UNDP–Data for Policy

Compendium of Climate Smart Agriculture Practices from the Farming Communities of Telangana

2022

Data on the various climate resilient practices were collected by RICH for UNDP

ABOUT THIS COMPENDIUM

Today, climate change is one of the biggest threats to agricultural productivity—and consequently, farmer livelihoods and food security—in India. In order to ensure future-fit food systems, policies that enable and support climate-resilient agricultural practices need to be implemented across the country.

As part of ongoing efforts to fulfil this need, UNDP, in partnership with the Government of Telangana, Rockefeller Foundation, and others, launched the 'Data for Policy' initiative—to identify the various agricultural practices which farmers in Telangana have adopted to mitigate the effects of climate change and use this information to inform anticipatory governance measures that can ultimately strengthen Telangana's food systems.

To execute the first leg of the project, Research and Innovation Circle of Hyderabad (RICH)—an initiative of the Government of Telangana, and the Hyderabad Science and Technology Cluster under the Office of the Principal Scientific Adviser to the Government of India—travelled to villages within the three main farming ecosystems in Telangana, dryland, wetland, and garden land, to gather information on the climate-resilient practices that farmers there are implementing. These practices ranged from traditional methods of irrigation and natural fertilisation to innovative technologies like laser land levelling machines and seed drills.

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DRYLAND

UNDP–DATA FOR POLICY

A COMPENDIUM OF FIELD STORIES ON GOOD PRACTICES FROM THE FARMING COMMUNITY COLLECTED BY CITIZEN SCIENTISTS

SAVING LOCAL VARIETIES FOR THE FUTURE

Samamma of Bidekanne village, Zaheerabad mandal of Sangareddy district, has been practicing traditional farming for over three decades. She has been growing over 100 crop varieties, but many have become extinct. She says, “We have been growing many varieties of sorghum, green gram, groundnut, and other crops. For instance, we had sorghum varieties like *Sai Jonnalu, Nalla Jonnalu,* and *Muda a Jonnalu,* which are suitable to grow during high rainfall, as they have loose panicles. This variety is hardly being grown now. We have lost many crop varieties in the past two decades.” She attributes the loss of crop varieties to climate change and the lack of seed storage structures in the village.

> ***Landraces are genetically heterogeneous varieties that have evolved in certain eco-geographical areas and adapted to edaphic and climatic conditions and traditional management practices.***

Samamma has been practicing a unique seed storage method that has helped her and other farmers in her village to store seeds for a year with no reduction in their viability and minimal loss in quantity, resulting in increased biodiversity within the cropping system to sustain crop production. She believes that traditional landraces can adapt to the effect of climate change better than newly released varieties.

Samamma stores the seeds in bamboo baskets coated with a mixture of cow dung, neem leaves, and cow urine, which prevents or minimises the incidence of storage pests. “Last year, we received heavy rains during June-July that caused acute water logging and crop loss. Seeds stored in these baskets remained safe and we could sow them after the rains receded and realised good profits. We store seeds in these baskets individually or as communities at the village level. These seed baskets make us independent from the private seed companies and reduce the cost of seeds and our overall cost of cultivation”, she says.

Samamma winnowing seeds for seed basket storage
Image credits: UNDP–Data for Policy

Seed basket ready for storage
Image credits: UNDP–Data for Policy

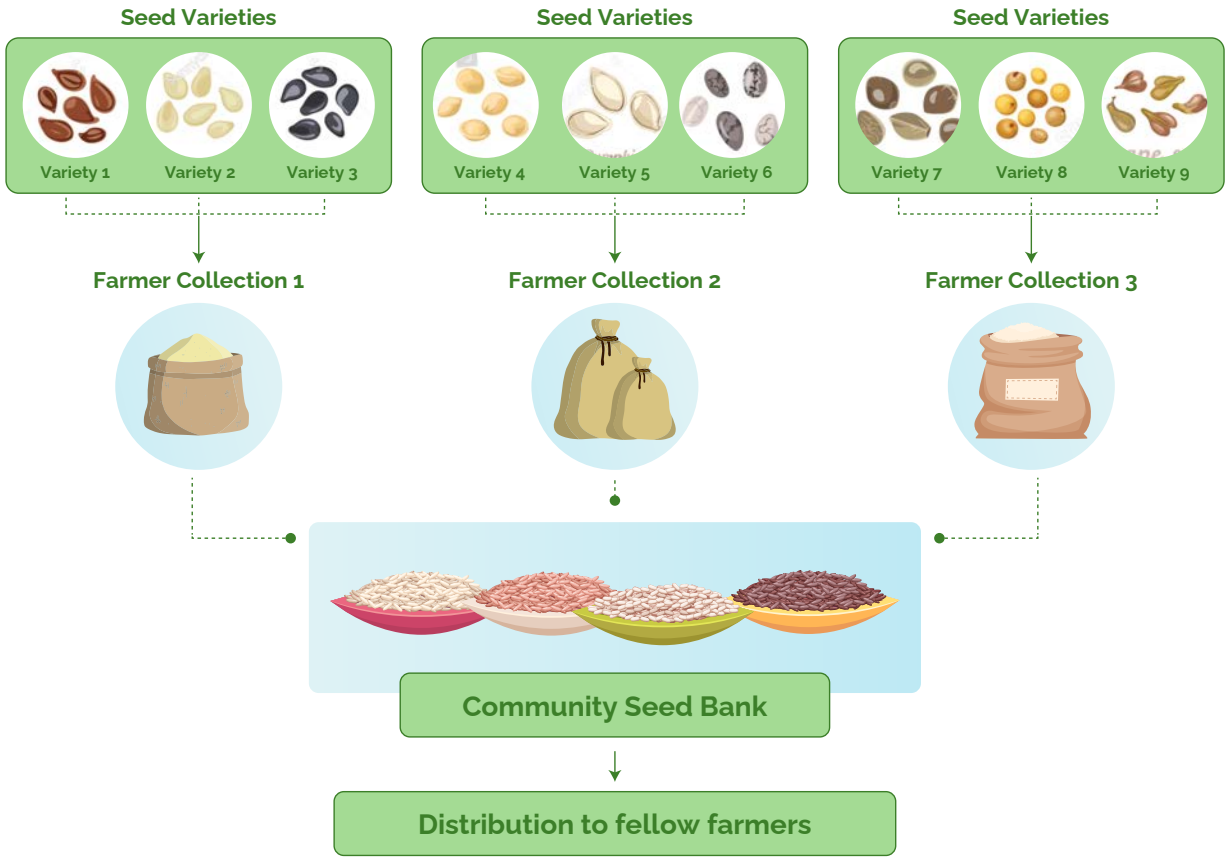
The seed basket storage system practiced by Samamma and farmers in her village offers them a chance to conserve varieties that have adapted to changing ecology. However, the number of seeds stored and their viability are at a low scale. There is an urgent need for government intervention, considering the requirement of maintaining biodiversity amidst climate change. The announcement by the Government of Telangana to establish an ultra-modern cold storage facility to store seeds produced by the Corporation is a welcome sign for improving seed systems in the State. However, policies to support and establish traditional seed storage systems through the combined intervention of the Department of Agriculture and the Telangana State Seeds Development Corporation would be hugely beneficial to the farmers and can help the local community with long-term seed storage and conserving local varieties.

COMMUNITY-BASED SEED STORAGE SYSTEM STRATEGIES

Most farmers face challenges with procuring seeds of improved varieties for better yield. As a key input, the seed has a direct impact on agricultural production and productivity. Traditional varieties have improved characters in terms of withstanding harsh weather and defending against diseases and pests. It is therefore important to conserve locally adapted crops and varieties.

Realising the importance of saving seeds, Kamalamma from Bidekanne village has been following traditional methods to successfully store seeds. Currently, she stores more than 15 varieties of seeds in her miniature seed bank, which helps her grow good-quality crops. Furthermore, progressive farmers like Kamalamma follow a collective seed storage system at the community level and support the procurement of quality seeds and sharing them with fellow farmers. This model ensures the availability of diversified seeds of multiple crops, with traits suitable for different conditions.
This inclusive approach recognises and builds upon a diversity of seed systems that can guide the designing and implementation of seed sector interventions. It will support farmers with accessing and storing quality seeds of superior varieties. This will also lead to a self-sustaining crop production model and enhance collaborative community development.

Community-based seed storage systems need to be promoted to complement the efforts made by the state government in ensuring the timely availability of good quality seeds.



Community seed distribution system
Image credits: UNDP–Data for Policy

MULTIPLE CROPPING SYSTEM FOR CLIMATE-RESILIENT AGRICULTURE IN THE DRYLANDS

Over the years, there has been rapid decline in the soil nutrient status in Telangana. Aberrations in weather on account of climate change have worsened this situation with increasing heat waves, droughts, and erratic rainfall. The monocropping system has also led to a rapid reduction in soil nutrient and soil productivity levels, which has triggered indiscriminate use of fertilisers to compensate for the nutrient loss and for better yield. It has also led to an increased incidence and spread of pests and diseases.

The Centre for Sustainable Agriculture, a civil society organisation operating in the agricultural livelihood development sector in Telangana, cites monocropping of rice, pest and disease infestation, and loss of soil structure and productivity as major reasons for crop loss in Telangana. It is important to address these issues to design strategies that can adapt to and mitigate the impact of climate change, and at the same time, improve agricultural productivity to ensure food and nutritional security.

Monoculture is one of the most disputable topics in today's agriculture industry. As the World's population increases and the demand for food keeps rising, many farmers deem monoculture to be the simplest solution for meeting the demand. Monoculture, however, upsets the natural balance of soils. Too many of the same plant species in one field area can rob the soil of its nutrients, resulting in decreasing varieties of bacteria and microorganisms needed to maintain soil fertility. The production of a single plant species over a large area also has a negative effect on the structure of the underlying soil.

Multiple cropping and crop selection are some of the better crop-resilient practices that can be considered in reversing this existing cropping trend. Multiple cropping, defined as growing multiple crops sequentially within a year, can increase production and income, and has additional benefits such as increased crop diversity, improved functioning of agricultural systems, and reduced use of inorganic fertiliser and pesticides. It also helps in reducing the impact of a crop failure on farm-based livelihood, promotes better use of resources, and improves bio-diversity. At the other end of the value chain, it contributes to meeting the demand for diverse crop produce and ensuring price diversity in the market for different crops.

Thuljamma from the drylands of Zaheerabad district struggled with crop selection and has experienced many crop losses. Over time though, she has been successful in being able to decide on the right crop for different climatic conditions. She strongly believes that monocropping will not be helpful in climate-resilient cropping and that multiple cropping is the better solution.

Thuljamma and other women farmers of Zaheerabad participating in a discussion
Image credits: UNDP–Data for Policy

Crop sequence and selection play a major role in ensuring better crop production and field performance. In Zaheerabad district, farmers grow crops such as foxtail millet, sorghum, pigeon pea, pearl millet, green gram, horse gram, safflower, and groundnut. Vegetables are grown on irrigated lands. Intercropping is adopted in every field with at least two crops, which can go up to four. Some of the multiple cropping systems in the district comprise sorghum and pigeon pea (six rows with one row), sorghum and horse gram (three rows with one row), or a mix of vegetables such as tomato–okra–brinjal (two–three–two rows) under irrigated conditions.

In multiple cropping system, the sowing time is extremely critical. As part of the field preparation, farmers apply farmyard manure during Ugadhi (April 2nd week) and sowing starts from the last week of May through June. The applied manure decomposes fast at high temperatures, releasing nutrients that aid in better seed germination.

Thuljamma says, “I sow foxtail millet (korallu) during the last week of May, if I feel that the monsoon is delayed, and the temperatures are high.” Though the temperatures are high during May, foxtail millet is found to tolerate heat up to 45 °C. The seed coat of foxtail millets is strong and can protect the seed from high temperatures. Moreover, they germinate and establish faster than weeds with the receipt of the first rains, thereby reducing weeding costs. If the rain arrives in the first week of June, Tuljamma sows sesamum and green gram from 07–15 June, while if the rains are late, she prefers to sow finger millet.

Government interventions to improve wider adoption of multiple cropping and inter-crop recommendation based on soil, weather, and base-crop could be implemented. Such a strategy could build resilience in the production system and reduce the dependence and associated production constraints due to fluctuations in weather. Such agriculture policies can be focused on promoting food security, while maintaining remunerative prices for producers and protecting consumers’ interests by making food produce available at reasonable costs.

INTEGRATED FARMING SYSTEM FOR THE DRYLANDS

In the drylands of Telangana, crop loss can lead farmers into unending debt traps for meeting their livelihood needs. One of the ways to mitigate the complete loss of farm-based livelihood due to climate change is to opt for multiple cropping models. Increasing the area under economically important trees (agro-forestry) and exploring a holistic integrated farming system incorporating different agricultural segments could offer farmers a way forward to reduce dependence on local money lenders and financial agencies for their financial requirements. In fact, Global Forest Watch data show that in the past two decades, Telangana has lost over 41,000 ha of tree cover, which is equivalent to a 6.2 percent decrease in tree coverage since 2000 and 13.3 Mt of CO_2 emissions. Such changes leave farmers unable to figure out a solution to realise income on one hand and deal with the effects of climate change on the other.

"Our grandfathers followed multiple farming system; over time, people shifted to monocropping."

–Kistaiah from Bidekanne village

Integrated Farming System (IFS) offers continuous income during all the cropping seasons to farmers. The IFS is an inter-dependent, inter-related production system based on crops, animals, and related subsidiary enterprises that maximises the utilisation of resources of each system, thereby minimising the negative effect on the environment.

Kistaiah, a progressive farmer in the Sangareddy district of Telangana, has been practicing IFS on his six-acre farm. On three acres of his land, as part of the agro-forestry component, he grows Eucalyptus and Teak wood, which could be sold to the timber and pulp industry. The remaining three acres are used for growing maize and millets during the *Kharif* season and vegetables in the *Rabi* season. He also rears buffaloes and goats in his farmyard. This system ensures the generation of income throughout the year and, in Kistaiah's opinion, reduces the possibility of crop loss.

The Government of Telangana supports agro-forestry through various schemes. Telangana Haritha Haaram, a flagship program of the Government, aims to increase tree cover to 33 percent of the total geographical area of the State. In addition, practicing IFS helps with better resource utilisation, reduces crop loss owing to climate change and its impact on farm livelihoods, and improves the environmental and ecological balance.

Integrated farming model at Bidekanne village
Image credits: UNDP–Data for Policy

Agro-forestry
Image credits: UNDP–Data for Policy

PITCHER IRRIGATION

Vegetable crops are sensitive to moisture stress and its effect is further magnified by other weather parameters. Low rainfall and changing weather patterns reduce the available soil moisture considerably. Under these circumstances, vegetable farmers in Sangareddy have adopted unique methods of irrigation such as pitcher irrigation, which has proven to be among the better methods to irrigate vegetable crops.

Anil and Suresh are young farmers and entrepreneurs from Venkatapur village in the Kohir mandal of Sangareddy district in Telangana. They grow vegetables such as bottle gourd, pumpkin, and coccinia on two acres of land by adopting pitcher irrigation technology, which efficiently stores and utilises water judiciously.

Installation of pitchers with wick
Image credits: UNDP–Data for Policy

Pitcher irrigation is an effective, cost-friendly, and natural method of irrigation. The technique employs an unglazed clay pot with a cotton wick at the bottom, buried into the soil (with the neck outside) and placed near the root zone.

> ***Rhizosphere is the narrow region of soil directly influenced by root secretions and associated soil microorganisms known as the root microbiome.***

Once filled, the water seeps out of the pot walls due to the pressure gradient and maintains soil moisture around the rhizosphere. Natural pores in the pot wall allow water to seep laterally into the soil. The wick attached at the bottom of the pot increases water flow and delivers water directly to the plant roots. The pot can be refilled based on the crop water requirement. Pitchers are generally placed at distances so that wet areas do not overlap.

This method helps in maintaining a healthy rhizosphere for plants to survive any adverse conditions owing to erratic rainfall or limited access to irrigation sources. Thus, smallholder farmers could be encouraged to take this traditional and effective method of irrigation, especially for vegetable crops.

GREEN MANURE MULCHING

Reports show that Telangana was the second-highest fertiliser consumer during 2015–19. Excessive consumption of fertilisers has been shown to render soil lifeless. There is also a high probability of synthetic fertilisers getting mixed with waterbodies and an increasing incidence of soil run-off due to weakened structure. In the soil, nitrogen-based fertilisers get broken down by microbes that convert nitrogen to nitrous oxide for plant growth. However, excessive use of such fertilisers means faster conversion and production of this highly potent greenhouse gas, which is the biggest human-related threat to the ozone layer, and a big risk for developing climate-resilient agriculture models. The unabsorbed nitrous oxide leaches out of the soil and moves to water basins and oceans.

Meenamma from Bidekanne village owns a three-acre organic horticultural farm. To ensure the proper availability of nutrients for the robust growth of horticultural crops, Meenamma practices live green leaf mulching and grows green manure crops around the fruit trees.

“We have been practicing green leaf mulching over a decade and it has rendered our soil healthy and productive for ages.”

–Meenamma

Meenamma pinching the green manure crops
Image credits: UNDP–Data for Policy

Meenamma grows green manure crops, such as sunn hemp (*Crotalaria juncea*), dhaincha (*Sesbania aculeata*), and Pillipesara (*Phaseolus trilobus*), around the ring basin of each crop. She pinches the green succulent leaves of these crops, spreads them on the basin, and sprinkles water to serve them as a live green leaf mulch. By the time the main crops are at the flowering stage, the green mulch is incorporated into the soil. These green manure crops supply nitrogen in the most available form for the main crops to take up and ensure the availability of soil organic matter while improving soil structure. By following green manure cropping, she not only saves on the cost of fertilisers but also keeps the soil healthy.

The Government of Telangana distributes green manure crop seeds under subsidy seed distribution schemes. However, farmers seldom take green manure crops under subsidy due to the extra work involved in maintaining and incorporating them into the soil. Therefore, sensitisation on the benefits of green manure crops needs to be undertaken for building sustainable climate-resilient agricultural systems.

DRY LEAF MULCHING–AN ORGANIC COVER TO PROTECT CROPS

The effects of climate change are more prominently felt on horticultural crops. High temperatures, erratic rainfall, and increased incidence of pests and diseases considerably reduce the yield of these crops. For instance, increased temperatures lead to physiological disorders in the crops and also render the soil extremely dry.

“Those times fruits were available in plenty; now the yield of fruit crops has reduced owing to new pests and diseases and elevated temperatures.”

–Durgamma from Bidekanne village

Durgamma believes that nature has a solution for everything. She figured out an effective way to make use of the dry leaves by mulching them around the crop. Mulching is the process of covering the soil around the plant root zone to protect it from adverse micro-climatic conditions. Mulch cover creates an environment for the plant to perform at its best by maintaining and optimising soil moisture, temperature, and humidity for carbon enrichment and increased microbial performance in the soil.

Durgamma collects dry leaves from her farm and mixes them with soil. She spreads the mixture in the ring basin around the crops. She sprinkles water on the leaf litter layer to maintain a minimum level of moisture. Mulching with dry leaves maintains soil moisture, reduces weed growth, mitigates soil erosion, and improves the soil condition. Dried mulch decomposes into nutrient-rich compost, improving soil organic carbon levels and supplying essential nutrients to crops.

Durgamma spreading the dry leaves-soil mixture
Image credits: UNDP–Data for Policy

Rythu Vedika is a farmer platform initiated by the Government of Telangana to address the issues faced by the farmers in the state. Set up in all districts of Telangana, the platform also helps farmers with marketing and selling of their produce.

Rythu Vedika, a platform established under the Department of Agriculture by the Government of Telangana, has been used to demonstrate the importance of organic mulching to maintain a better micro-climate for crops. Yet, owing to the extra labour involved in maintaining and processing them, farmers tend to look for other synthetic alternatives, which are not necessarily sustainable and eco-friendly in the long-term. Government interventions should focus on encouraging farmers to follow and adopt these eco-friendly organic mulching practices.

GROUP CROP INSURANCE

Unpredictable crop loss has been amongst the farmers' toughest challenges for ages. Telangana has seen elevated temperatures, irregular pattern rainfall, and other climate issues, which have impaired crop production and favoured the emergence of new pests and diseases. Climate change has only exacerbated the impact of crop and income loss on farmers and their families.

Kishtanna from Bidekanne village shared his experience on the depletion of land quality due to increased usage of chemical fertilisers and incessant pesticide spraying in the region. Soil quality has also deteriorated and it has impacted crop production. Multiple strategies and interventions are needed to tackle this major challenge.

Aranya Agricultural Alternatives (Aranya), a Civil Society Organisation (CSO) operating in Bidekanne village, in Sangareddy district has been educating farmers on the benefits of Group Crop Insurance to offset the risk of crop loss and minimise debts. The CSO also conducts training programs for farmers in their region on crop insurance and ways to achieve group insurance and adopt better agricultural practices.

Aranya has been operating in the Bidekanne region for a long time and has identified pockets of areas of more than 50 acres to promote the group crop insurance model. Farmers having their lands in these pockets are categorised based on the proximity of the field, sharecroppers, and tenant farmers provided they are growing the notified crops in that area. These farmers are then grouped to take up insurance in the name of the farmer group. The effective premium and processing charge for insurance per farmer would be very little when compared to individual insurance.

There are two scenarios under which the claim can be processed: widespread calamities or local calamities. In the first case, the insurance companies would work out the claim settlement once the government puts forth actual yield data. The companies would directly settle the claim with the insured group without any intimation from the policyholder. In case of a local mishap, the farmer group is required to intimate the insurance company. In this situation, the insurance claim amount would be distributed based on the extent of damage in each field. The CSO acts as a managing agency for these individual farmer claims.

Farmer groups, in climate-vulnerable regions, could take up crop insurance collectively, which could attract insurance companies due to scale. It also helps farmers to cover their crops with small premiums.

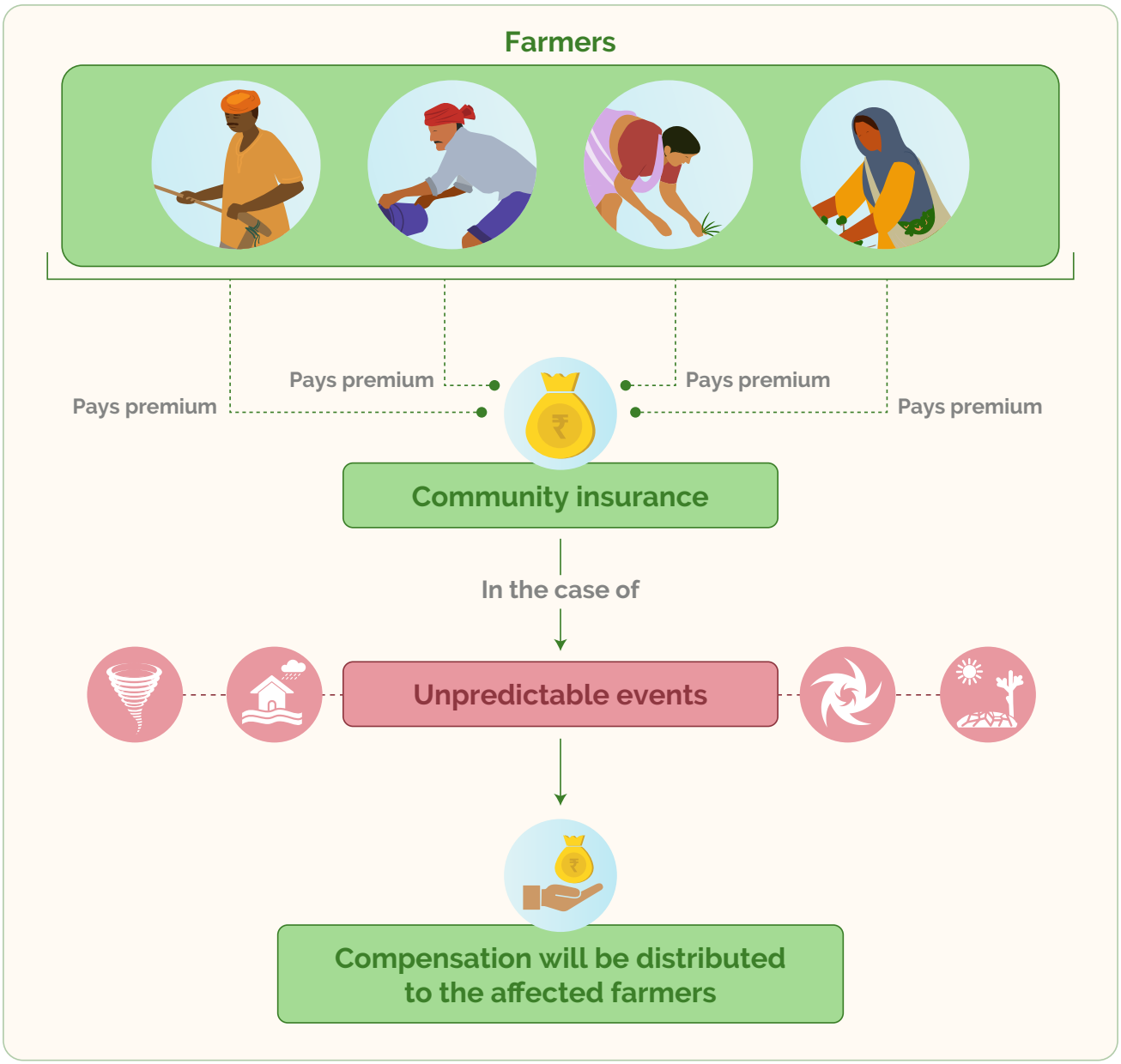


Image credits: UNDP–Data for Policy

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A COMPENDIUM OF FIELD STORIES ON GOOD PRACTICES FROM THE FARMING COMMUNITY COLLECTED BY CITIZEN SCIENTISTS

INTEGRATED FARMING SYSTEM– SMART WAY TO CLIMATE RESILIENCE

For many smallholder farmers in India, agriculture is the major livelihood source to support their families. Climate change poses a major challenge to them to sustain farming. An Integrated Farming System (IFS) approach could be a solution to maintain farm income during all cropping seasons, notwithstanding crop failures.

"Biodiversity is the key to healthy farming for nutrient recycling, and reducing pest and disease infestation. It improves the population of beneficial insects for pollination and thus overall farm productivity"

–Bobbala Yakub Reddy

Bobbala Yakub Reddy is a progressive farmer from Aminapuram village in Kesamudram mandal of Mahabubabad district who has been practising natural farming for over 40 years. He is also the recipient of the Best Farmer Award from the Department of Agriculture and the Professor Jayashankar Telangana State Agricultural University (PJTSAU).

Bobbala Yakub Reddy explaining about Integrated Farming System
Image credits: UNDP–Data for Policy

Reddy maintains an integrated farm of 7.5 acres around his house, in which dairy, poultry, field crops, and horticultural crop components are included. In dairy, he raises milch cows and buffaloes, which provide milk and dung throughout the year. The dung is used for organic agriculture on his farm. He has around 1000 layer chickens that provide eggs throughout the year. After 50 weeks of laying, the poultry birds are used for meat. Poultry manure is also used for the crops. He grows turmeric, cotton, paddy, chilies, and green gram, and has established a mango orchard as well, which is maintained with organic inputs.

He ensures that each system is up-to-date in terms of best practices and technology. Cows as well as poultry birds are vaccinated and fed on time. He uses drip irrigation technology to optimise the usage of water resources on his farm. Other farming practices followed are that of raised beds and mulching to improve growth while reducing weeds, pests, and disease infestation. He also participates in all the farmer training and awareness programs in order to remain informed on agricultural technologies and implement the most viable ones on his farm. He is also a leading resource person for the Krishi Vigyan Kendra in Malyal.

Including animal husbandry into the farming system is an important step towards IFS. Awareness and training programs for farmers on designing and implementing IFS models would help in better uptake of the concept. The technology-driven platform could aid in field management and availing support from the Government via platforms such as “**eLaabh**”, a web-based Production Management System designed for the welfare of dairy farmers and fishermen, to obtain subsidies under various schemes implemented by the Government of Telangana could immensely help farmers.

SUSTAINABLE OIL PALM PRODUCTION

Oil palm is a perennial crop with the highest vegetable oil yield and has huge demand in national and international markets. It can be an alternative to the traditional monoculture practices in Telangana and offers farmers potential revenue streams amid climate change. In the garden land regions of Telangana, water tables have increased with the completion of major irrigation projects. Excess rainfall has turned the region humid. With this change in climate, increased water table, and Government schemes like National Mission on Edible Oils, farmers have started to cultivate oil palm replacing other horticultural crops.

Valluri Krishna Reddy is a progressive farmer from Jayaram village in Mahabubabad district. With 30 years of farming experience, he decided to start commercial production of oil palm and transition to a sustainable agriculture model, with government assistance in production and marketing, to offset the low output from traditional crops. He believes that commercial agriculture should not harm the environment.

Reddy took up oil palm production training and attended workshops prior to making the transition to commercial oil palm plantations. On his seven acres of land, he applies cow dung and grows green manure crops, which are later incorporated into the soil during the flowering stage. This ensures adequate nutrient supply for crop growth and improves soil structure while lowering fertiliser costs. Proper land management practices are used to ensure long-term oil palm production.

Under the Telangana Oil Palm Mission, the Government of Telangana provides various support to farmers, such as subsidies up to ₹36,000 per acre and a well-established supply chain and procurement process, to encourage them to take up oil palm production.

Valluri Krishna Reddy
Image credits: UNDP–Data for Policy

MANGO HIGH-DENSITY CROPPING

Climate change disturbs the flowering cycle of mango crops and overall mango production. Unseasonal winter rains hinder flowering, and if the fruiting season coincides with summer rainfall, the quality of the fruit also deteriorates. As severe heat or cold can cause flowers to wilt and fall off before they have a chance to grow, temperature variations can have a significant impact. To increase the production and improve the quality of fruits some climate-resilient practices need to be followed, given that mango grown in orchards require a lot of agri-inputs and labour.

"Earlier I used to practice 12 m × 9 m spacing; later, I shifted to a 6 m × 6 m spacing high-density cropping system. This has improved my yield by 40 percent when compared to the former spacing system."

–Raja Rao

Raja Rao is a progressive farmer in Seethampeta village of Mahabubabad district and is a well-known mango grower in the region. He has been following a high-density mango cropping system (6 m × 6 m) in his orchard with yearly pruning. It has increased the yield by up to 40 percent and the quality of the fruit has improved as well.

Raja Rao at his mango orchard
Image credits: UNDP–Data for Policy

The major principle of high-density planting is the control of excessive vegetative growth in the tree for increased productivity. Canopy management is necessary for a high-density planting system to control the tree size and to bring a balance between vigour and productivity. Apart from improving crop yield, this system facilitates more efficient use of water, fertilisers, pesticides, and solar radiation. Furthermore, the cost of pesticide and fertiliser reduces by up to 40 percent when compared to traditional mango farming approaches.

Rao applies organic manure and neem cake mixture as well in his orchard. Since the spacing is less, there is more per unit area production and better utilisation of the land. He emphasises that a 4 m × 2 m Ultra High-Density Cropping System (HDCS) can also be accomplished provided multiple pruning is performed per year along with the use of raised bed and mulching sheet for crop production.

India is the largest producer and exporter of mango in the world; however, climate change can affect its productivity and quality. Hence, Government interventions would be required to develop strategies, such as promoting HDCS, and marketing assistance for improving resilience and productivity in mango to cope with climate change.

PULSE CROP AS A MANURE

The unpredictability of climate change not only threatens the global food system but also can exacerbate malnutrition in developing and poorer countries. Climate change, whether in the form of droughts, floods, or hurricanes, influences all levels of food production, affecting food security and food price instability of the impacted farming communities. A healthy society depends on people consuming nutrient-dense foods in their diets. Making the switch to nutrient-rich and protein-rich foods aids in their overall development. The cheapest source of protein is pulse crops.

Gopal Reddy from Aliyur village of Nellikuthur mandal of Mahabubabad district is a progressive farmer with over 45 years of experience in farming.

"I have been cultivating vegetable and grain crops, whose yield has reduced with the years. However, after shifting to pulse crops and green manure pulse crops as an intercrop, the yields have increased."

–Gopal Reddy

Gopal Reddy speaking about the benefits of pulse crops
Image credits: UNDP–Data for Policy

Earlier Reddy used to cultivate vegetables and grain crops using fertilisers and pesticides, but with time, the soil productivity declined considerably. He started practicing mixed cropping of cowpea, pigeon pea, green gram, Bengal gram along with vegetables and grain crops to improve the soil nutrient levels. He also applied farmyard manure to retain the natural health of the soil. The pulse crops were also used as fodder crops for cattle, as he believes pulse-based silage improves milk production in dairy cattle.

The pulse-inclusive production system can be used strategically to target both nutritional improvement and soil health. In drought-prone locations, pulses with high-water efficiency can be successfully produced. These plants also increase soil fertility by fixing atmospheric nitrogen in the soil. Growing pulses also promotes sustainable agriculture, as pulse crops help decrease greenhouse gases and increase soil health. Pulses have a low carbon footprint as they require half the energy inputs of other crops.

Government policies to encourage farmers to take up short and long-duration pulse crops will enable farmers to earn additional income and reduce the cost of synthetic fertilisers. Incorporating this nutritious food into diet systems will also contribute to improving their health. Providing short-duration pulse crops seeds on subsidy to farmers could encourage them to adopt it as an inter-crop. Extension agencies could demonstrate the procedures involved in pulse-based silage preparation.

TRADITIONAL METHODS TO CONTROL PESTS

Pests are always a menace in agriculture as they reduce yields and quality of the produce. When a single crop occupies a larger area, the pest associated with the crop will also increase exponentially in the ecosystem amid a declining natural predator population. Climate change has added to these woes through minor pests turning into a major threat as well as the emergence of new pests. Farmers have been trying out multiple methods for pest eradication. Pesticides help in the quick eradication of pests, but at the risk of wiping out beneficial insect populations and to the detriment of soil, humans, and the natural ecosystem.

An integrated pest management system needs to be adapted while monitoring the pest population. Bobbala Yakub Reddy from Aminapuram village in Kesamudram mandal in Mahabubabad district has been practising natural farming for over four decades. He recalls using natural methods of pest control on his farm, which turned out to be effective in controlling the pest population.

“An integrated pest management system needs to be adopted while monitoring pest population.”

–Yakub Reddy

Bobbala Yakub Reddy explaining integrated pest control practices
Image credits: UNDP–Data for Policy

FIELD SMOKING

Dry leaves collected from farms and green leaves are mixed and heaped for a week. When this heap is burnt at dusk, the pests that are attracted by light will move to the flame and perish. This practice is repeated every week to keep the pest population under control.

STICKY POTS

Old earthen pots with a layer of lime wash are coated with grease, engine oil, or castor oil. These pots are grounded and kept over a wooden log. The sucking pests in the field will get stuck to the grease or engine oil applied to the pots and die, thus keeping their population under control.

PHEROMONE TRAPS

Native technologies, when integrated with modern technologies like pheromone traps are effective in controlling crop pests. Reddy uses chemical pesticides on the field only if the pest population is more than the Economic Threshold Level (ETL) or uncontrollable.

The Economic Threshold Level (ETL) is the pest population density at which control measures should be determined to prevent an increasing pest population from reaching the economic injury level.

These practices go well along with his integrated farming system.

The best strategy for pest control would be to use integrated pest management practices that incorporate traditional methods, natural/organic pest control methods, and at times with optimum chemical usage. Awareness programs for farmers on crop-specific practices could also enable them to control pest population and realise better yields.

SUB-SOIL SPRAYING

The increasing incidence of pests and diseases tends to lead farmers to apply various insecticides that dump more chemicals into the soil and disturb the natural soil health rejuvenation system. Farmers spend large amounts of money on agricultural chemicals and pesticides to get rid of pests and improve the nutrient availability, which ultimately hampers soil productivity and reduces farm returns.

Pradapanu Pullayya from Nallasangisa village, Kuruvi mandal in Mahabubabad has been practicing farming for over 40 years. He is very aware that the application of pesticides and fertilisers is detrimental to the soil and some of the residual chemicals can enter our food chain.

“Application of chemicals will gradually lead to loss of life in the soil. Soil is the solution for many field problems.”

–Pullayya

Pradapanu Pullayya at his field.
Image credits: UNDP–Data for Policy

In his field, Pullayya utilises sub-soil as an alternative for pesticides and fertilisers. For this technique, an organic soil source devoid of any chemicals is identified for taking sub-soil, which is sundried and mixed with 200 litres of water and 500 millilitres of castor oil to a liquid formulation; this quantity would be sufficient for 1 acre of land. This liquid formulation is then sprayed on the leaves and stems of crops like cotton and chillies. When the subsoil is sprayed, the plant will get the required natural nutrients. The infested pests feed on the clay-rich soil, but as they cannot digest the soil content, they die. Using this approach, the infestation of mealy bugs, aphids, defoliating caterpillars, and stem borer were eradicated. Thus, this is an effective and natural method of pest reduction.

For soil nutrient management, around 20 kg of the sub-soil is mixed with 2 kg of grounded sprouted wheat and applied near the root zone of crops. This is based on an age-old principle that the topsoil needs to be rejuvenated for depleted nutrients. This technique is known as CVR technique, invented by renowned farmer Shri Chintala Venkat Reddy for which he got an international patent.

Indigenous techniques like CVR should be encouraged amongst farmers to reduce their dependence on chemical applications. The line departments and extension officers can be trained in CVR practices to promote this method in the state.

SELF-SUSTAINING POLYHOUSES WITH PONDS

Flower production, like that of marigold, gladiolus, tuberose, and rose, in open field conditions has drastically reduced due to climate changes. The flowering plants that require frost and low temperatures such as orchids, rhododendrons, and balsam are also adversely influenced. In floriculture, ambient temperature influences the production and volatility of floral fragrances. High temperatures can also affect floral pigmentation leading to dull shades. Changing pattern of photoperiodism and thermo-periodism also greatly alters the flowering pattern. Shorter blooming period, improper colour development, and smaller flower size reduce the market value of the flowers.

Electrical conductivity is the ability of a solution to conduct an electrical current. As soluble salts increase in the media, the solution becomes a better conductor of electricity and the EC increases.

Irrigation water quality plays a critical role in high-quality flower production. Due to erratic rainfall, farmers depend on ground water for irrigation. For irrigation water, the usual criteria include salinity, sodicity, and ion toxicities. In most cases, the Electrical Conductivity (EC) value of ground water belongs to class C_2 (medium salinity) and C_3 (high salinity), which are not prescribed for flower crops.

Goguloth Ramesh is a floriculturist from Ammapuram village in Mahabubabad district and a recipient of the Innovative Farmer Award in 2021 from the Government of Telangana. He received a subsidy to set up a polyhouse of 1 acre from the Department of Agriculture in which he grows chrysanthemum and tuberose.

"Climate change has brought down the floriculture production, but with polyhouse and effective utilisation of rainwater, flower production could be increased."

–Ramesh

Using polyhouse for floral production has many advantages. The external weather extremities do not affect the crops in the polyhouse. The side slits in the roof-top of the polyhouse help in maintaining the temperature. Incidence of pests and disease are also considerably reduced. During off-season, Ramesh grows high quality chilli and chrysanthemum nurseries in the polyhouse, which are then supplied to the nearby farmers in his village; this ensures income throughout the year.

For irrigating the crops, an effective rainwater harvesting system has been established and further routed to the farm pond near the polyhouse. The rain falling on the poly house is collected and routed to the farm pond. The rainwater stored in the farm pond has an EC value in C_1 class (<1 dS/m^3), which is optimum for floriculture crops. Water in the farm pond is supplied back to the crops inside the polyhouse through a drip irrigation system.

Government of Telangana provide subsidies of more than 75 percent for setting up polyhouses. Farmers can effectively grow high-value and high-maintenance crops in polyhouses with supplemental irrigation from farm ponds. Extensive extension activities could increase awareness among farmers about polyhouses and effective utilisation of water to grow high-value crops even during off-seasons.

Ramesh near his poly house farm
Image credits: UNDP–Data for Policy

TURMERIC AS A MULTI-CROPPING SYSTEM

Climate change affects agriculture and increases the prevalence of pests and diseases. In the event of extreme weather, entire crops can be lost in monocropping systems. In contrast, crops in multi-cropping systems can have synergistic effects and can support each other in terms of growth and productivity. Hence, farmers need to be encouraged to adopt a multi-cropping system.

Narasimha Reddy from Kesamudram mandal of Mahabubabad district owns 10 acres of land where he adopts multi-cropping system. The crop land is used to grow turmeric, cotton, and paddy. Turmeric is the most important crop in his cropping system, accounting for roughly one-third of the total crop land, with paddy and cotton accounting for the remainder.

Turmeric, as the base crop, is well known for its anti-bacterial and therapeutic properties. It is grown on raised beds and has a synergistic effect in reducing the incidence of pests and diseases to some extent. Reddy claims that this multi-cropping system helps him save money on pesticides and fungicides while also increasing the yield significantly.

“Turmeric crop supports the growth of other crops and reduces the incidence of pests and diseases”

–Narasimha Reddy

Narasimha Reddy
UNDP–Data for Policy

These success stories of progressive farmers engaged in multiple cropping should be shared with farmers via Rythu Vedika to encourage adoption of multi-cropping system to increase their income and reduce the risk of crop failure amid the constant threat of climate change.

HOLISTIC CLIMATE-RESILIENT SUPPORT THROUGH FPOs

The increasing frequency of aberrations in weather events has a direct impact on yield, stability, quality, and marketability of crops. Crops that grow well in one year may not yield in the subsequent year due to changing climate patterns. Season-based crop selection, which has been practised since ages, are not practical nowadays. Continuous price fluctuations in the market and involvement of middlemen leads to more loss for the farmers.

"FPO-based production and marketing approach can counter the effect of climate change and enable farmers to realise good income."

–Netaji

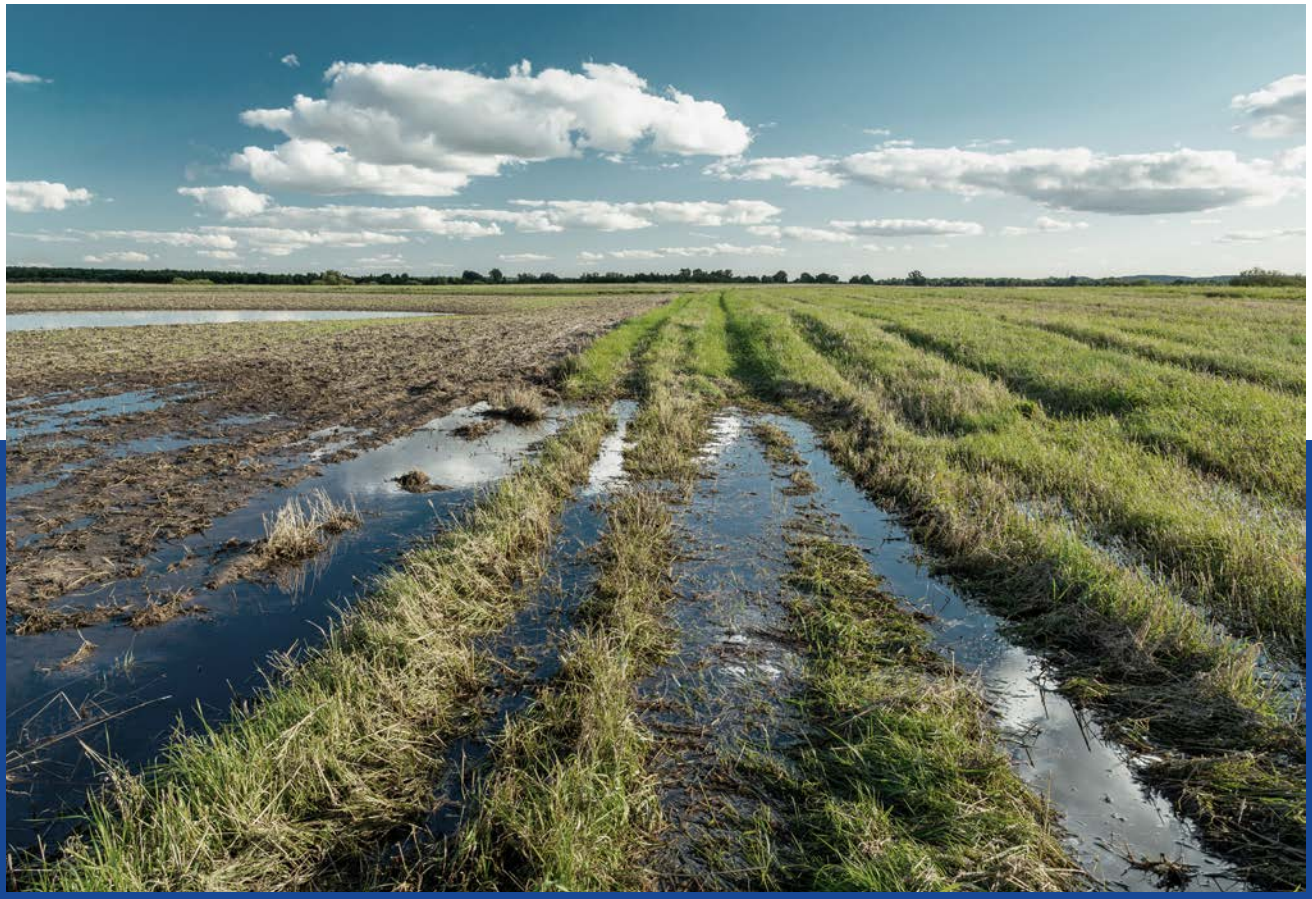
Kaylor Netaji, a turmeric farmer from Chinnamupparam village, Nellikuthu mandal, Mahabubabad district is the head of Mahabubabad Farmer Producer Organisation (FPO). The FPO began operations in 2000 and includes 324 farmers growing turmeric, chillies, and other horticulture crops. Since its inception, it has been helping farmers from crop selection to marketability and post-harvest value additions. In 2021, the FPO won the Best FPO Award from the National Horticultural Board, Government of India

Netaji speaking about the FPO and its activities during the FIG interaction conducted KVK at Malyal.
Image credits: UNDP–Data for Policy

The FPO leadership team helps in crop selection based on predictive weather, marketability of produce, price trends, technical advice from scientists, and Government schemes and subsidies. Through the FPO, farmers are given training on the best practices and technologies of crop production. The FPO procures the produce and also conducts grading and processing of the produce. The post-harvest processing units owned by the FPO are set up for produce such as turmeric, chillies, and pigeon pea, for further value addition. High-value and graded produce are exported to other countries such as the UK. The farmers can also sell these produce through the FPO via its commercial tie-ups and market access. In this way, the FPO provides holistic support in the agricultural production system.

There are many initiatives underway to support FPO formation in Telangana and the country. More support needs to be provided to the FPO leadership team for strengthening governance mechanisms and implementing field-based systems to track climate pattern along with relevant advisory and marketing assistance.

WETLAND



UNDP–DATA FOR POLICY

A COMPENDIUM OF FIELD STORIES ON GOOD PRACTICES FROM THE FARMING COMMUNITY COLLECTED BY CITIZEN SCIENTISTS

LASER LAND LEVELLING

Poor land consolidation, field undulations, and ineffective agronomic practices are some of the major challenges in rice production. Undulations in rice fields cause uneven water distribution that hamper crop establishment, and lead to increased use of seed, water, fertilisers and other inputs, and increased weed infestation. Imprudent use of resources like water, energy, and soil thus result in increased cost of cultivation, with the risk of low yield and returns. Given these conditions, it is crucial to use climate-smart agricultural practices and technologies to conserve and manage natural resources while improving yield and revenue, and lowering the environmental footprint.

Banda Raghava Reddy is a farmer from the Miryalaguda district with a rich experience of 20 years. He adopted laser land levelling technology in his rice field in order to conserve resources and maintain accurate and equal levelling of the plot by setting a 5 mm level. Land levelling is an important pre-condition for land preparation and for good seedbed preparation. Laser levelling costs around ₹2,000–3,000 per acre and such prepared lands can be maintained for up to 2 years. This reduces the cost and energy requirement in land preparation for every season.

"With one time investment in land levelling, which can be maintained for 2 years, the cost of production has reduced and the yield has increased."

–Banda Raghava Reddy

Banda Raghava Reddy explaining laser levelling
Image credits: UNDP–Data for Policy

Even distribution of water is ensured by laser levelling, which reduces water usage by 30–40 percent. A levelled land requires comparatively fewer seeds and less amount of pesticides and promotes efficient use of fertilisers. It also reduces weed infestation by up to 25 percent in the field. There is a considerable increase in the yield by up to 30 percent with the optimum use of resources. Soil erosion is also controlled with ideal water usage.

Through this climate-smart agriculture system, the cost of cultivation, including expenses in land preparation, seeds, fertilisers, and pesticides, can be reduced.

The Rythu Vedika platform can be used to demonstrate climate-smart agricultural technologies across Telangana. Success stories of innovative farmers can also be shown at these forums to promote the wide adoption of these technologies. Proven technologies such as laser levelling enabled land preparation systems can be implemented through Custom Hiring Centres operated by FPOs or rural entrepreneurs to enable faster adoption and utilisation of implements.

SEED DRILL: A CLIMATE-SMART TECHNOLOGY IN RICE PRODUCTION

One of the main causes of the poor establishment of rice in the field is thought to be the contracted hand transplantation of paddy seedlings. The rice seedlings are transplanted at a wider distance than is advised, which leads to increased transplantation shock, poorer crop establishment, and a lower yield. Additionally, transplantation stress causes transplanted crops to mature slowly. Transplantation is a labour-intensive process in rice crops, with labour costs accounting for 40 percent of the entire cost of cultivation. With dwindling production and decrease in natural resources amid climate change, such costs are a hard blow to farmers.

Pradeep Reddy, an innovative farmer from Narayanapuram village, Madugupally mandal, Miryalaguda district owns 30 acres of land. The labour cost for transplanting is around ₹10,000 per acre. He says that seed drill is an effective method to reduce costs.

The seed drill is a climate-smart technology for the direct sowing of seeds in rice fields. It is an agricultural tool that sows seeds by placing them in the ground and burying them to a particular depth while being pulled by a tractor. This ensures that seeds are equally distributed at the proper depth while maintaining equal distance.

Pradeep Reddy beside his field
Image credits: UNDP–Data for Policy

“With the introduction of seed drill, the labor cost and overall cost of cultivation has reduced drastically. With better crop establishment, the yield of crop has increased.”

–Pradeep Reddy

The seed drill-based sowing consumes very less time compared to manual methods and seed wastage also reduces considerably. Due to better seed placement and crop establishment, the yield also considerably improves.

Climate resilience should be the primary focus of any novel technology while not compromising on the output. The Government of Telangana has been encouraging farmers to adopt climate-smart technologies like seed drills. But further interventions are required for the wider adoption of such practices amongst farmers.

SEED CUM FERTILISER DRILL–A TECHNOLOGY FOR SUSTAINABLE AGRICULTURE

Farmers tend to overspend on fertilisers, leading to increased cost of cultivation. Application of the right form of fertilisers at the right quantity and at the right time plays a key role in plant growth. Fertiliser use efficiency depends on the placement of fertiliser, type of soil, and stage of crop growth.

One of the guiding principles of climate-smart agriculture is to increase the soil organic carbon pool. Resource conservation technologies are practical options for production-focused and profit-focused sustainable farming in the context of climate change that can lower cultivation costs and energy consumption and strengthen climate resilience in the agricultural production system. Precision agriculture machinery is particularly effective in fields by reducing greenhouse gas emissions.

Shaik Pasha is a progressive farmer from Kasanaguda village of Kethepalli mandal of Nalgonda district with 20 years of farming experience. He states that labour shortage and high wages are two major problems he encountered while farming on his 24-acre paddy field. Farmers have to spend a lot of time sowing seeds and applying fertiliser, but with the advent of seed-cum-fertiliser drill machines, their labour cost has now come down.

Shaik Pasha with the seed-cum-fertiliser drill
Image credits: UNDP–Data for Policy

“By using the seed-cum-fertiliser drill, the cost of labour has reduced, and the fertiliser efficiency has improved”

–Shaik Pasha

The seed-cum-fertiliser drill performs simultaneous activities of seeding and fertiliser application process in a single operation. It assures placement of seed and fertiliser at the right depth for better crop establishment and fertiliser uptake, thereby leading to better productivity. The cost of cultivation has also been reduced on account of this.

The Department of Agriculture, Government of Telangana State is implementing various subsidy schemes for supplying different type of agricultural implements/machinery to farmers. The Rythu Vedika platform promotes the wider adoption of climate-resilient precision agriculture practices amongst farmers. The seed-cum-fertiliser drill method should be demonstrated to the farmers and its benefits explained by agricultural extension officers.

METHODS FOR ORGANIC FARMING

India's agriculture sector needs new strategies to improve farm-based livelihoods while reducing emissions and adjusting to climate change. There have been discernible effects on crop yield, insect, disease, and weed dynamics, soil properties, and microbial compositions owing to climate variations. To ensure sustainable food production system, it is mandatory to transit to agriculture and food production that can adapt to the rampant climate change while preserving our natural resources, maintaining soil health, improving farmer livelihood and protecting the health and well-being of all fellow beings.

Organic farming is of paramount importance in the agricultural system as a climate-resilient practice. It allows farmers to switch from using chemical inputs to low-cost, non-chemical farming and multiple cropping. Wider adoption of natural farming can help reduce greenhouse gas emissions while also providing significant advantages, such as increased system resilience to climate change, preservation of soil fertility, and improvement of biodiversity on farmland.

Anjaneyalu–a progressive farmer from Maryagudem village, Tripuraram mandal of Miryalaguda district–has a successful story of organic farming. He owns 14 acres of paddy fields, where he has been adopting organic farming strategies involving natural products such as neem cake, neem powder, cow dung, and cow urine. By adopting organic farming practices and avoiding chemical fertilisers and pesticides, he has been able to improve soil resilience. Post adopting natural farming practices, the carbon percentage of the soil has gone up from 0.15 percent to 1 percent. He claims that there is a notable increase in the yield and natural resistance in the crops.

Anjaneyalu near his farm
Image credits: UNDP–Data for Policy

“My soil smells so natural and the carbon content has also improved when compared to the other fields that use chemicals”

–Anjaneyalu

To improve the carbon content in the soil, 10 kg of cow dung is added to 10 litres of cow urine, to which 2 kg of jaggery and gram flour are mixed. To this mixture, 5 kg of soil and neem oil is added. The mixture is ground and kept overnight. Later it is applied to the soil. He also uses Azotobacter as an alternative to chemical fertilisers. About 4 kg of azotobacter biofertiliser is mixed with 200 kg of compost and kept overnight. This mixture is then incorporated into the soil at the time of sowing or planting.

Organic farming is being encouraged widely by the Government of Telangana through Rythu Vedika. Despite this, farmers are not able to follow organic farming owing to the production requirements and longer time required for organic certification. There is a need for more studies to understand the lower adoption of organic farming. The recent thrust on regenerative agriculture and increasing climate change challenges might help in more widespread adoption of such practices.

NEEM POWDER AND NEEM EXTRACT–AN INDIGENOUS SOLUTION TO CONTROL PESTS

Climate change affects the natural ecosystem and its inhabitants. Chemical fertilisers harden the soil, decrease soil fertility, and strengthen the pest population by reducing the mix of natural predators. These chemicals release greenhouse gasses and are also known to pollute the air and water. This invites a variety of hazards to the environment and human health.

Natural farming is a solution to counter the effects of climate change and reduce its impacts on the environment and inhabitants. Owing to their economic viability and eco-friendly nature, plant products play a significant role in the management of insect pests. Neem, an indigenous tree used since the Vedic period in India, is a solution for countering most of the crop pests.

The limonoids, like azadirachtin, salanin, nimbin, and meliantriol, are the most important active ingredients found in neem. These limonoids have insecticidal, ovicidal, anti-feedant, growth-regulating, adult sterilising, and insect-repellent properties.

Kandi Somayya explaining about neem powder products
Image credits: UNDP–Data for Policy

“In agriculture, neem has got an important place; these indigenous trees can be used as an all-in-one solution for crops”

–Sommaya

Kandi Somayya, a farmer from Tripurarum mandal of Miryalaguda district is known in his village for adopting neem-based product application in his field. He applies neem powder prepared from neem leaves that are sun-dried for two days and grounded. This can be either drenched to the crop root zone or applied as a spray on the crops.

He applies neem powder to the soil around the plant root zone, which increases the carbon content and nitrogen availability in the soil. It also protects the crop from nematodes, soil grubs, and other pests.

Somayya mixes 100 g of neem powder in 1 litre of water for 24 hours, which is then filtered. The filtrate is later diluted by adding 1 litre of water and then later sprayed on crops once in 15 days. This neem spray is an efficient method of pest control.

Neem-based products are eco-friendly and the best effective method of controlling pests. Farmers are aware of the benefits of neem, yet very few adopt it. Therefore, value-added neem products should be made available in the market for farmers to begin adopting natural farming. Government support to promote the use of neem-based products would encourage farmers to adopt it.

JEEVAMRITHAM–AN ALTERNATIVE TO CHEMICAL FERTILISERS IN RICE PRODUCTION

Climate change takes a toll on the soil, leading to soil erosion and changes in organic carbon, nutrients, and alkalinity level. Many soil properties are affected by changes in temperature and rainfall. To improve soil fertility and increase yield, farmers apply chemical fertilisers at the cost of the environment. Excessive use of fertilisers could seriously reduce soil microbial diversity. The beneficial soil microbes are critical for nutrient cycling and soil productivity. Consequences of climate change such as increased temperatures, CO_2 concentration, and drought conditions have also reduced the soil microbial population considerably, decreasing soil resilience, resistance, and productivity. It is important to introduce organic fertiliser alternatives to improve soil health and soil microbial diversity.

Mangamma, a progressive women farmer from Nirmalur mandal of Nalgonda district, has been using a low-cost improvised organic fertiliser preparation called *jeevamrutham* in her rice fields. *Jeevamrutham* is a microbial culture, prepared from cow dung and cow urine, used in organic farming to meet the nutritional requirement of crops. She has been applying *jeevamrutham* formulation in her field for the past four years and it has significantly enhanced soil fertility and soil health.

Mangamma
Image credits: UNDP–Data for Policy

Jeevamrutham is a microbial culture made in *dhrava* (Liquid) and *ghana* (Solid) forms. For ghana form, 100 kg of desi cow dung (cow dung is good only for 21 days and should be stored by keeping it moist by sprinkling water and stored in shade), 1 kg Jaggery, and 1 kg pulse flour are mixed well and stored as a heap for 48 hours in shade. If the temperature drops below 12 degrees, the heap should be covered with rug sack to maintain a constant temperature for conducive climatic conditions for micro-organisms. After 48 hours, the mixture is spread on a clean surface and sun dried, with the regular flipping to ensure rapid drying and that all particles are exposed to sunlight. Once it is completely dried, the lumps are broken into powder form with a wooden bat, filled into sacks, and stored in a cool and dry place. This powdered form is later drenched into the soil before seed plantation.

"The crops are much more profuse, robust, and natural after shifting to organic fertiliser."

–Mangamma

For preparing the dhrava form, 10 kg fresh local cow dung and 5–10 litres of aged cow urine is added to 200 litres of water in a barrel. About 2 kg of jaggery and 2 kg of pulse flour and a handful of soil is added to the barrel. The solution is stirred at regular intervals and allowed to ferment for 48 hours in the shade. During this process, the aerobic and anaerobic bacteria present in the cow dung and cow urine multiply as they eat up organic ingredients (like pulse flour). Thereafter, it can be applied with irrigation water or as a foliar spray.

The Government of Telangana has been encouraging farmers to shift to organic farming through various schemes. Awareness programmes with an emphasis on the impact of organic farming on the environment, availability of adequate post-harvest infrastructure for organic produce, proper marketing facilities and marketing channels, and premium price for the organic produce among others would certainly motivate farmers towards organic farming thereby increasing its coverage in the country.

ALTERNATE WETTING AND DRYING

A climate-smart strategy that offers both adaptation and mitigation is essential to combat climate change in rice production. Traditional methods of rice production use too many resources and potentially increase global methane emissions. Optimum utilisation of the resources while reducing methane emissions into the atmosphere remains a major challenge in rice production.

In irrigated lowland rice, alternate wetting and drying (AWD) is a management technique that preserves yields while conserving water and lowering greenhouse gas emissions. In general, this technique is a cheap and practical alternative for poor communities, promoting proper utilisation of available water. For farmers who cannot rely on rainwater owing to climate change, it presents a valuable adaptation option. It reduces methane emissions and irrigation pumping costs and enhances the efficiency of water usage. AWD technology eliminates plant lodging issues, encourages strong root anchorage, and conserves water. It reduces the frequency of flooding in rice farms, which then improves the quality of soil structures. Better soil structures allow farmers to intercrop rice with other agricultural crops.

"I could conserve water and soil structure is also maintained by alternate wetting and drying."

–Vamshi Krishna Reddy

Vamshi Krishna Reddy near his rice field
Image credits: UNDP–Data for Policy

Vamshi Krishna Reddy is a progressive farmer from Narayanapuram village of Madugulapally Mandal of Nalgonda district. He has been practising AWD in his 20 acres of rice fields. Lowland rice farmers can utilise AWD as a water-saving technique to cut back on the amount of water they use in irrigated fields.

A water tube 30 cm in length and 10 cm in diameter made up of bamboo is installed in the field. The bottom 15 cm of the tubes are drilled into the field and is buried to 20 cm depth so that half-length of the tube remains on the surface. The field is re-flooded with 5 cm of pond water once the water level has sunk to a depth of 15 cm below the soil surface. This procedure is referred to as Safe AWD.

Many NGOs and formal extension institutes are mainstreaming AWD in their extension initiatives. The curricula of agricultural schools, universities, and extension certification programmes offer training and extension materials on AWD. Through government interventions, wider adoption of AWD could be encouraged amongst farmers.

INTEGRATED FARM MANAGEMENT SYSTEM

Lower agricultural productivity due to climate change has an impact on food production. The availability of nutritious food is of paramount importance for the overall development of society. Maintaining food security, supply of nutritious food and sustainable development are some of the biggest challenges facing nations.

Fundamental adaptation measures like introduction of novel technologies, changes in crop patterns and judicious use of resources like water and soil need to be implemented for a climate-resilient agriculture system. An integrated farming system involving multiple production system for continuous income from various sources help in sustainable development. If such a system incorporates proper marketing channels for the produce involving farmer groups, there would be negligible risk involved. K. Srinivasa Rao is an innovative farmer from Veerappaguda village of Miryalaguda district. He has established an integrated farming system involving 60 goats, 4 buffaloes, and 80 hens.

He has allocated 8 acres of land for the cultivation of crops, including rice, pulses, and chillies; this ensures income from crops, milk, egg, and meat production. He also rears a new variety of poultry *Kadaknath*, the meat of which is high in nutritional value and has huge demand all around the country. The establishment of high-value poultry production provides him with continuous income throughout the year.

Srinivas Rao beside his poultry farm
Image credits: UNDP–Data for Policy

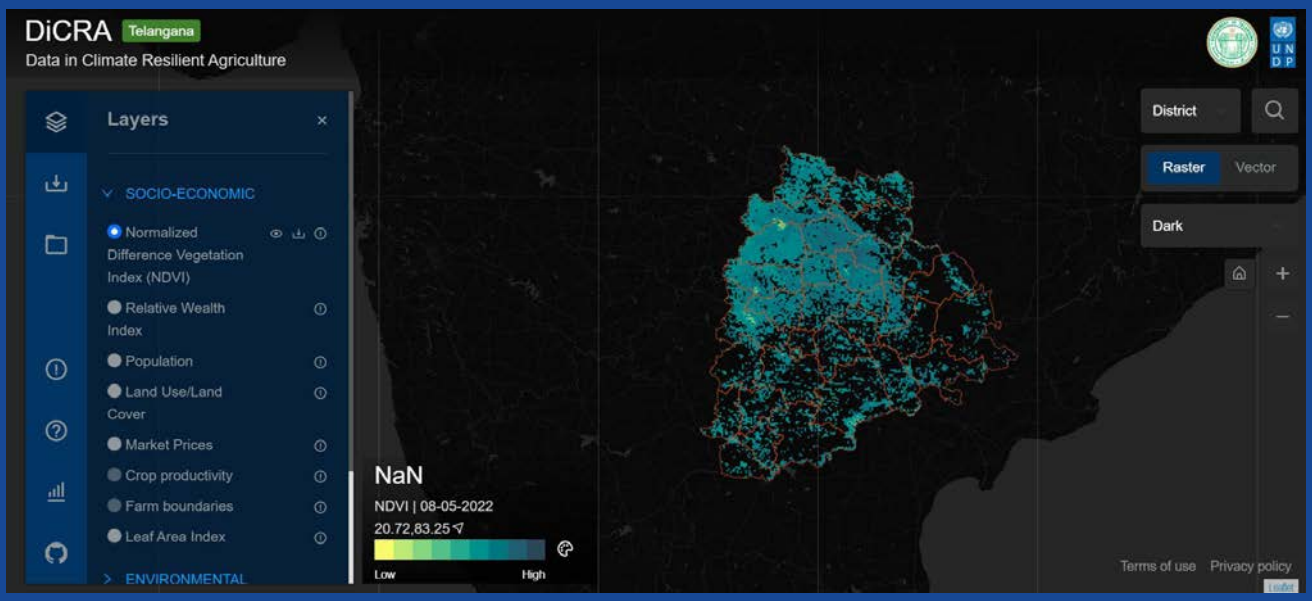
The poultry droppings from the poultry farm are clumped and mixed with water and are later drenched into the soil. The poultry manure is rich in nitrogen, potassium, and calcium and is better in terms of nutrient supply and nutrient availability than other farmyard manures. Apart from that, to improve the carbon content of the soil, he applies goat droppings and cow manure as well.

Apart from having an established integrated farming system, he also set up an FPO for procuring eggs and milk from all the nearby farmers involved in the integrated farming system. Through the FPO, a stall has been started for selling milk, egg, and meat. Marketing of high-value produce is also facilitated through the FPO, thereby enabling the farmers to sell their produce at a better price.

The Government of Telangana should support farmers to take up rearing high-value new variety of poultry through integrated farming system. It should also provide support for establishing a marketing system for farmers involved in integrated farming system. The introduction of nutritious crop varieties and poultry breeds is also important for the sustainable development of society.

OUTRO

Climate-resilient agricultural practices are the way forward to establish a national food supply system which can withstand the harmful effects of climate change. By gathering information on tried and tested practices within farming communities and scaling them up to a national level, we can work towards securing a future which allows for greater crop productivity, assured farmer livelihoods, and global food security, while also preserving what nature has yet to offer to us.



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