

Successful farming ventures

for prosperity in arid zone

Dheeraj Singh¹, M. K. Choudhary², S. K. Sharma³, Devi Dayal⁴ and O. P. Yadav⁵

Central Arid Zone Research Institute, Jodhpur (Rajasthan) 342 003

The farming in arid regions is very challenging and risk-prone due to climatic stresses and poor economic conditions of communities. Farmers are mainly engaged in subsistence farming. With the small technological interventions and appropriate training and capacity building of farmers coupled with innovations, not only risk can be minimized but income of farmers can also be enhanced. The successful examples presented in this paper showed how innovations of individual farmers serve as inspiration for others in communities ultimately leading to transformation of their social life.

Key words: Arid zone, Ber budder, Drip irrigation, Farmers, Hi-tech horticulture, Seed producer

THE arid western part of Rajasthan is very challenging from farming point of view owing to low and erratic rainfall. The area is dominated by small-scale farmers undertaking subsistence farming who are averse to taking risks. Therefore, livestock rearing, cultivation of horticultural crops, integrated farming system and use of drought tolerant crop cultivars are potential technologies that can substantially subsidize the risk. The Central Arid Zone Research Institute and its three Krishi Vigyan Kendra are helping farmers by providing them suitable technological interventions and by enhancing their capacity. These include planting of drought tolerant and early maturing crops and varieties, moisture conservation techniques, rainwater harvesting, diversification of livelihood systems and community education and awareness about drought and climate change. Experiences of successful technologies and farmers adopting them with new initiatives at their field are discussed here.

Integrated farming system: Over the years, economic considerations have overtaken the sustainability issue. Low and erratic rainfall, frequent

droughts, the increasing costs of cultivation, lower compensation of labour and inputs made farming in the arid regions a challenging enterprise. With the increased cost of production of farm commodities, the competition has toughened for the resource-constrained farmers especially of the arid regions. In this scenario, the farmers could benefit greatly by introducing diversification in the farming and by strengthening the traditional systems. A successful example of this approach was demonstrated by Shri Sawat Ram Patel of Lunawas Khara, Panchayat Samiti Luni of Jodhpur who has adopted integrated farming system (crop + fruit cultivation + dairy) with improved technologies under technical guidance of KVK, CAZRI, Jodhpur. Shri Ram has replaced traditional seed with improved seed of new varieties which increased crop yield substantially. Shri Ram had five cows and maximizing the productivity of animals through proper health management by use of mineral mixture, MNFB block and enrichment of dry fodder. Integrated farming system (Horti + Crop + Dairy system) provided cash flow throughout the year as compared to

crop-based farming where farmers get return only once a year. The use of solar pump and drip irrigation at his farm increased the productivity of crop. Recycling of farm and home waste through compost making and using as manure has also increased the soil fertility and reduced the weed infestation. The system is environment friendly and provides higher returns.

Another example of innovative farmer adopting integrated farming system is Shre Om Giri (Fig. 1) who adopted IFS (crops, dairy, fruit cultivation, vegetable production and agroforestry) on his 9 ha farm in Palri Ranawta in Bhopalgarh tehsil of Jodhpur with improved technologies under technical guidance of CAZRI, Jodhpur.

Shri Giri had 18 animals with fruit orchard in 1 ha area and established solar pump and drip irrigation facility at farm. The adoption of CAZRI interventions increased the productivity of crops and water use efficiency. The use of farm machinery in agricultural operations has further reduced the cost of cultivation resulting in higher profitability. The utilization of solar animal feed cooker saved the fuel and reduced drudgery

of women of his family. The post-harvest loss in vegetables and fruit crops was reduced by zero energy cool chambers. The productivity of animals was increased by the use of mineral mixture and proper health management. The rearing of buffalo bull for timely heat detection and servicing of buffalo led timely parturition and increased animal productivity. The cultivation of fodder crops, perennial grasses and tree provided green and nutritious fodder to animals. Replacement of traditional seed with new varieties also helped in increasing the crop yield. To irrigate more area from limited underground water and increase profitability, Shri Giri adopted drip irrigation and fertigation system. The recycling of farm and home waste through compost making and using as manure also increased the soil fertility and reduced the weed infestation. Presently his average net annual income is about ₹ 13.50 lakh per annum.

Shri Gordhan Ram of village-Newra Road, Panchayat Samiti-Osian, Jodhpur adopted technologies like solar animal feed cooker, vermi-composting, nursery of arid fruits, improved breeds of livestock like Tharparkar (cow), Murrha (buffalo) and Parbatsari (goat); improved cultivars of crops and fruits plants and seed production of *moong*, moth bean, cumin and wheat. Shri Ram achieved substantial improvement in productivity and profitability. He has motivated nearly 750 farmers for raising nursery and growing improved cultivars of fruits and annual crops. He received an award as progressive farmers by ATMA and CAZRI; received 'Haldhar Ratna' by Government of Rajasthan. His Success story finds place in various agricultural magazines.

Multi-nutrient-feed-block Technology: Feeding of livestock was a challenging job in western zone of Rajasthan where persistent famine and droughts results in poor health and reduced milk production. Under these conditions Multi-nutrient feed blocks, developed by CAZRI, was capable of providing balanced nutrition to arid livestock and in



Fig. 1. Sh. Om Giri depicting improving technologies at his farm

experimental trials at institute as well as at farmers' field it proved very beneficial. Based on these results CAZRI initiated transferring this technology to livestock owners and when the demand of multi-nutrient feed block from farmers of Pali and nearby district went too high it was decided to train the livestock rearers of rural community for production of multi-nutrient feed block their own. Under this programme, scientists trained the farmers about advantages of feeding multi-nutrient feed block mixture and its preparation by farmers themselves that improved interaction and fostered community participation. After gaining training several young farmers started their own enterprise.

Shre Deda Ram Patel started the Multi-Nutrient-Feed-Block production unit with great enthusiasm to overcome the fodder and nutrient shortage at his village. The enterprise became a successful and is boosting livestock population in arid tracts of Rajasthan. Above events clearly spoke about successful extension, popularity and viability of broader participatory approach to rural development that empowers farmer. Now Deda Ram's success became a success story for others. In his innovation, he utilized the locally available raw materials for making multi-nutrient feed block and reduced the cost of production by half. He is also using solar drier for quick and uniform drying of blocks which is a cost effective and environmental friendly technique. Now, Shri Deda Ram Patel (Fig. 2) became a successful entrepreneur and he is motivating other farmers also to adopt this technology. Presently, he is not only earning ₹ 20,000 to 25,000/



Fig. 2. Shri Deda Ram demonstrating preparation of multi-nutrient feed block and MNF mixture

month from this intervention. This product has become popular among livestock farmers in Pali district and is in great demand in other districts of Rajasthan and adjoining states.

Promoting improved varieties and in-situ budding in ber: Ber is nutritious and drought-hardy crop in arid and semi-arid regions. Varieties Seb, Gola and Umran most popular varieties of ber. The CAZRI standardized *in-situ* budding and plant management. This provided a good scope of converting locally grown ber (*Ziziphus rotandifolia*) plants into improved orchards of ber. One of the farmers Mr Mala Ram from Rampura village in Rohat block of Pali district of Rajasthan was inspired by the potential of ber. Shri Mala Ram was also having *desi ber* growing on the bunds and within the field itself which gave sour and small fruit with little market value. Shri Mala Ram thought of converting these plants to high-yielding improved varieties. He got practical knowledge of ber budding from CAZRI and with his dedication converted all his *desi ber* plants to improved variety budded plants. On getting better returns from these plants, his interest further promoted him for organized plantation. Today, Shri Mala Ram is having 180 ber plants with circular catchments for *in-situ* rainwater harvesting. Shri Mala Ram developed a system for regular and throughout season production of ber by planting early, mid- and late-season varieties i.e. Seb, Gola and Umran (Table 1) of ber so that he can capture the season from November till the end of March. He packed the fruits after grading in interwoven plastic threads and sells his fruits on highway near his field at premium price. Shri Mala



Fig. 3. Shri Mala Ram demonstrating in situ budding and fruits of success in ber



Fig. 4. Shri Govind Ram involved in seed production and receiving award



Fig. 5. Shri Gordhan Singh at his orchard of pomegranate and strawberry

Table 1. Performance of varieties of *ber* and yield in the field of Shri Mala Ram

Variety	Average height (m)	Plant spread (m ²)	Average fruit weight (g)	Fruiting time	Yield (q/ha)
Gola	3.20	32.30	18.50	Dec. - Mid Feb.	60.10
Seb	2.70	16.09	21.00	15 Jan. - Feb. end	51.20
Umrn	2.80	22.20	25.00	Feb. - Mar.	62.20

Ram (Fig. 3) budded more than 4,750 ber plants of needy farmers. Proper selection of variety and better management practices increased his income from ₹ 90,000 to ₹ 3.58 lakh/year. His passion for budding and improved agriculture was recognized by public agencies and he was honoured as Krishak Mitra by Union Minister of Agriculture and Farmers Welfare also.

Seed production programme for improved livelihood: The cultivation of legume crops is important activity in arid areas as these crops are the most stable under and hostile agro-ecosystem of arid regions. Hence, improved seed becomes very crucial and basic input for increasing yield and there is increasing demand of improved seed of these crops. Keeping this in view CAZRI initiated different programmes on seed production of important varieties in active seed chain and production technologies for legumes and other crops of arid zone involving different departments, NGOs, seed production agencies and progressive farmers. One traditional farmer Shri Govind Ram from Rohat (Pali) was cultivating traditional crops. After coming in contact with CAZRI scientists he started cultivation of these crops on scientific basis and followed deep summer ploughing, soil-testing, application of gypsum as per soil report, rainwater harvesting, green manuring, *in-situ* moisture conservation and line sowing. The results in yield and quality were

encouraging. As the result of this achievement, Shri Ram took further training on seed production technology and successfully completed 200 hr skill development training programme on seed production technology. Now, Shri Govind Ram (Fig. 4) became a certified seed producer and produces seed for Rajasthan State Seed Corporation and for CAZRI under seed hub programme for arid pulses (Table 2). Shri Govind uses mechanized agriculture and has rotovator, thresher, seed-cum-fertilizer drill, diesel operated water lifting pump, tractor operated sprayer and seed grading plant of his own. Further by the encouragement of KVK scientists, Shri Govind also started Farmers' Producer Organization 'Sresta Natural Bio-products Pvt. Limited' and now more than 900 farmers are its active members. Now the farmer has established the several crop enterprises and has diversified his farm raising his net income from ₹ 4.5 to ₹ 15.76 lakh annum. Keeping in view the progress of farmer and his interest in farming, Shri Govind was awarded with Krishak Mitra Award, IFFCO Innovative farmer; ATMA District Level Best Farmer Award, Seed Entrepreneur Award and Best Innovative farmer at Farmers Innovator meet at Udaipur.

Crop diversification and promotion of high-value horticulture crops: In present scenario introduced fruit crops like pomegranate, guava, tissue-cultured

Table 2. Income from seed production

Crop	Variety	Production (q)	Revenue earned (₹ lakhs)
Wheat	Raj 4083	80.00	1.84
Chickpea	RSG 895	105.00	6.09
Green gram	GM 4	160.00	12.16
Cumin	GC 4	50.00	8.00
Total		395	28.09

date palm etc. are gaining momentum as high value commercial crops in arid and semi-arid regions. The CAZRI is also imparting technical knowhow and promoting popular horticultural-based systems of arid zone. Since per unit returns from horticultural crops are always higher, their inclusion in the system improves the net return of farmer and would impart resilience to aberrant weather. Such interventions also showed potential to utilize surplus labour during lean period and ensures year round cash flow. Under the present scenario, immense opportunity exists for quality production of some horticultural crops only in arid regions. Pomegranate showed its potential as commercial crop in different parts of the country. Arid climate suits for good quality of pomegranate. Date palm cultivation is also being promoted on large-scale in arid regions. With improved marketing and processing facilities some of the regions' minor horticultural crops now emerged as profitable ventures viz. *aonla*, *bael*, *phalsa*, fig, *kair*, *gonda*, *lasora*, drumstick, *karonda*, pilu etc. Similarly, strawberry is also gaining momentum in arid and semi-arid region because of high price in shortest possible time. But at the same time such crops are only profitable and successful when these are grown with utmost care, because they require specific package of practices, which

Table 3. Comparison of different cultivars of strawberry at farmer's field

Variety of strawberry	Average fruit weight (g)	Fruit quality	Plant growth	Yield and suitability
Camarosa	20	Very sweet	Poor	Poor and not suitable
Chandler	25	Sweet	Medium	Medium and not suitable

may vary from region to region.

To capture this opportunity, Shri Gordhan Singh (Fig. 5), village Chelawas, block Marwar Jun. (Pali) diverted his attention to diversified farming. Crop diversification and scientific cultivation of arid fruits at his farm was started under the guidance of KVK scientists. First of all Shri Singh set up pomegranate orchard with 3,000 plants intercropped with teak plantation. Due to his strong determination and care with scientific cultivation Shri Singh could earn handsome returns of ₹ 5.2 lakh. He also planted low chilling varieties of strawberry namely Chandler, Camarosa and Winterdawn (Table 3). Shri Singh transplanted all these varieties in separate rows at 40 × 60 cm² spacing using plastic mulch in October. After one month, flowering initiated leading to good crop and gave him a net return of about ₹ 2.10 lakh. Now the farmers' established

the several fruit enterprises at his farm viz. strawberry, pomegranate, acid lime, tissue culture, date palm and banana, *ber*, dragon fruit and *aonla*. He is using new technologies like drip irrigation, solar tube-wells, organic manure, and implements like seedling planter, automatic spray machine, and plastic mulch which have raised his annual income to ₹ 10.78 lakh/annum. Now, Shri Gordhan Singh is a role model for the rural youth and a number of farmers are motivated and plan to adopt his approach for increased income and better livelihood.

Another farmer Mr Khimji Jivabhai Chavda, from Lakhond village, Bhuj, Kachchh district, Gujarat was having 7 ha of land. He was practising traditional farming of cotton and castor in *kharif*, groundnut and pearl millet in summer on his land with high input and cost of cultivation. The net profit from these traditional crops was between 50,000 and 60,000/ha and but increasing salinity water and declined ground water level year- by- year led to low crop yield and declined profit. On his visit to KVK, he was advised to cultivate the drumstick which required very low input. He was provided all relevant information for the cultivation of this remunerative crop and planned to cultivate this crop under the supervision of scientists of KVK. From an investment of ₹ 55,000 he was able to

**Fig. 6.** Shri Champa Lal at his drip irrigated cumin field

fetch a net return of ₹ 206,700 in the first year itself. By the successful cultivation of drumstick with low input cost he motivated many farmers in his locality for cultivation of this crop. Now, more than 260 farmers are adopting this crop at large-scale in the district and getting high profit with minimum care and input cost.

Drip irrigation: CAZRI, Jodhpur along with its five regional stations and three Krishi Vigyan Kendras is actively involved in capacity building of farmers, farm-women, youth, SHGs, extension functionaries and other stakeholders along with technical backstopping to different programmes for development of arid agriculture. During such capacity building programme on visiting CAZRI- KVK, Pali a farmer Shri Champa Lal of Bahed Kalla village of Jaitaran was surprised to see all the field and spice crops growing on drip irrigation. Looking to his enthusiasm, his queries were addressed and he was also informed about various schemes of the government. A man of few words, Shri Champa Lal (Fig. 6) shared that he had earned a net income of ₹ 89,000 with average cumin yield of 9 q/ha. He further said he has improved cumin yield to 13.5 q/ha after drip irrigation system was adopted raising his net profit to ₹ 162,380. Although the drip irrigation is expensive compared to traditional forms of irrigation, his profit margin is higher. The cost of cultivation of cumin in 1 ha in traditional irrigation form is ₹ 46,000, whereas it is ₹ 40,120 in drip irrigation system (Table 5). Thus, small- and marginal-farmers are ushering in a silent revolution by switching to drip irrigation in seed spices, leaving no scope to waste water.

Table 4. Income from produce from 1 ha land

Date with year	Yield (q)	Selling price (₹/q)	Income (₹)
16 August 2016	6	4,000	24,000
16 September 2016	12	3,000	36,000
16 October 2016	28	2,500	70,000
16 November 2016	36	2,200	79,200
16 December 2016	23	1,500	34,500
17 January 2017	18	1,000	18,000
Total	123		261,700
Net return (₹)			206,700
B:C Ratio			4.76

Table 5. Comparison of different irrigation systems on cumin yield

River irrigation	(₹)	Drip irrigation	(₹)
Land preparation	5,600	Land preparation	4,500
Seed cost	3,900	Seed cost	3,120
Fertilizer and FYM	7,500	Fertilizer and FYM	9,000
Insecticide/Fungicide	8,500	Insecticide/Fungicide	7,000
Labour cost/Irrigation	6,500	Labour cost/Irrigation	4,000
Intercultivation/Weeding	7,500	Intercultivation/Weeding	6,000
Harvesting cost	6,500	Harvesting cost	7,500
Total cost of cultivation	46,000	Total cost of cultivation	40,120
Total yield (kg/ha)	900	Total yield (kg/ha)	1,350
Rate (₹/kg)	150	Rate (₹/kg)	150
Gross return (₹)	135,000	Gross return (₹)	202,500
Net return (₹)	89,000	Net return (₹)	162,380

FYM, Farmyard manure

^{1,3}Project Coordinator, ²ACTO, ⁴Head, ⁵Director, Corresponding authors' e mail: dheeraj.singh@icar.gov.in