The economics of soil conservation: The case study of the Fiji ginger industry

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ABSTRACT Ginger is one of Fiji's major agricultural industries. Severe land degradation now threatens the production base of the industry. Despite the financial benefits from adopting simple soil conservation measures, farmers have shown little interest in investing in them. To reverse this situation a combination of measures involving legislation, fiscal incentives, and information dissemination is proposed.

GINGER AND ITS PLACE IN THE FIJI ECONOMY

Over the last two decades root ginger has become one of Fiji's major agricultural industries. The main trade is in the export of mature fresh ginger rhizomes to North America, resulting in a significant ginger processing industry based on the brining and syruping of immature ginger. Export earnings now approach F$4(US$2.7) million, which means that ginger has become the second or third largest export earner depending on the copra price.

This high value crop has extremely labor-intensive production and marketing. All the numerous husbandry operations, ranging from land preparation to harvesting and packing, are accomplished completely by hand. Some 800 growers generate an estimated 250,000 man-days of employment (Agricultural Commodities Committee, 1985). The average harvested area is smaller than a hectare for mature ginger and considerably less for immature ginger. Although some farms, operated by Chinese growers, are as large as 6 ha, they have been found to be well in excess of optimum size and are often associated with the most severe land degradation.

Ginger is grown within a 80-km radius of the capital city of Suva (see map). The mature and immature crops tend to be grown by separate groups of farmers in different locations within the ginger growing perimeter. The immature ginger sector is dominated by Fijian smallholders and accounts for over 90% of the farmers and the planted area. Fijian farmers also make up about 75% of the mature ginger growers, cultivating 30% of the area, and account for 25% of production. The bulk of mature ginger production comes from the Chinese growers, many of whom are recent immigrants from China. The Fijian farmers are largely settlers from the outer islands who

A detailed analysis of this industry and its development is presented in McGregor (1988).
Ginger growing areas of Fiji
entered the industry after the collapse of the government sponsored Lomaivuna smallholder banana scheme. Both the Chinese and Fijian growers lease their land from the area's land owners via the Native Land Trust Board (NLTB).

FARMING SYSTEMS AND LAND DEGRADATION

Ginger is an annual crop that is planted in the spring. Immature ginger is harvested within 6 to 6.5 months, and mature ginger within 10 to 12 months. The ginger and commercial root crop industries are closely interdependent, with ginger grown in rotation with dalo (taro) and cassava. A recent significant increase in commercial root crop production can be partly attributed to the growth in the ginger industry.

Ginger thrives in a high temperature/high rainfall environment but demands well drained soil. Fiji's growing area has an ideal climate, with rainfall exceeding 3,000mm annually, accompanied by a prolonged hot season. However, the soil and topographical conditions are less than ideal. The soils are deeply weathered and strongly leached, range from acid to very acid, and have low to moderate fertility. In their virgin state, these soils have well developed profiles of sound structural stability. However, when used in excess of capability (e.g., ginger and root crops grown on excessively steep slopes), the soils become highly eroded. Other parts of Fiji have soil and terrain quality better suited to ginger growing. However, the government policy has concentrated production within a confined geographical area to safeguard the interests of growers already in place.

Farmers frequently tend to move to new land to reduce nematode infestation. There is a preference for steep land (15° to 30° and even greater) to avoid water logging. Land shortages also force some farmers into using steeper land, and about 40% of the main ginger growing area has slopes of at least 15°. Cultivation is often up and down the slope (Fig. 1). The justification for this practice is to ensure that water does not stagnate around the ginger roots in high rainfall conditions where the heavy clay soils often have compacted sub-horizons. Farmers also often maintain that hand cultivation is easier when working into the slope rather than across the contour.

The erodibility of the soils is compounded by the frequency of intense rainstorms. The record for the area is 720mm in 24hs in 1980 during Hurricane Wally (Campbell, 1984). The ginger/root crop rotation leaves the crop exposed for extended periods. The soils used for immature ginger are particularly vulnerable because immature ginger is harvested in the wet season and grown in rotation with cassava.

Available evidence indicates that land degradation in the area is not only serious but also rapid. The Universal Soil Loss Equation (USLE) calculations by Clarke and Morrison of a typical ginger/dalo farm at Waibau found soil losses in the order of 85t/ha/year (Clarke and Morrison, 1987). Their measurements show consequent reductions in carbon, calcium, and magnesium and increases in aluminium to toxic levels. The Soil Conservation Officer from the Ministry of
Primary Industries (MPI) estimated the soil loss for ginger grown on slopes of 12 to 15° to be 135t/ha/year without no soil conservation measures (Prasad, 1986). These loss rates are far in excess of the maximum "soil-loss tolerance" factor suggested for tropical areas. Rill, gully, and sheet erosion are evident throughout the area (Fig. 2).

The cultivation practices used in Chinese market gardens located in the environs of Suva in the 1930s and 40s are reported to be similar to many of today's ginger/root crop farmers (Jack, 1937; Parham, 1954; Clarke and Morrison, 1987). Most of these areas are now characterized by a total disappearance of soil.

Thus, despite the absence of systematic quantitative evidence, the production base of Fiji's ginger growing region seems to be deteriorating at an economically unacceptable rate. The viability of many farms, and eventually the industry itself at least in its present location, is threatened. The socioeconomic dimension of the problem is compounded by the area's high population density and its close proximity to Suva, which supports a large number of settlers from the outer islands.
FIG. 2 Sheet, rill, and gully erosion in Waibau.

EXTENSION RECOMMENDATIONS AND FARMER RESPONSE

An extension effort, which is relatively concentrated and commodity oriented, is now directed toward the ginger industry\(^2\). The MPI is promoting a package of practices that incorporates simple soil conservation measures. This package includes contour planting, simple hand dug contour drains, vetiver grass strips and/or double rows of pineapples, and appropriate crop rotations to minimize the incidence of nematodes (see MPI, 1987)\(^3\). Planting on slopes above 15° is not recommended.

\(^2\)The ginger/root crop extension team is composed of a technical officer, six extension officers, and three field men. They are supported by a Soil Conservation Officer, who is also responsible for the sugar growing areas. The Fiji Fresh Ginger Exporters Association also employs its own extension officer.

\(^3\)The recommendation for land in the slope range of 8-11° is for 5 contour drains (30cm x 30cm) per hectare, together with 0.5m wide vetiver grass strips (or pineapples) every 20m. To minimize nematode problems a four-year crop rotation of ginger-dalo-
Selected ginger/dalo "model" farms have been used by the MPI Soil Conservation Officer to demonstrate the effectiveness of these low cost measures. For example, vetiver grass strips were widely used as a soil conservation measure in the sugarcane areas of Fiji in the 1940s and 50s. Although most of these strips have been subsequently ploughed in to increase the area under cane, those that remain show the beneficial effect of this measure, particularly when associated with contour drains and strip cultivation. As a consequence of the Fiji experience, vetiver grass is now widely used in India as part of its soil conservation programs.

It has been shown that the adoption of these measures by farmers would be financially and economically worthwhile (Buresova, 1988). Using data obtained from farmer and extension staff questionnaires, Buresova undertook a "with" and "without" analysis for an average sized (0.525 ha) ginger/root crop farm. The estimated net present value (NPV) for a farm adopting the soil conservation measures was F$85,400, compared with F$47,500 for a farm not adopting the measures. (A discount rate of 13% was applied to a 15-year income stream.) The difference is due largely to yield differentials between farmers adopting and not adopting the measures. Buresova estimated that after one year the productivity of farmers adopting the measures was 10% higher than those that did not, with the difference increasing to 30% after five years. The income stream also included a cash subsidy payment of F$400 in each of the first two years.

Prasad (1986), using a partial budgeting/break-even methodology, also found that the adoption of a similar soil conservation package was financially attractive to farmers. He estimated the net revenue gain for a good farmer adopting the measures would be about F$500/ha/yr. These results were based on the following considerations: the cost of establishing the strips and drains amortized over a ten-year period, the revenue loss from the area occupied by strips and drains, the estimated loss in productivity from not adopting the measures, the estimated savings in fertilizer usage when the measures are adopted, and the revenue from the sale of pineapples used in conservation strips.

Despite the apparent financial benefits derived from investing in simple soil conservation measures, farmers generally have shown little interest in adopting them. Granted, the lack of systematic data could lead to an overestimation of the adverse impact of existing land-use practices on productivity. However, two reasons probably perpetuate prevailing cash cropping practices: (1) the farmers' preference for immediate cash earnings is significantly higher than the analysts had assumed and (2) there is a lack of knowledge about proper land management and its benefits.

Smallholder settler farmers who cultivate land on relatively short leases can be expected to prefer immediate cash earnings. By ignoring future returns, these farmers give scant regard to the land-use requirements of future generations. The Chinese immigrant ginger farmers probably perceive their position as even less secure.

cassava-fallow-ginger is recommended, along with the avoidance of land previously planted for bele, yams, bananas, and tomatoes.
and thus view intensive cash cropping as an interim step to other more remunerative economic activity.

Prior to 1966, legal lease arrangements could have an annual tenancy basis. The Agricultural Landlord and Tenants Act (ALTA) represented a major reform by allowing for 30-year leases. Most of the current leases under ALTA expire around the turn of the century—although the Act does provide for an additional 20 years' extension for land outside Native Reserve. ALTA also has provisions to compensate farmers for improvements made with the consent of landowners. These leases also contain a "good husbandry" clause requiring tenants to "farm and manage the land in such a way as to preserve its fertility and keep it in good condition." Leases can be legally cancelled if repeated noncompliance occurs. Yet the NLTB as landlord has seldom cancelled any leases probably because of: the absence of coordination between NLTB agents and MPI extension staff, the lack of clear guidelines of what constitutes bad husbandry practices, the limited resources, the training and background of NLTB agents, the priority given to rent collection, and a lack of appreciation of the magnitude of the land degradation problem by both the NLTB and the landowners themselves (Ministry of Primary Industries, 1987b).

Meanwhile, the average farmer remains ignorant of the needs and requirements of soil conservation and continues to cultivate up and down the slopes. The extension effort, while relatively intensive, has an inadequate soil conservation component. The MPI has only one Soil Conservation Officer. He is also responsible for the sugarcane growing areas, which are themselves characterized by extensive land degradation problems. Extension staff, like farmers, are more concerned with immediate production problems such as seed treatment, fertilizer application, and immature ginger harvest scheduling.

**RECOMMENDATIONS FOR APPROPRIATE POLICY AND IMPLEMENTATION MEASURES**

If the rate of land degradation in the ginger growing areas is to be stabilized at an economically acceptable level, sustained action must involve a balanced combination of appropriate "carrot and stick" measures and information dissemination. Concentration on any one aspect in isolation will be ineffective because all are mutually reinforcing. Thus, in 1987, an integrated project approach was launched known as the Waibau Integrated Soil Conservation Pilot Project; it was formulated under FAO technical assistance (Ministry of Primary Industries, 1987b). The project had three major components:

1. The "Stick." While existing legislation for enforcement is adequate, it needs to be exercised. The ginger growing area (the project area) should be declared a Conservation Area under the Land Conservation and Improvement Act. This designation would cause the NLTB and Soil Conservation Officers to focus on the conservation

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4 Reserved land is for the use of the land holding group. However, Fijians, who are not members of the land holding group, can obtain access to this land by obtaining a J lease. Such leases are not available to non-Fijians.
area with the view to terminating the leases when there is repeated
noncompliance with the "good husbandry" requirements.

2. The "Carrot." The farmers who meet the "good husbandry"
conditions of their leases would qualify for a cash subsidy to be
paid toward the farmer's own labor (75% of costs) used in planting
vegetative strips and leucaena hedgerows and in constructing simple
drains. This subsidy would be paid in accordance with plans
prepared by Conservation Officers and supervised by extension staff.
The rationale for such a subsidy is to offset the farmers' preference for immediate cash earnings, as opposed to investment in
longer-term soil conservation measures.

3. Information Dissemination. At the beginning of the project, a
demonstration farm would be established on typical topography. It
would be centrally located and commercially operated by a ginger
farmer of proven ability. Maintained on a permanent basis, the farm
would provide a focus for the project, as well as demonstrate the
measures expected of farmers and the actions required for the
subsidy. The farm would also be used to train extension and NLTB
staff in soil conservation requirements and their benefits. The
extension staff could then adopt an appropriate Training and Visit
(T&V) system of extension focused on increasing the adoption rate of
conservation practices and improving the overall cultural packages
ginger production.

The project also proposed an adaptive research program. The
objective would be to develop sustainable agricultural systems for
the hilly parts of Fiji, particularly the wet areas. The research
would also generate systematic data on the extent and rate of land
degradation. The project could also be a catalyst for a
comprehensive, nationwide educational program about soil
conservation in the schools and the media.

The project's cost over a three-year period was estimated in 1987
to be approximately $500,000, which included provision for
incremental staffing and the cost of the cash subsidy. Buresova
conducted an economic benefit/cost analysis of the project from the
viewpoint of society (Buresova, 1988). This involved the
aggregation of 126 farms covering an area of 66 hectares. A "with"
and "without" project methodology was again utilized, in which it
was assumed that soil conservation measures would not be adopted
without the project. Buresova estimated, and applied, a discount
rate (9.81%) that reflected the longer-term perspective taken by
society as a whole. Given the surplus of labor in the project area,
he also estimated shadow wage rates that more accurately reflected
the demand and supply of labor and thus its economic value. The
incremental economic NPV of the project over a 15-year period was
estimated to be $2.5 million.

The Waibau Project had the endorsement of the Ministry of Primary
Industries, the Agricultural Commodities Committee, and the General
Manager of the NLTB. However, implementation was stalled by the
unprecedented political and financial instability of 1987. In that
year Fiji had two military coups and six political administrations.
The ensuing financial crisis resulted in the termination of all
agricultural subsidies, as well as significant reductions in the
civil service. While many of these general subsidies were ineffective and merely represented transfers from taxpayers to farmers, 1987 was hardly the appropriate time to introduce a new cash subsidy to farmers, no matter how specific and justified (McGregor and Lee, 1986), nor was it a time to request additional staff. Yet the need for measures to encourage soil conservation is greater than ever and should be given the highest priority.

REFERENCES


