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# RAPPORTEUR'S REPORT

# ON

## FARMING SYSTEMS IN HILL AREAS

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Forty-four papers have been accepted for discussion on this subject. Keeping in view the current concern for the hill agricultural planning and development with ecological considerations, a wide range of related topics was suggested in the synopsis circulated. However, the response in terms of coverage of the subject has not been encouraging. Out of ten topics suggested for discussion, papers have been received only on six topics. The objective of providing a comprehensive synopsis was to give an integrated picture of the hill farming system. But the hope has been belied as except a few, most of the papers present just a sketchy discussion on the topics which is neither novel nor thought provoking. However, one good feature about the papers received is that these have covered almost all the States which have hilly terrains. In what follows, the contribution made by the authors is summarised in six sections. In the end the issues for discussion are spelt out.

### I

### ECONOMIC ANALYSIS OF SHIFTING CULTIVATION

Only five papers deal with this topic. K. Sain has examined the viability of shifting cultivation using the data collected by the Agro-Economic Research Centre, Jorhat (Assam) for a few villages of North-East India. He has found that jhum cycles varied from 6 to 10 years and jhum cultivation was highly land extensive and labour intensive with little capital investment. The cultivation showed mixed cropping with three or four crops. Some of the jhum villages have taken to settled cultivation, growing cash crops along with animal husbandry and poultry enterprises as a result of development of infrastructure. To avoid the vicious circle of shorter fallow leading to further exhaustion of soil, settled scientific agriculture has been suggested. However, the availability of land and the exorbitant capital cost of terracing may put serious limitation on the programme. He also advocates introduction of high-yielding varieties (HYV) of crops, horticultural and plantation crops, pastures and grass land development and afforestation. But these recommendations are not supported by adequate analysis and findings. D. K. Das has suggested several approaches for controlling shifting cultivation such as agro-forestry, animal husbandry, terracing, perennial tree crops, settled cultivation, population control, educational programmes, etc. He has not presented any factual data or

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analysis either to show the deleterious effects of shifting cultivation or the impact of the several approaches suggested for controlling jhuming. P. D. Saikia and D. Borah present data of shifting and settled cultivation in Darengiri village in Garo Hills of Meghalaya. Out of 50 sample families, 42 practised both jhum and settled agriculture and only 8 practised settled agriculture. They have found that the average gross return under shifting cultivation was about double that under settled cultivation. On the other hand, P. D. Saikia, K. Gogoi and Chitra Kalita, from their survey of six hill tribal villages of North-East India, have found that the returns per hectare of land from jhum and settled farming were nearly the same. Thus no valid conclusion can be drawn from such studies due to the small size of the sample from a few villages, sampling and non-sampling errors, etc. None of these papers has incorporated the deleterious effects of jhuming on the stability of agricultural production and productive capacity of land.

A refreshing departure from these is the study of Tirath Gupta and Shreekant Sambrani who have proposed an analytical framework for assessing the public programmes and schemes designed to control jhuming and resettle jhumias, and specified what they call as the necessary and sufficient conditions for the acceptance of the schemes. Of the several existing schemes that have been examined, resettling jhumias on terraced land and commercial plantations of rubber, coffee and cardamom are found, on *a priori* considerations, to be inadequate in providing sufficient 'bonus' to wean the jhumias away from jhuming. Another scheme envisaging the setting up of a 250-ton per day capacity paper mill based on bamboo plantation is found to be feasible and is recommended for further investigation. A multi-disciplinary approach to the exploitation of forest and forest-based industries emphasizing group participation and action is proposed as an effective measure to control jhuming. The authors argue that a certain amount of jhuming may have to be tolerated because it seems to represent the best economic opportunity in certain relatively remote and sparcely populated area. However, the framework proposed by the authors does not show how to incorporate the necessary and sufficient conditions into a planning or programming model, and what are the trade-offs between these conditions and the quality of environment. Moreover, not one but several alternatives to jhuming may be needed according to the conditions prevailing in a particular region.

## II

### CHANGES IN THE CROPPING PATTERN OVER TIME AND FACTORS AFFECTING THEM

As many as 17 papers have described the cropping pattern. It was expected that the impact of technology and socio-economic factors on cropping pattern would be brought out including economic analyses of farming system involving optimization of watershed precipitation. Whereas almost all the papers have described the cropping pattern, only few have studied the changes over time and the factors affecting the cropping pattern. None of the papers

deals with the problems of water harvesting and moisture conservation. Reference is, therefore, made in this section to only those papers which highlight the changes in the cropping pattern and factors affecting them.

B. Sridharan and S. A. Radhakrishnan have attempted to identify the factors affecting the changes in the acreage allocation between three major crops, namely, tea, coffee and potato in the Nilgiris district during the period from 1966-67 to 1976-77. The increase in tea acreage is attributed to (*i*) the establishment of processing and marketing facilities, (*ii*) decline in the number of large estates and increase in the number of small farms and (*iii*) introduction of hybrid and clonal selections of tea in the district. The relative importance of coffee declined by about 2 per cent over the period of study because of higher comparative economic advantage of tea which is its major competitor. The potato acreage fluctuated during the period and thereafter became stabilized because of successful control of golden nematode. Although the authors have used Kendall's rank correlation coefficient and concordance test to determine changes in the cropping pattern, the identification of causal factors is not supported by adequate quantitative analysis.

B. C. Bhowmick and P. C. Goswami have studied 45 farms of different size-groups in Mairang development block of Meghalaya. They have highlighted the importance of spring potato as a mono-crop or in mixture with maize or vegetables. The area under improved varieties is found to be low and yields are poor. Poor technological and infrastructural facilities are considered as constraints in the adoption of improved varieties and increasing the yields. S. R. Pawar and S. G. Borude have analysed time-series data of hill areas of Ratnagiri district of Maharashtra for the period from 1950-51 to 1974-75 in respect of land utilization and area under different crops. A linear trend equation is used. The increase in the area under high value fruits like Alphonso mango and cashew is attributed to demand from foreign countries, higher price, State Government's schemes of soil conservation-cum-cashew plantation and special horticultural development for mango and cashew. Irrigation is indicated as a limiting factor in the process of change in the cropping pattern. However, no attempt has been made to identify the other factors affecting the cropping pattern.

R. K. Singh *et al.* and J. S. Garg *et al.* have used data for Uttar Pradesh hills to examine the cropping intensity, area under irrigation, fertilizer use, etc. They found that the area under HYV wheat, paddy, maize, potato, fruits and vegetables increased. Vegetables, livestock, poultry and fishery enterprises have been recommended. The data used are highly aggregative and include the plains portion of some hill districts, where phenomenal progress in agricultural development has been achieved. The picture of cropping pattern in Uttar Pradesh hills emerging out of their analysis therefore becomes highly distorted. In the paper of R. K. Singh *et al.*, the authors' observation that there is no scope of raising the level of income and employment of the farming community in the region through agriculture appears to be misleading. V. S. Bhadauria *et al.* have analysed the trends in the cropping pattern for the pre-green revolution and the post-green revolution periods for 11 important

crops of Himachal Pradesh. Linear trends have been estimated for the share of each individual crop in the gross cropped area and yields per hectare separately for the two periods. The analysis showed that the technological breakthrough as reflected in the increased yield of wheat, paddy, maize, potato, apple, chillies led to an increase in the area under these crops. Which crops gained over the other crops and why, has not been brought out in the paper. B. L. Khodpia and R. Swarup have studied the changes in the cropping pattern in Himachal Pradesh during the period from 1951-52 to 1975-76. The authors have attributed the changes in the cropping pattern to the development of infrastructure such as credit and marketing facilities, IADP, SFDA and MFAL programmes. No statistical technique or economic model has been developed to support the hypothesis about the factors determining the cropping pattern. H. S. Aulakh *et al.* have found that the land use pattern in the Jammu & Kashmir State for the period 1965-66 to 1974-75 remained stagnant but the area under wheat and paddy increased significantly. The cropping intensity also increased and the increase in the cropping intensity was explained by the proportion of net area irrigated to the net area sown. The authors have not brought out the impact of new technology on the cropping pattern in Jammu & Kashmir.

## III

### IDENTIFICATION OF OPTIMAL FARMING SYSTEMS

Only eight papers deal with the identification of optimal farming systems. J. P. Bhati and C. Gopalakrishnan recommend the adoption of modern farm technology and intensification of cross-breeding programmes of exotic breeds in animal husbandry for increasing the productivity of land and animals and for reducing the pressure of human and animal population on land. The authors also refer to ecological considerations and soil erosion hazards in their paper, but they have not done any analysis for finding out the optimum human and animal population in the State under the improved technology after incorporating ecological considerations.

Using the linear programming technique, A. L. Nadda *et al.* have developed optimal crop plans for low, mid and high hill areas of Himachal Pradesh and compared income under the existing and optimal plans. No new crop activities appeared in the optimal plans but the acreage allocation was changed and the cropping intensity declined slightly for the low and high hills. Optimal crop plans had fewer number of crops as compared to the existing plans and thus indicated a tendency towards specialisation. The decline in the intensity of cultivation in the low and high hills is attributed to lack of capital. The authors could have introduced a borrowing activity in the model to examine the impact of relaxation of capital constraint. The community lands account for a substantial proportion of the total area in the hills, but the authors have not proposed any plans for the use of this category of land.

Katar Singh and K. M. B. Rahim have emphasized the importance of watershed as the most appropriate unit for land use and crop planning in the

hill areas. The watershed approach is stated to be a good means of internalizing the externalities inherent in land use and crop plans. Using an aggregative linear programming model, they have developed a set of five alternative optimal crop plans for the land suitable for cultivation in a sub-watershed of the Ramganga catchment of Uttar Pradesh hills. They have also suggested an improved land use plan for the community land which is found suitable for permanent vegetation. The optimal plans formulated for the land suitable for cultivation were characterized by the introduction of high-yielding varieties in the place of the local varieties and of new cash crops like soyabeans, capsicum, French beans, etc. Fruit orchards and pastures were the two major activities included in the improved land use plan for the community land in the sub-watershed. The optimal crop plans showed substantial potential for increasing returns over variable cost. The study could have been made more useful by incorporating the carrying capacity of the watershed in terms of population and animals as constraints in the model. Given the higher profitability of the improved crop pattern, the authors have also not examined the question of implementation of such micro level plans.

T. K. Jayaraman has evaluated the Mahi river watershed programme in the Aravalli hills of Gujarat by fitting production function to data from six villages of a mini catchment by regressing output on land, labour, fertilizer, draft power and seed. He has found that the average and marginal product of land, labour and fertilizer have increased after the watershed management programme. It would have been better to incorporate the variable of soil conservation measures also in the model to find out the returns to these measures. Ravi K. Sharma and S. C. Tewari have found the resource use productivity of hill agriculture in Himachal Pradesh. A sample of 56 farmers was taken and classified into two size-groups, *viz.*, less than 2.12 hectares and 2.12 hectares and above. They have found that the economic efficiency of fertilizer was more than unity in both the types of farms. Small farms were more intensively cultivated. On small farms, there was also excessive use of labour and bullock power. These findings are of a general nature and the authors have not indicated their implication for hill farming systems.

## IV

### ECONOMIC AND TECHNOLOGICAL FACTORS AFFECTING THE ADOPTION OF NEW FARMING SYSTEMS

Eleven papers fall under this category. In most of the papers only the economics of crops has been described. Only those papers which bring out the economic and technological factors affecting the adoption of new farming systems are discussed in this section.

P. N. Bhargava *et al.* have examined the economic aspects of nitrogenous fertilizer use for some of the rice varieties at different altitudes in Jammu & Kashmir region by using the data of the National Index of Agricultural

Field Experiment Scheme. The results show that the optimum dose for different varieties differs according to altitude. While explaining the fertilizer technology for rice, the authors could have also brought out how the new rice varieties fit into the new farming systems in the hills. T. V. S. Rao and N. Gopala Rao have examined the impact of Tribal Development Agencies on the farming system in the hilly districts of Srikakulam in Andhra Pradesh and Ganjam and Koraput in Orissa. They have found that the Tribal Development Agencies have been successful in altering the farming system in the area and the tribals are in favour of changing the traditional and shifting cultivation to improved and settled one if the main constraints of irrigation, credit availability, and lack of technology for rainfed agriculture are resolved. R. K. Pandey and Vimal Kishore have estimated shifts in the yields of wheat, barley, rice, maize and overall foodgrains for the different districts of Himachal Pradesh. They have found that the net shifts in the yield of wheat, barley, rice, maize and overall foodgrains showed much variation among the districts in the State. The yield shifts are attributed to technological change. What factors inhibited the dissemination of technology to other districts and how to resolve these constraints has not been brought out.

D. C. Sah and Amar S. Guleria have analysed the year to year increase in food production in Himachal Pradesh for the period from 1966-67 to 1975-76. They have found that the change in yield rather than cropping pattern is the main determinant of overall growth in foodgrain production. However, the changes in yield are significantly associated with weather rather than with yield increasing inputs. A. N. Sadhu and R. K. Mahajan have analysed the impact of new agricultural technology in a hill village of Kathua district in Jammu & Kashmir. The authors have asserted that there is an insignificant impact of new technology and they have attributed this to lack of irrigation, heterogeneous topography, and inhibitive socio-economic character of hill farm population but these factors have not been incorporated in the model.

## V

### RISK AND UNCERTAINTY IN HILL FARMING SYSTEMS

Only one paper by V. Rajagopalan and S. Varadarajan has dealt with risk and uncertainty in the hill farming systems. They have evaluated risk under the traditional and modern methods of farming in the Nilgiris hills. Using a quadratic programming model, they have formulated minimum risk optimal plan for two typical farms, *viz*, one traditional rainfed and another modern with sprinkler irrigation. They found that the risk minimizing optimum levels of activities were very close to the actual levels. The risk (coefficient of variation) was estimated to be 18 to 30 per cent for the traditional farm, and 21 to 33 per cent for the modern farm. Farming with dairying is found to be less risky than farming without dairy. Although the evaluation of economic benefits of formal and informal methods of risk management

has been stated as one of the objectives of the paper, the analysis is confined only to one of the methods, *i.e.*, diversification through dairying activities. Furthermore, the authors make a statement that about 10 per cent of the risk can be avoided by informal methods. The basis for this statement has not been made clear in the paper.

## VI

### EVALUATION OF HILL DEVELOPMENT PROJECTS

B. R. Atteri *et al.* have made an appraisal of the Indo-German Agricultural Project, Mandi, Himachal Pradesh by comparing the production of milk, wool and egg in the project area and in Bilaspur district, a non-project area. The increase in production in the project area is reported to be higher. Another paper by B. K. Sikka *et al.* have also evaluated the same project and their finding is that the productivity of wheat, maize and paddy did not differ significantly in the project and non-project areas. Both the papers lack statistical analysis for evaluating the impact of the project. From these papers, it appears that no definite conclusions can be drawn about the impact of the project.

## VII

### ISSUES FOR DISCUSSION

The following issues emerge for discussion of the Group:

1. The short-and long-term alternatives to jhuming.
2. The socio-economic and technological factors determining cropping patterns in the irrigated valleys and rainfed uplands in the hills in the different parts of the country and the measures needed for adoption of new agricultural technology in the hills.
3. Optimal integration of crop husbandry, animal husbandry and forestry incorporating ecological considerations in the hill farming systems. The short and long-term policy instruments and institutions needed to achieve the goal.
4. Multi-disciplinary research and action programmes that are needed to study the impact of farming system on ecology and the problems involved in organizing and co-ordinating such programmes.
5. Long-term resource use and management strategies in the hills.