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**VI CONGRESO LATINOAMERICANA Y DEL CARIBE DE
ECONOMÍA AGRICOLA**

**RURAL DEVELOPMENT CHALLENGES IN
THE NEXT CENTURY**

**EDITOR
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Selected Issues in the Development and Transfer of Agricultural Technology in the Caribbean

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Abstract

Many doubts have been expressed as to the ability of the agricultural sector in the Caribbean region to overcome the challenges arising out of trade liberalisation and other emerging forces. Since agricultural development is multi-faceted, action will have to be taken on several fronts but we focus directly in this paper on issues related to the "agricultural knowledge system" i.e. the utilisation, development and transfer of agricultural technology. The notion that the majority of our farmers are "traditional" and therefore, not sufficiently responsive to new technologies needs to be revisited. We argue that if appropriate strategies are used, farmers large and small can be mobilised to meet the challenge. The abuse of agricultural chemicals has been a bane to agriculture all over the world. The success of farmers "field schools" in promoting integrated pest management in some countries and Trinidad's success with biological control of the Pink Hibiscus Mealy Bug provide a good base for educational strategies to attack this problem. On the environmental front too, is the issue of deforestation and hillside farming. Again, a fresh look is called for using strategies that take a holistic perspective and use participatory approaches. Often technologies are not adopted because they are not "user friendly" and not appropriate to the wider social and institutional environment in which farmers operate.

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1. Introduction

As we move into the 21st century it is timely to consider whether goes agriculture in the Caribbean. Many have expressed doubts as to the ability of the agricultural sector in the region to meet the serious challenges arising from globalisation and other forces. They fear that our farmers will not be able to compete successfully with those farmers in more developed agricultural systems. Agricultural development depends on a number of factors but we focus directly in this paper on issues related to the "agricultural knowledge system". These include matters related to the development, transfer and utilisation of agricultural technology as follows:

1. Type of farmer and responsiveness to technology.
2. Use and abuse of agricultural chemicals.
3. Hillside farming and the environment.
4. The role of appropriate technology

2. Type of Farmer and Responsiveness to Technology

In exploring the perception that our farmers are unable to compete in the global arena, the notion of type of farmer comes to the fore as a primary issue. It is held that the majority of our farmers have a "traditional" or "subsistence" orientation. For them, farming is a "way of life" and not a "business," and the two perspectives are usually seen as

incompatible. Traditional farmers, according to this view, are not willing to adopt modern technologies including soft technologies such as the use of credit and management techniques. They are therefore exhorted to regard farming as a business and not merely as a way of life in order to move forward. And as a nation and a region, the challenge thus becomes the modernisation of agriculture.

Traditional farmers, it is felt, use "primitive" technologies such as "slash and burn" and "shifting cultivation" which are inimical to the environment and public welfare. On the other hand, when they do use modern technologies such as pesticides, they may use it inappropriately such as applying too much and using them too close to harvest.

The observation regarding the type of farmer and its relationship to responsiveness to technology indeed has a lot of merit and warrants closer scrutiny if we are to develop useful strategies to modernise agriculture. The problem, we think, may lie in the fact that some people tend to see traditional or business orientation as a product of innate or inherent characteristics. Thus, the traditional farmers are inherently "resistant to change" and have mainly themselves to blame for their "backwardness". It is felt, therefore that it is too much of a problem to bring them into the mainstream of modernisation. While not discounting entirely the possible influences of inherent traits we feel a clearer picture will emerge if we

examine in a holistic and systemic way, the circumstances leading to people's involvement in farming and the situation or environment (physical, social, economic, institutional, cultural) in which they operate.

We hold the view that our farmers can be placed somewhere on a continuum at one end of which is the "traditional" farm household which depends on farming for a livelihood. They probably have very few choices given their overall situation. Farming provides food and an income just sufficient for the farm family's survival and other basic requirements. Failures could therefore seriously hamper the household's ability to meet even their basic needs and thus, they are less inclined to take risks that could threaten their survival.

At the opposite end of the continuum are those who are interested mainly in profit maximisation. They are best exemplified by some relatively new entrants into agriculture in Trinidad and Tobago such as farmers in the cut flower industry. Some have left well paying professions because of the opportunities in the industry. They are clearly operating way above survival levels and are there by choice since they could have been earning a reasonable income through other means. They possess the know-how and the capability to negotiate with banks and could well handle risks. They would be quite eager to take advantage of any opportunity that would offer them higher

profits and thus, will always be interested in technologies that are likely to help them achieve that goal.

We have inferred that traditional farmers have limited opportunities. We should expect therefore that as opportunities are opened up the further they would move away from a traditional orientation as the examples below suggest.

For a long time, farmers in Trinidad grew rice mainly to supply the needs of their own households using traditional technologies. However, when government set about actively promoting rice production and introduced a guaranteed price, production shot up dramatically. Farmers introduced new high yielding varieties, used fertilisers, and practised close spacing. (Dowlath, 1995). In a study where the subsistence-commercial orientation of farmers was measured, the majority was closer to the commercial end (Ganpat and Seepersad, 1994).

1. At present, rice production is declining steadily coinciding with the introduction of a grading scheme as a basis for prices. This apparently has created new difficulties for farmers so that it is no longer feasible for them to produce rice commercially under the circumstances. Uncertainties because of trade liberalisation and possible consequences such as the removal of the price support may also have been responsible.
2. Other rice farmers increased their scale of production tremendously

when they seized the opportunity to gain access to more land. In one case, an extended family of five siblings cultivated 1500 acres of land using modern machinery such as harvesters and aeroplanes for spraying and seeding rice.

3. The vegetable farmers in Aranguez, Trinidad have been regarded as quite progressive for a long time and are well known even outside of the country. Circumstances felt to be largely responsible include: proximity to a large urban market; good quality land with water for irrigation; a great deal of interaction with University and Ministry researchers and private sector technical personnel.
4. A more recent example can be found in Nevis where the establishment of a large hotel a few years ago presented a market opportunity for local farmers. Although they lacked experience in vegetable production they were soon able to supply significant amounts of good quality to the hotel. Of course, the tremendous support provided by Extension, Research, and other arms of the Government were critical to their success.
5. Sometimes the timely provision of one or two critical inputs makes a big difference. In a recent success story reported in a newspaper (Anon, 1998c) a farmer lauded the difference that credit, provided by Fund Aid, an NGO, made to his fortunes. After two

modest loans for growing vegetables he was able to construct a fairly large house from his profits and planned to expand his operations.

The logical question at this point is: to what extent should we focus attention on "traditional" *vis-à-vis* "commercial" farmers. This indeed is a question that is always difficult to answer. The usual arguments for maintaining focus on traditional farmers are based on the need to stem the rural-urban drift, the need to combat unemployment and considerations relating to human resource development. Whether or not we should encourage people to stay in agriculture when opportunities for earning a reasonable living are limited is a moot question. Countries such as Taiwan and Malaysia have provided technological skills for industrialisation for their rural populations thus giving them more options.

But there are also arguments that show small farmers in a more positive light.

First is the issue of managing the rural environment and maintaining values associated with a rural way of life. It is more likely that those who have a strong attachment to those areas will be more inclined to look after them better. Many of the richer industrialised countries of the North are doing their utmost to keep or encourage people to stay in the countryside.

Second, the traditional farmers provide a stable core that can be relied

upon to ensure some measure of food security. Indeed, those who are motivated largely by profit maximisation are more likely to move out of agriculture if profitability is threatened.

The argument here is not for one or the other but that one should not neglect the small farmers especially when alternative opportunities do not exist. They should not be regarded as a problem that we would rather do without. The issue is now being played out in St. Lucia and neighbouring countries where more demanding measures have to be put in place to improve banana fruit quality. It is clear that some "marginal farmers" will not be able to meet the new challenges and will eventually be displaced. Indeed, St. Lucia is embarking on a multi-million dollar project, the St. Lucia Rural Enterprise Project, to deal with this situation. Displaced banana farmers will be encouraged into new enterprises and will be provided with much of the necessary support.

Similar concerns surfaced with the onset of trade liberalisation in Trinidad and Tobago. Studies commissioned by the Inter-American Development Bank (IDB) predicted that many farmers would be displaced causing much social upheaval. Provisions were therefore made in the Agriculture Sector Loan Agreement for social impact mitigation programmes to alleviate the hardships that affected families would have to face. While the two situations just discussed tend to suggest a gloomy future for small

farming, it is well to note the successes achieved in other countries such as India and Indonesia which have achieved a fair degree of self-sufficiency and exports based largely on a small farm sector.

2. Use and Abuse of Agricultural Chemicals

No discussion of agriculture in modern times is complete without addressing the issue of the use and abuse of agricultural chemicals (pesticides, fertilisers, feed additives and medication for livestock.). It is an area where, one can say, adoption has not been a problem; most farmers the world over use some type of agricultural chemical. The problem lies with the improper use and unsafe application of these products. This is borne out by a report of a study in County Victoria in Trinidad that pointed out, "The wide range of agro-chemicals being used implies a high level of sophistication and understanding of pesticide technology but this was not in fact revealed in the study" (Jones, 1988, p.124).

The dangers associated with the misuse of agricultural chemicals are well documented and we shall only briefly discuss some of the key issues. Unfortunately, few studies have been conducted and thus, there is not much hard evidence on pesticide residues on products offered for sale, and its effect on water quality. Among crops, the vegetable group is most associated with

misuse particularly those which are used uncooked.

Recently, too, large rice farmers in the Nariva Swamp, a protected wetland area in Trinidad, have caused much concern due to their use of pesticides. Livestock products are also prone to chemical abuse through feed additives such as antibiotics and hormones used to promote the growth of livestock and poultry. Europe has banned the use of hormones in livestock production and, in the U. S, their use is carefully regulated. It is not clear that we have sufficient capability in the Caribbean to monitor and regulate the situation and this problem warrants serious and urgent attention.

Problems associated with the misuse of pesticides are not confined to farms but equally apply to homes and offices. It is of course part of a wider problem of over-reliance on and overuse of chemical products generally, including human medicine. No doubt advances in science and medicine in the last few decades generated somewhat of a blind faith and even positive aura for chemicals. Now, however, the picture is changing and the confidence that such products enjoyed is being shaken. More and more examples are surfacing where chemicals are part of the problem rather than the solution. In the Caribbean, the failure of chemicals to deal with the Pink Hibiscus Mealy Bug and the success up to now of biological control should provide a strong boost for the fight against the over-reliance on pesticides.

The problem, as we have noted before, is more acute with high value crops such as vegetables where consumers express a strong preference for unblemished products. Farmers spray against pest and disease even before symptoms occur to protect their crops against the risk of possible damage or serious losses. We have noticed the same inclinations by householders when any of their cherished plants show the faintest signs of damage. One of the reasons for this situation is that people lack confidence in their ability to correctly identify the problem and to know what to use. Dosages may not be heeded too closely not only because they may not appreciate the significance of this point but also to a belief that repackaged materials may have been diluted. Thus, the normal dosages will have to be increased to maintain its efficacy. It is clear too that farmers rely a great deal on pesticide dealers for advice on products to use for their problems. Another point, too, is that most of the vegetable varieties in use today have been introduced from overseas and these may not be as tolerant to pest and diseases existing under local conditions as local ones.

How do we change the situation? A few suggestions are given below.

1. Information and education beyond the awareness level -- of damage to themselves, to consumers, etc. Many people may already have been told about the dangers of pesticides but

they need to be convinced that safer, cheaper, and equally effective alternatives exist. They must also have a great deal of confidence in their ability to correctly identify insect pests and diseases and to prescribe proper control measures.

An example from Indonesia, the world's third largest rice producer, might be instructive in this regard (Anon, 1996). In the 1970s, Indonesia was one of the world's largest consumers of pesticides. However, some years later they faced a severe problem with a pest known as the brown plant hopper, which developed resistance to the sprays. The chemicals, it was realised, were also killing off the natural predators of the pest. Faced with a major crisis, the government banned 57 of Indonesia's 63 major pesticides. But that alone was not sufficient. Eventually over 10,000 field schools were established throughout the country in a concentrated educational drive to teach farmers Integrated Pest Management (IPM). No doubt acceptance was hastened by the realisation that this approach cut down costs and even resulted in greater yields.

2. Of course, the agricultural knowledge system must be up to the task. Collaboration among private and public sector agencies will be critical to avoid them working at cross-purposes with one another.

Information must be widely available and easily accessible. The relative success that Trinidad has had in dealing with the Pink Mealy Bug problem was due in large measure to the large quantity of attention and resources devoted to the problem and the meaningful collaboration among the various stakeholders.

3. Behaviours associated with safety are often difficult to influence even when the dangers seem to be quite obvious as in the case of wearing seat belts or not smoking just to give two everyday examples. Thus, many times we have to leave the option to use "force" (laws and regulations) open. But having appropriate legislation in place is just a step in the right direction; it does not solve the problem as the example of Indonesia illustrates and as many Caribbean countries have come to realise. Monitoring and implementation are key elements in devising a successful strategy.

Some initiatives are also being taken at the international level. The United Nations Food and Agriculture Organisation (FAO) and the UN's Environment Programme (UNEP) held talks in March, 1998 with over 100 countries to finalise an international treaty curbing trade in potentially lethal chemicals and pesticides (Anon, 1998d). The proposed convention will require exporters of highly toxic substances that are banned or restricted in their own country to notify the recipient country.

4. Hillside Cultivation and Deforestation

As the public's legitimate concerns with the environment increase more and more attention is being focused on the activities of farmers in ecologically sensitive areas such as hillsides, and wetlands. Hillside cultivation not only results in the denudation of the forest cover but also creates problems such as flooding downstream. However, it should be noted that other activities such as quarrying and the development of lands for housing could also contribute significantly to such problems. Where such activities occur in peri-urban areas the problem is magnified several times. Most governments in the region have come to accept that the problem is multi-faceted and that solutions require co-ordination among several agencies in the state and private sector as well as civil society. Jamaica has developed a comprehensive land policy to deal with the problem at a national level and Trinidad and Tobago is also moving firmly in that direction.

In other places, projects such as the St. Lucia Rural Enterprise Project are considering dealing with this problem by moving farmers out of ecologically sensitive areas and relocating them to more suitable areas. While such initiatives are being put in place, there is hardly any doubt that certain agricultural solutions can help to mitigate the problem. We shall now touch on a few of those here.

First, it is important to distinguish between those areas that have been continuously farmed for a long time on a regular basis from those used on a "shifting cultivation" basis. Farmers in the latter group will not have as strong a stake in the land as the former. Although there seems to be a widespread perception that a high proportion of farmers on the hillsides practise shifting cultivation with associated "slash and burn" practices, a study in three hillside communities in Trinidad (Seepersad, 1994) found otherwise. The vast majority of the 140 respondents (84%) indicated that they generally operated on the same parcel/s from year to year. They may indeed burn their lands to get rid of weeds in the easiest way possible but not "slash" which is largely associated with clearing new lands. This is a matter that bears further investigation.

Burning is a very visible manifestation of destruction to the hillsides. The major problem occurs when the fire moves beyond the area being cleared and extends to the surrounding areas. In the dry season, it is difficult to contain such fires, and that is why the existing laws prohibit setting fires without permission from the appropriate authorities at that time of the year. Of course, bush fires are not limited to hillside areas, especially when the dry season is severe, and they sometimes cause destruction to cultivated areas and buildings. Again, it is not easy to enforce

the law since many fires occur in fairly inaccessible areas.

Fires, too, could start for reasons other than agricultural ones. Strategies to combat this problem will involve a combination of information and education, and greater resources for adequate surveillance, enforcement and control of the fires. Getting the community into the act through co-management approaches seems the best strategy for a long-term solution. In this regard, some success has been reported in Trinidad where "volunteer fire fighters" from a hillside community that is ravaged by fires every year, have been able, together with the Forestry Division, to curb the destruction normally caused by such fires (Anon, 1998a).

Certain types of tree crops provide the best protection for hillsides under cultivation. However, there are several reasons why this type of enterprise is not very popular.

1. Farmers generally operate on fairly small parcels and high value short-term crops offer the best opportunity for them to earn a livelihood.
2. Many farmers do not have secure tenure for lands on which they operate and this precludes tree crops, which assumes a long-term commitment. Seepersad's study (1994) found that only 15% of the sample owned the lands on which they operated and 55% operated on lands without any formal arrangement with the State or private owners, a

practice commonly referred as "squatting".

3. Tree crops are bulky, and given the difficult terrain on hillsides, this constitutes a disincentive.

In spite of the above situation, there are still opportunities for tree crops and a current University of the West Indies project, funded by the Inter-American Development Bank is investigating the possibilities in the Northern Range in Trinidad.

In addition to enterprise selection, soil conservation practices can also help. Most operations are carried out manually and thus, those practices which require the use of heavy equipment, such as bench terracing tends not to be favoured. More success has been achieved in encouraging farmers to use mini-terraces, eyebrow terraces, and other less demanding measures.

5. The Issue of Appropriate Technology

Much focus has been directed towards the issue of appropriate technology in the past 20 years or so when searching questions were asked regarding the reasons for apparently useful research findings collecting dust on shelves rather than used to improve the productivity of agriculture. While the process of technology transfer was a problem in some cases, often the technology was inappropriate to the socio-economic and even physical environment of farmers. It

was deemed quite important, therefore, for researchers to be well acquainted with the circumstances of the intended users of the technology through on-farm research so that there could be a better fit between the technology, the users and their environment. A few examples will help to illustrate the key issues.

5.1. The Caribbean Sheep Production and Marketing Project (CSP/M)

The CSP/M project represents a worthwhile attempt to develop appropriate technology for low resource sheep farmers using a Farming Systems approach. The project, conducted by CARDI and funded by the Canadian International Development Agency was conducted in Tobago, Barbados, and Guyana. Its long-term goal was to improve the overall welfare of low-income families involved in sheep rearing through the development of appropriate technologies that would improve their production and marketing capabilities. Some of the salient findings from project reports (Rajack, 1997; Haynes et al., 1997) are discussed below.

1. In most cases farmers seemed to appreciate the importance and usefulness of the technologies even though they may not have eventually adopted some of them,
2. Even though participatory approaches were used in identifying problems, in some cases, farmers did not think they had a problem or it was not an

issue for them and thus, they did not bother with the technology. Such was the case in Tobago where some farmers did not adopt the technological package on pre- and post-partum feeding because they did not think they had a lamb mortality problem.

3. The characteristic of the innovation also emerged as an important consideration. The relative advantage was judged mainly on the time and costs the technology required. For example, the use of forage banks and the molasses urea block compared to roadside harvesting of grass and buying concentrate feed was fairly widespread since it saved farmers time and money. When components required for the technology were not easy to access, such technologies were adopted slowly. The complexity of the technology was also a factor. Mixing of the feed compounds seemed to have been a problem for farmers after CARDI's assistance was withdrawn.
4. Certain values that they had, shared perhaps with many other people also posed a problem. In Barbados, farmers were unwilling to use poultry litter in their feed because they felt it was unhygienic and would lead to diseases among their animals.
5. In some cases, their reluctance was based on problems they perceived would occur in the long term. Thus, although poultry litter was available

free of charge at the time of the project, they feared that once the technology was adopted as a by-product for animal feed, a price might be eventually charged and costs would go up.

5.2. Other examples

With the advent of the Pink Mealy Bug it was felt that quick eradication should be the strategy since the pest was only present in isolated areas. Thus, the initial message was to "spray, cut and burn". Initially, when the attacks were seen only on the relatively small hibiscus plants, the recommendations did not seem to pose much difficulty. When, however, the attacks spread to large trees, it became quite evident that the recommendation would be extremely difficult, if not impossible to apply. There was hardly any other logical choice than to search for effective biological control measures.

In Nigeria, the International Institute of Tropical Agriculture (IITA) stated that "...scientists can do a great deal to ensure that the technology they develop has characteristics that encourage adoption." (Anon, 1994, p.8). The article then gives the rationale for opting for biological control for the control of the cassava mealy bug that had been devastating the crop in several countries:

Our understanding of the African environment precluded chemical control. We also realised that resistant varieties, even if they

could be developed quickly, would not be sufficiently rapidly adopted to solve the problem in a continent with poorly developed extension services. Hence the strategy of biological control was adopted, and its outstanding success is now history (p.8).

Harris (1995) discussed the difficult issue of promoting appropriate soil conservation measures among banana farmers on hillsides. He examined the feasibility of using "soft" biological technologies that were considered cheaper and more user friendly. These included (1) use of crop residues as mulch (used for a long time by hillside farmers in Paramin, Trinidad) and (2) planting grass lines with Vetivier grass. However, even with these rather simple technologies he had to be sensitive to farmers' reactions e.g. the grass impedes the movement of workers uphill and downhill.

Among his conclusions he emphasised that:

The real problem is that, although people pay lip service to the notion that combating erosion is a good idea, the consequences of not doing so are too far in the future. We, as scientists, must demonstrate more tangible benefits from land management practices such as these if we are to see them adopted (p.230).

There now seems to be a growing understanding of the relationship between

the appropriateness of the technology and its adoption. However our eagerness to rapidly increase productivity in the past may have caused us to overlook that aspect, leaving us with a legacy of problems that we are still struggling to overcome. This issue has been raised with the efforts to develop the dairy industry in Trinidad. A report (TAHAL, 1991) pointed out that after 25 years of research, there was still discussion as to the most suitable animal for milk production. The purebred Friesian-Holstein that was introduced from temperate countries could only survive under very high levels of nutrition and management. On the other hand, part of the success in the transformation of Indian agriculture has been attributed to the fact most of the technologies were developed indigenously (Anon, 1998b).

On-farm research, however, is not without problems. It is more costly and time consuming and it does not generate as many "scholarly" papers as traditional research. It thus suffers from a lower status within the academic community. Questions have been raised, too, as to its ability to develop technologies that will really enable small farmers to make the jump to being successful commercial farmers. Thus, it has become stuck with the small farmer label. However, that is changing as the U. S. and Canada among others are applying some components of farming systems research to the development of environmentally friendly technologies for sustainable agriculture

6. Conclusion

The small farmer will continue to play an important role in contributing to food security and maintaining the rural environment. They will provide stability in a constantly shifting agricultural scenario. However, we will have to look at past and emerging experiences such as those discussed in the paper to judge what strategies will be best for the future. New options may even involve introducing non-agricultural enterprises to provide enough employment in rural areas. Simultaneously, full support and encouragement should be given to those entrepreneurs who are prepared to "do battle" in the international arena since they will pave the way for others to follow.

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