

Adaptation as Innovation

Lessons from smallholder farmers in rainfed Karnataka

By Greeshma Hegde, Chandni Singh and Harpreet Kaur
Indian Institute for Human Settlements



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CARIAA
*Collaborative Adaptation Research
Initiative in Africa and Asia*



About ASSAR

All authors are team members of the ASSAR (Adaptation at Scale in Semi-Arid Regions) project, one of four hotspot research projects in CARIAA (the Collaborative Adaptation Research Initiative in Africa and Asia).

The international and interdisciplinary ASSAR team comprises a mix of research and practitioner organisations, and includes groups with global reach as well as those deeply embedded in their communities.

The ASSAR consortium is a partnership between five lead managing institutions – University of Cape Town (South Africa), University of East Anglia (United Kingdom), START (United States of America), Oxfam GB (United Kingdom) and Indian Institute for Human Settlements (India) – and 12 partners across Africa and India. Working in seven countries in semi-arid regions, ASSAR seeks to produce future-focused and societally-relevant knowledge of potential pathways to wellbeing through adaptation.

ASSAR's overarching research objective is to use insights from multiple-scale, interdisciplinary work to improve the understanding of the barriers, enablers and limits to effective, sustained, and widespread adaptation up to the 2030s.

ASSAR's research strives to integrate climatic, environmental, social and economic change. The dynamics of gender roles and relations form a particularly strong theme throughout our approach.

Each of ASSAR's teams conducts research focused on specific socio-ecological risks/dynamics that

relate centrally to livelihood transitions, and access, use and management of land and water resources in water-stressed environments.

In India, ASSAR works in Maharashtra (Sangamner region), Karnataka (Bangalore, Kolar and Gulbarga), and Tamil Nadu (Moyar Bhavani Basin). We focus on drivers of differential vulnerability among marginalised groups and the different response strategies people have to manage climatic and non-climatic risks. The project also has a strong focus on using the research findings to inform better practice and policymaking.

This booklet contributes to identifying barriers and enablers to local adaptation, uncovering how factors at multiple scales promote or constrain local innovation in agriculture, and provides direction for scaling up. The booklet is aimed at district and state-level government officials as well as local NGOs as a way to spread success stories and share reasons for failures between districts.



Introduction

Although 55% of India's employed population is dependent on agriculture and allied sectors for their livelihood, agriculture contributes only 14% to India's GDP (Gopalakrishnan and Thorat, 2015). National statistics show that 8.1 million farmers have left agriculture between 2001 and 2011 (Census of India, 2011). As a livelihood, agriculture is seeing a rapid exodus due to an interplay of many stressors, such as climate variability and change, deteriorating natural resources (e.g. water, green cover and soil), and wider fluctuations, for instance market dynamics, aspirational shifts, and policy changes.

In predominantly semi-arid states, such as Karnataka, approximately 65% is rainfed (Government of Karnataka, 2015), making agrarian livelihoods particularly sensitive to erratic rainfall. Climate projections estimate decreasing rainfall and increasing temperatures, which could exacerbate existing challenges in the groundwater-stressed areas of Southeast Karnataka and drought-prone areas of North Karnataka.

To deal with these risks, the Government of Karnataka has a range of rural development and agriculture-centric programmes, such as Bhoochetna, Krishi Bhagya, and Sujala. These are complemented by a long history of watershed development in Karnataka, which has fostered strong NGO presence in the state. However, despite these positive interventions, growing climatic risks and existing structural drivers of vulnerability, such as poverty, gender and caste-based differentiation, and land fragmentation, continue to challenge farmer livelihoods.

At the individual level, farmers deal with risk and uncertainty daily. Many of them use these conditions of stress as opportunities for agricultural innovation and improved risk management. Often, these innovative practices can result in 'triple wins' – higher incomes while maintaining ecological sustainability and adapting to climate change. This booklet aims to capture some of these lessons and identify factors that enable these processes of innovation.

To do this, we interviewed eight farmers in two semi-arid, water-scarce districts within Karnataka – Gulbarga and Kolar. All the farmers interviewed were recognised as 'progressive farmers' and are recipients of the Krishi Prashasthi Pandit Award by the Karnataka State Agricultural Department. We use these farmer stories to identify lessons on fostering innovation and enabling individual-led adaptation action. By doing so, we also gain insights into how the larger ecological, socio-institutional, and market environment mediate innovation. These insights are used to identify policy-relevant entry points discussed at the end of the booklet.

The aim of the booklet is to document cases of adaptation innovation and discuss lessons for similar semi-arid regions in India. We first describe key concepts used and then the methodology, followed by profiles of farmers interviewed and their innovative practices.

What is adaptation?

Simply put, adaptation is “the process of adjustment to actual or expected climate and its effects”.

Adaptation actions can occur at different levels (individual, household, community, village, district, nation) and by several actors (NGOs, farmers, government officials).

In Karnataka, for example, the following actors help local adaptation:

- **The Krishi Vigyan Kendra (KVK)** or Farmer Science Centre, which assesses location-specific technology to improve cultivation and agricultural output through technology demonstrations and trainings.



- **District-level horticulture and agriculture departments** acknowledge and support farmers using innovative farming practices by providing relevant information on available government schemes, climate services, such as weather advisories, and advice on fertiliser dosage and pest management.
- **National Bank for Agriculture and Rural Development (NABARD)** provides credit support through a range of programmes covering subsidies, financial inclusion, development of farmer cooperatives etc.
- **Non-governmental organisations**, such as Gram Vikas and MYRADA, play key roles in providing technical assistance and serving as knowledge brokers to facilitate capacity building at the grassroots level.

To adapt, people must have the capacity to do so.

This capacity to make adjustments in one’s practices, is called **adaptive capacity**.

It can be in the form of technical capacity (e.g. developing drought-tolerant crop varieties), informational capacity (e.g. access to weather forecasts), and institutional capacity (e.g. having policies and processes to implement adaptation at multiple scales).

Also critical is natural capacity (access to fertile soil and water for irrigation), social capacity (e.g. networks to rely upon during food shortages), financial capacity (credit facilities), and personal attributes (e.g. education).



Depending on when an adaptation activity takes place, the drivers to take up the activity, and who undertakes them, adaptation efforts can be categorised into five types:

- **Anticipatory or proactive adaptation** that takes place before the impacts of climate change are observed.
- **Autonomous or spontaneous adaptation** that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes or changes in human systems (e.g. market dynamics, policy shifts).
- **Planned adaptation** that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.
- **Public adaptation** that is initiated and implemented by governments at all levels.
- **Reactive adaptation** that takes place after impacts of climate change have been observed.

With growing scientific evidence around climate change impacts, especially in sensitive sectors, such as agriculture, the need for adaptation is being recognised. Climate projections indicate that, without adaptation, effects of changes in the climate will stress rainfed agricultural systems by decreasing yield and a loss in farm level net revenue. While there are several examples of adaptation interventions across India, they need to be scaled up in a way that more people can benefit, and better policies can be formed. This scaling up requires community participation, transfer of knowledge among different actors and stakeholders, and considering the processes of adaptation from policy design, implementation, and evaluation stages.

However, it is also crucial to clarify at the start, what do we want to achieve, i.e. what does effective adaptation look like?

What is effective adaptation?

There is a growing recognition that meeting basic development goals, such as reducing poverty, providing infrastructure and services, and building strong local institutions, is critical for adapting to climate change.

However, sometimes development interventions can have negative adaptation outcomes, either by excluding certain sectors (e.g. rapid urbanisation is threatening agriculture in peri-urban areas) or certain people (e.g. marginalised communities are trapped in historical cycles of deprivation and low-asset ownership).

Finally, some adaptation interventions themselves can have negative outcomes and make communities more vulnerable. For example, shifting to water-conserving crops may be maladaptive if there are no markets for such produce.

In this context, what would effective adaptation look like? Some researchers have called for 'sustainable adaptation' which is based on principles of social justice and environmental health. Sustainable



adaptation interventions would (1) identify the drivers of vulnerability; 2) acknowledge that divergent values and interests affect adaptation outcomes; 3) integrate local knowledge into adaptation responses; and 4) consider potential feedback between local and global processes.

Other studies (Appadurai et al. 2015) have identified good adaptation practices in rainfed India as interventions that:

- Incorporate findings from vulnerability assessments
- Incorporate analysis of past and future climate trends
- Provide climate information services
- Promote knowledge sharing
- Address uncertainty
- Ensure community ownership of the project and
- Ensure equitable participation by local communities

For adaptation to be effective, it is also important to have flexible, coproduced systems for monitoring and evaluation of interventions. Thus, effective adaptation can be understood as one that improves adaptive capacity to respond to and prepare for climatic risks, but also builds upon existing development interventions.

Key to effective adaptation is the idea that it should be ecologically sustainable, socially just, and minimise negative effects on other biophysical systems or communities in the present and future.

What is innovation, and how is it linked to adaptation?

In agriculture, innovation encompasses the successful development, transfer, adoption and diffusion of techniques and technologies to increase agricultural productivity. It is mediated by institutions (practices, norms, and policies), individuals or groups, and is specific to socio-economic and cultural contexts. Farmer innovations, in particular, are based on traditional knowledge as well as external knowledge (through agricultural extension, NGO projects) and take the form of informal experimentation or planned interventions.

Agricultural innovation is not just about new technologies; it also encompasses new ways of doing things, (institutional changes), new perspectives (cognitive changes), and aiming for different goals (aspirational changes). Grassroots innovations have been found to be effective among farmers because they tend to develop locally-appropriate technologies that are suited to particular contexts. However, linking the successes of such innovations to existing policies is often difficult because they are typically informal, difficult to test or replicate, and not recorded in the way scientific experiments are.

Whether an innovation will be adopted by others is difficult to predict. We try to address this gap by documenting innovations by farmers, assessing what has enabled these innovations, and exploring factors that have enabled diffusion of their innovation.

How are adaptation and innovation linked?

The growing severity and frequency of climatic risks on agriculture in India calls for proactive action to



minimise risks and improve adaptive capacities to deal with them. In such a context, business-as-usual strategies are being rendered ineffective. Given how climatic risks will exacerbate other risks in agriculture, innovative solutions can help mitigate some negative impacts.

Innovations are characterised by flexibility and ‘making do’ to even prospering under constraints. These features make innovative practices valuable for adapting to climate change. These innovations can be institutional or technological, undertaken by individuals or communities (social innovation), and involve changes across multiple scales. Given that farmers have been adapting to climatic risks and innovating within agriculture, it is useful to examine these innovations for their adaptation potential.

Our approach: State farmer awards

The Krishi Prashasthi Pandit Scheme was introduced by the State Agricultural Department of Karnataka in 2001-2002 with the aim of recognising and encouraging farmers who have contributed to the welfare of the farming community through their innovations. The award is given out every year to three farmers across the state by the Government of Karnataka.

To understand the awarding criteria and process of selection, we interviewed key informants at the district and state levels in the departments of agriculture and horticulture.

We are documenting practices of award-winning farmers as examples of successful innovation and lessons for scaling up individual adaptation. Based on their applications and field visits done by the authorities, farmers are marked on a score of 100. Farmers with a score of 65 and above are eligible for the award. The three applicants who score the highest marks are finally awarded.

Process of selection

The District Joint Director sends out a call for applications via newspapers. Completed applications are submitted to the Joint Director of Agriculture (JDA) or Assistant Director of Agriculture (ADA).

The screening committee consists of the JDA, who is the chairperson of the committee, one scientist from Krishi Vigyan Kendra (KVK), Deputy Director (DD), Divisional DD and the Member Secretary from the HQ.

A team visits the farmers' fields. Reports are sent to a committee headed by the Additional Director from the Human Resources Development department. This committee includes scientists from five regional departments of the University of Agricultural Sciences. The committee shortlists applicants.

Based on the sent applications and the field visits, the farmers are scored out of 100 using various criteria.

Criteria used by State government for innovative farmer awards

Scaling

- Utility/usefulness of the technique
(10 Marks)
- Level of applicability: whether the innovation is easy to adopt or not
(10 Marks)
- Dissemination of knowledge of good agricultural practices
(5 Marks)
- Involvement of family members in farming
(10 marks)
- Involvement in social responsibilities
(5 Marks)

Innovation

- Specialised knowledge of good farming practices: Judicious water use, organic farming, mechanised agriculture
(10 Marks)
- Correct management of agricultural techniques
(10 Marks)
- Reduced cultivation cost and higher farm income, so that finance is not a hindrance when other farmers try to adopt the innovation
(10 Marks)
- Management of organic farming techniques, vermicomposting, etc.
(10 Marks)

Marketing

- Measures taken to improve the quality of produce
(5 Marks)
- Adoption of e-marketing commodity association
(5 Marks)

Procedural

- Maintenance of records: Inventory, season-wise activity, cost and income record
(5 Marks)

Publicity

- Publicity of innovation through interviews, newspapers, other sources
(5 Marks)

Method

We collected a list of awardee farmers from the Krishi Vidyan Kendra (KVK) in Gulbarga and from the Horticulture Department in Kolar.

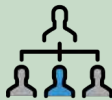
Eight farmers, four from each district, were chosen to cover a range of innovation types, with care to include small and large landholders and male and female farmers.

A team of two researchers visited the farms of the awardees and conducted semi-structured interviews with them.

The questions focussed on their agricultural practices, motivations to adopt these practices, decision-making around innovations (by whom, how, when), and forms of external support received.

From the interviews, we identified six categories of innovative practices with potential adaptation benefits (see icons below).

Next, we profile these eight farmers to highlight their innovations, potential adaptation co-benefits, and actors and processes that enabled the innovations. For each farmer, icons highlighted in green are those taken up by that farmer.



Judicial use of water

Unique practices to irrigate the farms and conserve/recharge existing water sources.

Organic farming

Practices that do not involve use of any synthetically prepared materials for manure, fertilisers or pesticides.

Knowledge transfer

Farmers attempting to take their methods to wider public by demonstration or providing training.

Innovation

Techniques or practices to improve quality or quantity of produce in a manner that is easy to adopt and has low cost.

Genetic conservation

Practices involving conservation of species that are bred or grown to maintain genetic quality.

Sustainable practices

Farmers engaged in methods like use of solar power for electricity, solar fencing, composting, etc.

Map of Gulbarga



Gulbarga

Gulbarga (lately renamed Kalaburgi) is a semi-arid district 600 km north of Bangalore. Average annual rainfall is 832 mm and temperatures vary from 45°C in summer to 10-15°C in winter. The black soils in Gulbarga are conducive for *tur daal* (pigeon pea) production, earning it the title of 'tur bowl of Karnataka'. Apart from pigeon pea, black gram, pearl millet, sesame, cotton, and sugarcane are key crops in the area.

Gulbarga faces frequent droughts and within-monsoon dry spells that affect rural livelihoods adversely. This is particularly concerning since 83% agriculture in the region is rainfed (CGWB, 2013). Besides agriculture, livestock rearing, stone mining, and wage labour are key livelihoods.

Gulbarga is consistently ranked poorly on development indices within Karnataka. According to the Human Development Report for Karnataka, Gulbarga has the lowest Human Development Index

(HDI) in the state (Government of Karnataka, 2005). Of the total population, 27% falls below the poverty line (Census of India, 2011).

Current vulnerabilities in Gulbarga can be traced back to a long history of underdevelopment and political marginalisation since pre-colonial times.

Its inhabitants are also exposed to climatic variability and change because the district is among the hottest and most arid regions of Karnataka.

People have adjusted their livelihoods and practices to suit this context of risk and climate vulnerability.

Historically, Gulbarga has been the source of migrants to Bangalore and neighbouring states of Andhra Pradesh and Maharashtra. This migration is mostly in the nature of long-term and seasonal migration (during the lean season), and in some cases permanent, as it is quite distant from any major urban centres.

Farmers interviewed



Shivlingappa Chorgasti

Sharanabasappa Patil

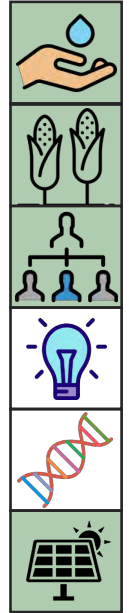
Shyamrao Patil

Shivsharanappa Bulla



Shivlingappa Choragasti

| | |
|-------------------|--|
| Age: | 57 years |
| Awarded for: | Organic farming |
| Caste: | General |
| Crops cultivated: | Pigeon pea, cotton, banana, coconut, sugarcane |
| Village: | Bhimahalli, Gulbarga |
| Landholding: | 20 acres |



Shivlingappa Choragasti's efforts to practise dryland agriculture, organic farming, and afforestation in an area that receives low rainfall, earned him the Krishi Prashasthi Pandit award in 2009. He has been experimenting with various methods over 40 years of farming.

Judicial use of water: Like most of Gulbarga, Bhimahalli village has scanty rainfall and faces acute water shortages. Borewells in the area repeatedly fail because they run dry in their first year. Almost on the brink of giving up on agriculture, Shivlingappa heard about a farmer who harvested rainwater and decided to try it. The method, which involves a combination of making check dams, sunken pits, farms ponds and harvesting tanks, has increased groundwater levels under his fields. He also practises mixed cropping along with cotton. Shivlingappa irrigates his fields through drip irrigation.

“Even with low rainfall, one can manage to grow crops if water is used prudently.”

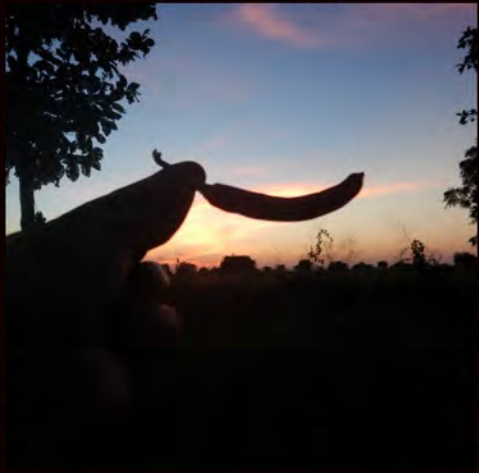
Organic farming: Shivlingappa currently practises organic farming on the land that he inherited from his father. Early on, he realised the benefits of organic farming and found that initial low yields while practising organic agriculture can be recovered substantially in later years. While initial investments are high, returns from crops like pigeon pea and cotton are not enough to recover investments. To other farmers hesitating to enter organic farming he suggests growing horticultural species: they are annual crops, require lower investment, and reap higher profits, thus reducing overall risk. Horticultural species can also be intercropped with pigeon pea and cotton.

Knowledge transfer: Shivlingappa is the district convenor of the District Organic Farmers' Parivara (family) and he advises other farmers about the benefits of organic farming, rainwater harvesting, afforestation and horticulture. Many farmers have visited his farm to learn the techniques he has adopted. He states that one needs to have a lot of patience to do agriculture. Beyond this, one needs both money and effort to make agriculture successful. In his opinion, the main problem faced by many families in the region is that even though they own small stretches of land, they do not attempt to experiment with farm ponds and check dams which can ensure water security.

Sustainable Practices: Shivlingappa utilises an innovative set-up to manage pest infestation. To prevent insects like the cotton borer from destroying his crop, Shivlingappa has set up light traps, with a small plate that contains few drops of kerosene kept under each trap. Borers lay their eggs in the evening (from 7-9pm). He exploits this so that when the borers come out, they get attracted to the light, fall into the plate, and die. Apart from agriculture, Shivlingappa has diversified his farming to include animal husbandry and poultry keeping. He produces biogas, using livestock manure, and uses it for cooking.

| Barriers | Enablers |
|--|--|
| Shortage of electricity: Bhimahhali village is supplied electricity for agriculture only at night. | Flexible practices: To deal with erratic electricity, Shivlingappa lets water flow into the check dam, sunken pits and his farm pond, and uses that water to irrigate his crops during the day. |
| Inadequate institutional support causes many farmers to spend large sums of money on buying or renting equipment rather using government schemes. Shivlingappa received Rs. 25,000 for constructing a check wall but the funds were insufficient. | Institutional support: Received guidance on technical aspects of several practices by the Krishi Vidyan Kendra and the Agricultural Department. |
| Increasing climate variability: Erratic rainfall patterns hinder crop productivity and yields. Excessive rains in 2015 halved his expected yield of 40 quintals of pigeon pea, leading to severe losses. | Better information: Contributions from the media (television, radio) in terms of weather reports, helped him prepare for extreme events. |
| | Experience: 40 years of experience in farming |

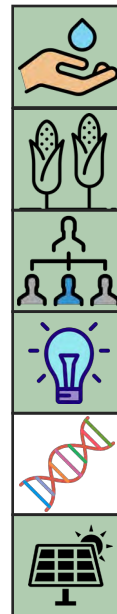
“Farming is always risky. I have managed to overcome a lot of the barriers in organic farming because of my vast experience in farming. I don’t wish that my children continue as farmers because it involves a lot of struggle and uncertainty, which will only increase in the future.”





Sharanabasappa Patil

| | |
|-------------------|--|
| Age: | 44 years |
| Awarded for: | Drip irrigation, water management, rain water harvesting. |
| Caste: | General |
| Crops cultivated: | Pigeon pea, cotton, banana, coconuts, lemons, guavas, wheat sugarcane, paddy |
| Village: | Hal Sultanpur, Gulbarga |
| Landholding: | 25 acres |



Sharanabasappa Patil uses unique, innovative irrigation techniques. He was instrumental in bringing down the cost of installing solar-powered fences for his farmlands by using locally available material. He also introduced the concept of tap irrigation for horticultural crops. He was awarded the Krishi Prashasthi Pandit award in 2008.

Judicial use of water: One of Patil's significant contributions is the promotion of tap irrigation, which he argues is more efficient than drip irrigation. Under this system, one can regulate water flow and use excess water for other plants. Tap irrigation requires installing taps near a plant. These taps can be used for 3-4 years and, according to Patil, save 120-140 litres of water, each time he irrigates his fields. Patil has also constructed farm ponds and adopted rain water harvesting to conserve water. He has left 1.5 acres of his land fallow to allow rainwater to percolate and replenish underground reserves. This fallow land harvests rainwater from 20-25 acres and helps recharge Patil's open wells and borewells.

"We use water very efficiently to reap maximum yields with minimal use of water. We only had water sufficient to irrigate half acres, but now with the same amount of water we have managed to irrigate three acres, and harvest rain water to recharge ground water."

Organic Farming: Patil practises integrated farming and grows lemon, pigeon pea, sugarcane, black gram, green gram, sorghum and pearl millet. He uses organic fertiliser for the crop. He initially practised conventional farming until he attended an organic farming training in 2006 and started to practise in five acres of his 25 acres of land. In three years, he produced yields equal to what he used to get with conventional farming. After three years, the yield from organic farming overtook yields from conventional farming.

Innovation: One of Patil's popular inventions is a machine made for nipping pigeon pea plants to improve vegetative growth of intercropped plants, like red gram. Trimming pigeon pea plants is a labour-intensive task that has become increasingly difficult because of rising labour costs and lower availability of labour. In response to these issues, Patil developed a nipping tool by attaching a hand-held battery-operated spraying machine to a disk with three slots, where three razor blades are inserted. This machine has met with success and Patil has sold it in Bellary, Bangalore, and Andhra Pradesh through support from ICRISAT. Water for farming is supplied in the night which makes it difficult for farmers to irrigate their crops. To overcome this problem, Patil uses a switch that measures the amount of water pumped out of a well. The amount of water pumped is almost 10 times the amount collected in the bucket. The switch is linked to a motor that automatically switches off when the water in the bucket reaches a certain level, thus avoiding wastage of water. He also uses solar light traps to curb pest attacks.

Knowledge transfer: Patil's innovations have gained him a lot of popularity across Karnataka. Apart from farming, he markets his harvesting device and solar fencing technique at various platforms and workshops. The Krishi Vigyan Kendra in Gulbarga has provided support in recognising and promoting his innovative efforts. He also helps farmers set up tap irrigation systems on their farms and advises them on ways to maximise farm returns. He routinely advises farmers not to burn crop residue, since it decreases soil fertility. He has also motivated 15-20 farmers to grow sugarcane by demonstrating high returns from the crop.

Sustainable practices: Patil has contributed to developing low-cost technology for farming by using solar fencing. Crop damage by wild boars is a significant menace in the area. To prevent this, Patil installed solar-powered fences that let out a siren when the fence is touched. So far, he has sold such fences to almost 2000 people across Karnataka. His efforts to use readily available, local materials has gained him recognition by power suppliers in Gulbarga. He also has a biogas set-up which he uses for cooking, and a solar-powered water heater for domestic use.

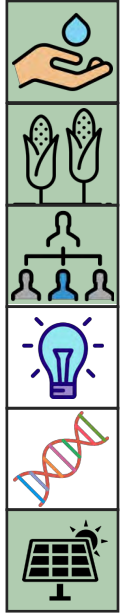
| Barriers | Enablers |
|--|--|
| <p>High entry barriers: Switching from conventional farming to organic farming is difficult because of low yield in the initial phases.</p> | <p>Experimentation: Despite minimal training in electronic engineering, Patil coupled this basic knowledge with slow and steady adjustment of his farming practices.</p> |
| <p>Risk aversion within family: Patil's family was initially very wary of his decision to take up organic farming as they were not convinced that the benefits gained from that practice would be enough to sustain them. However, Patil was determined to continue with organic farming.</p> | <p>External capacity building: Training by external agencies on organic farming influenced and exposed Patil to new ideas which he adjusted to his context.</p> <p>Personal drive: Patil's drive for agriculture and innovation to simplify his activities has helped him diversify his farming.</p> |





Shyamrao Patil and Lakshmi Bai Patil

| | |
|-------------------|---|
| Age: | 56 and 50 years |
| Awarded for: | Organic farming |
| Caste: | General |
| Crops cultivated: | Pigeon pea, banana, coconuts, guavas, papaya, tamarind, mangoes, sugarcane, watermelon, beans, onions |
| Village: | Garoor B, Gulbarga |
| Landholding: | 4 acres |



Shyamrao Patil is a smallholder farmer who has dedicated his farming experience towards improving his practices. With strong support from his wife, Lakshmi Bai Patil, who was also awarded the Krishi Pandita award in 2009, Shyamrao Patil received a progressive farmer award in 2014.

Judicial use of water: Shyamro Patil dug a few borewells for irrigation but the borewells had only a few inches of water and quickly went dry. He constructed check dams for which he received subsidies from the Watershed Department. In times of reduced rainfall, Shyamrao irrigates his plot in rows. For example, if one row is watered today, the next row is watered the following day. To ensure minimum wastage of water, some vegetables are watered using pots. Besides this, he also uses drip irrigation for all his horticultural produce.

“If we withdraw water from the ground, we also need to let the earth drink water. Hence, farmers need to construct farm ponds and check dams in their fields.”

Organic farming: Shyamrao uses a crop machine for processing pigeon pea after it is washed and dried. The processed pigeon pea sells at a better price. This whole process is the major source of income for Shyamrao and his family. The crop machine was introduced to Shyamrao Patil by the Agriculture Department in Gulbarga.

He also runs a dairy farm, rears goats, and has a poultry farm. Earlier, Shyamrao Patil used chemical fertilisers on his farm. However, they were costly, and he switched to organic farming where he can prepare his own fertiliser. He learned how to make organic fertilisers from a training workshop held by the Agriculture Department.

Shyamrao also acquired machines, such as a chilli pounding machine and Shavige (rice noodles) making machine, to help add value to his crops. He gradually shifted from chemical farming to organic farming. Although this process involved a reduction in his produce, he eventually reaped benefits from organic farming.

Knowledge transfer: Shyamrao is a member of the Bhagyavanti Sangha, a farmer Self-Help Group. Through this group, he advises other farmers on when to sow their seeds. He also is part of a farmer collective in his village called Punyakoti. With 15 other farmer members, the collective sells its produce together and gets competitive prices. Shyamrao also provides training for individual farmers and local organisations like MYRADA, Santha Loka Shikshana Samstha, and Bayaluseeme.

“I was told that if I grew organic crops, it was like opening a Fixed Deposit in the bank. If you spend 2 rupees now, 20 years later, it will give you returns of 1,000 rupees annually.”

Sustainable practices: Shyamrao was introduced to vermicomposting at a bus stop. The concept intrigued him and he attended a training session to learn more about the method. Soon after, he received government subsidies to purchase the worms and constructed a pit of 10ft x 3ft x 2ft (depth). At the bottom, he uses saw dust and organic waste. Water is added continuously for 25 days which leads to heating and decaying of the mixture. Worms are added and within three months about 500kg manure is ready. Apart from personal use, he also sells manure and uses biodegradable waste generated in his house to produce biogas for cooking.

| Barriers | Enablers |
|--|--|
| Water shortages: Acute water shortages caused severe damage to his lemon orchard. Borewell water has also dried up, stalling crop cultivation. | Supportive family: Having a supportive wife has helped Shyamrao experiment and innovate despite his small landholding. |
| Expense: Although Shyamrao transitioned from conventional farming to organic farming in stages, he still incurs heavy expenses and has less income. | Capacity building: Shyamrao received financial and capacity support from external organisations. The crop machine for processing pigeon peas was introduced by the Agricultural Department in Gulbarga. The Horticulture Department and KVK provided training and exposure visits on vermicomposting. |
| | Personal drive: Shyamrao emphasises the need to educate oneself, use updated technology, and mechanise one’s farming to make it profitable. |

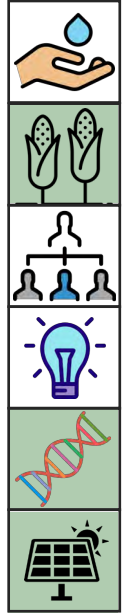
“I hope that at least one of my two sons continues with farming. I maximised my output from this small stretch of land by making good use of the Agriculture Department schemes.”





Shivsharanappa Bulla

| | |
|-------------------|---------------------------------------|
| Age: | 70 years |
| Awarded for: | Organic farming |
| Caste: | Koli |
| Crops cultivated: | Pigeon pea, sugarcane, coconut, onion |
| Village: | Aland , Gulbarga |
| Landholding: | 40 acres |



Shivsharanappa used to work as a mechanic in an automobile repair shop. Once he felt he had earned enough money, he decided to shift to agriculture. Shivsharanappa relied on books to train himself on organic farming and honed his practices through first-hand experience. One of the main influences driving the shift to organic farming was the health benefits associated with organic farming. The highly enterprising Shivsharanappa has employed a few farm hands that assist him. Shivsharanappa uses old unused goods wagons, that he transported from Mumbai, as his work cabin. This cabin is where his books on farming and awards are stored and it is equipped with temporary electricity and water supplies, to make his farm visits more comfortable.

Organic farming: After switching to agriculture, Shivsharanappa practised conventional farming. But the use of chemicals reduced soil fertility and, after 3-4 years, his yields fell. He used weedicides extensively to increase crop production but this led to further deterioration in soil quality. Also, weedicides discouraged agricultural work for up to 15 days (because of high levels of toxicity), leading to a loss of working days. The weedicides also affected crop health and yield negatively. Realising the risks of chemical farming, he switched to organic farming. While initial costs were high and yields low, he notes that in chemical farming, yields plateau after a point. Adding more fertiliser or insecticide will not significantly improve yields. From his experience, he found that organic farming entails less expenditure and greater harvest. He uses a mixture of cow urine, oilcakes, green manure, decomposed weeds, flour and jaggery to enhance soil fertility. Organic farming requires one tenth of the water he used before – a blessing in Gulbarga’s water-scarce terrain. Conversion of land for conventional farming to organic farming has been an iterative process. He still practises conventional farming on part of his land which he aims to convert to organic farming in future.

Genetic conservation: Shivsharanappa uses the best seeds (of native varieties) from his produce for the next crop. This, he reports, was key to improving yields. He found that hybrid seeds give bumper crops but cannot be used in the next season, making one reliant on shopkeepers.

Sustainable practices: Shivsharanappa uses biodegradable waste produced in his farm to produce biogas. He also produces manure by vermicomposting. The leftover sludge from his biogas plant is also used for vermicomposting. Apart from this, he also practises multi-cropping and crop rotation patterns on his fields. Weeds that grow in Shivsharanappa’s farm are used for mulching. Thus, all biodegradable material is used to feed the farm in a sustainable manner.

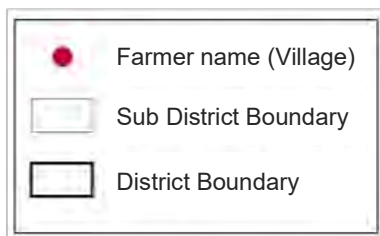
“Even our ancestors did crop rotation because certain plants store nutrients in their roots for the next season. Because of this, the next harvest is good. Earlier, crops were grown for their own personal use, not commercially. Now, everything is driven by money and market demand. When there is excessive production, prices fall.”

| Barriers | Enablers |
|--|--|
| <p>Labour shortages and expensive farm labour is leading to mechanisation. Shivsharanappa has shifted to using tractors and tillers.</p> | <p>Knowledge: Shivsharanappa equipped himself with the knowledge of farming through books. He is a lifetime member of BAIF and uses their book ‘Siri-Samruddhi’ on organic agriculture.</p> |
| <p>Dependence on others: Earlier, farming was simple. Crops were produced and consumed at an individual or family level. Now one needs to depend on the city for seeds and fertilisers and these inputs come at a very high cost.</p> | <p>Institutional encouragement: Initially, he was encouraged to take up farming by BAIF members. Later, the Deputy Director and Additional Director of the Agriculture Department also encouraged him to take up organic farming.</p> |

“If there is wind, light, and water in the right quantities, we can grow any kind of crop.”



Map of Kolar



KARNATAKA



KOLAR

Source: Administrative Atlas 2011
(Census of India) and Google Earth

Kolar

Kolar is a primarily agrarian district situated at the cusp of three Southern Indian states: Karnataka, Andhra Pradesh, and Tamil Nadu. Prominent rail lines and highways pass through the district, making it a site of cultural and linguistic intermingling and inter-state migration. Kolar is renowned for its sericulture, horticulture (mostly mango), and livestock rearing. It receives an annual average rainfall of 652mm. The average temperatures in Kolar during summers (April and May) rise to 40°C and 10°C in winter (November and December).

The region's livelihoods are strongly linked to the natural environment. Therefore, increasing climate variability (drought and erratic rainfall) and environmental degradation have had a profound impact on the lives and livelihoods of the local population. According to the 2011 census, 79% of the total population are engaged in economically productive activities for more than half of the year and, of these, 37.5% are cultivators while 31.5% are

agricultural labourers. While the main crops grown are finger millet, groundnut, pigeon pea, cowpea and rice, cropping patterns have changed significantly over the years with a shift away from multi-cropping to monocropping of cash crops and horticultural crops like flowers and vegetables. Of the total cultivated area in Kolar, 82.8% is rainfed, making it highly sensitive to climate variability (BCCI-K, 2011). Apart from agriculture, mining and wage labour are the other key livelihoods in Kolar.

With no major river systems and the absence of perennial irrigation, Kolar is heavily dependent on groundwater for farming. However, the groundwater situation, especially since 2000, is alarming, with all sub districts being classified as over-exploited. Well depths have reached 2000 feet in some areas, and failure of borewells is common. A further disruption to livelihoods was through the closure of the Kolar Gold Fields, which offered a significant source of employment before it was shut down in 2001.

Farmers interviewed



Papamma

Ashok Kumar

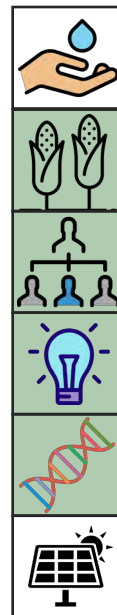
M Kempanna

Anjanappa Venkatappa



Papamma

| | |
|-------------------|--|
| Age: | 61 years |
| Awarded for: | Organic farming |
| Caste: | Scheduled Caste (SC) |
| Crops cultivated: | Finger millet, paddy, pearl millet, pigeon pea, green-gram, sesame, drumstick, bottle gourd, brinjal |
| Village: | D. Kurubarahalli, Mulbagal, Kolar |
| Landholding: | 3 acres |



Born into a family of organic farmers, Papamma has established a seed bank of more than 50 varieties. Papamma and her husband have been practising organic farming for the last 25 years. Papamma's stories of success have been reported in many newspaper and online articles. She also has many visitors and learners who visit her farm to learn and document her activities.

Organic farming: Lack of formal education did not deter Papamma to grow and conserve seeds organically. She has honed her skills by attending several training sessions organised by institutes, such as Gram Vikas and Purushottama Ramakrishna Research Foundation. Initially, Papamma did conventional farming and used chemicals and inorganic materials. She was part of a women's group that worked towards engaging more people into organic farming. This group was trained by a local NGO, Gram Vikas, on organic farming and other sustainable farming practices. One such method to prevent pest infestation was to soak leaves of sitaphal (*Annona squamosa*), and neem (*Azadirachta indica*) in a pot for 20 days and then spray it on plants. She also uses a mixture of fish, jaggery, eggs, and lemon as a plant spray. She reported that these practices have helped her become self-sufficient: for the past twenty years, she has been consuming farm-grown vegetables and does not buy any from the market. She has also diverted excess water from her kitchen to grow vegetables.

Knowledge Transfer: Papamma is the Secretary of the Grameena Mahila Okkuta (Rural Women's Federation) where she works with other women to motivate farmers into organic farming. Along with the group, Papamma travels to various places and provides training in organic farming. She has also been actively involved in protests to oppose the promotion of Bt Brinjal. Papamma also demonstrates her techniques of organic farming to visitors willing to learn.

Genetic preservation: Papamma has been preserving indigenous seeds. She has successfully maintained a seed bank in her village where she hands over the seeds harvested in one season to other farmers who return twice the amount of seeds after the subsequent harvest. Preference is given to farmers who practise organic farming to maintain the quality of the next produce. Papamma uses earthen pots to store these seeds. She uses a mixture of neem and manure to coat the seeds in order to enrich the soil fertility and eliminate pest attacks.

Out of the total land Papamma owns, she sows the different seed varieties in two acres, the rest she uses for paddy cultivation. Several institutions have provided Papamma with storage containers and bags to keep her seeds in.

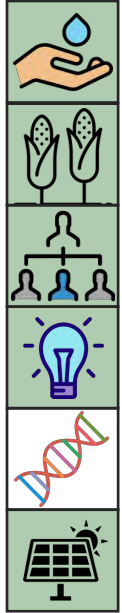
| Barriers | Enablers |
|--|---|
| <p>Water scarcity: Insufficient water supply in Kolar has posed as a major hindrance to Papamma’s seed bank. After her open well went dry, she couldn’t cultivate many crops and began selling the seeds to people who could afford to grow them. However, even the farmers that bought the seeds began facing acute water shortage and complained that the seeds were not sprouting.</p> | <p>External capacity building: Papamma has been a part of several training sessions given by external organisations.</p> |
| <p>Inadequate financial resources: Given the high investment required, Papamma was not able to dig a borewell or farm pond. She had applied for a few government schemes to finance a borewell but the funds have not been released for a long time.</p> | <p>Family support: Her husband and children have supported her decisions to farm organically over other sources of livelihood. They also extend their support through labour.</p> |
| | <p>Recognition: In appreciation of her efforts, Papamma has received several awards, the Rajyothsav Award being one of them, for her continued efforts to revolutionise natural farming.</p> |





Ashok Kumar

| | |
|-------------------|---|
| Age: | 48 years |
| Awarded for: | Organic farming |
| Caste: | General |
| Crops cultivated: | Mango, sapota, millets, tomato, Milia dubia, tamarind |
| Village: | Srinivasapura, Kolar |
| Landholding: | 80 acres |



Trained as an agriculturist, Ashok Kumar is a lecturer-turned-farmer who practises horticulture, agriculture, sheep-rearing, and small-scale sericulture through organic farming. He uses innovative methods to conserve water without compromising on crop yields. He was awarded the Krishi Pandit Prashasthi award in Kolar in 2012-13 for his innovative irrigation methods.

Judicial use of water: Ashok Kumar believes that to make farming a viable livelihood in water-scarce areas, it is crucial to conserve water. In his 80-acre farm, he has a rainwater harvesting tank, drip irrigation setup, sunken pits, percolation pits, and water channels. He also has a farm pond, which he uses for irrigation. The farm pond is lined by a polythene sheet to prevent percolation of water.

“To sustain crops in dry regions, large volumes of water are not necessary. You need to conserve what you have.”

Organic farming: Ashok Kumar has been practising Zero Budget Net Farming techniques that combines scientific knowledge of ecology with traditional practices using locally available natural and bio-degradable materials. His inspiration for this has been Masanobu Fukuoka, Japanese thinker and environmentalist, who specialised in natural farming. He learned about this technique during his postgraduate education. For pest protection, Ashok Kumar sprays neem oil, which he gets from the Agricultural Department at subsidised rates. Practices like no-tillage and mixed cropping are key to Ashok’s farming. He grows horticultural plants, e.g. mangoes, papayas and guavas, by using mixed cropping methods. Apart from horticulture, Kumar also does sericulture, rears sheep, and has a dairy farm that he started 25 years ago.

Knowledge transfer: Kumar claims that over a 1000 people have visited his farm to learn his methods and techniques. He holds training sessions and workshops for farmers who are willing to learn. Several institutions and NGOs approach Kumar to learn about his innovative farming practices. He advises smallholders to diversifying their crops, incorporate integrated cropping techniques and, where possible, grow horticultural crops.

“My next aim is to prepare and train up as many people as possible.”

Innovation: For targeted irrigation, Kumar takes used plastic bottles and cuts the base of the bottle. These are inserted into the soil and attached to PVC pipes near the plant’s root system. Once a week, water is poured into the bottle which trickles down to the roots. This method reduces evaporation losses and helps the soil retain its moisture. According to Kumar, this setup requires minimum investment, no labour, and works well for horticultural plants.

Sustainable practices: The manure that Ashok Kumar uses for his fields is organically prepared. He intends to restart vermicomposting that he previously practised but had to stop due to water shortage.

| Barriers | Enablers |
|---|--|
| <p>Family reluctance: Ashok Kumar’s family were initially unwilling to accept the organic farming methods he had adopted. The initial profits were minimal but he regained these losses over the next few years.</p> | <p>Education: Ashok Kumar has an MSc. in Agriculture. His training in agriculture helps him apply and test science-based approaches on his own land.</p> |
| <p>Farm labour: Labour availability and increasing costs are major problems, especially with many people migrating out of villages.</p> | <p>Personal drive: Ashok Kumar’s love for organic farming despite reluctant family support has allowed him to successfully carry out agriculture even with little water availability.</p> |
| <p>Lack of institutional support: The lack of support from the agricultural and horticultural departments make it difficult to sustain organic farming.</p> | <p>Financial aid: Aid from the Agricultural Department has enabled him to construct a farm pond to collect rain water and irrigate his fields.</p> |
| <p>Marketing: Lack of proper markets for the sale of organic produce makes marketing a challenge. To overcome this, he decided to set up a market on his farm itself.</p> | |





M Kempanna

| | |
|-------------------|--|
| Age: | 80 years |
| Awarded for: | Integrated crop management |
| Caste: | General |
| Crops cultivated: | Mango, millets, coconut, tomato, jowar, cotton, horse gram |
| Village: | Thimanayakanahalli, Malur |
| Landholding: | 135 acres |



Veera Kempanna won the Krishi Pandit Prashasthi Award in 2013 for practising integrated crop management methods. He combines agriculture and horticulture with livestock rearing. Kempanna's father mainly focussed on animal husbandry but Kempanna expanded and integrated various techniques to his agricultural practices. Apart from the Krishi Pandit Prashasthi Award, Kempanna also received Krishi Ratna and Marigowda awards. Kempanna has no formal schooling and started working on his ancestral farmland from the age of eight. A self-taught expert on intercultural cropping, he has improved on his father's sowing practices and invested in arresting water flow on his farm, thereby increasing yields. He also prepares twenty cartloads of compost using dung from his cows, crop waste and biomass from his farm and surroundings. He has perfected a technique of getting higher yields by protecting secondary roots. This involves applying liberal quantities of farm yard manure, protecting secondary roots, and retaining water on the farm. It has resulted in yields of 40-45 quintals from two acres while his neighbours' harvests stand at 10 to 20 quintals from 3 acres.

Kempanna practises integrated farming and demonstrates how it can have significant monetary benefits. Due to acute water shortages in the 1970s, Kempanna decided to rear sheep to diversify his income. He also rears crossbred varieties of local and hybrid breeds. This, according to him, reduces flock mortality rate, improves average adult weight of sheep, and proffers quality to meat and wool. He has invested in 150 Australian Rambouillet sheep, known for their wool and meat, and rears Jamunapari goats, a hardy breed from Rajasthan known for its milk and meat. He was also the President of the Animal Husbandry organisation in Kolar.

"Farming is the only thing I know, so I like to fine-tune my skills and learn and experiment with new ways to do things."

Judicial use of water: Kempanna has made arrangements to collect rainfall from the rooftop of his house into a sump, from where it goes to his well, thereby recharging the borewell beside it. He also received support from the Horticulture Department under a NABARD scheme to build a 2.5-acre farm pond in his farm. He also uses drip irrigation for his farms.

Knowledge transfer: Kempanna has visited various states like Delhi, Maharashtra, Gujarat to learn from agricultural practices there. He has been selected as a member of Karnataka’s state delegation to study agricultural practices in Israel. Several farmers and government officers (from the veterinary, horticulture and agriculture departments) visit him for learning from his farm. He has also formed a local group along with twenty other farmers to discuss agricultural matters collectively regularly. Kempanna’s son has taken a deep interest in animal husbandry and farming techniques and has expanded this practice at a larger scale.

Sustainable practices: Kempanna practises mulching on the vegetables patches that he cultivates. The mulching paper is obtained from the Agriculture Department.

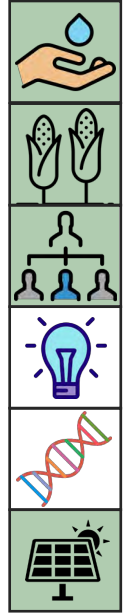
| Barriers | Enablers |
|---|---|
| <p>Ecological limits: Due to the lack of rain in Kolar, Kempanna and his family reduced the number of sheep they could rear. Lower rains affected their finger millet and paddy production as well as sericulture.</p> | <p>Capacity building training sessions and workshops: Kempanna has used knowledge from tours and workshops to improve farming.</p> |
| <p>Poor natural resource management: Lake encroachment has reduced water availability in the village. Eucalyptus plantations in Kolar district have degraded land.</p> | <p>Updating knowledge: Kempanna’s son, who now runs the farm, keeps himself abreast with the latest technological advances in farming.</p> |
| <p>High costs and low availability of agricultural labour</p> | <p>Mechanisation: Due to increasing labour shortage, Kempanna has mechanised his farm with harvesting machines, millet and paddy cutting machines, a pesticide spraying machine and a tractor.</p> |
| <p>Delayed institutional support: Delay or lack of institutional funds and excessive paperwork for using schemes.</p> | <p>Financial support from the government: To tide over water scarcity, Kempanna received a grant from NABARD to construct a farm pond. The three-acre farm pond is lined with stones and facilitates drip irrigation for 50 acres of his land. He has also received subsidies from the Horticultural Department for mulching paper, fertilisers etc.</p> |





Anjanappa Venkatappa

| | |
|-------------------|--|
| Age: | 50 years |
| Awarded for: | Best Horticulture Farmer |
| Caste: | General |
| Crops cultivated: | Banana, coconut, guava, mango, sandalwood, neem, sugarcane, chilli, tomato |
| Village: | Kenchapura, Kolar |
| Landholding: | 25 acres |



Anjanappa won the Best Horticulture Farmer in the year 2014-2015 for his efforts to pursue organic farming. He learnt these methods from his peers and decided to trial them. Anjanappa was approached by KVK who helped him gain recognition for the State-Level Horticulture Award. He was also the recipient of the district-level agricultural award.

Judicial use of water: Anjanappa initially started drip irrigation for watering his coconut trees in 1984 along with his brothers who began selling drip-irrigation sets. He was one of the first to adopt this method (before the government provided subsidies for drip irrigation). His main sources of water are bore wells and rainwater harvested in farm ponds, constructed through subsidies from the Agriculture Department.

Organic farming: In 2011, Anjanappa switched to organic farming to increase productivity and get a good harvest. In the initial 2-3 years of organic farming, he incurred losses but in the following years his yields improved substantially. He found that organic farming needed less maintenance since it focussed on multi-cropping. His learning has been an iterative process. In horticulture, he noted that crops do not need much attention. However, agricultural crops are relatively sensitive to climatic fluctuations and need regular tending. For protecting his crops from pest infestation, Anjanappa sprays neem oil which he buys at subsidised rates by the Krishi Vigyan Kendra (KVK), and Raitha Samparka Kendra (RSK). He argues that in areas with scanty rainfall, adopting organic farming is critical since it does not use chemical fertilisers that deprive the soil of the essential moisture.

“Earlier I neglected diversifying my income, but I learnt from friends and through experience that it helps to have a safety net.”

Knowledge transfer: Anjanappa has been providing information about organic farming to other farmers. In his opinion, farmers do not get enough financial support and are therefore hesitant to take up organic farming. Anjanappa himself has been part of several workshops and training sessions, most notably, one conducted by Subhash Palekar, a famous Indian farmer who advocates organic and zero budget farming. Ashok Kumar, another farmer who is documented in this booklet, was a major source of inspiration for Anjanappa to switch to organic farming, highlighting the importance of peer-to-peer learning.

Sustainable practices: On his farm, Anjanappa does mulching for tomato and hebbevu (*Milia dubia*) cultivation. He realised that the process of mulching yielded better results as compared to using organic manure. With his brothers, he runs a poultry farm, the roof of which is lined with solar panels. A part of the electricity generated from the solar panels is used for the farm. This is part of a collaborative approach that Anjanappa and his brothers took up to diversify their income. He sells the surplus energy to the Karnataka Power Transmission Corporation Limited (KPTCL). However, he mentions that with the introduction of the Niranthara Jyothi Yojana, which provides electricity for non-agricultural use, the use of solar power has reduced. Anjanappa has also installed a biodigester and large vermicomposting pits, both of which were subsidised by the Agriculture Department and KVK.

| Barriers | Enablers |
|---|---|
| <p>Poor initial returns and family mistrust: Initially, Anjanappa’s family members discouraged him to take up organic agriculture. They were apprehensive that returns from organic farming would be insufficient to sustain the family. The initial few years of switching to organic farming were very difficult but yields improved in the later years.</p> | <p>Power of demonstration and family support: Witnessing the progress he had made, Anjanappa’s brothers have also taken up organic farming. Now, Anjanappa and his brothers jointly take care of the farm.</p> |
| <p>Pest infestation: Severe pests damage guava and mango plants.</p> | <p>Livelihood diversification to spread risks: Besides organic farming, they also are involved in poultry farming, animal husbandry, and have a brick kiln.</p> |
| <p>Water shortage: Although Anjanappa’s fields are irrigated, at times seasonal shifts affect water availability, which affects fruiting.</p> | <p>External capacity building: Training and farmer’s fairs in Mysore and Bangalore have facilitated peer-to-peer learning. Personal experience has also helped Anjanappa to expand his horticulture farm.</p> |
| <p>No separate market for organic products: No platforms recognise organically grown products. There is a need for awareness programmes to create demand for organic products.</p> | |



Lessons learnt: from innovation to adaptation

We found several examples of sustainable agricultural practices and innovation in Kolar and Gulbarga. Many of them have potential climate change adaptation co-benefits. For example, Papamma's strategies of preserving local seed varieties can be bred for their drought tolerance and Shivlingappa's innovative water conservation practices can help manage farm-level water demand.

Many farmers showcased new ways of making farming remunerative despite financial and natural resource constraints, demonstrating that limits posed by small landholdings or insufficient water resources, can often be overcome in ingenious ways. There also emerged some barriers and enablers shaping individual innovations:

Barriers

- In semi-arid regions, biophysical factors like **water scarcity and land degradation make farming difficult**. Increasingly erratic rainfall and rising temperature are putting further pressure on agriculture.
- **High entry barriers for organic farming** such as delay between adoption of organic practices and profits, lack of proper markets for organic products, issues with certification for organic products, discrepancies between the price of organic versus conventional crops, and delay in the returns may serve as disincentives for scaling up.
- **Inadequate institutional support** constrains sustainable agriculture practices. Often, subsidies, infrastructural support or technical know-how are delayed, insufficient or lacking.
- **Lack of labour** or high labour costs and disinterest among the youth to engage in farming are prominent, making individual efforts to cultivate difficult.

Interestingly, commonly held notions about small landholdings and a lack of well ownership being significant barriers were not found. It points to the fact that innovative practices can overcome asset-based barriers to sustainable agriculture and adaptation.

Enablers

- **Leveraging personal farming experience and complementing it with new knowledge** (either by themselves or through younger, educated family members) were key characteristics across all innovators.
- Innovators were **typically curious, creative, problem-solvers, willing to take risks and forego short-term gains**. These personal traits were key to innovating and represented a solutions-oriented mindset.
- **Livelihood diversification** (into horticulture and poultry farming) allowed people to spread risk and absorb early failures. This diversification was further facilitated by having help from family members, financial support from the government, or, in some cases, being open to new opportunities.

- **Capacity building initiatives** by the government and civil society show tremendous promise in helping expose farmers to new ideas, providing technical training on innovative practices, and cross-pollination of ideas.
- **Institutional support** in the form of agriculture, horticulture and rural development schemes helps consolidate local adaptive capacity.
- **Knowledge intermediaries and brokers**, such as the Krishi Vigyan Kendra (KVK), district-level horticulture and agriculture departments, and NGO workers, play an important role in providing information on new methods and better inputs. New forms of information sharing, for example the use of mobile phones, play a key role too.
- **Peer-to-peer networks** facilitate exchange of context-specific information and knowledge among innovative farmers, and between them and other farmers trying new methods. Often informal networks emerge out of curious farmers witnessing the success of progressive farmers.
- **Public recognition** in the form of farmer awards and being showcased as a 'progressive farmer' inspires innovators to do better and support innovation diffusion. *Krishi mela* (farmer fairs) serve as important platforms for recognition of innovative practices as well as opportunities for knowledge exchange and transfer, and innovation diffusion.



Recommendations

For a farmer in water-scarce regions in Karnataka (and across India), innovating is a challenge. Given the growing risks that climate change poses, different actors at various levels must come together to reward innovators and foster an environment that facilitates upcoming innovators. Below, we suggest some ways of doing this:

National and state-level government

- Support innovators by investing in improving backward and forward linkages in agricultural value chain. This means:
 - ◊ R&D to develop better seeds and conserve local varieties,
 - ◊ provision of seeds in sufficient quantities and before sowing season,
 - ◊ developing post-harvest storage and on-farm processing facilities, especially for horticultural crops,
 - ◊ improving market linkages
- Continued focus on incentivised livelihood diversification into allied sectors, such as livestock rearing

State and district-level government

- Facilitate farmer-to-farmer knowledge transfer and innovation diffusion by organising regular and inclusive demonstration visits
- Setting up mobile phone-based platforms for peer-to-peer learning
- Champion farmers by public acknowledgement

- Improve hobli-level knowledge sharing by leveraging on progressive farmers as change agents
- Develop creative incentive structures where innovative farmers disseminating innovation are rewarded by infrastructural subsidies
- Expand current awarding criteria to include special marks for farmers below 30 to encourage youth participation and address growing disinterest in farming as a livelihood

Civil society

- Develop systems to document and disseminate existing practices that can have adaptation co-benefits
- Build in-village capacity to access new information, with a focus on children and youth

Farmers in Gulbarga and Kolar are innovating against all odds. They are finding ways to use water judiciously, save local seed varieties, practice organic farming and develop new tools to overcome labour and electricity shortages.

In small ways, these practices can incrementally lead to more robust agricultural systems that are economically feasible and environmentally sustainable.

Recognising and awarding such innovation is a critical step in incremental adaptation and this booklet is one step towards acknowledging and documenting such stories of change. We hope these farmer cases inspire other farmers, especially youngsters, to view farming as a viable livelihood.

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