

### Pathways to Sustainable Intensification: Participatory Designing of Adapted Farming System Innovations

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This native medicinal plant called shankhpushi has been introduced for cultivation in Barmer.

**M**ost farmers in Western Rajasthan, India face an uncertain, impoverished future. The region is affected by frequent droughts, over-exploitation of groundwater, deteriorating soil and water quality, low productivity, weak institutions, malnutrition, continuously decreasing landholding size, and a burgeoning population of 28 million. With negative water balance for all but a few months of the year, Rajasthani farmers are on the cutting edge of climate change. In this situation,

common property resources, such as fodder, herbs, and water, ease stress on livelihoods. By the same token, the social and environmental cost of the poor management of these resources is keenly felt. That is why the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), as part of the Consultative Group for International Agricultural Research (CGIAR) Program on Dryland Systems, has teamed up with rural dryland communities to find integrated approaches to resource management.

Critical for developing effective and efficient solutions, is the acknowledgment of the specific needs of each community. Using data from primary surveys and focused group discussions in Jodhpur, Barmer, and Jaisalmer districts, we developed maps of how farming communities share resources to allow us to understand both the potential and the limitations of each community. NGOs, local government departments, and the farmers themselves were then brought together to brainstorm for greater efficiency and to add value to their work.



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Participatory appraisal and planning with the community.

As a result of these discussions, a number of community-led solutions were designed and implemented during 2014 and 2015. One of the preferred solutions that emerged was the cultivation of high-value, low-maintenance medicinal plants for extra income.

Identifying medicinal plants that grow wild in the region, motivating farmers to grow them as an intercrop that requires virtually no maintenance, and linking them to a manufacturer of *Ayurvedic* (traditional Indian system of medicine) products has hugely benefited farmers. The shankhpushpi (*Convolvulus pluricaulis*), a native and naturally-occurring plant, was not cultivated by farmers due to lack of awareness and market. We facilitated a tripartite agreement in 2014 with Dabur India Ltd., the largest herbal medicine manufacturing company in India, to buy back the produce. Technical

backstopping in terms of training the farmers is also being done by ICRISAT and the Krishi Vigyan Kendra, in Barmer, one of many agricultural extension centers financed by the Indian Council of Agricultural Research.

In the first year, 25 farmers came forward for shankhpushpi cultivation. The additional income earned by farmers who grew shankhpushpi has attracted many other farmers. In the next year, 2015, more than 300 farmers in five to six villages of the Barmer district started cultivating shankhpushpi. The farmers could earn an additional annual income of USD\$75 to USD\$600 by introducing this medicinal plant as an intercrop under arid rain-fed conditions. Another medicinal plant, jivanti (*Leptadenia reticulata*), was introduced in 2015, and is being cultivated by 15 farmers. Jivanti is a climber and is planted as an intercrop with fruit trees. A

farmer can earn around USD\$4.50 to USD\$6 per plant. Another drought-tolerant medicinal plant, arna (*Clerodendrum phlomidis*), which was used for fencing and roofing, now has a buyback market providing an additional annual income of USD\$90 to USD\$320 per household.

Furthermore, organizing these farmers into a medicinal plant growers group better facilitated the capacity building and collective marketing to the herbal medicine industry. One of the farmers, Giana Ram, from Dhirasar village in Barmer, says, “We never expected that we could grow fruits and an orchard unit with a new *tanka* [a rainwater harvesting structure], as well as medicinal plants. It has changed my family’s life and provides us nutrition, water, and additional income. Now, neighboring farmers and villagers regularly visit my farm and appreciate me.”



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Farmers selling goats by weight in Jodhpur.

Another solution hit upon in community-led talks was the use of rainwater harvesting for perennial fruit-tree cultivation. Frequent failure of annual crops, millets, and legumes due to drought is common in this region, so farmers were encouraged to integrate fruit trees in order to stabilize farm income and enhance local nutrition. Intercropping legumes like moth bean, green gram, and cluster bean with local fruit trees—ber (*Ziziphus mauritiana*), gunda (*Cordia myxa*), and medicinal plants—is adding to the income of farmers. The leaves of the ber tree are used as fodder and gunda leaves are lopped and applied to fields for their anti-termite properties and for improving the organic content of the soil.

Water for the plants was harvested using earthen pots buried in the root zone of the plant to help conserve water. In addition, traditional water harvesting structures (a cistern, sized 15'x15'x15") called *tankas* are being improved with scientific inputs. One unit of 150 fruit plants as intercrop, along with *tankas*, would generate an additional income of USD\$376 to USD\$526 per annum per household starting from the third year.

In addition, women were encouraged to grow fruit trees for improving household nutrition. In one women's group, 20 women were given 20 fruit plants each and in another, 50 women were given 10 plants each. These units were started in 2014 in Govindpura

and Mansagar villages in the Jodhpur district; Dhirasar and Dhok villages in the Barmer district; and, Didhu and Sankaria villages in the Jaisalmer district.

Female help has also been enlisted to help manage common grazing areas which have become severely degraded due to poor governance. Our project created awareness amongst key stakeholders for the challenges in common property resources management. Communities were encouraged to design rules which gave every subgroup of the community equitable, but restricted, access and use rights to the land. The scale of decision making was decreased to the hamlet level. Women have played a key role



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Local women have begun keeping nutritional kitchen gardens.

in managing community-owned silvopastures where fodder grasses like dhaman (*Cenchrus ciliaris*) and sewan (*Lasiurus scindicus*), along with fodder and fruit trees, are grown. Four women sub-groups in Jodhpur and Barmer actively manage the pastures and harvesting, and sell the grass as livestock feed.

The improved condition of pastures has enabled farmers, especially women, to herd goats and sheep. Breeding bucks provided to two women's self-help groups helped to improve herd productivity. High middlemen's market margin (10 percent to 35 percent) on the sale of

live animals was a major constraint, so a weighing machine was introduced so that the locals could sell their own animals on the basis of weight. This improved their bargaining power and market integration. The women now earn 25 to 30 percent more than what they were previously making.

Integrated dryland farming is helping farmers improve productivity and income. The complexity it entails is a challenge for government and non-government agents. Impact is difficult to predict and measure where multiple system components interact. As a consequence, simple and standardized impact pathways are often preferred,

which ignore side effects and potential synergies. In Western Rajasthan, a participatory approach, which allowed all involved parties to identify innovative solutions, has helped strengthen farmers' earning potential and has facilitated self-organization among stakeholders. **S**

#### ACKNOWLEDGEMENTS

The research for development was funded by the CGIAR Research Program on Dryland Systems. GRAVIS, an NGO, Central Arid Zone Research Institute, Jodhpur, and Krishi Vigyan Kendra, Barmer were the key partners of ICRISAT in this effort.