CSIRO Publishing
The South Pacific Journal of Natural and Applied Sciences, **35**(1), 1-9, 2017
www.publish.csiro.au/journals/spjnas
10.1071/SP17001

Performance of Improved Sweetpotato (*Ipomoea batatas* L.) Cultivars Under Different Soil Types of Samoa

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Abstract

There is need to diversify crop production in Samoa which currently depends mainly on taro crop, that has proved to be susceptible to fungus and other diseases, to as safeguard against risks of crop failures and adapt to climatic changes. The potential of introducing sweetpotato as a second staple food in Samoa is explored in this study. The study analyses the suitability of sweetpotato cultivars in Samoan agro-environment and major soil types. For this purpose a twenty week pot experiment was conducted to investigate the performance of three improved sweetpotato cultivars (IB/PR/12, IB/PR/13 and IB/PH/03) on four different types of soils in Samoa (Savaia calcareous sandy loam, Matafa'a red acidic, Faleula silty clay and Saleimoa silty clay) in a factorial arrangement of treatments in randomised complete block design with three replications. Results revealed that soil type had a significant effect on vine growth, and storage root yield with the best yield obtained in the silty clay soils having high K content. Retarded plant growth observed under the acidic soil having low K content resulted in lowest storage root yield. A significant varietal difference was recorded in sweetpotato growth and yield. IB/PH/03 was inferior in vine length, but produced comparatively highest number of vines per plant, and storage root yield attesting its adaptability in all the four tested soil types of Samoa and has potentiality to be promoted for wider adoption. A follow-up field study is needed to verify our preliminary results under pot culture on different soil types of Samoa.

Keywords: *Sweetpotato cultivar, Soil type, Sweetpotato yield, Dry matter yield*

1. Introduction

Sweetpotato (*Ipomoea batatas* (L.) Lam) is a staple root crop in some countries in the Pacific region. It is an excellent source of carbohydrates, minerals and vitamins that forms an integral dietary component. The leaves have high nutrient contents and sometimes consumed as a green vegetable (Roshni *et al*., 2014; Woolfe, 1992). In Samoa, sweetpotato is still a relatively underutilized food crop. This is due to the established popularity of taro (*Colocasia esculenta*) at the dining table and its dominance in traditional ceremonies (Semisi, 1993). Furthermore, the high productivity of taro especially under fertile and high rainfall conditions (Ward and Ashcroft, 1998) ensured it remained a staple food. Unfortunately, the production was severely devastated in 1993 by the rampant infestation by taro leaf blight (TLB) (*Phytophthora colocasiae*) (Hunter *et al*., 1998), destroying about 95% of the farms nationwide (Pouono *et al*., 1994), and plummeted the taro export to 0.5% of 1993's export (WST$10 million) in 1994 (Chan, 1994). As taro production declined, food insecurity ensued and farmers were compelled to diversify in crop production as a result (Jackson, 1996; Semisi, 1993).

Presently, taro production is recovering following rapid distribution of TLB-resistant cultivars in the wake to revive the demised industry. However, very recently it was reported in local media that taro is again infected by a new unknown virus (Likou, 2017). Fearing another calamitous TLB breakout or other diseases, diversification of the food base to sustain food security remains imperative. In addition, the unprecedented changes in weather patterns may impose deleterious conditions on taro (Taylor and Iosefa, 2013). Taro also requires high quantity of chemical fertilisers and most farmers are incapable of purchasing these (F. Amosa, 2015, *personal communication*) and thus depleting soil fertility very quickly. There is a need to diversify crop production in Samoa which currently depends mainly on taro crop, that has proved to be susceptible to fungus and other diseases, to as safeguard against risks of crop failures and adapt to climate changes. Through concerted efforts to expand local food base, sweetpotato has emerged as one of the important crops the Samoan government endeavours to promote. The potential of introducing sweetpotato as a second crop in Samoa needs scientific exploration as very little information pertaining to crop performance under local conditions is available. Therefore, this study purposefully aimed at investigating the performance of introduced improved sweetpotato cultivars under different soil types of Samoa.

2. Materials and Method

2.1. Study Area, Treatments and Experimental Setup

The research work included (i) collection of four representative soil samples from four locations in Samoa and their analysis for chemical and physical characteristics, (ii) obtaining three sweetpotato cultivars, (iii) conducting two factor (3 x 4) randomised complete block design experiment with three replications for assessing the effect of sweetpotato cultivar and soil type on the crop yield. The pot experiment was conducted for twenty weeks in a screen house at the University of the South Pacific, School of Agriculture and Food Technology (USP-SAFT), Alafua Campus, Samoa in 2015. This area is characterised by tropical climate having an annual average temperature and rainfall ranges from 24-29 °C and 5000-7000 mm, respectively (Chand, 2002). In the experiment, one factor was three cultivars (C) (IB/PR/12, IB/PR/13 and IB/PH/03) and the other factor was four soils (S) (calcareous sandy, acidic clay and two silty clay soils). Hence, there were 12 treatment combinations (CxS) of cultivars (C) and soils (S) in the experiment and each treatment combination was replicated three times for a total of 36 pots.

2.2. Materials

In this study two Peruvian (PR) origin cultivars of sweetpotato (IB/PR/12 and IB/PR/13) and one cultivar (IB/PH/03) of the Philippine (PH) origin were used. These were the best high yielding cultivars after initial screening under Alafua condition in 2013 (Iosefa, unpublished data). The four samples of soils for the pot experiment were collected from four different locations in Samoa (Figure 1). The basis of selecting these soil types is to test how sweetpotato will perform agronomically when planted on a range soils in Samoa with varying inherent fertility levels. Each soil sample was homogenized and air-dried separately at room temperature. Air-dried soil was then sieved (< 1 cm) and placed in pots, each receiving 8 kg. In each pot, a healthy vine cutting (tip) of 30 cm long was planted with 2-3 nodes beneath the soil surface. Water was supplied as required to sustain the crop.

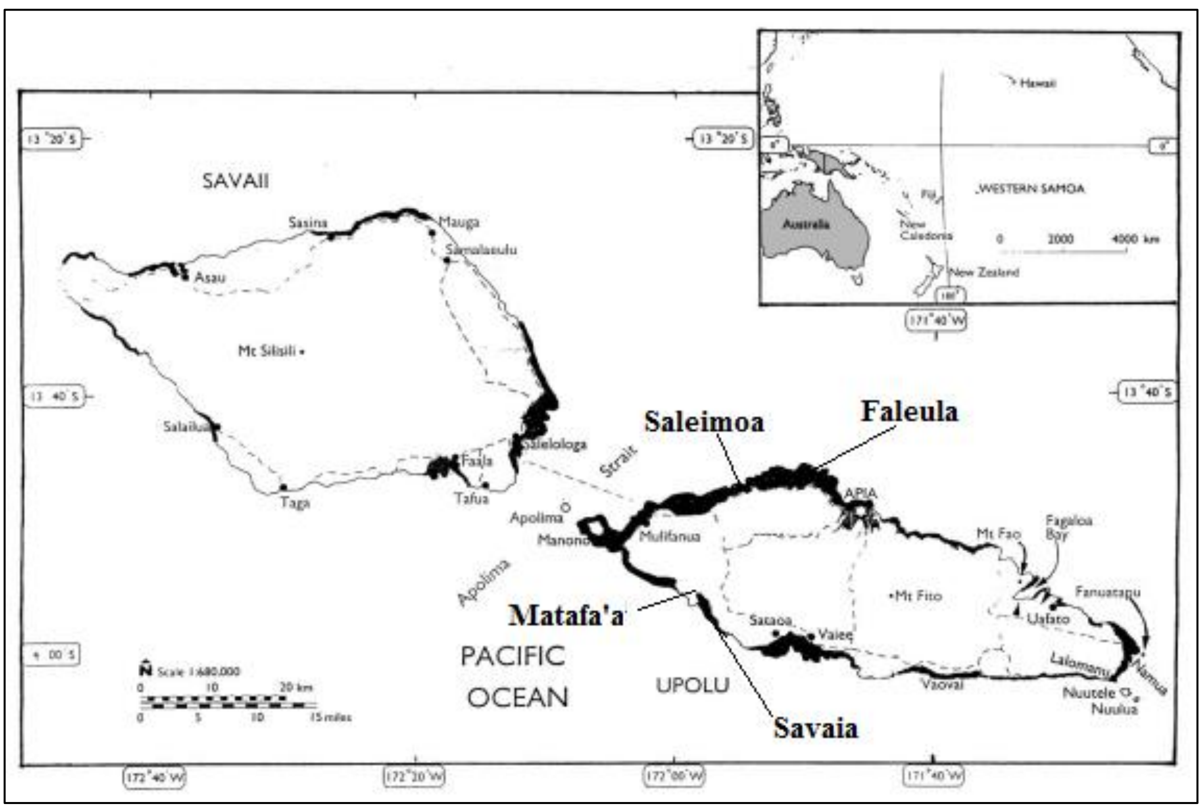

Figure 1. Location of farms where the soils were collected.

2.3. Soil Analysis

Soil samples obtained from four locations in Samoa were analysed for soil physical and chemical characteristics, e.g. soil texture, bulk density, pH, organic carbon (OC), total nitrogen (TN), available P, CEC, Ca, Mg, K, Fe, Mn, Cu, Zn. Except for TN and OC which required a sub-sample sieved at 0.25 mm, all the analyses were carried out using less than 2 mm sieved soil sample. Soil texture was determined using the hydrometer method (Bouyoucos, 1962). Soil pH was measured in 1:5 soil:water slurry using an Orin 720 pH meter after shaking for 1 hour. Total N (TN) was determined following the semi-micro Kjeldhal method (Blakemore *et al.*, 1987) whereas OC was measured following the wet oxidation method (Walkley and Black, 1934). Exchangeable base cations and cation exchange capacity (CEC) were extracted by shaking with 1.0 M ammonium acetate (NH_4AOc) buffered at pH 7.0 (Blakemore *et al.*, 1987; Daly *et al.*, 1984). Exchangeable base cations were measured by atomic absorption spectrophotometry, while CEC was measured following ammonium distillation and titration. Exchangeable acidity and aluminium (Al) were determined titrimetrically using 1 N KCl (Thomas, 1982). Available phosphorus (P) was extracted based on the Olsen *et al*. (1954) method and determined colorimetrically following Murphy and Riley (1961) method. Extractable iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn) were determined using the diethylenetriaminepenta-acetic acid (DTPA) as the extractant (Lindsay and Norvell, 1978). The physical and chemical properties of the four soil type are presented in Table 1.

Table 1. Some physical and chemical properties of the soils used in this study from four sites.

Soil properties	Savaia	Matafa'a	Faleula	Saleimoa
Bulk density (Mg m^{-3})	1.05	0.82	0.86	1.00
Texture				
Clay (%)	14	95	58	53
Silty (%)	8	2	41	43
Sand (%)	78	3	1	4
Textural class	Sandy loam	Clay	Silty clay	Silty clay
Classification (USDA taxonomy)†	Typic Tropopsamment	Humic Haploperox	Typic Hapludand	Typic Hapludand
pH	7.90	4.77	6.98	7.28
OC (%)	7.57	0.19	5.92	6.31
TN (%)	0.74	0.02	0.52	0.57
Available P (mg kg^{-1})	11.1	3.6	6.3	9.9
CEC (cmol (+) kg^{-1})	34.8	32.1	31.4	24.8
Exchangeable cation (cmol(+) kg^{-1})				
Ca	20.9	0.25	8.90	7.37
Mg	1.38	0.82	4.64	4.70
K	0.10	0.06	0.28	0.23
Al	nd*	5.21	0.098	0.098
Exchangeable acidity (cmol(+) kg^{-1})	0.20	5.27	0.25	0.25
Micronutrients (mg kg^{-1})				
Fe	22.4	7.6	59.3	65.7
Mn	31.6	12.7	157	152
Cu	0.39	0.10	7.56	6.03
Zn	3.46	0.05	9.29	7.47

* Not detected; † Russell (1990).

Based on soil ratings by Blakemore *et al.* (1987), Faleula and Saleimoa soils shared the same textural class of silty clay with *high* soil reactions corresponding to near neutral and slightly alkaline respectively. Organic C, TN, and exchangeable Ca content of these soils equally rated as *medium*. Both soil types have *high* CEC and Mg levels while available P and exchangeable K were found to be *very low*. On the contrary, Matafa'a red soil is a clay soil with *low* strongly acid pH, *very low* contents of OC, available P, and exchangeable Ca and K. Total N and exchangeable Mg are rated as *low*. However, it has a slightly higher CEC than the former soils which may be attributed to its high content of clay (95%). In the Savaia soil, the exceedingly *high* content of Ca reflects its calcareous nature and the high sand content (78%) is typical of a coastline soil type. Uncharacteristically, this soil comparatively had the highest TN and CEC which both rated *high*. Organic C and Mg levels were found to be *medium*.

2.4. Data Collection and Analysis

Since both the aboveground and belowground parts of the sweetpotato are important for consumption, data for both aboveground and belowground parts of sweetpotato have been analysed cultivar wise and soil type wise. The data on vegetative growth of vine was monitored on a four weekly basis to determine: primary, secondary, and tertiary vine lengths; and vines produced per plant. Twenty weeks after planting (WAP), plants were harvested, with both vine and root fresh weights were measured using a digital top loading balance. Primary vine length was measured using a tape measure on the initial planting material while secondary and tertiary vine lengths were recorded from the average lengths of each vine type produced respectively. Number of vines were recorded by counting. Dry matter content was measured after oven drying at 65 °C to constant weight. Percent dry matter is obtained by dividing oven dry weight by fresh weight and multiplying by 100.

All data collected were subjected to factorial ANOVA and where a significant difference was detected for the factor, the least significance difference (LSD) test was used to determine the difference between treatment means at $\alpha=0.05$ level of significance. Data were analysed using Statistical Tool for Agricultural Research (STAR, 2014).

3. Results and Discussion

3.1. Vegetative Growth

3.1.1. Vine Length

The sweetpotato cultivar-wise primary, secondary and tertiary vine length at four weeks interval are presented in Table 2. IB/PR/13 had the longest primary vine from planting to harvest although it did not differ statistically from IB/PR/12. On the other hand IB/PH/03 produced significantly shortest primary vine exhibiting a diminishing growth at 8 WAP. As regard secondary vine length, the IB/PH/03 cultivar produced a comparatively longer vine at 4 WAP, however, the IB/PR/12 and IB/PR/13 dominated thereafter until harvest. Longer tertiary vines were mostly produced by cultivar IB/PH/03. It appears that genotypically IB/PH/03 is a shorter vine type, while IB/PR/12 and IB/PR/13 conformed to long trailing vine type cultivar. It appears that as the plant ages, the primary vine growth declines at the expense of secondary and tertiary vines.

Vine length was also significantly affected by the different soil types (Table 3). A marked rapid growth of primary vine from 4-8 WAP, followed by slow growth was observed in all soils except Faleula. In this soil, vine was actively growing until 20WAP. Primary vine length produced under the acidic soil of Matafa'a was below par at each sequential measurement. All soil types revealed similar growth trend in secondary vine length with sweetpotato grown on Savaia soil showing longer vines that are still actively growing at harvest. Saleimoa soil produced the first tertiary vine as reflected by the recorded vine length at 4 WAP. The longest tertiary vines were produced in the Saleimoa and the Faleula soils. Matafa'a soil produced the least tertiary vine length.

Significant effect due to interaction between cultivar x soil type was also found at each vine type as represented by same LSD in corresponding measurement at each level of vine type as affected by the main effect of cultivar and soil, respectively (Tables 2 and 3). However, the effect was not consistent as the main effect of each respective factor. The effect was effectively consistent in the secondary vine than the primary and tertiary vines.

The difference in vine length produced by the different soil types can be attributed to the inherent soil chemical properties (Table 1) as the most suppressed vine growth was recorded under the lower nutrient contents of the Matafa'a acidic soil. Sweetpotato growth was increased in response to higher nutrient levels (Mukhopadhyay *et al.*, 1992).

Table 2. Sweetpotato primary, secondary and tertiary vine length (in cm) as affected by cultivars.

	Weeks after planting				
Cultivar	4	8	12	16	20
			Primary vine		
IB/PH/03	64.4b	71.0b	55.8b	31.1b	16.2b
IB/PR/12	99.1a	144.2a	143.8a	140.4a	149.5a
IB/PR/13	105.6a	171.3a	175.5a	189.4a	187.7a
LSD (0.05)	17.6	57.7	48.5	87.1	66.1
			Secondary vine		
IB/PH/03	41.0a	65.8a	69.5a	72.9b	64.1b
IB/PR/12	27.2b	70.8a	100.0a	112.8a	112.4a
IB/PR/13	8.31c	53.8a	79.0a	119.5a	139.5a
LSD (0.05)	10.1	22.8	29.7	65.0	67.3
			Tertiary vine		
IB/PH/03	0.34a	18.4a	30.3a	47.5a	60.8a
IB/PR/12	0.00a	6.58b	16.3b	32.3b	52.9a
IB/PR/13	0.00a	0.08c	1.92c	0.00c	0.00b
LSD (0.05)	ns	10.8	12.9	22.6	32.0

Vine length with similar letters within a column of each vine type are not significant at p=0.05; *ns = not significant*.

Table 3. Sweetpotato primary, secondary and tertiary vine length (in cm) as affected by contrasting soil types.

	Weeks after planting				
Soil type	**4**	**8**	**12**	**16**	**20**
			Primary vine length		
Savaia (Sandy loam)	106.8a	145.4a	157.0a	139.7a	127.2a
Matafa'a (Clay)	54.9b	61.9b	48.11b	43.0b	34.1b
Faleula (Silty clay)	96.8a	160.4a	169.2a	168.0a	171.3a
Saleimoa (Silty clay)	100.6a	147.6a	155.8a	131.1a	134.4a
LSD (0.05)	20.3	57.7	56.0	87.1	76.3
			Secondary vine length		
Savaia (Sandy loam)	47.24a	97.0a	117.7a	158.2a	181.5a
Matafa'a (Clay)	6.5c	13.2c	23.1b	31.8c	25.4c
Faleula (Silty clay)	27.1b	68.9b	101.4a	109.9b	105.4b
Saleimoa (Silty clay)	21.1b	74.7ab	89.0a	107.0b	109.1b
LSD (0.05)	11.6	22.8	29.7	65.0	67.3
			Tertiary vine length		
Savaia (Sandy loam)	0.0a	4.44b	11.3ab	21.8b	33.3b
Matafa'a (Clay)	0.0a	0.00b	0.00b	0.00c	1.22c
Faleula (Silty clay)	0.0a	13.8a	26.0a	42.4a	66.2a
Saleimoa (Silty clay)	0.45a	15.2a	27.5a	42.2a	50.5ab
LSD (0.05)	ns	10.8	14.9	22.6	32.0

Means followed by similar letters within the column of vine type are not significantly different from each other at p=0.05; *ns = not significant*.

3.1.2. Number of Vines

The cultivar and soil type effect on the number of vine produced per plant were significant (Figures 2 and 3) but their interaction was insignificant. Cultivar IB/PH/03 recorded the greatest number of total vines during the growth period with the highest produced at 8 WAP and a subsequent diminished growth ensued until harvest. This indicates the tendency of this cultivar to produce more vines relative to the other cultivars. Furthermore, this may have also influenced its longer lateral vines particularly the tertiary vines (Table 2). Conversely, the lowest number of vines was produced by IB/PR/13 confirming that it is a rather less branching genotype. Cultivar IB/PR/12 produced comparatively lower number of vines from 4-16 WAP but subsequently increased resulting in statistically similar number to that of IB/PH/03 at 20 WAP.

Saleimoa soil was superior vis-à-vis the highest number of vines produced with the highest recorded at 8 WAP. On the other hand, Matafa'a soil remained inferior in this parameter while Savaia and Faleula soils produced intermediate number of vines.

3.2. Vine Biomass

The fresh weight of vines at harvest was significantly affected by the type of cultivar (Table 4). Cultivar IB/PR/12 and IB/PR/13 recorded the highest fresh weight while IB/PH/03 was found inferior in this respect. Heavier vines were recorded at the Faleula and Saleimoa soils compared to the Savaia and Matafa'a soils. The lowest significant fresh weight was however, produced by the Matafa'a soil reflecting lower vegetative growth thereby resulting in lowest percent dry matter content. With regard to dry weight (g plant^{-1}), a significant interaction effect between soil type and sweetpotato cultivars was found (Table 5). Cultivars IB/PR/12 and IB/PR/13 accumulated significantly higher dry matter in Faleula and Saleimoa soils compared to other two soils and the least was attained at the Matafa'a soil. Dry matter accumulation in cultivar IB/PH/03 was greatly suppressed at the Matafa'a soil, while Saleimoa and Savaia produced the highest yield. Among the soil, dry matter production was significantly lower in Faleula and Salemoa soils for cultivar IB/PH/03 compared to cultivars IB/PR/12 and IB/PR/13. In Matafa'a and the Savaia soils, vines dry matter accumulation was statistically similar across all the cultivars. These results indicates sweetpotato produces aerial biomass profusely in the silty clay soils (Faleula and Saleimoa soils compared to the acidic clay (Matafa'a soil) and calcareous sandy (Savaia) soils. The difference in nutrient content is possibly explaining the variation dry matter production among the soils. Even within the same soil, sweetpotato growth was increased in response to higher nutrient levels (Mukhopadhyay *et al.*, 1992).

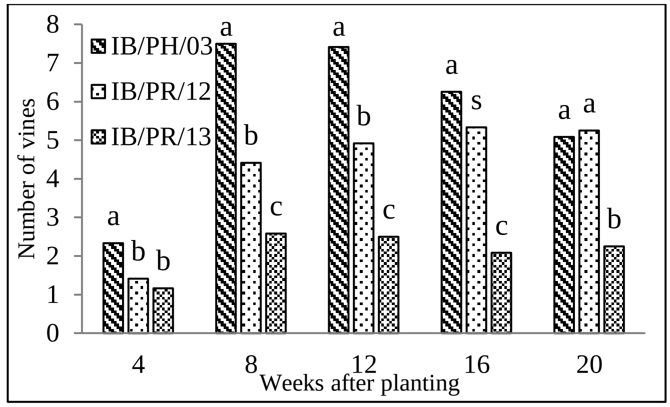

Figure 2. The effect of cultivars on the number of sweetpotato vines produced. Bars with similar letters within each sampling time are not significantly different at p=0.05.

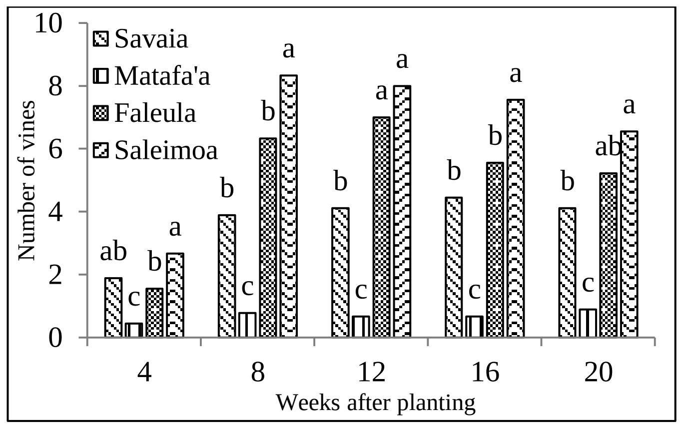

Figure 3. The effect of contrasting soil types on number of sweetpotato vines produced. Bars with similar letters within each sampling time are not significantly different at p=0.05.

Table 4. Aboveground biomass as affected by cultivars and soil types.

Treatment	Fresh weight (g plant^{-1})
Cultivar	
IB/PH/03	66.5b
IB/PR/12	132.6a
IB/PR/13	132.3a
LSD (0.05)	49.1
Soil type	
Savaia (Sandy loam)	99.9b
Matafa'a (Clay)	7.7c
Faleula (Silty clay)	170.7a
Saleimoa (Silty clay)	163.6a
LSD (0.05)	56.7

Means of treatments within a column with similar letters are not significantly different from each other at p=0.05; ns = not significant.

3.3. Sweetpotato Yield

A significant interaction effect between soil types and cultivars was found in the fresh weight of total storage root yield (Table 5) indicating that sweetpotato cultivars responded differently to the different type of soils. Comparing between soils, cultivars IB/PH/03 and IB/PR/12 responded in a similar manner, where significantly higher comparable yields were obtained at the silty clay soils (Faleula and Saleimoa) compared to other two soils (Savaia and Matafa'a soils). Cultivar IB/PR/13 responded differently to the soils. The highest yield was recorded in Saleimoa soil, followed by Faleula soil, Savaia soil with the lowest at Matafa'a soil. Comparing between cultivars at the calcareous sandy soil, IB/PR/13 had the highest yield, however it was statistically equivalent to IB/PH/03. Cultivar IB/PR/12 was found to be inferior, but statistically comparable to IB/PH/03. At the acidic soil, yield of cultivar IB/PR/12 was a clearly inferior to other two cultivars. Within each silty clay soil, interaction effect was significantly greatest in the case of cultivar IB/PH/03, followed by IB/PR/13 with the significantly lowest at cultivar IB/PR/12.

In reference to the lowest yield of each cultivar in each soil, the highest yield in IB/PH/03, IB/PR/12 and IB/PR/13 was increased by a magnitude of more than 14, 28, and 10 times, respectively. Between cultivars, IB/PR/13 showed the best performance under calcareous sandy soil within an increased yield by 108.2% in relation to the lowest produced at IB/PR/12. Under the acidic soil, IB/PH/03 had highest yield that increased by 314.8% compared to the lowest yield in cultivar IB/PR/12. Equally, cultivar IB/PH/03 scored the highest yield at Faleula and Saleimoa. Yield in each of these soils in relation to the lowest yield of IB/PR/12 was increased by 128.6% and 113.2%, respectively.

IB/PR/13 and IB/PH/03 accumulated similar root dry matter (g plant^{-1}) that are significantly higher than IB/PR/12 (Table 6). With regard to percent dry matter, IB/PH/03 had the significantly lower value. Plants grown on Faleula and Saleimoa soils accumulated the highest storage root dry matter followed by calcareous sandy soil. Conversely, the lowest dry matter was produced at the Matafa'a soil. Percent dry matter of roots was not affected by the soil type.

These results revealed that cultivar from the Philippines (IB/PH/03) outperformed those cultivars from Peru (IB/PR/13 and IB/PR/12) in case of fresh storage root. This could largely attribute to the genetic superiority of this cultivar under the tested soils. The significantly greater vine number possibly led to higher assimilate produce via higher leaves produced for higher yield. The early but steady decline in vine number of cultivar IB/PH/03 (Figure 2) could also signify the early investment of assimilates in root bulking (Van de Fliert and Braun, 1999). Furthermore, the cultivar's shorter vines (Table 2) reflect a short-distance assimilate transport from source to sink, that potentially led to greater storage root formation, and subsequent higher yield. Genotypic variations in sink capacity may also be attributed to this. Hahn (1977) reported that large sink capacity genotypes show greater yield.

Table 5. Interaction effect of soil types and cultivars on vine dry matter and fresh weight of storage root (g plant^{-1}).

Soil type	IB/PH/03	IB/PR/12	IB/PR/13
	Vine dry matter		
Savaia (Sandy loam)	21.3aA	25.1bA	32.8bA
Matafa'a (Clay)	0.86bA	1.8cA	0.6cA
Faleula (Silty clay)	16.6abB	47.2aA	60.0aA
Saleimoa (Silty clay)	23.5aB	59.2aA	44.3abA
LSD (0.05)	19.9	19.9	19.9
	Storage root fresh weight		
Savaia (Sandy loam)	55.0bAB	40.3bB	83.9Ca
Matafa'a (Clay)	23.4bA	5.4bB	22.4dA
Faleula (Silty clay)	321.5aA	140.6aC	186.1bB
Saleimoa (Silty clay)	329.6aA	154.6aC	231.6aB
LSD (0.05)	40.5	40.5	40.5

In a column, means of each parameter with similar letter are not significantly different from each other at p=0.05. Between columns, means of each parameter with similar capital letter are not significantly different from each other at p=0.05.

Table 6. Dry matter yield of storage root yield as affected by sweetpotato cultivars and soil types.

Treatment	Dry weight (g plant^{-1})	Dry matter content (%)
Cultivar		
IB/PH/03	44.1a	26.4b
IB/PR/12	33.7b	38.1a
IB/PR/13	49.5a	35.9a
LSD (0.05)	6.18	6.41
Soil		
Savaia (Sandy loam)	23.2b	38.0a
Matafa'a (Clay)	4.6c	28.6a
Faleula (Silty clay)	69.3a	34.6a
Saleimoa (Silty clay)	72.8a	32.6a
LSD (0.05)	7.14	ns

In a column, means with similar letters are not significantly different from each other at p=0.05.

Across the soil types, sweetpotato yield was adversely affected in poor soil conditions especially in the acidic soil of Matafa'a. The extremely high proportion of exchangeable aluminium (98.9%) in the exchangeable acidity of the soil may have largely contributed to the poor growth and yield. The high exchangeable Al in acidic soil (>2.6 cmol/kg soil) is widely known for its inhibitory effect on sweetpotato root elongation although the crop is considered as moderately tolerant to Al toxicity (O'Sullivan *et al.*, 1997). Faleula and Saleimoa silty clay soils having higher K contents proved better than the naturally acidic clay and alkaline calcareous sandy soils. Other two soils were poor in K, support the early findings by Blakemore (1973) and Naidu *et al.* (1990) who reported that K deficiency is common in most Samoa soils including Samoan acidic soils. Formation and development in sweetpotato storage root are influenced largely by potassium (O'Sullivan *et al.*, 1997) that was largely evident with higher yield of sweetpotato at both Faleula and Saleimoa soils. The substantially higher yield at the Saleimoa and Faleula locations implied that sweetpotato is more adaptable to these conditions than the acidic soil of Matafa'a and Savaia's calcareous sand soil. Although sweetpotato is a hardy crop and tolerates poor soils, it is envisaged the crop would not sustain in soils with limited supply of major nutrients in the long term, which necessitates the use of fertiliser to supplement these nutrients.

4. Conclusion

The vegetative growth of sweetpotato was affected by cultivar differences as well as by soil types. Cultivars IB/PR/12 and IB/PR/13 produced longer trailing vines which had more fresh (as well as dry) weight of vines as compared to the vine of cultivar IB/PH/03. However, the cultivar IB/PH/03 outperformed its rivals in terms of storage root yield confirming this cultivar's adaptability under these tested soil conditions better than IB/PR/12 and IB/PR/13. Superior vine growth of sweetpotato was observed in silty clay soils at the Faleula and Saleimoa locations in comparison to clay soil at Matafa'a and sandy loam soil at Savaia. Better yield of sweetpotato was observed in Faleula and Saleimoa soils. The cultivar IB/PH/03, as compared to two other cultivars, had significantly higher yields on all the four types of soils under study which showed potentiality of this cultivar for wider adoption in Samoa. This study revealed that Faleula and Saleimoa soils are good for sweetpotato cultivation compared to Matafa'a soil and Savaia soil. However, further research is necessary under field condition to make a solid recommendation. Selecting the right type of crop cultivar and then planting it on the right type of soil suitable for it to produce optimum yield should be the strategy for alleviating food insecurity as well as adapting crops to changing climate in the South Pacific island countries.

Acknowledgement

The authors are grateful to Mr. Tolo Iosefa of SPC for supplying the sweetpotato cultivars and the staff of the Samoan Ministry of Agriculture and Fisheries (MAF) help obtaining soil samples from selected villages. Messrs. Daya Perera, Dean Seuoti, and Samuelu Saulia were very helpful in the soil sampling and analysis processes. Senior author is thankful to the USP-Research office for providing scholarship for this PhD research project.

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