VIII Perspectives of National Agricultural Research Systems on the Challenges of Sustainable Development of Mountain Agriculture

Arid Zone Agriculture and Research in Pakistan

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The arid and semi-arid areas of Pakistan produce 12.5 per cent of the national wheat production. These rainfed crop lands also contribute 69 per cent of *Jowar (pennisetum* spp), 31 per cent of millet, 53 per cent of barley, 65 per cent of gram, 17 per cent of other pulses, 82 per cent of groundnuts, 17 per cent of sesame, 23 per cent of rape and mustard, 17 per cent of sun hemp and a significant percentage of *guar* (legume) seed to the overall national production of these crops.

The arid and semi-arid areas of Punjab support about 70 per cent of the livestock population, while more than 80 per cent of the livestock population in Balochistan is supported by the arid lands of this province which contribute more than one-third of the country's sheep and goat population. One estimate indicates that Balochistan produces about 56,000 tonnes of meat from 11.2 million sheep and 7.2 million goats, representing about 3.9 per cent of the total red meat production in Pakistan. If the live weight of each animal at slaughter is increased from 27 to 30 kg, an additional 62,000 tonnes of sheep and goat meat could be produced, increasing Balochistan's contribution to the national meat supply. Alternatively, better nutrition before mating could increase the lambing rate from 60 to 70 per cent and would result in another 5,600 tonnes of meat.

In arid and semi-arid areas of Pakistan, a single crop system of a *rabi* (winter) or a *kharif* (summer) crop is generally followed but, where rainfall patterns permit, a winter crop may be followed by a summer crop. Wheat continues to be the single largest crop for dryland agriculture. The rangelands, which constitute about 46 per cent of the area of the country, provide forage for 30 per cent of the cattle and buffaloes and 75 per cent of the sheep and goats. A large portion of these rangelands has been overgrazed and severely degraded. A comparatively smaller area of arid and semi-arid lands is used for growing fodder crops. In some areas, even wheat and barley are grazed once

before they are allowed to mature. Although livestock production is a major industry in the dryland areas, it suffers from mismanagement, malnutrition, and various diseases.

The farming systems in Balochistan integrate crops and livestock to produce foodstuffs for human and animal consumption. The animals are sold to raise cash whenever it is needed. The income from sheep and goats as a percentage of farm income ranges from 40 to 70 per cent for transhumants to 100 per cent in the case of nomadic pastoralists. Off-farm income is becoming increasingly important, as families fail to make a living from the land. It stabilises the farm income which is very susceptible to rainfall fluctuations.

Before the introduction of tubewells in the early 1970s, most wells in Balochistan were hand dug. By 1988-89, there were thought to be more than 10,000 tubewells. The water is used mostly for high-value cash crops such as apples, almonds, apricots, and vegetables, although some is used for wheat and alfalfa.

The farming systems in the arid areas vary from livestock and rangelands' management, subtropical crop systems, and range agroforestry to small grain *khushkaba* (dryland) and *sailaba* (irrigated) farming systems. However, these areas are experiencing a continuous process of intense land use from increasing human populations and livestock numbers. Periodic droughts have also been a factor. This has led to the disturbance of the fragile ecosystem with consequent degradation of vegetation, deterioration of soil, depletion of rangelands, acceleration of desertification, and lowering of agricultural productivity. Thus, the problems of arid land development and desertification control are complex, requiring a multidisciplinary approach for sustained economic amelioration of rural/pastoral communities in the hitherto backward regions.

Realising the magnitude of the problem, Pakistan Agricultural Research Council (PARC) has established a multi-disciplinary Arid Zone Research Institute (AZRI) for improving agricultural production in the arid and semi-arid areas of Pakistan. The AZRI is one of the federal agricultural research organisations forming part of the PARC's national network of agricultural support agencies. Its headquarters are located in Quetta, Balochistan, and it has three substations at Umerkot in Sindh, at Bahwalpur in Punjab, and at Dera Ismail Khan in the North West Frontier Province.

AZRI's ecological mandate in Pakistan encompasses two zones, the arid zone with annual rainfall of less than 150 mm and the semi-arid zone with less than 350 mm. These zones constitute about 85 per cent of the country's total area. A substantial part of this dryland, amounting to about 14 million ha, is at present served by canals and other sources of irrigation, and thus does not come within AZRI's sphere of responsibility. However, 40 million ha (or about half of Pakistan) are normally serviced by research from the Institute.

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Major Research Thrusts

The principal objective of AZRI's research programme is the sustained improvement of small ruminant production in the arid and semi-arid zones of Pakistan. To achieve this, four major research thrusts have been adopted. The first of these was, for the most part, completed between 1985 and 1990, and the other three are currently receiving attention.

The AZRI has made a sustained effort to collect the information necessary for devising an appropriate research programme and for formulating its development policies. This effort mainly consists of:

- extensive surveys of farmer practices and of household agricultural production systems,
- generation of community profiles,
- examination of constraints to and opportunities for agricultural extension,
- compilation of agricultural and related statistics for upland Balochistan from secondary sources, and
- compilations and probability analyses of long-run rainfall and temperature records.

The research designed to improve range forage resources by range rehabilitation and establishment of forage reserves on cultivable land currently focusses on identifying and testing indigenous range plant species, such as perennial grasses, forage legumes, and forage shrubs. The thrust for research designed to increase small ruminant productivity by improved livestock management has the following three components:

- nutritional management studies, feeding value trials, and examination of prophylactic health care against parasites;
- the effect of improved quantities and qualities of animal feed on sheep and goats throughout the annual cycle of production and determination of the relationships between different and variable sources of feed and key animal parameters; and
- studies on the feeding value of fourwing saltbush.

The thrust for research designed to increase animal feed sources by improving cropping systems on cultivable lands incorporates both analytical, agronomic and germplasm evaluation trials. Conventional technological interventions include improved varieties, use of nitrogen and phosphate fertilizers, weed and insect control, and tillage techniques.

Research activities at the AZRI Headquarters are focussed on highland Balochistan with six research disciplines; namely, (i) livestock management (ii) range management, (iii) germplasm evaluation, (iv) agronomy, (v) agricultural economics and farming systems, and (vi) agricultural extension and communications. AZRI's research activities in different provinces are carried out by its sub-stations.

AZRI-Generated Technologies

The AZRI has been working on multidisciplinary topics of dryland agriculture since 1985-86 in collaboration with ICARDA. As a result of intensive research in highland Balochistan as well as other arid parts of the country, the following technologies have been generated to help increase the agricultural productivity of the farming community.

- Yellow Rust Resistant Wheat and Barley Varieties
- High-yielding Food/Forage Legumes
- Catchment Basin Water Harvesting
- Computerised Rainfall Database
- High-yielding Forage and Fuelwood Shrubs
- Improved Livestock Management

Specific Long-Term Targets

For the development of arid lands, the AZRI needs to set itself certain long-term quantitative targets. The overall target should be to achieve the adoption of a number of technologies generated by AZRI for the farming community. More specific targets include:

- registration and releases of four varieties of bread wheats with resistance to yellow rust, three barleys, three lentils, and one forage legume;
- establishment of a greenhouse at AZRI to enhance the variety release programme;
- establishment of a seed industry for new crop varieties in collaboration with Provincial Departments and the private sector, so that the farmers in arid and semi-arid areas can get seeds for newly developed, high-yielding and disease resistant crop varieties;
- Development on a long-term basis of a large chunk of fallow or marginal land in highland Balochistan to establish forage reserves of fourwing saltbush or another shrub in collaboration with the Forestry, Livestock, and Agriculture departments;
- re-vegetation of degraded rangelands by using local and exotic grasses, shrubs, and trees in arid parts of Cholistan, Thar, and highland Balochistan (such activities would be coordinated with the Forestry and Livestock departments as well as NGOs involved in range improvement work in arid areas);
- implementation of a management plan for Maslakh Range, which will involve farmers who used to have access to the area, in collaboration with the Forestry and Livestock departments;
- application of improved sheep/goat husbandry practices that increase flock and herd off-take by 50 per cent, in a collaborative study with the Livestock Department;
- development of simple ex-ante bio-economic models to help define AZRI's research agenda and indicate the priority that

should be given to promising and sustainable technologies that have a high potential for adaptation and substantial impact on farm productivity; and

- conduction of studies on saline agriculture by using different salt tolerant crop and forage species for the reclamation of arid and semi-arid areas affected by salinity.

Problems of Agro-pastoral Farmers in China

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In the pastoral areas of China where there is no food production, food security is a very important issue. With increasing economic liberalisation, marketing systems, have also reached pastoral areas. Food has to be transported to the pastoral area, but markets are still developing and cannot always be relied upon to deliver food, especially at affordable prices. We have found that the farmers have been losers with increasing marketisation. They have limited ideas about marketing and most of the benefits have gone to the middlemen. Some kind of intervention from the government, or even from different institutions, has become necessary until people learn to deal with their own marketing problems.

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The next point is that the government also wants to introduce taxes in the pastoral economies. However, this has not been successful because the farmers have to pay most of the taxes while the middle men are taking most of the profits. After five years, these farmers, having realised that they are the losers in the marketing system, have organised themselves and formed village organisations to market their products collectively. With this kind of organisation farmers not only get better prices but can also deal with the middlemen in more favourable terms. This emphasises the fact that, when farmers are not organised properly, they cannot benefit from changes — as a matter of fact they could even suffer. When they are properly organised they can take advantage of the prevailing system. While scientists, decision-makers, and others can create the environment, it is only when farmers begin to help themselves that their conditions can improve.

In Southwest Sichuan Province in China, the mountains are vey high. Irrigation is very difficult at 3,000 - 4,000masl. These areas are rich in vast pastures and forests. But there are also several important problems, among which low temperature is a major constraint.

Soil erosion is increasing because of poor land management. Fragile sloping lands are fragmented into many small pieces. Transportation, communications, and markets are poorly developed. In these areas, the people are very poor, most of them are living below the poverty line. In these areas the first thing is to get enough food for the people; the second is to increase incomes for the poor people; and the third is to conserve resources and the environment. A team of experts has been

working in this high mountain region since 1988. Last year this team received a prize from the Chinese National Council for all their work and achievements. They focussed on producing enough food by introducing new varieties, advanced technologies, and fertilisation. Today food production in this area is improving. Some of the counties do not import food any more. A few are even exporting some food to neighbouring counties.

The pastures are also being managed for higher productivity. Improved yaks and pigs and new animal husbandry practices have been introduced. Orchards have also been developed along with the introduction of marketing. Research institutions are helping in many important aspects, and this will continue in the future.

Mixed Farming Systems in the Middle Hills of Nepal and the Education and Research System

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Many institutions present here from Nepal have been doing something on different aspects of farming systems. Farmers are engaged in raising crops, livestock, and multipurpose trees. Large numbers of crops are being grown in these mountains, because there are many different kinds of niche, given the fact that the climate ranges from tropical to subtropical.

Looking at the mixed farming system, what is the kind of education we are providing? In the Nepalese context, the current agricultural curriculum is oriented towards achieving high production using the green revolution. Very little focus has been on developing a holistic approach such as farming systems. Although many graduates have been produced, these graduates have not been taught about the farming systems' concepts needed for a proper understanding of farmers' problems. They have also not been exposed to the problems faced by the farmers — including ways to solve them.

The current research is also not oriented towards farming systems. It is very much commercially oriented and focusses on specific commodities. It is also mostly carried out in research stations. The agenda for researchers comes from the top and from higher authorities. Farmers' inputs are lacking and there are very few trained staff in research. The other problem is that the incentives for work are low and poor. People are not very motivated towards doing good research work. Facilities are inadequate. For example, research stations lack chemicals, proper laboratories, libraries, and so on. Consequently, because of the poor quality of research, most of the research recommendations are not accepted by the farmers.

We know that the farming systems' concept is very area specific. There are many niches, and the research findings vary from one place to another and do not completely apply to other places. There is a need for research on many of these different research sites. This needs many human and other resources. Insofar as the role of different institutions is concerned, there

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are two categories — universities and other institutions. The universities are supposed to develop and implement the farming systems' concept and practices in their curricula. The curricula need to be revised totally and focussed on this concept of farming systems. In the university, there is one course on farming systems and sustainable agriculture. This is not adequate, but a beginning has been made in exposing the students to the concepts of farming systems. When they go to the villages and meet the farmers they will at least know how to interact with them. On the research side, we have a research laboratory near the institute in the low hills where faculty members go and conduct different kinds of research.

We try to bring together different faculty members. We also take the students to observe faculty members doing their research. They assist in data collection and, by watching different activities, begin to learn a few things about mountain farming systems. This is a small beginning. There is a major role for other institutions such as ICIMOD, which has a pioneering role. The mountain farming systems' programme of ICIMOD has brought us together. Discussions like the present one are very important for bringing about the needed changes in research and educational programmes in mountain areas.

The Nepal Agricultural Research Council was part of the Ministry of Agriculture, and, for the past five years, it has been an autonomous institution which has many research stations throughout the country. It is also changing its focus towards research. The Institute of Agriculture and Animal Sciences, however, is part of the University, and not much research is being undertaken there, because we have not been mandated to focus on research.

Based on considerations of different agro ecological zones, the north-western areas are predominantly high altitude pastures with livestock ranges playing a very important role. The main livestock here are yak, sheep, and goats. There are a number of other opportunities in valley areas during the summer — especially seed and off-season vegetable production. Both teaching and research are directed towards improving human resources, and the agricultural productivity of these areas needs to be strengthened.

In mixed farming systems in the lower hills, the role of livestock is secondary, because the main activity is crop production. Other factors to be considered are livestock rearing, improvement of genetic potential, and fodder production.

Shifting Cultivation in the Northeastern Hills of India and Research Initiatives

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As far as the north-eastern hill (India) region is concerned, cultivation practices can be classified into four major categories — shifting cultivation, terrace system of cultivation, wet and dry valley land cultivation, and home gardens. The major thrust in

research has been to generate technology for all the different categories of farmers. Most hill or mountain areas, more or less, have a number of common problems and constraints, — marginality, inaccessibility, inadequate markets, and poor infrastructure and institutional linkages.

Interlinkages are weak at present. While this is a major constraint, there are also good opportunities and potentials because of the diversity of climate, biology, and culture in the north-eastern region. Seventy per cent of the people practice shifting cultivation on very steep slopes ranging from about 60 to 100 per cent. About four million tribal people are involved in shifting cultivation, covering an area of about two million hectares. A very purposive strategy has been adopted to solve this problem of shifting cultivation.

The first component in this strategy was to improve the productivity of shifting cultivation and minimise the soil erosion without upsetting the ecological balance. Because it has been a way of life, the system cannot be done away with completely. Alternative strategies will take some time. The first strategy was to improve the productivity of traditional farming systems. Under conditions of a 15 to 20-year fallow period, shifting cultivation is not as hazardous as people perceive it to be. The problem has been aggravated because of the growing population pressure. As a result, the fallow cycle has been reduced from 20 to 30 years to two to five years. Anthropologists were of the view that there was no loss at all of soil resources. If losses had occurred, the people, who have been practising shifting cultivation over the centuries, would have altered the landscape from sloping land to flat land or terraces. They have expressed the opinion that so-called changes would actually disrupt traditional practices if farmers were forced to stop shifting cultivation.

Realising the need for further studies, elaborate runoff studies were carried out under different systems of cropping. All the important soil parameters, such as erosivity, erodibility, and crop management factors, were examined. Climatic conditions were found to be much more responsible for erosivity than the soil erodibility factor. It was also found that grass strips introduced or integrated with mixed cropping systems can reduce soil erosion. Improved varieties were recommended for improving the productivity of shifting cultivation, particularly for maize. (As far as rice is concerned, we are not able to breed any varieties that can be well adapted to the mixed cropping situation.) Use of fertilizer was also advocated.

The second approach was to replace this traditional system of shifting cultivation with an alternative land-use system or farming system. Different land-use alternatives were comprehensively assessed on a micro-watershed basis and a land-capability classification was developed. If the soil depth was one metre, an agri-horti-pastoral system was possible, a silvi-pastoral and many other systems emerged. Agro-forestry scientists also helped to identify a sericulture-based system. The combination resulted in seri-agricultural, seri-horticultural, and sericultural systems.

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In the process of developing the new systems, we also did not lose sight of the traditional wisdom and ingenuity of the farmers and their knowledge. Their rich knowledge was seen in some of the classical examples of managing water for rice cultivation; the organic farming system, drip irrigation, and the *Chyabo* (which includes agroforestry, rice cultivation, and fish farming) system of cultivation in Nagaland used for collecting runoff water. The more we studied the traditional systems, the better we understood the reasons behind the practice. This also greatly helped to identify improved practices. The problems associated with shifting cultivation — particularly land degradation — can be managed effectively using integrated land management systems. The systems discussed have shown great potentials with regards to food security, employment, and maintenance of soil fertility. These need to be properly monitored and further developed.

Shifting Cultivation in Myanmar and the Development Process

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There are two major problems of hill farming in Myanmar; i.e., shifting cultivation and poppy plant cultivation. The country is heavily forested in mountains that are remote and mostly inaccessible. Native people living in these areas are isolated and their standards of living and educational levels are also very very low.

Shifting cultivation is a common practice in these regions. This practice is known as the *Tarria* cultivation method. In fact slash and burn techniques are widely used. Usually upland rice and maize are grown, and, after some years, the land is abandoned and the people shift to another place. Due to these practices, erosion and landslides are common.

In Myanmar more than 20 per cent of the cultivated land is still under shifting cultivation. The Government has laid down plans to eradicate shifting cultivation and poppy plant cultivation. Four regions have been selected covering about 49 thousand square miles (that is 9.1 % of the total area of the country). The Ministry of Progress for Border Areas was established in 1994 to look after these areas. The plan focusses on development of infrastructure such as roads and housing. Developments in education, health, trade, agriculture, livestock breeding, forestry, mineral exploration, and so on have been emphasised. Some of the hilly areas have minerals, such as rubies, that can be exploited. A number of external agencies are also helping the Government in this effort. ICIMOD has provided support to promote Appropriate Technologies for Soil Conserving Farming Systems such as Sloping Agricultural Land Technology (SALT) and water harvesting activities.

Different training programmes to help local farmers improve their knowledge of agricultural techniques, land management, and use of improved seeds, fertilizers, pesticides, and farm equipment have been undertaken. Myanmar Department of Agricultural Science has opened 67 agricultural extension stations around the border areas and posted more than 400

extension workers in those areas. All round efforts for development and coordination are being made by the Ministry of Border Areas and the results are showing.

Farmers' Perspectives on Role and Priorities of National Agricultural Research Systems (NARS)

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The first point to note is that farmers do not see agricultural research as being something separate from the overall agricultural process. One has to see the whole process in position if there is going to be a successful impact on the farmer. And the farmer himself will judge whether it meets his needs and aspirations or not.

Any technology or intervention must have some immediate impact on his or her actual situation. This is related to the fact that farmers are very conscious of the risk they are taking in adopting something which is outside of their perspective. It is not possible to ignore both the economic and the agro-ecological situations. The actual ingenuity of the farmer is quite amazing. Farmers will adopt technologies to suit their particular needs and also, in fact, engage in research. One example from the Eastern hill is *Charito,* a medicinal herb exported to India which is rapidly declining in availability. Already farmers are taking this herb and trying to cultivate it in their fields. There is no intervention there in terms of research and support from any other part of the agricultural organisation. Assessment of the perspective of the farmer means that we must be able to identify farmers' problems, which are obviously their priority. They must have a reasonable chance of intervention because we are working in adaptive research and not on basic research.

Many of the problems the farmers actually face or put forward are not researchable. They are problems that can be solved by interventions in other areas. In fact, if you talk to many farmers, direct agricultural intervention does not rank at the top of their priorities. They talk about the need for education, water, and roads. These should be taken into consideration when thinking about the priorities of our farmers. Obviously, given the priority in the hills, we have to be able to cope with these wide differences and, as a result of such considerations, we must be able to provide farmers with not just one but a portfolio of technologies that they themselves can pick up and adopt. Involvement of the farmer in all stages of research is critical. We also need to be able to provide the information and tools for both policy-makers and those providing support services. Involving farmers, not only in the identification of priorities but also in the research process, is essential for effectiveness. We need to know and understand what farmer strategies are being applied by them now and to used their knowledge.

How do we do this? We do it obviously by using some of the more traditional ways, through meetings and appraisal, but I would like to

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emphasise just one or two approaches we are using here. One is the emphasis on farms rather than on the centre. Most of our research in Nepal is in research centres, but at Lumle and Pakhribas we use the farmers and the farmers' fields for over 60 per cent of our work. We use both the typical and traditional agro-ecological means to identify common goals. The socioeconomic aspects that we have used have in fact been determined by the farmers themselves. We have carried out a modified form of wealth ranking by asking farmers to identify differences in their own situations. The baseline of all their categorisation is to see how much food is going into the household. So we actually are now working on four categories of farmer based on household food supply.

This leads us to focus on households, rather than farmers, because we have found that you need to take the household completely into consideration. Without understanding the household, it is not possible to determine how a particular farmer will respond. Women members of the household will be affected and respond and criticise any particular technology. The age-wise perspective is important in extended families, as the elders are also involved in the decision-making process in the household. We are taught a lot about using indigenous knowledge in a form that we can relate to in scientific terms. Much of the indigenous knowledge that we know is farmers' knowledge which is usually captured in an anthropological manner. This seems to be very descriptive and not so quantitative.

We are experimenting with using computerised systems that actually break down statements by farmers into a system of their own. Finding that this is much too flexible and descriptive, we have tried to refine it further. I would just say that we use a systems' approach, but I would also like to point out that we prefer to call it interdisciplinary rather than multidisciplinary. Pakhribas, being a multidisciplinary institution for a long time, is organised along a disciplinary line. We have found that, in fact, this has not always led to an interdisciplinary approach to answering the problems of the farmers. It has also tended to identify priorities based on a discipline rather than on a priority basis. And this is one of the major reasons that has led to the type of change in the institutional structure which Dr. Harding described earlier (Chapter VI).

Farmers' Needs and Horticultural Research and Development in Himachal Pradesh

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In the temperate region of Himachal Pradesh, apples and some flowers, along with other conventional agricultural crops, are grown. By tradition, the people from the hills are nature lovers. They are peaceful. But, with the advancement of industries and development during the colonial era the education system has isolated most of the educated people from the

environment. With industrialisation, development, and population growth, people started looking for prosperity in the plains, and this put pressure on the natural resources in mountain regions. What I am trying to say is that the self-sustainable living style of the mountain people was actually disturbed by the pressure from the plains rather than by the mountain people themselves.

The role of the National Agricultural Research Services was to increase productivity. By increased productivity, I mean increasing incomes. They focussed on getting more income regardless of what happened to the environment. Most of the time they recommended large fertilizer dosages and promoted varieties that later needed very high inputs in terms of pesticides, both of these interventions spoiled the environment. Apple-growing specialists recommended the cultivation of apples and nothing else. But, in the mixed farming system that is seen in the Hindu Kush-Himalayan region, where landholdings are very small, we need an integrated approach. Horticultural scientists describe only horticulture. They don't give the complete picture to growers who have cattle and other farming systems. Similarly, around the farms are forest areas also. Due to exploitation, forests are being lost, along with many medicinal and other plants, but scientists and extension people do not refer to any of these problems.

If our aim is to make the mountain farming household more sustainable, two things need to be done. The first is that somehow we need to curtail the use of natural resources by the people who do not belong to the mountains. I think this would control some of the environmental degradation. The second is to increase the standard of living by suggesting better crop combinations and identifying ways to improve productivity. The climate is very uncertain during the monsoons. There is no systematic study of the climate in the mountains. For every 100ft, there is a change in climate, but so far no predictability factor has been developed. So the apple growers sometimes pray to God that the weather will be good during the coming season. Surely this can be more scientifically managed? If it can be managed as in the west, through the use of satellite and other technologies, there may be ways to help the farmers.

Similarly, information on soils, soil survey maps, and soil fertility maps is not accessible to farmers, at least in Himachal Pradesh. They do not know the chemistry of the soil on which they are growing crops. Earlier scientists recommended monocultural practices, but now apple growers are facing lots of problems. Sometimes there were no crops at all for two to four years.

Small farmers cannot market their produce when they grow perishable products such as flowers and vegetables. We are trying to organise all the aspects of production and marketing through farmers' associations. We are also trying tissue culture. We have preserved at least four to five species that are becoming extinct in the Himalayan region. Through tissue culture, we are trying to mass propagate these and give

them to the farmers as new crops. The Government has not been helping us in any of these aspects.

Pest control is important, no doubt, but , instead of chemical sprays, we need to develop biological control measures.

The next important issue is plant genetic resources. Specialisation has created a situation in which many indigenous crops, e.g., *Setaria, Buckwheat, Amaranth* and *Chenopodium,* which used to grow in mountain areas, have been lost. Very few farmers even know about these now. So the genetic base is becoming very narrow. It is up to research scientists to do something about this and preserve these crops for future generations.

Many people still blame farmers for environmental problems in agriculture. This, however, shows little understanding of the problems that farmers face and the types of products that research organisations and development programmes are providing to farmers. If this can change, the farmers will also change. After all, no other group is as critically dependent on the conditions of the environment for their survival as the farmers of the mountain areas.

Amaranth, a traditional crop of marginal farm lands in parts of the HKH region
T. Partap