Accelerating Farm Incomes (AFI): Building Sustainable Soil Health, Markets and Productivity in Telangana State, India

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Walmart Foundation

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Acronyms and Abbreviations

AFI	Accelerating Farm Incomes
CBO	Community-based Organization
FPC	Farmer Producer Companies
FPO	Farmer Producer Organization
FYM	Farm Yard Manure
GAPs	Good Agricultural Practices
GI	Galvanized Iron
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and Communications Technology
IFDC	International Fertilizer Development Center
IFFCO	Indian Farmers Fertilizer Cooperative
IPM	Integrated Pest Management
ISP	Input and Service Provider
M&E	Monitoring and Evaluation
MOU	Memorandum of Understanding
NABARD	National Bank for Agriculture and Rural Development
NGO	Non-Governmental Organization
NPK	Nitrogen, Phosphorus, Potassium
PAD	Precision Agriculture for Development
PJTSAU	Professor Jaishankar Telangana State Agricultural University
PUA	Peri-Urban Agriculture
SFAC	Small Farmers Agri-business Consortium
SHG	Self-Help Group

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Project Description

The Walmart Foundation awarded the International Fertilizer Development Center (IFDC) a development project titled "Accelerating Farm Incomes (AFI): Building Sustainable Soil Health, Markets, and Productivity in Telangana State, India." This Walmart Foundation project is a two-year and 10-month intervention starting on October 1, 2019. It is designed to strengthen and reorient agricultural production systems in the peri-urban agriculture (PUA) and rural locations of Telangana State, India, through technology diffusion, capacity building, and micro-enterprise development. All three components are crucial for market-driven agriculture production system sustainability. The project is expected to achieve an immediate impact on improved productivity and production as well as increased farmer income due to enhanced resource use efficiency and by linking farmers with markets. AFI will focus on the following key issues in improving crop productivity and farmers' income in Telangana state:

1. Increasing productivity by creating awareness and enhancing farmer knowledge on good agriculture practices (GAPs).
2. Ensuring introduction and adoption of site-specific technologies (seed, fertilizers, crop protection practices, and products) to suit Telangana's marginal soils (with low nitrogen and phosphorus levels), which have severe nutrient deficiencies in semi-arid/rainfed conditions.
3. Creating access to viable marketing pathways and sustainable opportunities for selling farmers' produce and optimizing their income.

During Year 1, emphasis was placed on the dissemination of GAPs, including improved technologies to PUA farmers and rural farmers. The diffusion of improved technologies requires attention to both demand- and supply-side issues – creating awareness and enhancing knowledge on GAPs and innovative technologies (a precursor to demand growth) – and concurrently to stimulating entrepreneurial investment in agro-input and quality product supply to afford access. The implementation strategy involves focusing on and strengthening the following areas:

- Incorporating PUA as part of the poverty alleviation process.
- Linking targeted peri-urban poor to markets for timely sales and better price of their agricultural products.

- Empowering community with special emphasis on gender and youth by providing training and advisory services for capacity building.
- Disseminating climate-resilient and adaptable innovative technologies for enhancing the efficiency of natural resources (water, labor, and energy), mechanization, and quality seed use and reducing post-harvest losses for commodity groups, depending on the cropping pattern in the selected districts: rice-, maize-, pulse- and vegetable-based cropping systems following the GAPs approach:
  - Improving nutrient use efficiency in rice-, vegetable-, pulse-, and maize-based cropping systems.
  - Enhancing balanced nutrient use (secondary and micronutrient uptake) in cereal-based cropping systems.
  - Improving irrigation and water use efficiency in semi-arid agriculture systems.
  - Introducing smallholder farmer mechanization to enhance energy, labor, and time efficiency along with natural resources.
- Providing commercial orientation to PUA in Telangana State through the involvement of smallholder farmers, particularly by encouraging women and youth in such initiatives.
- Recognizing the growth and demand for horticultural products (vegetables) in the metropolis of Telangana State and the potential for export opportunities with the international airport, PUA-related interventions will help smallholders' access sustainable farming and income opportunities.

The project is expected to strengthen inter- and intra-partner relationships including resource-poor farmers, private sector extension agents, agricultural input suppliers, and output buyers in the project domain region and beyond. The forward and backward linkages establish achievement of a market demand-based sustainable production system. The project improves the technical capacity of private sector extension agents as well as resource-poor farmers toward the effective use of technologies. Sustainable partnerships are also expected to be developed through participatory learning processes, such as workshops, training, field days, field visits, farmer visits, and other innovative knowledge dissemination forums as web-based platforms.

This is the first annual progress report of the AFI project. This Year 1 progress report describes the planned activities and the outcomes under AFI from October 2019 to September 2020 and outcomes achieved.

Project Goal and Objectives

The project goal is to increase productive employment in agriculture and related enterprises through the creation of competitive but sustainable markets for stakeholders in the value chain involving agribusiness inputs, outputs, and technologies. The project vision is in line with the Walmart vision.

The specific objectives are to:

1. Accelerate farming incomes through productive technologies focusing on soil health, seed materials, and integrated approaches on nutrient-water management, i.e., an integrated soil-

seed-water approach, to ensure sustainable outcomes for rice-, maize-, pulse- and vegetable-based cropping systems in semi-arid regions of Telangana State.

Innovative technology transfer through farmer-based organizations or individual farmers and extensive consultations and advocacy campaigns through public extension and private firms imparting new and efficient products and delivery mechanisms will accomplish this.

2. Build thriving markets through commercial orientation to farming toward promoting peri-urban agriculture in Telangana State.

Project Location

AFI is implementing the project mainly in the PUA areas of three southern and central districts of Telangana – Mahbubnagar, Rangareddy, and Medak (Figure 1) to help improve farmers' crop productivity levels, link them to sustainable markets, and thus provide opportunities for generating off-farm and on-farm employment among the farming households.

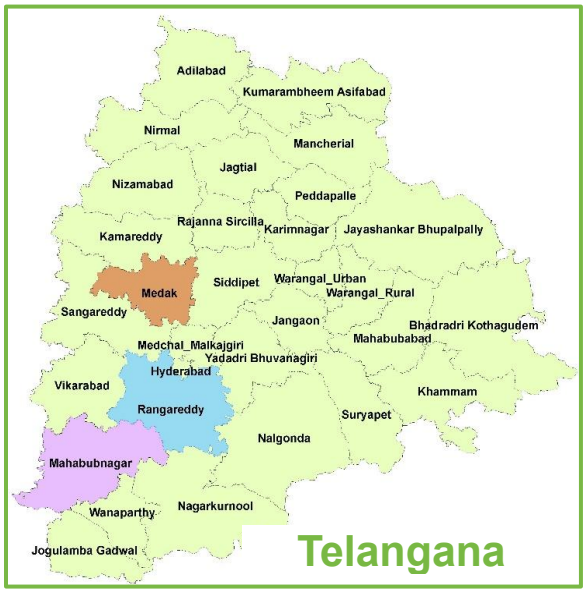

Figure 1. AFI Project Location

The main project office has been set up in Hyderabad. Two satellite offices are set up in Mahbubnagar and Medak. The field officers of Rangareddy will be working from the Hyderabad office. This office arrangement is consistent with both the technical requirements to achieve performance indicators and the budget. In total, nine mandals and 38 villages have been identified for selection of farmers in these three districts. Based on the baseline survey, AFI has started its work in these villages. Details on the mandals and villages and number of farmers selected in each village is presented in Appendix 1.

Project Activities in Year 1

The conceptualization of consumer products and services as a supply chain becomes extremely convenient when planning to focus on quality, improved logistics, and reduced transaction costs. Hyderabad, the capital city of Telangana, is a consumer city facing dependencies, especially on vegetable crops, due to urbanization and changes in food habits. Therefore, an assessment of the various agricultural and food supply chains is important. In a value chain, usefulness and efficiency are added to the products and services for enhancing customer utility. Enterprise development, processing, and value addition in agricultural commodities are essential for enhancing farmer's revenue, and hence, value-chain-based approaches are very much relevant in this context. Encouraging private sector participation, with a suitable mobile-based application to train farmers and retailers/market actors, helps ensure traceability toward quality assurance for market development, technology transfer, and sharing information to foster agri-entrepreneurship among

rural and peri-urban farmers. This potential could lead to an exciting paradigm shift, facilitating transparency and trust in food chains that will ensure the quality of food products. Major project activities planned and achieved during Year 1 are provided in Table 1.

Table 1. Annual Achievement of Technical Activities October 2019 through September 2020

Sl. No.	Activity	AFI Year 1		
		Target	Actual	% Achieved
Project Start-Up				
1	Setup of a project office	3	3	100%
2	Appointment, mobilization, and posting of all staff	18	11	61%
3	Procurement of furniture and equipment			
4	National launching ceremony	1	-	-
Reporting				
5	Annual work plan	1	1	100%
6	Monitoring and evaluation (M&E) plan	1	1	100%
7	Baseline survey	1	1	100%
9	COVID-19 situation analysis	-	1	-
10	Annual report	1	In process	-
Technical Activities (Objective 1: AFI through productive technologies)				
11	Stakeholders' orientation: one-on-one/informal meetings	Continuous	Continuing	-
12	Training sessions for farmers on productivity improvement	210	5	2%
13	Field days	50	-	-
14	Motivational field trip for farmers (1 day)	10	-	-
15	Motivational meeting with farmers	5	5	100%
16	Field demonstrations on crops	205	10	4%
17	Crop cuts – demo farms (impact indicators)	205	-	-
Objective 2: Building thriving markets through commercial orientation of farmers and market stakeholder towards promoting PUA				
18	Market assessment report	1	-	-
19	Stakeholders' seminar linking farmers with market actors	3	-	-
20	Training of agro-input dealers	3	-	-
21	Training of rural retailers and farmers on small business	3	-	-
22	Providing direct technical assistance to farmers/rural entrepreneurs	Continuous	Continuing	-
23	Media/communications	Continuous	Continuing	-
24	Training materials/brochures/handouts/signboards	Continuous	Continuing	-

Project Start up Activities

IFDC applied in February 2019 to relevant authorities of the Government of India to open a branch office as an international organization, which is yet to be approved. Therefore, IFDC management, in consultation with the Walmart Foundation, decided to start project implementation with the

assistance of International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The delay in opening of the IFDC office, followed by imposition of a five-month lockdown by the central and state governments, has further delayed the entire process of implementation of the project in Year 1. Therefore, there were delays in project start-up activities of appointing full staff, mobilizing them, and leasing offices. Also, the launching workshop could not be organized.

Reporting

In terms of reporting, IFDC managed to achieve submission of all reports on time, including the baseline survey. In addition, IFDC conducted a rapid assessment of the COVID-19 situation during the pandemic by interviewing 17 farmers, 16 retailers, 12 government extension officials, and five supermarket owners by phone. The key findings are attached in Appendix 2.

Technical Activities

The technical activities related to Objective 1 started in mid-July 2020 after the lockdown was lifted. All the field staff, including the senior staff, first started the one-on-one/informal meeting with various stakeholders and began identifying progressive farmers, including women, for attending the training programs. So far, 1,121 farmers have been selected as direct beneficiaries of the project.

Farmer Training on Good Agricultural Practices: As part of recognizing the role of horticulture crops in improving the PUA scenario, training to farmers on vegetable crops has been in the forefront this year. The farmer training programs have been designed to improve farmer knowledge of crop management in general, with emphasis on increasing awareness and knowledge of using good quality seeds, implementing soil fertility management, and promoting the agricultural farm as a commercial venture. The programs are events lasting only a few hours, with the trained AFI senior staff as the resource persons. The field coordinators and field monitoring officers also work as resource persons after receiving proper orientation by the senior staff. Retailers are also attending farmer training programs. As of September 30, 2020, five training programs had been conducted on tomato and integrated pest management (IPM), with participation of 160 farmers, including women (34%; Table 2). Details by village and mandal are provided in Appendix 3.

Table 2. AFI Farmer Training for Vegetable Crops through September 2020

Item	Number of Batches	Number of Farmers Trained		
		Men	Women	Total
Total Project	5	105	55	160

Source: AFI Training Database.

Field Demonstrations: Ten demonstrations have been established to show the farmers the benefits of GAPs and improved technologies in the project area for tomato, bitter gourd, ridge gourd, and green chili. The technologies/improved practices demonstrated include the following:

- Crop Support (Trellis system): Support provided to the crop/plants through bamboo/wooden poles, tying up with galvanized iron GI wire, and providing creeper mesh.

- Crop Protection: Biological traps, such as pheromone traps, yellow sticky traps, and fruit fly traps, to kill insects.
- Crop Nutrition: Fertigation (nitrogen, phosphorus, potassium [NPK] + Micronutrients) in drip irrigation and foliar application of micronutrients.
- Soil Health Management: Application of farmyard manure (FYM), vermicompost, and other organic fertilizers in combination with chemical fertilizers.
- Weed Management: Use of plastic mulch sheet to avoid weed germination.
- Bio-Control Agents: Seeds treated with bio-fungicides, such as *Trichoderma viride* or *Pseudomonas fluorescens*.
- Nursery Raising: Nursery raising in raised beds and seed trays.

Detailed information, with locations of 10 demonstrations established, is provided in Appendix 4.

Orientation Training on Establishing Demonstration Plots: Before establishing demo plots, an orientation training was conducted in each of the three districts to bring demo farmers to mutual agreement and provide the necessary knowledge on what demo themes will be undertaken, roles and responsibilities of each player, respective contributions, and expected outcomes of the demo.

Training and Promotional Materials: To make all the stakeholders aware of issues related to their health safety, two brochures on COVID-19 were prepared, and the material will be distributed to farmers, including women, and retailers/dealers/supermarket owners. In addition, as part of recognizing the role of vegetable crops in improving the PUA scenario, training to farmers on vegetable crops came in the forefront this year. By the end of September 2020, nine training modules on different vegetable crops (tomato, eggplant, okra, green chili, cucumber, bitter gourd, ridge gourd, bottle gourd, and onion), focusing on good or improved agricultural practices, including soil health management, IPM, benefit-cost ratio, and market linkages, were prepared, which are relevant to the project locations and are in demand by city dwellers.

Digital Tools and Mobile Applications: As a part of Objective 2, the AFI project targets increased access to information on agricultural technologies, markets, commodity prices, supply chain linkages, technology transfer, and knowledge transfer mechanisms using digital tools and mobile applications for farmers and input and service providers. The AFI project also aims at improving the capacities of extension personnel in state-of-the-art agricultural technologies and knowledge transfer mechanisms using information and communication technology (ICT) tools. ITC's e-Choupal initiative, supply chain linkages with market information through an e-platform, is a successful example to learn from. The AFI project held discussions with the following companies and organizations to explore mobile phone-based software solutions/tools suitable for the needs of the project:

- Kuza, Digital Micro Learning Platform (https://www.kuza.one/)
- eProd, Management Solutions for Agribusiness (https://www.eprod-solutions.com/)
- Precision Agriculture for Development (PAD), mobile phone-based agricultural extension (https://precisionag.org/)
- SourceTrace Systems, mobile phone-based software-powered digital agritech platform (https://www.sourcetrace.com/)
- iHub@ICRISAT, innovation hub for agritech entrepreneurs (https://www.icrisat.org/tag/ihub/)

We are in the advance stage with SourceTrace Systems, which offers suitable and appropriate solutions for farm management, farmer advisory services, training management, traceability, certification, supply chain management, monitoring and evaluation, market linkage, and financial services. The underlaying technology of SourceTrace comprises mobile applications, remote sensing, blockchain, machine learning, and artificial intelligence. SourceTrace now functions on a Software as a Service (Saas)-based model. The pricing includes a one-time onboarding cost, followed by a monthly/yearly subscription which is dependent on the number of farmers.

Project Outputs

- Trained 160 farmers, including 55 women, on GAPs and improved agricultural practices.
- Established 10 demo plots.

Project Outcomes

The AFI project is helping peri-urban farmers of Telangana State realize the large market opportunities created by the ever-growing consumer demand for fresh produce, such as vegetables, in the Hyderabad metropolitan area. Presently, 70% of Hyderabad's vegetable supplies during off season (February-September) come from non-Telangana state farmers (neighboring state farmers). Even during the season (October-January), 30% of Hyderabad's vegetable supplies come from non-Telangana state farmers. Due to the COVID-19 pandemic situation, consumers in Hyderabad city are avoiding highly crowded and unhygienic traditional vegetable markets and instead prefer to purchase vegetables from modern retails chain stores and exclusive fresh produce supermarkets. In the last six months of the pandemic period, many new modern retail chain stores (especially Ratnadeep) and exclusive fresh produce retail chain supermarkets (Polimeraas) have sprung up in the Hyderabad metro area. AFI project farmers have shown keen interest in increasing their acreage under high-value vegetable crops if access to markets and crop technologies are ensured.

In the 2020 Kharif (monsoon season) season, Telangana State Government has planned a regulated farming policy to make farming commercially attractive and viable and to regulate cropping with demand-driven crops. Vegetable crop colonies/clusters are to be part of regulated farming of the Telangana State Government. With favorable agro-climatic and ecological conditions for vegetable growing and with a world-class national highways network, Outer Ring Road (ORR, a 156-km ring around Hyderabad city) and the international airport in Hyderabad outskirts, Telangana State has the potential not only to meet the fresh produce demand of the Hyderabad metropolitan area, but also that of the other metro cities of India and export markets in Middle Eastern countries. There will not be any better time than this for a peri-urban agriculture project like IFDC's AFI to launch project interventions to increase the income of smallholder farmers. The AFI project team is confident in achieving the outcomes envisaged in the project.

Project Monitoring and Evaluation (M&E)

AFI project activities must be both timely and of high quality. This level of performance is crucial in achieving the envisioned goals. The planned activities, described in the Year 1 annual work plan, will require close collaboration with stakeholders. This collaboration will help to address supply-demand and policy-related issues that could impact goal achievement. Timely performance of activities must coincide with the crop growing seasons in Telangana to effectively achieve technology diffusion targets. AFI has, therefore, established an appropriate M&E system that (1) tracks progress in the achievement of performance indicator targets and (2) assesses progress in the achievement of impact indicators. The M&E system design will give attention to the measurement of performance at the activity, outcome, and objective levels. The M&E system design will allow for tracking progress in activities that will contribute to the achievement of performance indicator targets.

IFDC understands the significance of the M&E system and that it will be a critical tool in assessing the project's success. The final M&E system will be implemented in Year 1.

Gender and Youth Dimensions

The AFI project facilitates participation by women and youth. A key target is that 20% of those participating in technology diffusion training (including entrepreneurial and managerial) are women and 40% are youth. The project is linking women and young entrepreneurs with formal lending institutions, if needed, to facilitate participation at the micro-enterprise level with agro-input and improved technology product supply opportunities. Assistance from non-governmental organizations (NGOs) may be sought in identifying women and young farmers and entrepreneurs.

Building institutional support capacity includes training women and youth, encouraging participation by women and youth in all project activities, including field days, motivational trips, and direct training, and ensuring their access to agro-inputs. Also, AFI will link PUA women farmers with markets for selling their products and train PUA women entrepreneurs to improve their business process, thus improving their income.

The AFI project will not only emphasize women's participation in all activities but will ensure their access to good quality agro-inputs and equal opportunity to sell their products. The target is to have women participate at a level of 20% in project activities, including ownership in micro-enterprises. The participation of women will be monitored and reported in progress reports and other periodic M&E reports.

Collaboration

The AFI project offers significant potential for collaboration through linkages with: (a) other projects in Telangana that address agriculture sector development and expanding economic opportunities; and (b) various stakeholders and private sector entities. AFI is collaborating with Walmart Foundation-funded projects awarded to ICRISAT to improve the livelihoods of

smallholder farmers in Andhra Pradesh and other projects being implemented in Telangana. All of these projects employ a market-based approach to development and seek to generate economic opportunities through agriculture. The AFI project collaborates with all interested stakeholders who are interested in helping the smallholder farmers, private sector organizations, and NGOs on knowledge development and technology diffusion.

Ms. Ishrat Jahan, IFDC's Regional Director of Asia, has visited Hyderabad several times and has met Dr. V. Praveen Rao, honorable Vice Chancellor of Professor Jaishankar Telangana State Agricultural University (PJTSAU). She has briefed him on global IFDC activities and its vision and the Walmart Foundation-funded AFI project goal and objectives. The honorable Vice Chancellor also agreed to provide AFI office space at the PJTSAU campus. A memorandum of understanding (MOU) has been signed between IFDC and PJTSAU. AFI project staff have built a good rapport with all extension officers of the district agriculture and horticulture departments in all project districts and community leaders in selected villages to carry out the field activities.

Lessons Learned

AFI Project Locations: Telangana districts have been reorganized – 10 districts have been divided into 33 new districts for administrative convenience by the government. New Mahbubnagar and Medak districts are no more closer/adjacent to the Hyderabad metropolitan area. All the mandals/villages of new Mahbubnagar district are at least 70-100 kilometer (km) away from Hyderabad. In the new Medak district, only three to four mandals (sub-districts) are within a 60-km radius of Hyderabad and the remaining mandals are at least 70-100 (km) from Hyderabad. Peri-urban areas (mandals/villages) areas of Rangareddy, Medak, and Mahbubnagar districts are now in new districts of Medchal, Siddipet, and Rangareddy, respectively. To achieve desired outputs and outcomes, the AFI project needs to work in peri-urban areas of the former districts rather than rural areas of the new districts, and the focus must be on mandals/villages within a 60-km radius of Hyderabad metropolitan area, where there is the potential to bring commercial orientation to farming and to increase area under vegetable crops. Based on this criteria and existing vegetable crop cultivation clusters, we demarcated compact areas on the north and south side of Hyderabad as Outer Ring Road. On the north side, we have the Toopran-Wargal-Shamirpet-Medchal-Narsapur cluster, and on the south side, the Shadnagar-Kadthal-Maheswaran-Shamshabad-Chevella cluster.

Farmer Identification: Due to the COVID-19 lockdown and travel restrictions, we could not meet various organizations and businesses to discuss the possibilities for collaborative work. All 1,121 farmers identified so far were selected by AFI field staff. To reach the target of 30,000 farmers, AFI will need to follow a community approach in identifying and training farmers. We must actively collaborate with the private sector, especially agro-input retailers, seed companies, and crop output aggregators/traders/processors. We should also engage with Indian Fertilizer Farm Cooperative's (IFFCO) member cooperatives, farmer producer companies/organizations (FPCs/FPOs) promoted by the National Bank for Agriculture and Rural Development (NABARD), Small Farmers Agri-business Consortium (SFAC), and many other developmental organizations, Women self-help groups (SHGs), farmer groups, and community-based organizations (CBOs).

Infrastructure Support: In the AFI project budget under equipment and furnishing, there is a provision of U.S. $50,000 to support farmers and rural retailers. We feel it is better to establish a few (two or three) village-level model packhouses for vegetables on a cost-share basis with FPOs or women SHGs or farmer groups. These can be used by both farmers and crop output aggregators to add value to the fresh produce harvest before taking it to the consumer markets. If possible, additional budget provisions should be made for demonstrating farm-gate infrastructure in preserving produce freshness and adding value before transporting the vegetables to consumer markets by cleaning, grading, sorting, pre-cooling, and packaging.

Farmer Training with Agro-Input Kits: In the AFI project budget under human resource capacity building, there is a provision of U.S. $370,000 for farmer training with agro-input kits (training $200 + kit $200) for 1,000 batches of 30 farmers each. It is particularly important to design a standardized agro-input kit useful for precision agriculture that includes items such as personal safety equipment, soil amendments, small tools, crop support items (trellis system), and plastic mulching sheets, to be given to all 30,000 individual farmers. Otherwise, part of this amount, approximately $200,000, can be used for setting up community-level common facilities, such as a vegetable packhouse and collection center (crop output aggregation and selling point), to be used by individual farmers, FPOs, rural retailers, and crop output aggregators/traders.

Expenses Against Target in Year 1

As per the agreement with the Walmart Foundation, the target for expenditure and actual expenses for Year 1 is presented in Table 3. The AFI budget is a financial representation of the work plan. The Year 1 budget is estimated to be U.S. $834,700. However, due to initial delays and COVID-19, IFDC could not spend the amount as budgeted. Excluding the expenses of September 2020, we could achieve only 31% of the expenses. Payments of August field activities will be paid in September 2020. Details of expenses from October through August 2020 are provided in Table 3.

Table 3. Year 1 Actual Expenses against Budget Targeted during October 2019-September 2020

	Cost Item	Target	Actual Expense	% Achieved
1	Personnel	327,000	132,144	40%
2	Program Implementation	155,000	170	0%
3	Materials and Supplies	137,600	24,847	18%
4	Regrants	-	-	
5	Consultants	51,800	61,921	120%
6	Travel	87,400	19,105	22%
7	**DIRECT COSTS**	**758,800**	**238,187**	**31%**
8	**INDIRECT COSTS**	**75,900**	**23,819**	**10%**
9	**TOTAL PROGRAM BUDGET**	**834,700**	**262,006**	**31%**

Appendix 1. Project Locations by Mandal and Village

District	Mandal	Peri-Urban Village	Number of Farmers Identified
Mahbubnagar	Bhuthpur	1. Annasagar	18
		2. Hasnapur	47
		3. Sheripally	40
		4. Thatikonda	54
	Hanwada	5. Hanwada	22
		6. Tankara	54
		7. Dachakpally	50
		8. Kothapet	75
		9. Budharam	61
		10. Galenically	50
		11. Pedda Carnally	40
		12. Guddi Malkapur	50
		13. Enimidi Thanda	46
Medak	Toopran	14. Malkapur	30
		15. Konaipally	20
		16. Venkataipally	20
		17. Narsampally	13
	Shivampet	18. Gomaram	30
		19. Nawabpet	26
		20. Chandio	21
	Wargal	21. Nacharam	16
		22. Seetharampally	17
Rangareddy	Kadthal	23. Kadthal	39
		24. Challampally	13
		25. Raviched	10
		26. Anmaspally	10
		27. Takrajguda	10
		28. Madaram	26
	Kandukur	29. Mucherla	11
		30. Saireddygudem	09
		31. Dasarlapalle	13
		32. Debbadaguda	16
		33. Nedunur	08
	Farooqnagar	34. Madhurapur	48
		35. Dooskal	17
		36. Velijerla	42
		37. Kondannaguda	26
	Keshampet	38. Sangam	23
Total Number of Farmers Identified			**1,121**

Appendix 2. COVID-19 Situation Analysis Survey – Key Findings

Farmers' Responses

1. On average, each farmer is growing about three to four different vegetable crops and the main crops are okra, tomato, brinjal, chili, and gourd. Other crops grown are cluster beans, cabbage and leafy vegetables, onions, and cucumber.
2. There have been changes in the cropping plan of majority farmers (13 out of 17). This is mostly due to Telangana State Government's policy of regulating the cropping system and linking it to the Rythu Bandhu (Investment Support) DBT scheme.
3. Seven out of 17 farmers sell their vegetables by direct sale at Rythu bazaars and weekly markets; five farmers sell wholesale through a commission agent in Hyderabad and nearby towns; five farmers sell by both direct sale and wholesale.
4. The COVID-19 situation has affected normal sales process of farmers, and most of the farmers have resorted to direct retail sales within their village and in neighboring villages. This alternative way of selling has helped farmers receive a better price/income (10% more than normal process) and they can also avoid middlemen/commission agents in the process.
5. Limited selling hours and transportation problems due to a curfew imposed by the government led to unsold produce (wastage) and low commodity prices.
6. Most of the farmers (10 out of 17) buy agro-inputs from the distributors in nearby towns. The remaining farmers buy from retail shops in their village/town. There has been no change due to the COVID-19 situation in the source of their input purchases.
7. All farmer respondents except one source their labor within the village and few (four farmers) of them have faced a labor shortage.
8. All farmer respondents except one hire farm machinery and equipment for their farm operations, and the COVID-19 situation has not affected their ability to access the machinery on time (on demand). However, a few farmers have faced difficulty in hiring paddy harvesters due to reverse migration of machine operators (operators of paddy combine harvesters are outsiders, mostly from eastern India).
9. All farmer respondents except one buy agro-inputs on a cash basis.
10. All of the farmers are aware of COVID-19 and are taking necessary precautions, such as handwashing with soap/sanitizer, wearing face masks, and maintaining social/physical distancing.

Input Retailers' Responses – Key Findings

1. The majority of the input retailer respondents (14 out of 16) are selling fewer products than normal due to the COVID-19 situation.
2. They could not interact or have interacted less with the customers/farmers.
3. They have more difficulty in sourcing or getting inputs from wholesalers in towns.
4. Some of the input retailers are facing difficulties in distributing the products.
5. Transportation facilities were not available due to a curfew and travel restrictions imposed by the government.
6. Reduced hours to conduct business transactions have occurred due the curfew imposed by the governments
7. Half of the respondents are facing cash flow problems and are thus finding it difficult to pay off loans.

8. The COVID-19 situation has changed the standard business operation procedures of the majority of input retailer respondents. One major change is accepting payments through a mobile money transfer process. Other changes include collecting orders over the phone and arranging pickup at the store, procuring supplies through online shopping, selling only on a cash basis (no credit), and collective buying by farmers. Input retailers wanted to set up an online ordering system, but they face issues with access to technology as many farmers lack smartphones.
9. The COVID-19 situation has disrupted the input supply chain and created a shortage (10-50%) in the supply of materials/inputs. The shortfall is mostly in crop protection products (CPPs) and seeds. There have been no shortages in the supply of fertilizers as fertilizer procurement/imports, storage, and transportation is under government control. Input retailers have been able to meet the input needs of farmers in Rabi and summer crops to a large extent.
10. All of the input retailer respondents are advising their customers on COVID-19 precautions and safety measures orally in their stores and through WhatsApp messages. Television and newspapers are their source of information regarding COVID-19.
11. The majority of input retail respondents (10 out of 16) think that COVID-19 will not impact their ability to meet the demand for agro-inputs for the second season in 2020, i.e., Rabi 2020-21. But some respondents (six out of 16) think the COVID-19 crisis and lockdown situation will continue for a longer period of time, causing shortages in supply of all agro-inputs (including fertilizers) and they do not have any plans to deal with the potential negative effects of the situation. Thy expect the government to help them with transportation, subsidized bank loans to overcome cash flow issues, an interest waiver on existing loans, and increased commission on fertilizer sales.

Government Extension Officers' Responses – Key Findings

1. Most (eight out of 12) extension officers do not have any issue in contacting farmers and giving timely advice to them during the COVID-19 situation and lockdown. They do not foresee any major challenges in serving farmers in this cropping season (Kharif 2020).
2. The COVID-19 situation has changed the way extension officers provide services to farmers. Some of the extension officers are using digital services – mobile phones, WhatsApp groups, etc., and partnering with the private sector to disseminate agricultural advisory and information on government programs to their target farmers.
3. Paddy and vegetable crops have been the most affected due to COVID-19. Paddy crop faced a harvesting problem due to a combine harvester machine operator shortage. Machine operators are mostly migrant labor, and they have returned to their homes due to the lockdown and fear of contracting COVID-19. Vegetable crops faced a transportation and marketing problem due to lockdown restriction on road transport and vegetable markets operating hours.
4. Eleven out of 12 extension officers expect a normal cropping season for the rest of 2020. The reasons mentioned for expecting normal cropping season are lifting of lockdown restrictions, government ensuring supply of required quantities of fertilizers and seeds, and good monsoon rains.
5. To help farmers to cope with the COVID-19 situation, the government has scaled up Minimum Support Price (MSP) procurement, provided transportation support for vegetables, and operated truck-mounted mobile vegetable markets. The government has also allowed agro-input retail shops to open for limited hours during the lockdown period and assisted them with transportation of input supplies. Similarly, agricultural output traders were assisted with permits for transportation and limited hours of business operations.

6. All government extension officers are advising their clients about COVID-19 and safety precautions to avoid contracting the virus. Their main sources of information for advice are television, newspaper, and social media

Supermarkets' Responses – Key Findings

1. Three out of five supermarkets have claimed that their normal sales of vegetables have affected due to COVID-19. They have experienced a 20-30% decrease in sales, fewer customer visits, and absence of store staff.
2. All supermarkets usually source vegetables from their own distribution centers (DCs) situated in the outskirts of Hyderabad city and there has been no change in sourcing during the COVID-19 pandemic. There has also been no change in the business model for selling vegetables.
3. The prices of most vegetables have not changed due to COVID-19. Only highly perishable leafy vegetable prices have increased by 10%. Hence, store management has not implemented any promotional activity or incentive program for their sales staff.
4. All supermarkets are advising their clients about COVID-19 through a poster display of safety precautions to be followed at the entrance of their stores. They are also imposing strict rules for their customers to wear face masks, clean hands with sanitizers, and maintain physical distancing.

Appendix 3. Total Farmers Trained in Year 1 (October 2019-September 2020) under the AFI Project

District	Mandal	Total Batches	Village	Number of Participants			Training Subject
				Male	Female	Total	
Mahbubnagar	Bhootpur	1	Annasagar	4	-	4	Tomato Cultivation
			Hasnapur	4	-	4	
			Sherpalli	24	-	24	
	Bhootpur	1	Thatikonda	12	13	25	IPM in Vegetable Cultivation
	Hanwada	1	Dachakpally	-	42	42	Tomato Cultivation
Medak	Toopran	1	Konaipally	8		8	Tomato Cultivation
			Malkapur	22		22	
			Narsampally	10		10	
Rangareddy	Kadthal	1	Kadthal	21		21	Tomato Cultivation
Total:		**5**		**105**	**55**	**160**	

Source: AFI Training Database.

Appendix 4. Details of the Field Demonstrations Established in September 2020

Sl. No.	Farmer Name	Village	Mandal	District	Crop	Technologies to be Demonstrated
1	Arrolla Ramchandraiah	Kadthal	Kadthal	Rangareddy	Tomato	1. Seeds treated with bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 2. Crop support (trellising system) with bamboo poles and tying up with GI wire 3. IPM/biological pest control using traps such as pheromone traps, and yellow sticky traps
2	Sudha Venkatesh	Kadthal	Kadthal	Rangareddy	Bitter Gourd	1. Seeds treated with bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 2. Crop support (trellising system) with creeper mesh and bamboo poles 3. IPM/biological pest control using traps such as pheromone traps, and yellow sticky traps
3	Duddu Mallaiah	Kadthal	Kadthal	Rangareddy	Tomato	1. Seeds treated with bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 2. Crop support (trellising system) with bamboo poles and tying up with GI wire 3. IPM/biological pest control using traps such as pheromone traps, and yellow sticky traps
4	Goverdhan	Sheripally	Bhuthpur	Mahbubnagar	Tomato	*1.* Seeds treated with bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 2. Crop support (trellising system) with bamboo poles and tying up with GI wire 3. IPM/biological pest control using traps such as pheromone traps, and yellow sticky traps
5	Raghunandhan Reddy	Sheripally	Bhuthpur	Mahbubnagar	Bitter Gourd	*1.* Seeds treated with bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 2. Mulching for weed control using a plastic mulching sheet 3. IPM/biological pest control using traps such as pheromone traps, and yellow sticky traps
6	Krishnaveni	Dachakpally	Hanwada	Mahbubnagar	Tomato	*1.* Seeds treated with bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 2. Crop support (trellising system) with bamboo poles and tying up with GI wire

Sl. No.	Farmer Name	Village	Mandal	District	Crop	Technologies to be Demonstrated
						3. IPM/biological pest control using traps such as pheromone traps, and yellow sticky traps
7	Santhosha	Dachakpally	Hanwada	Mahbubnagar	Bitter Gourd	*1.* Seeds treated with bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 2. Crop support (trellising system) with creeper mesh and bamboo poles 3. IPM/biological pest control using traps such as pheromone traps, yellow sticky traps
8	Jinka Satyanarayana	Narsampally	Toopran	Medak	Green Chili	1. Micronutrient foliar application and fertigation through existing drip system 2. Mulching for weed control using a plastic mulching sheet 3. Bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 4. IPM/biological pest control using traps such as pheromone traps, and yellow sticky traps 5. Nursery raising in raised beds and seed trays
9	Raachendar Reddy	Malkapur	Toopran	Medak	Ridge Gourd	1. Micronutrient foliar application and fertigation through existing drip system 2. Mulching for weed control using a plastic mulching sheet 3. Bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 4. IPM/biological pest control using traps such as pheromone traps, and yellow sticky traps 5. Nursery raising in raised beds and seed trays
10	Pandu Yadav	Konaipally	Toopran	Medak	Tomato	1. Micronutrient foliar application and fertigation through existing drip system 2. Mulching for weed control using a plastic mulching sheet 3. Bio-fungicides such as *Trichoderma viride* or *Pseudomonas fluorescens* 4. IPM/biological pest control using traps such as pheromone traps, and yellow sticky traps 5. Nursery raising in raised beds and seed trays 6. Crop support (trellising system) with bamboo poles and tying up with GI wire