



January 2001

The production system research (PSR) under the National Agricultural Technology Project (NATP) is contemplated for applied and adaptive research for a well-defined target domain. It examines and prioritizes research needs of a production system taking care of all sub-systems like crops, livestock, natural resources and socio-economic, and their inter-linkages. A multi-disciplinary and system-based research design is the unique feature of this approach. This is in significant contrast to the conventional research planning approach based on disciplines and commodities.

Why Agro-Ecoregional Approach?

An agro-ecoregion (or agro-ecosystem) is a homogenous geographical area. The production environment of the region in terms of agro-climate, resource endowments and socio-economic conditions is homogenous, and majority of the farmers have similar production constraints and research needs. Specific advantages of agro-ecoregional approach for research planning are: (i) better identification of production constraints and research needs, (ii) better targeting of prospective technologies, (iii) improved assessment of farmers' responses to new technologies, and (iv) wider adoption and larger impact of research outputs. Accordingly, the NATP has divided the entire country into 5 broad agro-ecosystems (namely Arid, Coastal, Hill & Mountain, Irrigated and Rainfed). These are further divided into 14 production systems. This note delineates, maps and characterizes these agro-ecosystems and production systems in a more systematic and objective manner.

Framework for the Delineation

A number of attempts have been made in the past to delineate different agro-climatic regions of the country (for example, National Bureau of Soil Survey and Land Use Planning (NBSSLUP), Planning Commission, National Agricultural Research Project, and International Crops Research Institute for the Semi-Arid Tropics). The NBSSLUP's classification was primarily based on agro-climatic factors, while others incorporated socio-economic variables as well. The framework used here has incorporated key elements of all the past approaches. The specific steps used for the delineation are:

1. Arid, Coastal and Hill & Mountain Agro-ecoregions delineated by the NBSSLUP were retained as such, as topography, soil type and climate largely determine agricultural activities in these regions.
2. The remaining districts were classified into irrigated and rainfed agro-ecosystems based on the extent of irrigated area. The districts having 40 per cent or more irrigated area were included in the Irrigated Agro-ecosystem and the remaining districts were set in the Rainfed Agro-ecosystem.
3. To identify production systems, all districts within an agro-ecosystem were grouped using cluster analysis. We used cropping pattern for cluster analysis because it is a result of all climatic, physical and socio-economic factors. The sub-regions of Hill & Mountain and Coastal Agro-ecosystems were retained as production systems as effect of external interventions like irrigation is slow and limited, owing to topography, soils and climatic conditions of these regions.
4. To maintain contiguity, scattered districts were merged with the dominant agro-ecosystem or production system. The major changes on this account were made in the rainfed rice-based production system.

Characterization

As seen from the maps, the delineated production systems cut across administrative boundaries, suggesting a need for closer linkages between research institutions, particularly SAUs. The salient characteristics of the agro-ecosystems and production systems reveal three broad patterns (Table 1). First, livestock contributes significantly to agricultural output in all the production systems, and therefore, R&D strategy must consider crop-livestock linkages. Second, research strategy may differ between high input use-high productivity regions (Irrigated and Coastal ecosystems) and low input use-low productivity regions (Rainfed and Arid ecosystems). Third, pearl millet- and horticultural-based production systems of the Arid and Hill Agro-ecosystems, respectively, have very low productivity and high incidence of rural illiteracy. These fragile systems need more research efforts than that justified by their economic significance. List of districts in each agro-ecosystem and production system is given in Table 2.

* National Centre for Agricultural Economics and Policy Research, New Delhi. The authors are grateful to Dr Dayanatha Jha, Dr Mruthyunjaya, Dr James G. Ryan and other members of NATP Review Mission for their useful comments.

Map 1: Agro-ecological zones and production systems

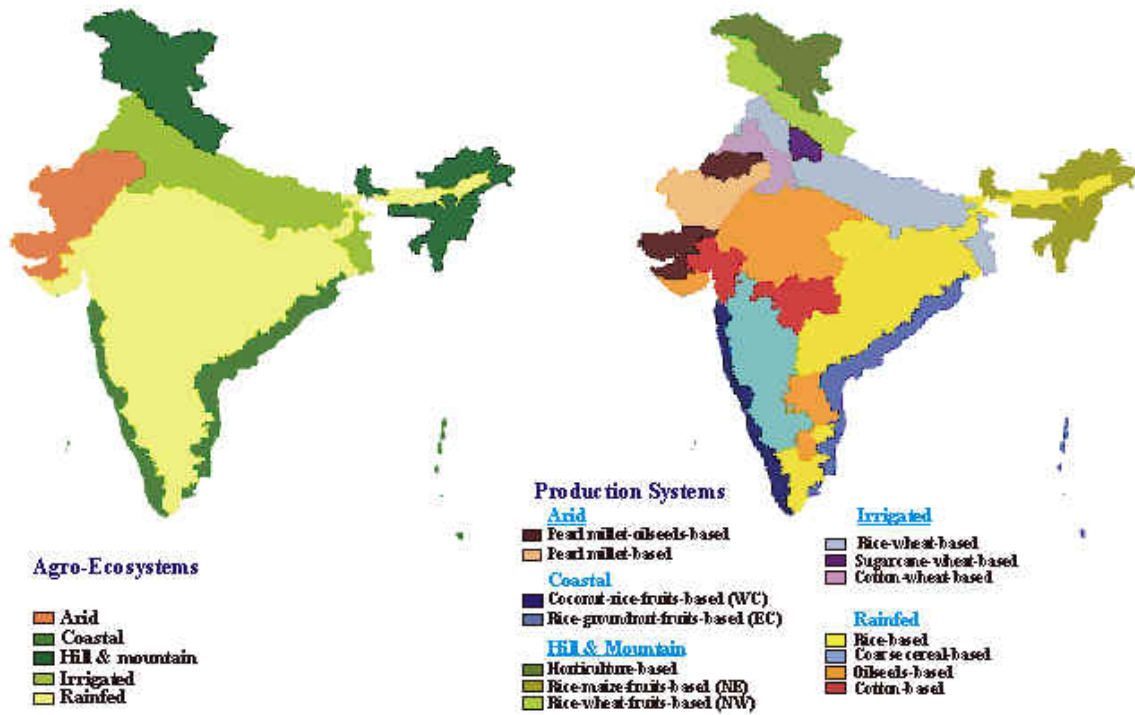


Table 2. List of districts in various agro-ecosystems (AES) and production systems

AES	Production system	State	District	
Arid	Pearl millet-based	Rajasthan	Barmer, Jaisalmer, Jalore, Jhunjhunu, Jodhpur, Nagaur, Pali, Sikar, Sirohi	
	Pearl millet-oilseeds-based	Gujarat	Banaskantha, Jamnagar, Kutch, Rajkot	
Coastal	Rice-gnut-fruits-based (EC)	Rajasthan	Bikaner, Churu	
		Union Territories	Andaman & Nicobar, Dadra & Nagar Haveli, Daman & Diu, Lakshadweep, Pondicherry	
		Andhra Pradesh	East Godavari, Guntur, Krishna, Nellore, Prakasam, Srikakulam, Vishakhapatnam, Vizyanagaram, West Godavari	
		Orissa	Baleswar, Cuttack, Ganjam, Puri	
	Coconut-rice-fruits-based (WC)	Tamil Nadu	Chengai Anna, Madras, Ramanathapuram, South Arcot, Thanjavur	
		Goa	North and South Goa	
		Karnataka	Dakshin Kannada, Uttar Kannada	
		Kerala	Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Kozhikode, Malappuram, Palakkad, Pathanamthitta, Thiruvananthapuram, Thrissur, Wayanad	
Maharashtra	Bombay, Raigarh, Ratnagiri, Sindhudurg, Thane			
	Tamil Nadu	Kanyakumari		
Hill & Mountain	Horticulture-based	Himachal Pradesh	Kinnaur, Lahul Spiti	
		Jammu & Kashmir	Gilgit, Kargil, Ladakh	
	Rice-maize-fruits-based (NE)	North-east states	Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura	
		Assam	Cachar, Hailakandi, Karbi-Anglong, Karimganj, N.C. Hills	
	Rice-wheat-fruits-based (NW)	West Bengal	Darjiling, Jalpaiguri	
		Himachal Pradesh	Bilaspur, Chamba, Hamirpur, Kangra, Kullu, Mandi, Shimla, Sirmaur, Solan, Una	
Irrigated	Rice-wheat-based	Jammu & Kashmir	Anantnag, Badgam, Baramula, Chilas, Doda, Jammu, Kathua, Kupwara, Mirpur, Pulwama, Punch, Rajauri, Srinagar, Udhampur	
		Uttar Pradesh	Almora, Chamoli, Dehradun, Garhwal, Nainital, Pithoragarh, Tehri Garhwal, Uttarkashi	
		Bihar	Aurangabad, Begusarai, Bhagalpur, Bhojpur, Darbhanga, Gaya, Gopalganj, Jehanabad, Khagaria, Madhepura, Madhubani, Munger, Muzaffarpur, Nalanda, Newada, Pashchim Champaran, Patna, Purbi Champaran, Purnea, Rohtas, Saharsa, Samastipur, Saran, Siwan, Vaishali	
		Haryana	Ambala, Faridabad, Jind, Kaithal, Karnal, Kurukshetra, Panipat, Sonapat	
	Punjab	Amritsar, Firozpur, Gurdaspur, Hoshiarpur, Jalandhar, Kapurthala, Ludhiana, Patiala, Roopnagar, Sangrur		
		Uttar Pradesh	Agra, Aligarh, Allahabad, Azamgarh, Bagraich, Ballia, Barabanki, Bareilly, Basti, Budaun, Bulandshahar, Deoria, Etah, Etawah, Faizabad, Farrukhabad, Fatehpur, Firozabad, Ghazipur, Gonda, Gorakhpur, Hardoi, Jaunpur, Kanpur(Rural and Urban), Kheri, Lucknow, Maharajganj, Mainpuri, Mathura, Mau, Mirzapur, Pilibhit, Pratapgarh, Rae-bareilly, Rampur, Shahjahanpur, Siddharthanagar, Sitapur, Sonbhadra, Sultanpur, Unnao, Varanasi	
	West Bengal	Bardhaman, Birbhum, Calcutta, Haora, Hugli, Maldah, Murshidabad, Nadia, 24 Parganas (North and South)		
		Haryana	Bhiwani, Gurgaon, Hissar, Mahendragarh, Rewari, Rohtak, Sirsa	
	Cotton-wheat-based	Punjab	Bhatinda and Faridkot	
		Rajasthan	Alwar, Bharatpur, Ganganagar and Jaipur	
	Sugar cane-wheat-based	Haryana	Yamunanagar	
		Uttar Pradesh	Bijnor, Ghaziabad, Haridwar, Meerut, Moradabad, Muzaffarnagar, Saharanpur.	
	Rainfed	Rice-based	Andhra Pradesh	Adilabad, Hyderabad, Karimnagar, Khammam, Mahbubnagar, Medak, Nalgonda, Nizamabad, Rangareddi, Warangal
			Assam	Barpeta, Bongaigaon, Darrang, Dhemji, Dhubri, Dibrugarh, Goalpara, Golaghat, Jorhat, Kamrup, Kokrajhar, Lakhimpur, Marigaon, Nagaon, Nalbari, Sibsagar, Sonitpur, Tinsukia
Bihar			Deoghar, Dhanbad, Dumka, Giridih, Godda, Gumla, Hazaribag, Katihar, Kishanganj, Lohardagga, Palamu, Singhbhum(East and West), Ranchi, Araria, Sahibganj and Sitamarhi	
Madhya Pradesh			Balaghat, Bastar, Bilaspur, Damoh, Durg, Jabalpur, Mandla, Panna, Raigarh, Raipur, Rajnandgaon, Rewa, Satna, Shahdol, Sidhi, Surguja	
Maharashtra			Bhandara, Gadchiroli	
Orissa			Bolangir, Dhenkanal, Kalahandi, Keonjhar, Koraput, Mayurbhanj, Phulbani, Sambalpur, Sundergarh	
Tamil Nadu			Chidambaram, Coimbatore, Dindigul Anna, Kamarajar, Madurai, Nilgiri, North Arcot, Pasumpon Thevar, Periyar, Pudukkottai, Tiruchirapalli, Tirunelveli, Tiruvannamalai	
West Bengal		Purulia, West Dinajpur, Bankura, Medinipur, Koch Bihar		
		Karnataka	Bangalore, Belgum, Bellary, Bidar, Bijapur, Chikamagalur, Chitradurga, Dharwad, Gulbarga, Hassan, Kodagu, Kolar, Mandya, Mysore, Raichur, Shimoga, Tumkur	
Maharashtra		Ahmadnagar, Aurangabad, Beed, Dhule, Nasik, Jalna, Kolhapur, Latur, Osmanabad, Pune, Sangli, Satara and Solapur		
		Andhra Pradesh	Anantapur, Chittoor, Cuddapah, Kurmool	
Oilseed-based		Gujarat	Amreli, Bhavnagar, Junagarh, Sabarkantha	
		Madhya Pradesh	Betul, Bhind, Bhopal, Chhatarpur, Chhindwara, Datia, Dewas, Dhar, East Nimar, Guna, Gwalior, Hoshangabad, Indore, Jhabua, Mandasaur, Morena, Narsinghpur, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Seoni, Shajapur, Shivpuri, Tikamgarh, Ujjain, Vidisha, West Nimar	
		Rajasthan	Ajmer, Banswara, Bhilwara, Bundi, Chittaurgarh, Dholpur, Dungarpur, Jhalawar, Kota, Sawai Madhopur, Tonk, Udaipur	
		Tamil Nadu	Dharmapuri, Salem	
		Uttar Pradesh	Banda, Hamirpur, Jalaun, Jhansi, Lalitpur	
		Gujarat	Ahmedabad, Bharuch, Gandhinagar, Kheda, Mehsana, Panch Mahals, Surat, Surendranagar, The Dangs, Vadodara, Valsad	
Cotton-based		Maharashtra	Akola, Amravati, Buldhana, Chandrapur, Jalgaon, Nagpur, Nanded, Parbhani, Wardha, Yeotmal	

Note: The list includes all states and districts as existed in 1991.