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On Critical Policy Issues in India's Agricultural Economy

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Contents

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Harnessing Solar Energy: A Novel Solar Cooperative Initiative in India

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Introduction

- In India, a country distressed with an irregular and ill-spread monsoon, irrigation is the mainstay of agriculture. Particularly in western India, canal irrigation is scarce and mostly unreliable in terms of time and duration. This makes irrigation largely dependent on ground water withdrawal, using irrigation pumps driven with either electricity or diesel. India currently has about 15 million electrified irrigation tube wells, with an estimated power subsidy of about 70,000 crore rupees.
- Besides, the existing electricity supply is insufficient, non-reliable, fluctuating in voltage and often available only at inconvenient hours. New electricity connections are hard to get, with a waiting list running into lakhs. In eastern India also, in spite of the abundance of ground water, it cannot be harnessed due to the shortage of electricity. As a result, irrigation in India is done mainly through about 9 million diesel-run pumps. This burdens the exchequer with huge subsidies given on diesel and also generates environmental pollution.
- Solar power generation on the farm itself through installation of solar PV (photovoltaic) panels, and the usage of same for the extraction of groundwater could just be the solution to address these concerns. Solar pumps come with a user-friendly technology and are economically viable. They are easy to use, require little or no maintenance and run on near-zero marginal cost. Solar power is more reliable, without voltage fluctuation and available during the convenient day-time. India is blessed with more than 300 sunny days in the year that are ideal for solar energy generation, aptly supported by promotional policies of the Government of India.
- In light of the above, an attempt was made to study the Dhundi Solar Irrigation Cooperative (DSIC). DSIC is the first ever cooperative of farmers for decentralized solar power generation and usage in irrigation formed in 2015 in Gujarat, India. A field survey was conducted in which all the 6 members of DSIC were included in the sample. Besides, 6 non-members of DSIC were randomly selected. Thus, total number of respondents was 12.

Findings

- *Impact of DSIC on Water Markets* - The prevailing rate of buying water for irrigation through a 5 HP solar pump is Rs. 400 per *bigha* (0.25 acres). If the water seller were to withdraw water with the help of a diesel pump, he would be spending on diesel as well as occasional maintenance costs of the pump-set. It was estimated that approximately 5 litres of diesel was consumed in irrigating 1 *bigha* of land. Assuming the price of the diesel to be Rs. 50 per litre, the amount spent would be Rs. 250 to sell water worth Rs. 400. Hence, the net profit per *bigha* would be around Rs. 150.
- On the other hand, if the water seller sells water withdrawn through the solar pump, operating costs would be near-zero, while the price that he could charge could be anywhere between Rs. 400 (the ongoing rate) and Rs. 250. Suppose the water seller charges Rs. 400, his net profit would be more than double. Alternately, if the water seller were to charge a reduced rate of Rs. 250 per *bigha* (as resolved by DSIC members), net profit would still be Rs. 250, which is more than that accrued by using a diesel pump. Hence, DSIC members were encouraged to extract more ground water and sell it, but at a lower price than before. This would result in expanded demand for ground water in Dhundi. This happens because ground water is 'free' and extraction of the same is not regulated by the state.
- In fact, geographical distance between the water buyer and water seller is the only factor that could put a tab on the unabated extraction of ground water in Dhundi. However, if the government were to bring in stringent laws and regulations for groundwater extraction, unabated expansion of groundwater demand could be controlled. Hence, it could be said that due to the onset of solar pumps, ground water extraction is perceived to have become much cheaper, encouraging the farmers to gear up their water sales.
- It was observed that total hours of water extraction for sale have increased by more than 135 percent. However, the number of pumping hours per day was reported to have reduced, as the solar pumps extracted more water per unit of time. Also, instances of a break down and heating up of the motor were found to have been reduced. The number of water buyers has more than doubled after the solarisation of irrigation pumps, increasing the income of water sellers in DSIC by more than 400 percent.
- *Impact of DSIC on Costs of Irrigation* - Earlier, farmers used to incur high direct costs on buying diesel, repairs and maintenance of pump-sets. These costs have disappeared after they moved from diesel-

powered to solar-powered pump-sets. The annual savings on cost of diesel after shifting to solar powered irrigation was reported to be around Rs. 13,375 per month. Apart from this, the expenditure on repairs and maintenance of diesel engines was reported to be around Rs. 8,250 per year. Thus, direct monetary savings would come to Rs. 1,15,250 per annum.

- *Impact of DSIC on ground water level* - Near-zero operating costs of solar pumps were reported to have resulted in over-extraction of ground water. At present, the farmers of DSIC are not worrying about the consequences as the water table in their bore-wells was quite comfortable. However, in the long term, this situation is bound to get more serious. This issue was discussed with the respondents in greater depth. It emerged that only 33.33 percent respondents recognized the negative impact of over-extraction of ground water. They explained the reason for this by saying that since the irrigation canal was quite nearby, ground water would be recharged naturally. None of the members had made any attempt or expenditure on artificial recharge of their bore wells.
- *Impact of DSIC on* the *Use of Diesel* - Use of solar power has greatly reduced the dependence on diesel and resultant air and noise pollution.
- Members reported that they were involved in the functioning of DSIC only to the extent of cleaning and maintaining the solar panels on their own farms and rotating them regularly. They did not do any other work of technical nature like arrangement of meetings, preparation of agenda and minutes of the meetings, maintenance of accounts, solution of problems faced by fellow members, and maintenance of various records and registers. All the above functions were currently handled by one particular member only. Capacity-building of members for running and expansion on their own after the withdrawal of International Water Management Institute (IWMI) was yet to be done. The DSIC had not yet decided its secretary, membership fee, yearly operation and maintenance charges.

Figure 1: A Farm Worker Cleaning the Solar Panels Installed in the Farm

Source: *www.c1.staticflickr.com*

- SWOC Analysis of DSIC: Even though the DSIC is in its infancy, an attempt was made for a SWOC analysis of various aspects of the cooperative such as formation, functioning, financing and sustainability.
- *Strengths*: The cooperative model of DSIC made decentralized solar power generation less complicated because the Madhya Gujarat Vij Company Limited (MGVCL) did not have to engage with individual farmers, which brought speed and efficiency in solar power generation. DSIC enabled the MGVCL to save on transaction and vigilance costs. With the formation of DSIC, the MGVCL could evacuate power through a single point, which has cut down on transmission losses to a considerable extent. Payments could be made at a single point, i.e. DSIC, which saves on metering and monitoring

costs and hassles of individual payments. The process of emptying power to the grid was reported to be transparent and fair, which inspired confidence amongst members. Shifting to solar power brought substantial gains for the farmers in terms of savings on costs of diesel. This improved their returns from agriculture, thereby reducing the carbon footprint of irrigation.

- *Weaknesses*: DSIC was formed through IWMI's support. Capacity building of the members or financial planning for self-sufficiency post-withdrawal of IWMI has not been done yet. Membership fee was not decided. No provision was made for meeting the routine administrative expenditure. With use of solar power, irrigation would be possible only during day time. This may bring more evaporation and greater water use, in turn negatively affecting water use efficiency.
- Opportunities: The DSIC promises to bring a win-win situation for both, the farmers and the MGVCL. The farmers get free power for their irrigation needs and the MGVCL could buy power at a cheaper rate than that obtained from thermal plants. Reduction of the use of diesel pumps for irrigation would liberate the MGVCL and Gujarat state government from the heavy burden of agricultural power subsidies. In future, power sale by DSIC could be opened up for private electricity companies as well.
- *Challenges*: If the upsurge in sale of ground water is not dealt with urgently, it could have a very negative impact on ground water levels in the long run.

Recommendations and Conclusions

- The DSIC could be termed a successful model in reducing the dependence and costs of diesel or electricity for irrigation. It also provides the farmer with another avenue for earning supplementary income. However, the sale of solar power to the MGVCL is not attractive for the members at the tariff offered at present, which is why they choose the more profitable option of selling ground water to their neighbouring farmers. This has resulted in an upsurge in ground water extraction, decreasing its price and expanding the water market to a great extent. Although it brings cheer to the members of DSIC and their neighbouring farmers in the short term, in the long term it threatens a fall in the ground water table.
- The MGVCL needs to revisit its power purchase price to discourage this phenomenon. It could also explore the possibility of redesigning the Power Purchase Agreement (PPA) with DSIC to enforce a large amount of solar power which is made obligatory to be supplied to MGVCL. Thus, DSIC could be an economically viable model of decentralized solar power generation. However, it is necessary to devise a policy which not only encourages solar pumps but also manages to regulate ground water extraction through them. Only then, would it become a sustainable solution for energy needs in irrigated agriculture.

(Cover Photo: www.i2.wp.com/govinfo.me)

Managing Soil Fertility Including Carbon & Micronutrients for Doubling Farmers' Income

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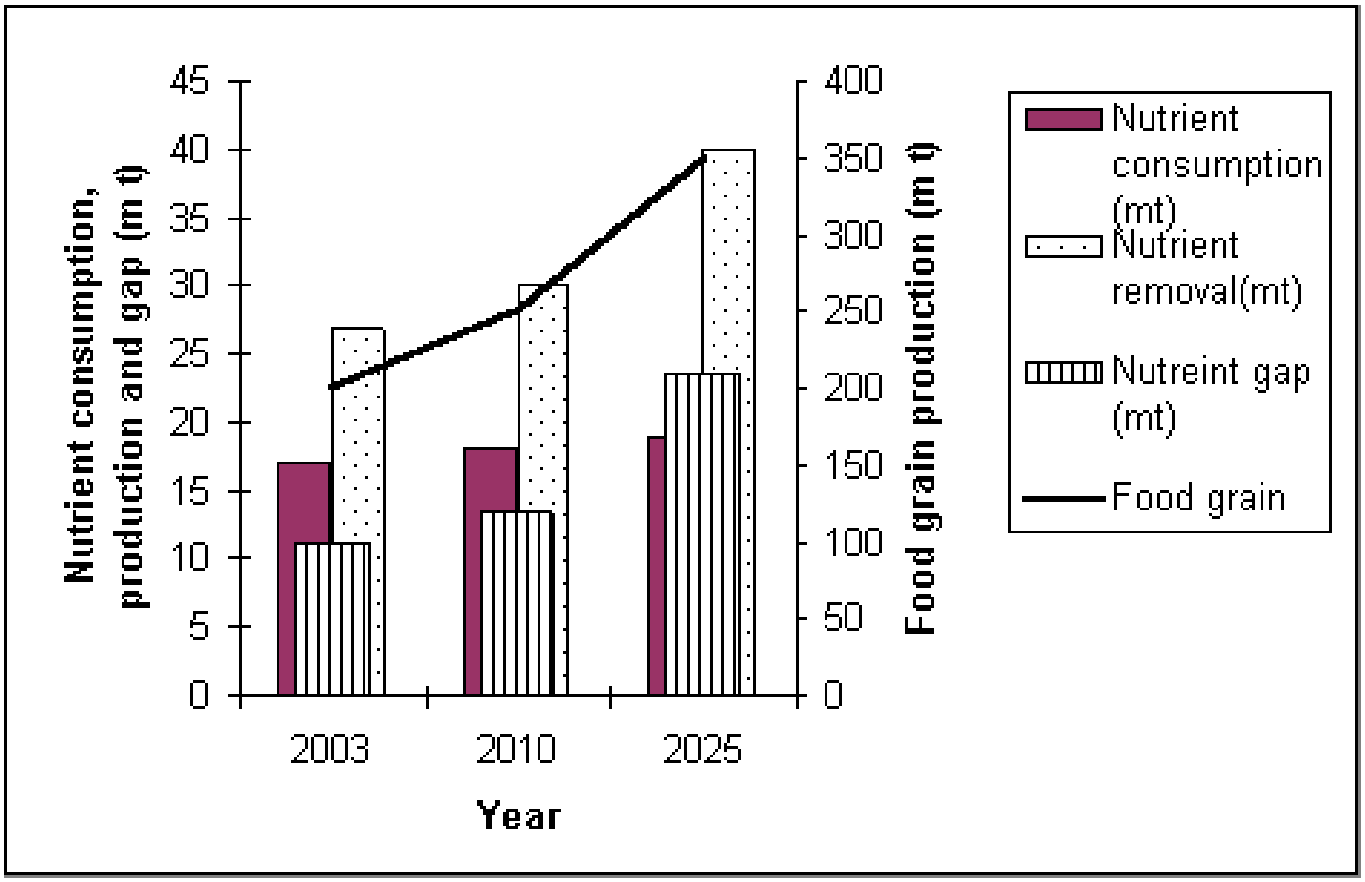
Introduction

- The food grain production in India is projected to increase to 400 million tonnes by 2070 as the population of India is expected to reach 1.7 billion by 2070 from 1.34 billion in 2017. With an increase in population, per capita gross availability of food would reach 220 kg per person per year from the current 204 kg per person per year.
- After the Green Revolution, second generation problems emerged such as wide gap between nutrient demand and supply, improper use of agri-inputs, shrinking water resources, insufficient use of organics, disproportionate growth of microbial population, natural and anthropogenic calamities and emergence of new pests.
- The on-going rate of growth in farm income needs acceleration in order to double the income of farmers. This needs better management of soil and water resources appropriately in various agro-ecosystems.

Findings

- The major threat to soil quality (physical, chemical and biological) result from erosion, loss of organic carbon, nutrient imbalance, compaction, salinization, water-logging, decline in biodiversity, contamination with heavy metals and pesticides, and adverse impact of climate change. Soil organic carbon enhancement is one solution to the many woes listed above.
- The nutrient imbalance in soil is increasing day by day and is projected to increase further without there being corrective actions at national as well as state levels (Figure 2).

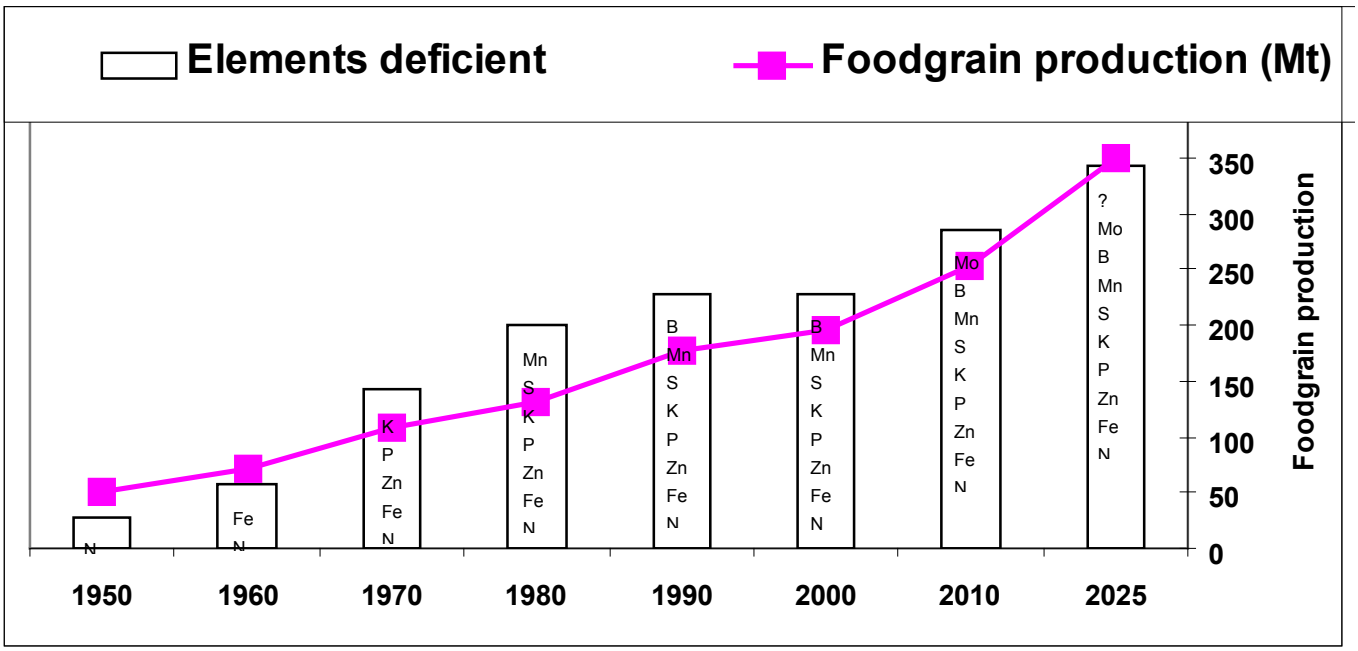
Figure 2: Projected Food Grain Production in Relation to Nutrient (N-P_2O_5-K_2O) Consumption, Removal and Nutrient Gap



Source: *www.fao.org/docrep/010/ag120e/AG120E09.htm*

- As food grain production increased with time, the number of elements becoming deficient in soil and crops has also increased due to the imbalance in fertilization use (Figure 3).

Figure 3: Actual and Projected Food Grain Production and Element Deficiency in Soils in India



Source: *Rao, K. V. (2012). Efficient Management of Micronutrients in Rice [Powerpoint Slides]. Retrieved from - https://www.slideserve.com/neil/efficient-management-of-micronutrients-in-rice*

- Every year India generates 664 million tonnes of crop residue which contains nearly 40 percent organic carbon. Even if 50 percent of total crop residue is properly managed on farms, it can add 1.6 billion

U.S. dollars of organic carbon content to the Indian soils.

- Total dung produced by the livestock in India is approximately 562 million tonnes per year. This huge amount of dung if used for biogas production, can contribute 11 million tonnes of soil organic carbon by application of slurry obtained from biogas chamber. This has the potential to add 1.6 billion U.S. dollars to the farmers' income per year.
- India can utilize the rotting grains, post-harvest losses of fruits and vegetables to add 0.7 billion U.S. dollars' worth of income to farmers.
- The above mentioned additional incomes are added which sums up to nearly 4 billion dollars annually. This is sufficient to increase income of Indian farmers by 1.24 percent annually directly along with the indirect benefits of enhanced water holding capacity and increased partial factor productivity of added nutrients.

Recommendations

- Application of farm yard manures along with chemical fertilizer is required. There should also be an inclusion of legumes in cropping pattern as legumes are helpful in sustaining soil organic carbon in the soil, in the long run.
- There is a need to mobilise part of agricultural input subsidy for enhancing soil organic carbon. This would reduce the WTO pressure on Government of India for not breaching the subsidy ceiling of 10 percent of annual agricultural Gross Domestic Product (GDP).
- Since crop residue, animal dung and post-harvest losses in agriculture have hidden income potential of nearly 4 billion dollars annually, steps must be undertaken for harvesting the full potential of converting the crop residue and post-harvest losses into soil organic carbon through proper management of biomass in order to enhance farmers' income.

Pulses Procurement and Minimum Support Prices

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Introduction

- The Central Government has announced that Minimum Support Prices (MSP) would be set as one and a half times the cost of production for most agricultural commodities. In this context, there have been many questions about the existing support price, its relevance and likely implications.
- Findings of a study submitted to the Ministry of Agriculture in 2016 throws light on the relative effectiveness of MSP in an open economy. This is illustrated with certain pulses such as *Urad* (Black Gram), *Arhar* (Pigeon Pea) and *Masur* (Lentil), as there was a belief that prices of these pulses were largely above the MSP. The information presented is for the past years but such situation still prevails.

Findings

- Table 1 shows the months in which average price for a state was less than MSP between 2010 and 2018 (also marked by ♯) and years when the market price was above MSP (marked by *). Information in the table is for states for which price information was available on the website of AgMarknet. The table suggests that for many pulses, the market price remained lower than MSP during the reference period.

Table 1 - Periods (Months) When Market Prices of Commodities were Below MSP

Urad								
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
M.P.	Jul-Jun (♯)	*	Oct-Feb (♯)	Sep-Feb, Apr-Jun (♯)	Oct, Jan, Feb (♯)	Apr (♯)	Dec (♯)	*
Gujarat	Aug-Sep (♯)	*	Dec, Jan (♯)	Oct-Feb (♯)	Jan (♯)	*	*	*
U.P.	Aug (♯)	*	All Months (♯)	Jul, Aug, Jan-Mar (♯)	*	*	*	*
Chhattisgarh	Jul, Oct-Jun (♯)	*	Dec, Jun (♯)	Jan, Feb (♯)	*	*	*	*
W.B.	*	*	Jul, Oct, Jan-Jun (♯)	Jul-Oct, Jan-Jun (♯)	*	*	*	*
Assam	*	*	Jul, Dec, Jun (♯)	Jan (♯)	*	Feb (♯)	*	*

Arhar								
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Delhi	*	*	Nov-May (♯)	Jul-Feb, Jun (♯)	Jan-May (♯)	*	*	*
Karnataka	Nov-Dec, Mar-Jun (♯)	*	Feb, Mar (♯)	Jul, Aug, Dec-Feb, Jun (♯)	Jul, Nov, Jan-Apr, Jun (♯)	*	Dec (♯)	*
Andhra Pradesh	*	*	Oct-May (♯)	All Months (♯)	Jul, Jan-Jun (♯)	*	Dec (♯)	*
Masur								
	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
M.P.	*	Aug (♯)	Mar, Apr (♯)	*	*	Jan (♯)	*	Sep-Dec, Apr (♯)

Note: *Months are abbreviated as first three letters. Asterisk mark (*) in certain spaces shows that market price for that commodity was above the MSP of commodity for that year, while Pound sign (♯) indicates that market price for that commodity was below the MSP.*

Source: *Directorate of Market Inspection (DMI), Government of India*

- If market price of a commodity remains lower than MSP, the price support programme warrants that government designated agencies like NAFED (National Agriculture Cooperative Marketing Federation) should procure the commodities from such regions.
- Table 2 shows amount of procurement of some pulses between 2010 and 2015. Following procurement, market price of the commodity should be equal to or above MSP.

Table 2 - Procurement of Pulses (*Urad* and *Arhar*) in Recent Years

***Urad* (Black Gram)**		
Year	**State**	**Quantity Procured (tons)**
2010-11	Madhya Pradesh	129.66
2012-13	Rajasthan	1.57
2013-14	Andhra Pradesh, Uttar Pradesh , Madhya Pradesh	77050.8
2014-15	Jharkhand, West Bengal, Andhra Pradesh, Maharashtra, Uttar Pradesh	7453.26

***Arhar*, *Tur*, Red Gram (Pigeon Pea)**		
Year	**State**	**Quantity procured (tons)**
2010-11	Andhra Pradesh, Karnataka, Maharashtra	291
2012-13	Maharashtra, Andhra Pradesh, Madhya Pradesh	16004.83
2013-14	Maharashtra, Andhra Pradesh	42693
2014-15	Maharashtra, Andhra Pradesh	1079.64

Source: *Ministry of Agriculture and Farmers' Welfare (MOAFW, GOI), New Delhi*

- However, Table 3 shows that price of many commodities despite procurement, remained lower than MSP in specific markets of the states.

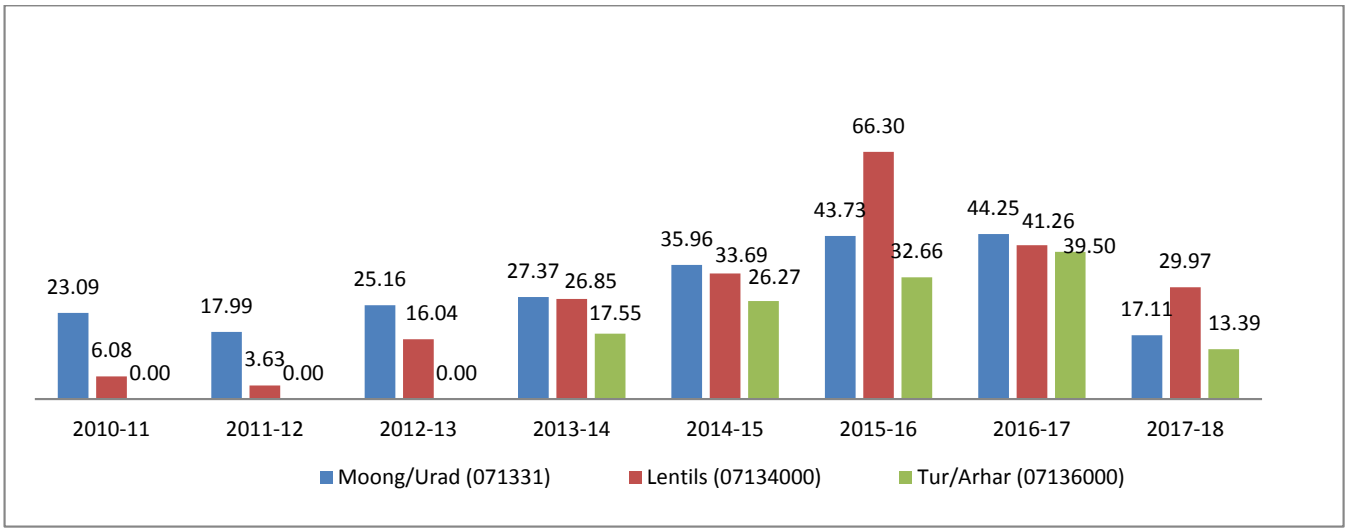
Table 3: Market Price Lower than MSP Despite Intervention in Different Markets of States

Crops and MSP	Intervention Period	Amount procured (Quintal)	Price in Markets with Dates in Madhya Pradesh
Urad Kharif Rs. 2900 per quintal	From 26-11-2010 to 14-12-2010	1296.6	Market price was lower than MSP in Sironj and Ashoknagar from 01-12-2010 to 14-12-2010.
Urad Kharif Rs. 4300 per quintal	From 16-11-2012 to 26-02-2013	33188.9	Market price was lower than MSP in Vidisha on many days, in Mandsaur on few days. It was equal to MSP in Shamshabad only.
			Information on market price was not available for many markets where procurement took place. For example, Ashoknagar, Guna, Ganj Basoda, Jaora, Jawad, Pipariya, and Sheopur Kalan in M.P.
	Intervention Period	**Amount procured (Quintal)**	**Price in Markets with Dates in Rajasthan**
	From 20-11-2012 to 31-03-2013	84085.1	Procurement happened in Atru, Baran, Bhawanimandi, Bhilwara, Bundi, Chomela, Dei, Dungarpur, Gulabpura, Jhalrapatan, Kekri, Kota, Pratapgarh, Ramganj Mandi, Shahpura, Sarwad but price in these markets remained significantly lower than the MSP. Bhilwara was an exception where market price was closer to MSP on some days.
	Intervention Period	**Amount procured (Quintal)**	**Price in Markets with Dates in Uttar Pradesh**
	From 17-11-2012 to 21-01-2013	153263	Procurement took place in the following districts of UP: Banda, Jhansi, Chandausi, Chirgaon, Lalitpur, Chitrakoot, Shahjahanpur, Bulandshahr, Budaun, Sambhal but market prices in most of places were lower than MSP except Bulandshahr (29-31 Dec 2012 and 15-19 Jan 2013).
Toor/ Arhar / Red Gram (Pigeon Pea) Rs. 3000 per quintal	**Intervention Period**	**Amount procured (Quintal)**	**Price in Markets with Dates in Maharashtra**
	From 3-1-2011 to 28-02-2011	1814.4	Market prices available during the intervention period were higher on most of dates in (Akola, Buldhana, Beed, Washim, Amravati, except Risod in Washim on10th Jan 2011, Mehekar in Buldhana on11th Jan 2011, Chikhali in Buldhana on 17th Jan 2011.
Toor/ Arhar / Red Gram (Pigeon Pea) Rs. 3850 per quintal	**Intervention Period**	**Amount procured (Quintal)**	**Price in Markets with Dates in Andhra Pradesh**
	From 18-1-2013 to 08-03-2013	70400.4	Procurement happened in centres in Tandur, Adilabad, Nirmal, Siddipet, Vikarabad, Bhainsa, and market price available from centres are higher than MSP in most of places except Tandur on 18th Jan, 2013, 6th – 16th Feb 2013), Vikarabad (6th – 13th Feb 2013)

Source: *Unpublished information from National Agricultural Cooperative and Marketing Federation (NAFED), New Delhi*

- The situation thus indicates that despite significant public expenditure in procurement, it was not easy to ensure MSP in an open economy. Information also suggests that there have been imports of different kinds of pulses in significant amount (Figure 6). Since the policy for import of pulse is embedded in the import quota of 5 metric tonnes with variable import tariff, it provides limited potential of altering imports for pulse under a World Trade Organisation (WTO) framework.

Figure 4: Net Imports of Selected Pulses (000' Million Rupees)



Source: *DGCI&S, Kolkata (Ministry of Commerce and Industry, GOI)*

Recommendations

- If there is scope, it would be desirable to adjust the MSP of pulses over the years. Procurement after six months of announcing MSP may take into account the movement in international prices of the commodities.
- If possible, for procurement of the commodity the MSP may be adjusted with reference to import price of that commodity. This may help better management of supply and demand in the market.

Economics of Fruit Cultivation in Himachal Pradesh Under Organic and Inorganic Conditions - Study of Mango, Citrus and Stone Fruits

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Introduction

- Himachal Pradesh has large diversity in food, fodder, vegetables, horticultural, forest and medicinal plants. The National Mission for Sustainable Agriculture (NMSA) too emphasizes promotion of good agriculture practices in order to promote organic agriculture. The Agriculture Department of the state has also come up with a policy framework for promoting organic agriculture.
- Adoption of organic practices in crop husbandry has been facing a lot of deterrents. Under such circumstances, the favourable economics of growing crops organically would potentially be a motivating factor. It becomes, therefore, important to quantify the differentials in cost of cultivation of fruits under organic and inorganic scenarios. Any positive differential in favour of organic methods could definitely be used to popularize the organic methods and most importantly in bringing down the cost of fruits production and hence enhancing the profitability levels for orchardists.
- In this empirical investigation an attempt has been made to analyze the economics of mango, citrus and stone fruits under organic and inorganic conditions. The state of Himachal Pradesh was divided into various agro-climatic zones and the ones having selected fruits crops (low-hill and mid-hill zones) were incorporated in the study. The district of Shimla was taken for stone fruit crop, while Kangra district was taken for mango and citrus fruit crops. Further, Rampur Block in district Shimla and Indora Block in district Kangra were taken because these have the largest area under selected fruits. A sample of 15 organic and 15 inorganic farmers was randomly selected.

Findings

- *Stone Fruit Plum*: Table 4 represents per hectare cost and return from the cultivation of stone fruit plum. Cost A here refers to the sum of wages of hired labour, charges of bullock labour, hired machinery charges, value of seeds, charges of manure, charges of fertilizers, charges of plant protection chemicals,

depreciation of implement and machinery, land revenue and taxes, and interest on working capital. Cost B refers to the sum of Cost A, imputed value of owned land (net land revenue), rent paid for leased in land, and imputed interest on owned fixed capital (excluding land). Cost C refers to the sum of Cost B and the imputed value of family labour. Cost D is equal to the sum of Cost C and management cost at 10 percent over Cost C.

- The per hectare Cost A, Cost B, Cost C and Cost D for organic as well as inorganic stone fruit growers has been given in Table 4.

Table 4: Costs and Returns in the Cultivation of Stone Fruit Plum under Organic and Inorganic Conditions

Particulars	Organic (in Rupees)	Inorganic (in Rupees)
Cost A	27173.71	42674.87
Cost B	78652.66	109626.29
Cost C	81881.51	116038.20
Cost D	90069.66	127642.02
Gross Returns	201917.50	204792.2
Net Returns	111847.84	77150.18
Input-Output Ratio	1:2.24	1:1.60

Source: *Calculated by the authors, AERC Shimla*

- The per hectare gross returns for organic stone fruit growers was Rs. 2,01,917.50 while for inorganic stone fruit growers it was Rs. 2,04,792.20. The per hectare net return for organic stone fruit growers was Rs. 1,11,847.84 and while for inorganic stone fruit growers it was Rs. 2,04,792.20. The input-output ratio for organic growers was 1:2.24 and for inorganic stone fruit growers it was 1:1.60.
- *Mango*: Per hectare cost and return from the cultivation of mango is presented in Table 5.

Table 5: Costs and Returns in the Cultivation of Mango Fruit under Organic and Inorganic Conditions

Particulars	Organic (in Rupees)	Inorganic (in Rupees)
Cost A	31741.92	49430.30
Cost B	70949.81	111354.70
Cost C	75897.72	115995.41
Cost D	76392.51	127594.95
Gross Returns	156817.5	243688.6
Net Returns	80424.99	116094.6
Input-Output Ratio	1:2.05	1:1.90

Source: *Calculated by the authors, AERC Shimla*

- Per hectare gross returns for organic mango growers was Rs. 1,56,817.50 while for inorganic growers it was Rs. 2,43,688.60. Per hectare net return for organic mango growers was Rs. 80,424.99 while for inorganic growers it was Rs. 1,16,094.60. The input-output ratio for organic growers was 1:2.05 and for inorganic growers the ratio was 1:1.90.
- *Citrus Fruit (Kinnow and Sangtara)*: Per hectare cost and return from the cultivation of citrus fruits is presented in Table 6.

Table 6: Costs and Returns in the Cultivation of Citrus Fruit (Kinnow and Sangtara) under Organic and Inorganic Conditions

Particulars	Organic (in Rupees)	Inorganic (in Rupees)
Cost A	9190.05	47272.97
Cost B	87500.45	101317.64
Cost C	93342.73	111654.59
Cost D	102677.00	122820.04
Gross Returns	248990.00	214169.63
Net Returns	111847.84	77150.18
Input-Output Ratio	1:2.42	1:1.74

Source: *Calculated by the authors, AERC Shimla*

- Per hectare gross returns for organic citrus fruit growers was Rs. 2,48,990 while for inorganic growers it was Rs. 2,14,169.63. Per hectare net return for organic growers was Rs. 1,46,313 while for inorganic growers it was Rs. 91,349.59. The input-output ratio for organic growers was 1:2.42 and for inorganic stone fruit growers it was 1:1.74.

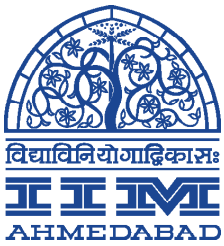
Figure 5: Citrus Fruit (Kinnow) and Stone Fruit Plum

Source: *www.flickr.com;www.isons.com*

- From the above analysis it can be concluded that the total cost of cultivation of organic mango, citrus and stone fruit crops was comparatively less as compared to the fruit crops cultivated under inorganic conditions. The input-output ratio was comparatively high among organic growers as compared to inorganic growers.
- The orchardists were adopting organic farming due to soil health, environment and human health concerns along with government support and high prices of chemical inputs. The constraints in adoption of organic farming were lack of technical knowledge and low awareness about marketing facilities for organic products.

Recommendations

- Capacity building of the orchardists in organic horticulture should be done and the organic orchardists should be linked with potential markets for organic produce.
- Government should develop a policy for the promotion and development of organic horticulture in Himachal Pradesh.
- Guidelines of Agricultural and Processed Food Products Export Development Authority (APEDA) should be followed.
- Importance should be given to local resources and indigenous knowledge in the promotion of organic horticulture.



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