FPI's AGRICULTURE RESEARCH AND DEVELOPMENT

Current concerns for food security stem from both the unacceptability of current levels of food-insecure people and the recognition that agriculture will have to feed an increasing human population, forecast to reach 8 billion by 2050, of whom 86% will be in developing countries. In most developing countries, the majority of the poor live in rural areas and depend on agriculture for their livelihoods. Expanding food production to include them as production partners will enable sustainable food production that will feed this increasing population while alleviating poverty through gainful employment in the agriculture value chain to the rest of the population, which is a formidable challenge.

In addition to food production and the vital contribution that it makes to food security, the Agriculture Research & Development Approach recognizes three further broad functions

1) Environmental 2) Economic 3) Social.

The Environmental Function. Agriculture and related land use can have beneficial or harmful effects on the environment. The R & D approach can help to identify opportunities to optimise the linkages between agriculture and the biological and physical properties of the natural environment. The environmental function of the R & D Approach is relevant to a number of critical global environmental problems including biodiversity, climate change, desertification, water quality and availability, and pollution.

The Economic Function. Agriculture remains a principal force in sustaining the operation and growth of the whole economy, even in highly industrialised countries. Valuation of the various economic functions requires assessment of short, medium, and long-term benefits. Important determinants of economic function include the complexity and maturity of market development and the level of institutional development.

The Social Function. Both the maintenance and continuing dynamism of rural communities are basic to sustaining Agroecology and improving the quality of life (and indeed, to assuring the very survival) of rural residents, particularly of the young. On another level, the capitalization of local knowledge and the forging of relationships between local and external sources of expertise, information, and advice is fundamental to the future of existing rural communities. Social viability includes the maintenance of cultural heritage: for we know that in many instances, societies still identify strongly with their historical origins in agrarian communities and rural lifestyles.

FPI's Agriculture Research and Development is divided into four broad themes: **food security, natural resource management, institutional strengthening, and socioeconomics** (alternative for this term) and policy. There are complex and interdependent links between these themes, which all contribute towards the primary goal of food security and poverty alleviation in developing countries.

Food Security

Although the rate of population growth is increasing in Africa, agriculture will continue to provide the main income stream and source of livelihoods to the majority of the rural poor throughout the developing world. Importantly, however, agricultural income streams are both seasonal and variable. Long-term food security, therefore, requires, in part, that productive resources are shifted from good years to bad ones, or from locations of surplus to those of deficit. There can be little doubt then, that food security remains a basic foundation of any process of substantial long-term poverty alleviation and ultimately, political stability.

At the national level, food security policies frequently include initiatives directed at raising the level of self-sufficiency through domestic production and storage, promoting farmer education and training, encouraging decentralized food production as a safeguard against crop failure, and taking measures to counteract the degradation of the natural resource base. Natural disasters such as drought and disease outbreaks, political instability, and wars disrupt normal means of food supply to create emergencies, which may require immediate government intervention.

Self-help and village servings are well placed to address the twin issues of food security and poverty alleviation through their primary emphasis on bringing people together to pull up resources and promote productivity-oriented and natural resource management research. National Agricultural Research and Extension Systems (NARES) include new and improved varieties, quality seeds, farm-level machinery, and equipment, as well as knowledge and skills in natural resource management. Many of the new technologies often demand additional farmer education and extension effort to ensure effective use. Partnerships have therefore been formed with farmers in a participatory approach to research. These have targeted research more accurately to the needs of farming communities. Besides working with farmers, FPI has entered into partnerships with Non-Government Organisations (NGOs), NARES, Advanced Research Institutes (ARIs), and the private sector in tackling the global problem of food security through joint efforts.

Natural Resource Management

The capacity of agriculture to continue providing food for rural and urban populations must be balanced with the capability of the land. Here, agriculture has an important role in protecting and improving natural resources (i.e., the land users' resource base) and the environment in such as way as to ensure the preservation of natural capital and foster sustainable development.

Pressure on land leads to the exploitation and degradation of natural resources. Land users frequently lack both the technology and the financial resources to apply sound appropriate land-management practices and to invest in effective resource maintenance and enhancement. (This is further exacerbated when farmers lack the security to use or ownership rights of the land resources they use). As a result, agricultural activity, especially in marginal areas, frequently leads to the unsustainable over-exploitation of land resources. Stated simply, land users are often forced into this situation in order to ensure minimum daily needs and basic household livelihoods. Clearly, increasing population and concomitant consumption growth accentuate these pressures, particularly in fragile and marginal land areas. In instances in which no suitable alternatives are developed and applied, the degradation of natural resources can quickly extend beyond recoverable thresholds.

Agricultural production frequently fails to match the needs and expectations of land users. In these cases, production and/or income alternatives have to be developed in order to safeguard the future development and well-being of rural regions and their people. Solutions may also lie in non-conventional and/or non-agricultural use of land resources. The maintenance and, where possible, the enhancement of the natural resource base is one of the principal goals of research in soil use and management. Effective solutions to these and related problems will have to be sensitive to the trade-offs between different goals and objectives. How for example, does one balance the demands of household food security with those of good environmental management? Similarly, questions of scale and time are important, raising issues such as the varied impact of practices through space (such as up-stream and down-stream impacts in a river system) and likewise, the balance between short and long-term needs and effects.

In many parts of the developing world, resource-poor farmers are both the causes and victims of inappropriate land-use practices. This can lead to a vicious cycle of degradation and natural resource depletion. Effective research can help to break this sequence. In the final instance, research should lead to solutions that benefit both producers and the environment. It is clear then, that effective research across a wide range of different ecosystems requires an adequate understanding of their characteristics and multi-functionality. Knowledge of the socio-economic and biophysical processes which govern resource husbandry (i.e., depletion and enhancement of the natural and human resources) is critical for developing sustainable land-use practices which both improve the livelihood of the rural population and ensure the appropriate use of natural resources.

Individual land use scenarios and the most applicable management practices are location-specific within a larger environment. International research institutions cannot be everywhere. They must work on a generic level, developing research mechanisms to permit the extrapolation and adaptation of technologies and methods to other regions. This means research scenarios have to be representative of other, larger areas with similar characteristics. The multi-scale characterization of agro-eco-regions and their multifunctional particularities is therefore of great importance for appropriate natural resources management.

Effective agricultural research must be people-centred. If research in natural resource management is to contribute to development, the land users must play a central role. Instead, there is a tendency for researchers to perceive problems in their terms and to develop strategic solutions from their own point of view. This can often lead to incongruence between real-world problems and research-based solutions. Instead, it should be recognized that, the conditions prevailing at the land-user level set the limits for, and the pace of the adoption of improved and more appropriate technologies.

Sustainable agricultural productivity is not only dependent on the direct management of natural resources. It also requires appropriate enabling environments in terms of both general socio-economic conditions and a supportive policy matrix. Enabling environments include incentives that encourage producers to invest in the strategies necessary for improved land use. Domestic policies, for example, may provide direct support to initiatives that deliver positive benefits to the environment. Similarly, functioning local markets will allow producers to benefit from increased production surpluses resulting from new agricultural practices. Indeed, it is widely recognized that access to factor input (finance, equipment, natural resources) and factor output markets are decisive factors in shaping the viability of new innovations. Secure and reliable access to necessary land resources, for example,

coupled with suitable marketing and adequate rural infrastructure all encourage land users to invest and care for their land. In such enabling environments, improved technologies developed through research will become more effective. When these conditions exist, research can help develop better production technologies and ways to optimise the management of natural resources for improved and more sustainable land productivity and environmental sustainability.

Sound agricultural practices not only involve better economic use of resources but also foster environmental protection. Downstream effects of, for example, increased water use, soil erosion, nutrient translocation, and pesticide emissions are usually of national concern and of little interest to individual land users. Decreasing environmental hazards and building environmental resilience are overriding objectives at sub-regional (e.g., watershed), regional, and national levels.

Socio-economic Conditions and Policy

The multifunctional character of agriculture and land refers to the full range of goods and services resulting from agricultural activity and related land-use. Carbon sequestration through improved crop and soil management practices, provides an example of an international public good whilst increasing employment opportunities and improved health are best viewed as national (or sub-national) public goods. Sustainable rural livelihoods and poverty reduction are common goals throughout the world. Clearly, the relative value and importance of these objectives vary through time and space, and even within countries themselves. Individual sectors within a single country, for example, will benefit differently from improvements in rural livelihoods (and indeed, some sectors may decline as a result of these changes). Likewise, the value of these public goods may vary between urban and rural areas. Similarly, the relative importance attached to these goals in terms of overall policy priorities varies between developed and developing countries and between rural and largely rural societies. Research undertaken in the ARD on issues including socio-economic conditions and processes and the policy-making process, in general, contribute to understanding the nature and significance of these differential valuations and can contribute to the eventual production of an improved and more effective mix of the goods and services that constitute the multifunctional character of agriculture and land. Several key issues for this type of research and its links with the multifunctional character are examined below.

Continuing this logic, it is clear that for most agricultural producers, the primary objective of agricultural activity is food production, for either domestic consumption or for sale in the marketplace. Socio-economic and policy research, guided by recognition of the multifunctional character of agriculture and land, examines how the mix of agricultural goods and services produced affects food security, the welfare of producers, sustainability of natural resources utilization, and the environment. Natural resources and environmental degradation have costs in terms of human health, pollution, and loss of natural habitats. The decisions producers make in choosing certain agricultural practices to depend on the incentives and opportunities provided by markets and government policies. Socio-economic research sheds light through empirical studies on the effects of agricultural production systems on these negative externalities. Recently, bio-economic models have been used at community levels in assessing the complex interactions between population, agricultural practices, rural income, natural resources use, migration, and government policies. However, more work is needed particularly on assessing the impact of policies and consequent agricultural practices on the

positive externalities of agriculture. Both macro- and micro-level studies are needed to answer questions at different levels of scale.

A range of methods are recognised for assessing the value of the goods and services that are produced by agriculture but not traded in the market. Owing, however, to the perceived limitations of these valuation methods and their limited application in developing countries, the contribution of agriculture on the non-income functions may be underestimated. This can lead to policy distortions. Likewise, the impact of agricultural technology on non-food benefits of agriculture is inadequately understood.

A key function of agriculture refers to the contribution it makes toward poverty reduction. Similarly, the fight against poverty is the overriding goal of the ARD System. and is a cornerstone of the individual mission statements of all the constituent centers. The ARD center aims to achieve this goal mainly through increased and sustained agricultural productivity, and an improved socio-economic and policy environment. In many ways, the Green Revolution attests to the record of the ARD in this regard.. But, in spite of this and similar successes, poverty remains prevalent throughout most rural areas in developing countries. Nonetheless, poverty is a complex problem and likewise, understanding of its causes and effects is evolving continually within development and research communities.

There is little doubt, however, that agriculture remains an important element in poverty reduction in rural areas throughout many parts of the world. Socio-economic research can lead to an improved understanding of the role of agricultural research in poverty alleviation. The effects can be direct (in the case of improved nutrition and calorie intake) or indirect (through price effects and the labour market) and are influenced by many factors. The first step in poverty alleviation is to understand the constraints and opportunities of the poor. Future socioeconomic research will deepen our understanding of the different dimensions of poverty and improve the efficacy of agricultural research in alleviating poverty.

Traditional agricultural research and extension approaches will not meet the needs of rural communities. Particularly in the less favoured environments, where agriculture is practiced in difficult terrain, marginal soils, and variable weather conditions, farmers have used indigenous knowledge and local skills over many centuries to develop ways to survive in these difficult environments. However, their production systems and the local institutional arrangements that govern the management of their natural resources are threatened by socio-economic changes. Development of sustainable production systems and rational use of natural resources and the environment therefore calls for a new research and extension approach with the participation of local communities. The ARD Approach should illuminate many of the key issues that are important to both communities and the environment and provides a useful descriptive framework for their assessment.

Social scientists, in collaboration with biophysical scientists, must build new partnerships with producers, land users, NGOs, and relevant Government departments of developing countries and advanced institutions. These partnerships will implement farmer participatory research involving producers as active partners rather than as mere recipients of the information. This approach is expected to empower farmers with knowledge and skills that enable them to experiment with different options and choose those best for them. The ARD System's participatory research initiatives offer new opportunities for technology development and dissemination, help to re-examine the roles of research, extension, and of producers, and help to assess the impact of technology on the multiple functions of

agriculture. For example, participatory poverty assessment is a powerful tool for giving a deeper and more comprehensive understanding of poverty. However, this new approach is still in its infancy and its impact has to be fully evaluated.

Institutional Strengthening

Addressing the multifunctional character of agriculture requires a multi-partnership approach, which forges active relationships among national and international research centers and other players in the development process, including government departments, NGOs, and the private sector. It is important that multiple actors work together and contribute their respective comparative advantages in knowledge, skills, and experiences since no single organization can educate and empower farmers to make changes that can fulfill the multifunctional character of agriculture. Moreover, since the capacity of institutions varies from country to country, a complementary mix of institutions may seem a better way to effect change.

Intensive collaboration and networking with local agriculture institutions are crucial to adapting the generic research outputs of ARDs to local conditions. Where local institutions do not have the full capacity to do this, institutional capacity building is an important tool to encourage and enhance appropriate adaptive research. This applies particularly to the important local partners attached to the role the land users themselves have in research.

FPI-I endeavors to strengthen local capacity through training, technology transfer, information exchange, and helping to influence policy reform. Many national programs in developing countries do not have the capacity to provide technologies suited to local needs due to a lack of trained persons, weak institutional arrangements, and limited research and extension capabilities. There is a consequent need for assistance to be provided from outside. Local institutions have been found to be well-suited to provide much of that assistance in the following ways:

- Collaborative research efforts between FPI and local institutions must focus on problems that are best solved through joint research. International centers have scientific expertise, modern equipment, and research methodology for tackling researchable issues in countries of their mandate regions. These countries provide a testing ground for research outputs or technologies and through cooperative efforts gradually develop their own capabilities for independent research.
- Short-term professional training at country and regional levels for thousands of National Extension staff. Sustainable agriculture approaches will not develop unless communities and institutions themselves develop through education and training.
- Longer-term degree training and research experience for more senior staff from national programs.
- Wide information dissemination through reports, and advisory services to farming communities, and to policymakers responsible for spreading knowledge and progress.
- Technical networks for exchanging insights and experience.
- Decentralised research and management through outreach programs that are focused on location-specific realities and needs.

The collaboration between FPI's ARD and national programs will enable more effective on-farm research, field demonstrations, and training, which together could contribute to a better understanding of the multifunctional nature of agriculture and its impact on economic growth, food security, and poverty alleviation in developing countries.