



MOVING THE NEEDLE IN THE FIGHT AGAINST MALNUTRITION



**TECHNICAL ASSISTANCE AND RESEARCH FOR
INDIAN NUTRITION AND AGRICULTURE (TARINA)**

2018

Tata–Cornell Institute for Agriculture and Nutrition (TCI)
College of Agriculture and Life Sciences | Cornell University



TARINA CONSORTIUM PARTNERS

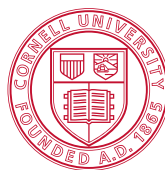


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FROM THE DIRECTOR OF THE TATA-CORNELL INSTITUTE FOR AGRICULTURE AND NUTRITION

TARINA—Technical Assistance and Research for Indian Nutrition and Agriculture is moving forward in its fight against malnutrition in India. Connecting multidisciplinary academic researchers, nongovernmental organizations, development partners and policymakers, TARINA works to address the complex problem of malnutrition through a nutrition-sensitive food system approach.

I am happy to report that TARINA has successfully completed its third year, empowering 12,700 farmers and impacting more than 119,000 people in 23,000 households, in 162 villages of 4 districts of Bihar, Odisha, and Uttar Pradesh.

TARINA's efforts have led to 3,800 acres employing a diversified cropping pattern, by encouraging cultivation of pulses, other legumes, vegetables, and oilseeds. The number of farmers growing pulses during the Kharif season has significantly increased in TARINA villages.

TARINA has not only been empowering women in agriculture by strengthening women farmer's collectives and improving market linkages but also by reducing the drudgery and time stress in farming. We have trained 1,378 farmers in managing 25 innovative technologies. Working through women's self-help groups, TARINA has also set up Custom Hiring Centers to help women farmers in reducing drudgery and enhancing their access to agricultural services.

Recognizing the importance of income pathways within the food system, TARINA is improving incomes of farmers engaged in the raising of small ruminants, through better animal health care services, livestock management, market awareness, and community platforms for collective support and innovative laboratory technology input, such as artificial insemination for improved goat breeding.

TARINA is committed to ensuring households' uninterrupted and expanded access to diversified food across the seasons. One in three households in TARINA villages has adopted a kitchen garden as an expanded source of diversified food, and the number is growing. TARINA is also achieving success in reducing postharvest loss of food quality and quantity

by introducing different storage technologies. 55 tons of crops from 820 households have been preserved.

TARINA's social and behavior change communication strategy, through various engendered training modules, tools, and methods is not only empowering women farmers but also building motivated communities to sustain a food system. TARINA has trained 9,187 peer-level change agents who, in turn, influence, demonstrate, and share with their families and community members their newly gained knowledge about nutrition and innovative strategies for improved farming.

TCI-TARINA researchers and their partners are implementing eight different research studies such as the impacts of agri-market dynamics on farmers; the feasibility of diversifying the public distribution system; intensification of goat production through a sustainable feeding system; promotion of orange-fleshed sweet potatoes to address micronutrient deficiency; improved sanitation through community mobilization; postharvest loss management with a focus on mycotoxins; measurement of empowerment among women farmers of livestock. TARINA's Center of Excellence (CoE) has developed more than 18 policy-influencing research products.

To translate the learnings into policy and scaled-up practices, TARINA is engaging policymakers in several discourses. TARINA has facilitated six such dialogues related to the food system and nutrition at national and state levels. TARINA is also committed to improving human resources that can be key to success with a nutrition-sensitive food system. The CoE is engaged in capacity building of such key players with different training programs and workshops.

As TARINA enters Year 4, I am excited by the intensified efforts of the TARINA team in amplifying the impact and creating a platform of sustainability to make the food system more nutrition sensitive.

Sincerely,
Professor Prabhu Pingali, Director,
Tata-Cornell Institute

ACRONYMS AND DEFINITIONS

ADRI Asian Development Research Institute

AI Artificial Insemination

APMC Act Agricultural Produce Market Committees Act

BCC Behavior Change Communication

BMGF Bill & Melinda Gates Foundation

BUG Buck User Group

CHC Custom Hiring Center

CoE Center of Excellence

DCT Direct Cash Transfer

DFS District Fact Sheet

DSR Direct Seeding of Rice

FFS Farmer Field School

FHP Farm Harvest Price

FPC Farmer Producer Company

FPO Farmer Producer Organization

FPS Fair Price Shop

GDS Grameen Development Services

GOI Government of India

IFPRI International Food Policy Research Institute

IPC Interpersonal Communication

LST Labor-Saving Technologies

M&E Monitoring and Evaluation

NFHS National Family Health Survey

NGTK Nutrition Gender Toolkit

NHRDF National Horticulture Research and Development Foundation

OD Open Defecation

ODF Open Defecation Free

PDS Public Distribution System

PHLM Postharvest Loss Management

PoP Package of Practices

PPR Peste des Petits Ruminants

SBCC Social and Behavioral Change Communication

SHG Self-Help Group

TARINA Technical Assistance and Research for Indian Nutrition and Agriculture

TBS TARINA Baseline Survey

TBSI TARINA Baseline Survey Intervention

TCI Tata–Cornell Institute for Agriculture and Nutrition

TISS Tata Institute of Social Sciences

WASH Water, Sanitation, and Hygiene

WUG Water User Group

Krishi Sakhi: A Community-based Agriculture Support Project (CASP) provider, in rural areas, where farm-based services for agricultural activities are not available on time or too expensive to afford by the rural poor.

Machan Cultivation: A multitier farming system which enables growing multiple crops on the same land.

Poshan Mela: An agriculture mass event during which street plays are performed, with themes of kitchen gardens and cultivation of pulses, nutritious fruits, and vegetables.

Wadi: A *Hindi* word that means small orchard, which is actually a tree-based farming system that consists of fruit trees suitable to the area or a combination of trees.

Zaid Season: The short farming season between Kharif and Rabi seasons in the months of March to July.





TARINA: GOALS, STRUCTURE, AND APPROACH

Technical Assistance and Research for Indian Nutrition and Agriculture (TARINA) is a consortium that connects policy-focused research partners with community-level, impact-focused implementation partners to address the complex problem of malnutrition in India. Led by the Tata-Cornell Institute for Agriculture and Nutrition (TCI), TARINA merges the evidence-generating expertise of Cornell University, Emory University, the International Food Policy Research Institute (IFPRI), and Tata Institute of Social Sciences (TISS) with the technical capabilities of leading development partners—BAIF Development Research Foundation, CARE India Solutions for Sustainable Development, Grameen Development Services (GDS), and Tata Trusts. Collectively, the consortium aims to promote a more diversified food system that enhances the availability and affordability of nutrient-rich foods for India's rural population and creates a sustainable platform to mitigate malnutrition.

TARINA was founded in December 2015, with a US\$13.4 million grant awarded to TCI from the Bill & Melinda Gates Foundation (BMGF). The grant is largely centered on agricultural pathways to improving nutrition outcomes using a **food systems approach**.¹ Three main objectives and nine intermediate results underwrite the grant's overarching goal to create a more nutrition-sensitive food system in India. Together, these components comprise TARINA's Results Framework. This framework is depicted in Figure 1, which shows the links between the components and how they align with the grant's primary goal.

TARINA'S RESULT FRAMEWORK: FROM EVIDENCE-BASED INTERVENTION TO ENABLED POLICY PLATFORM

Objective 1 of TARINA's Results Framework (Figure 1) focuses on field-based implementation, specifically, on redesigning agricultural projects to ensure positive nutrition outcomes at scale. This is achieved through the integration of nutrition-

focused objectives, actions, and metrics into agricultural projects implemented by NGOs and development partners in three Indian states—Bihar, Odisha, and Uttar Pradesh (Figure 2).

Objectives 2 and 3 are more research- and policy-oriented. Both of these objectives focus on evidence generation, advocacy, and capacity building for the design and implementation of nutrition-sensitive agricultural programs and policies. Drawing upon TARINA's ground-level interventions through implementing partners (BAIF, CARE, and GDS) at various locations and from evidence based on research done by TCI scholars, TARINA research partners (IFPRI and Emory University), and micro-level studies undertaken by implementing partners, TARINA continues to strengthen its knowledge base for making the rural food system in intervention districts more nutrition sensitive.

TARINA is a unique program with a live connection between intervention, evidence and advocacy (Figure 3). The field-level programs are continuously informed by the TARINA's active monitoring, learning, and evaluation system. The robust qualitative and quantitative program monitoring through the Quarterly Progress Reports (QPR) from TARINA partners and the real-time Management Information System (MIS), coupled with strategic evidence-generating activities—the TARINA baseline survey (TBS), midterm process documentation (PDs), and thematic research studies by TARINA partners and TCI scholars, inform and guide the intervention to assure its effectiveness. TARINA utilizes the collective evidence to influence policy through various advocacy platforms: by disseminating innovative research products through peer-reviewed publications, policy briefs, and manuals; and through engaging in discourses, such as roundtables, workshops, and consultations with impact makers. The Center of Excellence within TARINA leads and supports the generation of the evidence, in translating the findings into the high-value research products and utilizing the research products for building capacity and influencing policy around the food system and nutrition in India.

¹ Please refer to Figure 4 for further information on TARINA's food systems approach.

TARINA RESULTS FRAMEWORK

GOAL: A MORE NUTRITION-SENSITIVE FOOD SYSTEM
(Improved Availability and Affordability of Food Diversity and Quality)



Figure 1. TARINA Results Framework

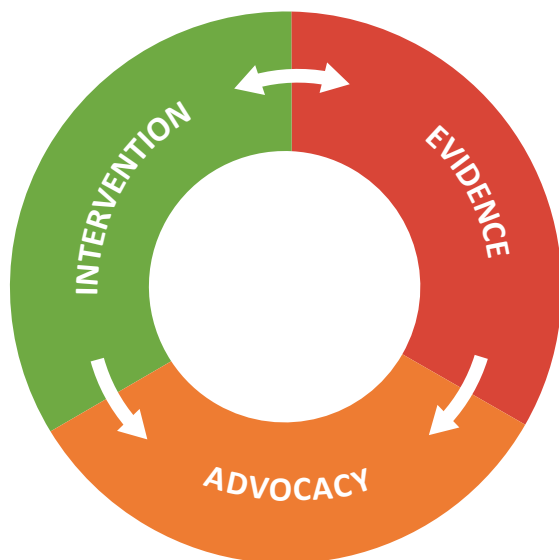
LOCATIONS AND PARTNERS



STATE	DISTRICT(S)	PARTNER(S)
Bihar	Munger	BAIF
Odisha	Kalahandi and Kandhamal	CARE India
Uttar Pradesh	Maharajganj	GDS and Tata Trusts

Figure 2. TARINA locations and implementation partners

TARINA: INTERVENTION, EVIDENCE AND ADVOCACY LOOP



INTERVENTION

Quarterly progress report
Quarterly MIS
Field monitoring visits
Process documentation

EVIDENCE

TARINA surveys
Thematic research studies
Policy analysis

ADVOCACY

Workshops
Policy dialogues
Roundtable discussions
Advocacy publication

Figure 3: Intervention, evidence, and advocacy



TARINA is committed to empower the smiles of many.

TARINA'S FOOD SYSTEMS APPROACH: SUSTAINABLE MITIGATION OF MALNUTRITION

TARINA advocates going beyond traditional food security for a sustainable mitigation of Indian malnutrition. TARINA aims to redirect agricultural policy away from “staple-grain fundamentalism” toward a much broader food systems focus, which considers the need to build better connections between agriculture and nutrition. More specifically, it emphasizes agricultural pathways to improve the rural poor’s year-round access to affordable, diverse, and high-quality foods that are rich in micronutrients. A food system includes all individuals, enterprises, and institutions that influence the supply, demand, consumption, and absorption of food and micronutrients. The interconnected components of a food system are depicted in

the diagram (Figure 4). TARINA’s food systems approach examines factors that influence both agriculture and nutrition within and between stages of the food supply chain, as well as among households, villages, districts, and beyond. TARINA’s food systems approach is twofold. It involves not only ground-level interventions at various stages of the food supply chain, but also policy reforms to support the diversification of agricultural production. Establishing a “crop-neutral” policy environment that ensures a level playing field for the production and marketing of nutritious non-staples, such as fresh fruits, legumes, and livestock products, is critical to creating a more robust and diversified food system.

GOVERNED BY INSTITUTIONS, REGULATIONS, & MARKETS

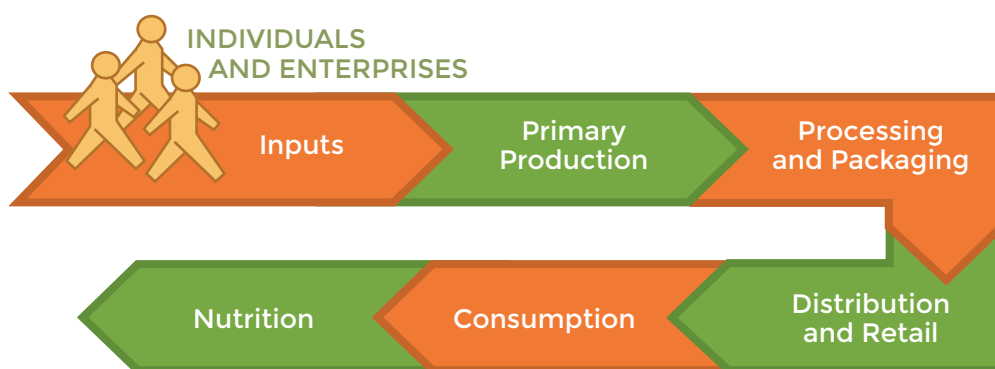


Figure 4: TARINA's Food System Pathway to Better Nutrition





YEAR 3: GAINING GROUND IN THE FIGHT AGAINST MALNUTRITION—TARINA'S PROGRESS

MAKING AGRICULTURE MORE DIVERSIFIED

Diversifying Staple Grain Production Systems by Adding Vegetables and Legumes

The implementing partners of TARINA are promoting cultivation of vegetables, pulses, and oilseeds to diversify staple grain production. Diversification of production systems is aimed at increasing availability of and accessibility to nutritious food and household access to it. Although methods and approaches to achieving this goal vary across the three states, all involve the provision of seeds, market linkages, and training on a recommended Package of Practices (PoP) for farmers.

TARINA has registered crop diversification over a total of **3,800 acres**, involving **12,700 farmers**, across four implementing districts in Odisha, Bihar, and Uttar Pradesh. As of August 2018, TARINA has enabled **about half** of the farmers in its villages to diversify in favor of the cultivation of non-staples, compared to just a little over one-fifth at the start of the program.

Since TARINA's intervention, there has been a considerable increase in the number of farmers who have diversified production toward non-staples. In the Munger district of Bihar, there has been more than a

Impacted and Counting...

- **12,700** farmers and **3,800** acres of land are brought into the fold of diversified agriculture
- Significant increase in the number of farmers growing pulses in Kharif season—from **10** farmers in Y1 to **3,000** farmers in Y3
- **6,597** farmers have received the training on improved farming practices

threefold increase in the number of farmers who are cultivating non-staples; similarly, in the Kalahandi and Kandhamal districts of Odisha, the number of farmers adopting non-staples increased by **more than two and a half times**, whereas in Maharajganj in Uttar Pradesh, the increase in the number of farmers diversifying has **doubled** since 2016 (Figure 5).

NUMBER OF FARMERS DIVERSIFYING CULTIVATION SINCE 2016

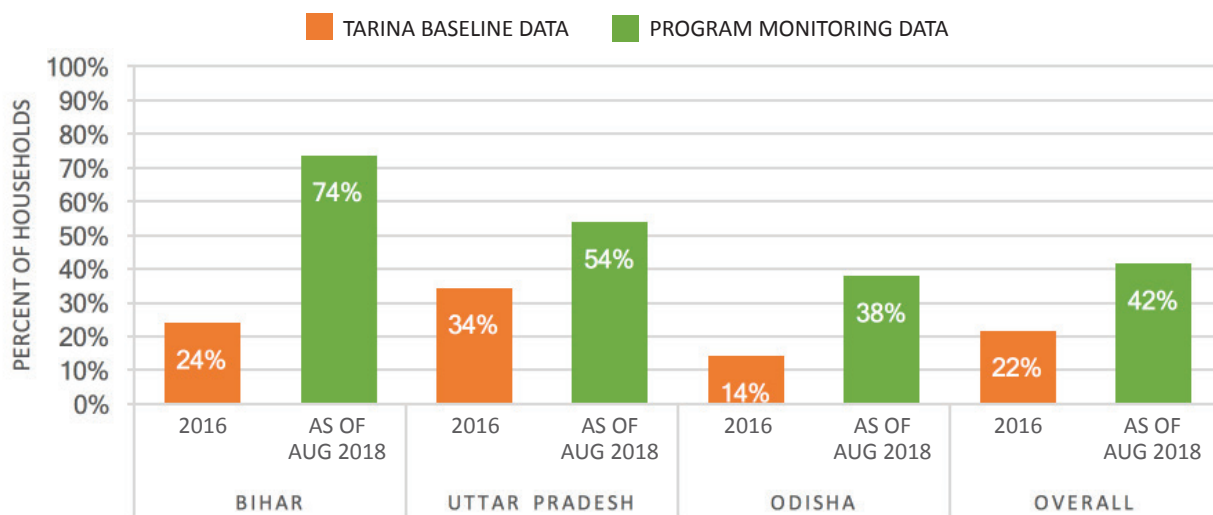


Figure 5: Increase in number of diversified farmers between 2016 and August 2018

Owing to TARINA's sustained efforts, pulses are now most preferred for diversification, followed by vegetables, mixed crops, and oilseeds across all the three states (Figure 6).

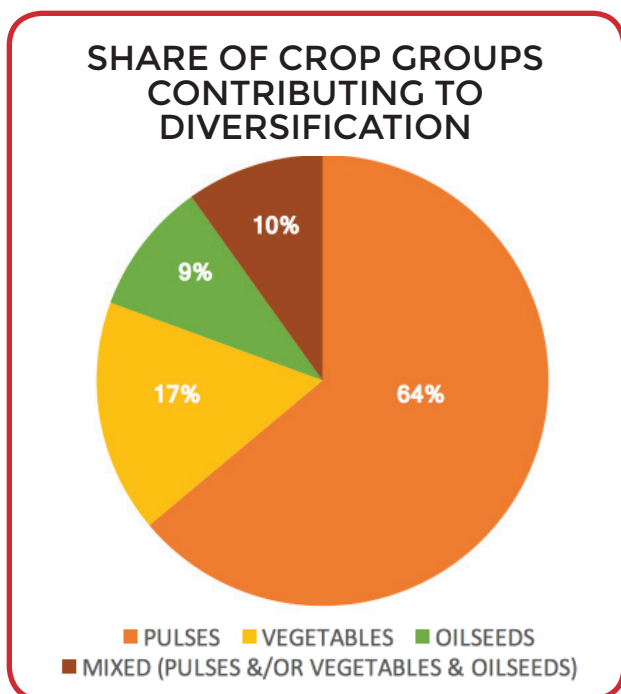


Figure 6: Share of crop groups contributing to diversification

To create an enabling environment and pathway for increasing adoption of non-staples in the intervention districts, an integrated approach of technical inputs and capacity-building interventions have been active on the ground. Apart from providing key inputs, such as seeds, insecticides, and pesticides, extensive customized training support also has been extended.

TARINA builds on existing community platforms, like SHGs and other interest groups, to promote crop diversification, especially among women farmers. Customized training on PoPs, such as land preparation, sowing techniques, seed treatment, and integrated pest management, are provided to farmers.

TARINA, together with BAIF, has also introduced the **Sustainable Multi-species Agricultural Resources-use Model Trials (SMART)** in Bihar. SMART develops mixed, sequential cropping models for farmers with small and marginal landholdings for the intensification of their production. Cultivation of mixed crops of maize and pulses or oilseeds and pulses has been encouraged. In another model,

TARINA is working toward the **integration of pulses and vegetables** into existing cropping systems.

Additionally, to address irrigation constraints and create a community-based platform, TARINA has formed **Water User Groups (WUGs)** in Munger by collectivizing and mobilizing farmers. Each of these groups consist of 10–12 members who promote collective use of water structures, such as shallow wells, bore wells, and pumps. Group members provide unskilled labor in construction of these water structures. This not only empowers farmers but also ensures collective ownership of the resources. As of August 2018, farmers in nearly 60 percent of the TARINA villages are benefitting from 46 wells (shallow and bore wells combined). With the use of these water structures, farmers have been able to cultivate non-staples in both the Rabi and Zaid seasons. For ensuring the sustainability of the WUGs, training is provided to members on water sharing rules, construction, repair and maintenance of water structures, and financial management of the WUGs.



TARINA has formed Water User Groups (WUGs) in the Munger district of Bihar by collectivizing and mobilizing farmers.

Notably, in the Munger district of Bihar, **604 farmers**, with irrigation support and follow-up training on recommended **POPs**, have started cultivating green gram in the Zaid season on **150 acres** of land in both 2017 and 2018, which was not the practice earlier.

To address technical knowledge gaps and demonstrate better farming methods in Odisha, CARE is working to increase adoption of pulses through formation of **large demonstration plots** in each village, each of which are comprised of smaller, contiguous plots contributed by interested farmers. Until August

Face of Change: Zaid Groundnut Crop Ensures Additional Income for Farmers in Maharajganj



Jagdish and Kumari from the Manahiya village in the Maharajganj district of Uttar Pradesh met their groundnut oil requirement through their own production. They are able to earn as well as save for their own consumption.

Kumari and her husband Jagdish of Manahiya village in the Maharajganj district of Uttar Pradesh have been farming their four acres for nearly three decades. Agriculture is important to the economic sustenance of their family of nine. In March 2018, she attended the first of regular meetings organized by GDS through TARINA to learn about better agricultural practices and new crop varieties. The meeting introduced farmers to a new short-duration groundnut variety, DH-86, for Zaid cultivation.

Kumari decided to grow groundnut on 0.15 acres. She was anxious about cultivating groundnut in the Zaid season, but was ready to learn new farming techniques, saying “Neither us, nor our neighbors were aware of the possibility of cultivating groundnut in Zaid. For us, it had always been a Kharif crop.”

In the trainings, she learned about land preparation techniques, line sowing, manure and pesticide application, and irrigation. After sustained efforts and hard work over 3.5 months, Kumari was ready to harvest DH-86.

To her joy, her total groundnut production was about 2 quintals, more than her groundnut crop in the preceding Kharif season: “Kharif groundnut was more vulnerable to pest attack (wilt) during flowering compared to the Zaid groundnut.” Speaking about storage methods and irrigation methods she’d learned about in her training, Kumari added, “The crop needed irrigation around eight times through bore wells ... I stored the groundnuts in jute and plastic bags to ensure they don’t get spoiled.”

“Zaid cultivation has increased my savings and my earnings,” said Kumari with a smile.

Kumari sold one quintal of the groundnut harvest in the local market, earning about INR 2500 (US\$35). She kept the remainder for household consumption—some for eating by roasting or frying the kernels or adding them to seasonal vegetables, and because groundnut kernels contain about 48% oil, some was used as oil for food preparation. Kumari was able to get 4.5 liters of oil from 10 kg of groundnut. Kumari said happily, “Purchasing from the market is always very expensive, a liter of groundnut oil is priced at INR 230 [US\$3], ... earlier, I would at times use mustard oil for cooking purposes, which is priced at INR 125 [US\$1.60] per liter, and that, too, is an expensive proposition for us.”

Kumari and her husband plan to increase the amount of their land devoted to groundnut cultivation in the next Zaid season. She is confident that with basic technical support from TARINA, she can cultivate more groundnut for the next Zaid.

2018, **102 Farmer Field School (FFS)** sessions were conducted on demonstration plots to train nearly **1,388 farmers** on best practices for farming.

In the Maharajganj district of eastern Uttar Pradesh, trellis-based cultivation, popularly known as ***Machan* cultivation**, is being promoted by GDS to optimize land constraints. *Machan* is providing farmers with options for the cultivation of multiple crops at the same time, encouraging them to grow both cucurbits (such as sponge gourd, bitter gourd, and bottle gourd) simultaneously with groundnuts and pulses (green gram, black gram). Around **60%** of these farmers are cultivating non-staples on the trellis-based model for the first time. In Maharajganj alone, **2,546 farmers** have diversified into pulses, vegetables, and oilseeds on **567 acres** of land in TARINA villages. To strengthen the peer-led approach to support farmers, “***Krishi Sakhis***” (“female farmer friends”) have been trained



Groundnut farmers in the Zaid season in the Maharajganj district of Uttar Pradesh.

on best cultivation practices. They are responsible for conducting demonstrations to influence farmers to adopt the recommended PoPs and for the generation of awareness on the importance of non-staples.

In all TARINA villages, nearly **50%** of the farmers has been provided various training about making informed decisions on crop diversification. As of August 2018, a total of **7,622 farmers**, including **5,985 women** and **1,637 men**, have attended these training sessions.

Role of Markets in Diversifying Agricultural Production: Spotlight on the APMC Act

A responsive marketing system, coupled with an adequate supply chain, can strengthen the income pathway for farmers through a diversified crop production system. Yet, agricultural marketing in India remains a challenge. As a part of TARINA's knowledge-building effort, **IFPRI** is conducting a study to evaluate, improve, and inform agricultural marketing policy (in Bihar) to incentivize year-round production and increase the supply of nutritious non-staples. The Government of Bihar repealed the existing Agriculture Production Market Corporation (APMC) Act in September 2006 and did not bring forth a new law to replace it. The repeal led to the creation of India's “*freest grain mandis*”—with no regulations, fees, or taxes, and no formal institutional arrangements to maintain the market infrastructure and ensure fair play. The study specifically focuses on the changes that occurred due to the repeal of the APMC Act. It attempts to understand the short-term and long-term impacts of the Act's repeal and the transaction costs involved along the value chain for various categories of farmers.

IFPRI, analyzing data on farm harvest prices (FHPs) and wholesale and retail prices of crops, such as paddy, maize, pulses, potato, and onion in Bihar and other states of India before and after 2006, found that the abolition of the APMC Act did not make agricultural markets more efficient in Bihar.

The wedge between average wholesale prices and farm harvest prices, or between retail and wholesale prices, did not come down after 2006 for any commodity. In Bihar, the gap between retail prices and FHPs remained as high as before the repeal of the APMC Act. This price gap occurred possibly because the old supply chains did not become shorter, as small and marginal farmers with small marketable surpluses continued to rely on a chain of *aarhatias* (middlemen) to sell their produce.

Farmers and buyers, after the repeal of the APMC Act, were free to bypass cartels of middlemen and deal with each other directly, at their preferred location, without paying any market fees. However, the repeal did not translate into a visible increase in competition among traders and aggregators for paddy and wheat. The study showed that no formal alternate arrangements emerged. Instead, markets fragmented

further, and price discovery became harder for farmers, especially for marginal farmers with smaller marketable surpluses. A complete deregulation of agricultural markets did not make supply chains shorter or more efficient. Potential benefits that may have accrued from abolition of taxes and *mandi* fees were cornered by the middlemen.



Key Publication Alert

- District Fact Sheet on Agri-production
- TBSI Report on Pulses (GDS/TCI)

The study further notes that the repeal of the APMC Act led to increases in the FHPs of maize and declines in the FHPs of rice and wheat, especially for marginal farmers. Bihar has emerged as a hub for exports of maize to other Indian states and to South Asian and South-East Asian countries. In the absence of administrative hurdles, deregulation has aided the enhanced procurement of maize. Maize growers, on the other hand, have benefited from the increased competition among aggregators and traders. The study indicates that deregulation does not necessarily make markets more efficient, especially when millions of smallholders are involved.

Deregulation of agricultural markets is likely to be more helpful to farmers (and consumers), if institutional platforms like Farmer Producer Companies (FPCs) are promoted to reduce the cost of aggregation and increase bargaining power of smallholders in the markets. The study further suggests that deregulation increases price realization by the farmers if it attracts private investment, as in the case of maize in Bihar.

CHANGING INDIVIDUAL AND COMMUNITY BEHAVIOR TOWARD BETTER NUTRITION

Enabling Individuals and Community through Social and Behavioral Change Communication Methods and Tools

Changing behavior at the individual, household, and community levels and creating an enabling social

landscape through strategic communication is one of the critical components of TARINA's strategy to achieve better nutritional outcomes. The two-tiered social and behavioral change communication (SBCC) intervention of TARINA focuses on (1) enhancing community-level capacity of technical knowledge and awareness of a better food system and enabling environment for improved nutritional outcomes; and (2) increasing demand and improving consumption of nutritious food at the household level, using an engendered approach for empowering individuals (Figure 7).

For the community-level intervention, **mass campaigns, meetings, workshops, and exposure visits to best practice sites** are some of the key interpersonal communication (IPC) mechanisms in the field. TARINA engages in a unique peer-led approach for its interpersonal communications to reshape the traditional perceptions and practices, moving the needle toward desired behavioral change. With a deliberate focus on women's groups, trainings focus on **improved cooking demonstrations, awareness about WASH (water, sanitation, and hygiene) behavior, knowledge of vitamins and micronutrient deficiencies, nutritional value of kitchen gardens**, and more. Since the onset of the program, TARINA has been creating a peer-driven community platform to influence perception and behavior change, both at individual and community levels. As of August 2018, **9,187 peers**, including women and men, have been trained toward catalyzing change.



Impacted and Counting...

- **9,187** peers trained as change agents
- **369** SHGs are reenergized through various training programs
- **6,712** women and **1,096** men participated in behavior change intervention through the incremental modules of NGTK

To strengthen the gendered approach for improving the rural food system and leveraging an enabled community awareness, TARINA's SBCC tries to impact individual-level behavior through the Nutrition Gender Toolkit (NGTK) (Figure 8),

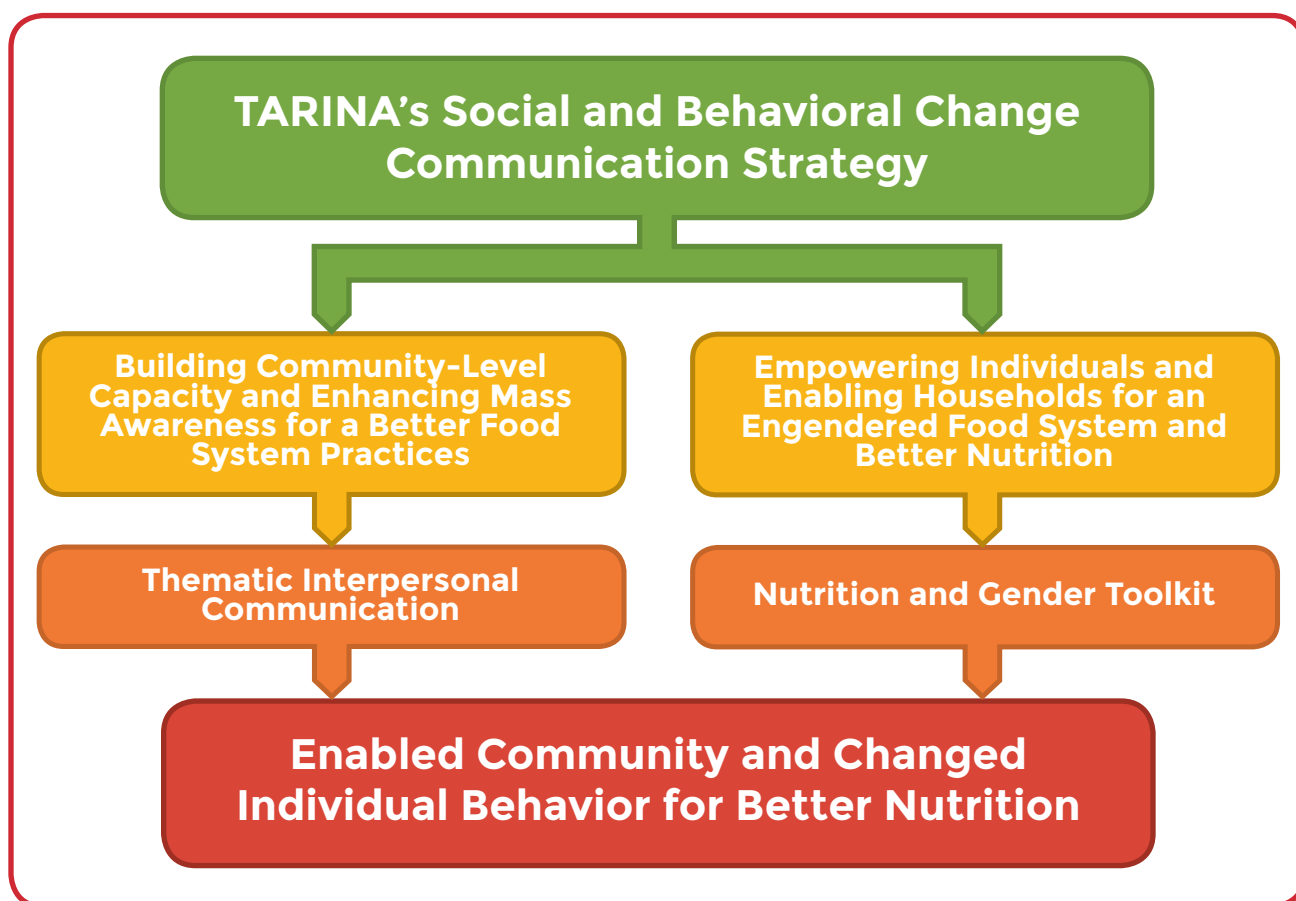


Figure 7: TARINA's social and behavioral change communication strategy



Interactive NGTK tools attract both men and women to talk about gender, food, and nutrition.

developed by CARE as one of the mechanisms of TARINA's SBCC strategy. The NGTK addresses issues that are critical to achieving better nutritional outcomes through the empowerment of women. The NGTK has eight incremental components, including issues such as women's access and control over resources to improving household diets. The toolkit utilizes methods like interactive flip-books and board games to impart messages through gender-based



Key Publication Alert

- District Factsheet on Dietary Diversity
- District Fact Sheet on Factors Influencing Demand
- District Fact Sheet on Maternal and Child Health

EIGHT TOOLS OF TARINA NUTRITION AND GENDER TOOL KIT (NGTK)

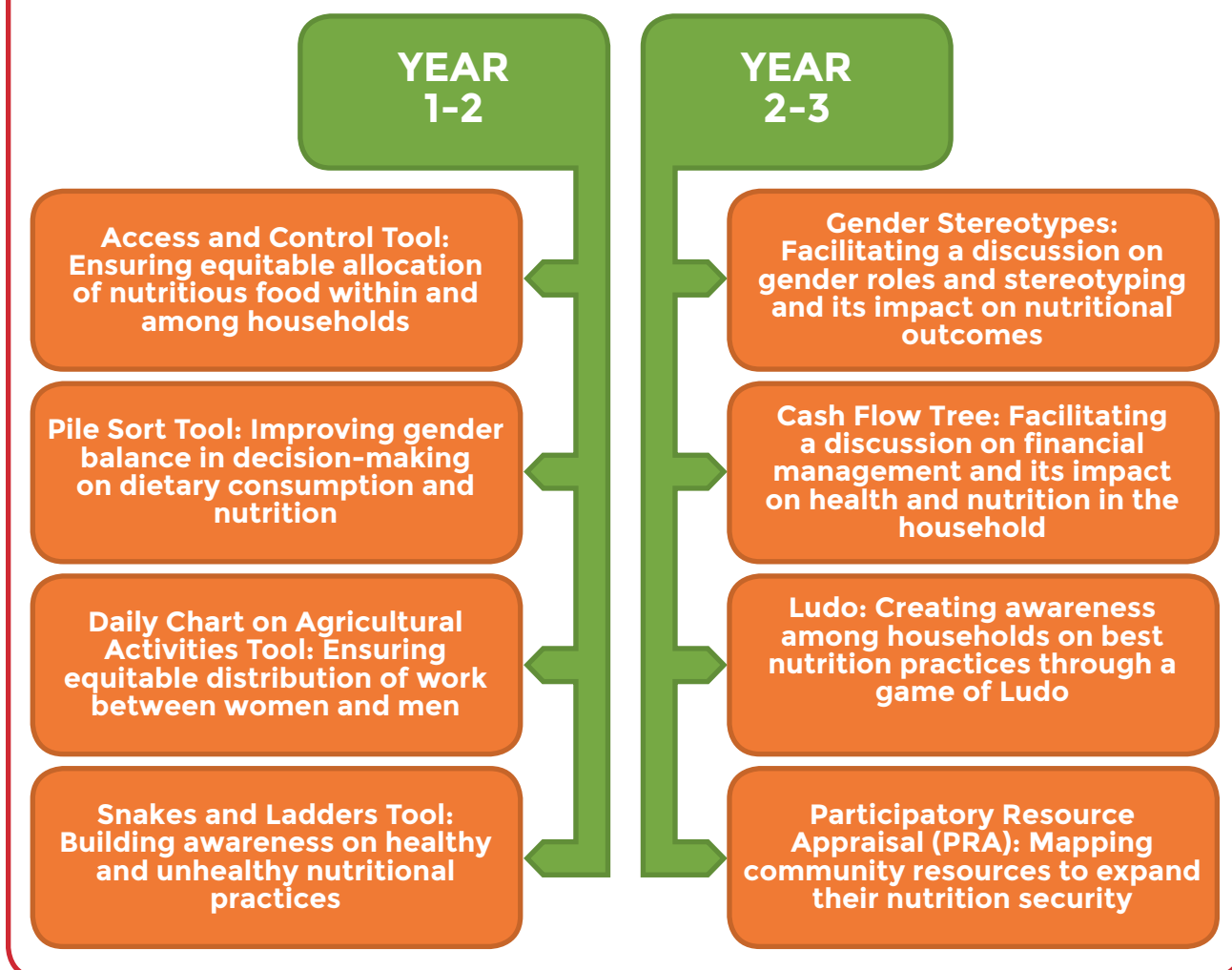


Figure 8: The NGTK Tools are evolving and acting as catalysts for desired behavior change

dialogues, to build awareness, and to translate it into action. The interactive tools highlight and challenge prevailing gender stereotypes and inequalities at the household level, thereby encouraging participants to discuss and debate those challenges and ideate possible solutions. The toolkit is being locally adopted and scaled up in all three states.

CARE's NGTK assesment study shows that the toolkit has a considerable impact in changing perceptions, knowledge, and practices about nutrition and gender. The study, which was conducted between two groups in the districts of Kandhamal and Kalahandi in Odisha—one which was exposed to

SBCC and the NGTK tools and the other which was not—clearly shows that those exposed to the SBCC intervention, including the NGTK tools, were better informed about a diversified diet and practiced the intra-household food distribution better (Figure 9). The participation of women in agriculture-related decision-making processes at the household level is also higher in villages treated with TARINA SBCC, indicating the translation of knowledge into action.

TARINA's SBCC intervention is successfully making a positive impact on individuals and is steadily making progress toward the creation of a growing demand and choice for nutritious food across all the districts.

PERCEPTION AND PRACTICES REGARDING DIVERSIFIED DIETS AT HOUSEHOLD LEVEL

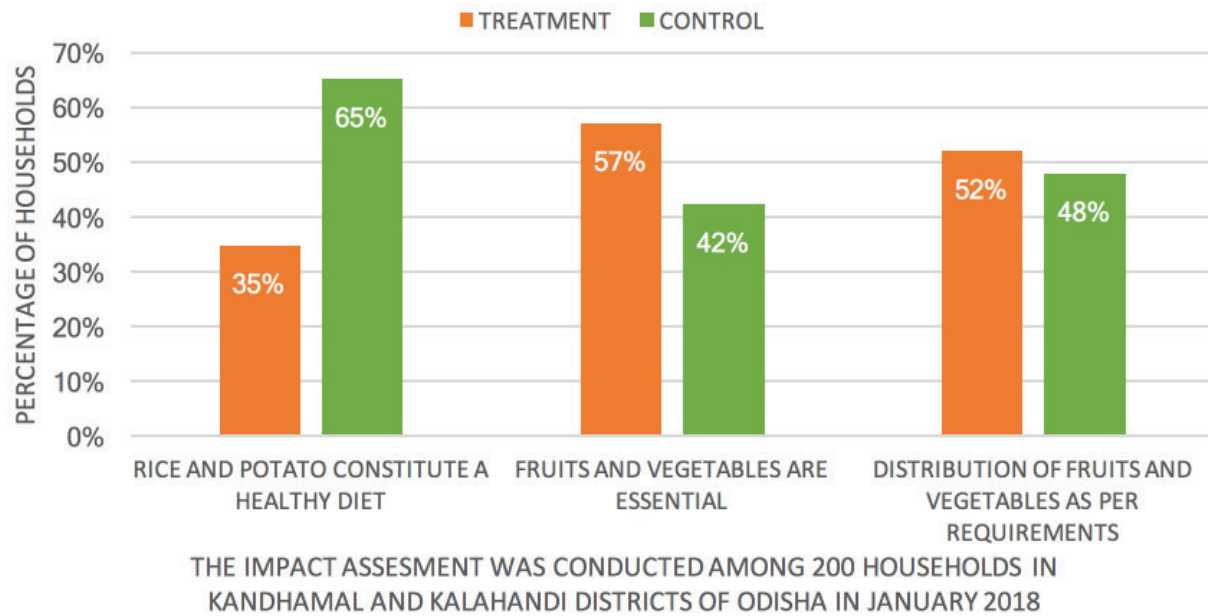


Figure 9: Observed differences in perception and practices of diversified healthy diets between the treatment and control groups

Increasing Production and Consumption of Orange-Fleshed Sweet Potatoes to Address Micronutrient Deficiencies

TARINA is continuously gathering evidence on ways to increase the demand for cultivation and consumption of micronutrient-rich vegetables such as orange-fleshed sweet potatoes (OFSP). OFSPs are rich in nutrients, particularly Vitamin A, which is essential during late pregnancy and for lactation, and is necessary for eye, lung, and immune system functions. As the crop is not grown traditionally in the country, TARINA works with farmers to train them on best practices for cultivation, and also works at the household level to demonstrate recipes using OFSP to encourage families to incorporate these new foods into the diets of mothers and children.

In the Maharajganj district of Eastern Uttar Pradesh, TARINA has already introduced OFSP, and **Tata-Cornell Scholar, Kathryn Merckel** is leading a research study on enhancing the production and consumption of OFSP. In order to understand the role that behavior change communication has on influencing agricultural decisions around OFSP,



Recipe demonstrations enable households to incorporate Orange-Fleshed Sweet Potatoes in diets.

the study is providing agricultural promotion in 10 villages, five of which were randomly selected to receive additional programs on nutrition behavior change and information on the importance of vitamin A in the diet. By assessing the differences in adoption and consumption between the villages receiving agricultural promotion only and the villages receiving both agricultural and nutrition promotion of OFSP, the study will better understand how knowledge of nutrition affects household production decisions that result in more diverse crop systems and healthier diets.

At the start of the intervention, every household in each intervention village had the opportunity to receive free OFSP vines at a promotional interest meeting if they also attended an intensive field training on the basics of OFSP cultivation. The baseline adoption of orange sweet potato was 18% in villages slated to receive only agriculture programming, and 10% in villages that were to receive both agricultural and nutrition programming. This difference is attributable to earlier programs promoting OFSP in some of the villages randomized to receive agriculture promotion only, a difference that will be taken into account in the final analysis. For the next five months, farmer field schools were conducted monthly in each village, and in villages receiving nutrition messaging intervention,

additional events were held to raise awareness about vitamin A deficiency, the role of orange sweet potato in a healthy diet, and proper diets for infants, young children, and mothers. After those five months, at the start of the next OFSP growing season, there was another opportunity to begin growing OFSP, this time receiving vines from friends or neighbors that grew them in the first season. In this second season, controlling for village size, OFSP adoption increased by an average of 95% in villages that received both agriculture and nutrition messaging interventions, and increased by an average of 50% in villages that received agricultural programming only. These findings demonstrate the beneficial role of nutrition messaging interventions in the increased adoption of new crops such as OFSP, through shifting the community motivation toward consumption of better nutrients. For example, the access to nutrition messaging intervention significantly increased the number of days that children under five years of age consumed vitamin A-rich food (Figure 10). However, the result also shows that even without this nutrition knowledge, there is momentum for continued spread of adoption of OFSP among farmers.

Further, the interim result of this study indicates that policies or programs that fall into assumptions of gendered division of agricultural responsibility will

CHILDREN CONSUMED A NUMBER OF VITAMIN A-RICH FOODS IN THE PAST 7 DAYS

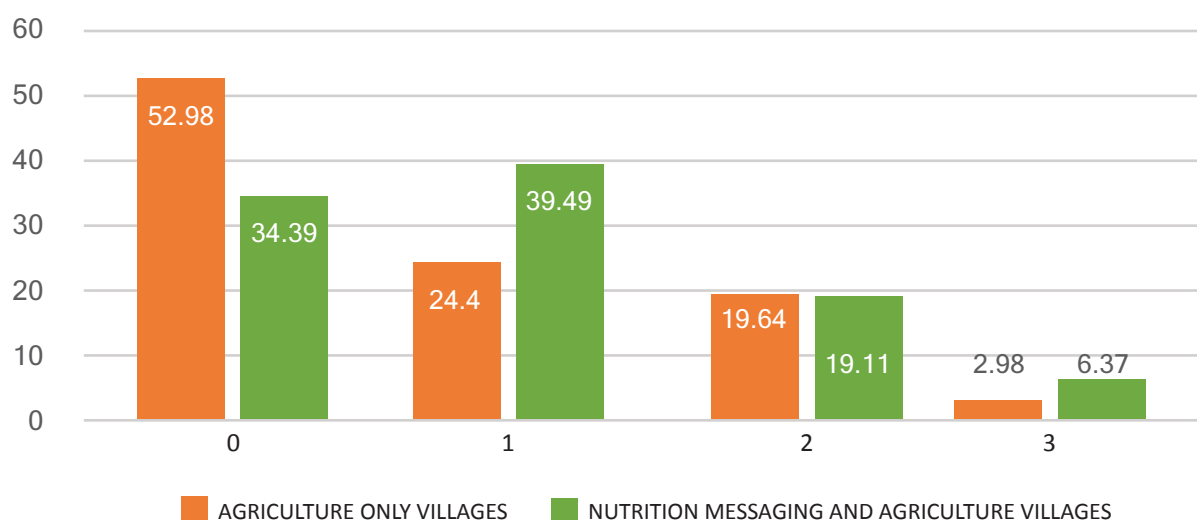


Figure 10: Villages with nutrition messaging intervention show better consumption of vitamin A-rich foods among children

miss key opportunities for small-scale production diversification. This observation is derived from the study findings that suggest no firm distinction between gendered responsibilities for production of OFSP in field plots versus home gardens. Women are as likely to be responsible for a plot of OFSP as a home garden, and men report responsibility for half of all home gardens being used to grow OFSP.

Diet diversification is a critical step in reducing micronutrient deficiencies and improving health outcomes, and projects like this one provide important data for understanding the underlying mechanisms that influence small farmer production systems and household decision-making around food selection. As a part of the TARINA project, this study aims to contribute to the objective of increasing demand for nutritious foods and diversifying production of nutrient-rich crops. As we learn more about how individuals and households in rural Uttar Pradesh share information about food, and how interventions that promote nutrition knowledge and agricultural technologies empower individuals to diversify their production and diets, we will be able to design policies and programs that are more effective and efficient at improving nutrition and health in rural India.

Achieving and Sustaining Open Defecation Free Villages through Community Mobilization

TARINA is working toward improving nutritional outcomes through a targeted approach, linking behavior changes around WASH. The linkages between open defecation and adverse nutritional outcomes in a country like India, where nearly 40% of its population defecate in the open, is critical to address (WHO and UNICEF 2017). The Indian policy response has largely been focused on the construction of toilets. Eliminating open defecation (OD) is one of the major challenges in building an enabling environment for better nutrition absorption.

A major unexplored factor behind the rampant practice of OD is the preference to do so, which the mere provision of toilets does not overcome. **Tata-Cornell Scholar, Payal Seth's** study builds on the tenets of community-led total sanitation (CLTS)—a behavioral change that stimulates community-level behavior to stop the practice of OD. Communities

are facilitated to conduct their own appraisals and analyses of open defecation (OD) and take their own actions to become ODF (open defecation free). At the heart of the CLTS lies the recognition that merely providing toilets does not guarantee their use, nor result in improved sanitation and hygiene.



TARINA uses the CLTS approach with the aim of achieving ODF villages in the Maharajganj district of Uttar Pradesh.

This study aims to find out the causal contribution of the behavioral change versus toilet construction approaches on outcomes, such as the use of toilets, child health, and safety of women. Our research design has two treatment arms and one control arm. The two treatment arms (Clusters A and B) are presented with the option of toilet construction, in which each household would receive one toilet. Tata-Cornell Institute covers 75% of the cost, and the rest is borne by the household. Additionally, a Cluster A household receives a behavioral change intervention before the decision is made to have the toilet built. Around 1,000 households in 15 villages in Maharajganj, Uttar Pradesh, are participants in this experiment.

Less than 3% of the households had access to toilets before the intervention. After the behavioral change intervention was successfully disseminated in all Cluster A villages, almost all households readily accepted having the toilets built. In Cluster B, around 84% of the households agreed to toilet construction. The difference in the amount of toilet construction in Clusters A and B is statistically significant at $p\text{-value} = 0.01^2$ (Figure 11).

² Please note that the toilets in Cluster C (our control group) were constructed by the Government of India and not by TCI-GDS.

TOILETS CONSTRUCTED IN CLUSTERS A, B AND C

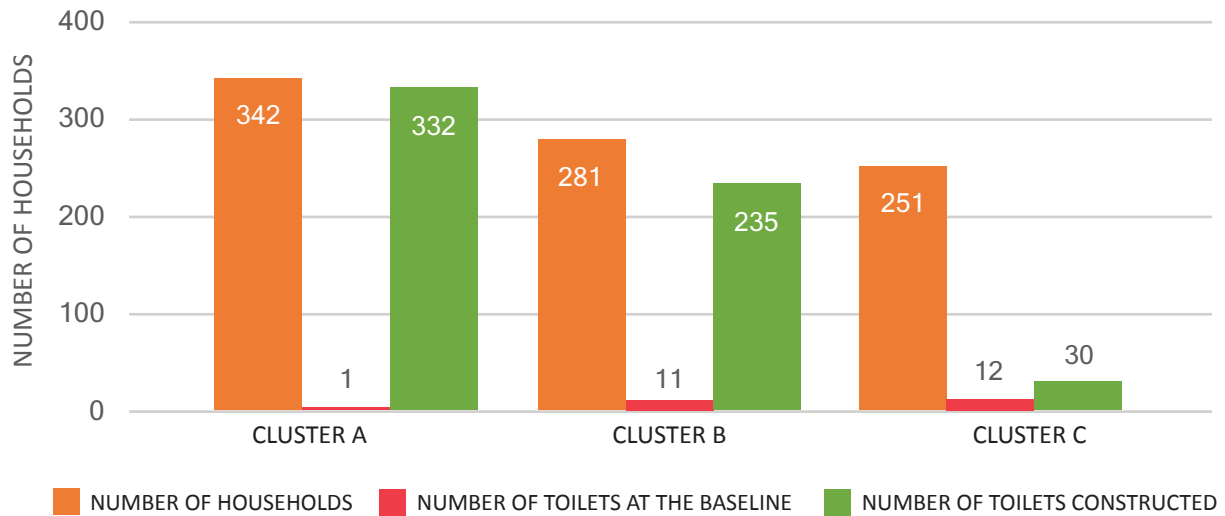


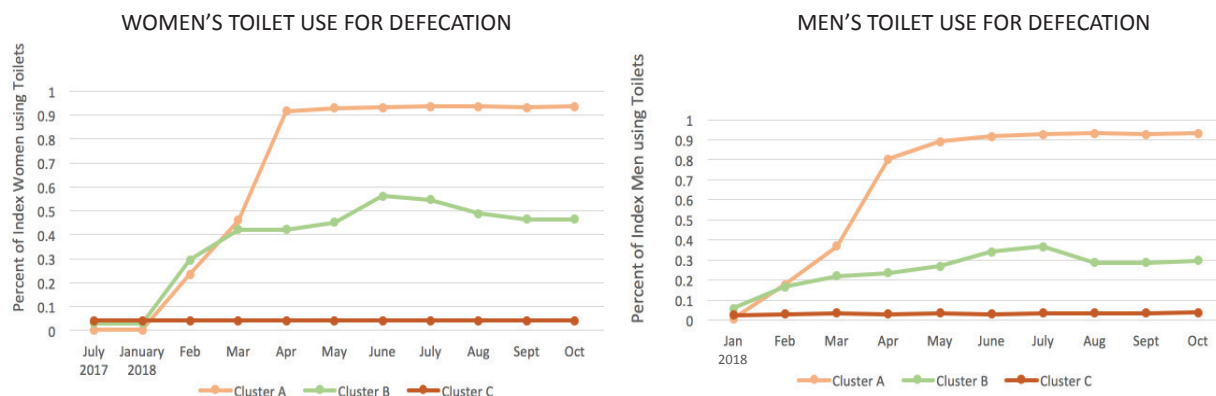
Figure 11: Toilets constructed in Clusters A, B and C

Toilet Use

Designed to gain more insight into understanding toilet use among the different clusters, our study tracks the monthly toilet usage of the heads of the households and their spouses in all households participating in this study (Figure 12).

There is a discernible difference in the toilet usage of the two treatment arms over the months in comparison to the control arm. Within the treatment arms, Cluster A, with behavior change communication, shows a significant increase in toilet use across gender. Women's use of toilets is significantly higher than that of the men in both

TOILET USE FOR DEFECACTION



Note: The graphs depict the monthly toilet usage of the index man and woman of the household. All responses are self-reported

Figure 12: Behavior change communication is the key in translating the availability of the toilets to the actual use

treatment arms. The qualitative findings from the semi-structured focus group discussions support the survey findings. The messages and demonstrations,³ which prompt the community for a closer appraisal of physical outcomes of open defecation are found as significant drivers for the increasing toilet use. The interim results from the study indicate the feasibility of adapting or scaling up the intervention to other TARINA study areas.

Exploring Feasible Options for Diversifying the Basket of Foods Included in India's Food-based Safety Net Program

India's Public Distribution System (PDS) is one of the largest food distribution systems in the world and caters to more than 86% of the total households in the country. The system facilitates the distribution of subsidized food grains and commodities through a network of approximately a half million Fair Price Shops (FPSs). The evidence on operational efficacy of the PDS and personal preferences to provide participants with subsidized food is crucial to the idea of engaging PDS in diversifying the food system.

To better understand the preferences, TARINA's research partner, IFPRI has completed a study assessing the PDS households for their preferences for the delivery mechanism of food—between existing PDS, direct cash transfer (DCT), or food coupons. The study focused on all three TARINA states: Bihar, Odisha, and Uttar Pradesh.

The study reveals that a regional diversity in household preferences exists across states. In Odisha, an overwhelmingly 94% of the households preferred the PDS to DCT (Figure 13). Households preferred the existing PDS in regions in which it is performing well. Other reasons for households' preferences for PDS are lack of awareness of the functioning of banks and lack of infrastructure facilities in rural areas. Fear, conditioned by previous experiences with other government schemes that promised cash subsidies

and by misuse of cash by the men of the households, also tends to weigh preferences in favor of the PDS.

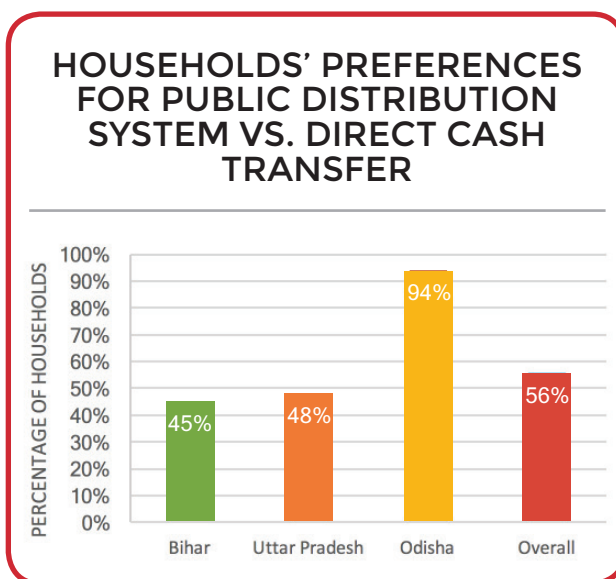


Figure 13: Households' preferences for public distribution system vs. direct cash transfer.

In Bihar and Eastern Uttar Pradesh, however, where the PDS was not functioning as well as in Odisha, almost half of the households preferred DCT to the PDS. The study shows that households preferred DCT, as it gave flexibility for purchasing the households' preferred quality and quantity of food and eased the transactions for the food. DCT also allowed households to better budget their savings and expenditures. Households did not have to interact with government officials and FPSs. The study also found that preference for cash transfers increased with higher levels of education of the household members.

In the context of adding pulses to the PDS food basket, the study sought to examine the dietary and consumption needs and preferences of the communities. There is an increasing demand to diversify the cereals-only PDS food basket to make

³ One such demonstration is the fecal-oral demonstration, found to be one of the crucial triggering activities for behavioral change. A strand of hair is dipped in a sample of old and foul-smelling excreta, and then in a glass of water, which is politely offered to the members of the community. Most indignantly refuse. Flies begin gathering around the feces and also sit atop a pile of rice strategically placed right next to the fecal matter. The community comes to understand that the fly, with 6 feet, is six times more likely to transfer infection from the feces to the rice, than a single hair dipped into the glass, which members rejected, one refusing angrily. The community concludes that they must abandon OD and seeks aid to further this goal, the behavioral change that we have found to be significant in the acceptance of the toilets.

it more nutrition sensitive. States such as Andhra Pradesh, Himachal Pradesh, Telangana, and Tamil Nadu have already added pulses to the basket of subsidized goods sold through the PDS. However, the study shows that adding subsidized pulses to the PDS basket leads to only a small increase in household consumption and an almost negligible net nutritional impact. States that have added pulses to the PDS provide only 1–2 kg of subsidized pulses per month per family. Also, in such a situation, the increase in pulse consumption from the PDS is offset by decreases in pulse consumption purchased from the market. Therefore, the quantity of pulses provided will have to be increased many times to have any substantial impact on total consumption and nutrition.

Also, the availability of pulses is low—both in India and in the international market. Therefore, subsidizing pulses through the PDS does not seem to be a feasible option to increase household-level consumption. Moreover, there is low substitution among different varieties of pulses, as Indian consumers show strong preferences for specific pulses in different regions. This implies that increasing the consumption of pulses requires policy support to increase the production of different varieties of pulses.

From a policy lens, the study indicates that the PDS operations should be decentralized as much as possible. Needs assessment and its mainstreaming in design and implementation of the PDS can offer more locally relevant systems that are accessible and acceptable to the households in different localities.

Interim findings highlight that assessing infrastructural capacities including banking facilities, awareness, and education are required before shifting to DCT in rural areas. The study also recommends that the feasibility of a change from the PDS to cash transfers should be studied in the local context. Based on local or regional preferences, the distribution mechanism for using food coupons (PDS and non-PDS) can also be explored as a pilot program and scaled up, based on an evaluation of the pilot. The food coupon system needs to be reoriented as a food stamp program, and the acceptability of food stamps by non-PDS shops must be ensured.

PROMOTING LIVESTOCK TO ENHANCE FOOD SYSTEM DIVERSITY

Enhancing Quality of Small Ruminants through Improved Animal Health Services

Promoting small ruminants like goats and poultry, dairy production through improved animal health services, and advanced livestock management is another strategy of TARINA for achieving better nutrition through a **strengthened income pathway**. Drawing on BAIF's expertise on small ruminants, TARINA is working toward enhanced health care, linkages with existing services, and better management of goats in the Munger district of Bihar. **Improved breeding, feeding systems, preventive health care, and better market linkages** are the pillars on which the intervention with small ruminants is designed



“There has been a substantial increase in the value of goats in the market. Earlier, our goats sold for INR 200–300/kg, but now go for INR 400–500/kg. This has made goat farming viable for small farmers like us,” shared Rami Kumari Soren, Goat Keeper, Village Lakadkola, Munger district, Bihar.

and are mediated through the **Buck User Groups (BUGs)**. As of August 2018, BUGs had been formed in nearly **one-quarter** of all the TARINA villages

Impacted and Counting...

- Ready to implement **3,000** artificial inseminations (AI) per month for improved breed of goats
- **6,966** goat-dewormings, **5,830** goat vaccinations; **721** poultry dewormings, and **1,587** poultry vaccinations have resulted in improved animal health in TARINA villages

BUGs consist of women members from 7-10 households, with each group keeping 40-50 goats. The members are encouraged to meet regularly for availing inputs and health care services for goats and for collective marketing to improve their incomes.

in Munger, and **36 Black Bengal bucks** have been provided to service the goats in these groups. To build the capacity of the goat keepers, as of August 2018, trainings had been provided to **686** individuals on methods of **goat weighing, castration, deworming, and vaccination**.

The trainings and awareness about available animal health care services in the locality have translated into increased practices of timely vaccination and deworming of goats (Figure 14).

PERCENTAGE OF GOATS DEWORMED AND VACCINATED

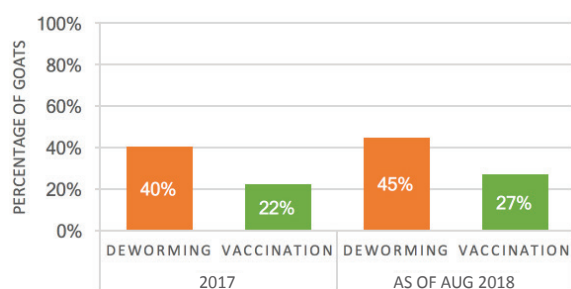


Figure 14: Increased number of animal health services in TARINA villages. (Source: Program monitoring data)

Reduced morbidity among goats is enabling goat keepers to fetch higher prices in the markets. As mentioned by Rami Kumari Soren, a goat keeper from Lakadkola Village from the Munger district, improved breeding and better health care of goats have started reaping results and have increased the value of their goats in the markets.

To give impetus to the technical knowledge for better animal health care, TARINA also provides partial financial support to goat keepers for the construction of goat sheds. A goat shed is a spacious housing for goats with high-raised dry platforms for health management, the use of which has been reducing cases of diseases among the goats.



TARINA provides partial financial support for construction of goat sheds.

Artificial Insemination

As part of breed improvement initiatives, TARINA has initiated **Artificial Insemination (AI)** of goats. With a technical facility set up in the Pune district of Maharashtra, TARINA is now equipped to produce at least **3,000 semen straws (per month)** drawn from various varieties of improved bucks.

“AI service is available at the doorstep, and it leads to better quality of breed selection. This method also eliminates the chances of disease transmission. For goat farmers, this method has helped us address morbidity among goats,” said Bipin Yadav, Goat Keeper, Village Amari, Munger district, Bihar.

Since the AI services are being delivered to the doorstep, the initiative has been gradually gaining ground and acceptance among goat keepers.

“We had been long using traditional methods of breeding, but when we got to know about AI through cluster meetings, and awareness camps, we thought of introducing AI in our goats. Through AI, we can better ensure the quality of breed selection and reduce morbidity. We have attended various training sessions and have an increased knowledge of AI, care of pregnant goats, etc.,” shared Pramila Devi, Goat Keeper, Village Panchrukhi, Munger district, Bihar.

Trainings have been imparted to build the capacity of semen collectors, lab attendants, and evaluators. Checks and balances are in place to ensure standardization of a quality semen freezing process. Protocols for semen collection, freezing, and delivery to households have been developed, building on BAIF's experience with AI for dairy cattle. Awareness programs for goat keepers on benefits of AI in goats and post-insemination care are being held at regular intervals. Distribution of frozen semen has already begun, and breeding of goats utilizing the first batch of 400 AI semen straws has been introduced.

Intensifying Goat Production through a Sustainable Feeding System

India's goat sector is constrained by feed shortages because of limited fodder cultivation, insufficient crop residues, and dependence on common property resources, which are small in size and increasingly degraded in vegetative quality and soil fertility. Human and livestock populations' future growth is expected to increase pressure on the availability and productivity of grazing lands, resulting in fewer feed resources for goats and other animals. TARINA is exploring ways to strengthen goat feeding systems within a larger context of constraints emerging from the growing livestock population, burdens on common property, and reduced availability of goat fodder, that small ruminant producers face. **Tata-Cornell Scholar, Maureen Valentine** conducted an experimental study in the Kandhamal district of Odisha involving goat-owning households in 2016. The research aims to understand the link between goat management decisions that impact animal health and the environment and the effects of goat intensification through semi-stall-fed production on goat health, kid survival, and farmer adoption interest.

Results indicated that the metabolizable energy of pasture forages was low, and there was a high proportion of non-native species among the forage. Goats graze repeatedly in the same grazing areas, which was exacerbating land management concerns, already complicated by deforestation and conversion to agricultural land. When comparing the traditional grazing management system to the semi-stall-fed research group, kid survivability was 4.26 times greater in the semi-stall-fed group. Kid mortality decreased by 22.5% in the semi-stall-fed group, compared to the traditional grazing group (Figure 15). Sixty-three percent of participating

farmers were interested in supplementing their goats after the project's conclusion. The interest and demand for more knowledge regarding best livestock management practices from participating farmers will be instructive for local extension personnel and development organizations on how they can involve farmers. Findings show the potential benefits of shifting to more intensive livestock production with improved feeds. Animal husbandry extension systems have immense potential to assist rural goat farmers with production system changes, but they require more direction about how to help small ruminant owners with preventive or advisory care, rather than the current focus on larger ruminants and curative veterinary services.



Reduction in goat kid mortality has a significant impact on increased community involvement in livestock.

This research furthers TARINA's goal to improve affordability of diet diversity for the rural poor by optimizing the productivity of livestock production systems to increase incomes. With improved



Key Publication Alert

- Determinants of dairy farmer's choice of marketing channels in Bihar, published in *Agricultural Economics Research Review* 2018, 31(1), 149-185
- TARINA Baseline Survey Intervention Report on Livestock

SURVIVAL PROBABILITY OF GOAT KIDS

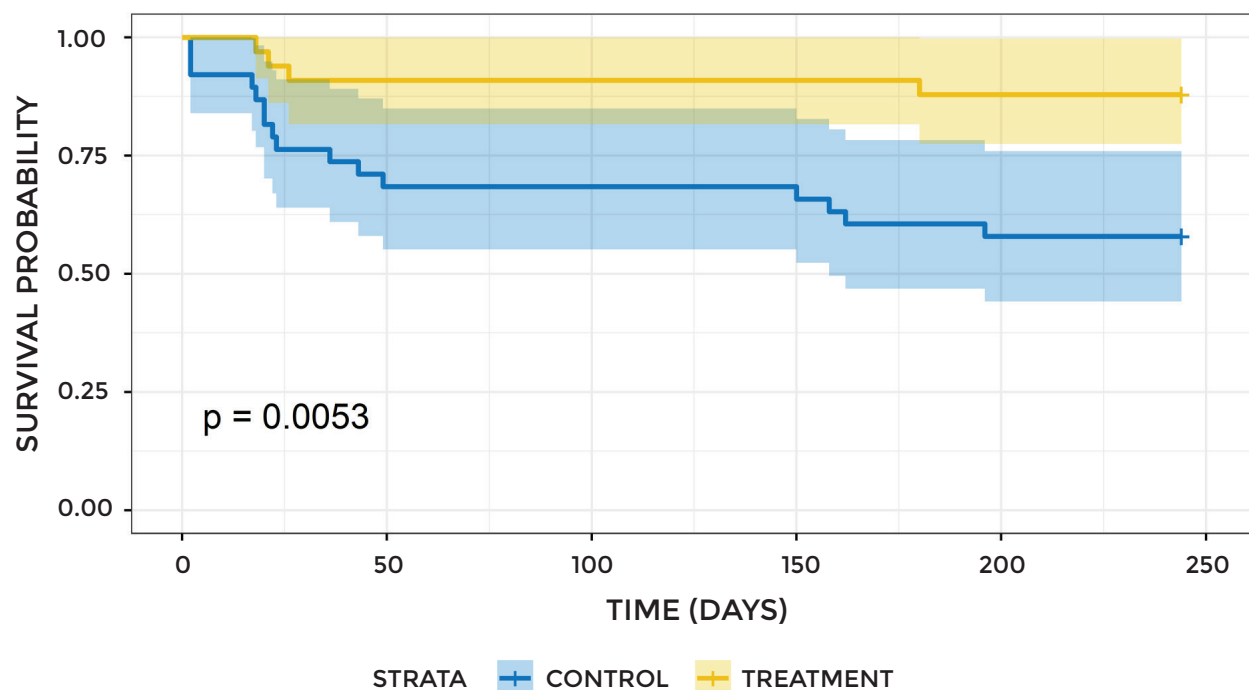


Figure 15: Survival probability of goat kids

incomes, Keyrural farmers will be able to select more diverse diets. In the short term, it is expected that increasing the productivity of the goat industry will better meet the growing domestic demand for goat meat and provide income to rural farmers who are the primary owners of goats. In the long term, more market availability of goat meat would reduce the overall price and afford lower income people the opportunity to purchase meat more frequently, which would drastically improve local diets.

EMPOWERING WOMEN IN AGRICULTURE

Engaging Innovative Technologies to Reduce Drudgery in Agriculture

Reducing women's drudgery in agriculture not only encourages larger participation of women in production systems but frees up their time and energy to also focus on improved childcare and personal and household health, thereby contributing to improved nutritional outcomes. TARINA is working toward

Impacted and Counting...

- 25 need-based innovative LSTs are piloted
- 1,384 farmers are trained on LSTs

this objective by piloting and scaling up various technologies, based on the needs assessed within the community. TARINA has introduced 25 innovative Labor Saving Technologies (LST) across all the

Key Publication Alert

- TARINA Baseline Survey Intervention Report on DSR
- District Fact Sheet on Women Empowerment

The Face of Change: The DSR empowers Santola's time use and resource management



Santola and her drum seeder in action.

My cost of cultivation has also been reduced, as now I can sow paddy on time and do not need to depend upon daily laborers.”

Santola shares how her farming has become a less excruciating exercise, leaving her enough time for her family, socializing with friends, and improving her farming knowledge through trainings. DSR has helped her save approximately 25–30% of irrigation water and has reduced, by seven days, the drudgery in one paddy season on her one-acre plot.

Santola would typically wake up at 5 a.m., finish household chores, and move to the field for transplanting seeds, beginning at 7 a.m. Her extremely tedious day would end only at dusk, leaving her with very little time and energy for herself and her family. She and her family members would complain about the various impacts of time stress in her daily life. After exposure to the demonstration of DSR, she decided to adopt the technology. It took very little time for Santola to be trained and ready to roll her new machine. After one year of using the technology, Santola smiles with pride when she talks about the DSR to other peer farmers in the village, “I first got to know about TARINA’s DSR in 2017, and in that year, I adopted the drum seeder in the Kharif season and later, the zero-till machine in Kharif 2018.

“I enjoy my free time, and now I can spend more time with my family and can monitor my children’s and grandchildren’s diets,” says Santola Shanan, with a happy face, when we talked to her about her experience.

three locations since the onset of the program. Of the technologies, the **Direct Seeding of Rice (DSR)** enables women to **minimize drudgery during transplantation in paddy cultivation**. In 2016, DSR was first introduced to 65 women farmers across **57 acres** of land. It was found to be highly effective and popular among women farmers, encouraging the program to scale up; as of August 2018, around **640 women farmers** had used the technology for paddy cultivation across **314 acres** of land in the Maharajganj district of Uttar Pradesh.

As the implementation gradually progressed, farmers were also trained on possible weed infestation and associated application of pre- and post-germination herbicides.

REDUCING SEASONAL FOOD DEFICITS

Expanding Household Access to Food Diversity by Promoting Kitchen Gardens

In India, farmers traditionally cultivate vegetables and other nutrient-rich crops for home consumption, and they sell surpluses in the local markets. However, the production is limited to only a few vegetables and only during a few months of the year, which can lead to gaps in access and availability of nutritious food throughout the year. TARINA is finding innovative approaches to expand homestead horticulture, working to ensure that farmers have increased

access and availability to diverse foods throughout the year.

Through sustained intervention, TARINA has been able to encourage **7,777 households** to set up kitchen gardens in Bihar, Uttar Pradesh, and Odisha. In 2016,



TARINA is continuing to motivate more households to adopt kitchen gardens across four districts of three states.

one out of 10 households in TARINA intervention areas had kitchen gardens, which **increased to one out of three households** by the end of August 2018 (Figure 16). Earlier, households were cultivating three to four types of vegetables per year in their kitchen gardens. After the intervention, there has been a

substantial diversity observed, with households now growing up to **13 different types of seasonal vegetables (including green leafy vegetables)** in their kitchen gardens.

To encourage more households to develop kitchen gardens, TARINA is engaging with community platforms like SHGs, FFSS, and other interest groups. Based upon the needs of the community, a unique combination of technical inputs, as well as understanding and knowledge of kitchen gardens and maintenance is given to the groups to support them and to enhance production levels. **Training**

Impacted and Counting...

- **One in three** households has adopted the kitchen garden for better access to diversified food across seasons
- **5,144** farmers are trained on PoP for better kitchen garden/wadi management

and **awareness** generation, especially on a critical **package of practices (PoP)**, which include **land preparation, sowing methods, pest management**, and the importance of **vegetables and fruits** in

INCREASE IN KITCHEN GARDENS IN TARINA INTERVENTION VILLAGES SINCE 2016

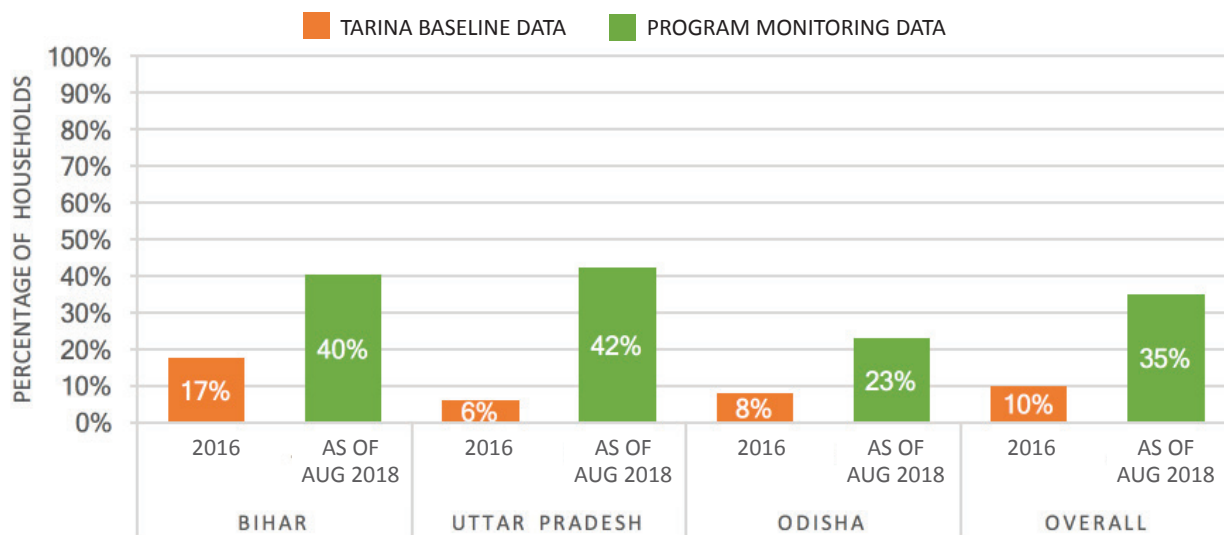


Figure 16: As of August 2018, there has been a considerable increase in the number of households having kitchen gardens.

Face of Change: Hamida's Food Plate is Now More Diversified through her New Kitchen Garden



Hamida (in center) talks about her success to peers.

establish a kitchen garden on her small plot of land. “I attended meetings and trainings on establishing kitchen gardens... I got to know why eating fruits and vegetables can help against malnutrition and prevent ill health within family,” reported Hamida.

Hamida also learned about plot preparation and line sowing practice in the kitchen garden. Within TARINA, BAIF provided a model layout for her to divide her plot into subplots to grow different vegetables concurrently. Hamida irrigated the plot by fetching water from wells.

“Earlier we used to eat only potatoes and onions, but now we will be able to grow okra, gourds, brinjals, chilies, coriander, etc. ... due to the kitchen garden, we can now eat a wide variety of vegetables and fruits,” shared Hamida. With seed support, she can now grow okra, brinjal, bitter gourd, sponge gourd, coriander, bottle gourd, and chilies during May–July, and spinach, amaranthus, radish, carrot, and beetroot during November–January. She is able to consume a variety of vegetables for at least 8–9 months in a year and produces enough yield for her large family.

Hamida Khatoon, of the Dhobiakoda Village in the Munger district of Bihar, lives with her extended family of 14. Her family lives in a semi-pucca (not concrete) house. In a remote area of Munger, villagers lack convenient access to markets and water; most are either landless or small farmers, growing pulses, rice, and potatoes. Hamida, too, grew only onions and potatoes for household consumption, spending around INR 1200–1500 (US\$16–20) monthly for vegetables from the markets.

Hamida did not have cultivable land around her house, but she received help from TARINA to

“Practicing the kitchen garden, using the model, has not only helped me to meet the nutritional needs of my family but is saving a significant amount of money that I used to spend on buying vegetables from the market,” said Hamida Khatoon.

daily diets is being provided for group members and general participants. Additionally, quality seeds procured from the government and private agencies at subsidized rates are being offered to households. BAIF, through its linkages with the National Horticulture Research and Development Foundation (NHRDF), ensures timely procurement of seeds.

Moreover, to address the issue of open grazing, which was a determining factor for many farmers against setting up kitchen gardens, BAIF has provided farmers with fences, and GDS has supported farmers by providing fencing at a subsidized rate.

In addition to kitchen gardens, BAIF within TARINA, has enabled **457 farmers across 20 villages** to address

seasonal deficits of fruits and vegetables through demonstrations for the promotion of seasonal and perennial tree-based farming *wadis*. Input support, such as seeds and saplings, irrigation and pesticides, along with training and supportive guidance on the recommended PoP, are being provided to the households.

Postharvest Loss Management with a Focus on Mycotoxin Exposure: Reducing Nutritional and Socioeconomic Burdens of Unsafe Food

Postharvest loss is one of the major challenges affecting not only the adequacy of food supply but

also the quality of household diets, in areas that which employ predominately traditional agriculture. Among the many factors that lead to the postharvest loss in the rural food system, mycotoxins are potent fungal metabolites that contaminate food and feed chains worldwide. Exposure to mycotoxins can result in diverse health and nutrition deficits, both chronic and acute, in humans and livestock. In addition to the reduced physical and nutritive quality of contaminated food, infestation by mycotoxin-producing fungi can reduce yield and marketability of commodities. In India, as in other parts of the developing world, local regulatory capacity is insufficient to adequately detect and ameliorate mycotoxin contamination, leaving many farmers' harvests unscreened and allowing potentially contaminated food and feed items into the diets of vulnerable people and animals.

The TARINA Baseline Survey revealed that about 19% of all farmers in TARINA locations reported loss of some stored crops; more than one-quarter reported fungal growth and aflatoxin accumulation as reasons for loss. Yet, there was little evidence on mold-produced toxic compounds affecting postharvest quality and quantity of the village food system in the Indian context.

TARINA has embarked upon a unique laboratory-based analytics and community participation-blended intensive research effort to assess the extent of mycotoxins in major crops, as well as create feasible and locally acceptable solutions and opportunities for reducing the nutritional and socioeconomic burdens of unsafe food.

TATA–Cornell Scholar, Anthony Wenndt is conducting a household-level longitudinal survey of mycotoxin contamination across a range of susceptible commodities in 184 houses, encompassing 6 villages in the Unnao district of Uttar Pradesh. In November 2017, stored batches of groundnut, maize, pearl millet, paddy, and milled rice from participating households' storage facilities were selected for study. Initial findings indicated mycotoxin contamination (primarily aflatoxin, the most potent known mycotoxin) was prevalent in these food systems at levels that can be detrimental to human and animal health and nutrition.

Maize and groundnuts are most affected by aflatoxin, both in terms of frequency and magnitude, with some contamination exceeding 1,000 ppb (India's regulated limit for safe human consumption is 15 ppb). Sizable

aflatoxin loads were detected in paddy (unmilled rice) and pearl millet. Preliminary comparisons between milled and unmilled rice from the same farms indicate that most of the toxin is in the husk and bran of the rice kernel and is, therefore, largely (but not completely) ameliorated by the milling process.

Deoxynivalenol (DON), a major wheat-affecting mycotoxin, has not been detected in any wheat samples from the study area. Similarly, a major carcinogenic maize- and millet-affecting toxin, fumonisin, is largely absent in samples collected in the study area. This finding, coupled with the lack of associated crop diseases reported in the field, suggests that the fungal species responsible for



Aspergillus flavus contaminated maize from household storage in Uttar Pradesh.

fumonisin and DON contamination are absent or non-toxicogenic in the study area—a finding that can help in identifying priorities for mycotoxin risk management and in conceptualizing how mycotoxins fit among spoilage agents in household grain storage.

Time-point data from the longitudinal survey to date has revealed several important trends in mycotoxin accumulation across the target commodities (Figure 17). In groundnuts, the mean aflatoxin contamination level has remained relatively constant over time. In maize, aflatoxin levels have consistently been very high across all time-points. Paddy, not traditionally considered highly susceptible to

TRENDS IN MYCOTOXIN ACCUMULATION ACROSS THE TARGET COMMODITIES

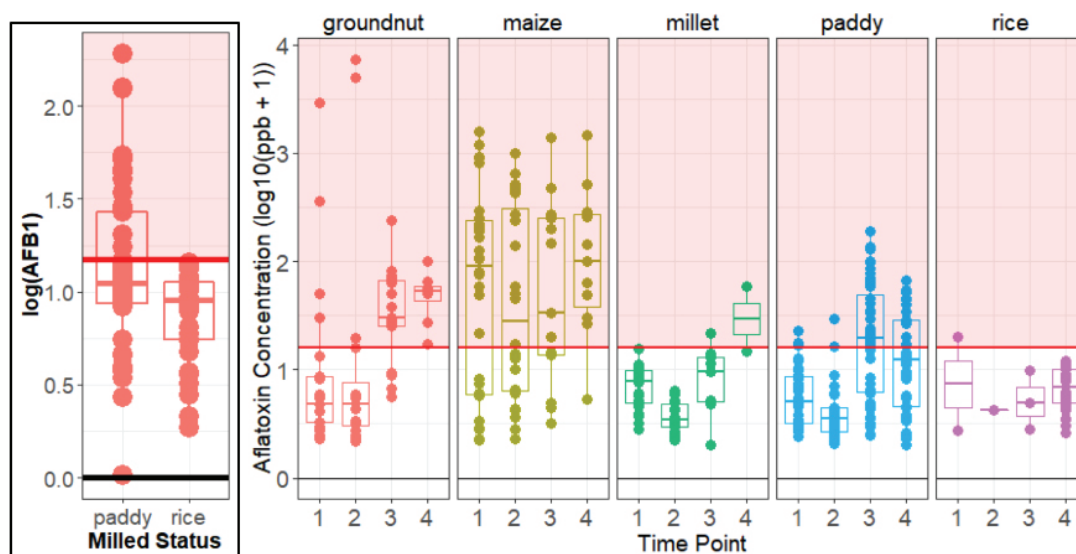


Figure 17: (Left) Aflatoxin concentration observed in milled and unmilled samples of the same rice batches, with samples having reduced, yet still quantifiable, levels of toxin post-milling. (Right) Time series progression of aflatoxin B1 contamination in enrolled household samples. Only samples with detectable (>1 ppb) levels of aflatoxin B1 are shown. The red line represents the regulated legal limit (15 ppb), and any points in the red-shaded portion of the figure represent samples with contamination in excess of that limit

aflatoxin contamination, has yielded considerable levels of the toxin throughout the longitudinal survey. There was an unexpectedly dramatic leap in aflatoxin contamination in paddy in March 2018 (Time-point 3), and TARINA is presently working to understand potential environmental and/or biological factors at play in this uptick at ~6 months postharvest. The lowest levels of aflatoxin contamination were observed in stored pearl millet and milled rice samples.

Efforts are ongoing to develop participatory data collection and problem-solving opportunities for target village communities (Figure 18). Farmers are being successfully engaged in ethnographically documenting seasonal cultivation and food management behaviors, and characterizing prominent grain storage pests and disease concerns.

Given the prevalence of sack-based grain storage systems in the study area and their demonstrated susceptibility to spoilage, our participatory research approach elevated hermetic (airtight) storage systems as a user-friendly intervention to introduce in enrolled households. The farmer-oriented training program has been successfully administered to 98%

Translating the Evidence to Action

Based on preliminary findings, TARINA is piloting and scaling up improved storage technologies like hermetic bags, grain storage drums, and moisture meters. These technologies have been introduced for pulses such as chickpea, green gram, and black gram; vegetables; and staples, including wheat, in all TARINA locations. Awareness is being generated through SHGs and FFS platforms. Around 820 households have received benefits of these technologies and have been able to store approximately 55 tons of crop harvest for future consumption, selling in the market, or using as seeds in the next sowing season.

of participating households (180/184 total enrolled households). Hermetic storage sacks were distributed

GUIDED PARTICIPATORY RESEARCH TOOL

भंडारण प्रथाओं की समूह गतिविधि

इस से... → इस में...

कठिनाई	वांछनीयता	कारण / टिप्पणियाँ
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● ● ●	● ● ●	
● ● ●	● ● ●	

HH ID: _____ ; Gender: M F ; Age: _____

1-10 के पैमाने पर प्रत्येक संकल्प की "कठिनाई" और "वांछनीयता" को रेट करें।
1 = सबसे कम
10 = सबसे अधिक

टाट की बोरी
पॉलिथीन बोरी
मिट्टी का सिलो
धातु सिलो

Figure 18: Guided participatory research activity, in which participants (top) rate the desirability and practicality of hypothetical switches between various grain storage systems using simple score cards (bottom)

(2 per participating household) to participants for a household-level trial. Participants have been engaged in monitoring the quality of their grain and the storage environment, and qualitative interviews indicate an overall positive usage experience.

This study, with implications for policymakers, is demonstrating that supervised local self-monitoring, enabled by structured and informative participatory process, can ideally cultivate an indigenous sense of value of food safety, an understanding of the link between food quality and nutrition security, while lifting some of the burden from formal but overburdened regulatory oversight, and also effectively mitigating mycotoxins and other food

Key Publication Alert

- District fact sheet on kitchen gardens/wadi
- TBSI report on kitchen gardens (GDS/TCI)

spoilage and waste in a locally adapted manner. The process is also producing a toolkit and organizational model for community action, which could be adapted for other efforts to realize nutritional and social gains.



Workshop

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DELHI



RE-IMAGINING FUTURES
ISS



ENHANCING CAPACITIES OF KEY PLAYERS AROUND FOOD SYSTEMS AND NUTRITION

Capacity Building Workshops in Year 3

- M&E Workshop for NGO Project Managers with Grameen Development Services (GDS)
- M&E Workshop for Managers of CSR (Corporate Social Responsibility) projects with Tata Institute of Social Sciences (TISS)

TARINA, through expertise and research products of its Center of Excellence (CoE), works toward building capacities of partner organizations, grassroots-level frontline workers, and various stakeholders. Throughout the past year, various training and workshops were held for Corporate Social Responsibility (CSR) managers and NGO project managers. Ranging from trainings on Monitoring

and Evaluation (M&E) to evidence-based solutions for development effectiveness, emphasis has been placed on effective program implementation, better monitoring, and impact evaluation for agriculture and food systems-oriented intervention programs.

In many technical sessions, these workshops focused on the fundamentals of M&E, including the Theory of Change (ToC) and Management Information System (MIS), evaluation methods, sampling methods, and data interpretation. Basics of drafting Terms of Reference (ToR) for commissioning studies, along with examples of best practices and good evaluations, were also shared. Overall, the workshops aimed at providing practical guidance on how managers can improve the implementation and effectiveness of their projects to maximize impact. TARINA will continue its efforts to prepare and strengthen M&E capacities of various stakeholders.



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ENGAGING POLICYMAKERS FOR INCREASED POLITICAL COMMITMENT TO NUTRITION-SENSITIVE AGRICULTURE IN INDIA

TARINA has been shifting gears in engaging with the state and central government, policymakers, sector leaders, and leading research institutions to increase awareness and political commitment for linking agriculture and nutrition in India. In collaboration with other partners, TARINA has held several national- and state-level fora to disseminate evidence and facilitate dialogue on strategic policy issues related to sustainable, nutrition-sensitive agriculture.

Roundtable Discussion on Nutrition-Sensitive Budgeting in India

Agricultural policies in India since the 1960s have largely focused on hunger alleviation, with emphasis on production of staple grains. Although this policy focus led to the successful reduction of widespread starvation, foods rich in micronutrients (vitamins and minerals needed for healthy human growth and development) have been neglected in crop production. Thus, in present-day India, the food security challenge has shifted to one of nutrition security. The “triple burden of malnutrition,” is emerging as an imminent public health concern. Although rural India still struggles with undernutrition, urban India is experiencing a greater prevalence of obesity and other noncommunicable disease burdens. So, it is crucial to look at the government’s policy priorities and assess the expenditure patterns that affect food production in India.

TARINA, along with the National Institute of Public Finance and Policy (NIPFP), co-hosted a national-level roundtable in February 2018 on “Budgeting for a Diversified Food System for Improved Nutritional Outcomes: Perspectives and Opportunities.” The focus of the dialogue and deliberation was to shine more light on the pattern of government expenditure on agriculture and assess how sensitive it is toward a diversified food system, which is essential to mitigate malnutrition.

The consortium identified, compiled, and analyzed the historical expenditure data on agriculture for 16 years within the Government of India’s budget. The analysis of the historical expenditure data suggests a greater part of the agriculture expenditure is directed toward food subsidies; even within the budget

allocation skewed toward crop husbandry, a major share goes toward fertilizer subsidies, which are largely used for production of staple crops. The share allocated for production of diversified crops has been low over the period of time analyzed, including the pulses within the crop husbandry allocation. Hence, in this context, there is a pressing need to increase the non-subsidy expenditures in the agriculture sector with a focus toward diversified crops, such as



Dr. Prabhu Pingali, Director, Tata–Cornell Institute, gives the inaugural talk in the roundtable discussion.

pulses, oilseeds, and horticultural crops for improved nutritional outcomes. TARINA is committed to further analysis to better understand, with more specificity, the needed budget distribution toward a better diversified food system at the national and state levels.

Advocacy Dialogue to Encourage Agricultural Diversification in Bihar

Bihar has benefited from the policy focus and active government support toward modernizing agricultural production, which is mostly centered on cereals, and has achieved food security in the state. However, high levels of hidden hunger and malnutrition persist in the state. The recent figures from the NFHS-4 survey on stunting among children under 5 years and anemia among women are quite high, as compared to figures for India as a whole. To address this problem, there is a need to strengthen the food system in the states with government support at different stages of production,

including diversification and incentivization of agricultural produce beyond cereals. This would not only benefit food and nutritional security, but also directly affect incomes of farmers.

In order to address some of the policy issues directly affecting the food systems in the state, **TARINA, in partnership with the Asian Development Research Institute (ADRI)**, held an advocacy dialogue on “**Towards Developing a Diversified Food System in Bihar for Improving Nutritional Outcomes**” in March 2018. Leading government officials, who are actively involved in policy-level decisions related to agriculture in Bihar, attended the policy dialogue.

The policy dialogue sought to deliberate upon diversifying food in Bihar and the related constraints, issues related to the animal husbandry sector, and increasing farmers’ incomes through improved markets and value chains.

There is a need for policymakers to think beyond staples and start promoting non-staple foods to ensure commercial viability of farms in the long run. Linking farmers, who cultivate non-staples, to the food value chain should be a key strategy for enhancing income, generating upstream and downstream employment, and reducing poverty.



Leading government officials at the policy dialogue in Bihar.

Encouraging the private sector to set up food processing facilities and modern value chains would add value to agricultural output and create more employment opportunities.

Strengthening allied sectors, such as the livestock sector, is equally important for diversifying food systems in Bihar. For this, breed improvement

is recognized as important to enhancing the productivity in the sector. To strengthen the livestock sector, improved animal health services (veterinary hospitals, diagnostic labs, AI centers, vaccinations, etc.) and fodder availability is required.

Adequate attention to processing and value addition is important to minimize postharvest losses, increase shelf life, and retain nutritive content of food products. Investment in rural infrastructure is needed to create an enabling environment that will attract private investment and encourage farmers to grow perishables. In addition, aggregation models for marketing through SHGs and FPOs need to be encouraged. Investment in research and extension activities to impart knowledge on commodity flows across national markets will be necessary for farmers to participate in the e-marketing processes of the global organic e-markets.

Policy Dialogue on Small Farm Aggregation Models

The amendment of the Companies Act in 2003 enabled the formation of Farmer Producer Companies (FPCs). The FPCs were envisaged to provide functional support to their members for access to credit, inputs, R&D, and training, as well as serve as platforms for contracts, aggregation before sale, and potentially higher bargaining power for its member farmers.

In this context, **TARINA, in partnership with the International Food Policy Research Institute (IFPRI)**, organized a policy workshop on “**Small Farm Aggregation Models in India**” in August 2018. The objective of the dialogue was to assess the challenges faced by the Farmer Producer Companies/ Farmer Producer Organizations (FPCs/FPOs) in governance, management, market linkage, vertical coordination, and larger private sector participation in linking small farmers to markets.

Recognizing that aggregation is a platform in which market asymmetry between buyers and sellers should be dissolved, from a policy perspective, it is imperative to focus research on this area. Setting the broad contours of an agenda for research on the subject, the deliberations suggested that future policy formulation for upscaling FPOs in India and enhancing their commercial viability should draw upon learning from aggregation practices adopted by the small and marginal farmers in other countries.

There are different competing models in agriculture, like cooperatives and aggregations through FPCs/ FPOs. Given that these models have differing characteristics, it was suggested that policy research should be undertaken, so that promoting one model

does not diminish other models. Simultaneously, research efforts would also be required for capacity building of FPOs to convert them into agri-entrepreneurs.



Policy dialogue held at New Delhi on "Small Farm Aggregation Models in India."



LOOKING AHEAD TO YEAR 4

In last three years, TARINA has significantly accelerated toward achieving its program goal (Figure 1, p. 7), by making tangible and significant changes in people's lives, gathering evidence about best practices, building capacities of key players around the food system, and engaging policymakers in various discourses. TARINA will continue its efforts into Year 4, where TCI and consortium partners envisage strengthening and scaling up field interventions, building newer policy-relevant evidence, and amplifying the capacity building and policy advocacy.

Field Intervention

Building on the intervention's success of reaching out to almost all targeted villages in TARINA districts, in Year 4, implementation partners plan to focus on intensifying the interventions, so that the impacts are more visible and achieve coverage saturation. Some of the key visions within the intervention are:

- More focus on the adherence to diversified cropping behavior among the farmers;
- Strengthening the linkages of households, communities, and villages, with enhanced access to input and output markets, including alternative approaches to small-farm aggregation;
- Scaling up of the artificial insemination of goats for improved breeding, after assessing the cost-benefit of natural breeding compared to artificial breeding;
- Strengthening the empowerment of women farmers in the context of resource access and utilization; and
- Expanding the social and behavioral change communication intervention to translate enhanced awareness to more nutrition-sensitive behavior.

Evidence Building

TARINA plans to conduct a midline survey in early 2019 to measure the magnitude and drivers of the changes by: (1) comparing villages within and outside of TARINA intervention; and (2) following up on the panel households. This survey is designed to support the implementation partners in identifying strengths and sharpening their respective ground-level activities.

In addition to more extensively analyzing the efforts of the past three years and disseminating the results of ongoing studies in the coming year, TCI and its research partners look forward to embarking on new studies related to:

- Understanding impacts of the dynamics of agricultural marketing on farmers;
- Creating better data on the agri-market;

- Further examining the linkages between gender, agriculture, and nutrition in India;
- Developing innovative behavior change strategy to improve complementary feeding of children; and
- Making economic assessments of various best practices for improving the food system and nutritional outcome at community level.

The findings from these research endeavors will further inform ground-level implementation and provide for policy-relevant recommendations.

Policy Advocacy and Capacity Building

In Year 4, TARINA aims to direct more of its energies on policy advocacy by utilizing the generated evidence, program learning, and research products of the CoE. As agriculture is in the domain of the state governments, TARINA plans to engage more of the state- and district-level policymakers in the discourses on making the food system more nutrition sensitive. Some of the key activities planned around agriculture and nutrition at national and state levels are focused on:

- Biofortification of food;
- Seed inputs and the agricultural market;
- Exploring how the agriculture budget can be more nutrition sensitive; and
- Fostering gender empowerment in agriculture.

TARINA also plans to continue its lecture series on different critical issues around food system and nutrition among academia and researchers.

TARINA will keep enhancing the capacity of the key players around agriculture, the food system, and nutrition through COE's various training manuals, training modules, and research products. The key themes of capacity building for Year 4 are:

- Designing nutrition-sensitive programs;
- Developing and utilizing more effective metrics for measuring the food system and nutrition-related outcomes;
- Designing and managing large-scale surveys around agriculture, the food system, and nutrition; and
- Implementing better data utilization.

TCI-TARINA also plans to intensify its outreach to organizations working in the agriculture-nutrition space and offer technical assistance in generating better evidence and translating the evidence to program and policy advocacy.



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