

Technological options for doubling farmers' income in Rajasthan by 2022

scope, strategy and action plan

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The agro-climatic conditions of Rajasthan pose serious challenges in production of crops and livestock resulting in low productivity and lesser income of farmers. However, there exist certain strength and opportunities in agriculture sector of the State. This article examines both challenges and strengths of agriculture and allied activities in Rajasthan in enhancing net returns from farming through improved technological interventions in existing framework of policy and marketing. The analysis of data indicated that annual compound growth rate is highest in livestock sector (18%) followed by fisheries(11%), crop sector (4.7%) and forest sector (3.8%). There exists a tremendous scope not only to maintain this rate of growth but also to raise it further using an inclusive approach of increasing crop and livestock productivity through proper technological interventions, stabilizing prices of local commodities through appropriate marketing policies in extra production, reducing cost of production, diversifying farming and cropping system, promoting secondary agriculture and value addition, and augmenting income from other sources. Action plan for up scaling technologies, capacity building and strengthening of marketing is discussed here to achieve the solemn goal of doubling farmers' income by 2022 in Rajasthan.

Key words: Agriculture, Farmer, Income, Marketing, Policy

BEING one of the big states of the country, Rajasthan has total cropped area of 24.86 million ha and net sown area is 17.93 million ha. Thus, only 6.93 million ha area is sown more than once. Forests occupy 2.75 million ha area, 1.88 million ha is under non-agricultural uses; 2.39 million ha area is barren and unculturable land and 4.11 million ha is culturable wasteland. Permanent pastures and other grazing lands occupy 1.69 million ha area and 3.49 million ha area is under fallow land.

Food crops are cultivated on 13.6 million ha area out of which pulses occupy 4.0 million ha. Horticultural crops are grown in 1.3 million ha. The most important food crops include pearl-millet, clusterbean, wheat, mustard, gram, mothbean,

mungbean, soybean and maize. The important fruit crops are citrus, pomegranate, ber, guava and datepalm. Seed spices are grown over an area 0.89 million ha and medicinal and aromatic plants on 0.3 million ha. The state has 57.7 million livestock population comprising of both small (goat, sheep), and large (cattle, buffalo, camel) ruminants and 8 million poultry.

Rajasthan has sub-tropical climate and more than 80% of annual rainfall is received during monsoon (June to September). Rainfall decreases from south-east to north-west direction. In arid north-western parts, average rainfall ranges from 100 mm in extreme west to over 450 mm, whereas in south-eastern parts rainfall ranges from 450 mm to over 870

mm. However, there is high variability in seasonal and annual rainfall, and droughts of varying intensities occur once in 3 to 8 years in different areas.

The state has very limited water resources as it has only 1.16% of the total surface water available in the country. There are 14 river basins in the state and it has 118 major and medium irrigation projects. Most of the rivers are rainfed. Mahi, Chambal and Banas are three major rivers of the state and Chambal and Mahi are the only perennial rivers. More than 50% of the state's surface water resources are from inter-state transfers. Net irrigated area is 7.42 million ha and gross irrigated area is 9.41 million ha.

Canals and wells are major source



of irrigation. Canal irrigation accounts for about one-fourth of net irrigated area. Reliance on tube-wells for irrigation has increased from 28.7 % to 44.5 % in net irrigated area during 2004-2014. The stage of groundwater development was just 35 % in 1984 that has now reached 139 %. In 2013, out of 248 blocks in the state, 164 blocks were over-exploited, 9 were critical, 28 were semi-critical and only 44 blocks were in safe category.

About 65% population of the state is dependent on agriculture and allied activities (horticulture, animal husbandry, forestry, and fisheries) for their livelihood. The contribution of

agriculture and allied sector in Gross State Domestic Product (GSDP), which was more than 40% in early eighties, has come down to 26.5%. The income gap between the farmers and people dependent on other economic activities is on increase resulting in distress among farming community. With this backdrop, government of India has set a target of doubling farmers' income by 2022-23.

The article deals with the scope of enhancing income of Rajasthan farmers by this time-line through technological interventions. Since income enhancement is a function of higher productivity, better marketing

access and appropriate policy, strategy and action plan of doubling farmers' income are to be planned in a holistic way. The analysis presented here is based on the secondary data from State and Central governments. The strategies and action plan have been scheduled taking cognizance of the existing policies of Government of Rajasthan in agriculture, agro-processing and agri-marketing, state action plan on climate change, State water policy, State MSME policy, livestock policy, reports of *NITI Aayog*, and improved production technologies available in agriculture and allied sectors.

Scope of growth in different sectors

Share of agriculture and allied sectors in GSDP indicates that share of crops is 51% followed by 39% contribution by livestock sector and 10% by forestry. Current compound annual growth rate (CAGR) is highest (18%) in livestock sector followed by 11% in fisheries, 4.7% in crop sector and 3.8% in forest sector (Table 1). If the four sectors maintain similar growth trend in next five years, their combined contribution in GSDP is likely to increase by 108% by 2022-23 on current price basis. Special emphasis thus would be needed to maintain the high growth rate in livestock sector. The CAGR of milk, meat and eggs production range from 8 to 13% since 2006-07.

There exists a tremendous gap between yield levels that are achievable and that are being achieved. A large number of demonstrations conducted at farmers' fields showed wide yield gaps between yields with farmers' practices and demonstration yields of cereals,

Table 1. Contribution of agriculture and allied sectors in GSDP at current prices, rate of growth and the expected contribution by 2022-23

Component	Contribution (₹ 000 crore)	CAGR (%)	Expected contribution by 2022-23 (₹ 000 crores)
Crops	85.87	4.7	118.47
Livestock	64.62	18.1	207.05
Forestry	15.94	3.81	20.71
Fisheries	0.53	11.95	1.17
Total	166.96	8.67	347.4

Table 2. Yield gap at farmers field owing to lack of technology adoption

Crops	Number of demonstrations	Area (ha)	Yield (q/ha) under		Increase in yield (%) under demonstration
			Farmers practice	Demonstration	
Wheat	389	143	34.7	41.0	22.4
Barley	413	143	35.6	42.7	20.7
Maize	350	120	26.0	35.6	43.2
Paddy	92	37	37.4	44.9	26.5
Pearl millet	347	231	14.2	19.3	37.7
Sorghum	25	10	14.1	18.1	28.1
Clusterbean	486	194	8.8	10.8	23.2
Green gram	254	93	7.1	9.2	31.4
Moth bean	70	30	5.2	6.6	25.4
Chickpea	218	99	13.8	17.5	28.0
Groundnut	90	34	26.4	33.6	26.7
Sesame	225	90	3.7	5.0	35.5
Mustard	606	263	16.9	19.6	16.9
Soybean	60	13	10.6	16.8	17.7

Table 3. Yield levels in spice crops in Rajasthan using improved technologies and farmers' practice

Crops	Themes	No. of demonstrations	Yield (q/ha)		
			Improved technologies	Farmers' practice	Increase in yield (%)
Coriander	ICM	82	16.39	13.69	19.71
	Varietal evaluation	65	13.23	11.53	15.04
Cumin	ICM	120	7.44	6.03	24.74
	Varietal evaluation	112	6.10	4.39	38.45
Fennel	Varietal evaluation	78	22.55	18.06	28.29
Fenugreek	ICM	128	17.50	12.50	40.00
	Varietal evaluation	25	16.15	13.05	25.38
Garlic	ICM	10	91.62	72.15	26.99
	Varietal evaluation	66	88.82	75.33	17.91

*ICM Integrated crop management

pulses, oilseeds, vegetables and spices. Average yield gaps between yield with farmers practice and improved practices range from 21 to 43% in cereals, 25 to 31% pulses and 17 to 36% in oilseeds across the state (Table 2). Similar yield gaps ranged from 20 to 31% in vegetables and 15 to 40% in spices (Table 3) in the demonstrations conducted in the state during 2016-17. The average milk productivity of non-descript cattle and buffalo having 30 to 40% of share in total population is 40 to 50% lower than productivity of improved breeds underlining a huge scope of improvement through improved breeds of livestock.

Strategies to enhance income

Multi-pronged strategies are needed to enhance income. The foremost of them is upscaling of adoption of production technology, currently low in Rajasthan, to produce marketable surplus after meeting farmers' house-hold requirements. Policy-level interventions are indispensable to develop a mechanism to absorb extra production as it was often observed that the enhanced production of commodities may not translate in extra income of farmer. Institutional strengthening and infrastructure development become most critical to realize better price of farm produce. Capacity building of farmers is also very essential to update their knowledge on newer technological options and to understand the intricacies of market. This would require a holistic approach of increasing crop and livestock

productivity through proper technological interventions in different agro-climatic zones, stabilizing prices of local commodities, enabling policies and their implementation, reducing cost of production, reducing risk factor in production chain, diversifying farming and cropping system, targeting secondary agriculture and value addition, production taking cognizance of natural resources, improving terms of trade for farmers and augmenting income from other sources.

Action plan for up-scaling technologies, capacity building and strengthening marketing

Increasing cropping intensity through efficient water management: Rajasthan has access to 1% of water resources inspite of having 10% geographical area of the country. Despite this, micro-irrigation techniques are being used in only 10% of area (1.3 million ha under canal command area of IGNP) under irrigation which has to be substantially increased to bring greater area under irrigation using same amount of water to increase cropping intensity in the state. It has been demonstrated that drip irrigation saves water up to 80%. The model of Narmada canal, that makes water to be essentially used only through pressurized irrigation, needs to be replicated in canal command area of IGNP. Low-water requirement crops like wheat, chickpea and mustard instead of water guzzlers like groundnut, castor, and rice in the irrigated areas needs to be promoted by legislation. *In-situ*



and *ex-situ* water harvesting would also play an important role in increasing cropping intensity. Utilization of waste water for irrigation purposes has a great potential especially in peri-urban areas.

Livestock-based integrated farming system approach: Cultivation of crops only in a typical rainfed farming situation gives, on an average, a net return of ₹ 16,000/ha, whereas average net return from an integrated farming system is ₹ 35,000/ha. Besides, IFS approach offers round-the-year employment. Several IFS models were suggested having an appropriate combination of horticulture, grasses, livestock, boundary plantation and crops for various agro-climatic zones of state. Developing entrepreneurship among farmers through FPOs, SHGs etc. is very important to maximize profit from IFS.

Improving livestock productivity: It is reported 30-40% shortage of dry stover for livestock and therefore augmenting fodder supply through rejuvenation of degraded grasslands become critically important. Use of region-specific multinutrient mixture, feed blocks or pellets can further help in improving the livestock productivity. Improvement of local breeds of livestock needs special emphasis and establishment of Artificial Insemination centers at block level is essential to achieve it. Semen-sexing is a potential technology to control population of non-productive animals.

Increasing crop productivity: The yield gap between productivity levels obtained at farmers' field with and without improved technology in various field crops in Rajasthan ranges from 17 to 41% highlighting the potential role of upscaling of production technology. Further, there



is only 8 to 15% seed replacement rate of pulses, and 50 to 60% of pearl millet and maize hybrids that needs further enhancement. Promoting early maturing cultivars especially in drought prone areas and quality planting material of horticultural crops would play an important role in further enhancing income levels.

Diversification with high-value crops and commodities: Diversification of agriculture offers a great opportunity to augment income. Specific interventions include cultivation of high-value fruits and vegetables. Protected cultivation is also emerging as viable option in Rajasthan especially in peri-urban areas having good market connectivity. New crops like Quinoa, Chia offer additional opportunities for diversifying the farming. Agri-voltaic system, also termed as solar farming, can also be an option of getting high annual returns per unit of land with a potential of ₹ 2.2 million/ha, though it requires a heavy investment in beginning.

Reducing cost of production: It can also be an additional avenue to increase net returns from farming. Integrated nutrient management based on fertility status of soil and nutritional requirement of crops are being suggested to reduce cost of inputs. Custom hiring centers have an important role to play to reduce the cost of production as mechanization helps in reduction of labour requirement and to reduce

losses during harvesting.

Supporting pioneer and unique crops of Rajasthan: Rajasthan is known for crops with unique attributes. Pearl millet is cultivated on 40 lakh ha (>50% of acreage of country) and maize on 9 lakh ha. These two crops showed highest growth in productivity since last more than 4 decades. Despite being drought tolerant, nutritionally rich, climate-change ready crops, the area under these two traditional food crops of Rajasthan is continuously declining as there is no incentive for farmers to produce more. The supply of wheat in PDS in Rajasthan, even in those areas where pearl millet and maize make traditional foods, has led to lesser importance of these two crops. There is need to procure pearl millet and maize and to distribute them in PDS in western and southern parts of state, respectively. Similarly, Rajasthan is known as hub for seed of spices but there are few processing plants and *mandies* for their marketing. It adds to the transportation cost while taking them in adjoining states for processing and marketing. There is urgent need of establishing processing industries of cumin, *isabgol*, coriander, fennel and fenugreek in the area of their production.

Capacity-building of farmers: Enhancing skill (particularly of youth) in dairying, farming, small-scale processing of seed spices, repair of farm machinery and protected-

cultivation structures etc. would provide additional avenue to increase farm productivity and to add additional sources of income. Trainings in handicrafts, cottage, and small- and medium-scale industries relevant for the region can be other option.

Providing better marketing and ushering reforms: Contract farming of seed spices and medicinal plants like *Aloe vera*, *isabgol* is a potential area to fetch assured income to farmers. Arranging direct purchase by bulk buyers and setting up of private markets would further encourage farmers for additional production of such commodities. The Government of Rajasthan has already denotified fruits and vegetables from APMC which is good initiative to provide free marketing. There is also need to connect remaining *mandies* of state to e-NAM. Establishment of export-oriented farm hubs for cumin, *isabgol*, fenugreek etc. is also required.

Enhancing storage facilities: Creation of more warehouses, cold storage facilities for fruits, onion, garlic, seed spices would be very helpful in avoiding losses. Primary processing of local produce through co-operatives, federations, FPOs and SHGs would lead to value-addition resulting in higher market price.

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