University of Hawaii · College of Tropical Agriculture and Human Resources
Project Report

Sweet Onion Variety Trials, Kula, Maui 1997 & 1998 Results

Robin Shimabuku, Hector R. Valenzuela, Robert Paull, Marissa Wall, and Mike Austin[*]

[*]University of Hawaii CES Extension Agent, Maui; UHM Vegetable Crops Assoc. Extension Specialist; Post-Harvest Physiology Professor, UHM; Visiting Postharvest Physiology Professor, from New Mexico State Univ., and Hawaii Agricultural Research Center Horticulturist, respectively.

Introduction

Sweet onion variety trials were conducted in Kula, Maui to identify varieties with improved horticultural traits and yields, for possible replacement of standard varieties grown in Kula, Maui. The trials were conducted during the Spring (Feb. to June) 1997, Fall (July to Nov.) 1997, and Spring 1998 at the Univ. of Hawaii Kula Ag Park (1200 ft) and Pulehu (2000 ft elevation) sub-station. Objectives included evaluation of superior cultivars in terms of yields and horticultural traits and for evaluation of tolerance to major pests and diseases (esp. pink root and fusarium basal plate rot).

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For additional information:
Robin Shimabuku, CES Maui, tel. 808-244-3242, fax 808-244-7089, shimabukur@avax.ctahr.hawaii.*edu*
Hector Valenzuela, UH Manoa, tel. 808-956-7903, fax 808-956-3894, hector@hawaii.edu
Robert Paull (Post-Harvest), UH Manoa, tel. 808-956-7369, fax 808-956-3542, paull@hawaii.edu

Sweet Onion Variety Trial

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UHM-CES, Horticulture, and HARC

Table 1. Yield of sweet onions grown at UH Kula substation, Feb-May 1997..

Cultivar	Bulb weight (lbs/bulb)	Grade A wt/bulb (lbs)	overall wt per 100 ft (lbs)	Bulk wt per Acre (lbs)	wt Gr. A per 100 ft (lbs)	wt Gr. A per Acre (lbs)	Grade A No. (per 400)	Off-grade No. (per 400)	Grade A (% of tot) (by no)	Bulk wt 100 bulbs (lbs)
Granex 429	**0.73a**	**0.69a**	**109.50**	**23761.50**	25.06	5437.56	92	288	24.21	**78.7a**
Pegasus	**0.58b**	**0.56b**	**87.00**	**18879.00**	49.82	10811.71	242	166	59.31	**62.7b**
Mercedes	**0.56bc**	**0.57b**	**84.00**	**18228.00**	**75.24**	**16327.08**	**352**	**48**	**88.00**	**60.6bc**
SSC-6200	0.54cd	**0.57b**	81.00	17577.00	28.00	6076.27	131	269	32.75	56.3bcde
Mr max	0.54cd	**0.55b**	81.00	17577.00	**66.00**	**14322.00**	320	80	**80.00**	59.4bcd
Rio zorro	0.54cd	**0.55b**	81.00	17577.00	**63.16**	**13705.90**	307	94	76.56	55bcde
Encino	0.53d	**0.58b**	79.50	17251.50	54.38	11799.38	250	150	62.50	56.7bcde
Regency	0.5e	0.51c	75.00	16275.00	30.60	6640.20	160	240	40.00	54.7bcde
Monsoon	0.49e	0.5cd	73.50	15949.50	**65.44**	**14199.94**	**349**	**51**	**87.25**	51.2def
yel. granex	0.48ef	0.48cde	72.00	15624.00	53.71	11655.50	373	127	74.60	52.4cdef
RCS-1903	0.47efg	0.46ef	70.50	15298.50	**60.69**	**13169.73**	289	111	72.25	50.3def
RCS-1004	0.45ghi	0.47def	67.50	14647.50	47.94	10402.98	272	128	68.00	55bcde
Daybreak	0.44ghi	0.48cde	66.00	14322.00	46.37	10061.53	246	136	64.40	45.2f
Riobravo	0.43hi	0.44f	64.50	13996.50	32.34	7017.78	196	204	49.00	47.5ef
Savannah	0.42i	0.45f	63.00	13671.00	56.19	**12194.04**	**333**	**67**	**83.25**	45.5f

Experiment: Two month old seedlings transplanted Feb. 12, 1997. Bulbs were weighted on May 29, 1997. The experimental design consisted of four rows per variety with 65-plants per row. Each treatment (variety) was replicated four times. Plant spacing was 12 inches between double rows and 8 inches between plants in the rows.

Data analysis: Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence level ($P<0.05$).

Yields: Yields per 100 ft row based on 8 inch spacing between plants in-the-row. Per acre yields estimated based on 32,500 plants/Acre (2 ft rows, 21,700 ft-rows per acre and 8 inch spacing between plants in-the-row).

Seed Source: *Maui Sweet Standards*: Yellow Granex F1, Granex 429 (Asgrow); *Petoseed*: Savannah Sweet, Mercedes; Asgrow: Pegasus, Encino; *Rio Colorado*: Rio Bravo, Mr. Max, Rio Zorro, RCS-1004, RCS-1903, Sweet Sunrise; *Shamrock Seed*: Daybreak, SCC-6200, Regency.

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Table 2. Grading (percentage by number) of sweet onion varieties grown at UH Kula substation, Feb.-May 1997.

Cultivar	Grade A (percent)	Decay (percent)	split (percent)	misshapen (percent)	small (percent)	white (percent)	doubles (percent)	purple (percent)	indent. (percent)	sun burn (percent)	Coeff. Variation
RCS-1004	68.00	1.50	9.25	**12.75**	0.75	0.00	7.50	0.00	0.00	0.25	36.30
RCS-1903	72.25	4.00	**14.50**	6.50	1.00	0.00	1.00	0.75	0.00	0.00	33.30
SSC-6200	32.75	0.50	**22.50**	**24.25**	1.75	0.00	**18.25**	0.00	0.00	0.00	37.00
Daybreak	64.40	1.83	7.07	8.12	**13.87**	0.00	4.71	0.00	0.00	0.00	51.10
Encino	62.50	3.75	1.25	**22.50**	6.25	0.00	3.75	0.00	0.00	0.00	39.80
Granex 429	24.21	2.11	**14.47**	3.16	4.21	0.00	**50.79**	1.05	0.00	0.00	42.30
Mercedes	**88.00**	1.50	0.75	4.75	1.50	0.25	2.25	1.00	0.00	0.00	**30.29**
Monsoon	**87.25**	1.50	3.00	3.50	4.00	0.00	0.75	0.00	0.00	0.00	38.40
Mr. Max	**80.00**	2.50	9.50	2.50	0.50	0.00	4.50	0.00	0.25	0.25	**31.70**
Pegasus	59.17	3.42	6.11	2.20	0.73	0.00	28.12	0.24	0.00	0.00	**33.00**
Regency	40.00	2.25	7.75	5.00	2.25	0.00	**42.75**	0.00	0.00	0.00	36.40
Rio Bravo	67.00	**19.75**	6.75	1.00	1.75	0.00	1.50	0.25	1.75	0.25	36.20
Rio Zorro	76.56	1.50	4.49	5.74	4.49	0.00	7.23	0.00	0.00	0.00	38.40
Savannah	**83.00**	2.25	2.75	1.75	6.25	0.00	1.50	0.25	0.00	**2.25**	36.60
Y. Granex	74.80	3.20	8.60	3.20	1.00	1.80	4.20	**2.80**	0.00	0.40	38.80
Average	65.33	3.44	7.92	7.13	3.35	0.14	11.92	0.42	0.13	0.23	37.31

Sampling: For each variety 400 bulbs (about 265 ft length row) were individually weighed and classified as Grade A or off-grade.
Grade A: Varieties with highest percentage of Grade A fruit included Mercedes, Monsoon, Mr. Max, and Savannah.
Decay: Rio Bravo had a high incidence of decay.
Split and doubles: High incidence shown by Granex 429, Regency, SSC-6200, RCS-1903. Varieties with the earliest maturity (and thus harvested too late in this experiment) may have shown the highest numbers of splits and doubles.
Misshapen and small bulbs: High incidence of misshapen bulbs was shown by SSC-6200, Encino, and RCS-1004; Daybreak had a high incidence of small bulbs.
Bulb uniformity (low Coefficient of variation): High bulb uniformity was shown by Mercedes, Mr. Max, and Pegasus. The

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Table 3. Yield of sweet onions grown at UH Pulehu Substation, Maui, Feb-June 1997.

Cultivar	Bulb weight (lbs/bulb)	GradeA wt/bulb (lbs)	Overall wt per 100 ft (lbs)	Bulk wt. per Acre (lbs)	wt Gr.A per 100 ft (lbs)	Wt Gr. A per Acre (lbs)	Grade A No. (per 400)	Off-Grade No. (per 400)	Grade A (% of tot) (by no.)	Bulk wt 100 bulbs (lbs)
	0.47e	0.45h	70.50	15298.50	44.55	9667.35	264	136	66.00	46.5f
Mercedes	**0.59a**	**0.6ab**	**88.50**	**19204.50**	**86.85**	**18846.45**	**386**	14	**96.50**	**61.0a**
SSC-6200	0.58ab	0.59abc	87.00	18879.00	50.00	10850.54	226	174	56.50	58.7abc
Mr Max	0.55c	0.57cde	82.50	17902.50	64.77	14054.28	303	97	75.75	57.8abc
Rio Zorro	**0.59a**	**0.61a**	**88.50**	**19204.50**	**80.52**	**17472.84**	**352**	48	**88.00**	59.3ab
Encino	0.5d	0.53f	75.00	16275.00	58.63	12722.98	295	105	73.75	49.5ef
Regency	0.49de	0.48g	73.50	15949.50	36.36	7890.12	202	**198**	50.50	50.3def
Monsoon	0.44f	0.45h	66.00	14322.00	52.82	11461.67	313	87	78.25	46.6f
Yell. granex	**0.60a**	**0.61a**	**90.00**	**19530.00**	44.38	9629.92	194	**206**	48.50	**60.5a**
RCS-1903	0.56bc	0.56de	84.00	18228.00	46.20	10025.40	220	180	55.00	56.7abc
RCS-1004	0.54c	0.57abcd	81.00	17577.00	57.71	12523.61	270	130	67.50	53.3cde
Daybreak	0.47ef	0.49g	70.50	15298.50	51.45	11164.65	280	120	70.00	46f
Rio Bravo	0.54c	0.55ef	81.00	17577.00	62.29	13516.39	302	98	75.50	55.8abcd
Savannah	0.55c	0.55ef	82.50	17902.50	73.63	**15977.98**	**357**	43	**89.25**	54.2abcde

Experiment: Two-month old seedlings transplanted Feb. 12, 1997. Bulbs were weighed on June 16, 1997. The experimental design consisted of four rows per variety with 65-plants per row. Each treatment (variety) was replicated four times. Plant spacing was 12 inches between double rows and 8 inches between plants in the row.

Data analysis: Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence level ($P<0.05$).

Yields: Yield per 100 ft row based on 8-inch spacing between plants in-the-row. Per acre yields estimated based on 32,500 plants/Acre (2 ft rows, 21,700 ft-rows per acre and 8-inch spacing between plants in-the-row).

Seed source: *Maui sweet standards*: Yellow Granex F1, Granex 429 (Asgrow); *Petoseed*: Savannah Sweet, Mercedes; Asgrow: Pegasus, Encino; *Rio Colorado*: Rio Bravo, Mr. Max, Rio Zorro, RCS-1004, RCS-1903, Sweet Sunrise; *Shamrock Seed*: Day-break, SCC-6200, Regency.

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Table 4. Grading (percentage by number) of sweet onion varieties grown at UH Pulehu sub-station, Maui, Feb-June 1997.

Cultivar	Grade A	Decay	Split	Misshapen	Small	White	Doubles	Purple	Indent	Sunburn	Coeff.
RCS-1004	67.50	3.00	8.75	12.00	2.00	0.00	6.50	0.00	0.00	0.25	28.3
RCS-1903	55.00	15.75	19.75	4.25	1.25	**3.00**	0.50	0.00	0.00	0.50	33.2
SSC-6200	56.50	**0.25**	14.75	**17.25**	1.25	0.00	**10.0**	0.00	0.00	0.00	36.3
Daybreak	70.25	0.75	7.00	12.25	**8.50**	0.00	1.25	0.00	0.00	0.00	40.3
Encino	74.00	1.00	4.25	**15.50**	**5.25**	0.00	0.00	0.00	0.00	0.00	39.7
Granex 429	46.00	3.50	**34.25**	9.25	0.50	0.00	6.25	0.25	0.00	0.00	29.1
Mercedes	**96.50**	**0.00**	0.25	0.50	1.50	0.25	0.75	0.00	0.25	0.00	**25.7**
Monsoon	78.50	2.25	2.75	**12.75**	1.50	0.25	1.75	0.00	0.25	0.00	32.4
Mr. Max	75.75	10.00	9.50	2.75	0.50	0.00	1.50	0.00	0.00	0.00	**27.2**
Pegasus	66.00	10.00	16.25	2.75	2.00	0.00	3.00	0.00	0.00	0.00	37.5
Regency	49.75	3.00	**20.75**	8.75	4.00	0.00	**13.2**	0.00	0.25	0.25	34.2
Rio Bravo	75.50	7.25	9.75	2.25	0.50	0.25	3.00	0.25	0.50	0.75	**27.2**
Rio Zorro	**88.00**	2.25	2.75	5.00	1.75	0.00	0.25	0.00	0.00	0.00	33.2
Savannah	**89.25**	5.50	2.00	1.75	0.50	0.00	0.75	0.00	0.25	0.00	**28.0**
Y. Granex	48.50	6.75	**24.75**	5.50	0.25	1.25	**10.2**	**2.75**	0.00	0.00	31.7
Average	69.13	4.75	11.83	7.50	2.08	0.33	3.93	0.22	0.10	0.12	32.27

Table 5. Pungency and soluble solid levels of sweet onion varieties, Kula, Spring 1997 (Ranking in parenthesis, the higher the better).

Cultivar	Soluble Solids (%) low-elevation	Soluble Solids (%) high elevation	Pungency low-elevation	Pungency High elevation	sugar/pung. low-elev.	sugar/pung. high-elev.
				4.6 (2)	**1.37 (1)**	**1.76 (1)**
Pegasus	**8.6 (1)**	**8.7 (1)**	7.2 (4)	6.0 (8)	**1.19 (2)**	1.45 (6)
Mr. Max	7.8 (5)	8.0 (5)	**7.0 (3)**	**5.2 (3)**	**1.11 (3)**	1.54 (5)
RCS-1004	7.6 (7)	7.5 (8)	**6.9 (2)**	**4.4 (1)**	1.10 (4)	**1.70 (2)**
Granex-429	**8.2 (3)**	8.1 (4)	7.5 (6)	6.3 (9)	1.09 (5)	1.29 (11)
Mercedes	**8.3 (2)**	**8.4 (3)**	7.9 (8)	6.8 (10)	1.05 (6)	1.24 (13)
SSC-6200	7.8 (5)	7.5 (8)	7.3 (5)	4.6 (2)	1.07 (7)	**1.63 (3)**
Regency	7.8 (5)	7.6 (7)	7.5 (6)	5.6 (5)	1.04 (8)	1.36 (8)
Rio Bravo	7.6 (7)	7.7 (6)	7.5 (6)	5.7 (6)	1.01 (9)	1.35 (9)
Monsoon	7.1 (11)	8.1 (4)	7.2 (4)	5.8 (7)	0.99 (10)	1.40 (7)
Yellow Granex	7.3 (10)	**8.6 (2)**	7.6 (7)	5.5 (4)	0.96 (11)	1.56 (4)
Rio Zorro	7.7 (6)	7.5 (8)	8.4 (9)	5.6 (5)	0.92 (12)	1.34 (10)
Sav. Sweet	7.4 (9)	7.6 (7)	8.2 (10)	5.9 (7)	0.90 (13)	1.29 (11)
Encino	7.4 (9)	7.7 (6)	8.8 (11)	6.9 (10)	0.84 (14)	1.12 (14)
Daybreak	7.5 (8)	8.0 (5)	9.3 (12)	6.3 (9)	0.81 (15)	1.27 (12)

Notes:

Pungency values expressed as μmoles pyruvic acid per ml of onion juice. This should not be confused with the other method of expression μmoles pyruvic acid per gram fresh weight (a value about half of the values shown here). The lower value for pyruvic acid, the less pungent. Values less than 7-8 can be regarded as non-pungent.

Soluble Solids (TSS), is a rough measure of sweetness. The higher the value, the better. Overall results are expressed as sugar/pungency ratio,

Sweet Onion Variety Trial, Kula Ag Park, Fall 1997

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Table 1. Yield of intermediate sweet onions grown at Kula Ag Park, Fall (July-Nov), 1997.

Cultivar	Bulb weight (lbs/bulb)	Grade A wt/bulb (lbs/blb)	Overall wt per 100 ft (lbs)	Bulk wt. per Acre (lbs)	wt Gr.A per 100 ft (lbs)	Wt Gr. A per Acre (lbs)	Grade A No. (per 400)	Off-Grade No. (per 400)	Grade A (% of tot) (by no.)	Bulk wt 100 bulbs (lbs)
			108.00	23436.00	74.55	16177.35	280	120	70.00	
pegasus	0.63b	0.59bc	94.50	20506.50	30.31	6577.54	137	263	34.25	
evita	0.61b	0.65b	91.50	19855.50	54.36	11795.31	223	177	55.75	
sw. sunrise	0.56c	0.59bc	84.00	18228.00	53.32	11570.71	241	159	60.25	
DPS-1001	0.54cd	0.57cd	81.00	17577.00	48.52	10529.11	227	173	56.75	
DPS-1067	0.54cd	0.5de	81.00	17577.00	18.94	4109.44	101	299	25.25	
sw. magnolia	0.52d	0.48ef	78.00	16926.00	26.28	5702.76	146	254	36.50	
grano 1015	0.52d	0.55cd	78.00	16926.00	31.43	6820.00	152	247	38.10	
r. selecto	0.52d	0.59bc	78.00	16926.00	22.57	4897.15	102	298	25.50	
DPS-1057	0.5d	0.54cd	75.00	16275.00	43.54	9447.64	215	185	53.75	
redbone	0.38e	0.42fg	57.00	12369.00	37.33	8100.07	237	163	59.25	
ar. sunset	0.36ef	0.37gh	54.00	11718.00	14.99	3252.39	101	273	27.01	
sw. honey	0.34fg	0.39gh	51.00	11067.00	12.02	2607.29	61	236	20.54	
RCS-1938	0.31g	0.33h	46.50	10090.50	11.39	2471.77	81	271	23.01	

Experiment:. The experimental design consisted of four rows per variety with 65-plants per row. Each treatment (variety) was replicated four times. Plant spacing was 12 inches between double rows and 8 inches between plants in the row.

Data analysis: Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence level ($P<0.05$).

Yields: Yield per 100 ft row based on 8-inch spacing between plants in-the-row. Per acre yields estimated based on 32,500 plants/Acre (2 ft rows, 21,700 ft-rows per acre and 8-inch spacing between plants in-the-row).

Seed Source: Petoseed: Chula vista, Linda vista; Rio Colorado: RCS 1938, Rio Selecto; Palmer: Sweet Magnolia, Arizona Sunset, DPS 1067, DPS 1057, DPS 1001; Asgrow- Pegasus.

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Table 2. Grading (percentage by number) of sweet onion varieties grown at Kula Ag Park, Fall 1997.

Cultivar	Grade A (percent)	Decay (percent)	Split (percent)	Misshapen (percent)	Small (percent)	Doubles (percent)	Color (percent)	indent. (percent)	Coeff. Variation
ch. vista	**63.75**	14.00	2.00	16.75	3.00	0.50	0.00	0.00	**38.40**
lin. vista	**70.00**	15.00	3.75	8.25	0.25	2.75	0.00	0.00	**33.30**
pegasus	34.25	11.00	**22.00**	1.50	5.75	**25.25**	0.25	0.00	45.70
evita	55.75	6.25	6.25	8.00	8.50	15.25	0.00	0.00	47.00
sw. sunrise	60.25	8.50	4.00	21.25	3.75	1.75	0.00	0.50	43.30
DPS-1001	61.56	14.44	6.00	9.33	4.22	4.22	0.22	0.00	46.50
DPS-1067	25.25	10.00	16.75	23.00	10.75	14.00	0.25	0.00	59.60
Sw. magnolia	36.00	22.25	11.00	4.00	5.50	19.75	1.25	0.25	82.50
Grano 1015	38.00	4.25	**17.50**	12.25	6.25	21.50	0.00	0.25	51.10
r. selecto	25.50	11.25	11.75	**40.50**	10.50	0.50	0.00	0.00	48.10
DPS-1057	53.50	8.50	4.00	20.50	9.50	3.25	0.75	0.00	49.10
redbone	59.25	7.25	3.75	11.50	13.00	5.00	0.00	0.25	49.40
ar. sunset	26.44	9.42	11.26	3.40	16.75	**29.58**	1.05	2.09	57.40
sw. honey	20.54	**44.78**	3.37	5.05	17.85	7.74	0.34	0.34	67.80
RCS-1938	21.88	37.22	5.68	3.69	**27.84**	3.13	0.28	0.28	42.90

ad high percentage of small bulbs.

Bulb uniformity (shown by low Coefficient of Variation): High bulb uniformity was shown by linda vista and chula vista. The poorest (lowest) uniformity shown by sweet magnolia, and sweet honey.

Seed Source: Petoseed: Chula vista, Linda vista; Rio Colorado: RCS 1938, Rio Selecto; Palmer: Sweet Magnolia, Arizona Sunset,

Sweet Onion Variety Trial, Pulehu, Fall 1997

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Table 3. Yield of intermediate day sweet onions grown at the UH Pulehu Substation, Fall 1997.

Cultivar	Bulb weight (lbs/bulb)	Grade A wt/bulb (lbs/blb)	Overall wt per 100 ft (lbs)	Bulk wt. per Acre (lbs)	wt Gr.A per 100 ft (lbs)	Wt Gr. A per Acre (lbs)	Grade A No.	Off-Grade No. (by no.)	Grade A (% of tot) (lbs)
		0.57a	70.50	15298.50	23.66	**5133.14**	83	217	27.67
l. vista	**0.56a**	**0.57a**	84.00	**18228.00**	21.95	4762.07	77	223	25.67
grano 1015	0.45b	0.5b	67.50	14647.50	12.50	2712.50	50	250	16.67
DPS-1067	0.45b	0.45bc	67.50	14647.50	11.25	2441.25	50	250	16.67
r. selecto	0.4c	0.41cd	60.00	13020.00	25.52	**5538.38**	83	117	**41.50**
sw. magnolia	0.37d	0.38de	55.50	12043.50	8.74	1896.58	46	254	15.33
pegasus	0.25f	0.37def	37.50	8137.50	8.51	1846.67	46	254	15.33
sw. sunrise	0.34de	0.36ef	51.00	11067.00	23.40	**5077.80**	130	170	43.33
DPS-1001	0.31e	0.35ef	46.50	10090.50	18.64	4044.34	71	129	35.50
DPS-1057	0.31e	0.35ef	46.50	10090.50	17.33	3759.53	66	134	33.00
ar. sunset	0.28f	0.34ef	42.00	9114.00	11.90	2582.30	70	230	23.33
redbone	0.26f	0.32f	39.00	8463.00	16.80	3645.60	105	195	35.00
RCS-1938	0.2g	0.25g	30.00	6510.00	7.31	1586.81	39	161	19.50

Experiment:. The experimental design consisted of four rows per variety with 65-plants per row. Each treatment (variety) was replicated three times. Plant spacing was 12 inches between double rows and 8 inches between plants in the row.

Data analysis: Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence level ($P<0.05$).

Yields: Yield per 100 ft row based on 8-inch spacing between plants in-the-row. Per acre yields estimated based on 32,500 plants/Acre (2 ft rows, 21,700 ft-rows per acre and 8-inch spacing between plants in-the-row).

Seed Source: Petoseed: Chula vista, Linda vista; Rio Colorado: RCS 1938, Rio Selecto; Palmer: Sweet Magnolia, Arizona Sunset, DPS 1067, DPS 1057, DPS 1001; Asgrow- Pegasus

Sweet Onion Variety Trial, Pulehu, Fall 1997

Robin Shimabuku, Hector Valenzuela, and Mike Austin
UHM-CES, Horticulture, HARC, and DOA

Table 4. Grading (percentage by number) of sweet onion varieties grown at the UH Pulehu Sub-Station, Fall 1997.

Cultivar	Grade A (percent)	Decay (percent)	Split (percent)	Misshapen (percent)	Small (percent)	Doubles (percent)	Color (percent)	indent. (percent)	Coeff. Variation
	27.33	33.00	14.67	13.33	6.00	5.67	0.00	0.00	39.1
l. vista	25.67	50.67	13.00	7.67	1.00	1.67	0.00	0.33	**29.7**
grano 1015	16.67	28.00	13.67	**20.33**	13.00	8.33	0.00	0.00	50.7
DPS-1067	16.67	29.67	**21.00**	4.00	11.67	16.67	0.33	0.00	54.8
r. selecto	**41.50**	26.00	18.00	7.00	5.00	1.00	1.50	0.00	36.2
sw. magnolia	15.33	32.00	**20.67**	0.33	17.00	14.33	0.33	0.00	47.5
pegasus	15.33	37.67	17.00	10.67	0.00	**19.33**	0.00	0.00	55.4
sw. sunrise	**43.33**	26.00	7.67	0.67	19.00	3.33	0.00	0.00	48.3
DPS-1001	**35.50**	27.50	11.00	1.00	21.50	3.50	0.00	0.00	49.8
DPS-1057	33.00	18.00	8.50	9.00	17.50	13.50	0.50	0.00	46.1
ar. sunset	23.33	**13.67**	16.00	0.33	22.00	**24.33**	0.33	0.00	44.4
redbone	35.00	**13.67**	10.67	5.00	**24.33**	10.33	1.00	0.00	43.8
RCS-1938	19.50	37.50	12.50	1.50	**29.00**	0.00	0.00	0.00	43.2
Average	27.40	30.60	13.49	5.77	13.57	8.86	0.29	0.02	45.12

Table 5. Pungency and soluble solid levels of sweet onion varieties, Kula, Fall 1997 (Ranking in parenthesis, the higher the better).

Cultivar	Soluble Solids (%)	Soluble Solids (%)	Pungency	Pungency	sugar/pung. low-elev.	sugar/pung. high-elev.
Pegasus	**7.2 (3)**	**6.6 (2)**	**4.6 (1)**	5.3 (7)	**1.57 (1)**	1.25 (5)
So. Honey	6.3 (8)	**6.4 (3)**	**5.2 (2)**	**2.1 (1)**	**1.21 (2)**	**3.05 (1)**
Evita	**8.3 (1)**	**8.2 (1)**	7.0 (8)	7.5 (12)	**1.19 (3)**	1.09 (9)
Red Bone	5.8 (10)	5.4 (9)	**5.9 (3)**	5.8 (8)	0.98 (4)	0.93 (10)
RCS-1938	6.5 (7)	5.9 (6)	6.7 (6)	4.1 (4)	0.97 (5)	1.44 (4)
Sw. Magnolia	6.3 (8)	**6.6 (2)**	6.6 (5)	7.1 (11)	0.95 (6)	0.93 (10)
DPS-1001	5.8 (10)	5.1 (11)	6.3 (4)	**2.5 (2)**	0.92 (7)	**2.04 (2)**
Sw. Sunrise	6.2 (9)	5.7 (7)	6.8 (7)	6.2 (9)	0.91 (8)	0.92 (11)
DPS-1057	6.7 (6)	5.7 (7)	7.5 (10)	6.9 (10)	0.89 (9)	0.83 (13)
Chula Vista	6.3 (8)	5.1 (11)	7.2 (9)	**2.6 (3)**	0.88 (10)	**1.96 (3)**
Linda Vista	6.5 (7)	5.6 (8)	8.2 (11)	4.6 (6)	0.79 (11)	1.22 (6)
Granex-1015	7.1 (4)	6.1 (5)	9.1 (12)	7.6 (13)	0.78 (12)	0.80 (14)
DPS-1067	7.0 (5)	6.3 (4)	9.4 (13)	5.3 (7)	0.74 (13)	1.19 (7)
Arizona Suns.	**7.8 (2)**	**6.6 (2)**	11.3 (14)	7.8 (14)	0.69 (14)	0.85 (12)
Rio Selecto	NA	5.2 (10)	NA	4.4 (5)	NA	1.18 (8)

Notes:

Pungency values expressed as μmoles pyruvic acid per ml of onion juice. This should not be confused with the other method of expression μmoles pyruvic acid per gram fresh weight (a value about half of the values shown here). The lower value for pyruvic acid, the less pungent. Values less than 7-8 can be regarded as non-pungent.

Soluble Solids (TSS), is a rough measure of sweetness. The higher the value, the better. Overall results are expressed as sugar/pungency ratio, with

Sweet Onion Variety Trial, UH Kula Ag Park, Spring 1998

Robin Shimabuku, Hector Valenzuela, and Bob Osgood
UHM-CES, Horticulture, HARC, and DOA

Table 1. Yield of intermediate sweet onions grown at the UH Kula Ag Park, Spring (March to June) 1998.

Cultivar	Bulb weight (lbs/bulb)	Grade A wt/bulb (lbs/blb)	Overall wt per 100 ft (lbs)	Bulk wt. per Acre (lbs)	wt Gr.A per 100 ft (lbs)	Wt Gr. A per Acre (lbs)	Grade A No. (per 400)	Off-Grade No. (per 400)	Grade A (% of tot) (by no.)	Bulk wt 100 bulbs (lbs)
			75.0b	16,275b	72.0b	15,624b	384	16	96.0	50.8b
Sw. Sunrise	0.51b	0.51b	76.5b	16,600b	68.0b	14,774b	356	44	89.0	45.6bc
Mr. Max	0.40bc	0.46c	60.0bc	13,020bc	61.2c	13,288c	355	45	88.7	46.5b
Rio Bravo	0.47c	0.46c	70.5c	15,298c	57.2c	12,427c	166	34	83.0	48.4b
Monsoon	0.38d	0.38d	57.0d	12,369d	54.1d	11,750d	380	20	95.0	37.0d
Savannah	0.40d	0.39d	60.0d	13,020c	48.7d	10,568d	333	67	83.2	40.1cd
Eureka	0.35e	0.35e	52.5e	11,392e	44.4e	09,655e	339	61	84.7	34.7d

Experiment:. The experimental design consisted of four rows per variety with 65-plants per row. Each treatment (variety) was replicated four times. Plant spacing was 12 inches between double rows and 8 inches between plants in the row.
Data analysis: Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence level ($P<0.05$).
Yields: Yield per 100 ft row based on 8-inch spacing between plants in-the-row. Per acre yields estimated based on 32,500 plants/Acre (2 ft rows, 21,700 ft-rows per acre and 8-inch spacing between plants in-the-row).
Seed Source: Petoseed: Chula vista; Rio Colorado: Rio Bravo

Sweet Onion Variety Trial
Robin Shimabuku, Hector Valenzuela, and Bob Osgood
UHM-CES, UHM Horticulture Dept, and HARC.

Table 2. Grading (percentage by number) of sweet onion varieties grown at the UH Kula Ag Park, Maui, March-June 1998.

Cultivar	Grade A (percent)	Decay (percent)	Split (percent)	Misshapen (percent)	Small (percent)	Doubles (percent)	Color (percent)	Coeff. Variation	Coeff. Variation
Grade A	All bulbs								
Eureka	84.75	3.25	1.50	5.25	2.50	2.50	0.25	50.5	49.9a
Mercedes	96.00	1.25	0.75	2.00	0.00	0.00	0.00	29.3	29.1b
Monsoon	95.00	1.50	1.50	1.75	0.00	0.25	0.00	37.1	37.5ab
Mr. Max	88.75	6.00	3.75	1.00	0.50	0.00	0.00	36.8	36.3b
Rio Bravo	83.00	5.00	10.50	1.50	0.00	0.00	0.00	36.4	35.7b
Savannah	83.25	6.25	6.50	0.75	2.00	0.50	0.75	39.4	40.5ab
Sw. Sunrise	89.00	2.50	2.75	3.00	1.25	0.50	1.00	41.3	41.6ab
Average	88.97	3.31	3.84	2.38	0.78	0.47	0.25	38.16	

Sweet Onion Variety Trial, UH Pulehu Substation, Spring 1998

Robin Shimabuku, Hector Valenzuela, and Mike Austin
UHM-CES, Horticulture, HARC, and DOA

Table 3. Yield of intermediate sweet onions grown at the UH Pulehu Substation, Spring (March to June) 1998.

Cultivar	Bulb weight	Grade A wt/bulb	Overall wt per 100 ft	Bulk wt. per Acre	wt Gr.A per 100 ft	Wt Gr. A per Acre	Grade A No.	Off-Grade No.	Grade A (% of tot)	Bulk wt 100 bulbs
	(lbs/bulb)	(lbs/blb)	(lbs)	(lbs)	(lbs)	(lbs)	(per 400)	(per 400)	(by no.)	(lbs)
				19,204b	81.3ab	17,655ab	345	43	88.9	61.5a
Sw. Sunrise	0.59b	0.60b	88.5b	19,204b	82.2b	17,840b	338	32	91.3	55.1ab
Rio Bravo	0.57b	0.57c	85.5b	18,553b	61.1c	13,265c	286	114	71.5	54.9ab
Eureka	0.47d	0.47e	70.5d	15,298d	48.1e	10,441e	273	127	68.2	45.3d
Savannah	0.52c	0.53d	78.0c	16,926c	47.9d	10,404d	234	154	60.3	52.0bc
Mr. Max	0.46d	0.54d	69.0d	14,973d	47.5d	10,326d	235	165	58.7	48.0cd
Monsoon	0.45d	0.46e	67.5d	14,647d	50.4e	10,953e	278	102	73.1	43.4d

Experiment:. The experimental design consisted of four rows per variety with 65-plants per row. Each treatment (variety) was replicated four times. Plant spacing was 12 inches between double rows and 8 inches between plants in the row.
Data analysis: Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence level ($P<0.05$).
Yields: Yield per 100 ft row based on 8-inch spacing between plants in-the-row. Per acre yields estimated based on 32,500 plants/Acre (2 ft rows, 21,700 ft-rows per acre and 8-inch spacing between plants in-the-row).
Seed Source: Petoseed: Chula vista; Rio Colorado: Rio Bravo

Sweet Onion Variety Trial

Robin Shimabuku, Hector Valenzuela, and Bob Osgood
UHM-CES, UHM Horticulture Dept, and HARC.

Table 4. Grading (percentage by number) of sweet onion varieties grown at the UH Pulehu sub-station, Maui, March-June 1998.

Cultivar	Grade A (percent)	Decay (percent)	Split (percent)	Misshapen (percent)	Small (percent)	Doubles (percent)	Color (percent)	Coeff. Variation Grade A	Coeff. Variation All bulbs
									37.0ab
Eureka	68.25	**21.00**	2.75	4.75	0.75	2.50	0.00	32.4	32.4ab
Mercedes	**88.92**	5.15	0.26	4.12	0.26	0.52	0.77	27.8	**29.3b**
Monsoon	73.16	12.37	5.79	**8.16**	0.26	0.26	0.00	31.5	**31.7b**
Mr. Max	58.75	15.25	**15.75**	1.00	0.25	**8.75**	0.25	35.8	40.8a
Rio Bravo	71.50	11.75	**14.00**	1.00	0.00	1.00	0.75	34.3	34.9ab
Savannah	60.31	**22.42**	**14.43**	0.77	0.26	0.77	1.03	34.0	33.3ab
Sw. Sunrise	**84.50**	6.75	3.75	4.25	0.00	0.00	0.75	36.3	34.3ab
Average	73.89	11.99	8.00	3.69	0.22	1.76	0.44	33.16	

Sampling: For each variety 400 bulbs (100 per rep.) were individually weighed and classified as Grade A or off-grade.

Data analysis: Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence level ($P<0.05$). Block mean values were used to statistically analyse the coefficient of variation data.

Decay: Eureka and Savannah Sweet had high decay rates, while Chula Vista and Mercedes had low decay rates.

Splits & doubles: Mr. Max, Rio Bravo, and Savannah Sweet had higher incidence of splits, while Mr. Max also had higher incidence of doubles.

Bulb Uniformity: (shown by low Coefficient of Variation, lower is better): High bulb uniformity was shown by Mercedes and Monsoon.

Maui Onion TSS & Pungency Evaluation
1997 August 12 (Report)

Total Soluble Solids (%)

Cultivar	1997 June Low Elevation	1997 July High Elevation
Mr. Max	7.8 + 0.4	8.0 + 0.8
Rio Bravo	7.6 + 0.6*	7.7 + 0.4
Mercedes	8.3 + 0.5	8.4 + 0.4
Savannah Sweet	7.4 + 0.2	7.6 + 0.4
RCS-1903	8.1 + 0.4	8.1 + 0.5
SSC-6200	7.8 + 0.4	7.5 + 0.6
Monsoon	7.1 + 0.4	8.1 + 0.6
Daybreak	7.5 + 0.5	8.0 + 0.1
Yellow Granex	7.3 + 0.4	8.6 + 0.8
Pegasus	8.6 + 0.4*	8.7 + 0.5*
Granex-429	8.2 + 0.4*	8.1 + 0.5 *
Encino	7.4.+ 0.5	7 7 + 0 4
Regency	7.8 + 0.5	7.6 + 0.4
RCS-1004	7.6 + 0.2	7.5 + 0.3
Rio Zorro	7.7 + 0.5	7.5 + 0.3

* Some rotting bulbs.
**note: + = ±

Comments on pungency analysis The 1998 January 06 data agrees wit
published values for the same varieties. The pungency values are ex-
pressed as
µmoles pyruvic acid per ml of onion juice. This should not be confused
with the
other method of expression. pmoles pyruvic acid per gram fresh weigh
The
latter will give a lower value (about half). The lower the value of pyruv
acid, the
less pungent. Values less than 7 or 8 can be regarded as non-pungent.
Soluble
solids (TSS) is a rough measure of sweetness. The higher value, the be
ter. In the
current results, there is little difference between the different cultivars
The
results are then expressed as sugar/pungency, higher ration being swe
non
pungent onions .

Pungency (µmoles / ml)

Cultivar	1997 June Low Elevation	1997 July High Elevation
Mr. Max	7.0	5.2
Rio Bravo	7.5	5.7
Mercedes	7.9	6.8
Savannah Sweet	8.2	5.9
RCS-1903	5.9	4.6
SSC-6200	7.3	4.6
Monsoon	7.2	5.8
Daybreak	9.3	6.3
YellowGranex	7.6	5.5
Pegasus	7.2	6.0
Granex-429	7.5	6.3
Encino	8.8	6.9
Regency	7.5	5.6
RCS-1004	6.9	4.4
Rio Zorro	8.4	5.6
Mean	7.6	5.7

Maui Onion TSS & Pungency Evaluation
1998 January 06

Total Soluble Solids (%)

Cultivar	1997 December 10 Low Elevation	1997 December 11 High Elevation
Linda Vista	6.5 + 0.4	5.6 + 0.7
Sweet Magnolia	6.3 + 0.1	6.6 + 0.9
Evita	8.3 + 0.3	8.2 + 0.8
Red Bone	5.8 + 0.2	5.4 + 0.5
RCS-1938	6.5 + 0.3	5.9 + 0.5
Arizona Sunset	7.8 + 0.4	6.6 + 0.4
DPS-1057	6.7 + 0.4	5.7 + 0.6
Sweet Sunrise	6.2 + 0.3	5.7 + 0.4
Southern Honey	6.3 + 0.7	6.4 + 0.2
DPS-1001	5.8 + 0.2	5.1 + 0.6
Pegasus	7.2 + 0.6	6.6 + 0.7
Granex-1015	7.1 +.0.2	6.1 + 1.1
DPS-1067	7.0 + 0.3	6.3 + 0.3
Chula Vista	6.3 + 0.4	5.1 + 0.2
Rio Selecto	—	5.2 + 0.4

**note: + = ±

Pungency (µmoles Pyruvate ml -') + SD

Cultivar	1997 December 10 LowElevation	1997 December 11 High Elevation
Linda Vista	8.2 + 2.4	4.6 + 2.9
Sweet Magnolia	6.6 + 1.9	7.1 + 3.5
Evita	7.0 + 2.0	7.5 + 2.8
RedBone	5.9 + 2.7	5.8 + 4.1
RCS-1938	6.7 + 4.5	4.1 + 0.7
Arizona Sunset	11.3 + 1.6	7.8 + 2.1
DPS-1057	7.5 + 1.0	6.9 + 3.4
SweetSunrise	6.8 + 0.7	6.2 + 0.8
Southern Honey	5.2 + 2.9	2.1 + 1.5
DPS-1001	6.3 + 1.3	2.5 + 1.3
Pegasus	4.6 + 2.5	5.3 + 1.7
Granex-1015	9.1 + 2.4	7.6 + 2.0
DPS-1067	9.4 + 1.7	5.3 + 0.5
ChulaVista	7.2 + 1.6	2.6 + 1.8
Rio Selecto	—	4.4 + 0.8

**note: + = ±

Table 1. Pungency and soluble solids content (SSC) of onion cultivars grown at two elevations on the island of Maui in spring 1998.

	Low elevation (1400 ft.)		High elevation (2100 ft.)	
Cultivar	Pungency (µm PA/gfw)	SSC (%)	Pungency (µm PA/gfw)	SSC (%)
Mercedes	5.45 + 0.45	8.9 + 0.3	4.93 + 0.54	7.0 + 0.7
Savannah Sweet	5.32 + 0.49	7.7 + 0.3	4.90 + 0.28	6.5 + 0.5
Monsoon	5.20 + 0.90	7.9 + 0.3	5.57 +.41	6.6 + 0.6
Eureka	5.11 + 0.83	9.5 + 0.4	6.09 + 0.71	8.4 + 0.7
MrMax	4.78 + 0.35	8.6 + 0.2	5.02 + 0.61	7.6 + 0.4
Rio Bravo	4.72 + 0.04	8.2 + 0.6	5.02 + 1.00	8.2 + 0.3
Sweet Sunrise	4.66 + 0.54	7.8 + 0.2	4.40 + 0.75	6.8 + 0.4
ChulaVista	4.52 + 0.22	7.5 + 0.2	4.80 + 0.43	6.3 + 0.3

**note: + = ±

Pungency is expressed as µmoles pyruvic acid (PA) per gram fresh weight i standard deviation. There were 4 replications, and composite samples were taken from 5 bulbs per replication. Soluble solids content (I SD) was measured using a refractometer.

There were no significant differewes in pungency among varieties at the low elevation site (p=0.05). At the high elevation site, only Eureka and Sweet Sunrise were significantly different.

Sweet Onion Varieties:

Asgrow Seed Company P.O Box 5038 Salinas, CA 93915 (405) 424-6905; *also see Chesmore & Rupp Seeds*.

***Granex 429**: Short-day hybrid with deep, near globe shape, medium to jumbo size bulbs with sweet mild flesh. Susceptible to pink root.

Encino: A short-day, grano shaped yellow skinned onion that can produce jumbo to colossal sized bulbs with a high percentage of single centers, and few splits or doubles. Pink root resistant and adapted for south Texas and northeast Mexico.

Pegasus: A light yellow skinned hybrid with sweet white flesh, high sugars and low pungency. Vigorous growth, good uniformity, classic granex shape, produces a higher percent of single centers than most granex hybrids.

Petoseed 1905 Lirio Street P.O. Box 4206 Saticoy, CA 93007-4206 (805) 647-1188, also *sold through Champion, Green Barn & Rupp Seeds.*

Mercedes: A hybid that was developed for the tropics and has early maturity, excellent uniformity and very mild white flesh. It has a tight neck that enables the large-jumbo size, globe -shaped bulbs to dry and cure quickly. The hard, firm bulbs are resistant to bruising and retain their golden yellow scale. Good tolerance / resistance to pink root.

Monsoon: Open-pollinated, main season maturity, deep grano shape straw yellow scale and white flesh. A high quality large-jumbo size grano type with a mild flavor, refined neck and good scale retention.

Savanna Sweet: This very early and highly adaptable short-day granex-type hybrid onion was bred for Southeast conditions. The white flesh has a mild flavor and high yield potential of medium-large uniform bulbs that are thick-flat in shape with small necks that cure throroughly and quickly. Bulbs have golden yellow scales with excellent retention.

***Yellow Granex Hybrid**: Short-day, medium-large size, deep flattened globe shape early maturing onion with very mild white flesh and thin yellow scales. Uniform, high quality Granex.

Rio Colorado Seeds: 4701 Gila Ridge Rd., Yuma, AZ 85365, *Sold through Champion Seeds*

Mr.Max: Yellow hybrid short-day Granex, early maturity, Deep Mod. Granex shape and short storage. Moderately tolerant to Pink Root, good bolt resistance.

Rio Bravo: Early maturing, Deep Mod. Granex shape, yellow hybrid short-day Granex. Moderately tolerant to Pink Root, good bolt resistance.

Rio Zorro: Early maturing, flattened globe shape, yellow hybrid short day Grano. Developed for an early yellow in Mexico and very tolerant to Pink Root Fungus.

RCS1004: Early maturity, good Pink Root tolerance

RCS1903: Sweet Vidalia variety that produces high percentage of jumbo sized onions

Shamrock Seed Co., Inc. 3 Harris Place, Salinas, CA 93901, 408-771-1500 FAX 408-771-1517

Daybreak: A grano onion with a uniform, deep globe-grano-shaped bulbs that have attractive light yellow scales and mild pungency. A high yielding variety that produces a large percentage of single-centered jumbo bulbs and have very strong pink root and bolting tolerance.

Regency: Early maturity, moderate Pink Root resistance, does well in tropics.

SSC 6200: Early maturing, grano-globe shape, mild, high single centered with moderate Pink Root and good bolting tolerance.

Wholesalers: Champion, 714-529-0702; Chesmore, 800-383-0865; Rupp, 419-337-1841; Green Barn, 800-882-7552

***Industry Standards**

Onion Variety Trial, Pulehu Sub-Station 1984

Conducted by: Ted Hori, CES County Extension Agent
Report: June 6, 1984

Seedlings transplanted on Feb. 14
Harvested on May 29.
The plots were 1.5 by 40 ft, with 7 rows per plot.
The seedlings were planted 6 inches apart.

The four Grano varieties seemed to have a milder flavor than the old Granos. These varieties have a light yellow scale (skin) like thr Granex. They are global in shape and have relatively heavy bulbs.

The Colossal is more oblong than global. The flavor varies from person to person, mild to hot. The yield is slightly better than the Granex.

Textar is flat and resembles Granex in appearance. It is also mild in flavor. This variety gave the second best yield.

Table 1. Yield of sweet onions grown at the Pulehu Sub-station Feb.-May, 1994 (yield in pounds).

Variety	Large[1] No./Wt/%	Medium No./Wt/%	Off-grade No./Wt/%	Culls No./Wt/%	Total No./Wt/%	Yield per Acre[2]
Greater Yield of Large Bulbs						
Grano 1015Y	62/61.5/89	8/3.8/11	-	-	70/65.3	47.409
Grano 1030Y	57/47/62	16/7.2/26	4/2.8/5	-	77/57	41,382
Yellow Granex	57/44.7/86	4.1/1.3/6	5/3.5/8	15/9.8	66/59.5	35,937
Lower Yield of Large Bulbs						
Grano 1025Y	48/41/62	20/9.8/26	9/4.8/12	-	77/55.6	40,366
Textar	47/39.8/59	20/10.2/25	12/10.1/15	-	80/60.3	43,778
Grano 1105Y	45/38/57	29/11.5/37	5/4.8/6	3/1	79/54.3	39,422
Colossal	43/33.5/54	28/12.7/35	5/5.3/6	-	80/52.5	38,115

[1]Note: Yield Per Row; [2]Estimated yield per Acre
Seed Source: Granos: Asgrow; Colossal (PRR, PVP, #7900076) and Textar F1: Arco (Atlanta Richmond Co.)

BULB ONION FIELD DAY

Waikele Farms, Inc.
March 29, 1997

Site Data

- Location: Kunia, Oahu, Hawaii
- Soil pH: 6.7
- Ave. annual rainfall: 30 in.
- Elevation: 600 ft. above sea level

Cultural Data

- Direct seeded w/tractor mounted Gramore seeder using pelleted seed; 1st seeded 10/31/96 - 11/4/96; 2nd seeded 11/27/96
- Fertilizer, 10-30-10, preplant incorporated at 800 lbs. per acre
- Weed control, stale seedbed with Gramoxone, pre-emergent with Dacthal after onion; seeding, post-emergent weed control with Goal
- Insect control, 2 applications of Warrior and 1 application of Lannate for onion thrips
- Disease control, 2 applications of Kocide for bacterial leaf streak
- Irrigation, solid set overhead sprinkler irrigation

Project Objective

Onion production on former sugarcane land for import replacement of bulb onions.

Project Scope

- 89% of Hawaii's onion consumption is imported
- A potential exists for cultivation of up to 700 acres for import replacement as well as additional production for the export market. Favorable economies of scale would make this possible
- Need to identify the appropriate hard, dry pungent onions for storage to allow industry to develop and move forward

Project Outcome

- Rio Zorro from Rio Colorado seed identified as a candidate hard, dry onion for commercial production
- Winter onion production in central Oahu is complicated by untimely, heavy rainfall (normal annual rainfall = 30 in., rainfall at Waikele Farms onion site, since 11/5/96 = 65 in.)

Variety Color Coding

Blue = 1015 (beds 1 - 44, 159 - 185); Red = Rio Zorro (beds 45 - 113); Green = Texas Grano 502 (beds 114 - 147); Yellow = 33Y (beds 186 -220), White = Sweet Sunrise (221 - 257); Yellow & Black = Rio Bravo (258 - 318).