8th National Conference on Krishi Vigyan Kendra - 2013

October 23 - 25, 2013 at UAS, Bangalore

Sustainable Intensification of Smallholder Farms

Souvenir

Indian Council of Agricultural Research, New Delhi
University of Agricultural Sciences, Bangalore

A March of Progress for Sustainable Small Holder Farmers : Gujarat and Rajasthan

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Introduction

Agriculture is a critical sector of the Indian economy. Though its contribution to the overall Gross Domestic Product (GDP) of the country has fallen from about 30 per cent in 1990-91 to less than 15 per cent in 2011-12, a trend that is expected in the development process of any economy, agriculture yet forms the backbone of development. An average Indian still spends almost half of the total expenditure on food, while roughly half of India's work force is still engaged in agriculture for its livelihood. The experience from Brazil, Russia, India, China & South Africa (BRICS) countries indicates that a 1per cent growth in agriculture is at least 2-3 times more effective in reducing poverty than the same growth emanating from non-agriculture sectors. Given that India is still home to the largest number of poor and malnourished people in the world, a higher priority to agriculture will achieve the goals of reducing poverty and malnutrition as well as of inclusive growth. Since agriculture is a state subject, the overall performance of the agriculture depends on what occurs at the state level. There is a wide variation in the performance of different states. The average size of operational holdings in India has declined progressively from 2.28 ha in 1970-71 to 1.55 ha in 1990-91 to 1.23 ha in 2005-06. As per Agriculture Census 2005-06, the proportion of marginal holdings (area less than 1 ha) has increased from 61.6 per cent in 1995-96 to 64.8per cent in 2005-06. This is followed by about 18 per cent small holdings (1-2 ha.), about 16per cent medium holdings (more than 2 to less than 10 ha.) and less than 1 per cent large holdings (10 ha. and above).

During 2003-04, 20.56 per cent area owned by 59.53 per cent small and marginal farmers in Rajasthan, while in Gujarat, 28.90 per cent area owned by 49.63 per cent small and marginal farmers (Rawal, 2008). Fragmentation of operational holdings has widened the base of the agrarian pyramid in most of the states. In most of states land holdings, being highly fragmented hamper the adoption of mechanized farming and modern farming practices. Hence, the small-holder farmers are vital for India's agriculture and rural economy. These small-holder farmers owned only 33 per cent of the cultivated land; their contribution to household food security and poverty alleviation is thus disproportionately high and is increasing. Moreover, as the national population increases, so does the

Presented during National Workshop on out scaling Farm Innovation held at New Delhi from 3-5 sept.2013.

number of small-holding farmers. KVKs of the zone-VI have addressed the various issues related to agriculture and brought significant change in Gujarat and Rajasthan.

Agricultural scenario in the region

Zonal Project Directorate, Zone-VI a unit of Indian Council of Agricultural Research (ICAR) comprised of Rajasthan, Gujarat and Union Territories of Daman & Diu and Dadra & Nagar Haveli which covers 5.39 lakh square km. geographical area. It supports 129 million human and 76.31 million livestock population. In India, about 53 per cent of total geographical area is under hot arid climate, of which 60per cent is in Rajasthan and 20 per cent in Gujarat alone. Arid and semi-arid together occupying 75 per cent of total geographical area are located in the extreme west of the country. These regions are characterized by low and erratic rainfall coupled with high wind velocity and high evaporation rates. In general, livestock based farming system is the mainstay of farming in Rajasthan and Gujarat.

The Rajasthan state is divided into 10 agro-climatic zones where rainfall ranges from 100 mm in Jaisalmer to 1200 mm in Jhalawar district. Out of 33 districts, 31 districts are facing the acute problem for ground water availability. Rainfall is erratic and scanty leading to frequent drought and poor ground water recharge. *Kharif* crops often experience the terminal drought on the one hand while *rabi* crops face the problem of early rise in temperature in February. The severe cold wave affects the production and productivity both during January. The state has only 20 per cent area under irrigation. Though canal network in Kota and western Rajasthan have shown promises but inadequate filling of reservoir and excessive use of water in canal command area led to low production. Excessive use of irrigation led to secondary salinization in canal command area. On the other hand the productivity of livestock is poor due to fodder scarcity and poor feeding management despite having good cattle breeds like Tharparkar, Rathi and Kankrej. Rajasthan is the second largest state having highest livestock population and second highest milk producing state. Farmers of tribal areas and arid districts have inadequate entrepreneurial scope due to illiteracy and unscientific management of natural resources. In spite of these facts, state has shown the promises in milk production, pulse production, spice production and crop diversification in the past.

Gujarat state is divided into 8 agro-climate zone where rainfall ranges from 250 mm in Kutch to 2200 mm in Dangs and Valsad districts. North Gujarat, Saurashtra and Kutch districts are facing the problem of ground water depletion while the hilly districts have the problem of water erosion due to destructions of forest. Canal command areas have the problem of secondary salinization (Mahi, Narmada and Tapi command areas), while, coastal areas are facing the problem of sea water ingression due to over exploitation of ground water. Around 30per cent of areas of the state have the problem of floride and nitrate in ground water affecting the health of human as well as livestock both. The tribal population migrates to

cities for livelihood due to inadequate agricultural activities round the year. Despite these hardships, Gujarat has done the excellent work in dairy sector, farmers' groups/associations, food processing, value addition and entrepreneurship development. Gujarat's milk and milk products are available in many developing and developed countries. Its spices and fruits are exported globally.

In the last 5 decades, increasing population has led a pressure on agricultural and other lands. Now in Rajasthan the per capita land availability is 3.38 ha, while in Gujarat it is 2.20 ha. Our agricultural land availability for cultivation is declining day by day. As a result the percentage of small and marginal farmers is increasing which adversely affects the use of agricultural machinery and other improved technique due to poor available resources in the hand of farming community. Under the dynamic leadership of Indian Council of Agricultural Research (ICAR), Zone-VI have a wide network of 70 Krishi Vigyan Kendras (KVKs), 42 in Rajasthan and 28 in Gujarat for out scaling the of agricultural technologies for making farmers more active in adopting the new technology for augmenting the production.

Like other seven zones in the country, Zone-VI was established in 1979 with a mission to transform the farming community through multi-faceted skills and knowledge backstopping and management to make agriculture more remunerative and economically viable. The Zone has focused on location specific technologies through assessment, refinement and demonstration. Client specific leadership is the main motto to provide the food and income security *vis-a-vis* maintaining agro system. KVKs are promoting entrepreneurship development in integrated farming systems (IFS) mode. The focus is on the alternate sources of income for drought proofing by empowering the rural youth and farm women through capacity building. Emphasis is given on Farmer-Research-Business-Public-Private Partnership to make agriculture globally more competitive and profitable. Under National Agricultural Research System (NARS), various research institutes like Central Arid Zone Research Institute (CAZRI), Jodhpur; Central Institute of Arid Horticulture (CIAH), Bikaner; National Research Centre on Camel (NRCC), Bikaner; Central Sheep and Wool Research Institute (CSWRI), Avikanagar; Central Institute for Research on Goats (CIRG) Magdhum; National Research Centre on Seed Spices (NRCSS), Ajmer; Directorate of Rapeseed and Mustard Research (DRMR), Bharatpur; Directorate of Groundnut Research (DGR), Junagadh and Directorate of Aromatic and Medicinal Plants, Anand. There are seven State Agricultural Universities (SAUs), *viz.*, Swami Keshwananda Rajasthan Agricultural University (SKRAU), Bikaner; Maharana Pratap University of Agriculture and Technology (MPUA&T), Udaipur; Sardarkrushinagar Dantiwada Agricultural University (SDAU), Dantiwada, Anand Agricultural University, Anand; Junagarh Agricu-lltural University, Junagadh; Navsari Agricultural University (NAU), Navsari and Rajasthan University of Veterinary and Animal Science, Bikaner

(RAJUVAS), Bikaner are functioning for the development of the region. Agricultural Technology Management Agency (ATMA)—district level agency and line departments are doing tremendous efforts to provide technical *'know-how'* on new agro technique in collaboration with KVKs. In recent past the focus is concentrated on web enabled system, mobile agro-advisory (SMS/vSMS) to reach fast to the farming community for speedy dissemination of agricultural technologies.

Large scale adoption of innovations

- Farmers have adopted dry land and improved agro-technique on Pearl Millet, oilseeds, cereals, cotton, spices, pulses, Horticulture crops and livestock sector.
- Management of Saline-Sodic soils adopted in both the states for enhancing the production on 22.9 lakh hectare land in both the states.
- Water harvesting for supplemental irrigation fish farming has not only conserved the water, but, also raised the income of poor land, less fish farming community.
- Cultivation of fodder crops and maintenance of pasture land helped in mitigating the fodder scarcity and enhancing the milk production.
- Gum production in western Rajasthan, diversification of cropping, processing and value addition proved as drought proof mechanism and employment opportunities in dry land areas of Rajasthan and Gujarat.
- Infertility improvement in livestock using NDRI protocol helped in enhancing the milk production in both the states.

Impact of out-scalable innovations

- Seed replacement rate was observed as to be 25-80per cent in various crops like Maize, Pulses, Oilseeds, Bt. cotton, Groundnut increased the production by 1-1.50 times during last one decade.
- Dry land technologies adopted in Watershed Command Areas particularly in South Rajasthan and Saurashtra in Gujarat had improved the production and productivity of various crops and cropping system.
- Pressurized irrigation has brought 9,07,486 ha and 2,00,000 ha land under sprinkler and drip irrigation in Rajasthan and Gujarat, respectively, for economizing the limited water.
- Tissue cultured Banana and Date Palm brought 60900 ha and 680 ha, respectively in Gujarat.
- Indigenous cotton replaced by Bt. Cotton which minimized the consumption of pesticides in both the states.
- Groundnut cultivation in tube well command area of western arid region enhanced the productivity up to 50 q/ha which made regular supply for confectionary groundnut industries in Gujarat.
- Dairying as sustainable enterprise for women in Gujarat made farm women economically empowered
- Self help group (SHG) formed in both the states had made farm women more powerful and economically empowered to make the Rajasthan

and Gujarat agriculturally more vibrant and progressive.

- Rajasthan achieved highest pulses production during 2010-11. Gujarat exported value added vegetable, fruits, milk and their products to various developed and developing countries in Asia and Europe.
- Through cultivation of medicinal crops and processing of different products particularly isabgol, musli, aloevera, fennel and spices in Rajasthan and Gujarat earned foreign exchange by export up to 60per cent of these products in the international market.
- Vegetable cultivation in tribal areas of Gujarat enhanced the farmers' income as the produces are exported to European countries.
- Floriculture in Southern Gujarat, Semi-Arid districts of Rajasthan like Ajmer, Bhilwara, Jaipur enhanced the export to European and gulf countries to earn foreign exchange.

Successful Convergence Models

Groundwater recharging - KVK, Bharatpur

With the collaboration of Central Research Institute for Dry Land Agriculture (CRIDA), Hyderabad and state line departments, KVK, Bhartpur introduced ground water recharging in shallow tube wells of flood prone areas of Bharatpur district of Rajasthan state. Bharatpur district was earlier known as flood prone area was facing the problem of water shortages as many streams flowing through Bharatpur have been dried due to construction of dams coupled with low and erratic rainfall. Cemented ring (9 ft diameter) inserted surround the tube well up to 35' which costed Rs.10000-15000/ha. If had recharged, 54 wells in Sitara village and brought 242 ha land out of 365 ha to provide irrigation to *rabi* crops, which increased the production by 1.5 to 2 times. Nearby villages are adopting this technology under the backstopping of Krishi Vigyan Kendra (KVK). For this, state government is providing the short-term loans to farmers from 2012-13.

Apiculture for employment to rural youth

Mustard crop is cultivated on 26.74 lakh ha area in Rajasthan which produce around 38.18 lakh tonnes mustard seed in a year. These areas have ample scope for apiculture. With the support of KVK, Bharatpur, DRMR, Bharatpur and National Horticultural Mission (NHM) imparted the trainings to the farmers. NHM has provided 50per cent subsidy to each farmer for initiating apiculture. Now 55 farmers from 40 villages have adopted this technology and in Alwar and Bharatpur districts. Around, 500 units are operating in mustard grown district of Rajasthan. Each farmer is earning Rs. 2-5 lakh per year through selling of honey. Private organization like Bruj Healthcare, Indian Apiaries, Bharatpur and Kunleta Products, Alwar have associated to provide market opportunities to honey bee keepers in the region. Farmers have the opinion that honey filter plants may be established in each district for the purification of honey. In summer farmers have to migrate to Shivalik hill areas of Uttarakhand, Himachal Pradesh and Jammu & Kashmir for getting sufficient nectar for honey. It is costing on transportation. So, it is advised that plantation of nectar bearing

plants like neem, karanj, sisam (*Dalbergia sissoo*), jamun on forest and waste land area may be promoted to stop migration of honey bee keepers. Better marketing linkages are needed besides subsidy to provide good price for honey to the farmers.

Value addition to ginger : Unique entrepreneur

India has a total of 1,49,000 ha area under Ginger cultivation. Ginger growers, are not getting better prices for their products in absence of poor "*know-how*" on processing, polishing, drying & packaging. KVK, Anand has provided training to farmers of Anand and Vadodara districts on ginger processing. It costs only Rs. 25,000, but now farmers are earning Rs. 8,40,000 per ha while earlier the income was ranging from Rs. 2.5 to 3.75 lakh/ha. Now farmers are earning Rs.4,65,000/ha additional income by processing, polishing, drying and packing mechanism. This model needs further up-scaling in other parts of the country to raise the farmers' income.

Safed musli - An income earning crop

Safed musli is an upcoming crop in Baran, Kota, Jhalawar and Bundi districts of Rajasthan. In absence of good agro-techniques and processing techniques farmers were not able to get good prices for musli by the traders of Madhya Pradesh. KVK, Baran trained farmers on raised bed technique, digging of crop and processing of musli roots. Raised bed technique saved up to 40 per cent of water and increased the yield by 120 per cent. Intercropping of coriander with musli provided additional income of Rs.50,000/ha. Digging by chisel plough saved Rs. 25,000 to 30,000 on labour. Processing machine processed 50 kg musli just in 2 hour up to 90per cent of total material. Processed product fetched good income and farmers are earning Rs. 6 to 15 lakh by processing only. Around, 180 farmers have adopted the technique. This technology needs further upscaling on digging and processing in other districts of Rajasthan.

Fennel processing - A profitable venture in tribal area

Isac Ali, a farmer of Kachaoli village, district Sirohi, having 8 ha land earned Rs.3.60 lakh in 2006. He was not able to pull on his livelihoods for the joint family. KVK, Sirohi provided training on raised bed paired row cultivation and processing of fennel along with a group of other farmers. Now the farmer is earning Rs. 28 lakh per annum. Abu saunf *(C. V.)* replaced 3500 ha out of 6000 ha, while, paired row planting covered 3000 ha under fennel cultivation. Farmer has developed a bamboo made shed where he is drying the fennel. Skilled labour graded the fennel into four grades a, b, c & d. Now the fennel of Sirohi is exported to Australia and France. Thresher-cum-grader implement is also available in surrounding villages. These technologies need up-scaling in adjoining state of Gujarat to enhance the foreign exchange by exporting good quality fennel.

Date palm cultivation for high income in kutch

In Kutch, 19 lakh plants produce 16 lakh tonnes date palm fruit annually. Date palm is traditionally propagated by seed and off-shoot technique. Frequent-drought coupled with ingression of sea-

water in coastal area affected crop production drastically. In view of above, KVK, Kutch (Mundra) encouraged farmers to go for cultivation of table purpose date palm in coastal area. This centre has a unit of tissue culture lab on date palm. The cost of tissue culture plant is 10 times higher than off-shoot plant. Around 724 farmers have planted 84810 plants on 680 ha land. KVK has developed PVC pollinator technique where a barber's instrument is attached with a pole and tube. The pollens along with talcom powder are filled in the bottle and air is blown by pipe with mouth to pollinate the female flowers. It has reduced drudgery and injury to the farmers. This technique is quite economical and highly popular among the farming community. Now, 246 farmers formed a farmers association and selling the fruits @ Rs.80/kg to fruit merchants. This technique needs up-scaling in coastal areas of Jamnagar and Porbandar districts of Saurasthra where date palm cultivation is gaining momentum.

Value addition in mango - A way of prosperity

Mango is cultivated on 1,10,000 ha area in Gujarat. District Navsari has 12800 ha area under mango cultivation and produces around 20,160 metric tonnes. KVK, Navsari has provided training on mango pulp extraction and preservation. A farmer has adopted this technology of pulp extraction and processed 10 per cent of mango produced. He is earning around Rs.10-15 lakh per annum using processing technique. Such technique is needed to be up-scaled in other mango growing areas. Small scale industry may solve the problem of fruits damage due to untimely rain.

Public-private and community partnership

Jaipur district is facing the problem of declining ground water which affected the earning of farmers particularly in Chomu tehsil of Jaipur district. KVK, Jaipur has organized a training programme on vegetable cultivation under drip irrigation and associated NHM, Coca Cola for financial support and NUNHEM for marketing support. Since 2006, 573 farmers have associated with this model and brought 257 ha land under vegetable in drip irrigation. It saved 40-55 per cent water and brought 25-40 per cent additional land under cultivation. Now, 70 villages have adopted this technology and farmers are getting 20-25 per cent more income under contract farming. Onion seed production through contract farming earned Rs.139 lakh involving 101 farmers in Chomu tehsil. Such public-private and community partnership model as per location specific need have to be developed and up-scaled in water deficient areas of Rajasthan and Gujarat.

Water harvesting for supplemental irrigation and fisheries in arid areas

Arid areas of Rajasthan and Gujarat are facing the problem of erratic, low and scanty rainfall. Secondly the soil being sandy loam to sandy does not hold moisture for longer time due to deep percolation and evaporation losses. KVK, Jhunjhunu has developed a technology on rainwater harvesting, which has been adopted in a village near processing, fish oil processing, herbal pesticide, diversification of farming and

Pilani with the financial support of Dalmiya group. Farm ponds are filled with roof water harvesting channel and field runoff water. These ponds not only have recharged the groundwater, but, also provided supplemental irrigation to the field crops. KVK, Jhunjhunu has also started fish farming in these ponds and supplying fingerlings to different villages with the support of state line departments. Diggi constructed in Hanumangarh, Ganganagar and Bikaner under Indira Gandhi Canal Command Area also rear fish in the diggi to earn extra income from fish farming. KVK, Hanumangarh is also providing fingerlings and technological support to fish farmers in western region. This technique has ample scope in arid and semi-arid areas of Rajasthan where 2-3 showers are highly intense to generate the runoff.

Fish farming for inland farmers - A source of income

In coastal area of southern Gujarat, a number of farm ponds do exist. KVK, Navsari has trained farmers on inland fish farming in Navsari district and formed a group of 17 farmers. Farmers have used fingerlings of Rohu, Catla and Jhinga in the beginning. Initially farmers earned an income of Rs. 20 lakh from 4 ponds. Looking into the success, now 500 farmers from 40 villages have joined this group and now doing inland fisheries in the region. Technique is getting momentum in coastal districts like Bharuch, Vadodara, Anand and Kheda. KVKs have also developed indigenous bamboo cage system (Pen) to produce fingerlings. Earlier farmers used to buy fingerlings from West Bengal. Fish cultivation has proved an economic preposition to small and landless farmers in these districts.

Entrepreneurship in agriculture/ allied sector

Dairying activity is adopted by women farmers in Banaskantha, Mehsana, Anand, Vadodara, Jamnagar districts and now it has come up in big way. Group of farm women is involved in dairying from production to the sale through cooperative. In Baran district, different SHG of farm women after obtaining training from KVK, Baran has established their enterprise on soya product and spice product. Each woman is earning Rs.10,000-15,000 per month. Each SHG has member of 15-25 farm women. Around, 5 SHGs have been formed in Pali and Jodhpur district through the technological back up of KVKs. They had established their own unit of animal feed (bricks, mineral mixture) using local material. The farmers are not only meeting their requirement but also doing the business. Each farmer is earning Rs. 8,000-10,000 per month.

In 12th five year plan (FYP), secondary agriculture has to be given top priority in these states to enhance the livelihood and income of farmers. Zone-VI has identified various activities under secondary agriculture for each district. KVK will address these activities at district level. In Rajasthan state, 21 activities have been identified while 15 areas have been pinpointed for the Gujarat state. The prominent activities *viz.*, dal mill, oil mill, guar gum, cotton ginning & spinning, fruit processing, spice processing, wool spinning, essence and scent distillation, paper pulp processing, poultry and animal feed, corn processing, bamboo products, wax

integrated farming system will be given more importance to harness the maximum benefit from secondary agriculture activity during next one decade.

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