Strategies for Sustainable and Inclusive Agriculture Development in Jharkhand

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Strategies for Sustainable and Inclusive Agriculture Development in Jharkhand

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Rainfed farming systems of Jharkhand

Jharkhand, a newly created state of India in 2000, was formerly part of Bihar. Despite having rich mineral and biotic resources with some of India's most industrialized cities, it is amongst the third poorest state in India. Some 26% of the population is classified as 'Scheduled Tribes' and a further 12% as 'Scheduled Castes'. The rural economy in Jharkhand is dominated by smallholder rain-fed farming and use of extensive common property resources. Nearly 56% of holdings are less than 1 hectare (2.5 acres) in size. The smallholder crop-livestock farming system is major source of livelihood, especially for the tribes. Most farmers raise livestock and grow rice, although pulses, maize, wheat and oil seeds are also grown. The State has a fairly high potential but the development of agriculture and adoption of modern technologies has not really taken off in the State, leading to below national average production and productivity. The productivity of important cereals i.e. rice, maize and wheat is 1.55, 1.17 and 1.54 tonne/ha respectively, against the 2.12. 2.02 and 2.9 tonne/ha national average. (fig 1). Also at the district level the yields are much lower than the state average (fig 2.)

Fig 1: Productivity of important cereals (in Kg/ha)

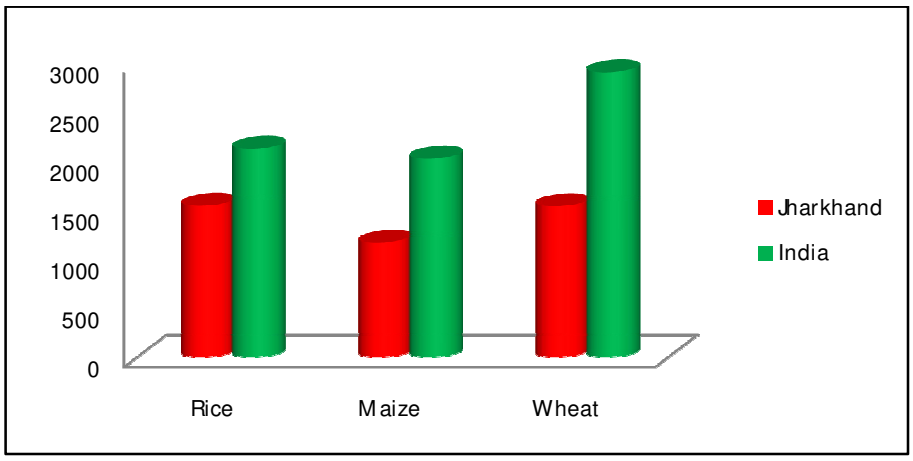
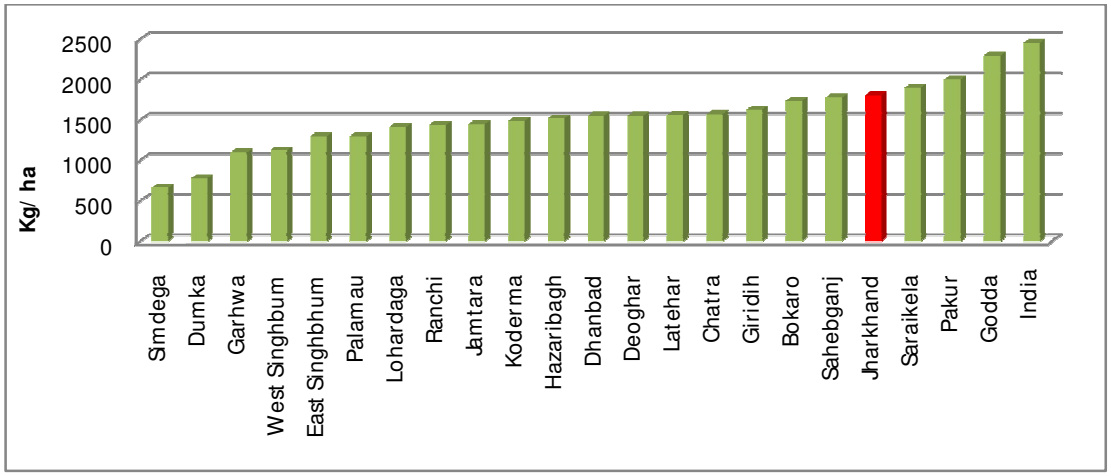


Fig 2: District-wise Maize Productivity in Jharkhand (in Kg/ha)



Constraints

Characterisation study based on Participatory Rapid Appraisal (PRA) conducted in a cluster of three villages in three districts of Jharkhand (Appendix table 1, 2) reveals that this area has serious environmental as well as socio-economic problems. Undulating terrain and deforestation, causes strait run-off of the rainfall water in *Tande* area (local name of rainfed upland), which effects the soil erosion and degradation and ultimately limits the productivity. The climate change has influenced recurrence and spread of drought in such regions seriously affecting cropping pattern and agriculture development. The sustainable development of agriculture presupposes increasing economic opportunities in the short-run, and the ecosystem stability in the long-run. According to Park and Seaton (1994), "the sustainable pathways are described in terms of desirability and viability which accounts for the need of change to be both economically beneficial in the short-term and ecologically sound over longer time periods". The major issues include soil degradation, active erosion in sloping areas, lack of irrigation facility, poor-quality seeds, expensive and unreliable fertilizer supplies and lack of efficient value chains.

Irrigation plays important role to enhance the productivity. In Jharkhand, most of the area is dependent on rainfall. Reliable access to water typically increases the use of fertilizers, high-quality seeds, and agrochemicals for plant protection (Namara et al., 2010). The net sown area is 18.1lakh ha and only 2.6 lakh ha area is sown more than once. The uneven, undulation and rolling topography poses challenge to develop irrigation facility in the region. The

groundwater depletion rates are severe and energy costs for pumping are accelerating as the water table recedes and during summer in some areas even faces water scarcity for drinking and home consumption. Due to lack of water availability and heat stress, the agricultural intensity is only 116% and maximum area remains fallow after rainy season.

Low inputs – quality seed, chemical fertiliser, pesticide and herbicides - are major limiting factor. And the vast majority of rainfed farmers in remote areas still practice very low external input farming which is well integrated with livestock, particularly small ruminants. Most farmers are not aware about hybrid seed, pesticide and herbicide. The average use of chemical fertilizers in rainfed area is only 18.5 kg as against 58 kg in the irrigated districts (Katyal and Reddy, 1997). Based on several surveys and reports, it is estimated that up to 30% of the rainfed farmers in many remote areas of the country do not use chemical fertilizers and pesticides.

Markets do not have organised structure in the remote areas, and Jharkhand is no exception. Backward and forward market linkages are week. Farmer faces problem to get quality inputs and to sell outputs at fair price. In remote area, farmers' are basically dependent on weekly Hatts (rural markets). Local retailer and middleman have dominance over the markets and outside traders' are reluctant, probably due to Maoist's insurgency. Lack of agro-based and forest-based industries in the region has made the rural product value chain quite inefficient. Lack of investment in infrastructure (only 8% of the sown area is irrigated), poor extension services, lack of input supplies and services as well as a lack of training have led to low agricultural yields and very low incomes.

Farmers' inaccessibility to information on agricultural practices and the inability to disseminate the available knowledge are other major constraints in this region. In tribal areas it could be attributed as the root-cause of all problems in the rainfed farming systems.

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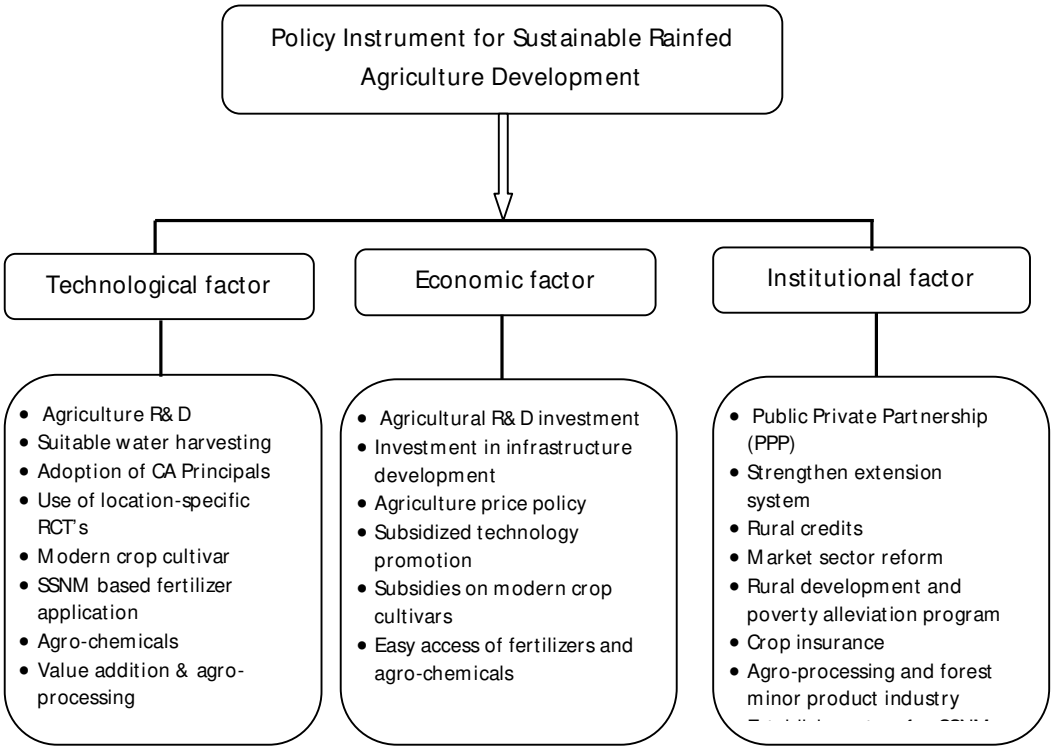
Past food surpluses in India was mainly achieved by intensifying irrigated farming systems, however, crop yields in these favourable areas have not increased for more than a decade. In order to meet future food needs and to foster economic development among the rural poor, there is a growing consensus among researchers and policy makers that development efforts must prioritize rainfed agricultural systems where current productivity is low but sufficient

scope exists for intensification (Namara et al., 2010; Rockstrom et al., 2010). The agriculture growth should be technologically, economically and environmentally viable at long-run. So, the major issue is to increase farm productivity and have sustainable agricultural development by increasing the resource use efficiencies combined with transfer of modern technologies.

Fig 3: Policy instrument for sustainable agriculture development



Source: adopted with modification; Sharma, Vijay Paul (2012)

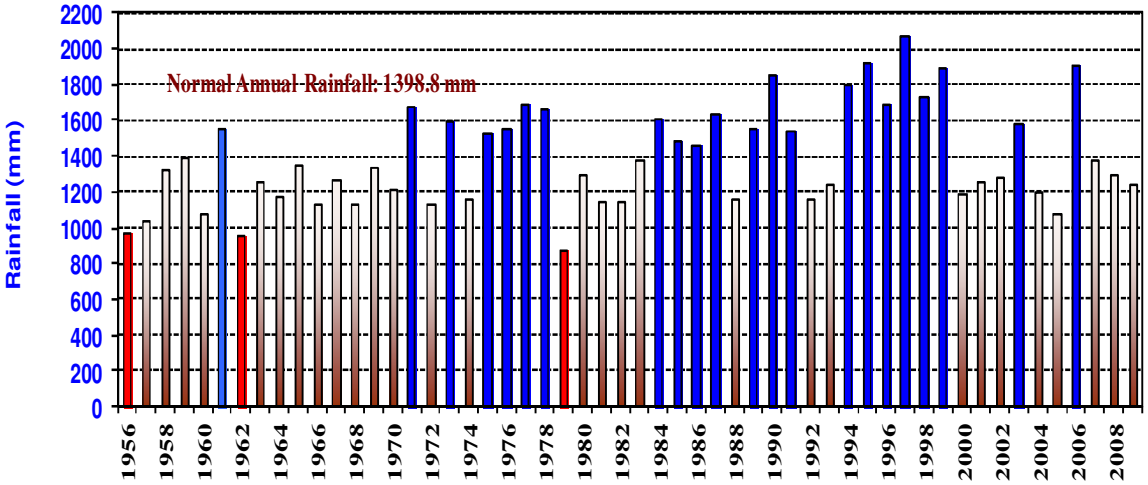
The basic aim of sustainable development is to evolve an eco-regenerative production cycle in which the conservation and development is integrated in ecologic-economic relations. Since, the agricultural system in this region is extensive and subsistent, it is necessary to intensify the production and productivity. Since, the growth of irrigation is highly correlated with technology transfer, it is necessary to conserve water resources and develop irrigation system which will not only ensure bio-productive regeneration, but would also influence absorption / transfer of modern technology for higher level productivity. It is also observed

that higher farm productivity has an impact on conservation and development of agriculture in the agro-ecosystem.

In order to implement the sustainable strategy at long run, three types of policy instruments – technological, economical and institutional could be implemented (Sharma, 2012) (figure 3).

1. **Technological factors**- Considering the importance of rainfed farming systems and higher payoff of research with extension interface, the state and central government as well as national and international donor agencies need to provide more financial assistance for research and development (R&D). The Public Private Partnership (PPP) can also play an important role for efficient agricultural innovation process. Increasing the cropping intensity might be one of the efficient tools to increase food security for the tribal households. The present cropping intensity is low and it needs to be increase up to 130% by 2020 (Jharkhand Plan Document). Considering the topographical barriers, the efficient conservation of rainwater can play important role. Analysis of 54 years rainfall data reveals that 42 years has received normal (1398.8 mm) or above, 9 years below normal but above 1000 mm and only 3 years below 1000 mm rainfall (fig 4). It indicates that the proper *In situ* water harvesting could be better option to increase area under irrigation. The simple technologies like vegetative

Fig 4: Rainfall in previous 54 years (1956-2009), Ranchi, Kanke



barriers, compartmental bunding, cover cropping, inter-plot rainwater harvesting, check-dams, dug-out ponds, percolation tanks, bridges and furrows, etc. can enable greater water infiltration and prolongs the availability of moisture under these conditions. Rural development and poverty reduction program like as Mahatma Gandhi Rural Employment

Guarantee Act (MNREGA) could be better linked to create infrastructure at Panchayat and village level.

Considering the economic and environmental viability of Conservation Agriculture (CA), it is strongly recommend for rainfed farming systems. Various studies have indicated that the CA practices effectively reduce production costs and labor requirements (Erenstein and Laxmi, 2008) thereby ensuring timely field operations in the irrigated conditions. Since these practices moderate soil temperature, improve soil quality and reduce erosion, enhance rainfall infiltration and reduce evaporative losses, its potential to effectively enhance the rainfed production systems could be highly significant. The concept of CA encompasses three management objectives, viz. minimizing soil disturbance, retaining crop residues on the soil surface, and encouraging economically viable crop rotations that best complement reduced tillage and crop residue retention, thereby striving to achieve acceptable profits, high and sustained production levels and ensure environmental conservation (Wall, 2007; FAO, 2009). According to Paroda (2009), poor land management attributes to significant degradation of soil, and enormous quantity of soil carbon is lost due to inefficient production methods. Reduced tillage or no-tillage, in-bed sowing and residue retention on surface ultimately reduces soil erosion and soil degradation (Govaerts et al., 2007). It is evident with the on-station trail of ongoing project "Sustainable Intensification of Smallholder Maize-Livestock Farming Systems in Hill Areas of South Asia" at Birsa Agricultural University (BAU) that raise bed sowing of maize performs well. In long run these practices uplift water table through rainfall infiltration and reduce evaporative loses (Verhulst et al., 2009) and ultimately it would stable and provide higher crop yield in rainfed conditions (Govaerts et al., 2005). Crop productivity among smallholder farmers in many rainfed areas could be increased with proper management and the introduction of modern crop cultivars with superior yield potential and stress tolerance (IWMI, 2007).

2. **Economic and Institutional Factors**- Modern input plays important role to successfully introduce the CA practices. Identification of suitable cultivar and other machinery for local condition, appropriate use of chemical fertilizers, better weed management practices and easy access to market are essential to achieve the goal. The Site Specific Nutrient Management (SSNM) has shown its potential to enrich the soil and know the nutrient deficiency. The Public-Private-Partnership (PPP) can provide better market access and information to the farmers in the region. Seed companies, fertilizer suppliers, local businessman and machinery

suppliers can create a better marketing environment. Equipment for CA-systems should be locally manufactured and modified according to local needs of small plot and undulating terrains. The farmers' of Jharkhand are smallholder and poor, and the purchasing power is low, government support in providing these equipments with appropriate financial assistance with be a great incentive for the farmers of Jharkhand to adopt this technology.

The tribal regions are resource regions having rich biotic and mineral resources. A very high level of dependency on agriculture has not only degraded the local resources but also has resulted in unemployment and poverty. The occupational mobility of the rural workers is limited to the non-farm activities. Community based co-operative development programs around agro-processing and forest based activity would help in not only, conserve the biotic resources but also initiate development in non-farm processing activities in the region. With the help of resource based planning, a grass-root approach to economic and social development may be initiated so as to maximize employment and income of the tribes as well as provide surplus for the market for secondary and tertiary level processing. The institutional rigidities are constraining the efficient use of resources and development of resource based production cycles and regional production systems.

Marketing infrastructure needs to be strengthened. Both the input and the output markets need to have proper infrastructure and connectivity with farmers. Strengthening of human resource development programs is required. Training of farmers, improved agriculture education and awareness through better extension activities should be done at the planning and policy level. Setting up seed certification centres and provision of seed production training will encourage seed production of modern varieties leading to improvement in seed replacement ratio and also leading to yield improvements.

Efforts need to be made to strengthen the extension services to reduce the widening knowledge and information gap between the research and farmers. Modern Information and communication technology can be used in targeted manner to bridge the information gap. There is also need to develop local innovation systems comprising multiple agents to address the smallholder farmer's needs in rainfed regions.

Conclusion

Considering the importance of rainfed farming systems and potentials of CA, we strongly recommend the CA technologies for Jharkhand, India. It is well understood that next phase green revolution in India can be achieved by intensifying rainfed farming systems. The productivity is very low in Jharkhand, which could be increased with proper management and the introduction of modern crop cultivars with superior yield potential and stress tolerance. Despite the several constraints in these farming systems, there is a scope for sustainable intensification through the tailoring and location – specific modification in RCT's. The Public - Private – Partnership (PPP) would provide better platform to modern input, market and information access, even in remote area. Above all - researcher, policy makers, extension agents, government as well as donor agencies – must prioritise these regions as the engine of development.

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Appendix Table 1: District-wise production constraints in selected districts of project domain

Ranchi	Khunti	Gumla
• Erratic rainfall and lack of proper water management and conservation technologies • Poor soil quality due to soil erosion • Lack of access to improved agronomic management practices • Low yielding cattle • Lack of improved and small scale machinery • Traditional crop varieties	• Erratic rainfall and lack of proper water management and conservation technologies • Subsistence farming • Poor soil quality due to soil erosion • Lack of access to improved agronomic management practices • lack of efficient value chain • Low yielding cattle • Lack of improved and small scale machinery • Traditional crop varieties	• Erratic rainfall and lack of proper water management and conservation technologies • Subsistence farming • Poor soil quality due to soil erosion • Lack of access to improved agronomic management practices • lack of efficient value chain • Low yielding cattle • Lack of improved and small scale machinery • Traditional crop varieties

Source: Secondary information and Participatory Rapid Appraisal (PRA)

Appendix Table 2: Selected attributes of surveyed districts

Characteristics	Districts		
	Ranchi	Khunti	Gumla
Geographical location	Central	Central	West (bordering with Chhattisgarh)
Topography	Hilly, rolling	Hilly, rolling	Hilly, rolling
Agro-climatic zone	Zone I & II	Zone I	Zone I
Average annual rainfall (mm)	1161	1086	1077
Important cropping pattern	Rice-fallow, Maize-fallow, Rice -wheat, Maize-fallow	Rice-fallow, Maize-fallow Rice –wheat Maize-fallow	Rice-fallow-Maize-fallow, Rice -wheat, Pulses - fallow
Farming system	Mixed crop-livestock	Mixed crop-livestock	Mixed crop-livestock
Maize productivity (kg)	927	1206	898
Status of farm mechanisation	Average (transforming)	Poor (traditional)	Poor (traditional)
Status of livestock Production system	Transforming (traditional to commercial)	Traditional	Traditional
Access to market	Good	Poor	Poor
Access to farm inputs and other services	Good	Poor	Poor

Source: Secondary data, Govt of Jharkhand and Participatory Rapid Appraisal (PRA)