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Rapporteur's Report on Management of Renewable Natural Resources/Sustainability of Agriculture

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I

INTRODUCTION

Natural resource management is a useful tool for the development of the economy in general and agricultural economy in particular. Efficient management increases the productivity and employment and also alleviates poverty of the rural masses through various developmental programmes. The natural resources like land, water (snow), vegetation and minerals are interrelated and changes affecting one have repercussions on others. These resources range from renewable to non-renewable, but none is unlimited and therefore their use and conservation need intensive management, keeping in view the requirement of the future generations.

Every generation of mankind creates as well as destroys certain amount of resources for its development purposes. But the nature and rate of present development are such that the rate of destruction of resources is greater than the rate of creation. If this trend continues beyond a century or so, it is apprehended that there would be economic stagnation or even disaster. A few authors are of the view that the use of natural resources may already have reached a point of no return in this respect. To reverse this trend the present generation should either drastically curtail the exploitation of renewable resources or re-cycle at least as much amount of resources as it uses up. Considering the importance of the subject, the recent concern of social scientists all over the world is about rapid degradation and depletion of natural resources. This necessitates the study of human/natural resource interrelation by inquiring into the institutional arrangements that define members of a human community with respect to variable natural resources. May be for the above reasons, the Indian Society of Agricultural Economics thought it appropriate to discuss the subject in these perspectives.

The theme selected deals with the basic issues affecting long-term sustainability of agriculture with relation to management of renewable natural resources. The response of researchers to this theme has been very encouraging. In all, 38 papers have been accepted for discussion on the subject. Among the issues listed in the synopsis, the papers received are classified in two major categories so as to facilitate the discussion on different issues. And these are main theme papers which are directly related to the Conference topic and objectives, and specific theme papers which are on specific subjects though related to the Conference topic. The main theme papers are further grouped in four sections.

- I. Fisheries production/management including co-operative production system (3 papers).
- II. Status of regional resource management for sustainable production (5 papers).
- III. Natural resources, potential and management for sustainable production (5 papers).

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IV. Wasteland and soil conservation management for sustainable production (10 papers).

Specific theme papers are further classified in three sections: (i) Irrigation system/water management (3 papers), (ii) Energy system/management (7 papers) and (iii) Farming system/management (5 papers).

The papers selected under these sub-themes are discussed in brief in subsequent sections. In the last section, an attempt is made to consolidate the important conclusions of the discussion and identify the issues for discussion at the Conference.

II

FISHERIES PRODUCTION/MANAGEMENT AND CO-OPERATIVE PRODUCTION SYSTEM

In the growing menace of food scarcity and declining nutritional standard of the masses, particularly in the third world countries, the long-term sustainability of fisheries production becomes a vital concern to all. In spite of such importance, the response of researchers to contribute papers on this aspect is rather very poor. Out of only three papers on this theme, two papers focus their attention on marine fish resources and one on inland fisheries. Interestingly, each paper deals with a different aspect, *i.e.*, one on technological choice in production, the second on co-operative sea tenure system and experiences from other countries and the third one is on fisheries co-operative presented as a model for rural development. The question as to what are the policy instruments that could be and should be used for increasing production and productivity of fisheries in the country is left unattempted.

The paper of Katar Singh critically examines the role of co-operatives in managing marine fisheries based on Kerala's and Japan's experiences and explores the problems and prospects of creating co-operative sea tenure system. He has concluded that the marine fishermen's co-operatives in Kerala have not yet done anything to restore the depleting fish stock and regulate its exploitation. The co-operatives have, however, helped their member-fishermen in the motorisation of their boats and in acquiring modern nets and other equipments, etc. The adoption of motorisation and use of modern nets have helped to increase the average catch per unit of fishing effort and reduce the drudgery involved in fishing. However, they do not play any role in propagation of fish and in regulating fishing in their jurisdiction as is done in Japan and other countries. On the basis of Japan's experience, the author advocates the creation and granting of sea tenure to fishermen's co-operatives. He also suggests that despite problems in its implementation, co-operative sea tenure offers opportunities for exercising local control over marine fisheries and managing them for sustainable yield.

S.K. Chauhan and S.K. Sharma have attempted to highlight the experience of reservoir fisheries in Himachal Pradesh. The study undertaken in the Pong dam reservoir of Himachal Pradesh reveals that the number of co-operative societies, their membership as well as fish production have increased significantly over the last fifteen years. The authors have also assessed the status of fish fauna in the area concerned. The annual average fish catch per fishery co-operative society is estimated to be 703 quintals, out of which the share of individual fisherman is 8.58 quintals. The share of fishing to the fisherman's net income varied from 43 to 94 per cent among co-operative societies. The authors have also listed

some factors responsible for the success of fisheries co-operatives and these are (i) close co-ordination between fisheries co-operatives and state department, (ii) provision of marketing facilities, (iii) implementation of close period and use of recommended mesh size for gillnets, (iv) proper spawning and supervision by qualified persons, (v) administration of fishing right system and (vi) provision of group insurance.

P.G. Marvania has made an attempt to study the technological choice for managing marine fish resources in Coastal Saurashtra. He has observed that the high degree of sophisticated mechanisation has led to large catch but its operational efficiency in terms of unit cost has declined. Over a period, the high degree of mechanisation has led to rapid fall in production and revenue per boat. Thus he suggests that rather than be guided by mere marginal cost and revenue earned, the concern of sustainable development be given priority while selecting technology for this sector. He also suggests that over-fishing is to be avoided and a medium technology such as use of OBM boats with certain technical modifications which can equip it for both near and off-shore fishing be encouraged.

III

STATUS OF REGIONAL RESOURCE MANAGEMENT FOR SUSTAINABLE PRODUCTION

Of the five papers which are concerned with this theme, four deal with the watershed management approach for imparting sustainability to agricultural production. One paper deals with the quantification of agricultural sustainability on certain assumptions and parameters in different agro-climatic regions of India.

Though quantification of sustainability in agriculture is a ticklish proposition, despite the lack of accurate and comparable information on various aspects, R. Maria Saleth has tried to work out relative agricultural sustainability status of different agro-climatic sub-zones of India with the help of Sustainable Livelihood Security Index (SLSI), *i.e.*, ecology, economics and equity. In each dimension, three variables were selected for construction of indices and (i) Ecological Security Index (ESI), (ii) Economic Efficiency Index (EEI) and (iii) Social Equity Index (SEI). The author has worked out the values and ranks of SLSI as well as ESI, EEI and SEI for different sub-zones of India. The values of ESI, EEI and SEI range respectively from 0.992 to 0.147, from 0.885 to 0.068 and from 0.844 to 0.253. This indicates that the agricultural systems of the different regions display wider variation in their ecological and economic aspects than in equity aspects. Similarly, the SLSI shows a range of 0.645-0.214. The SLSI rankings of different regions show that the regions having the best conditions for agricultural sustainability are not in Punjab, Haryana and Western Uttar Pradesh but in Andhra Pradesh, Orissa, West Bengal and Madhya Pradesh. On the other hand, the regions with poor potential for agricultural sustainability are in Rajasthan, Bihar and Eastern Uttar Pradesh. The author advocates that despite the limitations of the SLSI approach, it does have useful policy role not only in establishing inter-regional priority for agricultural investment allocation but also to prioritise programmes/projects specific to each region.

G.V. Jyothi and K.R. Chowdry have argued for the adoption of watershed management approach for the development of production assets for sustainable agriculture. The assets identified by the authors include soil conservation, land and irrigation development, agro-forestry and pastures. The authors have also worked out the cost of development measures for the above assets but they have not tried to assess the growth of assets and their likely

impact on sustainability of agriculture. It could have been better if the impact of watershed management on the growth of assets is worked out in the light of sustainability of agriculture. B.J. Hinge *et al.* have tried to assess the situation before and after the watershed development programme in water scarcity areas of Maharashtra. Their findings reveal that new crops have been introduced and low value crops have been substituted with high value crops. The crop cultivation has improved by the use of modern technology and the area under irrigation has also increased. The increase in productivity has resulted in the increase in gross income. The gross income before the project which was Rs. 2,139/ha. has increased to Rs. 3,631/ha. after the development of watershed with a benefit cost (B-C) ratio of 2.07. The authors have also identified the lack of people's participation as a major constraint for the success of the Integrated Watershed Development Programme. J.M. Talathi *et al.* have made an economic evaluation of a micro watershed in Thane district of Maharashtra. The authors have quantified the gains of watershed development in the form of change in cropping pattern, use of high-yielding variety (HYV) seeds, introduction of horticultural crops and increase in the productivity of crops and employment. The results clearly indicate the significant increase in yield, employment and groundwater level in the project area. They have also identified some constraints and put forward some suggestions for effective management of micro watershed development. Amita Shah has tried to assess the economic potential of watershed development in dryland agriculture in Gujarat. Her findings indicate that the improved measures for soil and moisture conservation do provide substantial yield gains which in turn also enhance on-farm employment. She has also shown pessimism about the gains and concludes that actual experience does not confirm significant positive impact under more constrained agro-climatic environment. She has argued in favour of vegetative treatments in such areas as the same appears to be environmentally sound and low cost as well as widely replicable.

IV

NATURAL RESOURCES, POTENTIAL AND MANAGEMENT FOR SUSTAINABLE PRODUCTION

Five papers have been considered in this section and of these two deal with the degradation of common property resources (CPRs), mainly land and water whereas another two papers are devoted to marketing of minor forest products. The remaining one paper analyses the production potential and prospects of land based natural resources and its impact on agriculture as well as economic sustainability.

D.V. Singh in his paper has identified agricultural support land as a boon to economic sustainability in general and agriculture in particular. He defines agricultural support land as that piece of land which helps directly or indirectly the agricultural production process and complements a number of economic activities. He concludes that in hills, support land provides livelihood to the hillman in the form of food, fodder, fuel, timber and herbs, etc. He has also quantified the gains in monetary terms, *i.e.*, an average rural household in hills receives benefits worth Rs. 8,755 per annum from support land in the form of fodder, fuelwood, timber, etc. And tribal families are getting more than that, *i.e.*, Rs. 10,594 annually including the sale of herbs and medicinal plants. The dependence of hillmen on support land reveals that 86, 90 and 85 per cent of their requirements of fodder, fuel and timber respectively are fulfilled from support land. He has also argued in favour of balanced ratio between

agricultural and support land which is declining over the years and hence affecting the sustainability of agriculture.

K. Aanantha Ram *et al.* have documented and analysed the process of degradation of soil, vegetation and water resources in the arid zone of Rajasthan and the factors associated with the degradation process. Dalbir Singh and Narinder Kumar Sharda have attempted to examine the process of shrinkage of land-CPRs and the impact of development of agriculture on the size of land-CPRs in different agro-climatic regions of Himachal Pradesh. N. Gopala Rao has studied the role of Girijan Co-operative Corporation in the marketing of minor forest produce in Andhra Pradesh. R.K. Pandey and S.P. Bhardwaj have attempted to study the shellac trade in India.

V

WASTELAND AND SOIL CONSERVATION MANAGEMENT FOR SUSTAINABLE PRODUCTION

The ten papers on this theme deal with the management of degraded natural resources, mainly of land and water. Out of these, one paper deals with institutional arrangements in managing village commons, two papers discuss the wasteland management through community forestry and six papers examine the causes of land degradation and soil conservation measures. Another paper has quantified the sustainable development through a mathematical model.

Dinesh K. Marothia has examined the relevance of property regimes and institutional arrangements for managing village commons. In his paper Oakerson conceptual framework has been used to analyse CPR management systems operating in a village of Madhya Pradesh. His findings suggest that the success of management of community village tanks for fish and crop production under common property regimes does not depend solely on the technical-physical nature of the resources but on a combination of these key attributes.

Vijay Laxmi and V.K. Pandey have made a useful study on the use and management of wastelands for fodder/fuel and timber production through community forestry in Almora district of Uttar Pradesh. On the other hand, T.V. Moorti has examined the extent of wastelands and their rehabilitation through management skills in the Western Himalayas. He concludes that people's participation is the only alternative in wastelands regeneration activity based on the concept of equal participation, equal benefits.

B. Anuradha has made an attempt to evaluate the soil conservation programme in two watersheds in Tamil Nadu. She concludes that there is an increase in yields, income and employment due to soil conservation measures in the watersheds. V. Govindaru has made an economic evaluation of soil erosion and soil conservation work in a high range agricultural region of Kerala. His study indicates that the income forgone due to soil erosion is estimated to be about 4 per cent of every year's yield in pepper gardens. The paper of Ajit Kumar Singh highlights the imbalances in land use created by the extreme biotic pressure and suggests a strategy for sustainable development for Uttar Pradesh. R.R. Doshi in his paper purports to delve into the experiences of land degradation observed in sugarcane growing belts of Kolhapur and Sangli districts of Maharashtra wherein vast area of the best deep black soil has become unfit for production due to salinity.

P.K. Joshi and B.L. Gajja have examined the adverse effects of land degradation: some evidences on soil salinity and waterlogging in different agro-climatic regions of India. K.K.

Datta has studied the technological option to sustain agriculture in saline lands of Haryana. The author concludes that after the installation of drainage, land utilisation has been intensified and a sizeable area of formerly fallow land has been brought under cultivation. An increase in cropping intensity, changes in cropping pattern and improvement in crop yields are also observed. D.V. Subba Rao has suggested a dynamic linear programming approach for guiding sustainable agricultural development in Andhra Pradesh. The results in his paper indicate that the income can be increased at the expense of soil loss by 3.26 per cent at 12 per cent discount rate and a minimum of 8.9 per cent of land should be under forests in order to ensure sustainability at 12 per cent discount rate.

VI

SPECIFIC THEME PAPERS

A. Irrigation System/Water Management

Of the three papers on this topic, the paper of Jai Singh and D.S. Nandal on sustainability of agriculture on degraded irrigated lands in Haryana shows that 4-5 per cent of the total geographical area of the state is already affected by soil salinity and waterlogging problems. Productivity and return over variable cost from all crops declined on both types of problem soils. Their results show that land degradation is mainly responsible for reduction in the use of inputs and consequently in the decline in the yield of paddy, cotton, wheat and sugarcane. A.S. Saini *et al.* have discussed the water resource management for sustainable agriculture in Himachal Pradesh. They conclude that because of ignorance, the farmers at head and middle reaches of canal generally over-irrigated their crops which, instead of improving, decreased their crop and water productivity and deteriorated the soil health which adversely affected the sustainability of agriculture. The paper of Ramesh Chand and S.C. Tewari highlights the experience and lessons from traditional irrigation system (*kuhls*) and government assistance in Himachal Pradesh.

B. Energy System/Management

In all seven papers have discussed this issue. Of these, five papers have examined the domestic energy use pattern in rural areas and two papers are on energy plantations. Jacob George and K. Hanumantha Rao have examined the role of some factors in influencing the domestic energy use in rural Andhra Pradesh. They conclude that due to low opportunity cost of labour in rainfed areas and access to forest and CPRs, the fuel requirements are met through collection of crop residue, twigs and shrubs. A.S. Solanki *et al.* in their paper report that empirical evidences lead to establish the suitability of biogas technology both for cooking and lighting energy on the basis of cost effectiveness. P. Indira Devi and P.K. Ajithkumar have studied the energy need of rural people in Kerala State. Their results show that 89 per cent of the sample households depended fully on fuelwood/crop residues for cooking. Family income and holding size are found to be the major determinants for selecting the energy source in the rural areas. Sudesh Gandhi *et al.* have discussed the non-commercial fuel consumption pattern in the rural areas of Haryana State. Their study suggests that the fuel requirements can be effectively reduced to one-half to one-third through the use of improved smokeless stoves, biogas plants and improved fuel saving devices like solar

cookers, pressure cookers, etc. D.A. Patel and P.K. Singh have studied the role of gobar gas plants in cooking energy use in Gujarat State. Their results indicate that the households belonging to non-plant owner category used more cooking energy than those with gobar gas plants. They suggest that an average plant owner realised the benefits of about Rs. 2,241 per year, of which 73.84 per cent was in the form of saving in fuel cost and the rest due to additional value of manure from slurry.

C.L. Thakur *et al.* have examined the details of renewable energy resources and management of village ecosystems in Madhya Pradesh. H.K. Gupta's paper deals with the energy plantations on degraded forests and common lands in Himachal Pradesh. He suggests that the forest department should play an active role in promoting and facilitating the local people in effective sharing of benefits from these plantations.

C. Farming System/Management

Of the five papers which have considered this issue, four have examined the role of cropping system with regard to sustainability aspects of agriculture. One paper highlights the strategies for promoting sustainable agriculture.

The paper by T.R. Sharma *et al.* have discussed the present scenario and future strategies of agricultural development in the Western Himalayan region of India. Their findings suggest that land use should be rationalised by demarcating land suitable for agriculture/horticulture/pasture/forestry. They have also suggested watershed development approach for sustainable development of mountain agriculture.

Lal Singh Gangwar and Chandra Sen have discussed the impact of conventional farming system on long-term sustainability of agricultural production in Uttar Pradesh hills. G.C. Srivastava and Kanhaiya Jha have examined the factors determining the agricultural sustainability of North-East Alluvial Plains of Bihar which is a highly flood-prone region. They have estimated the efficiency of determinants of agricultural sustainability by using log-linear form of factor demand function. Joginder Singh *et al.* have studied the impact of substitution of traditional crops with paddy and wheat on human and animal health in Punjab State. Prem Prakash Dubey has tried to evolve an alternative production strategy for sustainability of agriculture in Eastern Uttar Pradesh. With the help of mathematical model he has suggested alternative crop plans for putting the agricultural production on sustainable footing.

VII

ISSUES FOR DISCUSSION

The following issues are outlined for discussion:

1. What is agricultural sustainability and its linkages with other sections of the economy? What are the best criteria for evaluating agricultural sustainability?
2. What should be the policy measures for ensuring the rational use of renewable resources?
3. What should be the technology for the use of resources with regard to present and future needs of the population?
4. How is it possible to check the over-exploitation of natural resources by people who have legal/social rights for the same?

5. What alternatives can be provided for halting of over-exploitation of natural resources?
6. Who will bear the cost of rehabilitation of degradation and depletion of resources? What should be the *modus operandi* for this?
7. The masses are generally interested in short-term gains. Why should they forgo their immediate return for something which is to be realised only in future? A general conception of "A bird in the hand is worth two in the bush" may play a vital role in this respect.
8. Do the normal project evaluation techniques suffice the needs of Watershed Projects or should the pricing be based on social cost concepts?
9. What steps should be taken to develop social accounting instead of cost accounting in development programmes?

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