Indigenous and modern practices in yam cultivation in the Pacific Islands

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Abstract

An experiment was conducted to test a Tongan traditional belief that changing the direction of vine growth after two months of growth in the field results in higher yields and also the effect of mulching using guinea grass on growth and yield of yams *Dioscorea nummularia* var Palaimaoa'i. Yam plants arranged in a randomized complete block design with four treatments and five replications were harvested after seven months of growth on November 16th 2014.

Yield at harvest showed that changing the direction of vine growth after two months of vegetative growth produced significantly more tubers compared to not changing direction and the mulched plots had significantly lesser weeds compared to non-mulched plots ($P<0.05$). However, no significant differences were observed ($P>0.05$) in the mean vine length and tuber weight between treatments.

Another experiment was conducted to determine the best growth medium for rooting vine cuttings as an alternative source of planting material to yam tubers. The three growth media used were sterilised topsoil, riversand and carbonised sawdust. The treatment designwas a factorial arrangement of three growth media and four harvest dates replicated 3 times using a completely randomised design. The top soil medium produced significantly longer roots (5.8cm) at five weeks after planting followed by river sand (4.7cm) and carbonised sawdust (0.9cm). No differences were seen in the number of roots between the different media

It is therefore concluded that farmers should be encouraged to use changing of the yam vine direction technique and to use top soil for raising yam vine cuttings in the Pacific Countries. These techniques have increased the number of tubers produced by yam plants and result in faster root growth of yam vine cuttings respectively.

Indigenous and modern practices in yam cultivation in the Pacific Islands

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Content

Introduction:

- Importance of yams
  - Cultural
  - Economic/Social
- Indigenous practice of changing vine direction after three months of growth in the field
- Vine cutting technology
- Summary

Introduction

- **Yam is an important crop in the Pacific islands**

1. **Cultural:** "History tells us that true traditional Tongan agriculture was very much influenced by the kings and nobility and was centered on yam (*Dioscorea alata*) production. Yam was considered the noblest crop, produced mainly for presentation to kings and nobles and for traditional feasts and festivals, such as the annual festival called Inasi, the festival for presenting the first yam harvest to kings and nobles before common consumption."
   Finau Pole

2. Economic

- Yam production by area and yield for four countries in the Pacific

	Scale	Area Harvested	Yield	Production Quantity	
Units		Ha	Hg/Ha	tonnes	
2004	units	338.000	165976.330	5610.000	Tonga
2005	units	347.000	161412.100	5601.000	
2006	units	360.000	127777.780	4600.000	
2007	units	370.000	127027.030	4700.000	
2008	units	458.000	141048.030	6460.000	
2009	units	356.000	111629.210	3974.000	
2010	units	398.000	138894.470	5528.000	
2011	units	352.000	138750.000	4884.000	
2012	units	360.000	138888.890	5000.000	
2013	units	400.000	131250.000	**5250.000**	
2004	units	900.000	10900.000	981.000	Fiji
2008	units	3522.000	11445.200	4031.000	
2009	units	1040.000	11750.000	1222.000	
2010	units	1400.000	12142.860	1700.000	
2011	units	4500.000	13184.440	5933.000	
2012	units	4500.000	13097.780	5894.000	
2013	units	4500.000	12444.440	**5600.000**	
2004	units	535.000	49906.540	2670.000	Samoa
2005	units	549.000	48542.810	2665.000	
2006	units	560.000	47321.430	2650.000	
2007	units	570.000	47228.070	2692.000	
2008	units	590.000	46694.920	2755.000	
2009	units	630.000	46873.020	2953.000	
2010	units	650.000	46153.850	3000.000	
2011	units	574.000	46167.250	2650.000	
2012	units	580.000	47413.790	2750.000	
2013	units	580.000	47413.790	**2750.000**	
2004	units	3600.000	86111.110	31000.000	Solomons
2005	units	3900.000	82051.280	32000.000	
2006	units	3500.000	85714.290	30000.000	
2007	units	3900.000	82051.280	32000.000	
2008	units	4000.000	85000.000	34000.000	
2009	units	4100.000	85365.850	35000.000	
2010	units	4100.000	85365.850	35000.000	
2011	units	4100.000	85365.850	35000.000	
2012	units	4000.000	110000.000	44000.000	
2013	units	4200.000	107142.860	45000.000	

- In Tonga, it is tradition for yam farmers to compete for the best farmer of the year.
- One of the winners, Paula Faka'utoki has shared with us his traditional knowledge (secret) about how he became a successful yam farmer.
- This secret is in changing the direction of growth of the vines to the opposite side after two months of growth in the field.

- In the past 10 years, farmers of Tonga have cultivated squash for export to Japan, Korea and New Zealand.
- After five years, the remaining vegetation is just guinea grass and there is no more bush vegetation for stakes.
- Farmers are now using grass mulches for the yams in place of stakes as a trellis system.

Research objectives:

- To compare the effect of changing vine direction to the opposite direction on yam growth and tuber yield
- To compare the effect of mulching on yam growth and tuber yields
- To compare the effect of mulching on weed incidence in yam plots

Methodology:

- A randomized complete block design (RCBD) was employed, with yam planted in each treatment being grown five blocks
- **Trial treatments**
- T1 – no direction, no mulch
- T2 – direction, no mulch
- T3 – no direction, mulch
- T4 – direction, mulch

Plot Management

- **Land preparation:**
- Selected land area was cleared and planting holes were dug for four plants per plot and sixteen per block which amounted to eighty plants from five blocks.

- Hand pulling of weeds

Mulching

Guinea grass was used as mulch for the mulch treatments.

- **Changing the vine direction**

- Changing of the directions of yam vines was done after the first three months after planting.

- Hook stick were used to maintain the vines in the changed direction.

Harvesting

Statistical Analysis

- All the data collected was subjected to analysis of variance using the standard ANOVA of a RCBD design.
- Where significant differences ($P<0.05$) were observed, the least significant difference (LSD) method was used to compare means.

Results and discussions

Treatments	Vine Length (m)	Number of Weeds/plot	Tuber Number	Tuber Weight
No mulch & no direction	1.978^{ns}	219.6 ^{a}	2.4^{c}	3.78^{ns}
Direction & no mulch	2.288^{ns}	178.8 ^{a}	3.8^{b}	4.11^{ns}
Mulching & no direction	2.118^{ns}	64.6 b^{b}	3.0^{c}	4.33^{ns}
Direction & Mulching	2.396^{ns}	45.6^{b}	4.4^{a}	4.56^{ns}
LSD	0.567	50.39	1.01	1.83

Source of variance	df	S.S	M.S.	v.r.	F pr
Block stratum	4	8.8000	2.2000	4.12	
Block. *Units* stratum					
Treatments	3	11.6000	3.8667	7.25	0.005
Mulch vs No mulch	1	1.8000	1.8000	3.38	0.091
Direction vs No direction	1	9.8000	9.8000	18.38	0.001
Residual	12	6.4000	0.5333		
Total	19	26.8000			

Conclusions

- Mulch did not improve yam growth and yield but reduced the occurrence of weeds.
- Training yam vines to the opposite direction increased tuber numbers.

Rooting vine cuttings for field planting

Falaniko Amosa

Propagation

1. Corm

2. Minisetts

Problems

1. Tubers are the edible portion of the crop and is also the propagule used by farmers for planting out the crop in the field.

   This leads to big losses in farmers' income and food supply.

2. Tubers are dormant and only allow one crop per year

Vine cuttings

Research

- Considering the opportunities presented by the vine cutting technology this research was conducted at Vaitele Samoa.

Research Objectives:

1. Determine the best growth medium for rooting vine cuttings
2. Determine if vine cuttings can be rooted
3. To compare field growth and yield of vine propagated yams after three months.

Methodology

- Experimental design: CRD
- Treatment design:
  Factorial arrangement of three growth media and four harvest dates replicated 3 times
- Treatments:
  - Sterilised top soil
  - River sand
  - Carbonised sawdust

Vine cutting preparation

Vine cuttings

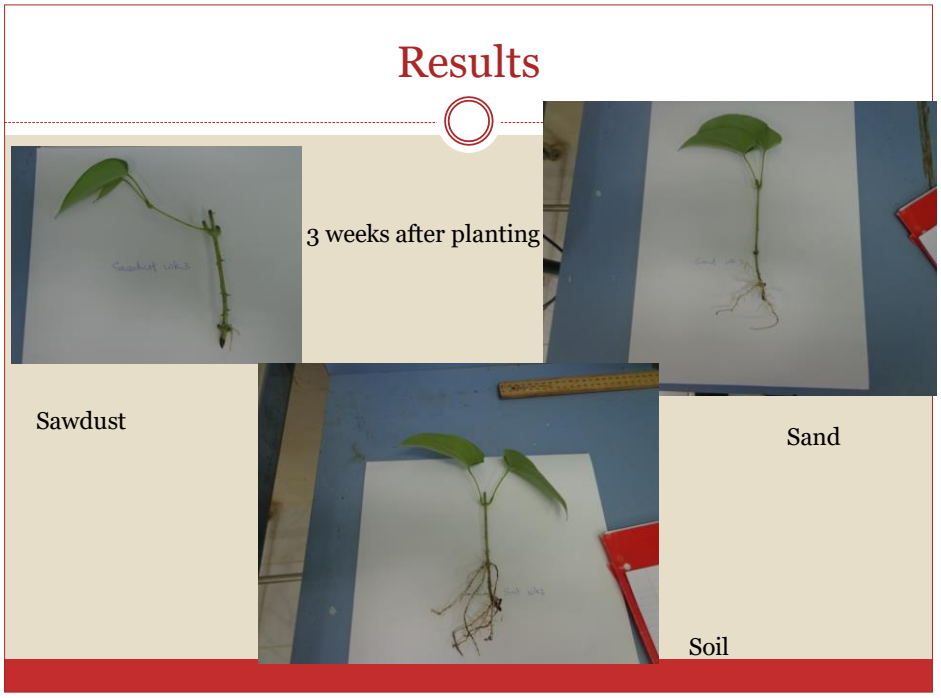
•Taken from plants 2 – 3 months old

•Cuttings with about 3 – 4 nodes

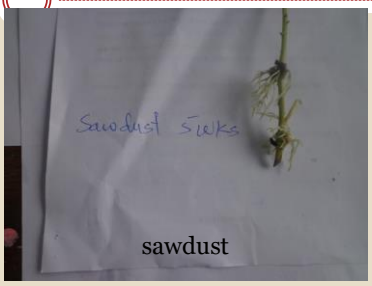
•Leaves removed from lower nodes

- Vines were dipped in a rooting hormone
- Planted in plastic bags
- Bags put in an enclosed space

- Data Collection
  - Root number
  - Root length
  - Mortality percentage
- Data analysis: ANOVA of CRD


Results
3 weeks after planting
Sawdust
Sand
Soil

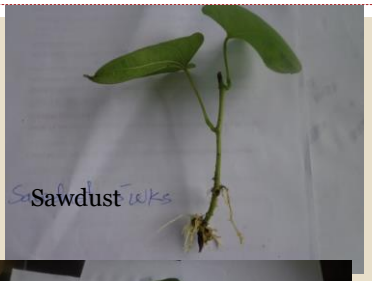
Root Number



Means for Treat

Sand	Sawdust	Soil
7.0	10.3	8.0 ns

Root length (cm)



Means for Treat

Sand	Sawdust	Soil
4.7 b	0.9 c	5.8 a

Conclusions

- After five weeks of growing vine cuttings in nursery:
  - The Top soil Medium proved to be the best medium followed by the River sand medium.

Comparing field growth of three months old vine propagated yams raised on three different nursery growth media

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Materials and Methods

- The experiment was carried out at Vaitele–uta Apia Samoa.
- Five weeks old vine propagated yam plants were planted in raised beds 0.5m between plants and 1m between beds in a Randomised Complete Block Design with three treatments and five replications.

Data Collection

Data for the following parameters was collected 3 months after transplanting of the vines:

- Number of roots and root length;
- Number of tuberous roots (tuber number and weight); and,
- Total Biomass (dried at 65 degrees Celsius).

Statistical Analysis

- All the data collected was subjected to analysis of variance using an RCB design.
- Where significant variance ratios (P<0.05) was observed, least significant differences (LSD) was used to separate and compare means between the growth media.

RESULTS AND DISCUSSION

A. Mean Root Length (cm)

TREATMENT	TOP SOIL	RIVER SAND	CARBONISED SAWDUST
MEANS	13.90 *a*	17.80 *a*	8.50 *b*
LSD (5%) = 5.2			

➢Yam vines propagated on topsoil and river sand media produced significantly (P<0.05) longer roots as compared to vines propagated on carbonised sawdust medium 3 months after transplanting.

➢This result indicates that plants with longer roots at transplanting will result in faster root growth in the field (Amosa 2014 unpublished).

B. Number of Roots

TREATMENT	TOP SOIL	RIVER SAND	CARBONISED SAWDUST
MEANS	9.8 *a*	8.0 *a*	9.4 *a*
LSD = 5.0			



- There were no significant differences observed (P>0.05) in the mean number of roots produced by yam vine cuttings propagated using the three different media.
- This result is consistent with the results by Amosa ,2014.
- Root initiation is control by other factors other than growth medium.

- **Number of Tubers**

TREATMENT	TOP SOIL	RIVER SAND	CARBONISED SAWDUST
MEANS	1.8 *a*	1.8 *a*	0.2 *b*
LSD = 1.3			



- Yam vines propagated on topsoil and river media produced significantly ($P<0.05$) more number of tubers as compared to vines propagated on carbonised sawdust media.

- This is because the plants in top soil and river sand media had longer roots at transplanting which enabled them to absorb more nutrients and moisture that allows for better growth and tuber formation 3 months after transplanting.

- **Tuber Weight (g)**

TREATMENT	TOP SOIL	RIVER SAND	CARBONISED SAWDUST
MEAN	13.8 *a*	6.3 *ab*	0.1 *b*
LSD = 8.63			



- Yam vines propagated using topsoil media produced significantly heavier (P<0.05) tubers than those propagated using carbonised sawdust.
- However tuber weight were comparable between topsoil media and river sand
- Perhaps, the lowered number of mini tubers obtained in carbonised sawdust was due to the slow growth after transplanting due to smaller roots.

Total Biomass (g)

TREATMENT	TOP SOIL	RIVER SAND	CARBONISED SAWDUST
MEANS	20.42*a*	17.0*ab*	11.97*b*
LSD =7.66			

Plant Total biomass was higher in topsoil media (P<0.05) than plants using carbonised sawdust.

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CONCLUSIONS

- Yields produced at harvest, 12 weeks after transplanting on the field, showed that using Top soil and River sand as the nursery planting media produced more and bigger tubers compared to plants propagated on carbonised sawdust.

- Besides, the technique offers hopes of alternative planting material to the tuber otherwise needed as energy food source for animals and man.
- Vine cutting technology offers an opportunity to plant more crops of yams in a year

RECOMMENDATIONS

- It is recommended that at early stage of vine propagated yams, a proper management practice to be done which includes:
- A) fertilizer application and frequent watering to boost the vegetative growth of the plants.
- B) Application of pesticides to protect new plants from pests and diseases

- Farmers should be encouraged to use yam vines as the planting materials to plant yams where ever feasible in the South Pacific countries. This is to save tubers for sale and allows for growing more than one crop per year.

Summary

- Indigenous knowledge and practices still work.
- The way forward for the Pacific island farmers for increasing yam production is the merging of old and new knowledge and practises.


THANK YOU