VILLAGE AND FARM SCHOOLS SHOW GREAT SUCCESS IN THE PROMOTION OF EXTENSION TECHNOLOGIES IN THE MARKHAM VALLEY, PAPUA NEW GUINEA

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ABSTRACT

Discussed below is the process of empowering farmers directly through training. The leader farmers were also encouraged and assisted to train others. The method was resorted to as a result of inadequate agricultural extension in the Huon and Kaiapit program areas. The results obtained indicated that village level training has economic benefits to rural households.

Key words: *Village and farm schools, Farmer leaders, model farms, extension visit, community groups, village level training.*

INTRODUCTION

In PNG the population is growing at 3.2 %, (NSO 2001) while agricultural production is said to be growing at only 1.6% (NADS 2001). About 82% of the population is rural and subsistence. Agricultural extension is limiting in numbers as well as quality. Coupled with poor road and transport infrastructure in many rural areas, these create big difficulty in reaching farmers with extension technologies and advice. Hence one of the problems for the declining productivity and production in agriculture is lack of adequate technology and information at the farm level by majority of the farmers.

As part of the Food and Agricultural Organization (FAO) of the United Nations Global drive to address Food Insecurity in Low Income and Food Deficit Developing Countries [LIFDC], a Pilot Phase of a Special Program In Support of Food Security [SPFS] was launched and implemented in the Marhkam Valley of Morobe Province in Papua New Guinea from 1996-2000. It was a joint program of the FAO, the Department of Agriculture and Livestock and the Farmers in the Program areas of Huon and Kaiapit districts. The program was set up to address food security needs on a limited scale in the selected sites. It was expected that achievements and lessons learnt from this pilot phase would be a guide in the extension and expansion of the program to other districts in Papua New Guinea in the future.

The Program begun with an Initial Farming Systems Analysis using Rapid Rural Appraisal/Participatory Rural Appraisal [RRA/PRA] methods, and it was identified that in view of the shortage of extension information at the field level and the inefficiency of the extension delivery system[Bammann H. *et al.* 1996, Dekuku. R. C 1997, Dekuku *et al.* 1999] , farmer training should be a major component of the pilot phase program [Bammann. H. *et al.* 1996]. As such, one of the recommendations was that 'model farms' be established on-station and on farmers fields for demonstration and extension purposes, so as to reach more farmers.

Discussed below is the implementation of such model training program and some of the achievements. The model emphasises learning through experience and experimentation of real field related problems. The training according to such principle implies facilitation of the learning process, rather than instruction, and is based in all cases more on hands-on practical experiences [learning by doing and doing by learning].

Main Villages involved

The Program was implemented in four villages in the Kaiapit District, and five villages in the Huon district, all in the Markham Valley. The agricultural activities were centered around, rice, vegetables, aquaculture, irrigation and yams [Table 1]

The levels of farmer training

Three level of farmer training were identified and implemented, as follows;

Level 1. Training the Farmer Leaders [Trainer-Trainees] on Station and on-farm

Key farmers were identified in each village, through consultation with the Village Farmer Association and the District Extension personnel. These farmers become the Farmer Leaders in the particular field

of training. Training on station takes 2-3 weeks, and the number of participants is limited to less than 40 farmers/course session.

On station training looks at the whole crop from seed to seed [planting to harvesting], using pre-planted fields with plants at various growth stages. Lectures are given in simple English, and field work accounts for approximately 70% of the time, and 'classroom' work for the other 30% of the time. Accommodation, three meals a day and transportation are provided to the trainer-trainees

Level 2. Extension staff and Farmer Leaders train the Farmers on Farm /Village

On return from the training, the Trained Farmer Leaders team up with the SPFS Extension /Technical personnel in training the other farmers in the villages. Trained Farmer Leaders were encouraged as resource personnel to take the lead in the training, while the SPFS Team provide back up support.

This village level training in terms of crops takes 1-2 days at a time, while aquaculture training takes one week. The numbers of participants are not limited. Instructions/demonstrations are in simple English /Pidgin [local language].

Demonstrations, field work and discussions take 85-95% of the time, while 'lectures' take 5-15% of the time. Training on crop husbandry is done in stages at various field operation or plant growth stages, such as; land preparation, planting, weed control, fertilization, harvest and post harvest times. Aquaculture training takes a week and covers all operational functions, using existing and new ponds.

Farmers stay home and come in the morning and disperse after the day's work. Snacks and soft drinks are provided at lunch time.

Since the village level training operation take place during the crop season, the farmers go back and as soon as possible put into practice what they learnt on their own fields. The trained Farmer Leaders jointly with the SPFS Staff supervise the field operation of the other farmers when they go to put into operation the new knowledge. By so doing, the Farmers Leaders gain more experience and confidence in the technologies themselves. At the same time, the other farmers look upon them as their peer and supervisors on whom they could rely on for direction. This creates a strong bond within members of the community and a sense of mutual respect among them.

At the same time, it creates some level of expertise and first level of 'extension farmer officers' at the grass roots or village level, and serves as the first 'port of call' for other farmers seeking advice.

Level 3. Farmer Leaders and Farmers train the other Farmers on Farm

Farmer Leaders and other trained or pioneer farmers that benefited from levels 1 and 2 above, provide voluntary training to their relatives and friends on farm. They choose their own free time. They normally share a meal, because the new farmers assist the trainers in their field operations, as part of the learning process. These new farmers, after the partial and voluntary 'apprenticeship' on the farm of the others, go to put their acquired skills into practice on their own farms.

For the period August 1996 to August 2000, 1,626 farmer leaders and farmers were trained directly by the SPFS Team and Farmer Leaders. While another 1,626 farmers were trained by the Farmer Leaders/ Pioneer Farmers. This makes a total of at least 3,352 trained farmers. If we take into consideration that the average household size in PNG is 6 , based on the 2000 Census, and that children in farm households learn by doing, the overall number of

***Table 1.* The Special Program in Support of Food Security Pilot Sites and Activities**

Huon District	Activities	Kaiapit District	Activities
1. Gabsonkeg	Aquaculture	6. Naratumua	Rice
2. Nasuampun	Aquaculture	7. Minimian	Rice
3. Yalu	Aquaculture	8. Ragiampun	Rice, vegetables and irrigation
4. Mare	Aquaculture	9. Intoap	Rice, vegetables, irrigation & yams
5. Wampup	Vegetables & irrigation		

individuals that benefited from this village level training is far in excess of the total of 3,352.

Significance of regular extension visits to the farmers.

In addition to training, the SPFS staff paid regular extension visits to the program sites. The local District Extension staffs visit the sites at least one to two times each week, and the Erap SPFS Program Manager and staff visit each village/site once a week, in this case every Wednesday to provide back up support to the farmers. Fixed day visits were preferred by the farmers and the extension staff instead of unplanned and varying days. Fixed day visits allowed the farmers as well as the extension officer to plan their other activities for the other days.

We found out that, the farmers appreciated greatly the regular extension visits. They devoted these days to discuss their problems and to get solutions, show off and discuss their achievements in the field or in storage on timely basis, and to discuss and request for new training in other areas of need. The visits also assisted the farmers in the sense that they do not have to waste their funds and time travelling away from their work individually to reach us at the SPFS Headquarters at Erap which might result in waste of a half to whole day as a result of irregular public transportation.

Access to market

In the promotion of training for participation in food and livestock production, it was realised that excess production beyond family needs would result. The need to help farmers dispose of the excess production was a component of the production promoting process. The SPFS and collaborating partners therefore assisted the farmers in identifying market sources and demands, in terms of what to produce and where to market their produce / products, quantity and the prices. Trainings in quality of marketed produce / product management were also conducted for the selected farmers.

The result was that different farmers have decided, based on their awareness, as to what marketed crops to cultivate, the time and quantity to cultivate. This has led to diversified and specialised production by various farmers. For example in vegetables some of the farmers specialised in capsicum, others in bulb onion, tomatoes, water melon, leafy vegetables. This guides them to avoid excess production beyond home and market demands.

Since late 1997, our Markham Valley farmers have become some of the key suppliers of vegetable to local and supermarkets and hotels in Lae. Before then, most of the vegetable come from the Highlands; Goroka and Mt. Hagen. This demand for the Markham produce and the access to market has encouraged our trained farmers to continue production beyond home consumption levels and to now earn cash income unlike before.

The formation of farmer groups contributed to the success of extension and to farmers welfare

We realise very early in the Program formulation and the initial farming systems analysis study that it would be easier to work with farmer groups, than with many individual farmers scattered all over the Markham Valley Program area. We discussed and encouraged farmers to form Village level groups, for ease of channel of communication, assembly, collective problem discussions, training, participation and decision making.

Five permanent farmer groups were formed, at Naratumua, Ragiampun, Intoap, Minimian and Wampup, with executives; Chairman, Secretary and Treasurer. The formation of the groups had further strengthened the collaboration and cohesion and a sense of belonging and cooperation within the farmers and between them and the Program Staff. This allows us to plan and run many training courses on farm and on –station with maximum collaboration and attendance.

The Group formation also allows for procurement of inputs, sharing of production and processing equipment, transportation arrangements and group marketing of produce, which were in the past difficult on individual basis.

It is expected that these Groups would become the pioneers of Farmer Cooperative in the near future.

Some results achieved by our Farmers after training

The result of the training is an overall increased awareness and increased production and productivity in the program sites, as indicated in the SPFS Overview Report [Dekuku. R.C. 2001] and component of which are presented below.

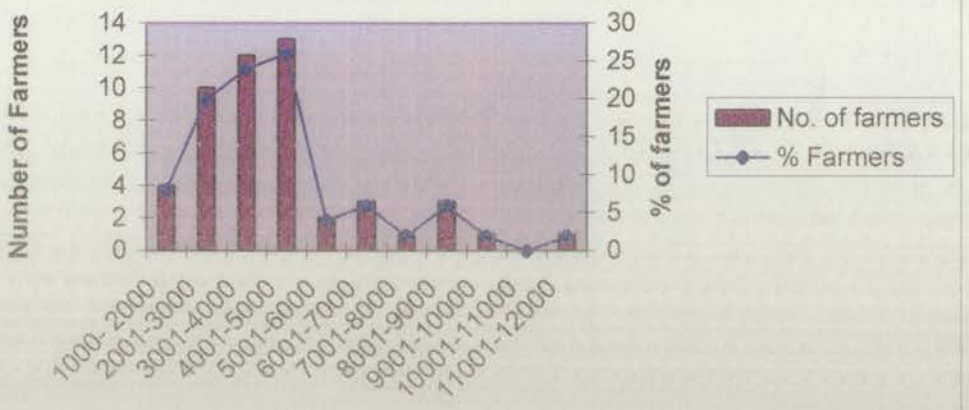
Naratumua 1997/98 Rice Production

The SPFS first village level training of farmers was in Naratumua Village in rice cultivation. As in most parts of the Upper Markham Valley, the predominant farming activities at Naratumua and other surrounding villages are peanut cultivation for cash income, and the cultivation of taro, banana and leafy vegetables for home consumption. Income from peanut is used for the purchase of store goods, meet other necessities and paying of bills. In 1997, a

serious drought brought about by El-Nino affected most parts of Papua New Guinea, including the Markham Valley. The farmers of Naratumua and surrounding villages could only grow and harvest one crop of peanuts, instead of the normal three per year. Short of cash and food, the farmer Leaders approached the SPFS to help them cultivate rice for food once the rain starts. The farmers were trained to grow rice following the 3 levels discussed above.

Members of Mamaferan Clan agreed to accept the other clans to participate with them and share the benefits from the model farm. Members from eleven clans comprising over 481 farm households were involved. The model farm was set up in July/August 1998, initially as a venue to learn modern agriculture production techniques. Vegetable crops, irrigated and rainfed rices, fish, ducks and aquaculture were included in the demonstration. On – site hands on training was given around each crop and livestock

Fig. 1. Naratumua Rice yields kg/ha in 1998



Rice yields were high, ranging from 1,000 - 12,000 kg/ha (1.0 - 12.0 tons/ha) with means yield of 3.96 tons/ha (Figure 1).

Gross margins indicated that small scale rainfed rice production is economical [Fig.6], with highest gross margin of 300-400%.

Ragiampun 1998 model farm summary report

The Ragiampun Model Farm was our second village level on-farm training program. Eleven Clan groups were involved [Tab. 2]. It was a training Program that united people by breaking through traditional 'Clan barriers', whereby people from various Clans work together voluntarily in this case.

A collaborative approach was used in setting up the model, demonstration and training farm at Ragiampun Village. This was based on the community's request, after seeing the success of rice work at the neighboring Naratumua Village. The FAO/DAL Special Program in Support of Food Security, invited the R.O.C [Taiwan] Technical Mission and The DAL-Mutzing Extension Division to join in the program.

following the crop/livestock growth cycle. Farmers sleep at home and report for training and work on selected days of the week. Initially all farmers were involved, but subsequently were divided to work on alternating days. This way, they could also attend to their other domestic needs on the other days. The farmers learned and provided labor on the management of the model farm. At harvest time, they were provided access to market and marketed some of their produce and used the rest for home consumption. The Member of Parliament for Markham was happy with the Model farm concept and the performance of the clan members, and donated to them a two-ton truck to help their operations, especially inputs procurement and marketing of produce.

A successful field day was held on 16/10/98, to coincide with the World Food Day, and to show case their work and achievements to others. Approximately 1, 500 people attended the field day, made up of 80% interested and curious farmers from other sites. Other participants were; politicians, scientists, administrators, extension workers, students and the general public **[In a country of**

Table 2. **Summary of Farmer Leaders and Farmer Training Courses Conducted by the SPFP/ PNG/4501 Program, August 1996 to August 2000**

No.	Course Title	No. of Participants	Description
1	Farming systems development training	200	Farmer Leaders & farmers from two districts
2	Rabbit husbandry	42	Farmer Leaders and farmers
3	Aquaculture	74	Farmers Markham farmers
4	Vegetable production	36	Farmer Leaders
5	Vegetable production	261	Farmers from 2 districts in 2 batches
6	Rice culture [Naratumua, Ragiampun, Intoap, Minimian Villages]	450	Farmer Leaders and farmers covering 4 locations and involving 20 Clans
7	Food technology	12	Farmer Leaders
8	Sheep and goats husbandry	40	Markham farmers
9	Peanut fertilization	24	Markham farmers
10	Hands on on-farm irrigation	100	Ragiampun Farmer Leaders & farmers [involving 14 Clans]
11	Shallow well construction	8	Intoap Farm families
12	Operation of water pumps	8	Intoap farm Families
13	Aquaculture, for farmer leaders	16	Farmer Leaders
14	Yam Miniset Technique	12	Key farmers
15	Aquaculture , for farmers	29	Gabsonkeg farmers
16	Aquaculture for farmers	45	Nasuapum farmers
17	Training in rice culture	50	New Intoap families
18	Training in Agriculture & Food processing	25	Morobe Women Leaders
19	Training in Rice top dressing	50	Intoap farmers
20	Training in aquaculture	54	Farmers from Yalu.
21	Training in aquaculture	68	Mare farmers
22	Rice post harvest/rice mill course	22	Markham Farmer Leaders
	Total Direct Training	**1626**	
28	Indirect Training [by farmer, leaders and pioneer farmers through learning by doing]1:1 ratio	1626	Children, relatives & others etc.
	Total Direct / Indirect Training	**3352**	

Table 3. **Clans involved in the Ragiampun Model Farm Training Program in 1998**

No.	Clan Name	Clan Leader
1	Mamaferan	John Nario
2	Mayangcharia	Ima Gainde
3	Itat	Rarang Anangk
4	Muim	Bogen Buga
5	Gananggadang	Tuna Jamoam
6	Garamurum	Maruwin Gadi
7	Arifiwat	Chiram Mimari
8	Uramragin	Rawi James
9	Dampidampi	Gabi Urubit
10	Buni	Ita Sambanga
11	Muntua	Klemens Nglring

only 5.13 Million people scattered over many islands, the turn out was high].

Record of production and farm income (but not exclusive) were done (Table 3). The production records obtained here serves as a sample of the minimum funds achieved, since some of the produces were harvested for home consumption and also as gifts. Estimated income was K 17, 785 for the first harvest of crops. The Farmers were surprised, amazed and very happy to have such much income within a very short time of 3-4 months.

To date, the Mamaferan Clan farming community had accepted the initiative of the model farm. They have expressed this through their dedicated daily commitment and interest by their full participation. They cultivate the plots 2-3 times a year. The SPFS has since installed a 5Hp water pump to help them expand on the irrigated fields for more food production.

The other Clans have gone back to their traditional lands to practice what they have acquired.

Training and Rice Production in other sites

Work at Erap, Naratumua and Ragiampun had further indicated that rice has potential in the Markham Valley. Other farmers from Minimian and Intoap and later Wampup also joined and embraced the rice technology, and are also producing rice for home consumption and saving money for not having to buy rice often anymore. Our results, based on data from 128 farms in the Markham Valley within the period 1998 to 2000; indicated that, even without irrigation, average yield of 2.000 - 3000 kg/ha could be obtained, and yield equivalents above 5 tons/ha are common [Fig.2,] The yields are high compared to those for rainfed rices world wide, which indicated a high quality of adoption and adaptation of the optimum production processes by the Markham Farmers.

The Special Program has since purchased four rice mills and installed them at four sites in the Markham Valley, so as to help farmers have access to mills, for processing. Farmers are happy with the rice program, as they now produce rice for home consumption and sharing with their extended families.

Yams

Yam species ***Dioscorea rotundata*** [Guinea or African Yam] was introduced to farmers in the valley, by the SPFP Team, because of its good taste, higher yields and relatively long storage period [two to six months] and relative drought tolerance. Farmers were taught to propagate their yams using the 'minisett technique'.

Very good results were obtained by the pioneer 11 farmers, and the yams and technology of propagation has started to spread widely in and around the Markham Valley and the number of farmers increased from 11 to 349 in the second season, and further to 1,000 by year 3 [table 4]. The additional farmers after year 1 were trained by the Farmer Leaders and other pioneer farmers. This is a good reflection on our village level expertise development program.

From less than hundred plants per farmer in the first year, the initial 11 farmers increased their yam plantings in year 2; the 2000/01 crop season [Table 6].

Fig. 2. Mean Rice Yields in Markham Valley, 1998 to 2000

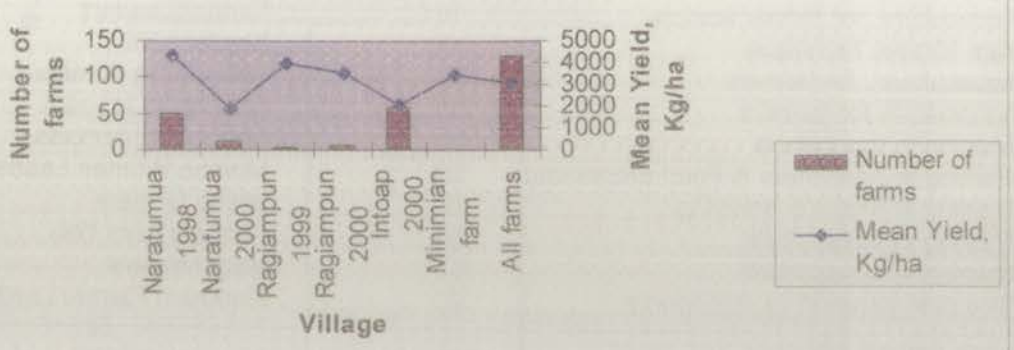


Table 4. **Ragiampun 1998 Model Farm Data**

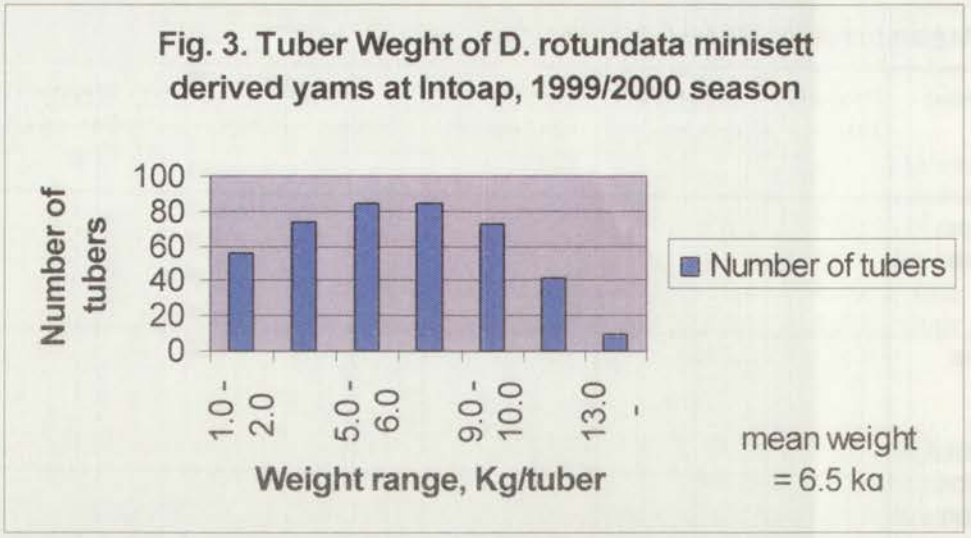
Crops Planted	Plot size Ha.	Actual Yield Tons	Income equivalent Kina	Yield/ha basis	Price /ton Kina	Income on per ha basis Kina
Irrigated rice	0.35	2.03	812	5.8	400	2,320
Rainfed rice	1.85	4.16	1,665	2.2	400	880
Tomatoes	0.09	1.65	825	18.3	500	9,150
Capsicum	0.51	1.075	537.5	2.1	500	1,050
Long Beans	0.42	0.946	473	2.3	500	1,150
Okra	0.18	0.426	340.8	2.4	800	1,920
Cucumber	0.78	1.95	1,560	2.5	800	2,000
English cabbage	0.21	3.78	2,268	18.0	600	10,800
Spring Onion	0.33	0.396	1,584	1.2	4,000	4,800
Water Melon Sugar baby	0.18	850 pieces	3.400	4,722	4/piece	18,888
Water melon M. glory	0.27	386 pieces	4.320	14,42	1.1/piece	15,872
Total income	**5.17**		**17,785.30**			**68,830**

Table 5. **Introduced *Dioscorea rotundata* [African Yam] Farmers in MarkhamValley in three crop seasons**

1	Number of Farmers in 1999/2000 season	**11**
2	Number of Farmers in 2000/2001 season	349
3	Number of Farmers in 2001/2002 season	**1,000**

Table 6. **African Yam Impact Evaluation for Two Crop Seasons in Intoap Village.**

		Number of Yams [Mounds]	
No.	**Name**	**1999/2000 Season**	**2000/2001Season**
1	Asam Kasi	103	2900
2	Maria & Peter Linibi	870	878
3	Ka Gaunga	2	310
4	John Linibi	190	480
5	Timothy Guru	50	300
6	Tau Busil	200	1000
7	Buya Timothy	200	500
8	Giram Maning	200	1000
9	Giamoki Buri	20	70
10	Gore and Yarambi	54	210
11	Tande Linibi	10	403
	Total	**1899**	**8051**
	Percent increase over	**1999/2000 season**	**424.38%**



Yam yields were found to be high. Tuber weights ranged from 1 to 14 kg, with a mean of 6.5kg/tuber [Fig 3]. Occasional weights of up to 20kg/tuber were obtained in some fields.

Yam yield data from selected farmers gave yield equivalents of 49,334 kg/ha to 75,208 kg/ha. These correspond to potential income equivalent of K49,334 to K150,416, depending on if the yams are sold at the current village and market prices of 1Kina/Kg or 2 Kina/Kg[table 6], Dekuku, R.C 2001b estimated that yam production costs could be relatively high; K22,550/ha, if based on hired labour. But even in this case he reported Gross Margin or Profit to be 314%. Considering that cultivation of food crops including yams in the Markham Valley are usually done using family labour or 'sweat equity' without cash payment, the actual production costs would be far lower than the reported estimated production cost. This would make yam production even more profitable.

Thus in the deep Markham Valley soils, D. rotundata is showing great promise, as a potential crop for food security and hunger elimination. The long storage period of the yam, 2- 6 months, gives it an added advantage over the other traditional staples, such as taro, bananas and sweet potatoes that have less storage time. This makes it a crop with potential for long storage and distance markets. As such, the Yam Technology is spreading like wild fire and there is very high demand from other farmers for this particular yam variety and the propagation method introduced to the farmers by the SPFS Team.

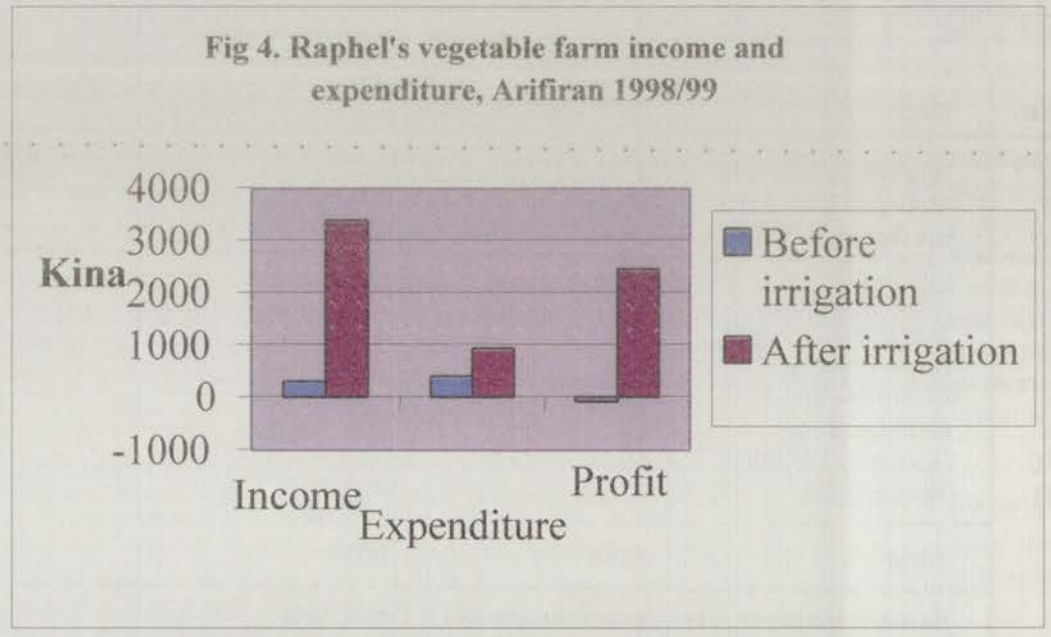


Table 7. **Yam Production Data From Selected Farmers, Intoap Village 2000**

Farmer	Number of tubers sampled	Total Weight, Kg	Weight on per ha. basis*	Potential minimum Income, Kina	Potential maximum Income, Kina
Buyai	62	400	64,516	64,516	129,032
Giram	64	414	64,688	64,688	129,371
Yalambing	48	332	69,168	69,168	138,336
Asam	64	431	67,344	67,344	134,688
Tau	96	722	75,208	75,208	150,416
John	90	444	49,334	49,334	98,668

* Based on 1m x 1m planting distance [minimum of 10,000 plants [tubers] per ha. Minimum income based on K1/Kg and maximum income on K2/Kg

Some Vegetable Production Results

Thirty Six Farmer Leaders were trained on Station by the SPFS Team covering most aspects of vegetable production including quality and packaging. On return the Farmer Leaders assisted by the SPFS Team trained 261 farmers at the village level. Vegetables have become a major cash crop for our farmers. They have been supplying commercial houses and Hotels in Lae, since 1997, as a result of the training and subsequent irrigation provided them by the SPFP.

Results presented [tables 8 to 11 and figure 4) indicate that vegetable production by our trained farmers is profitable. Production with supplemental irrigation gives better results.

The crops identified with high income potential are; Water melon, Chinese cabbage, English cabbage, Tomato, Eggplant and Capsicum

A Typical small farmer sales and expenditure data indicated that semi-commercial vegetable production, in this case Capsicum, even in the 1997 drought year with limited supplementary irrigation gave promising results and revenue. By investing some of the capsicum income into chicken and second hand clothing, the farmer further improved on his income [Table 10]

Training in Small Scale Irrigation Development and Management

With the serious effect of the 1997 El Nino vividly in the minds of the SPFS Team and the farmers, a program for small irrigation development was formulated and funded. In order to keep the irrigation development costs low, the farmers were reasoned with to play significant parts in the irrigation development. For example, farmers were taught to make liners for their shallow tube wells. They dug their tube wells and also trenches for the laying of pipelines under training and supervision by the Experts. They were also taught how to handle and maintain and service their water pumps. The result was that irrigation development costs were reduced [Table 12], due to active farmer participation in the development.

The farmers were expected to pay back 80% of material costs, as they provided their own labour. Without training and active farmer participation, costs would have been higher.

The irrigation programs have been found very useful, as indicated for vegetables above. They are also source of domestic water supply to the farm families.

AQUACULTURE RESULTS

Aquaculture is one of our major thrusts. The idea is to train farmers, to produce fish in ponds, and to supplement/ meet their protein needs. The surplus could then be marketed. The Program train farmers for a week, supervised them to dig ponds, supply them Tilapia or Carp fingerlings, and provide extension support. Up to date 286 farmers have been trained and over 202 [71%] of them that completed their ponds were supplied fingerlings. Over 18,790 fingerlings have been distributed free of charge to the farmers so far [Table 13]. The Special Program provides extension support. Fish are fed on household food surpluses, such as rice, potatoes, rice bran, bananas etc and supplemented by chicken pellets.

The earlier farmers have fish weighing between 250-700 grams and are harvesting them for home consumption and sale to neighbours [table 14]. Aquaculture has great potential to improve on the

Table 8. **Comparative income for vegetable production under rainfed and irrigated systems in the Markham Valley in 1999-2000, in Kina/ha basis[1]**

Crop	Village	Rainfed	Supplementary irrigated
Water melon	Arifiran	1,200	
Water melon	Arifiran		30,400
Water melon	Ragiampun		18,888
Water melon	Ragiampun		15,872
Cucumber	Arifiran	8,800	
Cucumber	Ragiampun		2,000
Cabbage[pakchoi]	Arifiran		28,400
English cabbage	Ragiampun		10,800
Spring onion	Arifiran	3,200	
Spring onion	Arifiran		2,600
Spring onion	Ragiampun		4,800
Tomato	Arifiran	5,900	
Tomato	Ragiampun		9,150
Egg plant	Arifiran		10,400
Capsicum	Ragiampun		10,400
Capsicum	Intoap		15,537

1: Based on production and sales figures from collaborating farmers, adjusted to per ha. basis

Table 9. **Wampup vegetable production results**

Tab. Revenue[1] from vegetables within one season, Wampup 2000, PNG Kina						
No	Crop	Area, m2 basis	Area in hectares	Revenue on plot basis	Revenue on per ha. basis	
1	Chinese cabbage	3169	0.32	4,680	14,768	picked once
2	Tomato	2915	0.29	6,560	22,504	picked 4 times
3	Capsicum	1037	0.1	3,480	33,558	picked 3 times
4	Water melon	580	0.058	2,400	41,379	picked once
5	Round cabbage	317	0.032	920	29,022	picked once
	Total	**8018**	**0.8**	**18,040**	**141,231**	
Less Land development and seed costs				-1,118.19		
	Profit from 0.8 ha field			**16,921.81**		

1. **Note: Some farmers were reluctant to declare their income. So this figure is not maximum value.**

2. **Sales were done in Lae Main Market, Anderson, Erap road and Trukai Industries Office**

Table 10. **Summary of Asam Kasi's Capsicum sales and expenditure during the 1997 drought year***

Month	Income [PNG Kina]	Transport, food and other Expenditure**
January	555.4	67
February	665.4	194
March	400.8	197
April	616.5	76
May	396	68
June	450	53
July	414	73
August	515.4	42
September	1202	277.5
October	805	61
November	308	138
December	1439.2	155
Capsicum Total	**7767.7**	**1401.5**
Other revenue using Capsicum income for investment		
Sale of chicken/Sale of 2nd hand clothes	8,000/2,500	1301.7/660
Total other Capsicum supported income	**10,500**	**1,961.7**
Total Capsicum related income	**18,267.7**	**3,363.2**
Net Income	**14,904.5**	

Note.

*. Based on two 1/5th ha Capsicum plots during the severe 1997 drought year, with twice a week shallow supplementary irrigation only.

**. Other expenses include use of vegetable money as capital in investing into day-old chicks and second hand clothing for re-sale later on. It includes also other household expenses, and fuel for supplementary irrigation.

Table 11. **Vegatable income figures for Raphel's farm in 1999 with and without irrigation.**

Production System / Crop	Without irrigation				With irrigation			
Crop	**Area**	**Amount, Kina**	**Kina/m2**	**Kina /ha. basis**	**Area**	**Amount/ Kina**	**Kina / m2**	**Kina/ha. basis**
Water melon	520 m²	62	0.12	**1,200**	920m²	2,800	3.04	**30,400**
Cucumber	40m²	35	0.88	**8,800**				
Cabbage [pakchoi]					198m²	563	2.84	**28,400**
Spring onion	224m²	72	0.32	**3,200**	560m²	150	0.26	**2,600**
Tomato	80m²	47	0.59	**5,900**				
Egg plant					80m²	83	1.04	**10,400**
Capsicum					108m²			
TOTAL		**216**				**3,596**		

nutrition and income of the households, and interest continues to be high.

A faster growing Tilapia species [Nile Tilapia, Gift Strain {Oreochromis niloticus}] has been introduced for trials in the valley. Initial results at Erap and Gabsonkeg gave promising fish weights of 220-300 g within 4 months. This new specie would be distributed to the farmers after the necessary introductory quarantine clearance.

An example of a our trained Farmer Leaders contribution in helping other farmers

The successful contribution of one of our trained Farmer Leaders, Mrs. Maria Linibi to other farmers in support of their food security needs in the Markham Valley is narrated below.
Mrs. Maria Linibi was trained by the SPFS on Station as one of **the Farmer Leaders** in vegetable production in 1997, in rabbits, rice and irrigation development and management in 1998 and in yam mini-sett techniques in 1999. In all cases, on return, the SPFS supported her to train other farmers in her group [Intoap Farmer's Group] of which she is the Secretary. Even after the pilot phase, the other farmers in the community look to her for guidance in their agricultural development needs.

Mrs Linibi's capabilities were realised by other agricultural programs in the area, and she was contracted by the Small Scale Subsistence Pilot Phase Program[SSSPP] agricultural contracting project in Lae, Morobe Province to train other farmers.

In 2001 1ST four months she;

1. Trained 239 farmers on water melon and Bulb onion cultivation
2. Trained 241 farmers in Rice Production
3. She and the members of her group are cultivating and eating their own rice. They have milled over 100 tons of rice so far for home consumption [from their 1998 to 2001 rice harvest]. They are keeping the other rice harvests for later milling [there was no rice production in the area prior to the SPFS training and introduction of rice to the farmers]
4. She and 6 members of her group have distributed 3855 tubers of yams [of various weights] to other farmers [3,000]. These were harvests from their own farms from mini-setts.
5. The National Agricultural Research Institute is using Maria and her husband Peter Linibi [also one of our farmer leaders] as their village level extension advisers on rice in the Intoap area.
6. She and her family are continuing to cultivate vegetables that they sell to the Lae Hotels and Supermarkets.

Table 12. **Costs of irrigation development at Intoap in the Markham Valley, 1999 in PNG Kina.**

Name	No of Taps	Unit price 1)	Pump	Unit price	No. of wells	Unit price	Total costs	No of Ha	Cost / Ha	80% Cost
Peter & Maria	5	302	1.00	2561.00	1.00	450	**4521.00**	1.82	**2484.07**	**3616.8**
Tande 2)	3	302	0.50	2561.00	0.50	450	**2411.50**	1.06	**2275.00**	**1929.2**
John 2)	4	302	0.50	2561.00	0.50	450	**2713.50**	1.29	**2103.49**	**2170**
Giram 3)	4	302	0.50	2561.00	0.50	450	**2713.50**	1.42	**1910.92**	**2170**
Narura 3)	4	302	0.50	2561.00	0.50	450	**2713.50**	1.27	**2136.61**	**2170.8**
Timothy	4	302	1.00	2561.00	1.00	450	**4219.00**	1.47	**2870.07**	**3375.2**
Tau Busil 4)	4	302	1.00	2561.00	1.00	450	**4219.00**	1.50	**2812.67**	**3375.20**
Asam Panda	4	302	1.00	2561.00	1.00	450	**4219.00**	4.31	**978.89**	**3375.2**
Ungkul 5)	3	302	0.33	2561.00	0.33	450	**1909.67**	0.96	**1989.24**	**1527.7**
Michael Sam 5)	3	302	0.33	2561.00	0.33	450	**1909.67**	0.96	**1989.24**	**1527.7**
Buri Ungkul 5)	3	302	0.33	2561.00	0.33	450	**1909.67**	0.96	**1989.24**	**1527.7**
Peter	5	302	1.00	2561.00	1.00	450	**4521.00**	1.43	**3161.54**	**3616.8**
Total							**37980.00**	18.45		**30382.3**

1) Unit price for taps includes all fittings, pipes etcetera
2) Tande & John share their well and the pump
3) Giram & Narura share the well and the pump
5) Panda Ungkul, Michael Sam and Buri Ungkul share their well and pump

Table 13. **The Special Program Aquaculture Projects in the Markham Valley as at 30/12/2000**

A.	Kaiapit District				
No.	**Village**	**Number of Farmers**	**Number of Ponds**	**Number of Fish**	**Fish Type**
1	Waritsian	2	2	395	Carp / Tilapia
2	Naratumua	1	2	350	Carp/Tilapia
3	Ragiampun	1	7	77	Carp
4	Inpoap	1	2	27	Carp
5	Sampugan	1	1	200	Carp
6	Sauruen	1	1	96	Carp
	Sub Total	**7**	**15**	**1145**	
B.	**Huon District**				**Carp**
No.	**Village**	**Number of Farmers**	**Number of Ponds**	**Number of Fish**	**Fish Type**
1	Gabsonkeg	26	28	3424	Carp/ Tilapia
2	Nasuapum	18	21	1926	Carp
3	Yalu	19	19	1521	Carp
4	Mare	50	50	5000	Carp
5	Tararan	1	1	210	Carp
6	Wawin	1	1	180	Carp
7	Fayang	1	1	100	Carp
8	Naramonki	2	4	401	Carp
9	Munkip	7	11	1198	Carp
10	Gabmanzung	1	1	280	Carp
11	Munum	1	1	100	Carp
12	Wampup	1	1	300	Carp
13	Sifu	1	1	100	Carp
	Sub Total	**129**	**140**	**14740**	
C.	**Nawae District**				
1	Wasin	2	2	80	Carp
2	Kasin	31	31	1174	Carp
3	Kain	2	2	90	Carp
4	Guffin	4	4	243	Carp
5	Moembling	1	1	70	Carp
6	Fii	2	2	122	Carp
7	Sibi	5	5	227	Carp
8	Banzain	1	1	32	Carp
9	Boana	1	1	50	Carp
10	Tinibe	2	2	98	Carp
11	Mungreng	2	2	115	Carp
12	Badibo	1	1	54	Carp
13	Peli	1	1	42	Carp
14	Kasuka	9	9	401	Carp
15	Wambangan	1	1	67	Carp
16	Migima	1	1	42	
	Sub Total	**66**	**66**	**2907**	
	TOTAL	**202**	**221**	**18,792**	

Table 14. **Fish Production by Selected Farmers in the Markham Valley**

No.	Name	Village	Weight range, grams	Mean weight, grams
1	Yariman Pumu	Waritsian	240 - 270	252
2	Henry	Waritsian	160 - 260	212
3	Mare Tepo	Gabsonkeg	260 - 360	316
4	Seth Tepo	Gabsonkeg	320 - 580	468
5	Zobbie Yaffon	Gabsonkeg	180 - 680	328
6	Elijah David	Gabsonkeg	200 - 700	392
7	Andrew Ruben	Gabsonkeg	240 - 320	296
	Total			**2264**
	Mean			**323**

Note: Age of fish 8-10 months

The above achievements were a result of the SPFS making her what she is now. She was a retrenched Officer, practicing only subsistence farming. Now she is happy with her achievements, and is producing and marketing her agricultural products, as well as helping others to understand the agricultural practices better. Thanks to the SPFS.

Advantages of Village Level Training

We found out that Village level training is **Economical,** we save on housing, meals and some transportation costs, compared to on station training, and **many more farmers could be trained** within a short time. It **fits into farmers own terrain and time.** Farmers have time **to attend to their other activities** in between training periods. Farmers do not have **to be locked away from their families** [which most of them resent]. Village level training **promotes community spirit, pride and also a stronger bond between the farmers and the Training Team.** It also promoted **competitiveness among the farmers** as each goes to prove that they could do better. It also **promotes experts at the village level.** Above all it **contributes to better farming and food security of the community**.

CONCLUSION

The Special Program in Food Security Pilot Phase Team in the Markham Valley identified at the start of the Program that poor farmer knowledge and inadequate extension delivery hamper agricultural development in the Markham Valley.

Training of Staff and farmers on Station and on farm were pursued to promote better understanding of farming in the program areas. Village level training was the predominant. The results indicated improved production and productivity in the villages involved. The SPFS Team recommends to other extension programs to consider Village Level training as a major component of their programs/ projects, as the achievements are numerous as indicated above

ACKNOWLEDGEMENT

We acknowledge the tireless contribution of the following in our farmer training and extension programs. They are; Messrs Weni Yabi and Dakia Wokio, DAL-Mutzing, Mr. Dan Lung Chyau of R.O.C Taiwan, Bubia, Mrs Rudy Atrango of Fresh Produce Development Company, Erap, and Farmer Leaders of Naratumua, Ragiampun, Intoap, Minimian and Arifarin.

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