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What does Village-level Evidence Suggest for Research and Development Priorities?

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The latest round of ICRISAT's village-level surveys in India's Deccan Plateau present evidence on the significant changes in the village economies of the Semi-Arid Tropics (SAT). This calls for a policy that reduces the widening gap between more favored and less favored regions and capitalizes on the potential of SAT agriculture for India's sustainable development. This policy brief highlights important issues and opportunities facing SAT agriculture, such as water scarcity, diversified sources of income, cropping pattern changes, livestock enterprises, and integration of labor markets and migration. The major changes in SAT agriculture are highlighted with their implications for future research strategy and government policies.

A panel of 400 households has been tracked through ICRISAT's Village-Level Studies (VLS[1]) (Figure 1). The VLS surveys were resumed in 2001-2003 to draw key observations through follow-up formal surveys, augmented by participatory focus group meetings and rapid rural appraisals. This follow-up study provides a strong basis for identifying major changes in the village economies, particularly for drawing investment priorities and implications for future research and development strategies (Table 1). It presents village-level scenarios showing the demonstrated resilience of SAT agriculture and livelihoods in the face of fragile and adverse environmental conditions and constrained resources.

Underlying the observations from the new round of VLS is India's rapid growth over the last four decades through the Green Revolution, whereby food production was boosted, resulting in increased per capita availability of food and substantial buffer stocks. The Green Revolution technology was mainly directed at increasing crop productivity and food output. However, in order to maximize the productivity of land and water resources, growth investments were focused in well-endowed regions and rainfed agriculture was bypassed.

The Indian SAT, home to more than 360 million people, covers about 37% of the country's total area. It has a large rural population of nearly 248 million. SAT areas account for 41% of the 147 million rural poor in India.

With productivity greatly limited by low and erratic rainfall, lack of irrigation and poor soils, the SAT contrasts sharply with the irrigated Green Revolution areas. It is increasingly being recognized that SAT areas are marginalized: there is widespread poverty, a risk-prone environment, water scarcity, degradation of productive resources, the adverse effects of trade liberalization and lack of competitiveness.

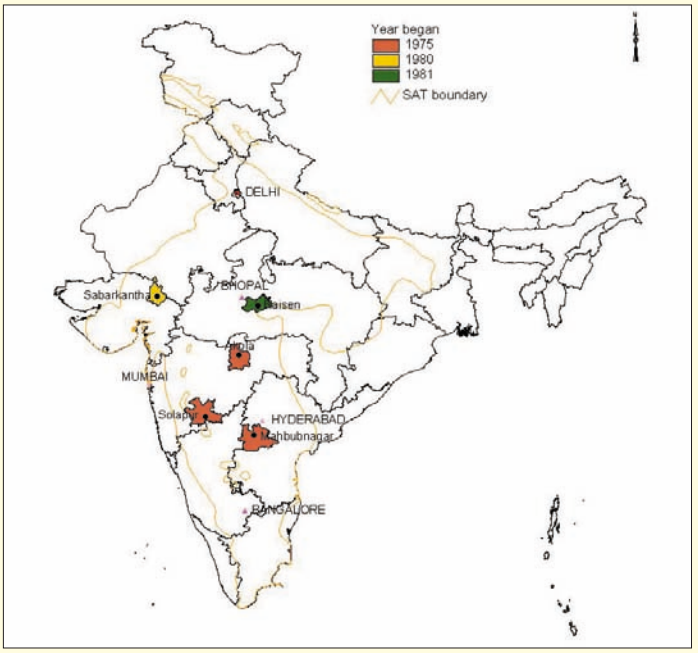

Figure 1. Village-Level Studies conducted in India.

The VLS villages represent three scenarios of resource endowments. Aurepalle and Dokur villages in Mahbubnagar district of Andhra Pradesh represent a low and unreliable rainfall region with relatively infertile alfisols. Shirapur and Kalman villages in Solapur district of Maharashtra have deep vertisols (with high water-holding capacity) and low and uncertain rainfall. Kanzara and Kinkheda villages in Akola district of Maharashtra represent a medium but more reliable rainfall situation with vertisols of medium depth.

Table 1. Drivers of change in VLS villages (1980s to 2000s).

Parameters	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
Surface irrigation	↓	↓	↑	↓	↑	↑
Groundwater irrigation	↑	↑	↑	↓	↑	↑
Technology adoption	↑	↑	↑	⇔	↑	↑
Non-farm income	↑	↑↑	↑↑	↑↑	↑	↑
Income from migration/caste occupation	↑	↑	⇔	⇔	⇔	⇔

↑↑ – Increased significantly ; ↑ – Increased; ⇔ – Stable; ↓ – Decreased.

Evidence from Village-Level Studies

Water scarcity. One of the major policy instruments that helped achieve rapid growth through the Green Revolution was the provision of capital subsidies to farmers in the command areas of surface irrigation projects. As Green Revolution technologies enhanced the marginal productivity of irrigation water, individual farmers realized the significant benefits of investing their own capital in accessing groundwater. These farmers obtained subsidized power for extracting groundwater. It was observed that farmers with access to irrigation were provided fertilizer subsidies and institutional credit to ensure higher crop productivity and greater profits, while those with little or no access did not directly benefit much from these policy incentives.

Population growth and increasing incomes have raised the demand for alternate uses of water (for industry, domestic use, drinking, etc), thereby limiting the per capita water available for irrigation. This is more so in rainfed areas and the SAT where persistent drought and water scarcity force farmers to invest in exploiting groundwater at an unsustainable pace.

Evidence from the villages of Aurepalle and Dokur reveals the acute effects of the growing water scarcity. Almost all dug wells have dried up due to drought. In Dokur, farmers have left their lands fallow as the village tanks have not filled up for a decade. This is in sharp contrast to the 1970s and 1980s when two rice crops used to be grown under the tank command area and runoff water was sufficient to fill the tanks. Similar observations were made in Kalman village where farmers were unable to grow sufficient foodcrops to meet household consumption needs due to low rainfall and a depleted water table. Three other villages in Maharashtra (Shirapur, Kanzara and Kinkheda) present a contrasting picture. All the three villages benefited from the irrigation support — though relatively limited and uncertain — provided by the irrigation projects of the State Government. Access to irrigation water emerged as the major factor influencing higher levels of agricultural productivity and better standards of living for the growing population in these SAT villages.

Sources of income. The sources of livelihood in the SAT are a combination of farm work (crops, livestock, wage labor), non-farm work and migrant remittances (Table 2).

Due to water scarcity and land degradation, the productivity and profitability of crops in many rainfed SAT villages have been declining. Aurepalle and Dokur showed a significant drop in the share of crops in the total net household income. The decline has been very significant in Dokur due to the persistent drought the village has experienced during the last 12 years. The share of livestock in net household income fell in Aurepalle, while it increased sharply in Dokur since farm households increasingly diversified their livelihood options to include non-crop activities. In fact, livestock, non-farm income and seasonal migration have now increasingly become the most important sources of income in Dokur. The opportunity to switch to alternative livelihood options allows households to deal effectively with risks imposed by a highly variable environment.

A decline in the share of agricultural wage income was noticed in these villages. Caste occupations such as toddy tapping and sheep rearing emerged as the largest sources of net household income in Aurepalle. Migration, both temporary and permanent, was found to have far-reaching implications. There is growing evidence to show that migration may be accumulative, and that remittances are an important part of the economy, especially in drought-prone areas.

The share of crops and agricultural wage income in the total net household income declined in Shirapur and Kalman villages. The share of livestock in the net household income remained constant in Shirapur, while

Table 2. Changes (%) in the sources and levels of household net income in the VLS villages.

Sources of income	Aurepalle		Dokur		Shirapur		Kalman		Kanzara		Kinkheda	
	1975-78	2001-02	1975-78	2001-02	1975-78	2001-02	1975-78	2001-02	1975-78	2001-02	1975-78	2001-02
Crops	29.8	15.0	46.1	3.0	33.7	22.8	46.0	26.4	43.9	52.0	43.4	40.0
Ag. labor	32.8	24.0	46.3	14.0	42.6	18.8	42.1	18.0	38.7	21.8	40.8	30.0
Livestock	25.5	9.0	2.0	18.0	15.0	15.7	0.8	6.5	9.0	5.7	13.1	2.1
Non-farm	11.6	13.0	1.2	24.0	0.2	31.8	4.1	37.5	2.4	10.4	5.3	20.1
Caste occupation	–	28.0	–	6.0	0.2	0.3	–	2.2	–	1.9	–	1.8
Seasonal migration	–	8.0	–	20.0	–	0.9	–	0.2	–	1.6	–	1.5
Others	0.3	4.0	4.4	15.0	8.5	9.7	7.0	9.2	6.0	6.6	2.6	4.5
Net household income[1]	2361.0 (15205)	31561.0	2967.0 (19107)	36757.0	2995.0 (19288)	51390.0	1942.0 (12506)	43943.0	3856.0 (24833)	60687.0	25221.0 (16242)	36606.0

1. Figures in parentheses represent the equivalent values of base year incomes at current prices (2001-2002) based on the wholesale price index for all commodities.

– Not applicable.

it increased significantly in Kalman. The share of non-farm income increased substantially in both the villages. Caste occupations and seasonal migration did not contribute much to the net incomes of households here.

In contrast, it is only in the villages in Akola district that the share of crops in the total net household income has been maintained if not improved. While non-farm income too increased, the income shares of labor and livestock declined.

Overall, the total net incomes of the households increased in all the villages. The least increase was found in Dokur, where income increased by only 1.92 times (or a 92% increase) over the income level in 1975-78 converted to present value using the wholesale price index for all commodities. The most significant increase was noted in Kalman, where the corresponding increase was by 2.51 times (or a 151% increase over the base level). In terms of average net household income, Kanzara had the highest income, followed by Shirapur, Kalman, Dokur, Kinkheda and Aurepalle.

Cropping pattern changes. Dramatic and rapid changes in cropping patterns were observed in the VLS villages. The area under rainy-season sorghum fell drastically (replaced mainly by oilseeds) in the four villages in Mahbubnagar and Akola districts, while the area under postrainy-season sorghum was maintained in the villages in Solapur district.

The rural household's consumption pattern shifted from coarse grains (like sorghum, pearl millet and finger millet) to finer cereal grains (like rice and wheat) largely due to subsidies given to rice and wheat by the Indian Public Distribution System (PDS). Furthermore, despite substantial yield gains, cultivation of coarse cereals became less profitable on account of the decline in their relative market prices. As a consequence, farmers turned to the cultivation of pulses, oilseeds and commercial crops like cotton.

Livestock enterprises. The livestock population has declined in all the villages except Kanzara. Tractorization has reduced the demand for draft animals and many farmers disposed of their bullocks and hired tractors instead. The shrinking of common pool resources (such as land) as well as fodder shortage accounted for the drop in livestock population.

Integration of labor markets. With the development of road and transport networks and communication systems, segmentation of labor markets was reduced in the villages. Lack of sufficient employment and income-earning opportunities motivated poorer farmers and agricultural laborers to migrate to urban destinations and rural areas with more intensive agricultural operations. Employment opportunities outside their villages have led to increases in real wage rates, though labor productivity has not kept pace.

Migration. Seasonal migration has become an important source of livelihood and income in the drought-prone villages of Dokur and Aurepalle. In 2000-01, more than 48% of the households in Dokur and more than 21% in Aurepalle had at least one household member involved in seasonal migration as a source of livelihood. Seasonal migration from Dokur and Aurepalle began as a trickle in the 1970s but increased rapidly after 1992-93 because of population growth and persistent droughts. Small and marginal (men and women) farmers migrate in the month of

August after completing major farm operations. Housekeeping, childcare and agricultural activities during the migrant's absence were taken over by the elders.

What does this evidence suggest for public policy and research priorities?

Data on income sources have shown that agriculture could provide a substantial part of the SAT rural household's net income especially in villages that had access to groundwater or benefited from irrigation investments. Given the critical importance of supplemental irrigation in drought-prone areas, governments have to explore alternative ways of providing such services to enhance sustainability of livelihoods in SAT agriculture. Similarly, capital subsidies on irrigation and power have compounded the disadvantages of rainfed agriculture. To partially offset these effects, public investment in water conservation and recycling are vital for the development of land and water resources in rainfed areas.

Rainfed crops suffered substantial discrimination in the government's procurement and public distribution policies. Although minimum support prices are announced for rainfed crops as well, they are seldom backed by procurement operations. Farmers who have grown these crops often incur losses due to low market prices. Many have shifted their cropping patterns by reducing the areas allocated to coarse cereals. The PDS and the heavily subsidized rice and wheat have further eroded the competitiveness of rainfed crops and altered market price ratios. Substituting the PDS with a food stamps system leaves beneficiaries the option of buying grains of their choice. In Andhra Pradesh, the use of coupons to distribute kerosene has benefited low-income consumers. Similarly, food stamps worth Rs 150 per month (equivalent to the current level of subsidy) may be given to households below the poverty line to enable them to buy grains of their choice. This will serve two purposes — the benefit of food subsidy will be spread over all grains and the disadvantage that producers of coarse grains face will be partially offset. Unless these policy initiatives to reverse the policy bias are taken up vigorously, rainfed crops and farmers growing them may be marginalized further, forcing them to seek livelihood options outside agriculture. More importantly, the goal of improving agricultural productivity in the SAT is closely linked to reducing poverty and promoting sustainable development.

The findings also have implications for future research priorities. First, with water scarcity emerging as the most important issue in the Indian SAT, watershed development research should receive priority for guiding the resource development efforts of governments and donors. This should be complemented by research on drought tolerance. Second, SAT farmers are increasingly allocating more land to pulses, oilseeds and commercial crops like cotton, suggesting a greater emphasis on cropping systems research on green gram, black gram, pigeonpea, soybean, cotton, castor bean, among others. Improved varieties of legumes have been adopted by farmers only to a limited extent. This calls for innovative partnerships among public and private seed sector companies to facilitate the availability of improved varieties. It was also observed that the rainy-season sorghum crop is increasingly marginalized in the SAT while the postrainy-season crop remains important. The latter deserves greater attention. Research on rainy-season sorghum should focus on reducing unit cost of production in order to arrest the decline in its area, and alternative uses to increase demand and therefore prices.

Lastly, evidence on diversified livelihood sources in the more drought-prone villages suggests that *a priori* assumptions about the survival strategies of rural households cannot be made. Regional specificity and participatory priority identification are required to develop innovative strategies for the more complex and constrained rainfed SAT environment. Information on modified consumption patterns and the increasing reliance on non-farm sources of income identifies specific areas for more in-depth investigations for responsive policy action. Indeed, more questions need to be answered, such as, which problems of the poor are amenable to technical solutions and how can they have the capacity to utilize technologies that may be developed? Which markets are important for the poor and how can interventions help create these markets or fill gaps where markets are missing? Our ongoing research aims to find answers to these intriguing questions.

1. The Village-Level Studies (VLS) of ICRISAT (1975-89) generated longitudinal databases that were used by the research community all over the world to test theories of economic behavior of SAT farm households and to develop research and development priorities and policies.

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