IMPACT ASSESSMENT OF THREE IMPROVED TARO (*COLOCASIA ESCULENTA*) VARIETIES IN THE MOROBE PROVINCE, PAPUA NEW GUINEA.

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ABSTRACT

In 2001, the National Agricultural Research Institute released three new taro varieties from its taro breeding programme. The breeding programme was funded by AusAID under the TaroGen project. Since the release, a considerable amount of planting material has been distributed to farmers. To capture the impact of the new technology, an impact assessment survey was conducted in the Morobe province to estimate how the target beneficiaries, their households and communities will benefit in the longer term as a result of these taro varieties and to identify drawbacks of the released material for further research if needed. Apart from the TLB resistance and high yielding characteristics of these varieties, the farmers interviewed found the taro varieties to have impressive plant growth characteristics which are of importance and play a major role in production of the crop. The varieties have shown outstanding performance in farmer fields as compared to local varieties. This gives significant importance to these new varieties for improved food supply and diets of the people and, alternatively, promising varieties for income generation.

Keywords: *Taro varieties, breeding programme, impact assessment survey, Morobe Province, TBL resistance, farmers fields.*

INTRODUCTION

Taro (*Colocasia esculenta* (L.) Schott), a member of the Araceae family, is an ancient crop grown throughout the humid tropics for its edible corms and leaves. The crop is also closely associated with local culture and tradition. In Papua New Guinea (PNG) the crop has retained supreme importance in the diets of the inhabitants. Quantitatively it remains the fourth most important food crop (Bourke and Vlassak 2004) and many people depend heavily upon it as a staple food.

The past few decades have seen major changes in the farming systems of PNG. Increase in insect pest and disease levels and anthropogenic activities have contributed to the loss of genetic diversity and the consequent deleterious replacement of traditional taro varieties by other crop species. In order to ensure sustainability of taro production and grower confidence in the crop, the National Agricultural Research Institute (NARI) established a taro breeding programme (Okpul *et al.* 1997). One of the major aims of the programme was to address taro leaf blight (TLB) disease, caused by the fungal pathogen *Phythophtora colocasiae*. Agronomic traits of importance such as yield, and good eating quality, were other considerations along with consistent performance of these characteristics in varied agro-ecological conditions throughout PNG. The system of breeding using recurrent selection was adopted in which breeding populations undergo sequential crossing followed by progeny evaluation and selection in a series of Cycles prior to recommendation and release of new varieties. One cycle generally takes approximately two years but this may vary between 18 and 24 months depending on the situation during the cyclic period (Okpul and Ivancic 1996). Using this breeding approach, NARI released three new taro varieties designated NT (NARI Taro) 1, 2 and 3 from breeding Cycle 2 in 2001. Selection and recommendation was based on TLB resistance, improved yield and eating quality and, more importantly, a trend of consistent performance of these traits across tested environments. Since the release, a considerable amount of planting material has been distributed to farmers directly by the institute, through the extension services and by non-government organizations. This study was aimed at assessing the impact of the improved varieties on farmers in the Morobe province.

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OBJECTIVES

The major objectives of this study were to:

- v provide an estimate of how the target beneficiaries, their households and communities in the Morobe province will benefit in the longer term as a result of adopting these varieties;
- v give an opportunity to identify drawbacks in the released material, if any, and redefine the selection criteria if necessary; and
- v provide an opportunity for rationalization of resources for further research in this area.

METHODOLOGY

Survey questionnaires were formulated based on simple direct questions offering multiple choices related to eight major areas: farmer information, location information, farm or farmer information related to taro production, acquisition, multiplication and distribution of NARI taros, adaptation and performance of the new varieties, level of adoption, impact on livelihoods and future work needed.

The selection of survey sites (Appendix) was based on the status of taro in the farming systems of the rural people of Morobe, where taro is a dominant or sub-dominant staple, and on distribution records of planting materials of the improved NT varieties. Five districts (Finschhafen, Huon Gulf, Markham, Nawaeb and Tewae-Siassi) were identified for the survey. In each of the five districts, three villages were chosen as major survey areas and ten sample farmers were chosen from each area for interview. This gave a total of thirty interviewees in each of the five districts and 150 samples overall. Groups of three to four interviewers were formed and assigned to survey sites in each district over a period of four weeks.

RESULTS AND DISCUSSIONS

Farmer Information

The numbers of men and women who participated in the survey are represented in Figure 1. Male

Table 1. Impact assessment survey sites in five districts of Morobe province

Village	District	Altitude (masl)	Annual rainfall (mm)
Kamlawa	Finschhafen	<40	4000-5000
Katika	Finschhafen	<40	4000-5000
Heldsbach	Finschhafen	<300	4000-5000
Musom Tale	Nawaeb	<40	4000-5000
Tikeleng	Nawaeb	<40	4000-5000
Morobe Coast	Huon Gulf	<40	3000-4000
Hobu	Nawaeb	200-600	3000-4000
Muru	Tewae-Siassi	<40	3000-4000
Izon	Tewae-Siassi	<40	3000-4000
Yaga	Tewae-Siassi	<40	3000-4000
Pusika	Huon Gulf	<80	2000-3000
Arifiran	Markham	200-400	2000-3000
Mutzing	Markham	200-400	2000-3000
Ragiampun	Markham	200-400	2000-3000
Noa	Huon Gulf	100-200	1000-2000

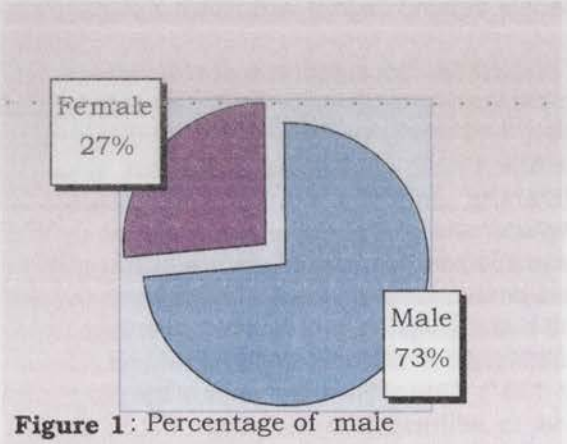


Figure 1: Percentage of male and female participants in the survey.

farmers, mostly aged between 30-45 years, dominated with nearly three-quarters of the sample population. This gave an indication that men of the older age group are actively involved in such organized activity in rural areas.

Household size of the farmers varied greatly from less than five to 15 family members. However, most families were in the range of 5-10 persons as observed in all five districts.

Depending on the household, farming land varied between families and from district to district. Nevertheless, a significant number of people cultivate land areas between 0.5 and one hectare.

Food Crops Grown by Farmers

The crops grown for own consumption include aibika *(Abelmoschus manihot)*, banana, cassava, *Xanthosoma* taro, maize, peanut, pitpit (*Saccharum edule*), rice, sweet potato, *Colocasia* taro, greater yam (*Dioscorea alata)* mami (*D. esculenta),* african yam (*D.rotundata*) and various vegetables. However, the dominant staple crops said to be grown were african yam, banana, cassava, mami, sweet potato and taro. In general, most people in all districts highly preferred banana while other staple crops, including taro, remain secondary in their diets.

For income generation, a significant number of people indicated vegetable production as a major enterprise for cash income, apart from semi-commercial crops such as betel nut and its associated mustard plus vanilla which has become popular in recent times due to its good market price.

Farmer Information Related to Taro

Farmer land under taro production ranged between less than 0.5 to one hectare (Figure 2) in all districts, but the majority of farmers cultivate taro on less than 0.25 ha of land. The produce from their land gives a good yield with most corm sizes between medium and large. The number of taro varieties owned by farmers varied between five and 15 cultivars. However, the highest percentage (49.7%) of the population responded as having at least five taro cultivars.

Farmers have various reasons for maintaining taro varieties. However, eating quality is the major characteristic on which selection of taro varieties is based. Presence of taro leaf blight (TLB) was mentioned as a common problem in the taro gardens, while virus diseases such as Alomae and Bobone Virus Complex (ABVC), Dasheen Mosaic Virus (DsMV) and Taro Vein Chlorosis Virus (TVCV) were regarded as minor diseases causing

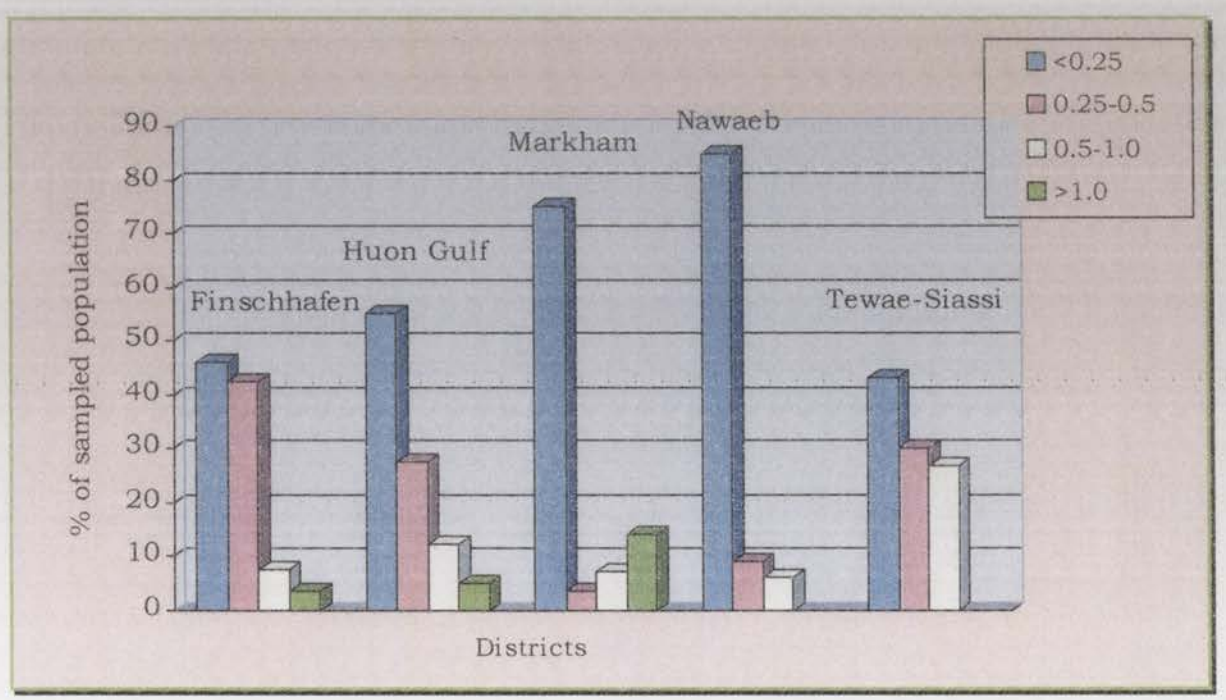


Figure 2: Farmer land under taro production in the five districts

less significant crop losses. On the other hand, taro beetle (*Papuana sp.*) is a major pest problem in all areas, causing more than fifty per cent of crop losses (Figure 3).

multiplication of NT planting material. However, farmers commented that improved NT varieties have sufficient suckering ability (5-7 suckers) in their gardens. The results gave very little indication of wider distribution of NT planting materials in all five districts and it was found that most farmers

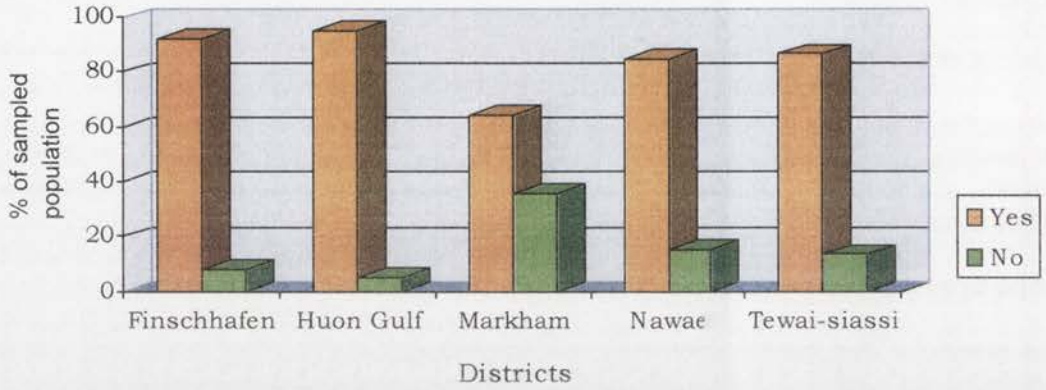


Figure 3: Farmer indication of taro beetle problem in respective districts.

Acquisition, Multiplication and Distribution of NARI Taro

Farmers indicated that most planting materials of NT varieties were obtained through extension providers in their area, while other means such as from the Morobe provincial shows and NARI open days remain restricted as there is minimal chance of getting into town for such activities. Farmers mentioned that the materials have been delivered to them without cost.

The use of suckers and the mini-sett technique were identified as common for farmers in

did not further distribute planting material to other farmers.

Performance and Adaptation of NTs

It was clear that overall, the NT varieties have better performance with outstanding growth rate and plant vigour (Figure 5) in comparison to the local taro varieties. More importantly, farmers are impressed with NT varieties for their TLB resistance. TLB incidence in the fields was rarely seen and plants remain healthy and absolutely clean. Only rare cases (Figure 6) of viral diseases such as Alomae and Bobone Virus Complex

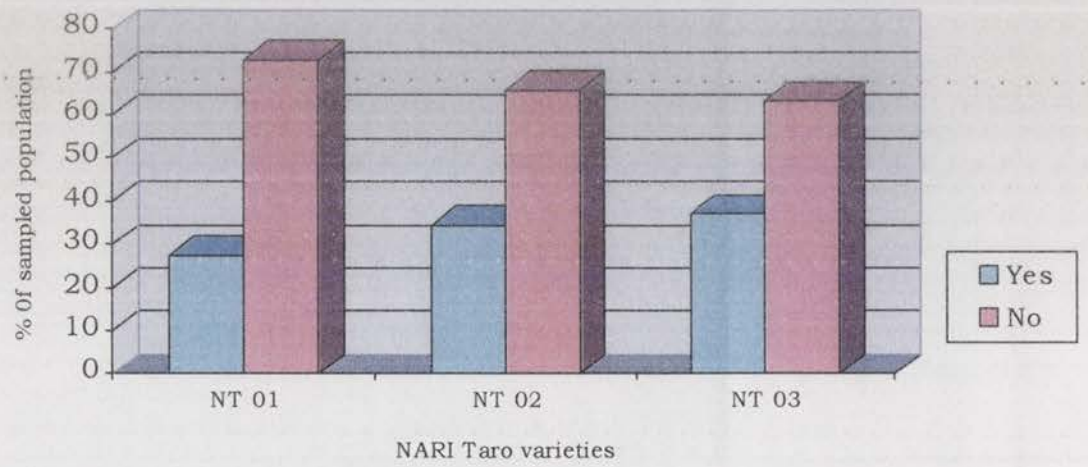
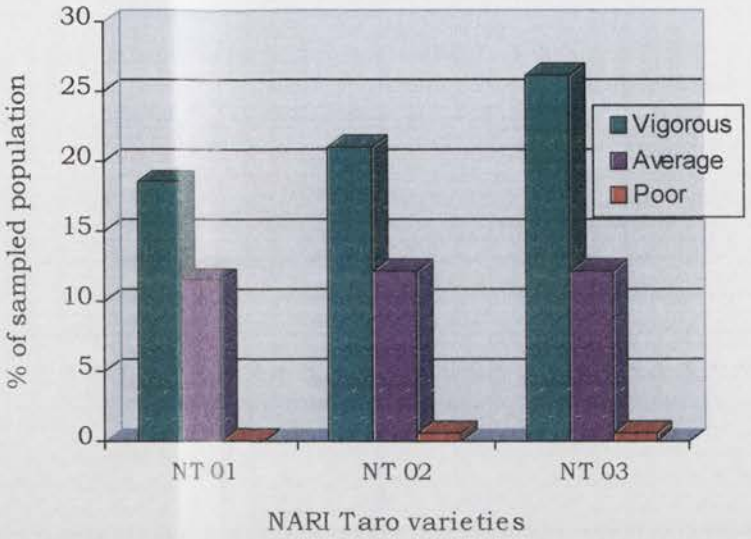


Figure 4: Planting materials of the three NT varieties in farmer fields

Figure 5: Plan growth performance of each of the three NT varieties



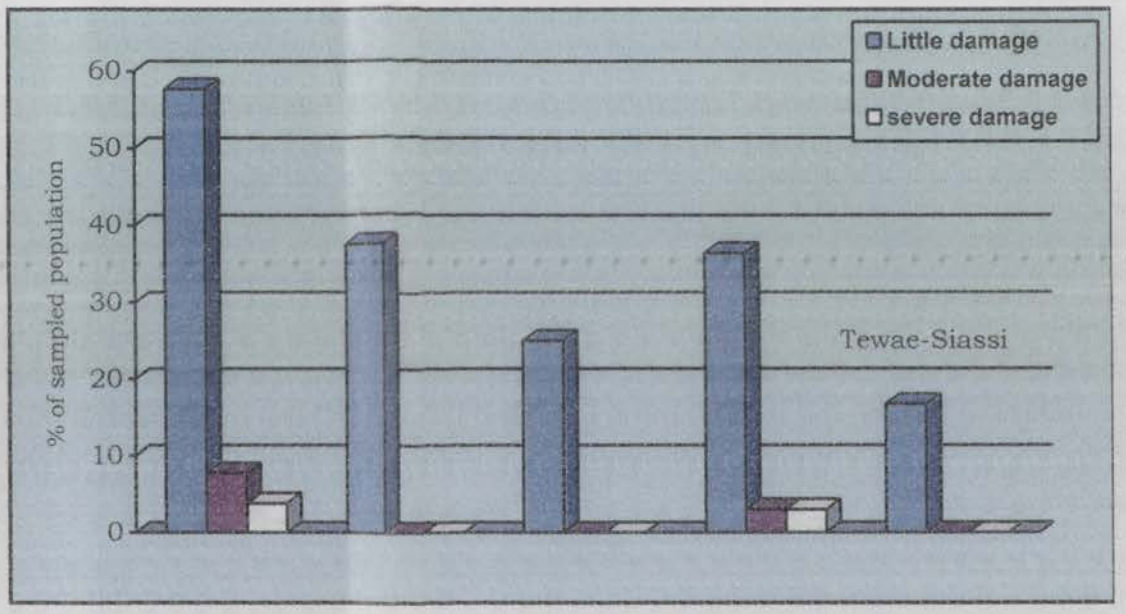


Figure 6: Effect of viral diseases in each of the five districts

(ABVC) were reported to affect the improved taro varieties.

Adoption of NTs

With respect to adoption of NT varieties, the sample population showed positive responses. Most people are satisfied with their performance and continuity of growing the new varieties is undisturbed. Farmers indicated that NT varieties are better in terms of withstanding TLB disease and production in their garden yields larger corm sizes in comparison to the local varieties. Despite this, it was observed that there is insufficient supply of planting material, especially in the Huon Gulf, Markham and Tewae-Siassi districts (Figure 7). Farmers who initially obtained the varieties retained very little of what they received and, as a result, this has restricted further distribution of planting materials. This indicates behavioral

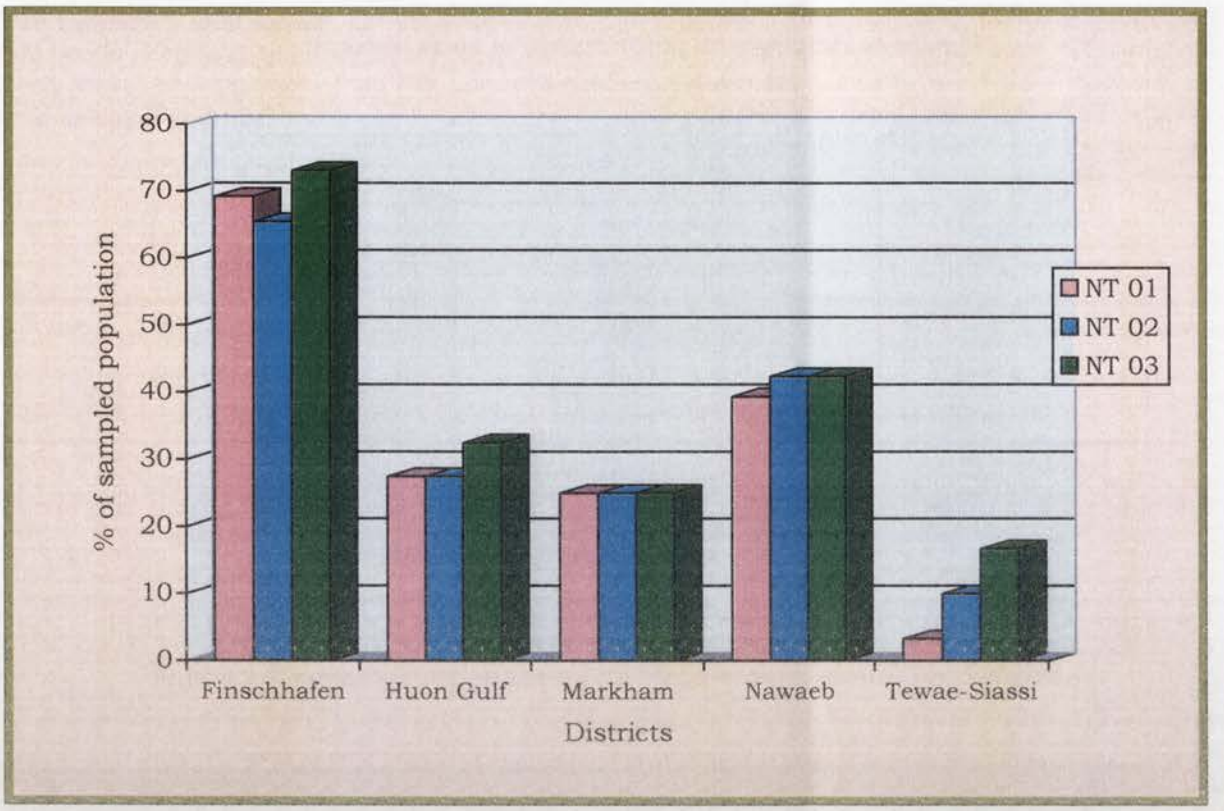


Figure 7: Estimated occurrence and proportions of NT varieties in farmer fields in each of the five districts

attitudes that many subsistence gardeners in PNG have in maintaining genetic resources.

Impact on Livelihoods

In general, the most appropriate uses of traditional taro varieties were indicated by farmers as for self-consumption, diversification, cash income and special occasions including bride price ceremonies and feasting. The majority of the population was impressed with the NT varieties because of their improved morphological characteristics such as growth vigour and large corm size. This adds significant importance to these new varieties for improved food supply in the diets of the people (Table 2). The released taro varieties have been in high demand for their usefulness in managing TLB incidence among local cultivated varieties, to the extent of creating buffers against TLB in farmer fields. Moreover, many farmers commented that the new varieties, although not yet reaching many farmers, would contribute significantly towards cultural activities like bride price ceremonies and feasting; when large quantities of taro corms are required. In addition, the new varieties are seen to have advantage in quality over local cultivars with greater potential for alternative enterprise in revenue generation.

Future work

The majority of farmers (93 %) indicated positively their wishes to collaborate with NARI in taro breeding trials and showed interest in receiving new NT varieties. Farmers viewed the most important characteristics of new taro varieties as being high yielding and having good eating quality.

Table 2: Farmer expectations of NTs on the livelihoods of people in the five districts (% of farmers)

Major impact on livelihood	• Districts				
	Finschhafen	Huon Gulf	Markham	Nawaeb	Tewae-Siassi
Improved food supply	84.6	42.5	35.7	30.3	16.7
Income generation	30.8	7.5	17.9	27.3	16.7
Less fertilizer use	0.0	2.5	3.6	3.0	3.3
Less fungicide use	3.8	0.0	0.0	3.0	3.3

For eating quality, characteristics such as stickiness and hard corm texture should be major traits for research since taro preferences are based on these features.

CONCLUSIONS

The impact assessment survey was carried out in five districts of the Morobe province where records have shown distribution of planting materials after the release of NT 01, NT 02 and NT 03 in 2001. During the survey, involvement of farming communities in responding to the questionnaire was dominated by males in every interviewed household. The male participants were, in particular, family heads and, in some cases, older persons in an extended family with an age range of 30-45 years.

Taro, although seen as a dominant crop in these areas, is planted with other staple food crops such as banana, cassava, *Xanthosoma* taro, mami yam, sweet potato and other yams as alternatives in mixed cropping gardening systems. Much of the produce from these staple starchy food crops is retained for self-consumption while very little, usually in small quantities, reaches local market places together with a variety of vegetables for daily cash income needs. Meanwhile, crops such as betel nut, mustard and vanilla play a major role in generating revenue for the household for financing bigger items, which in many instances is being budgeted to meet school fees.

Taro production in farmer fields is small scale, usually taking up to about a quarter of the total land area in the mixed cropping garden. This means that the land under taro is generally less than 0.5 hectares for most farmers. The restriction of farming on a small scale has many practical reasons, the major ones including a high incidence of pests and diseases, lack of marketing opportunity and labour input requirements.

The introduction of NARI released varieties was highly appreciated by many farmers since the new taro lines carry the improved characteristics of resistance to TLB disease and favourable performance in the field. Nevertheless, not enough materials have reached farmers; indicating poor linkages between the research institute and extension providers, and this has resulted in a very narrow distribution of the released technology. This will remain a problem and onward distribution will be limited until adoption becomes more substantial and wide-spread.

RECOMMENDATIONS

The following recommendations are made based on responses of the sampled population with respect to adaptation, adoption and impact of the released NT varieties:

a) Agricultural Policy

Government policies are needed to support research and extension services with more emphasis on root crop subsistence production. Taro plays a major role in food security and determines rural livelihoods in the taro growing areas. Signs of increased land pressure demand improved production techniques. Suggested policies may include considerations of:

a. Household food security
b. Taro marketing at the national level (local and regional markets)
c. Taro as an export product

b) Linkages between Research, Extension and Farmer

The establishment of linkages between the three major parties concerned with technology generation, dissemination and adoption is considered a necessity to allow effective information flows and feed-back, thus making possible desired changes to improve taro production in areas where the crop is known for its popularity.

c) Agricultural Research

The results of the survey show the importance of crop improvement, indicating the necessity for policies and funds to support breeding programmes in other crops, especially considering the crop diversity in PNG and therefore the genetic resources which breeders can work with.

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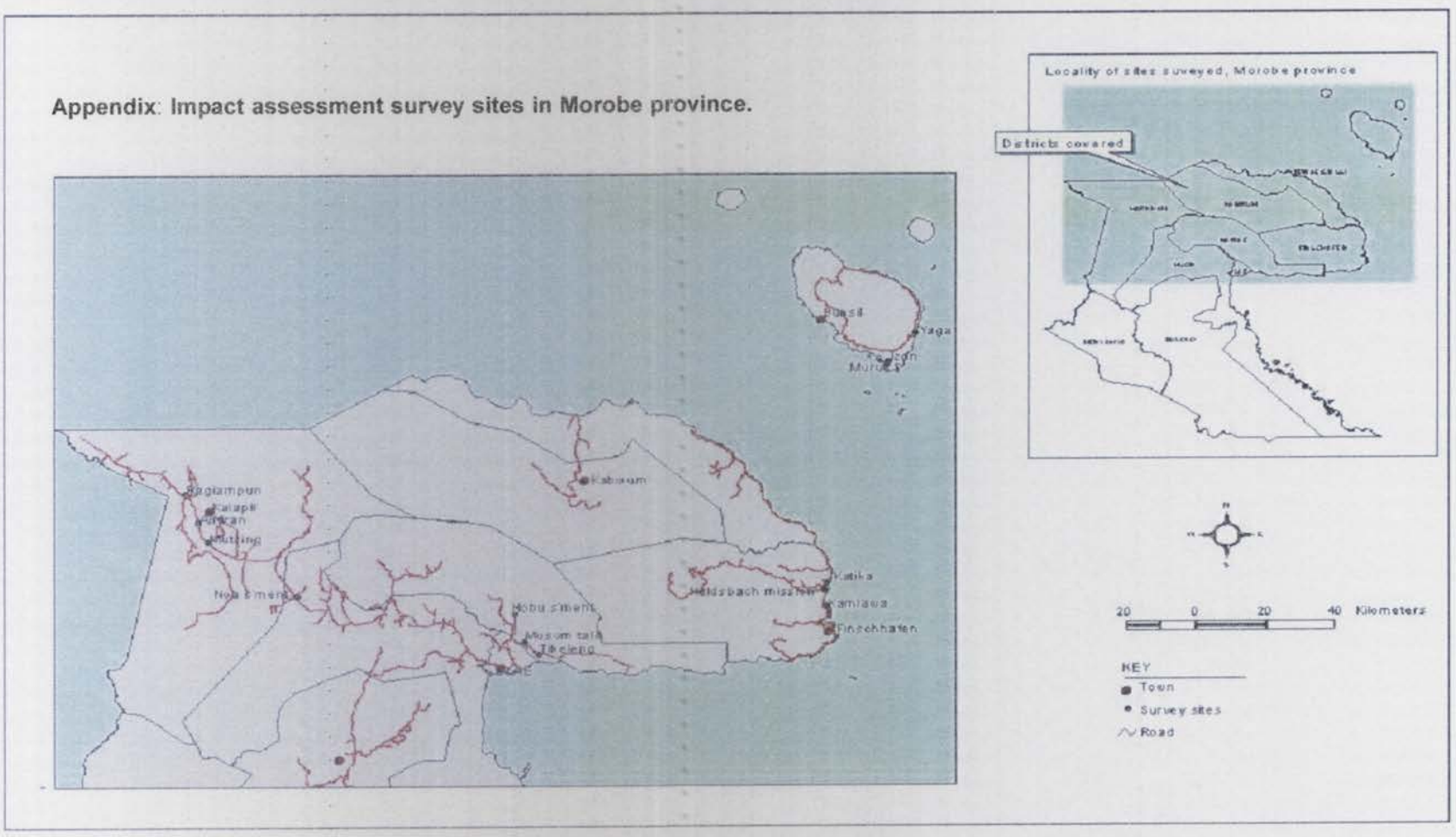
Appendix: Impact assessment survey sites in Morobe province.



Geographical Information System (GIS), National Agricultural Research Institute