AGRICULTURAL RESEARCH TO HELP THE SMALL-SCALE FARMER IN DEVELOPING COUNTRIES

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INTRODUCTION

After decades of modern agricultural research, the small-scale farmer in most developing countries is still poor, and is still operating a largely traditional technology at little above subsistence level. In nearly every case, this type of farming co-exists side by side with highly capitalized commercial farms, on which wealthier farmers have adopted modern agricultural technology, with considerable success. The modern agricultural technology has not been developed with the wealthier farmer as the specific target, but nor has it been designed specifically with the poorer small-scale farmer in mind. It is always the strong who are best able to take advantage of changing circumstances and new opportunities. On the whole, agricultural research in the developing world is now benefiting those who need it least—those who are well endowed with resources and who are already practicing modern, highly productive systems of agriculture.

If agricultural research is to help the small-scale farmer, there must be a selective emphasis on technology appropriate for the typical small-farm situation of scarce financial resources, poor access to information and transport, a scarcity of market outlets both for purchasing agricultural inputs and selling farm produce, and, of course, a limited land holding.

SELECTION OF APPROPRIATE TECHNOLOGY

At the moment, one of the main criterion for evaluating an agricultural innovation under development is whether it is agronomically successful. Typically, a research report concludes with an account of the extent to which the new technology has increased production, compared to the control. To develop technology suitable for the small-scale framer, this must be only the first step.

The second question must be whether it is cost effective. To answer this adequately is likely to require farm testing under local conditions, in that prices of both inputs and produce vary considerably, depending on the number of suppliers/wholesalers and their distance from population centers. Even a fairly general indication, however, would be a considerable improvement on the present situation, whereby it is left to the individual farmer to test by his own experience whether investment into additional farm inputs is profitable or not.

Provided a new technology proves to be agronomically successful and economically viable, it is then essential to evaluate new technology in its context of use by the small-scale farmer.

Although it is obvious that small-scale farmers in developing countries, particularly in remote rural areas, are unlikely to be able to duplicate the experimental conditions of research stations on their own farms, this aspect is often not given sufficient emphasis. Farm testing of new technology will be discussed in a later section of this paper. On-farm research is a very rewarding approach in developing and testing small farm technology, but it is expensive and time consuming. Furthermore, its very advantage, that technology is tailored to closely fit local requirements, also has the drawback that repeated testing may be necessary in different areas to cover different situations, particularly in countries where small farms follow diverse agricultural patterns in a range of environments. Some preliminary assessment of technology in terms of its suitability for small farms, is needed, not only for new but also for existing technology.

The most obvious general requirements are that it should be simple and cheap. Technology for the small-scale farmer in developing countries should also be assessed
in terms of its probable mode of use. It is well known that experimental results obtained in field trials are usually higher than average yields obtained on ordinary farms, because the research plot is given a higher standard of management. Research needs to be assessed in terms of its success or failure when low-cost local materials are substituted for recommended ones, or when inputs applied have a lower quality or quantity than those recommended. Some types of technology are comparatively flexible in their requirements, while others involve a more rigid set of conditions which must be met if the technology is to succeed. The latter type of technology should not be introduced to the small-scale farmer unless there is good infrastructural support to ensure that farm practices reach a sufficiently high level, which is unlikely to be the case in a developing country.

For example, a system of pest control which is effective and economical, but which requires a close match between pesticide and pest species, accurate timing of pesticide application, and strict control over quality and quantity of pesticide, is not likely to be suitable for the small-scale farmer in developing countries. Nor is the high yielding variety which is highly successful only under good management and with a high level of standardized inputs, unless the small farmer has strong government support and a good supply and distribution system. Where the farmer, in spite of subsidies, must operate independently for the most part, according to his own scarce resources, as is usual in developing countries, a less demanding variety, even if less productive, would be preferable.

Varieties or agricultural techniques which are flexible in terms of site and management level are also more likely to be resilient to other factors such as weather and pests, which means a lower level of risk in small-farm investment.

I also wonder whether it would not be useful for farmers and extension specialists if more information were available concerning minimum effective rates. It is quite common for the small-scale farmer with a limited knowledge of fertilizers and soil nutrients to apply very small quantities of fertilizer, which are all he feels he can afford, in the belief that some fertilizer is better than none. Below a certain critical level, this is not true: applied fertilizer has no detectable effect on crop yield. Of course, there will be some slight increase in soil fertility, but any slight increase in yield this produces is out-weighed by the effect of other factors such as the weather or the extent of crop damage by pests.

Indications of minimum effective rates are not usually part of the standard recommendations to farmers on fertilizer or pesticide rates – perhaps in developing countries they should be. Information on minimum critical levels in implied in fertilizer response curves, but it is fairly rare to find a clear statement of minimum effective level based on these, and such statements tend to be scattered through the literature in publications on a variety of topics. For example, Dr. Keerati-Kasikorn in a paper on soils and pasture development refers to research indicating that on phosphorus deficient granite soils in northern Thailand, even where phosphorus deficiency was severe no response was seen to applications of 20 kg/ha P or less: if the farmer could not afford to apply effective rates, it was better to apply to phosphorus at all. (Keerati Kasikorn 1984, Gibson 1975).

Although most experienced agricultural extension agents working in the field with small farmers must have a fairly good idea of the level at which fertilizer or pesticide applications are too low to be effective, knowledge based on experience is formed as the result of trial and error. Error in this situation means that the farmer has been convinced to make an investment, out of scarce resources, in the hope of a return which did not materialize. Modern technology has failed him, and made his already difficult situation worse.

It is sobering to realize that we shall never know how many thousands of small-scale farmers have suffered from trying to modernize their production, using means which were ineffective and inappropriate, because they misunderstood the nature of the technology they were dealing with, and because they were constrained by poverty to approximations of the model recommended by the extension specialist.
SMALL FARM INNOVATIONS AND RISK AVERSION

It is widely acknowledged that the risk factor is an important component in determining whether a farmer will adopt technology which is new to him, and that it operates particularly against the poorer farmer, in that he has few reserves to protect him in the event of failure. A number of studies have emphasized the role risk aversion plays in slowing down the adoption of new technology. Small-scale farmers have no margin of error, because there is little or no production surplus. Crop failure or the death of a single animal may be a disastrous loss, 'A poverty ratchet on an irreversible course to greater misery' (Robert Chambers, quoted Roling 1985 p. 17).

Both common sense and several published surveys indicate that small-scale farmers are likely to be slower to adopt new technology when the risk involved in high. However, in practice the risk factor seems to have had a surprisingly small effect on research design or technology recommendations, where small farms are concerned.

In part, this is because it is difficult to evaluate the importance of risk aversion in farmers’ response to new technology, and it is difficult to incorporate into research something it is not easy to demonstrate and is impossible to quantify.

The relationship between the adoption or rejection of new technology and risk aversion is not a simple one. As Feder et al. (1981) have pointed out, innovation entails both a subjective risk, in that lack of familiarity with new technology makes the farmer’s yield less certain, and an objective risk, in that the innovation may be more vulnerable to bad weather or pests than the traditional practice it replaces. The farmer’s assessment of the risk involved is a composite of many factors, of which the nature of the technology itself is only one. Others include his faith in the extension worker’s competence, previous experience in agricultural innovation, and the amount of information he is given concerning the new technology. (A number of studies have shown a strong relationship between the farmer’s decision to adopt new varieties and his access to information about them, whether by extension agents, demonstration plots or the mass media). Furthermore, new technology may in some cases reduce rather than increase risk, as when effective pest control techniques lower the risk of crop damage or failure (Roumasset 1977).

The difficulty involved in isolating or measuring the different variables means that, although risk aversion is assumed to be a component in the behavior of small-scale farmers (as it is of human beings generally), there is very little certainty as to its relative importance, and as to the extent to which the farmer’s perception of risk is a correct one.

There is, however, a growing feeling that in many cases a small-scale farmer’s refusal to risk investment in new technology may be justified, in the sense of being a correct assessment of the objective facts. When agricultural scientists and extension specialists first faced the problem a few decades ago of the widespread refusal by small-scale farmers to adopt modern agricultural technology, researchers naturally looked for an explanation by comparing the farmers who did not modernize with those who did. At that time, modernization of agriculture implied a strong value judgement, and it was generally assumed that those who adopted new technology were enterprising and innovative, while the ‘laggards’ who did not represented the more conservative and passive farmers. Later, it was realized that the innovators were not so much enterprising as comparatively wealthy, while the laggards were generally poor, so that the major cause of non-adoption was believed to be lack of resources with which to do so. In the neat phrases of Capland and Nelson, ‘person blame’ was replaced by ‘system blame’ (Capland and Nelson, quoted Roling 1984). The chain of causation was felt to run from wealth to innovation, rather than the reverse, as had been believed earlier (Meyers 1982).

The poverty of the small-scale farmer in developing countries means that, not only does he have few resources to invest, but that any capital investment at all involves a much higher level of risk than it does for the wealthy farmer. It is a tenet of gambling that a rational decision on whether a risk is justified or not depends on an evaluation, not only of potential losses versus potential gains, but of whether those potential losses are manageable (should they occur) in relation to assets already owned. The degree of risk
involved in investing $100 depends, not just on the chances of success, but on the proportion between that $100 and the investor’s total resources. A $100 investment is a very small risk to a millionaire, whatever the probable outcome, but it is a very big risk to a poor man with an annual income of $200.

Technology for the small-scale farmer, therefore, should carry as little risk as possible, and the level of risk should be defined in terms, not only of the probability of gain versus loss, but in terms of the proportion the maximum possible losses bear to total farm income.

An example of programs for small-scale farmers which have not taken this aspect sufficiently into account can be seen in several livestock programs recently established in this region. These are intended specifically to give the poorer farmer supplementary income. Several of these programs provide the farmer with livestock on credit, the money to be repaid when the animal is sold for meat after being fattened by the farmer, or from the profit from dairy products. However, even when large, very expensive animals such as cattle are involved, there is generally no livestock insurance program. The farmer bears the whole risk of the value of the animal, which may be more than his total annual income.

**Low-input agriculture for the small-scale farmer**

In view of the lack of resources characteristic of the small-scale farmer in developing countries, in the absence of strong government support both livestock and crop production programs designed for such farmers should emphasize low capital investment and low risk, rather than maximization of production. Modern agricultural research aimed at maximizing production nearly always involves relatively high inputs, since the basic strategy is to breed plant or animal species into varieties which are extremely efficient converters of nutrients to agricultural products, and then manage these improved species in such a way as to maximize their rate of conversion.

A research bias towards capital intensive technology with a high level of inputs always mean a bias towards the large-scale farmer. Research for the small farmer means as emphasis on the circumstance of the user of the technology.

**Risk aversion – the longterm considerations**

A further point to consider in the problem of risk aversion and new agricultural technology is that the scientist tends to evaluate success over rather a short term – two to three years is a common period for farm testing for a particular technology – while the farmer’s time scale in evaluating success is a very much longer one, continuing indefinitely into the future over the generations.

As Newman et al. have pointed out (1980), it is common in studies of farmers at a micro level for researchers to assume a ‘point bias’ – a tendency to consider the farmer at one point in time, and overlook the fact that the farmer today is a product of what happened in the past. To the agricultural scientist, traditional farming practices appear inadequate, almost a failure, since he compares their productivity with the potential yields of new technology. To the farmer, the success of traditional agriculture has been demonstrated by the fact that it enabled his ancestors to survive and give rise to surviving descendants, as he hopes to do himself. The traditional farmer has inherited his farm practices, and the social structure which goes with them, as part of a cultural tradition which has roots in the distant past, but which has been constantly modified to adapt to changing circumstances. It is true that some traditional farming systems, in particular slash and burn farming, are at the point of collapse, but in general terms the traditional farming economy could reasonably be viewed as a composite of successful adaptations and decisions carried out over a long period of time, a system which incorporates the information gained by centuries of farming experience.

It can be assumed that the present day farming system is at least partly geared to survival in the long term, in the face of crises such as drought which may occur only intermittently but are potentially disastrous. It is a basic tenet of biology that the population of a species is determined by the amount of food available at the time of greatest food shortage. Although human beings can use technology to store food reserves more
efficiently than any other species, famines are part of the history of every human society. Famines can occur without any substantial change in food availability: what is important is access to food and who is entitled to it. Although there are food exchange relationships in most traditional farming communities, for the most part the farm household operates as an economically independent unit in terms of subsistence, and is dependant on its own efforts for its food. Any short-fall in food production in any one year is likely to mean hunger, and this consideration has been influencing the farm economy since its earliest beginnings.

If we view the traditional agriculture as a longterm survival mechanism, a number of farm practices which seem relatively inefficient at any one point in time may be advantageous in the long term, in terms of increasing the chances of survival. For example, in his analysis of smallholder agriculture in Western Province, Kenya, an area with a seasonal rainfall in which the main rainy season is followed by a very dry one, Oluoch-Kosura found that farmers could obtain the highest yields of maize (the staple crop) if they planted early in the rainy season, so the maize could ripen while soil moisture was relatively high. However, if he planted early, he also ran the risk of a delay in the rainy season and a crop failure from water shortage. ‘Farmers tend to forgo the higher yields which result from early planting in favor of a greater certainty that the rains have actually started, and will continue’ (Oluoch-Kosura 1983, p. 11).

Of the farm practices which are retained by the farmer in preference to modern agricultural techniques, it is difficult to identify those which have a long-term protective function. However, an effort by researchers to identify long-term survival strategies in the traditional agricultural economy may give a better understanding of the particular local environmental constraints, and how to overcome these with limited resources.

**Minimizing risk – not just a technological problem**

To regard research as the key to development implies that the problems of third world farmers are predominantly technical ones. To a large extent this is not true: the primary problems are organizational ones. Study after study of rural conditions has found that in developing countries there is a marked lack of credit facilities for small-scale framers, or if government or bank credit is available, complex and lengthy procedures are needed to obtain it. Supplies of inputs such as high quality fertilizers, seeds and pesticides at controlled prices are inadequate. Even where these constraints are overcome and increased production is achieved, local markets are generally incapable of offering price levels high enough to encourage innovation: indeed, increased production is likely to glut local markets and lower prices even further. Higher prices are available at town or city markets, but these are usually paid to the middleman rather than the producer, who is isolated by poor roads, lack of transport, and often, a powerful closed network of dealers. ‘Under these conditions, a refusal to adopt innovations in agricultural technology is a rational response to objective conditions’ (Murdoch 1980).

It should also be remembered that the three countries in the region (or indeed in the world) which have been most successful in transforming largely subsistence farming into modern commercial farming by small-scale farmers – Korea, Japan, and Taiwan ROC – did so during the 1950’s and 1960’s with the technology available at that time. From 1953 to 1962, using the agricultural technology of a generation ago, Taiwan increased its agricultural output by an average of 4.8% per annum, and from 1963 to 1972 production continued to increase by over 4% each year. Two Chinese economic experts, Hsieh and Lee (1966) have argued that the main secret of Taiwan’s economic development was her ability to meet the organizational requirements, particularly in terms of providing public goods at socially optimum levels and prices. Thus Taiwan in the early 1950’s had an effective supply and distribution system for chemical fertilizers of standardized quality. Land reform achieved social equity in rural areas, and gave the farmer the land he tilled and the profits from his labor. Taiwan has also established a highly efficient production and distribution system for improved seeds and other inputs, and a farm produce marketing system which gives the farmer a high level of marketing information and choice of marketing outlets,
along with good rural transport to take produce to market. Agricultural development in Japan and Korea has followed a similar pattern.

Taiwan’s policy of decentralized industrial development, which provided rural areas with employment opportunities, also provided farmers with off-farm income to invest in agriculture. By 1980, 91% of Taiwan’s farmers were part-time and earned most of their income in the industrial sector. Income generation in rural areas may be an important factor in encouraging agricultural innovation by small-scale farmers. Several studies in Kenya, for example, have suggested that income earned off the farm is a key element in determining farm productivity and output, because of the technological improvements it makes possible. Other studies, however, from the same country indicate that, given the choice, smallholders prefer to earn supplementary income off the farm rather than by cash cropping, largely because off-farm income is more reliable (Meyers 1982).

Probably increased employment opportunities vary in their effect on smallholder agriculture in different areas, and even on different farms in the same area. The smallholder may or may not wish to use the income thus generated to invest in increased agricultural production. However, it is certain that without capital or credit, he is unable to do so even if he wants to.

**BRIDGING THE GAP BETWEEN THE SCIENTIST AND THE FARMER**

It is now become a commonplace that the farmer’s selection and use of agricultural technology is related to a range of socio-economic factors. Of these, economic gain is only one motivating force, and may be less important than social and cultural factors.

Like the world of the farmer, the world of the scientist has its own socioeconomic factors, which govern behavior and influence choices. The scientist in developing countries has much the same career structure as his counterpart in the developed world, in which success is rewarded with increased income and prestige – success in this context meaning scientific success. The practical effectiveness of his work in developing small farm agriculture is not part of the scientific career structure: since this is usually not monitored, it is not usually known, and therefore has no public impact, unlike the conference papers and publications which build a scientist’s reputation. In most developing countries there is in fact an organizational barrier between the scientist and the farmer, in that research and extension function independently of each other, and the extension services regard contact with farmers as their professional territory, to be defended from encroachment by outsiders. Those programs which combine research and extension in a single organization have generally been very successful, as for example the seed development and distribution program in Thailand, which is one of the most successful improved seed programs found in any developing country.

The great advantage of combining research and extension into a single system is that research can incorporate feedback from farmers, so the scientist is able to correct research design where necessary and produce innovations which are acceptable to the small farmer. It also becomes possible for the scientist to find out the research needs of the small farmer; a question which is generally ignored by the world of research.

If the scientist is to develop technology appropriate to the small farm situation, he needs to know if the innovation is compatible with the rest of the present farming system; if the necessary labor and inputs are available to operate it; if it is economically feasible gives viable returns; and if it is in accordance with the social and cultural values of their farmer.

“...scientists can come closer to understanding their [farmer] clients by trying to ‘think like a farmer’. If in the farmer’s place, given the circumstances and resources, what would be one’s view of the technology being proposed? At this point it is best to remember a simple rule of thumb: the farmer is the teacher, ‘the expert’ about local farming practices, and much of value can be learned from the farmer”. (Rhoades 1984, p. 65).

Increasingly, agricultural research for small-scale farmers in developing countries is being integrated into the extension process, and farm testing of new agricultural technology is now being pioneered by most of the international agricultural centers, as well as a number of national agricultural organizations.

The testing of research at the farm level helps ensure that the technology is
appropriate, not only to the farmer’s requirements, but to the requirements of the particular local environment, which is likely to have a number of constraints not present in the research station.

**FARM TESTING OF NEW TECHNOLOGY**

Agricultural research is concerned with isolating major determining factors affecting the success or failure of a particular system of crop production. Thus, it is carried out in such a way as to subject the experiments to strict scientific control, in order to eliminate as far as possible variability caused by external factors in the environment, so that the effect of the factors under study can be measured exactly. What emerges is a model which, under the conditions tested, has proved markedly successful in achieving its stated ends.

Whereas the research station where the model is developed tends to emphasize uniformity as part of the scientific method, small-scale farmers show marked variation in production practices within even fairly small areas, reflecting the heterogeneity of the natural environment. The extent to which the model is successful when applied elsewhere will be mostly related to the degree of similarity between the field conditions at the test site and those where the new technology is being applied.

Heterogeneity in farmers’ fields is likely to be more marked in rolling or upland terrain, where differences of slope and altitude produce a variety of microclimates, and is also more likely to be more marked in rainfed areas, in that wetland rice cultivation by its nature has created an artificial, relatively homogeneous, production environment. Small framers are experienced only in local conditions, but they have spent their lives observing these, and are likely to be very much aware of even slight differences in soil moisture, fertility, microclimate etc. As mentioned above, long experience is likely to have worked out production practices which are finely tuned to the requirements of the particular environment. Thus one study of farming practices in a mountainous part of Ecuador found more than 100 different cropping patterns within a small district of 3 km², all of which incorporated the staple crops of maize and beans in various combinations, using a range of local varieties. The authors concluded that:

“It is evident from many conversations that farmers have extensive knowledge about their ecological environment and the effects it has on their crops. While farmers often cannot express or understand such knowledge in scientific terms, we recognize that small farmers have taught us a great deal about the relationships between crops, physical and biotic factors of the environment and the activities of man in the Project area.

A farmer chooses the crop or crop association, the variety and the plant-to-plant spacing according to the characteristics, including potential productivity, of each piece of land. Furthermore he understands the need to adjust these agronomic factors as soil fertility changes…

Bearing in mind the rationality of many local practices, we do not believe that experiments to determine rotations, associations, or optimal planting densities within the range of crops and varieties presently available in the area would be worthwhile. However, more information about these factors may be needed whenever this would allow the improvement of criteria to be employed in the selection of potential innovations”. (Kirkby, Gallegos and Cornick 1981, p. 18).

Although research centers in the Asian and Pacific region have often in the past carried out field trials in farmer’s fields, and extension services have laid out demonstration plots in rural areas which have followed much the same pattern, it is only fairly recently that farm testing has been carried out on a large scale as an integral part of major research projects, using several test sites, a careful delineation of the area under study, and careful selection of test farms to ensure that they constitute a representative sample of the target group. It is usual for this type of testing to be combined with a study of the crop production system already in existence, both as a source of information and for comparative purpose. Assessment of the technology and evaluation of the trial is based, not just on yield, but on the farmer’s assessment of the technology under test, and the cost/benefit ration involved. Methodological problems such as sample selection, experimental design, and how to evaluate the traditional technology in terms of effectiveness and yield, are still being
Because of the difficulty in obtaining precise information, and the lack of control over many variables, farm testing is a difficult type of research to carry out. Some of the major difficulties involved are outline in the outstanding report of the collaborative research into small-farm potato production in the Philippines, carried out by the International Potato Center (CIP), PCARRD, and the Ministry of Agriculture of the Philippines. (Potts ed. 1983). Initially, they found that farmers tended to cultivate the test plots by the method they considered most useful, rather than the experimental design of the scientists, which made the comparison of plots very difficult: they also found that their original sample of farmers who took part in the farm testing represented wealthier farmers, with larger farms than the target population of ordinary farmers. These problems were later solved by revising the methodology of the trials, including the method of site selection, and by reducing the size of test plots so that small farms could be included.

Data collection, and particularly quantitative data on yields from traditional practices as a comparative base, is a major problem in research carried out in farmers’ fields. This is hardly surprising, since it is the data from research carried out under controlled conditions in the experimental station which sets the standards of scientific accuracy.

The effectiveness of on-farm research in the development of technology suitable for the small-scale farmer is already making itself felt. International agricultural research centers are allocating it an increasing level of personnel and funds, and the approach is being adopted by a growing number of national agricultural research organizations. It seems that on-farm testing of new technology will become a major part of all agricultural research in developing countries in which the technology is intended for adoption by the ordinary farmer. On-farm research is a process, not only of technology testing, but of technology generation, as farmers contribute their specialized practical knowledge to the information pool.

CONCLUSION

To feed their growing populations and raise the living standards of their people, developing countries must increase their agricultural production, and it is the agricultural scientists working in these countries who will develop the means to do this. However, in his pursuit of technological improvements, the scientist in developing countries has paid too much attention to the end – increased production – and too little attention to the means – the user of the technology, the ordinary small-scale farmer with limited resources. Much of the technology developed over the last few decades is not appropriate for the poor farmer, but for the comparatively wealthy. It does not use inputs the farmer can produce himself from his own local resources, it use inputs manufactured outside the local system which the farmer is ill equipped to finance. It is often rigid in terms of the quality and quantity of inputs required and the timing of these, although in general developing countries cannot afford to supply the poor farmer with subsidized inputs and the necessary information to ensure that these technical requirements are met.

In part, this research bias stems from the very success of modern technology, which enables the wealthier farmers who use it to attain very high levels of production, and often supply a major part of the agricultural produce grown for the commercial market and for export. In part, it is because in nearly all societies there are few structural linkages between the farmer and the scientist. Finally, the research bias towards high input agriculture also partly stems from the fact the scientific method in itself, by which strongly controlled experiments test a limited and quantified range of variables, is best fitted for the development of technology which follows a similar pattern – highly controlled inputs in controlled environments.

This may be the reason why modern agricultural research in developing countries for small-scale farms has been most successful where the farmer’s control over the agricultural environment has traditionally been strongest – i.e. wet rice cultivation. This is also the system of traditional agriculture which has the highest level of inputs, both of labor and materials.

Developing technology for the small-scale upland farmer is proving much more difficult. Dryland fields are much more variable than paddy fields, so it is more difficult to develop
standard recommendations for new technology. The rainfed farmer has less control than the wet rice farmer over the variables affecting his crop, and in a climate of seasonal rainfall has no control over his most vital input, water.

Since the timing and quantity of rain generally varies from year to year, accurate timing of planting is both essential and very difficult in rainfed farming. Modern inputs such as chemical fertilizers and pesticides do not protect the small-scale rainfed farmer from crop failure due to water stress, and the high level of risk inherent in such farming systems is a disincentive for investment.

REFERENCES


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DISCUSSION

Q. In the Philippines, cock-fighting is a very popular sport, and poor farmers often bet relatively large sums on the result of these fights. This involves a 50-50 chance of winning or losing. How can we reconcile this with the reluctance of the small-scale farmer to risk his resources on new technology?

A. The decision as to whether an investment into new agricultural technology is viable or not is usually taken well in advance, and is based on the individual’s best knowledge of whether it is likely to lead to economic gain or involve unacceptable loss. In other words, it is a calculated risk. I don’t think bets made in cock-fighting are usually of this kind: there is great thrill and excitement involved, and spectators become carried away.

Comment: (Mr. Donal B. Bishop)
In our experience, at the Zamboanga del Sur Development Project, the risk of debt is one of the major factors influencing farmers whether or not to adopt new technology. Although our loans to small farmers in the project had a very good repayment rate of 90% after the first cropping, 50% of the farmers then dropped out of the project, due to their fear of debt.

Q. Who determines the appropriateness of the technology?

A. This is not an objective judgment, but is based on experience of whether the technology does what it is meant to. I suppose the primary judge of this is the farmer himself.

Q. You mention in your paper technology for the small farmer should be ‘simple and cheap’. What level would you consider ‘cheap’?

A. This is not an absolute standard, but must be considered in relation to the resources at the farmer’s disposal. An investment of US$100 would be relatively cheap for a farmer in Taiwan, for example, but a very expensive one in most developing countries.