addition, four putative badnavirus-like groups (A, B, C, and M) are present in Hawaii. Information derived from this study will be important for the development of control strategies to reduce or eliminate spread of PMWaVs and badnaviruses.

Update on Pineapple Production in Hawaii

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Del Monte Fresh Produce Hawaii, Inc. Closes After 100 Years in Hawaii

In February 2006 Del Monte Fresh Produce Hawaii Inc. announced the company's intent to close its Hawaii plantation by December 2008. Management announced that harvesting, packing and shipping of fresh fruit to the U.S. mainland would continue during this period. However, in November of 2006 the company abruptly announced that all operations would cease by February of 2007 and most workers were to be terminated by the end of December of 2006. Only a small number of workers would remain into 2007 to close down all remaining operations on the plantation. All plants and fruit in the field were to be destroyed and a cover crop was to be planted on the fallowed lands. By the end March, most of the process of closing down the plantation had been completed and lands, which were owned by the Campbell Estate, had begun to be sold. On April 5, 2007, it was announced that Monsanto Co. would buy 2,300 acres formerly farmed by Del Monte for the company's seed corn breeding program. By the end of April a partnership betweenthe U.S. Army and Actus Lend Lease, a developer of military housing, announced that they had jointly acquired an additional 2,500 acres of land formerly farmed by Del Monte. Some of the land was to be used for military housing and the balance was to be leased to farmers.

Maui Pineapple Company Announces Closure of Pineapple Cannery

At the end of April, 2007 Maui Pineapple Company announced that it would close its cannery at Kahului, Maui at the end of June, 2007. Approximately 120 jobs will be eliminated. The company will still process juice but will focus on its more profitable premium fresh fruit business. Both fresh and processed fruit production and sales for the Hawaii industry were down in 2006 and it can be expected that they will drop further in 2007.◆

News From Viet Nam

Evaluation of Ten 'Smooth Cayenne' and Seven 'Queen' Pineapple Clones Under Different Soil Conditions in Viet Nam

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Abstract

Two pineapple comparison experiments for yield and fruit characters were conducted for ten 'Smooth Cayenne' and seven 'Queen' clones separately in 2004-2005 in different soils in south Viet Nam. In each experiment, a split plot design was followed with locations as the main plot and cultivars as the subplot. Cayenne Thailand performed the best with regard to flowering percentage (95.0%), fruit weight (1607g) and yield (88.8 tonnes ha^{-1}), followed by GF449 and Cayenne Lam Dong (79.0 and 78.5 tonnes ha^{-1}, respectively). 'Smooth Cayenne' clone GF449 had excellent total soluble solids (TSS) with 17.4 ºBrix) and vitamin C (8.3 mg $100ml^{-1}$). 'Queen' clone GU044 was superior for fruit weight (1217g) and yield (74.7 tonnes ha^{-1}), followed by clones RE044 and GF450 (71.4 and 70.4 tonnes ha^{-1}). 'Queen' clone Kien Giang and Ben Luc had high TSS (17.6 ºBrix) while TA039 had good fruit firmness (1.92 kg cm^{-2}). Pooled data from three locations of each experiment were presented.

Introduction

Pineapple is an important tropical fruit of Viet Nam as it is in high demand from both local and international markets for fresh fruit as well as processed products. Cultivation of pineapple has been commercially practiced in Viet Nam for many years, and is grown on about 43,350 ha and 422,251 metric tonnes were produced in 2004. While the area planted to pineapple has expanded yearly, growers in Viet Nam still face problems. An important problem is a lack of desirable cultivars for different growing areas that are resistant to the major pests and diseases. These obstacles lead to low income for growers as compared to those in other countries. The Southern Fruit Research Institute (SOFRI) introduced pineapple clones from abroad in 1998 and clonal selection was begun in 2003. The primary breeding objective was to provide elite pineapple clones to farmers for better production. The

results of the evaluation of ten 'Smooth Cayenne' (SC) and seven 'Queen' (Q) pineapple clones under different soils are reported in this paper.

Materials and Methods

Experiment 1: Comparison of ten 'Smooth Cayenne' (SC) pineapple clones in three soils

The trials were carried out on three soils at Chau Thanh; Tan Phuoc Dist. (Tien Giang province) and Tan Thanh (Ba Ria-Vung Tau province) in 2004-2005. In each soil type, the 10 clones (HA10, CI09, CI036, AN38, GF449, GU114, and AU124 from France; Cayenne Thailand; Cayenne Trung Quoc from China; Cayenne Lam Đong from Viet Namnam as the check) were arranged in a randomized complete block design (RBD) with 3 replications and 80 plants/replicate. The soil properties at the three locations are shown in Table 1.

Experiment 2: Comparison of seven 'Queen' (Q) pineapple clones in three soils

Seven 'Queen' clones were grown in 2004-2005 in trials conducted on three soils at Chau Thanh; Tan Phuoc (Tien Giang province) and Ben Luc (Long An province) (Table 1) following the procedures described for 'Smooth Cayenne' clones. Clones GU044, GU076, GF450, RE044, and TA039 were from France while Kien Giang and Ben Luc were local clones.

Table 1:Soil properties of pineapple trials.

Observation	Châu Thành (Long Đinh comumne)		Tân Phuoc (Tân Lập commune)		Ben Luc (Lương Hòa commune)		Tân thành (Hac dich commne)	
	5,52	medium acid	3,25	high acid	592	low acid	52	medium acid
pH KCl	4,06	high acid	3,03	high acid	427	high acid	4,1	high acid
N total (%)	0,10	pH H_2O	0,04	poor	73	poor	0,16	medium
P soluable (mg/100g)	19,90	high	11,30	medium	94	poor	4,0	poor
K exhanged (mg/100g)	17,50	high	10,05	medium	96	poor	3,18	poor
Organics (%)	4,26	high	3,04	medium	592	low acid	1,6	poor
Ca (me/100 g)	1,65	poor	0,38	poor	241	medium	0,62	poor
Mg (me/100g)	0,54	poor	0,20	poor	55	poor	1,4	poor
EC (mmhos/cm)	0,24	low salt	0,24	low salt	34	low salt	0,24	low salt

The planting density was approximately 61,500 plants ha^{-1} for both SC and Q. All cultural practices were followed for proper production and fertilizers applied per year were as follows: $CaCO_3$ (500 kg ha^{-1}), farm yard manure (10-12 tonnes ha^{-1}); N (10g $plant^{-1}$); P_2O_5 (6g $plant^{-1}$); K_2O (12g $plant^{-1}$). Flower forcing (forcing) for 'Queen' clones was by application of 50-60 ml of 2% CaC_2 solution over the top of the plant in early morning (6-8 a.m.) 13^{th} months after planting when pineapple plants had approximately 40-42 leaves. For the SC clones, 60 mL of a solution containing of 2% CaC_2 and 2% Urea was applied at night (7-8pm) at 13^{th} months after planting. A second application was made 3 days later. Data were collected on on the number of days from forcing to harvest for the different clones (Tables 2 and 3). The data were analyzed using IRRIStat 3.1 and pooled data from 3 three locations of each experiment are presented.

Results and discussion

Experiment 1 'Smooth Cayenne' (SC)

Flowering percentages for Cayenne Thailand (95.0%), GF449 and Cayenne Lam Dong were highest and not significantly different (Table 2). The lowest percentage flowering was found for clones HA10, AN38, Ci036 and GU114, which were not different from each other (Table 2).

Average fruit weight of clone AU124 (1619g) was not different from those of clones GU114, GF449, Cayenne Trung Quoc, Cayenne Thailand, and Cayenne Lam Dong (Table 2). Clones CI036 and CI09 produced the smallest fruits. Fruit yield of clones GF449 and Cayenne Thailand were the highest though not significantly higher than that for Cayenne Lam Dong (Table 2). Clones AN38, CI036 and HA10 produced the lowest yields. The high fruit yields of GF449, Cayenne Thailand, and Cayenne Lam Dong observed in the present investigation probably are due to the high percentage of flowering of these clones. However, greater fruit weight of these clones also contributed significantly to total yield per unit area.

Differences in the top:bottom diameter ratio (T:BD) among the clones was small with only clone GU114 having a significantly lower ratio than the other clones. However, fruit shapes did differ as follows: GF449, Cayenne Trung Quoc, Cayenne Thailand and Cayenne Lam Dong were long cylindrical; CI09 and AN38 were medium cylindrical; AU124 was trapezium; CI036 was medium trapezium; and HA10 and GU114 were long trapezium. The results were consistent with findings of OCAB (2003) who reported that fruits of GF449, AU124 and HA10 were cylindrical in shape while fruits of GU114 were trapezium-shaped.

Total soluble solids (TSS) was quite high for most of the clones. Clone GF449 had significantly higher TSS than all clones but CI036. Clone HA10 had significantly lower TSS than all other clones. Clone CI09 had the highest vitamin C content among

the SC clones though it was not significantly higher than levels for Cayenne Thailand, GF449, or Cayenne Lam Dong. The lowest vitamin C content was found for clone HA10. The vitamin C content of clone CI09 in the present study was lower than that reported by the findings of OCAB (2003) who found 13 mg/100ml fruit juice for clone CI09. The highest titratable acidity (TA) values were found for Cayenne Lam Dong, AU124, GU114, AN38, CI09, and Cayenne Trung Quoc, which were not different from each other. Clones HA10 and Cayenne Thailand had the lowest TA values (Table 2).

Table 2: Yield and fruit characters of 10 'Smooth Cayenne' clones averaged over three soils in south Viet Nam.

Clone	FH, days†	Flowering (%)	F.weight (g)	Yield, T ha^{-1}	T:B D#	TSS, %*	VitaminC, mg/100ml	TA*, g/100g
AU124	169	79,6 bcd	1619 a	68,5 bc	0,91 abc	15,8 c	8,0 bc	0,89 a
GU114	167-169	75,2 cde	1573 a	63,4 c	0,89 c	15,8 c	7,8 bc	0,89 a
GF449	167	88,2 ab	1622 a	79,0 a	0,94 a	17,4 a	8,3 ab	0,81 bc
AN38	168-169	72,5 de	1390 bc	50,6 d	0,93 ab	16,3 bc	7,8 bc	0,84 abc
Ci09	165-166	82,5 bcd	1369 c	58,2 cd	0,94 a	15,8 c	9,1 a	0,88 a
Ci036	167-168	73,8 cde	1359 c	48,7 d	0,90 bc	16,7 ab	7,1 cd	0,80 cd
Trung Quoc	165-166	88,1 ab	1544 ab	74,9 b	0,94 a	16,1 bc	8,2 ab	0,86 ab
C. Thailand	163-164	95,0 a	1607 a	88,8 a	0,93 ab	15,9 bc	9,1 a	0,74 de
Lam Đong	163-165	84,6 abc	1654 a	78,5 ab	0,94 a	16,0 bc	8,6 ab	0,90 a
HA10	170	69,0 e	1395 bc	48,5 d	0,91 abc	14,0 d	6,6 d	0,73 e
Population mean		809	1513	659	92	159	81	0.84
CV(%)		16.9	8.6	22.3	4.5	7.4	11	11.1

†Days from forcing of flowering to harvest
#Ratio of fruit top:bottom diameter
*Undefined units are TSS, total soluble solids, TA, titratable acidity.

Experiment 2 'Queen'

'Queen' clone GU044 had the greatest fruit weight though it was not significantly greater than those for clones GU076 and RE044. 'Queen' clones Ben Luc, Kien Giang and TA 039 produced the smallest fruits (Table 3). 'Queen' clone GU044 produced the highest yield though it was not significantly greater than yields for clones RE044 and GF450 (Table 3). The lowest yield was recorded for clone TA039.

Fruits of 'Queen' clone Ben Luc had the highest T:BD ratio although it was not significantly higher than the ratios for clone Kien Giang (Table 3). 'Queen' clone RE044 had a low T:BD ratio. Fruit shape among the 'Queen' clones varied as follows: Ben Luc was medium cylindrical; Kien Giang, GU044, GU076, and GF450 were long cylindrical; and TA039 and RE044 were long trapezium. Fruit shapes reported by OCAB (2003) were cylindrical for clones GU076 and RE044 and trapezium for clones GU044, TA039 and GF450.

The 'Queen' clones had slightly higher average TSS than did the SC clones. Among the Q clones Ben Luc and Kien Giang had the highest TSS values (Table 3) while TSS for GU044 was slightly but significantly lower. Clones GU076, RE044, TA039, and GF450 all had significantly lower TSS values. Clone TA039 had the highest fruit firmness value though it was not significantly different from values for Ben Luc, Kien Giang and GF450. Clone GU076 had the lowest firmness value while the values for the other cultivars were intermediate (Table 3). OCAB (2003) also found a high fruit firmness value for TA039, and medium values for GF450 and GU076.

All of the 'Queen' clones had higher vitamin C content than did the SC clones. 'Queen' clones Ben Luc, GU076, GU044, TA039 and GF450 all had high vitamin C contents. Clone RE044 had a very low vitamin C content and perhaps due to that low value, the CV for vitamin C among the Q clones was somewhat higher than that for the SC clones. Average titratable acidity for the Q clones was lower than for the SC clones and the CV for the Q clones also was slightly lower than that for the SC clones. The highest TA values were found for Q clones Kien Giang and Queen Ben Luc though they were not significantly greater than values for clone GU076. Clone RE044 had low acid in the fruit.

Conclusion

'Smooth Cayenne' clones such as Cayenne Thailand, GF449 and Queen varieties GU044, RE044, and GF450 were found to be superior to the other clones tested for production in south Viet Nam. However, further larger scale testing is needed fully evaluate the stability of these clones.

Reference

OCAB (Organisation Centrale de Producteurs Exportateurs D'ananas et de Bananes de Cote D'Ivoire), 2003. Fich de synthese pineaple fruit (141)

Table 3: Yield and fruit characters of 7 'Queen' clones averaged over three soils in south Viet Nam.

Clone	FH, days†	F.weight (g)	Yield, T ha^{-1}	T:B D#	TSS, %*	Firmness (kg/cm^2)	Vitamin.C, mg/100ml	TA*, g/100g
Ben Luc	140-143	877 c	66,7 bc	0,93 a	17,6 a	1,89 ab	12,9 a	0,79 a
Kien Giang	140-142	944 c	61,2 c	0,92 ab	17,6 a	1,8 a-d	10,8 bc	0,80 a
GU076	147-149	1129 ab	66,2 bc	0,89 cd	15,7 c	1,63 d	12,6 ab	0,72 ab
GU044	146-148	1217 a	74,7 a	0,90 bc	16,6 b	1,68 cd	10,9 abc	0,67 bc
RE044	144-145	1129 ab	71,4 ab	0,87 d	15,8 c	1,72 bcd	9,5 c	0,63 c
TA039	142-143	965 c	54,3 d	0,91 bc	15,5 c	1,92 a	11,5 abc	0,67 bc
GF450	150-151	1071 b	70,4 ab	0,90bc	15,3 c	1,84 abc	11,3 abc	0,68 bc
Pop. mean		1047	66.4	0.9	16.3	1.78	11.4	0.71
CV(%)		11.6	10.4	2.1	3.5	10.7	14.5	10.2

†Days from forcing of flowering to harvest
#Ratio of fruit top:bottom diameter
*Undefined units are TSS, total soluble solids, TA, titratable acidity.◆

Reviews of Books and Book Chapters

No reviews provided for this issue.

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Notices

Commercial Services

Maintain CF 125 continues to be available for use in pineapple plant propagation. A renewal letter for registration of the product was received in 2003. For further information, contact Bhushan Mandava, Repar Corporation, P.O. Box 4321, Silver Spring, MD 20914 Tel: 202-223-1424 Fax: 202-223-0141; E-Mail: mandava@compuserve.com

Commercial Sources of Pineapple Plants Propagated by Tissue Culture

Centro de Bioplantas. Dr. Justo L. Gonzalez Olmedo, Director of Foreign Affairs Office, Centro De Bioplantas. Universidad De Ciego De Avila, Carretera a Moron Km 9. Cp69450. Cuba. Centro De Bioplantas offers certificates of authenticity for pineapple material propagated in their tissue culture facility. Web site: http://www.Bioplantas.cu

LAMERSA, Dole's meristem laboratory in Honduras. Contact John T. Mirenda PhD, Dole Fresh Fruit International Ltd., San Jose, Costa Rica. Phone: 506 287 2175. Fax: 506 287 2675. E-mail: Jmirenda@la.dole.com. The laboratory can produce meristematically-derived plants of pineapple as well as banana and other crops.

Vitropic, Zone d'Activités Economiques des Avants, 34270 Saint Mathieu de Tréviers France; Tel: + 33 (0)4 67 55 34 58; Fax: + 33 (0)4 67 55 23 05. E-mail : vitropic@vitropic.fr. Web site: www.vitropic.fr. Vitropic proposes the best individuals from the CIRAD FHLOR selected clones including: Cayenne Group, Queen Group, Perolera Group, MD2, Ornamentals pineapples. The range is continuously extending, do not hesitate to ask for more information.

Directory of Professionals

This listing is maintained as a convenience for those seeking assistance from professionals with experience in pineapple production and processing. If you have such expertise and are able to provide consulting services, please send you rname, address, E-mail address, and areas of expertise to D.P. Bartholomew (duaneb@hawaii.edu).

Dr. Mark Paul Culik. INCAPER, Rua Alfonso Sarlo 160, CEP 29052-010, Vitoria, ES, Brazil; Tel: 27-3137-9874; markculik3@yahoo.com. Experience: PhD in Entomology with more than 25 years of agricultural pest management experience in crops ranging from apples to papaya and pineapple, identification of pests and beneficial arthropods ranging from Collembola to fruit flies, and current work on scale insects with emphasis on pineapple mealybugs. Areas of specialization: Entomology, Insect and Pest Identification, Integrated Pest Management.