

Changing food production systems among smallholders

Koczberski, G., Curry, G.N., Nake, S., Gemis, E., Bue, V. & Tilden, G.

This Technical Note in this series on food security, examines how LSS smallholders are responding and adapting to declining access to garden land to maintain household food security. As outlined in Technical Note 34, up to three generations of people are now residing on LSS blocks and the full 6 ha are now planted to oil palm. Yet, despite growing population and consequent income and land pressures, food gardening continues to be an important daily livelihood activity. Garden crops continue to be a major component of daily meals and provide an important source of income for smallholders, especially women. This note identifies how smallholders are responding to the reduced area of land available for food gardening. Adaptation is more than simply intensifying the production of food crops, it also involves new innovations for accessing land which have been effective in increasing the supply of land available for food production.

ADAPTATION STRATEGIES

Farmers in PNG and across the Pacific display considerable adaptability and responsiveness to changing economic, environmental and institutional circumstances. Historically, populations survived gradual and rapid change by adaptation. LSS smallholders are no exception; they have been responding to increasing population and shortages of gardening land in several ways including:

- ◆ Intensifying garden production
- ◆ Diversifying income sources
- ◆ Increasing the proportion of store foods in daily diets
- ◆ Resettling family members on nearby customary land
- ◆ Locating gardens in new areas on and off the LSS block
- ◆ Developing exchange relationships with other growers to increase the supply of land available for food gardening

Evidence of the use of these strategies was supported by data collected from the household and garden surveys described in the first note of this series (Technical Note 33).

Intensification of garden production

A key response by smallholders to land pressures has been through agricultural intensification. Since 1975, when the first food garden surveys were conducted on the Hoskins LSS (Benjamin 1977), there has been an intensification of food garden production. More recent garden data collected by Bue (2013) and in the current ACIAR project indicate that:

1. There has been a significant reduction in the fallow period and increased cultivation periods over the past 15 years.
2. Compared to 1975, smallholders are planting less sweet potato and yams and relying more on bananas, Chinese taro and

cassava (Table 1) (this pattern does vary somewhat amongst different ethnic groups). Shorter fallow periods result in the depletion of soil nutrients and these new crops have the capacity to tolerate less fertile soils. Twenty years ago cassava was an insignificant crop. Smallholders are also planting quicker maturing crop varieties such as *wan mun* sweet potato and *kiaukiau* banana. *Wan mun* kaukau is ready to harvest after 3 months compared with older varieties that take over 6 months to mature.

Table 1: Main garden food crops grown in smallholder food gardens in 1975 and 2010-2015.

Food crops	1975*	2010- 2015*
Main food crops	1.Sweet potato 2.Chinese Taro 3.Taro 4.Yams (area)	1.Banana 2.Chinese Taro 3.Sweet potato 4.Cassava (area & % of gardens)

* Benjamin 1977 Survey of 140 gardens at Kapore, Tamba, Sarakolok, Buvussi, Galai, Kauvui and Kaugara subdivisions. Bue 2012, survey of 118 gardens at Kapore subdivision. 2015. Household surveys, data on 230 gardens at Kapore, Tamba, Sarakolok, and Buvussi

3. Many smallholders now apply fertiliser and pesticides in their food gardens: such practices were not observed in 2000-2001 (Koczberski et al 2001). In 2015 pesticides were applied to some crops in 40% of gardens surveyed at Bialla and 24% at Hoskins.

4. Legumes such as peanuts have been incorporated into crop rotations.



Plate 1: Smallholder replant section

5. Smallholders are now intercropping replanted juvenile oil palm with food crops, a practice not observed 15 to 20 years ago. These gardens are intensively cultivated for up to 2 to 2.5

years until they are shaded out by the maturing oil palm.

Income diversification

Smallholders are also adapting to declining access to land by diversifying their income sources. Whilst income from oil palm and food gardening provide the bulk of household income, many families draw on several income sources. The average number of income sources per smallholder household (excluding oil palm) is 5.5 and 5 for Hoskins and Bialla respectively.

Purchased food is very important for diet quality. Cash enables smallholder households access to appropriate foods for a nutritious diet. For example, fish and meat are very important nutritionally but the PNG traditional diet of bulky root crops is low in protein and energy. On the LSS most protein consumed is purchased.

Access to cash income also enables food to be purchased during environmental shocks or stresses like pest outbreaks or droughts and floods, or if land disputes disrupt garden food supply. Income diversification demonstrates the adaptability of smallholders to adjust their labour and land-use strategies in response to negative changes, and their capacity to exploit economic opportunities as they arise.

Expanding the supply of land on and off the block

Despite most smallholders planting their full 6 ha LSS block to oil palm, 60% of gardens are on smallholders' own blocks (Figure 1). Gardens are cultivated at the rear of the block on small plots of land not planted to oil palm. Some smallholders are bringing into production small patches of land not previously cultivated or which were considered unsuitable for gardening (e.g. hilly sites).

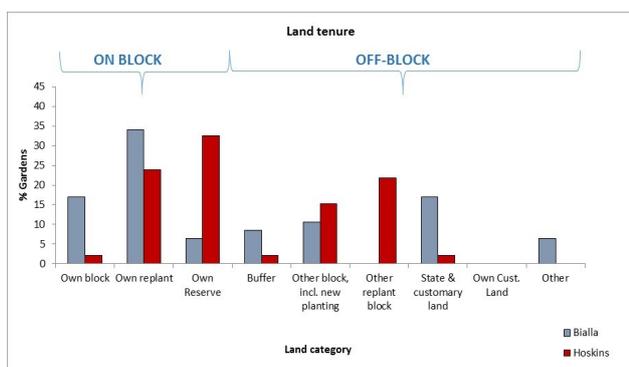


Figure 1: Location of food gardens.

Some smallholders are not replanting the full number of palms at the replant stage and instead omitting an edge row of palms to make land available for food gardens. Thus, as land pressures rise, land access strategies have begun to be developed which most often includes land next to the house site, edge rows of oil palm and steep sections of the block not suitable for oil palm.

An important strategy smallholders have adopted in response to reduced gardening land on their own LSS blocks has been to establish food gardens off-block.

Forty per cent of gardens at both Bialla and Hoskins are located

off-block (Figure 1). This has been achieved by:

- (i) resettling family members on nearby customary land
- (ii) locating gardens on someone else's LSS block, or on State or customary land.
- (iii) developing relationships with other growers to increase the amount of land available for food gardening.

More distant gardens means that more time is spent travelling to and from the garden. Also, those gardens cultivated on State or customary land, have less secure tenure, and theft of food crops can be a significant problem.

A key innovation to expand the supply of land available for food gardening has been the adoption of intercropping of immature oil palm with food crops. On the Bialla and Hoskins LSS, 53% and 45% respectively of all household gardens were located in oil palm replant sections, either on smallholders' own blocks or in the replant sections of other smallholders (Figure 1). Thus replant areas now play a critical role in food production and food security on the LSSs. By gardening on replant sections smallholders are not only using their small parcels of land more efficiently, they are also exploiting the few areas of high soil fertility available on the blocks (fertiliser for juvenile palms is applied in replant sections).

Development of exchange relationships

As replant sections become more important for food production, social and kinship networks are becoming critical for assisting smallholders to access additional land for food production. It is now common for a block-owner to allocate plots of land within his/her 2 ha replant section to people residing on other leasehold blocks. Most often these people are relatives, friends and neighbours living on other blocks where land is short and there is no replant section available for gardening.



Figure 2: replant section

Figure 2 is a 1-ha replant section on an LSS block. Sixteen garden plots were cultivated by 13 different households on this 1 ha replant section. The photo is one garden plot within a replant section and shows peanut seedlings protected from birds with

banana stalks. Of the 16 garden plots, six were cultivated by individuals living on the block and the remaining gardens were cultivated by friends and relatives residing on other oil palm blocks.

People from other blocks cultivating gardens on this replant section were a mix of:

- (i) people who previously allowed the owner of the replant section to cultivate gardens on their own block when a replant section was available for gardening. Thus there was an existing exchange relationship between the parties; or
- (ii) people who for the first time had accepted the invitation to garden in the replant section.

Both groups were aware of their future obligations to the block owner to reciprocate access to land on their own oil palm block when oil palm replanting occurs and land becomes available for gardening. By allocating garden land to non-resident households, the blockholder is securing his/her future access to land for food gardens and gaining experience of managing such reciprocal relationships.

These reciprocal land access arrangements have now become common on the LSS and are a way of responding to land pressures. These arrangements serve to:

1. Expand access to garden land
2. Ensure access to land for gardening in the future
3. Introduce flexibility into a rigid lease agreement
4. Assist households to better manage risk
5. Reduce household vulnerability to food insecurity

If smallholders were dependent solely on the land on their own blocks for food gardening, they would be exposed to much higher levels of food insecurity.

The use of exchange relationships to gain temporary access rights to land and other resources is not new in PNG. Until recently, however, such strategies were not practised widely (if at all) on the LSSs, largely because most smallholders living on the LSS blocks generally had sufficient access to land for food gardening. As land pressures have increased, traditional arrangements of accessing land which operated within customary land tenure principles in rural villages, are now being transferred to leasehold land as a way to manage food security risks associated with rising land and population pressures.

Increased reliance on purchased foods in daily diets

Another way in which smallholders are responding to less gardening land is by increasing their consumption of purchased food.

Although garden produce is eaten virtually everyday as part of the main meal (see Technical Note 36), it is now common place for purchased foods, either from stores or local markets, to form part of most meals.

For example, in a 24 hour dietary recall survey conducted among 181 households in 2016, 91% of all evening meals contained some foods that had been purchased (mostly from the store, but also from the market — 51% of the meals consumed contained some rice). These results differ considerably from other rural populations in PNG where the consumption of rice is

much lower (e.g. Saweri 2001). Thus, access to a steady and regular income to purchase food is one strategy for overcoming land shortages for food gardens and reduces a household's vulnerability to food insecurity.

Technical Note 36 in this series will focus on food utilisation. This will explore in more detail food consumption patterns, food sources and their nutritional value.

CONCLUSIONS

Smallholders are adapting to demographic and economic pressures through pursuing a range of strategies to maintain food security. Some of these strategies, such as agricultural intensification have been reported elsewhere in PNG among farming households residing in areas under land and resource pressure. What are less often observed are the innovations introduced into farming systems by farmers themselves. Oil palm farmers are finding new ways to manage and mobilise land through expanding social and kinship networks and introducing new land access arrangements. These changes are important for reducing uncertainty in the farming system. It is through a combination of adaptive strategies and importantly, innovation, that oil palm farmers are successfully maintaining household food security. The link between food and nutritional security is discussed in the next Technical Note (36)

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For further information contact:

Steven Nake, OPRA
Head of Smallholder and Socioeconomic Research
Dami Research Station
PO Box 97, Kimbe
West New Britain Province, Papua New Guinea
Tel: +675 985 4015/4009
e-mail: steven.nake@pngopra.org.pg