6 Dryland farming: Jamaica

Background and justification

The economy of Jamaica, the third largest island in the Caribbean, is based on agriculture, aluminium and bauxite exports, tourism, light manufacturing and financial services. Although the climate is generally tropical and humid, the area to the south of the highlands that cross the island from east to west has lower rainfall than the area to the north and this has significant consequences for the types of agriculture practised in the two areas.

The southeastern section of the parish of St. Elizabeth is home to some 150,000 inhabitants and covers over 1,200 square kilometres of the semi-arid zone of southwestern Jamaica. As with the rest of the country, St. Elizabeth has two periods of high rainfall—from April to June and from September to October—which alternate with the long (November to March) and short (July to August) dry periods. Local soils tend to drain very quickly and are therefore susceptible to drought and erosion, so the regular rains do not provide enough soil moisture for crop production to be practised throughout the year. Additional water, therefore, must be supplied from rainwater storage and from sources outside the area. In recent years, this situation has been exacerbated by the late or non-arrival of the spring rains and the reduced frequency of the autumn ones, which has had a

detrimental effect on crops, livestock and infrastructure. Despite these difficulties, farmers in the St. Elizabeth area have developed profitable and sustainable agricultural practices.

Description

Over the years, with the help of extension experts from the Ministry of Agriculture (MoA), the Jamaica Agricultural Society (JAS) and private companies, the St. Elizabeth farmers have developed an agricultural system that copes with the region's semi-arid conditions. The main products of this system are cash crops such as vegetables, condiments and root crops. Tree crops such as mango, ackee (Jamaica's national fruit), sweetsop (a kind of custard or sugar apple) and cashew are grown on the edges of fields and in other suitable areas but, although they may provide some additional income, they are regarded as minor crops.

The agricultural system developed addresses the following issues:

- crop selection;
- mulching;
- water storage and conservation;
- fallowing and crop rotation;
- soil fertility management;
- disease and pest management;
- flexible activities that respond to fluctuating market conditions;
- farmer autonomy through judicious use of capital and sharing of labour; and
- research and technology transfer.

The farmers, in their effort to survive the harsh semi-arid conditions and their overwhelming desire to be independent, used a system of trial and error to develop suitable varieties of vegetable, condiment and root crops. The aim was not only to develop new varieties but also to test their resistance to pests and diseases and their ability to yield well given only a limited water supply. To this end, some of the more progressive farmers embarked on a research programme to develop suitable varieties, initially using water stored in partially sunken concrete tanks. Later, plastic water tanks were also introduced along with drip irrigation techniques.

About 15 years ago, for example, farmer and businessperson Osbourne McCarthy assumed a leading role in the testing and selection of vegetable crop varieties and has now become an authority on the system. Plant breeders provide seeds for testing traits such as pest and disease resistance, growth habits, quality and consumer preference, while agricultural chemical companies provide fertilizers, herbicides and pesticides, which are tested for their soil fertility management and weed, disease and pest control qualities. To date, about 25 crop varieties and about 30 herbicides and pesticides have been tested. Among the project's successes are the Yardley carrot variety, Gem Pear and Gem Pride tomatoes, Glory and Emperor watermelons, and Mercedes and Lexus onion varieties.

As the research continued, farmers realized that supplementing soil moisture from the limited rainfall with stored water and water piped in from outside the area would not adequately solve the problem of an inadequate water supply. To counter this, they developed a unique system of moisture conservation through mulching. This involves the use of guinea grass (*Panicum maximum*), either grown mainly for this purpose by the farmers themselves or bought from other farmers in the area. This practice leads to fallowing (growing grass on the land after producing a commercial crop) and crop rotation, which helps to maintain good soil structure and soil fertility and reduce the build-up of pests and diseases.

Mulching is now an essential part of the dryland farming system developed in Jamaica. It reduces evaporation from the soil, maintains an even soil temperature, prevents soil erosion, controls weeds, enriches the soil, protects such delicate crops as tomatoes and watermelons, and anchors the tendrils of vine crops. Indeed, many farmers in the St. Elizabeth area often will not plant cash crops unless they have a guaranteed supply of guinea grass. At about US$100-$130 a tonne, the grass is expensive, but the benefits of using it far outweigh the costs. One hectare of land produces between 4 and 10 tonnes of grass. The amount of mulch required varies from crop to crop, with tomato, watermelon, yam, cucumber and beans requiring more than cassava, carrot, escallion, peanut, onion, thyme, pigeon pea, corn, pepper, garlic and eggplant (some of which can even be grown without mulch in certain areas).

Typically, a field will be mulched and a high-mulch crop planted immediately. Fallowing and crop rotation help to maintain soil fertility, promote soil regeneration and reduce soil erosion. Although crop rotation usually involves changing the crop after each crop cycle, in southern St. Elizabeth, several cycles of the same crop may be repeated. For example, during a good rainy season or with irrigation, three to four watermelon crops may be grown, followed by low-mulch crops such as onion or carrot and then cucumber. This rotation will take about two and a half years and is usually followed by pigeon pea and guinea grass crops and then by escallion or thyme, which are typically grown on the same field for at least three years.

For irrigation, rainwater is collected and stored in metal and plastic drums and in partially sunken tanks and is used sparingly when necessary during the dry season. On small farms of less than 2 hectares, crops are watered manually by hand sprinklers, mini-drips and, very occasionally, overhead sprinklers. Larger farms usually use overhead sprinklers and the mini-drip system, which has been specifically adapted to local conditions and can operate with a water storage capacity of as little as 4,500 litres. The mini-drip system is the most efficient way of using water. Since 2000, a Ministry of Water and Housing scheme has been encouraging farmers with more than 10 hectares of land to use drip irrigation to

expand their productive areas. At present, however, the scheme does not supply enough water to satisfy demand, so farmers have to share the limited resources and make up shortfalls by buying water elsewhere. Farmers believe, though, that the water shortage could be relieved by piping water from wells tapping into an aquifer in the local Newport limestone formation or, as the study area has no surface water, from the Black River, which flows nearby. The farmers also hope that the Government will establish a system for paying for water.

Soil fertility is maintained by applying commercial fertilizers, mulching, crop rotation, fallowing and the use of such practices as minimum tillage, land clearing, herbicides and judicious water use. Occasionally, more fertilizer than required is applied, but farmers maintain that any excess will be used by successive crops (although there have been cases of excess nutrients in the soil). Fertilizer is applied at rates of about 1 tonne per hectare some three to four days before planting. A similar quantity of ammonium sulphate is then applied about three to four weeks after seed germination.

Pests and diseases are also controlled by chemicals as well as by the practices of crop rotation and fallowing and the selection of resistant crop varieties whenever possible. Here, the dry conditions can be advantageous, as many pests and diseases flourish in moist environments. Pesticides and insecticides are used sparingly, although applications must be increased during the rainy season when the risks are highest. Chemicals from different groups of active ingredient are applied in rotation in order to avoid pests and diseases becoming resistant to them.

Farmers use their knowledge of local environmental conditions and market demand to plan cropping and planting cycles that obtain the highest possible returns on outputs. MoA, seed and fertilizer companies and other farmers provide technical assistance, as do various MoA projects such as the Domestic Food Crop and Marketing Programme, the Fruit Tree Crop Project, the Rapid Water Response initiative and the tank building programmes.

Partnerships

The St. Elizabeth study area has close links with various government and private institutions, including MoA and the Rural Agricultural Development Authority (RADA), as well as local organizations and associations. Collaborative projects in the study area include: the Joint Food Project with the International Centre for Environmental and Nuclear Sciences (ICENS) of the University of the West Indies; RADA and the MoA Rural Physical Planning Division (RPPD), which aims to determine the nutrient status of the soil and food and to test levels of harmful heavy metals in food samples; joint testing of soil and plant-tissue samples with RPPD, RADA and the Antilles Chemical Company, a private fertilizer company; and testing of

the effects of different fertilizer application rates on specific crops with Agro-Grace, a chain of farm stores, and the Antilles Chemical Company.

Replicability

Many of the project area's crop husbandry practices—including the mini-drip irrigation system and the use of guinea grass for fallowing and to provide livestock feed—are simple, do not require a large capital outlay, are not location-specific and produce good returns. As a result, they could be directly applied or adapted to fit similar dry areas of Jamaica or other countries, especially if thorough research is used when adapting them to specific local conditions.

Lessons learned

While the dryland farming system has many positive features in terms of low technology use, crop selection, soil moisture control, use of agricultural chemicals and flexible cropping patterns that are adapted to changing climatic and market conditions, it also has some negative features relating to the overuse of fertilizers and the use of fire for land clearance, which sometimes results in the uncontrolled spread of wildfires.

Impact

The parish of St. Elizabeth is the breadbasket of Jamaica, producing more than 24 per cent of the country's total food crop. Farmers in the project area are among the most progressive in Jamaica and enjoy better infrastructure and a higher standard of living than many of their colleagues elsewhere in the country. Among the reasons for their success is their willingness to share labour by working for each other when required, combined with their use of hired labour. The quality and quantity of the agricultural output that they produce have also improved significantly over recent years. Overall, the system is sustainable and promotes the conservation of limited biodiversity resources. It has generated self-reliance among local farmers and an understanding of the value of research and technology transfer.

Future plans

In view of the Government's plans to increase agricultural productivity and production in order to satisfy local market demands, including from the growing numbers of hotels and restaurants, there is a need to carry out further research into soil fertility management, chemical pest control, harvesting and post-harvest treatments within the study area. More frequent and systematic soil and plant tissue tests should be carried out and farmers need more training and education in the use of fertilizers, chemical pest and disease control, and the drip irrigation system.

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