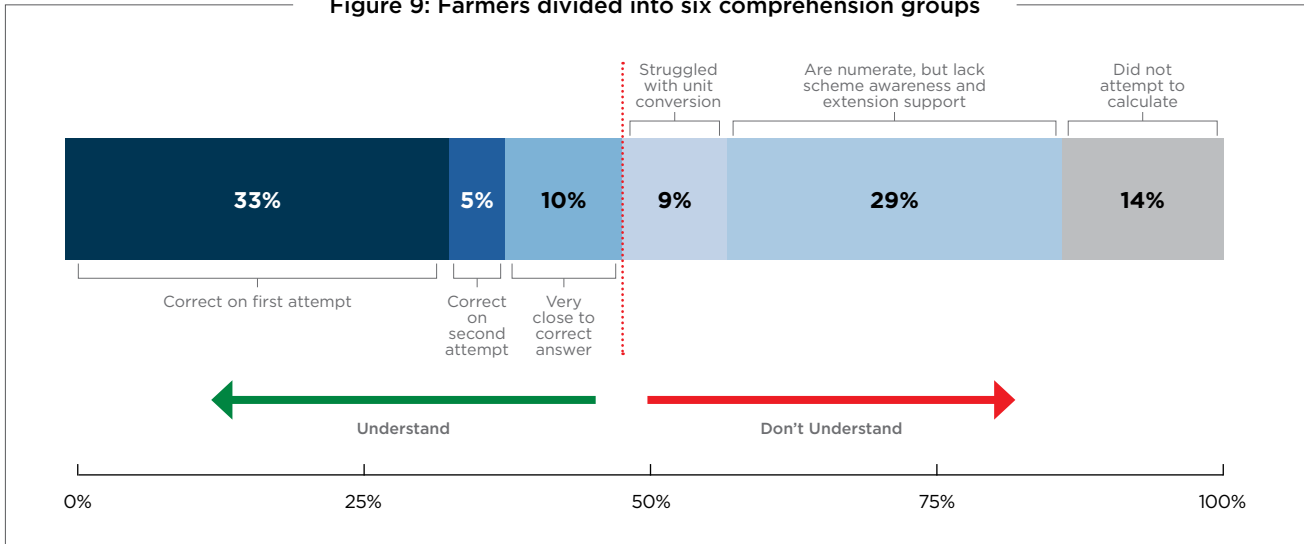
Based on our data, we hypothesise that farmers fall into one of six groups with respect to their comprehension of the card:

1. Immediate responders: These farmers correctly calculated their recommended fertiliser quantity on their first attempt.

2. Eventual responders: Farmers who require some light coaching to help them comprehend the card in its entirety.

3. Approximate responders: Farmers who have some inherent ability and awareness to comprehend the new card accurately, but may lack the exact arithmetic skills and/or motivation to do so. These farmers' calculations were within 10% of their true recommended fertiliser quantity. We hypothesise that this deviation is reflective of convenient calculations (i.e, rounding up from 48 to 50) rather than a systematic misunderstanding of the card, and as such, is likely to be rectified in a setting that is more natural than our experiment.

4. Unit converters: While the use of local land units in the card ensures that the vast majority of farmers do not suffer from this issue, a small minority of farmers use units that are different from the majority. We found that about 53% of farmers who used local land units understood the new card, compared to about 17% of farmers who used other land units.

5. Farmers lacking scheme awareness: Despite being more numerate than farmers who understood the card, farmers in this group were unable to correctly calculate their recommended fertiliser quantity. We hypothesise that this is due to these farmers' lack of scheme awareness and general lack of access to formal extension channels. These farmers are 9% less likely to be aware of the scheme, 8% less likely to have received the card in the past and 11% less likely to have access to extension workers.

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09

6. Farmers requiring substantial support: These farmers did not attempt to calculate their recommended quantity. About 70% of these farmers failed to correctly identify any crops or fertilisers on their card. We hypothesise that this is due to illiteracy, as 89% of the farmers who did not correctly identify any crop/fertiliser were illiterate.

Comprehension Groups and their Characteristics				
Group Name	**%**	**Understand**	**Inherent Ability**	**Characteristics**
Immediate responders	33%	✓	✓	None
Eventual responders	5%	✓	✓	These farmers correctly calculated their recommended fertiliser quantity on their second attempt.
Approximate responders	10%	✓	✓	These farmers' calculations were within 10% of their true recommended fertiliser quantity.
Unit converters	9%	✗	✓	These farmers struggle to convert land units from the card to the units they use in their daily life.
Farmers lacking scheme awareness	29%	✗	✓	Lack of understanding is due to these farmers' lack of scheme awareness and general lack of access to formal extension channels.
Farmers requiring substantial support	14%	✗	✗	These farmers (who are largely illiterate) did not attempt to calculate their recommended fertiliser quantity.

While looking at specific demographic groups, we found that literacy and numeracy are key drivers of understanding: literate farmers are about 15% more likely to understand the new card. Thus, farmers who are less likely to possess these skills (e.g: women farmers, older farmers, low-income farmers) require more support from extension workers.

However, we find signs that overall levels of farmers' understanding may improve as a larger proportion comprehend the card and spread this knowledge to others around them. Farmers who reported discussing the new card with their peers before our endline survey were about 11% more likely to understand the card, irrespective of literacy or numeracy status. Additionally, about 38% of farmers who were aware of the Soil Health Card scheme correctly interpreted the multiple options in the macronutrient table, compared to ~25% of farmers who were not aware of the scheme.

These findings suggest that as community awareness of this scheme increases, and as a larger proportion of farmers begin to understand the card, the remaining set of farmers are may be 'crowded in', as they are more likely to have the baseline level of awareness required to understand the purpose of the scheme, and are more likely to have access to peer farmers who can help them understand their card.

Thus, the redesigned card will help create this initial critical mass of farmers who understand and can help spark deeper, more widespread knowledge.

However, while understanding the recommendations is a necessary first step for farmers to adopt them, it is important to acknowledge that they are numerous other behavioural challenges limiting the success of this scheme that require closer examination. We hope that the Ministry will continue gathering evidence on these barriers, and will conduct similar experiments to refine the scheme.

Authors
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Vinod Kumar Sharma, Field Manager
Will Thompson, Economist

1 Prices are likely to vary by state, volume and vendor
2 Press Information Bureau, Government of India, Ministry of Agriculture & Farmers Welfare (05-December-2018)
3 Soil samples are drawn from a 2.5ha grid (irrigated) and 10ha grid (rain-fed), using GPS devices and revenue maps.
4 The AMAL (Action-focussed Measurement and Learning) Unit, set up by IDinsight, is supporting NITI Aayog on the "Transform Aspirational Districts" initiative.
   The AMAL Unit is supported by the Bill and Melinda Gates Foundation.
5 Mishra, J., Nair, D., Singh, R., Gazeley, U., and Adlakha, R., 2018. "Improving the Soil Health Card Scheme." IDinsight Policy Brief.
   Available at: https://www.idinsight.org/projects/amal-unit-agriculture
6 Singh, V., Ganguly, S., and Dakshinamurthy, V., 2018. "Evaluation of India's Soil Health Card from Users' Perspectives", CSISA Research Note 12
7 Printing costs were incurred in Uttar Pradesh, and are likely to vary based on state, volume and vendor

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