

A study of indigenous knowledge and its role to sustainable agriculture in Samoa

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Abstract

The primary objective of this paper is to identify the Indigenous Knowledge used in sustainable agriculture in Samoa. Indigenous Knowledge (IK) is the knowledge that has been developed over time in a community mainly through accumulation of experiences and intimate understanding of the environment in a given culture. This research covers indigenous knowledge on farming tasks such as managing soil fertility, controlling pests and diseases, controlling weeds, soil preparation, planting materials, harvesting and storage of indigenous root crops and animals here in Samoa. From the results, we can conclude that indigenous knowledge should be recorded and used to devise innovative research for agricultural researchers, extension workers, development practitioners, and environmentalists for sustainable agriculture development and management of Samoa's natural resources. Understanding and conserving Indigenous Knowledge will help to sustain farming practices which will not cause so much plant genetic erosion and environmental deterioration. Indigenous knowledge should cater for sustainable food security and conservation of the variety and variability of animals, plants and very vital soil properties such as physical, biological and chemical properties. Conservation of Samoa's natural resources depends on human beings and their interaction with the environment which is very much related to the Indigenous knowledge that has been communicated and passed down from generation to generation through family members and communities.

Introduction

Samoa comprises of eight islands, the two main islands are Upolu and Savaii. A country of natural beauty and some species of wild life. This beauty will soon be vanished due to population pressure and industrial development such as farming. Agriculture development has evolved in Samoa as it is the main stay in domestic food supply, employment, cash income, foreign exchange, raw material for processing and handicraft for Samoans. Wild species and traditional crops are becoming extinct and environmental deterioration of which modern farming system practices is a major contributor. Agriculture and Forestry are the largest sector in Samoa's economy (Suavi 1998). As such traditional cropping practices such as multistory is disappearing due to increased use in external inputs such as inorganic fertilizer, pesticides and mechanization that diminishes the role/significance of nature. Introduced agricultural crop diversification like wise contribute to the loss of agro biodiversity and causes other environmental problems.

This paper therefore examines Indigenous Knowledge and its roles to sustain agriculture in Samoa. Indigenous Knowledge (IK) is the knowledge that has been developed over time in a community mainly through accumulation of experiences and intimate understanding of the environment in a given culture. As Samoan farmers are semi-subsistence and smallholder oriented, Indigenous Knowledge therefore plays a very vital role in sustainable agriculture

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because farmers are familiar with practices and technologies. Indigenous knowledge need to be recorded and can be of good use to devise innovative research for agricultural researchers, extension workers, development practioners, and environmentalists for sustainable agriculture development and management of Samoa's natural resources. Understanding Indigenous Knowledge in agriculture helps to ensure that farming practices will not cause so much plant genetic erosion and environmental erosion. In fact it should cater for sustainable food security and conservation of the variety and variability of animals, plants and very vital soil properties such as physical, biological and chemical properties. Conservation of Samoa's natural resources depends on human beings and their interaction with the environment which is very much related to the Indigenous knowledge that has been communicated and passed down from generation to generation through family members and communities.

Objectives

The objectives of this study are;

- i) To identify the Indigenous Knowledge that are used in agriculture.
- ii) To identify the role of Indigenous Knowledge to sustainable agriculture in Samoa.

Literature review

Samoa like any other small island nations provides challenges for economic development and environmental management. Farming for all Samoans is mainly subsistence with small scale plots which are usually village based. Out of the total Samoan Agriculture, only 7% is classified as whole commercial (WSG, 1989). The need for sustainable agriculture development focuses on improving and sustaining food security and improving the quality of life for the people of Samoa and its future generations greater than ever before. Traditionally, all household requirements from agriculture were provided by very complex, robust and traditional farming system. These were multistoried rational fallow systems utilizing bush or grass fallowed for several by series of root crop intercropped with coconut and other tree species (census of agriculture report in Western Samoa, 1999).

Only 7% of the farm were classified as whole commercial (WSG, 1989). Traditional farming system was proved sustainable in the past but highly affected due to population pressure and urban development which shortened fallow periods and declined fertility. Samoans had been using their indigenous knowledge to select disease resistant varieties and use natural solutions to reduce pest invention such as the Tarophagus proserpine by collection of dried coconut fronds and setting alight among taro plants (Tolova'a, 1982).

This same method has also been reported in else where in the Pacific (Anon, 1982). According to Weightman 1989, In Vanuatu, yam gardens are raked clean and the have logs placed on the which are set alight using coconut fronds. These burning logs are dragged over the entire garden for several days. This practice is very common in Santo, Malekula, Maewo, West Ambae, North Pentecost, Paama, Erromango and Tanna (Weightman, B, 1989).

In Tonga, shifting cultivation is the oldest method of cultivation and is still practiced today, specifically on the island of Niuafu'ou, Niuatopatupu and some of the volcaniv islands such as Tofua, Kao and tafahi. Crops are usually sequentially cropped for several years before the land is abandoned to fallow (*Traditional Farming and their contributions to the economy and sustainability of production-IRETA workshop*).

In Fiji, a traditional system of raised bed has been described for shifting cultivation of taro (Parry, 1994). According to Parry, 1994, these are created by ditches which allows drainage.

In Fiji, it is known as *vuci, solove or vuevue* and are found on small scales in many local areas (Kulhken, 19994). The high organic contents and activities of these soils are said to have reduced the nematode population by producing toxic substances to the nematodes. In Papua New Guinea, good storable aroid products are obtained by sun drying, foe example, colocasia suckers and headsets (Ochse, 1931). In Kiribati, *Cytosperma* corms are scalded, chopped and sundried and are stored for several months (Massal and Barrau 1955b).

Research and materials and methodology

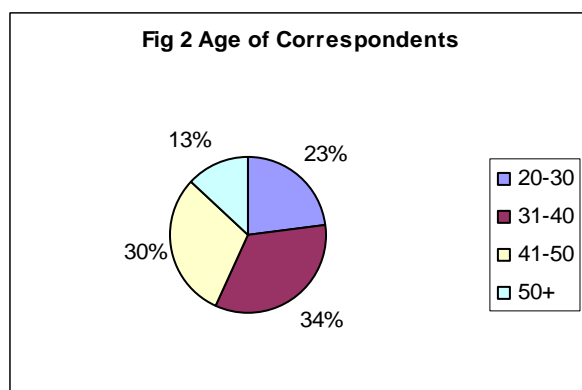
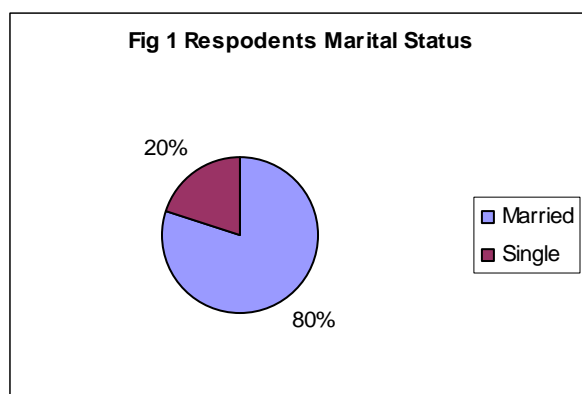
This study was carried out on the islands of Savaii and Upolu (Samoa). Interview Schedule of earlier field-test questionnaire was used to collect information from farmers through the use of Samoan Language. The questionnaires was divided into six sections. Sections A deals with the type of Indigenous Knowledge in the rural Samoan Community while section B solicited for information on the Indigenous Knowledge (IK) used in Agriculture development in Samoa, Section C is the impact of indigenous knowledge on sustainable agriculture and section D is the Demographic variables. This questionnaire was translated into Samoan Language and fifty copies were made. Twenty copies were randomly distributed to farmers in Savaii while thirty were randomly distributed to farmers in Upolu by the help of the extension division of MAFFM, Samoa.

In all out of fifty questionnaires distributed only 30 (65%) questionnaires were returned. Subject pertaining to the topic was researched at the library of the School of Agriculture, Alafua campus and some information were obtained from the internet using “Google search”.

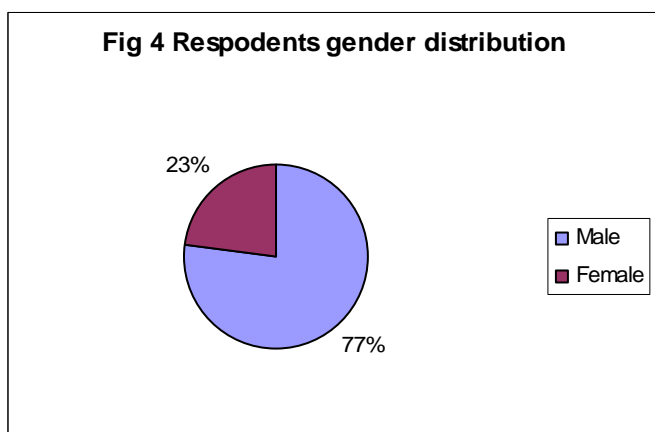
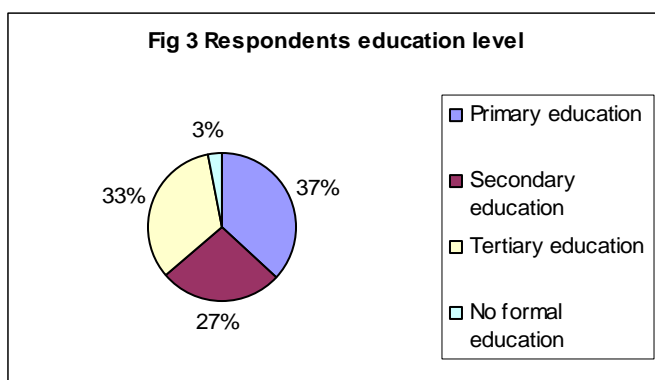
Results and discussions

Respondents personal characteristics

Fig 1 shows that majority (80%) were married and only 20% were unmarried. This is expected as all respondents were adults when viewed against the age distribution in Fig 2. That is because majority were around the age of 30-50 years old (63), thus are well experienced and knowledgeable in the local Samoan method of farming.



The distribution of respondents according to educational level (Fig 3) shows that there is a high level of farmers in Samoa who have gone through formal education (only 1% no formal education). This indicated that farmers in Samoa have recognized the benefits and values of indigenous knowledge and its impacts of environment of Samoa.



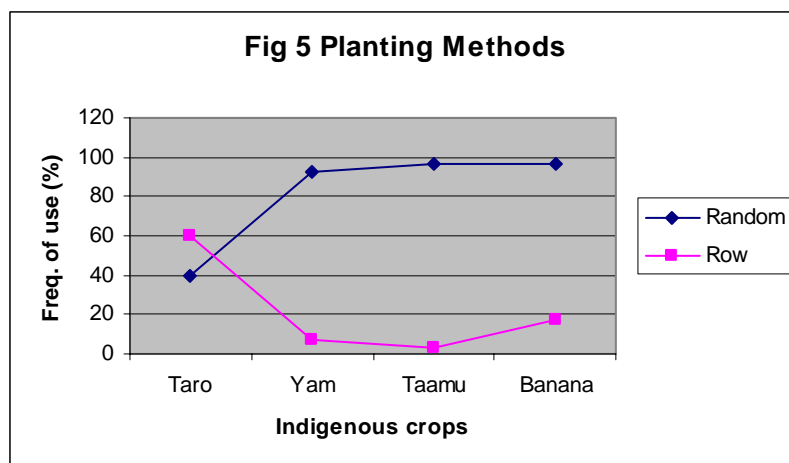
Furthermore, the study indicated that 77% of the respondents were male (Fig 4). It indicated that male are responsible for the greater part of food production in Samoa. However, there is an increase of 23% (Fig 4) of female involving in farming. This is a remarkable figure, as traditionally females do not farm. However, this result has indicated the changing role of women.

Farming task variables: Indigenous soil preparation and planting materials

Traditionally farmers in the Pacific Islands countries practice non-tillage farming techniques. This means that farmers normally clear the land which is either done by hand or burning and raise crops with minimum disturbance to the soil (soil is not tilled). Holes for planting are made with a stick (oso) that is large enough for the planting material. In the case of taro (esculenta) the apex of the shoot (tiapula) is placed in the hole and base is covered with soil. With taro, there are no significant differences on yield between tillage and non-tillage treatments. However, weed infestation is greater with tillage with other benefits such as soil conservation and lower labour inputs.

67% of farmers in Samoa plant taro, yams and taamu with the use of planting stick (oso). Normally they work the digging stick to the soil and lever in three or four directions to make a hole of accepted size. The tiapula is then placed into the hole and oso is used to press the soil against the shoot.

3% of farmers indicated that taro should be planted with the arrival of rainy season. They explain that planting in the dry season might affect taro from suffering from lack of moisture. Results also indicated that 93% of the respondents plant yam randomly and only 7% plant yams in rows.

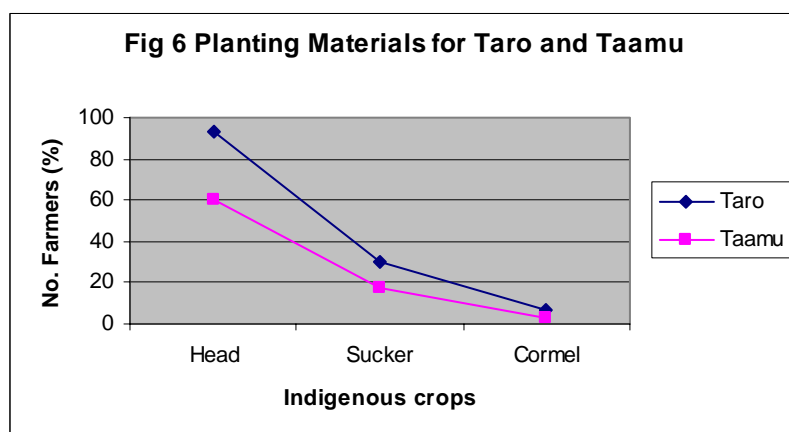


Indigenous Preparation of planting materials and parts used for taro and taamu.

According to Table 1, it is evident that majority of farmers agreed that the bigger the stipule, the bigger the yield. Some farmers indicated that the tiapula and lauvai or piles of taro tops and suckers (ofaga) are covered with banana leaves and left under shade for 1-2 weeks before planting. Fig 6 indicates that majority of farmers used tiapula as the best planting materials for taro and taamu.

Table 1 Preparation of planting materials and parts used for taro and taamu (n=30)

Activity	Frequency of use			
	Taro	%	Taamu	%
Leave headsets 1-2 weeks before planting	15	50	15	50
Select large Suckers only	5	17	5	17
Planting at the start of rainy season	20	67	5	17
Parts used for planting				
Plant head sets (tiapula)	28	93	18	60
Plant suckers (Lauvai)	15	30	5	17
Plant control	2	7	1	3



Preparation for planting materials and parts used for planting yams

In Table 3 a majority (80%) of farmers plant yams on mounds and 70% use headpiece as planting materials. Headpieces are normally treated with ashes to prevent diseases infestation before planting. While 50% of the respondents allow the headpiece to sprout before planting.

Table 3 Preparation of planting materials and parts for – yam (n=30)

Activity	Freq. of use	Percent
Preparation		
Planting on flats and dug holes	23	
Planting on mounds	24	
Sprouting before planting	15	
Parts used for planting		
Headpieces	21	70
Middle	2	7
Tails	1	3
Milk Yam	4	14
Small whole yams	5	17

Preparation of planting materials and parts used for planting banana

In Table 4, it shows that 67% of farmers prefer to trim shoots from the suckers' corms before planting and 83% used sword sucker as best planting materials for banana.

Table 4 Preparation of planting materials and parts used for – banana (n=30).

Activity	Freq. of use	%
Preparation		
Plant broad leaf suckers with leaves removed	16	
Plant suckers with roots removed (Trimmed)	20	
Remove roots and leave suckers under shade for 1 week before planting	4	
Parts for planting		
Sword suckers	25	83
Broad leaf Suckers	2	7
Stumps	1	3

Indigenous methods of controlling pests and diseases

In Table 5, it indicated that farmers in Samoa have practiced various indigenous knowledge to control pests and disease even before the advent of modern synthetic insecticides. Most of the indigenous insect pest control methods were to disrupt pests' life cycle by periodically denying their food and to achieve the maximum control the manipulation of ordinary agricultural practices would follow.

McKenzie (1990) stated that pacific island countries have a broad range of plant diseases of concern (e.g. taro leaf blight, Mitimiti disease of taro, Alomae and Bobone disease of taro, bacterial blight of cassava, papaya ring spot, coconut tinangaja, Panama disease of banana, Vascular streak of cocoa). There is continual worry over spread of diseases and their control. The late includes diseases with the potential to spread over the Pacific – those currently of restricted distribution within the Pacific and those which are present outside the Pacific region. Besides these diseases of restriction, distribution, there are many serious and widespread diseases which limit crop production and hence the potential to export (e.g. Kava

dieback, taro corm rots, ginger rhizomes rots, banana leaf steak, cucurbit viruses). Fruit flies and taro beetles deserve a mention because of the resources allocated to reducing their spread and developing control methods. Here in Samoa, (see Fig 7) farmers use rouging as a method of controlling pests and diseases taro, yam, taamu and banana. From this result, I believe that farmers also use rouging to control the other diseases that were already mentioned.

There are concerns over the control of diseases already present in the country such as taro leaf blight (*Phytophthora colocasiae*), and concerns of diseases of quarantine risks. However from Table 5, we see that 33% of farmers used smoke to the field. Unfortunately, according to Tolivaa (1994), there is no record to support the effectiveness of this method.

Table 5 Indigenous methods of control of pests and diseases of taro, taamu and banana. (n=30)

Indigenous control methods	Frequency of use							
	Taro	%	Yam	%	Taamu	%	Banana	%
Sanitation (hygiene)	10	33	23	77	15	50	17	57
Burning & smoking	5	16	6	20	1	3	10	33
Use of resistant variety	24	80	15	50	1	3	3	10
Variatal Mixtr/intercropping	20	67	24	70	14	47	5	17
Rouging of diseased plants and leaves	25	83	21	70	3	10	16	53
Use parts as repellent/or attractant	24	80	3	10	1	3	-	-
Dusted planting materials (Ashes)	10	33	26	87	2	7	-	-
Dusted planting materials (sand)			5	17	-	-	-	-
Hand picking and squashing of beetles	15	50	15	50	5	10	1	3
Fallowing and Shifting cultivation	23	77	17	57	6	20	1	3
Using physical barriers	5	17	6	20	1	3	7	23
Selection of planting materials	25	83	20	67	2	7	20	67
Drying of setts prior to planting	-	-	12	40	-	-	-	-
Manipulation of planting season	22	73	9	30	1	3	-	-
Scaring devices for vertebrate pests	1	3	1	3	1	3	5	17
Slash and burn	11	37	1	3	3	10	14	47

Table 5, shows that fire ashes (lefulefu) are commonly used to treat yam cuttings or setts to prevent further infestation of pests and diseases. Hygiene (Table 4.2) often has a pest control purpose. The destruction of crop residues removes residual pest population and eliminates plant debris on the soil surface in which many pests find shelter for hibernation.

In Table 5, its shows that burning is not a common practices for controlling pests and diseases here in Samoa. Most farmers stated that burning could lead to soil erosion and other fertility problems. However, there are some cases that are applies to control pests and diseases. Soil scientists at the International Institute of for Tropical Agriculture, Nigeria have

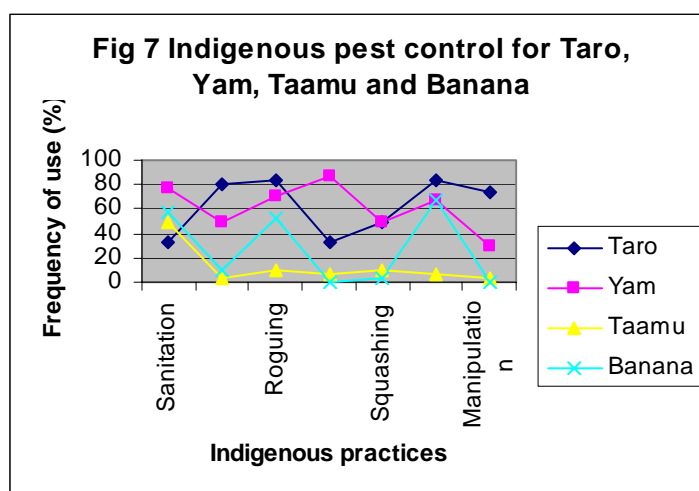
stated that burning a 10cm layer of plant litter can destroy nematodes to a depth of 9cm (AG 112 course book, pg).

Effectiveness of indigenous control methods

The respondent rating of the effectiveness of various indigenous control methods of pests and diseases is presented in Table 6, According to the result, the effectiveness of these control methods of pests and diseases depends on the type of pests and diseases concerned and the complexity of the attack.

Table 6 Frequency distribution according to the respondents ranking of the effectiveness of indigenous control methods for taro, yam, taamu and banana (n=30).

Control methods	Not effective	%	Effective	%	Very Effective	%
Sanitation	7	23	17	57	7	23
Bush burning & smoking	16	53	8	27	4	13
Use of Resistant Variety	15	50	16	53	-	-
Variatal mixture/ or intercropping	4	13	24	80	2	7
Rouging of diseased plants & leaves			27	90	5	17
Shifting cultivation fallow	11	37	19	63	5	17
Use of plants as repellants	6	20	4	13	-	-
Treated materials (ashes)	12	40	17	57	1	3
Treated materials (sand)	19	63	3	10	1	3
Scaring devices for vertebrates	20	67	1	3	-	-



According to Fig 7, indigenous control methods using hygiene, intercropping, fallowing and rouging of diseased plants and leaves are effective in controlling pests and diseases of taro, yam, taamu and banana.

Indigenous methods of maintaining soil fertility

In Table 7, it can be seen that mixed cropping is one of the frequently used indigenous methods of maintaining soil fertility for the four crops surveyed. According to Tofiga (2003), he described mixed cropping as the growing two or more crops simultaneously on the same piece of land with or without distinct row management. Mixed cropping systems create favourable condition for the soil, water, nutrients and provide excellent environmental conservation and sustainability. Eighty three (83%) of the respondents have practiced fallowing to maintain soil fertility on taro production. For many years, farmers in Samoa have

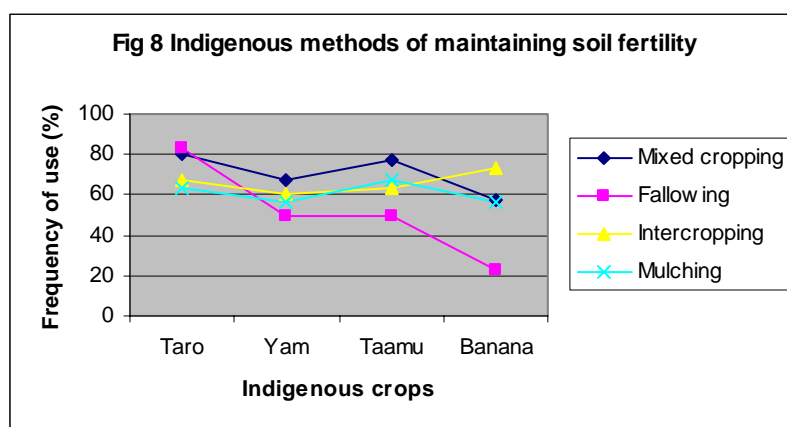
successfully practiced cultivation of taro (*esculenta*), farmers traditionally plant taro on newly cleared lands for 2-3 years and then must fallow 8-20 years, depending on the inherent soil fertility and land pressure (Wils, 1989). Recently increasing population has driven farmers to shorten the fallow periods resulting in the loss of soil fertility (Wright, 1963; Vergara, 1987a; Nile, 1988).

According to Paulson (1992), the parentage of cleared land in fallow varies considerably between villages. For instance, he stated that the percentage of land fallow in Taga and Saanapu in 1988 was 16% and 17% respectively. Intercropping is also common practice use to maintain soil fertility (Table 4.5) and controlling of pests and diseases (Table 7). In his research, Paulson also indicated that in Saanapu, about 50% of coconut land was both intercropped in both 1954 and 1988. the percentage of coconut land intercropped increased from 33% to 58% in Uafato and from 25% to 45% in Taga between 1954 and 1988. This he said was not an indication of intensification. However, young coconuts are also intercropped with taro (Paulson D 1992).

Table 7 Frequency distribution according to indigenous methods of maintaining soil fertility of taro, yam, taamu and banana (n=30)

Indigenous method of maintaining soil fertility	Frequency of use							
	Taro	%	Yam	%	Taamu	%	Banana	%
Fallow	19	83	25	50	15	50	7	23
Planting local legumes	10	33	6	20	2	7	2	7
Mulching	1	3	18	60	16	53	-	-
Adding compost (dead leaves)	1	3	12	40	1	3	1	3
Mixed cropping	24	80	20	67	23	77	17	57
Mulching (coconut husk)	19	63	17	56	20	67	17	56
Shifting cultivation	20	67	14	47	15	50	1	3
Charcoal and ashes	15	50	1	3	1	3	-	-
Intercropping	20	67	18	60	19	63	23	73
Sea weeds			1	3	1	3	1	3
Animal manure	5	17	8	27	1	3	1	3

In Fig 8, shows that there are majority of farmers who use mixed cropping, fallowing, intercropping, and mulching to maintain soil fertility.



Indigenous methods for controlling weeds

Majority of small holder farms in Samoa (Table 8) still practice cultural methods such as pull and burn, mulching, shifting cultivation, fallowing, slash and burn, intercropping, cover cropping and shallow cultivation to control weeds in the garden. It is clear from the result (Table 8) that 60%-70% of farmers in Samoa are practicing the indigenous method of “pull and burn” and “fallowing” to control weeds of taro, yam and taamu.

Table 8 Frequency distribution according to indigenous methods of weed control in taro, yam, taamu and banana. (n=30).

Indigenous weed control method	Frequency of use							
	Taro	%	Yam	%	Taamu	%	Banana	%
Pull & burn	20	67	18	60	20	67	10	33
Mulching	14	47	23	77	1	3	1	3
Shifting cultivation and fallowing	22	73	22	73	18	60	5	17
Hand weeding	21	70	18	60	16	53	14	47
Slash and burn	5	17	12	40	5	17	14	47
Intercropping	21	70	20	67	5	17	26	87
Shallow cultivation	5	17	8	27	5	17	1	3
Plant cover crop	2	7	5	17	1	3	8	27

Effectiveness of indigenous method of controlling weeds for Taro, yam, taamu and banana. The respondents rating of the effectiveness of the various indigenous control methods of weeds is presented in Table 9, indigenous control methods using mulching, fallowing, intercropping and planting cover drop are effective in controlling weeds here in Samoa.

Table 9 Frequency distribution according to the respondents ranking of the effectiveness of indigenous control methods (=30)

Control methods	Not effective		Effective		Very effective	
		%		%		%
Bush burning (slash & burn)	15	47	10	33	3	10
Mulching	6	20	18	60	8	27
Shifting cultivation fallow	11	37	19	63	10	33
Intercropping	12	40	17	57	5	17
Plant cover-cropping	5	17	19	63	9	30

Indigenous methods of harvesting and storage of the four root crops surveyed

Table 10 shows some traditional storage systems that are used to store roots crops. Taro, yam, taamu, together with cooking bananas (plantains) are perishable staple food crops. Many communities in Samoa traditionally practice a greater or lesser degree of “storage avoidance”, i.e. harvesting only for immediate or short term requirements throughout much of. Or even the whole year. Thus, storage systems are usually relatively short term (the yams, the most highly seasonal of the perishable crops, provide a marked exception). Nevertheless, many traditional communities in Samoa have been primarily dependent on the perishable staples for centuries or often millennia, have devised many highly ingenious storage and processing techniques for these staples. The culture-historical evolution of these societies in relationship to their food plants has, in general, made them strongly eccentric in their thinking, in contrast to the technocentric philosophies prevailing in the developed world, while further their material resource bases are strictly limited. Their storage (see table 4.7) and processing systems are generally, therefore, extremely simple and have only minimal impact on the total environment. Owing to their simplicity and the fact that they are usually individually small-scale, they have often been disregarded or even despised as “primitive” by

qualified agricultural scientists; this attitude has been reinforced by the fact that the vegetative-propagated crops from which these staples are derived are poorly understood within and alien to the “Western” cultures within which scientific thinking developed.

Table 10 Indigenous methods of harvesting & storage – taro (n=30)

Activity	Frequency	Percent
<u>Harvest</u>		
After 6 months	4	13
After 6-8 months	6	20
After 7-9 months	1	3
After 10-12 months	1	3
<u>Storage</u>		
Pit storage	8	26
Store in cool place (shade)	23	77

Table 11 shows that 90% of the respondents harvest yams when the plant dies and 67% harvested yams twice. The first harvest is when the tubers are large and the second is when the tubers die. The storage life of yams is finally terminated by breaking of dormancy and subsequent sprouting but storage of tubers for food use can be extended by as much as a month by breaking off emergent sprouts when they are 20-30 mm long (Coursey, 1981). Most farmers in traditional yam growing societies are well aware that only sound healthy tubers are suitable for storage and others are set aside for consumption and processing.

Figure 9 shows respondents indicating that the simplest storage technique for yam is leaving the tubers on the ground until they are needed during the planting time.

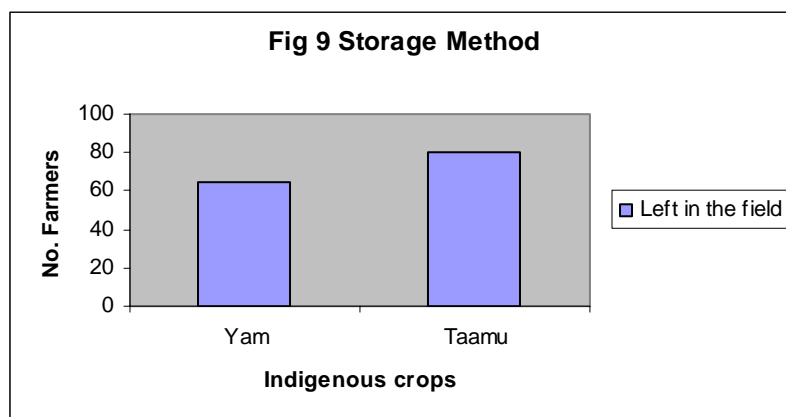


Table 11 Indigenous methods of harvesting and storage – yam (n=30)

Activity	Frequency of use	Percent
<u>Harvest</u>		
6-12 months	2	7
Yam plants die	27	90
First harvest & second Yam harvest	20	67
Harvest done by hand	30	100
<u>Storage</u>		
Avoid breaking & scratching	18	60
Store in hatch house	6	20
Left in ground	12	40
Store in dry shade	3	10

In Table 12 shows that majority (73%) of respondents agreed that taamu must be stored under well ventilated shade and must be harvested when corm are fully dormant.

Table 12 Indigenous method of harvesting & storage – taamu (n=30)

Activity	Frequency	Percent
<u>Harvest</u>		
7-9 months	1	3
12-18 months	15	50
Leaf decrease in size and corm fully dormant	23	73
<u>Storage</u>		
Left in the field (ground)	25	83
Store under shade (coconut leaves)	10	33
Proper ventilated area	5	17

In Table 13, it was found that none of the respondents has indicated the storage method for banana. However majority (53%) harvested their banana when the finger is plump but still green.

Table 13 Indigenous methods of harvesting & storage of banana (n=30)

Activity	Frequency	Percent
<u>Harvest</u>		
Harvest when finger turn yellow	2	7
Finger are plump but still green	16	53
Fully mature	2	7
Some fruits are ripe	2	7
<u>Storage</u>		
(There is no record)		

Importance of IK to sustainable agriculture in crop and animal production

Tables 14 and 15 have indicated the importance of indigenous knowledge in crop and animal production here in Samoa. For instance, 97% (table 4: 8.1) of respondents indicated that indigenous method for controlling pests and diseases in crop production are effective and cost effective. This will be true because from table 4.2 are the lists of indigenous control methods that are appropriate for farmers to use in terms of their small scale production.

Table 14: Importance of IK to sustainable agriculture – crop production (n=30)

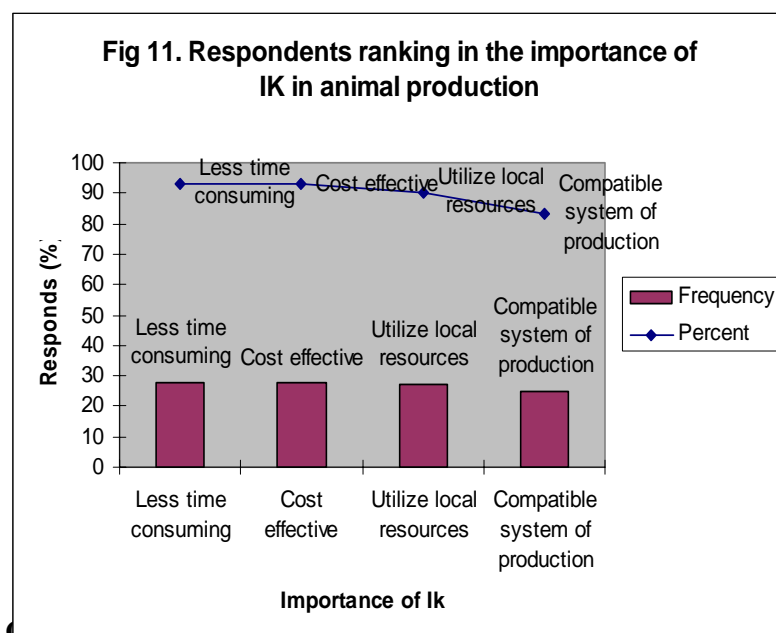
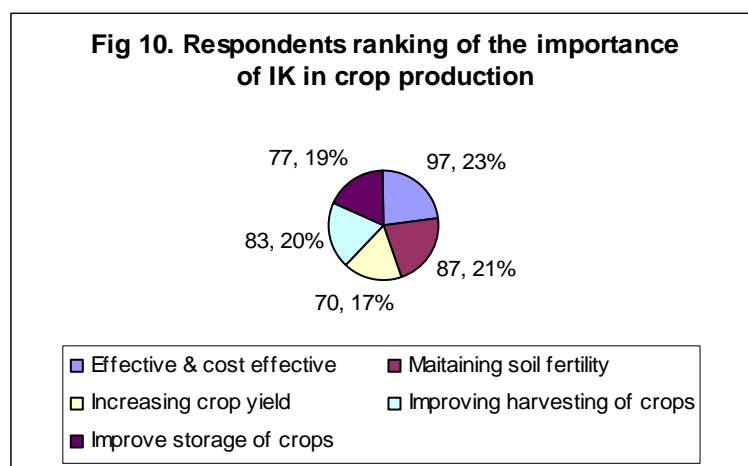
Practices	Frequency	Percent
Seed preparation promotes early germination & health		
Seedlings	20	67
Preparing planting materials produce healthy crops	25	83
Spacing produce high yield	13	43
Weed control reduces pests & diseases	17	56
Pest control are effective & cost effective	29	97
Maintaining soil fertility	26	87
Increasing crop yield	21	70
Improving harvesting of crops	25	83
Improves storage	23	77

In Fig 10, shows that majority of small scale farmers use IK in crop production because it is;

- Effective and cost effective
- Sustainable way of maintaining soil fertility
- Improves and increases crop production
- Improves storage

Table 15 Importance of IK to sustainable agriculture – animal production (n=30)

Practices	Frequency	Percent
Improves animal behavior	15	50
Improves labor intensity	14	47
Improves animal management	19	63
Sustain feed availability to animals	21	70
Less time consuming	28	93
Cost effective	28	93
Utilize local resources	27	90
Compatible system of production	25	83
Use of appropriate facility	14	47



The 80-90% (see Fig 11 and Table 15), of farmers indicated that IK in animal, production.

- Less time consuming and cost effective. This may be true because chemicals and feed are expensive, its require ongoing cash and majority of farmers here in Samoa are small holders and cannot afford to rely on it because it might be five time their average household income.

- Sustainable feed availability to animals. Indigenous knowledge draws on local resources. People are less dependant of outside supplies which can be cost scarce and available only irregularly.
- Less time consuming. This is because of smallness of the farms and the system of production compatible.
- Compatible system of production. Farmers are familiar with indigenous practices and technologies. They can understand, handle and maintain them better than introduced western practices and technologies.

Conclusion and recommendation

Conclusion

- There is much to be learnt from the IK system if we are to move toward interactive technology development from the conventional transfer of technology approach, it is feasible, efficient and cost effective to learn from the village – level experts (IAD vol.,13).
- Traditional knowledge is vital to sustainable development of Samoa's natural resources. Sustainable Agriculture development and conservation of Samoa's resources could be significantly advanced if modern scientific knowledge could be incorporated with the traditional knowledge system.
- Much of the IK has been lost since early European colonial and more recent internally eco-colonialism. Whether traditional knowledge used in Agricultural production will survive the millennium remains the question of time. There should be an awareness programme about the value of IK for development in order for the communities to conserve their indigenous knowledge.
- Small scale farmers in Samoa rely on IK for agriculture production because it is efficient and cost effective.
- Sustainability of Samoa's natural resources and Agriculture production depends on indigenous knowledge and traditional farming.
- Central and local Governments, environmental community and universities could become components of valuing, preserving and protecting Samoa's invaluable traditional knowledge before it disappears forever.
- IK should provide effective alternatives to western know-how. It should provide local Samoan, development workers or extension workers extra opinions when designing projects instead of searching only western technologies for feasible solutions. They can either choose from IK or combine indigenous and western technology in the development program.

Recommendation

The following recommendations have been derived from the conclusions of this research study. Since IK is important to sustainable agriculture:

- Recommended to do proper recording and documentation of IK used for agriculture. However, when recording, it is important to find who knows what in order to tap the right source. Otherwise data will not truly reflect IK in the community.
- Recommended to do research in improving IK used for agriculture by integrating with western technology.
- Recommended to preserve, protect and use IK to promote sustainable (ecological, socially and economically) agriculture development.

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