THE DEVELOPMENT OF DRYLAND AGRICULTURE[1]

W. David Hopper,
The Rockefeller Foundation,
New Delhi, India.

The Feasibility Components of Agricultural Development

The recent upsurge in the productivity of tropical irrigated and humid agriculture has turned attention to those vast areas of the world where farm output is limited by moisture availability, areas that seem to be bypassed by the course of human progress. There are many reasons why attention should now turn to the development problems of drylands. Huge areas of the earth's surface are still poorly productive and seemingly incapable of being made more productive by the present state of farming arts. A fact that builds an anxiety for the well-being of those peoples who depend on dry areas for their livelihood and to whom can be given no feasible prescriptions that will permit them by their own efforts to share in the advances of human welfare.

But it is important to recognize that regardless of whether a concern for dryland development springs from a desire to better use man's inheritance for abundance, or from a solicitude for human welfare, or even from the fact that for many nations the modernization of domestic agriculture must centre

---

[1] A paper prepared for the "International Conference on Mechanized Dryland Farming" to be held at Moline, Illinois, August 11-13, 1969.

on the transformation of farming in dry regions, there is as yet little in the history of dryland development to found a belief that the experience in fostering the transition from traditional to scientific farming in moisture abundant regions will have more than marginal relevance to turning a similar trick in areas of moisture deficit. What has been learned from world development experience that is relevant, however, is the broad substance that must be embodied in any successful approach to initiating and sustaining a growth in the productivity of land and the efforts of farm people. This paper focuses on those attributes of dryland agriculture that make real and give form to the complex of activities that must be embraced in any effort to generate the transformation of dryland farming.

If agricultural development is seen as sustained expansion in the real productivity of farms and farmers, it is evident from the accumulated experience of two decades that development efforts must centre on the farmer and embrace with increasing firmness and sophistication the inducements necessary for him to apply in his farming the findings of modern agricultural science and technology. In surveying the uncertain course of rural progress over the last twenty years it is obvious that most of the frustration of "lagging" agriculture arose from a failure to focus without equivocation on the farmer as the crucial agent of development, and from an unthinking neglect of the role modern farm technology plays as the vehicle of progress. It is apparent from the rural history of the fifties and early sixties that even those who should have known better forgot that farming is an endeavour that combines both technological and economic considerations, and that the farmer can innovate only when he is given new opportunities for adopting scientific methods that are technically, economically and operationally feasible.

The recent breakthrough in farm productivity in the well watered areas of the tropics and subtropics has been laid primarily to the rapid spread of exotic, fertilizer responsive cereal varieties, particularly varieties of wheat, rice and maize. There can be no doubt that a new biological base for farming was the key to making an agricultural dynamic technically possible in those areas where crop water was not limiting. But in the excitement generated by the growth in output seemingly triggered by the introduction of new plant materials, farm price relationships that made farmer innovations economically feasible by giving the new technology the stamp of profitability are often overlooked. And because a traditional agriculture founded on reasonably assured water could support a population density sufficient to pay the costs of being serviced by social and private capital investment in transportation and markets, farmer adoption of the new technologies was made operationally tractable by the availability close to hand of supplies of needed exotic inputs, the credit for their purchase and the market outlets for surplus product.

To argue that rural development is rooted in the technical, economic and operational feasibility of the opportunities for change presented to the farmer is to suggest an independence of these components that does not exist in reality. What does exist is a complex of interacting pieces, but because each of these is susceptible to influence by separate development strategies, it is possible conceptually to treat each separately. In doing so, however, there must be a continued awareness that progress arises from a grand strategy that successfully articulates and mixes into a reinforcing whole the separate strategies and tactics of fostering change. This Conference is centred on one aspect of the technical component of the total development complex. There are good reasons to believe that the selected component, mechanization, is the key ingredient around which our present knowledge of farming science can be organized to provide the technical feasibility for progress in dryland areas. In concentrating on the technical aspects of dryland agriculture, however, it would be dangerous to repeat, in inverted form, the historical mistake of ignoring the several other components necessary for inducing change. The paragraphs that follow seek to preserve a balance among these and to place into perspective the technical aspects of the development quest.

The Technical Feasibility of Developing Dryland Farming

The term "dryland farming" is more a convenient label for the class of farming done under circumstances of limited moisture than a term capable of scholarly definition. In its ubiquitous embraciveness it has little inherent power to focus attention on the tractable. It is not the concept of farming that gives pause, it is the meaning of "dryland" when used in juxtaposition with farming that creates a hiatus in definitional rigour.

If farming is defined as the exploitation by man of his environment through the cultivation of crops and the raising of livestock, then in varying degrees this exploitation involves establishing a purposeful relation with the course of natural events by an adaptation to or a manipulation of the environment. It can be argued that traditional agriculture with its primitive tools and limited understanding of natural phenomena, is an adapted agriculture. In contrast, modern agriculture is a manipulated agriculture. And the process of development is a process of introducing the technologies of manipulation to enhance the yield of the environment for a given human effort. This is an important definition for by implication the title of this Conference embodies the assumption that the application of mechanical power and equipment can provide a superior way of effecting the exploitation of environments that are water limited for the production of crops and livestock.

What is involved in the concept of a water limited environment, or to put it another way: What is dryland? Obviously it has something to do with the availability of water for crop production or the raising of livestock, an availability expressed in some form of probability within and across production seasons and embracing some limits as minimum moisture requirements for different types of agriculture. Although these are easy attributes to define, one looks in vain in the world's agronomic and

and geographic literature for their precise formulation and specification to give substance to the term dryland farming. Drawing from the large and excellent body of research literature on the water needs of irrigated crops, it is clear that the what, why and where of delineating dryland areas requires an elaborate breakdown of diurnal moisture balance probabilities that pushes beyond the boundaries of present-day work in agricultural geography as it is applied to all except very limited areas of the world.

Crop water requirement studies made under irrigated conditions provide rigorous proof, if any is necessary, of the fallacy of drawing a simplistic correlation between rainfall and a classification of dry farming types, a correlation too often assumed valid. East Pakistan, West Bengal and Assam are dark areas on any rainfall map. Annual rain receipts vary from 2,500 to over 10,000 cm., 100 to over 400 inches. Yet one of the substations selected by the Indian Council of Agricultural Research for investigations into dryland farming is at Jorhat in Assam where rain receipts average 160" per year, and the Government of East Pakistan has invested heavily in the past few years in the development of irrigation. The pattern of alternating rainy monsoonal and dry wind systems leaves farmers in this part of the subcontinent with several months of cloudless weather when temperatures are suitable for cropping and sunlight intensity best for high yield photosynthesis. Few would include the acres of East Pakistan or its multi-millions of rural people in the account of the world's dry areas, yet the very fact of its over 55 million population argues a major human welfare case for being concerned about the use of its land during the dry season. Indeed, in terms of people affected, East Pakistan has as strong a claim on a concern for enhancing dryland productivity as all of Central Africa.

At the other end of the rainfall distribution are the numerous pockets in the world where total annual rain receipts are small but where, because of local topography or prevailing climatic patterns, the distribution of rainfall is ideal for crop production. In fact, to even sketch a world picture of the degrees of dryness relevant to understanding world agriculture and its development potential requires a sophisticated analysis of cumulative daily or weekly rainfall receipts adjusted for water losses from the root zone through evaporation, transpiration and percolation, and aggregated over time in seasonal probability classes that can be compared with detailed data on minimum moisture needs for different types of farming endeavours. It will be a long time before information of this kind will be available to the scholar examining the nature and scope of dryland agriculture.

A detailed understanding of soil moisture alone will not provide more than a beginning in building a picture of the technical limitations and requirements for improving dryland farming. Water is only one leg of the tripod formed by an interacting system of soil-plant-water relationships. The depth, structure, physical properties and topography of the soil can combine to set conditions that will constrain just as effectively as a lack of moisture the agricultural enterprise alternatives open to the farmer. Or they can work to ease, even offset, the disadvantages of low or sporadic moisture receipts. Carefully chosen plant materials can often redress in substantial measure limitations on farm productivity of a small or uncertain rainfall or of relatively poor soil conditions. Improperly selected plants can impose great hazards on farming. A recognition that the tripod of soils, plants and water establishes the fundamental base of farming is important to maintaining a balanced search for new technical feasibilities of dryland development because it is most likely that such development will demand the evolution of different sets of farming practices, each adapted to the unique circumstance of a local agricultural ecology.

From a rapidly mounting body of evidence accumulating from research and farming experience in many parts of the world, it appears probable that mechanical power and farm implements will play a central role in many of these sets of adapted farm practices. It now seems apparent that the skilful use of mechanical tools can alter traditional tillage and crop management methods in a manner that increases the efficiency of water absorption and retention in many of the world's soils, and contributes an enhanced potential for applying modern science to all systems of crop and livestock production. The use of mechanical power and appropriate tools to break soil hard-pans formed through the ages by traditional implements drawn with the limited draught of animal power, is one proven way of facilitating greater water and root penetration into the lower soil horizons. In areas of seasonal rainfall, the breaking of the soil surface by the application of large amounts of power during the dry season permits the capture of the first rain water that now is usually lost through runoff because it cannot penetrate deeply into hard backed soil. Careful cultivation and the planting of crops with deep rooting habits can tap and use limited amounts of moisture by enlarging the effective root zone of the plant. Mechanical methods of laying a layer of low permeability to provide a perched water table at root zone depth in soils of high porosity are now being tested in practical and evidently successful trials in various areas of the world. Crops grown under moisture conditions that limit soil nutrient uptake have shown promise of responding well to nitrogen applied as a foliar spray in microscopic droplets. Mechanical methods of water conveyance and field application have opened opportunities for large improvements in the efficiency with which water can be collected, impounded, held and used for crop production. Indeed, there is now a vast catalogue of modern technologies in various stages of refinement built on an increasingly imaginative application of farm machinery to dry area problems; a profuse richness that is marred only by an absence of order and precision and understanding of the circumstances of their relevance, a flaw that stems as much from the underlying complexities of the concept of dryland as from the immature state of research into modernization and mechanization of traditional farming in dry regions.

The Economic Feasibility of Developing Dryland Farming

The course of agricultural development depends not alone on the creation of new methods of farming. These methods must be profitable for the farmer to employ and be capable of application in his farm operation. The types of farming undertaken in moisture deficit areas throughout the world can be placed on a continuum that ranges from nomadic livestock raising in arid regions, through the shifting cultivation pattern of slash and burn agriculture on semi-arid lands, to crop production by sedentary peoples living in permanent settlements. The continuum is correlated with rainfall, soils, topography and sunlight incidence as the major determinants of the soil moisture budget and the biological ecology this budget will support. Within these boundaries, and those set by the broad social and economic institutions of man, the farming community must seek an equilibrium that assures its members of daily sustenance throughout the year and preserves the existence and integrity of the group from generation to generation.

Recent anthropological research on human ecology has uncovered a rich fulness of human adjustments to environment that embrace an inherent symbiosis with the short run features of climate and soil and the long run uncertainties of natural events as these endanger or guard the present and future well-being of different societies. The African herder on arid grasslands where rainfall is widely variable in time and space relies on his livestock for a daily diet of blood and milk in a climate that is inimical to the storage of nearly all livestock products and where, by the very nature of the uncertainties surrounding rain receipts, crop cultivation is almost impossible. The Bedouin have built a viable economic system on nomadic sheep and goat herding, camel transport and trade, and a rigidly and elaborately defined pattern of raiding relations that assure a continued redistribution of income and wealth among the many tribes. Shifting cultivation is a worldwide phenomenon that finds its justification (and often condemnation) in balancing the protection of tropical soils with the organic matter requirements of crop production in a hot climate. The Hopi Indians of the Southwest U.S.A. evolved a culture in an arid environment that was and is built on growing maize in the beds of numerous ephemeral streams formed at the base of desert mesa and fed by periodic rainfall. But these are only a few examples of the ingenuity and wisdom demonstrated by man in adapting his economic endeavours to the opportunities and limits set by his physical surroundings.

Enhancing the productivity of the world's drylands (however crudely defined) carries with it an implicit need to alter the traditional ecological equilibrium established between man and nature. To effect this alteration it is necessary that a new equilibrium be created that is more satisfying to those adopting the change than was the traditional one replaced. It is in this sense that profit and the economic feasibility for change must be reckoned.

Until recently there were substantial doubts among social scientists about the extent to which human societies and individuals would respond to economic incentives. It now seems apparent that there is a universal rationality in human economic behaviour that differs from culture to culture only to the extent that there is a variation in the size of the incentives required to induce new patterns of productive activity. It is the fact of an incentive that sets the economic climate for change. To motivate change, the incentive must be perceived as a gain that is real and capable of being captured for private or social benefit by the innovative action of an individual or group.

At the core of the traditional economic systems of dryland agriculture is the need to meet the daily demands for sustenance of the individual, the family, and the society as a whole. In areas where climatic patterns are unpredictable in space or time, or where soil moisture budgets are so low that domesticated cereal crops cannot with any assurance be carried through the growth cycle to the point where plant carbohydrate will be fixed in a form suitable to direct human consumption, but where there is, however scattered and however small, enough moisture to generate the early vegetative stages of grass growth, human communities have turned to herding livestock and to using the life processes of the animal as a source of daily food and as a means of storing tomorrow's consumption. When livestock production is viewed as a method of storing food and insuring daily needs it is fully understandable why societies that rely on animals place a high premium on numbers rather than quality, often to the detriment of their own grazing areas through over-grazing, and even to the long run stability and existence of the society itself by a failure to perceive and check the consequences in the erosion of soil and the changes in plant cover that can arise from overstocking a range. The experience of administrators, conservationists, livestock experts and all the other assorted scientists from the many biological and social disciplines that have sought to soften the destructive impact of large herds on limited grazing areas, suggests that altering the focus of livestock oriented societies from numbers to quality is one of the most difficult aspects of generating a transformation from subsistence stock raising to modern ranching. But if the desired change is assessed in terms of its economic feasibility, it is obvious that unless farmers are offered alternative sources of food and food storage that are cheaper and more satisfying than blood, milk and meat and storage on the hoof, there will be no incentive in the short term to alter the traditional equilibrium. It is similar for the herder who raises cattle for sale as a byproduct of a semi-subsistence agriculture and who is too far from market to be paid more than a flat price for a live animal (that then must be driven long distances to slaughter and either sold for the lowest grade meat or fattened at the end of the trek for a quality premium), to him the argument that he ought to cut his stock numbers and produce a quality product rings economically hollow.

Moving upward on the continuum of moisture availability there is a steady increase in the complexity and sophistication of the farming activities of pastoral peoples. In areas where rainfall is heavier or the micro topography concentrates drainage water sufficiently to support a rudimentary crop agriculture, a society can enjoy the advantages of both cereals and livestock. For such groups an assured daily supply of livestock products is supplemented by grain when the rains are "good." Because cereal production under such circumstances will normally centre on the same areas of land from year to year, and because grain can be stored for daily use over long periods, societies farming in this kind of an environment can establish rudimentary permanent communities. In those areas where rainfall is dispersed over a substantial part of the year, and where winters are not too severe, it is usual to find combined herding and crop agriculture leading to labour specialization wherein the women and children remain settled near the ground where crops are grown while the men from adolescent boyhood to old age are nomadic, moving the herd or flock over a wide grazing area in search of grass.

In areas where rainfall is usually sufficient to carry a cereal crop to maturity, albeit at a low level of yield, agricultural societies take on a still more sedentary character. Again the determining factors are the soil moisture budget of the growing season and the variability in this budget from year to year. In a broad band of the tropics where annual rain receipts are sufficiently certain and large enough to permit a dependence on cereal cultivation, but where the topography and the need to maintain adequate organic matter of the upper soil horizons prevents long term sedentary farming, shifting cultivation has emerged as the traditional form of environmental equilibrium.

It is not easy to find the basis for generating economic incentives for change in societies following these types of farming systems. To argue that shifting cultivation is destructive of forest wealth and often leads to the erosion of hill soils means little to the tribal group whose population balance is directly dependent upon the superiority of crop agriculture to yield an output larger than that which would be obtained from hunting and gathering in a forest environment. To press modern methods of water harvesting on societies that must combine livestock raising with crop farming because rainfall variability is too high to permit a full dependence on gr

an incentive for

that gave validi

With the further increase in soil moisture availability and a lowering of crop season variabilities in water receipts, traditional farming takes on the pastoral aspects of community agriculture. In large settlement areas these communities usually establish ties with each other and interact socially and economically to forge the bonds that functionally define a region and ultimately a nation state. It is a relatively easy task to create economic incentives for generating change among farmers who are to some extent participants in the economic life of a nation. National markets and a money calculus provide the development strategist with an efficient means for manipulating the economic feasibilities of technical opportunities for change, and they give the farmer an effective method for assessing the gains of innovation.

The closer the integration between the economic life of an individual or community with the operations of a national market, the greater the role farm prices will play in setting the economic climate for progress. Farming for subsistence provides few opportunities for specializing either the skills of the farmer or the products of his enterprise. In such circumstances the economic feasibility for changing the technical base of agriculture must arise from the immediate and local demands of the small community. There are abundant examples of changes in traditional farming made in response to new technical opportunities that held also a promise of filling local needs: the use of new world crops such as maize and potatoes by old world societies, and the adoption of high energy root crops and tapioca by communities whose population presses heavily on land supply are among the many that could be cited.

It is obvious from the widespread use by diverse cultures of farming implements of common design, that tools and the practices that must accompany their use have diffused from centres of invention because of the economic benefits of less labour or higher yield that could be captured by their adoption.

But whilst it is clear from the history of human cultures and from the observations of remote societies today that subsistence agriculture is not synonymous with technically stagnant agriculture, it is apparent also that the diversity of technical opportunities for change are greatly multiplied by an expansion in the size and range of consumer demands that are open to the farmer through his participation in a national market system. It is the operations of the market that allow a specialization of farm enterprises to meet most economically a selected set of final demands, and it is through the market that farmers are provided potential access to a large array of non-farm factors of production that can offer new technical alternatives.

Whether accounted in money terms or in the realities of a physical flow of milk and grain, sweat and fatigue, the costs of and returns to and profits from farming are implicit in the technical relations of the production processes used by the farmer. The economic incentive to subsititute new production techniques for tried and familiar methods of cultivation arises only from the gains such a substitution would provide through a re-alignment of costs and returns that result in larger profits. It is the realizable profit from innovation that establishes the economic feasibility for developing agriculture.

The Operational Feasibility of Developing Dryland Farming

The technical and economic feasibilities for agricultural development set the opportunities and give the incentives for altering the basis of traditional agriculture. But change comes about only if the cultivator implements a decision to do things differently. The technical and economic aspects of change are passive, they arise from research and product development and the interplay of market forces to set the potential for progress. One hopes an act will follow. Whether it does or not depends on whether it is operationally feasible for the cultivator to make effective a decision to adopt a new and profitable farming method.

There are many elements that establish the operational feasibility of innovative farming. Of prime importance among them is the structure of capital and human services that can support and give substance to a farmer's decision for change. These services comprise the list of infrastructure components so familiar to students of rural development: extension services, roads and trucks, supply depots for seeds and fertilizer and plant protection chemicals, product stores and processing plants, banks and credit agencies, sales and service centres for machinery and farm implements, even drains and water channels.

In most dry farming ares of the world the level of farm services available to support cultivator decisions for change ranges from virtually non-existent to inadequate to barely minimal. This is not surprising: traditional farming methods seldom needed more than a rude set of off-farm services to support its conduct. But only in an infrequent case can a significant transformation in farming methods be made without the practical support of a fairly elaborate set of facilities to give operational feasibility to cultivator decisions. If large segments of dryland agriculture are to be altered by the introduction of new technologies of the kind central to the deliberations of this Conference, the desired dynamic will have to be built on prior investments in the structure, content and organization of the social capital serving farm people.

This is an obvious point, but it is a point with ramifications often overlooked in development programmes. The extension of wheat cultivation to a large area of former range lands in East Africa is an example. The technical and economic feasibilites of such an innovation were favourable. The programme proved a failure because the new areas were inadequately served by roads and market facilities. The nomadic herders who evinced a willingness to become crop cultivators for at least part of the year found their decision was not operationally feasible within the context of the available network of services whose support they needed. The manufacturer of farm machinery who refuses to invest in building sales and service agencies for his product until there is strong evidence of real farmer demand (and there are many who take this attitude even though their products successfully pass the tests of technical and economic soundness) acts to limit the operational capacity of the cultivator to opt for change.

While there is no disputing the importance and need to better the social services available to people in dry areas, it is not an easy task to do so. The limitations of dry zone agriculture are limitations that lower the productivity of land. Consequently, dry regions are usually more sparsely settled than regions enjoying more favourable moisture budgets. Low population densities raise the per capita costs of providing external farm support services, and the low yields to land reduce the ability of farmers to meet these costs. Indeed, in many instances, peoples farming dry environments by traditional methods have reached a Malthusian equilibrium between their numbers and a long-run ability to sustain these numbers that leaves little excess product above the requirements of subsistence that can be allocated to social capital formation. To create and maintain an infrastructure of economic services in a circumstance where economic activities can contribute little or nothing in the initial stages of development, makes necessary an injection of resources from extramural sources if indigenous farmers are to be given realizable opportunities for improving their agricultures.

The configuration of social utilities and capital forms serving and facilitating the production decisions of farmers is the most important component in setting the boundaries of the operational feasibility for developing dryland farming. But it is only one component of many. In assessing the operational feasibility of a change in farming practices it is often useful to recognize the distinction between those innovations that can be adopted by the farmer acting alone and for his own benefit, and those which carry capturable rewards only if adopted by a community or cluster of communities. The growing of new crops or new varieties, the use of fertilizer or improved implements and power units, the practice of cultivation methods of conserving field moisture are among the techniques that usually can eb adopted by the individual cultivator without reference to the decisions and actions of his neighbours. It is the group acting in concert, however, that controls the adoption of such technical innovations as large scale land shaping to improve water harvesting or the placing of limitation on the grazing of common range land, or the acceptance of new methods and rotations to beneficially alter older patterns of shifting cultivation.

Actions of individuals pursuing private rewards for innovation are the least troublesome to analyze. In some cultures social pressures are often brough to bear to discourage acts that break traditional forms of behaviour, but it appears that in time these pressures usually succumb to the general pursuit of development opportunities. In other cultures private decisions to innovate can be constrained because of the individual's responsibility to share fully any addition to his income with assorted relatives or landlords or chiefs, a responsibility that can sap the vitality of an economic incentive by making negligible the real return to innovative acts.

However, it is in the realm of establishing the operational feasibility of group action that one encounters the greatest difficulty of assessing the likelihood of change. To realize and distribute the benefits of group behaviour a society must have some form of political process for decision making, some system for administering the implementation of decisions, and some method of distributing the rewards that arise from successful collective action.

The small subsistence or semi-subsistence communities established on a dryland base have seldom enjoyed the economic surpluses necessary to the development of a comprehensive political organization. Tiny nomadic tribes, isolated mountain peoples, and the inhabitants of grassy plains are famous for their individualistic cultures and fierce pride in personal independence. These are not peoples who will readily accept, and their cultures were not formed under conditions that would foster the establishment of a highly organized political-administrative structure. For such groups cooperative endeavour to capture even very large gains is difficult if not impossible to engender. Indeed, if the gains are large enough it is likely that the group will be dispossessed of its environment by more disciplined and organized peoples before its members coalesce with sufficient vigour to exploit by their own efforts the fruits of innovation.

The lack of strong political systems to effect group change, or the presence of cultural restrictions on the freedom of individuals to act in their own best interests are not the only constraints setting boundaries on the operational feasibility of development in subsistence and semi-subsistence societies. Most technical prescriptions for development involve some form of investment of labour or wealth. In most communities founded on the exploitation of dry environments by farming, the surplus wealth available for such investment is small and often held in forms unsuited to modern capital needs. In livestock based cultures, herds and flocks represent not only a store of daily sustenance but also of wealth, and the natural increase of animals is the major source of capital growth. In crop based societies, wealth is held in stores of grain, in the legacy of land, and in the totems and housing and collected artifacts of the group. Thus it is often the case that the quantum of accumulated wealth or the form in which it is held (frequently a form that has value only to a unique people although the prizing of gold and precious stones seems a universal human trait) is insufficient or unsuitable as a source of resources for development investment. To determine the operational feasibility for changing dry farming methods in such societies, it is necessary to assess not only the profitability of innovation investments, but additionally to contrast the magnitude of the investment required with the real investable resources of the society.

The operational feasibility of private and social opportunities for changing older modes of agricultural production is more easily assessed when it is determined within the context of the economic life of the nation. The greater embraciveness of a national political process and the much larger base from which to draw investable resources provide substantial assurance that private and group decisions for development can be made effective, and that over time investment needs are unlikely to surpass the wealth and savings that can be tapped from a national product.

The development of farming is akin to the construction of a three-legged stool. The legs of discovering technical potentials, of creating economic incentives, and of establishing operational practicabilities give the stool stability and make it useful. For that ill-defined class of farming called "dry," these legs are difficult to fashion. But if development is the goal, each must be fashioned and their lengths made equal for they must found and support the heavy task of making progress feasible.