

North Carolina Performance Trials for Cultivars of Parthenocarpic Pickling Cucumber

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Introduction

Traditionally, cucumber cultivars have been sold as a blend of gynoecious (88%) and monoecious (12%) hybrids to provide sufficient pollen for uniform fruit set (Wehner and Maynard, 2003). This type of production system has the disadvantage of requiring insect pollinators and using valuable field space for lower yield pollenizers (moneocious hybrid).

Parthenocarpy, the ability of plants to form fruits without pollination or fertilization, has been identified in cucumber since the early 1900s (Gustafson, 1942; Pandolfini et al., 2009). Originally, poor fruit quality such as soft fruit and bloating during brining negatively impacted adoption of parthenocarpic pickling cucumbers. Yet the potential advantage of parthenocarpic cucumber to produce uniform seedless fruit in the absence of monoecious pollenizers and insect pollinators, could increase both fruit yield and quality. The development of fruit without pollination permits earlier and more uniform fruit production (Pandolfini et al., 2009). Traditional breeding has significantly improved fruit quality characteristics, making parthenocarpic cucumbers more attractive to producers in the U.S. There is no need for growers to provide hives of honeybees to pollinate the crop in each field. Higher yields along with higher fruit quality make parthenocarpic cultivars an attractive alternative for pickling cucumber growers.

Cultivars are commercially available from seed companies including: Bejo Seeds, Nunhems, Rijk Zwaan, Seminis, HortAg, and US Agriseeds. Seeds of parthenocarpic pickling cultivars from these companies were obtained to evaluate performance in two years and two seasons in North Carolina. The objective of this study was to determine the best performing cultivars in trials run in North Carolina of the parthenocarpic types available.

Methods

The study was conducted at the Cunningham Research Station in Kinston, North Carolina to evaluate yield and quality of parthenocarpic pickling cucumber cultivars for production

in North Carolina. Soils were a Norfolk loamy sand (Typic Kandiudults) (Natural Resources Conservation Service, 2017).

2014. Spring plots were sown on 6 May. Harvests were made on 20, 24, 27, 30 June and 3, 8, 11, 15 July. Summer plots were sown on 17 June. Harvests were made on 25, 28, 31 July, and 4, 11, 15 August.

2015. Spring plots were planted 19 May. Harvests were made on 23, 26, 29 June, 3, 7, 10, 14, and 20. Summer plots were planted 25 June. Harvests were made on 31 July, 4, 7, 11, 14, 18, 21, and 25 August.

Cultural Practices. Plots were planted on raised beds covered in black plastic mulch in 2014. In 2015, spring plots were planted on black plastic mulch and summer plots were on white plastic mulch. Plots were 6 m long and on 1.5 m centers. We over-seeded plots by 15% of the desired planting density (49,000 plants/ha) at a depth of 10-15 mm and covered by hand. At 15 days after planting (DAP), plots were thinned to 49,000 plants/ha. Standard production practices were followed (Schultheis et al., 2000). Plots were harvested eight times (six in the summer season of 2014).

Fruit yield and fresh fruit quality. At each harvest, fruit were collected and separated into grades 1 (0 to 27 mm), 2 (28 to 38 mm), 3 (39 to 51 mm), 4 (greater than 51 mm in diameter; oversize), and misshapen culls (nubbins, crooked) (Wehner, 1986). Weights were summed by grade for each plot. Five grade 2 fruits were measured to determine average length: diameter ratio of each plot. Fruit firmness was measured on three grade 3 fruit using a Magness-Taylor tester with an 8 mm (5/16") tip.

Brined fruit quality, bloater, and defect evaluation. After data collection at the second, fourth, and sixth harvest, fruit of each cultivar were combined over replications in a burlap sack and transported to Mt. Olive Pickle Company in Mt. Olive, North Carolina to be brined for later evaluation of fruit quality.

In November of both years, cucumber industry personnel were invited to Mt. Olive Pickle Company to judge the brined fruit quality of the cultivars. There were nine judges in 2014 and 11 judges in 2015. Fruit quality was rated 1-9 (1 = poor, 5 = average, 9 = excellent) for categories including fruit shape, exterior color, seed cell size, fruit uniformity, and fruit texture. Those ratings were averaged for an average quality rating.

Fruit firmness was measured on ten grade 3 fruits using a Magness-Taylor tester with an 8 mm (5/16") tip.

Longitudinal cross sections of ten to twenty grade 3 fruit were evaluated for bloaters (balloon, lens, honeycomb) and defects (blossom-end, placental hollows, soft centers). Estimates of total volume as a percentage of each fruit that was damaged were recorded.

Disease ratings. In 2015, disease ratings were taken twice for symptoms of downy mildew (causal agent *Pseudoperonospora cubensis*) and once for symptoms of anthracnose (causal agent *Colletotrichum orbiculare*). Disease ratings were from 0 to 9, with 0 meaning no disease, 1-2 meaning trace, 3-4 slight, 5-6 moderate, 7-8 severe, and 9 dead.

Spininess. The level of spininess or number of spines on the fruit surface was rated in the field in two independent ratings with a 0 to 9 scale (0 = no spines, 3 = few spines, 5 = moderate spines, 7 = numerous spines).

Data analysis. Data were subjected to PROC MEANS and GLM (ANOVA) using SAS v 9.4 (SAS Institute, Cary, NC). Years were analyzed separately. Fruit value (\$/ha) was calculated based on the weight of the marketable fruit (grades 1, 2, and 3, excluding cull and oversize). Early yield percentage, total yield, total marketable yield, and corresponding dollar values were calculated based on the first two harvests and all harvests, respectively. Fruit value of each grade was determined using industry values (P. Denlinger, 2016, Mt. Olive Pickle Co., NC, personal communication, 2016), and that was used to calculate total and early fruit value. The values used for grades 1, 2 and 3 were \$13.50/bu, \$8.50/bu, and \$6.00/bu, respectively.

Results

Parthenocarpic pickling cucumbers have potential for commercial field production in the United States. Seed companies including Rijk Zwaan, Nunhems, and Seminis Vegetable Seeds have developed cultivars suitable for production in the southeast U.S. Before growers are likely to purchase seed that is four times more expensive than conventional (\$12 for seedless vs. \$3 for seeded) (Chris Dyk, personal communications; Bayer Crop Science), evaluation of production methods and quality metrics are needed. Parthenocarpic cucumber cultivars evaluated in this study showed large variability in fruit quality traits and yield between years and seasons, but also demonstrated high quality and return value when planted at recommended densities.

Fresh fruit evaluations: Early dollar value was affected by season and cultivar in both 2014 and 2015 (Table A4.1).

Values ranged from \$316 to \$2177 per hectare to \$816 to \$7280 in 2014 and 2015, respectively (Table 1, 2). Desired planting density was not achieved for eight of the 17 cultivars tested in 2014, which explained, in part, the lower range in early dollar value for that year. Cultivars that consistently performed well for earliness achieving 40 (2014)/ 30 (2015) percent or greater of the total tonnage in the first two harvests included: 12-109, Gershwin, and Puccini. While some other cultivars did have higher yields in 2014 or 2015, they were not consistent. Total dollar value for all cultivars ranged from \$1989 to \$4423 per hectare in 2014 to \$16,008 to \$19,903 per hectare in 2015. Planting density was a contributing factor for the reduced total dollar value in 2014. The percentage of oversize fruit was not consistent with any of the cultivars tested between years, though the highest percentage of culls (15-21%) was seen in cultivars Gershwin and Puccini. Cultivar consistently affected percent culls, but season and year also contributed to variability observed.

Fruit shape (length:diameter ratios) varied among cultivars and years. Cultivars that consistently produced long fruit (L:D ratios of 3.7 to 4.0) included: Gershwin (Rijk Zwaan) (Table 3, Table 4). Cultivars with fruit with a L:D consistently > 3.2 included: Merengue, Puccini, 12-109, Wagner, Stravinsky. Fresh fruit firmness also varied among years with highest firmness in fresh fruit observed in cultivars 12-109, Surya, Gershwin, NCSU-01, and Wagner (80 to 92 N) in 2014 and RZ-13, Stravinsky, Surya, and Wagner (87-9 4N) in 2015.

For all cultivars, downy mildew ratings were between 4 and 6 (Table 5), indicating moderate disease severity. Cultivars with low (3) one-time ratings for anthracnose symptoms included: 10-170, 20002, Surya, and Wagner. Disease and spininess ratings were only conducted in 2015. Cultivars with numerous spines (7 to 9) included: 10-170, Atik, Karaoke, NUN0001, NUN2001, NUN2002, Liszt, Rubinstein, and RZ-17 (Table 5). Cultivars judged moderately spiny (4 to 6) included: NQ5007, RZ-12, RZ-15, and Merengue. Cultivars with few spines included: 21-340, 20002, 12-109, Bowie, Gershwin, Puccini, RZ-13, Stravinsky, Surya, and Wagner.

Brined fruit evaluations: Most of the brined fruit evaluations were affected, in part, by judge and cultivar, with the exception of bloater ratings (Table 3, 4). Though exact ratings varied, judges were in agreement between high and low quality brined fruit of the cultivars evaluated for shape, exterior, texture, seed cell, and uniformity. Average quality ratings for brined fruit were highest (6.3 to 6.6) for cultivars: 12-109, Gershwin, and Stravinsky (Table 7, Table 8). Brined fruit texture ratings were highest for cultivars 12-109 and Stravinsky. Only cultivar Gershwin consistently was rated high for uniformity across both years.

Brined fruit firmness was highest (90 to 102 N and 98 to 112 N in 2014 and 2015, respectively) for cultivars Puccini, Gershwin, Karaoke, Wagner.

Overall, only cultivar Gershwin consistently had high quality (pre and post brining) and early return across both years evaluated. However, several cultivars that were not tested in both years performed well for yield, quality, and disease resistance. Those cultivars should be tested further for possible use in North Carolina production.

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Table 1. Fruit yield of parthenocarpic pickling cucumbers tested in Kinston, North Carolina for spring and summer seasons of 2014 (cultivars are ranked by dollar value summed over 8 harvests).

Cultivar	Seed source	Yield summary					Fruit grade distribution (percentage by weight)						
		Harvests 1 & 2		Harvests 1-8			Harvests 1-8						
		% of Mg/ha total	\$/ha	\$/ha	Mg/ha Total	Mg/ha Marketable	Culls	No. 1	No. 2	No. 3	No. 4	Marketable	thp/ha
12-110	Rijk Zwaan	52 ^z	1973	4423	13	11	17	17	44	20	2	81	50
12-109	Rijk Zwaan	54	1923	3999	11	9	16	21	45	17	1	82	42
Merengue	Seminis	46	1465	3979	12	11	13	10	43	31	2	85	44
Puccini	Rijk Zwaan	60	2177	3937	13	10	21	12	38	26	2	76	48
Surya	Rijk Zwaan	45	1439	3777	12	9	19	15	43	20	4	78	49
Gershwin	Rijk Zwaan	53	1444	3615	11	9	21	14	47	18	0	79	44
NUN-55007	Nunhems	49	1493	3597	13	10	13	10	35	38	5	82	42
USACR10540	US Agriseeds	34	1102	3519	13	10	16	8	34	30	12	72	41
2943	Bejo Seeds	44	1105	3404	11	9	12	10	48	25	4	84	39
Karaoke	Rijk Zwaan	27	740	3389	11	9	13	14	42	25	6	80	35
Artist F1	Bejo Seeds	41	984	3301	11	9	18	18	43	19	2	80	34
NCSU-01	NC State	24	738	3280	11	9	9	8	30	28	9	79	28
Wagner	Rijk Zwaan	27	922	3114	9	8	11	17	37	17	1	85	42
Stravinsky	Rijk Zwaan	50	1095	2642	8	6	24	15	40	20	1	75	36
HSX-4415-2	Hort Ag	16	316	2124	7	5	9	14	31	19	10	77	24
Ansor F1	Bejo Seeds	40	572	2031	7	5	17	17	48	16	2	81	30
Aviator F1	Bejo Seeds	31	416	1989	6	5	11	15	56	17	1	89	27
Mean		40	1171	3301	11	9	16	14	41	23	4	80	39
LSD (5%)		16	598	1360	4	4	7	8	11	11	6		10

^zData are means of three replications from either harvest 1 and harvest 2 or harvests 1 through 8.

Table 2. Fruit yield of parthenocarpic pickling cucumbers tested in Kinston, North Carolina for spring and summer seasons of 2015 (cultivars are ranked by fruit value).

Cultivar	Seed source	Yield summary					Fruit grade distribution (percentage by weight)					
		Harvests 1 & 2		Harvests 1-8			Harvests 1-8					
		\$/ha	% of total	\$/ha	Total (Mg/ha)	Marketable (Mg/ha)	Culls	No. 1	No. 2	No. 3	No. 4	Marketable
Wagner	Rijk Zwaan	6532 ^z	31	19903	59	51	11	13	49	25	3	86
Surya	Rijk Zwaan	4888	25	19786	56	49	9	15	51	21	4	87
Gershwin	Rijk Zwaan	6084	32	19746	63	51	16	11	47	22	4	80
Bowie	Rijk Zwaan	6662	34	19267	56	49	10	13	51	24	2	88
10-170	Bejo Seeds	5021	29	18862	54	49	4	12	54	25	6	90
RZ-17	Rijk Zwaan	4835	26	18221	50	46	7	15	53	23	3	91
Liszt	Rijk Zwaan	4105	20	18075	54	48	5	11	45	31	8	87
Stravinsky	Rijk Zwaan	7280	40	17049	57	46	16	10	37	31	6	79
12-109	Rijk Zwaan	6239	36	16321	51	42	15	13	45	24	3	82
Karaoke	Rijk Zwaan	3436	21	16009	53	44	7	8	41	34	10	83
NUN0001	Nunhems	5693	37	16008	49	43	7	10	45	32	6	87
RZ-15	Rijk Zwaan	6374	41	15614	51	41	15	11	42	28	5	80
Rubinstein	Rijk Zwaan	3104	20	15288	46	40	6	12	48	27	7	87
Puccini	Rijk Zwaan	4889	33	15034	52	40	17	11	41	25	7	77
RZ-12	Rijk Zwaan	4557	33	14682	50	40	9	9	37	35	10	81
RZ-13	Rijk Zwaan	5238	40	13282	41	35	12	11	44	29	4	84
Merengue	Seminis	2523	20	13090	41	35	6	11	42	33	9	86
NQ5007	Nunhems	3416	26	13080	46	36	7	7	37	35	14	79
Atik	Bejo Seeds	1396	12	12605	41	35	5	8	42	34	10	84
21-340	Bejo Seeds	3067	23	12396	43	34	9	8	38	32	12	79
20002	Rijk Zwaan	4333	34	11650	39	29	20	12	41	22	5	75
NUN2001	Nunhems	1631	15	11395	48	33	9	4	27	39	21	69
NUN2002	Nunhems	816	8	10746	35	29	7	9	41	33	10	83
Mean		4440	28	15570	49	41	10	11	43	29	7	83
LSD (5%)		1946	9	4084	13	11	3	3	5	6	4	4

^zData are means of three replications.

Table 3. Fruit quality data collected on fresh and brined parthenocarpic pickling cucumber cultivars, 2014.

Cultivar	Seed source	Length:diameter	Fresh firmness (N)	Brined firmness (N)	Judged brinestock quality					
					Average	Shape	Exterior	Texture	Seedcell	Uniformity
2943	Bejo Seeds	3.0 ^z	65	66	5.7	5.2	6.1	5.4	5.4	6.5
Ansor F1	Bejo Seeds	3.3	61	65	5.5	4.6	5.6	5.6	6.1	5.6
Artist F1	Bejo Seeds	3.3	59	61	5.5	4.9	5.4	5.4	6.3	5.4
Aviator F1	Bejo Seeds	2.9	53	60	5.7	4.5	5.7	6.0	6.2	6.1
HSX-4415-2	Hort Ag	2.9	67	80	5.0	4.1	4.2	5.7	5.7	5.4
NCSU-01	NC State	3.2	80	91	5.6	5.8	5.5	5.2	5.3	6.2
NUN-55007	Nunhems	3.8	71	83	5.6	5.4	6.2	5.2	5.7	5.7
12-109	Rijk Zwaan	3.8	92	99	6.3	5.2	6.5	6.9	7.0	5.9
12-110	Rijk Zwaan	4.0	77	99	6.3	5.6	6.2	6.8	7.0	6.1
Gershwin	Rijk Zwaan	3.8	86	98	6.3	5.5	6.3	6.7	6.8	6.1
Karaoke	Rijk Zwaan	3.1	73	90	5.5	4.9	5.1	5.8	5.7	5.8
Puccini	Rijk Zwaan	3.5	71	96	5.9	5.3	6.1	6.4	6.3	5.6
Stravinsky	Rijk Zwaan	3.4	73	94	6.5	5.6	6.5	7.3	7.3	6.0
Surya	Rijk Zwaan	3.3	83	102	6.6	6.1	6.5	7.1	7.1	6.2
Wagner	Rijk Zwaan	3.5	85	97	6.4	6.3	6.4	6.4	6.6	6.3
Merengue	Seminis	3.5	64	64	5.6	5.6	5.9	5.1	5.6	5.8
USACR10540	US Agriseeds	3.3	70	87	5.7	5.6	5.7	5.6	5.4	6.0
Mean		3.4	51	84	5.9	5.3	5.9	6.0	6.2	5.9
LSD (5%)		0.3	13	12	0.3	0.6	0.4	0.5	0.5	0.4

^zData are means of three replications (taken from harvests 2, 4 and 6).

Table 4. Fruit quality data collected on fresh and brined parthenocarpic pickling cucumber cultivars, 2015.^z

Cultivar	Seed source	Length:diameter	Fresh firmness (N)	Brined firmness (N)	Judged brined quality					
					Average	Shape	Exterior	Texture	Seed cell	Uniformity
10-170	Bejo Seeds	3.3	78	91	6.0	5.7	5.6	6.2	6.3	6.1
21-340	Bejo Seeds	3.4	82	94	4.7	4.3	4.1	5.1	5.2	4.6
Atik	Bejo Seeds	3.3	71	81	5.4	5.3	5.3	5.4	5.3	5.9
NQ5007	Nunhems	4.0	71	91	5.1	5.1	4.7	5.2	5.5	5.2
NUN0001	Nunhems	3.7	80	96	5.3	5.4	5.8	4.8	5.3	5.5
NUN2001	Nunhems	3.6	77	88	5.6	5.6	5.3	5.5	5.7	5.9
NUN2002	Nunhems	3.7	75	85	5.5	5.1	4.6	5.9	5.9	5.8
20002	Rijk Zwaan	3.5	83	98	5.4	4.9	5.0	5.8	6.0	5.1
12-109	Rijk Zwaan	3.5	92	104	5.6	5.3	5.4	6.2	5.7	5.5
Bowie	Rijk Zwaan	3.8	82	90	5.7	5.3	6.0	5.7	5.8	5.8
Gershwin	Rijk Zwaan	3.7	82	104	6.0	5.6	6.0	6.1	6.3	5.8
Karaoke	Rijk Zwaan	3.3	83	102	5.6	5.7	4.3	5.8	6.0	5.9
Liszt	Rijk Zwaan	3.7	66	74	5.9	6.3	5.1	5.9	6.2	6.2
Puccini	Rijk Zwaan	3.4	81	100	5.8	5.5	5.7	6.1	6.2	5.6
Rubinstein	Rijk Zwaan	3.7	77	80	5.4	5.4	5.3	5.3	5.3	5.6
RZ-12	Rijk Zwaan	3.7	77	88	5.0	4.9	4.6	5.5	5.2	5.1
RZ-13	Rijk Zwaan	3.5	94	99	5.4	5.2	5.9	5.3	5.1	5.6
RZ-15	Rijk Zwaan	3.6	79	88	5.8	5.9	5.7	5.8	6.0	5.8
RZ-17	Rijk Zwaan	3.2	66	70	5.3	5.0	4.8	5.1	5.5	5.9
Stravinsky	Rijk Zwaan	3.6	84	88	5.6	5.0	5.9	6.1	5.7	5.3
Surya	Rijk Zwaan	3.6	91	95	5.4	5.1	5.3	5.7	5.8	5.1
Wagner	Rijk Zwaan	3.8	87	112	5.5	5.5	5.7	5.4	5.5	5.5
Merengue	Seminis	3.5	63	77	5.5	5.7	4.7	5.7	5.9	5.6
Means		3.6	79	91	5.5	5.3	5.3	5.6	5.7	5.6
LSD (5%)		0.1	9	15	0.4	0.7	0.5	0.6	0.6	0.6

LSD = least significant difference

^zData are means of three replications (taken from harvests 2, 4 and 6).

Table 5. Disease and spininess ratings for parthenocarpic pickling cucumber cultivars, 2015.

Cultivar	Seed Source	Disease Rating		
		Downy Mildew	Anthracnose	Spininess
10-170	Bejo Seeds	6 ^z	3 ^y	7
21-340	Bejo Seeds	6	7	3
Atik	Bejo Seeds	5	7	7
NQ5007	Nunhems	6	7	6
NUN0001	Nunhems	5	7	7
NUN2001	Nunhems	5	6	7
NUN2002	Nunhems	4	5	7
20002	Rijk Zwaan	5	3	3
12-109	Rijk Zwaan	5	7	3
Bowie	Rijk Zwaan	6	7	3
Gershwin	Rijk Zwaan	5	7	3
Karaoke	Rijk Zwaan	5	6	7
Liszt	Rijk Zwaan	4	6	8
Puccini	Rijk Zwaan	4	7	3
Rubinstein	Rijk Zwaan	6	7	7
RZ-12	Rijk Zwaan	6	7	5
RZ-13	Rijk Zwaan	6	7	3
RZ-15	Rijk Zwaan	5	5	4
RZ-17	Rijk Zwaan	6	5	8
Stravinsky	Rijk Zwaan	6	8	3
Surya	Rijk Zwaan	5	3	3
Wagner	Rijk Zwaan	4	3	3
Merengue	Seminis	6	7	6
Mean		5	6	5

^zData are means of two ratings of three replications.

^yData are means of one rating of three replications.

Table 6. Quality evaluation for brined parthenocarpic pickling cucumber cultivars, 2014.^z

Cultivar	Seed Source	Total	Total bloaters	% Balloon	Total defects	% Placental hollows	% Blossom end defects	% Soft centers
2943	Bejo Seeds	7.3	2.7	2.7	4.7	0.0	0.0	4.7
Ansor F1	Bejo Seeds	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Artist F1	Bejo Seeds	1.0	1.0	1.0	0.0	0.0	0.0	0.0
Aviator F1	Bejo Seeds	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HSX-4415-2	Hort Ag	3.3	0.0	0.0	3.3	0.7	0.0	2.7
NCSU-01	NC State	2.0	0.0	0.0	2.0	1.3	0.0	0.7
NUN-55007	Nunhems	1.3	0.7	1.0	0.7	0.0	0.0	0.7
12-109	Rijk Zwaan	6.7	0.0	0.0	6.7	6.7	0.0	0.0
12-110	Rijk Zwaan	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gershwin	Rijk Zwaan	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Karaoke	Rijk Zwaan	1.7	0.0	0.0	1.7	0.3	0.0	1.3
Puccini	Rijk Zwaan	0.7	0.0	0.0	0.7	0.7	0.0	0.0
Stravinsky	Rijk Zwaan	2.3	1.0	1.0	1.3	1.3	0.0	0.0
Surya	Rijk Zwaan	2.7	1.3	1.3	1.3	0.7	0.7	0.0
Wagner	Rijk Zwaan	2.0	0.0		2.0	1.7	0.0	0.3
Merengue	Seminis	4.3	3.7	3.7	0.7	0.7	0.0	0.0
USACR10540	US Agriseeds	4.0	1.3	1.3	2.7	0.7	0.7	1.3
Mean		2.3	0.7	0.7	1.6	0.9	0.1	0.7
LSD (5%)		6.2	2.7	2.7	5.6	4.8	0.6	2.7

^zData are means of three replications (taken from harvests 2, 4 and 6).

Table 7. Quality evaluation for brined parthenocarpic pickling cucumber cultivars, 2015.^z

Cultivar	Seed Source	Total	Total bloaters	% Balloon	% Lens	% Honeycomb	Total defects	% Placental hollows	% Blossom end defects	% Soft centers
10-170	Bejo Seeds	1.3	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0
21-340	Bejo Seeds	4.3	2.7	2.0	0.7	0.0	1.7	1.0	0.0	0.7
Atik	Bejo Seeds	2.3	0.0	0.0	0.0	0.0	2.3	1.0	0.7	0.7
NQ5007	Nunhems	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NUN0001	Nunhems	1.3	0.0	0.0	0.0	0.0	1.3	0.0	0.0	1.3
NUN2001	Nunhems	2.0	0.7	0.3	0.0	0.3	1.3	0.3	0.0	1.0
NUN2002	Nunhems	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20002	Rijk Zwaan	1.3	0.7	0.7	0.0	0.0	0.7	0.0	0.0	0.7
12-109	Rijk Zwaan	2.3	0.0	0.0	0.0	0.0	2.3	0.7	0.0	1.7
Bowie	Rijk Zwaan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gershwin	Rijk Zwaan	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Karaoke	Rijk Zwaan	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3
Liszt	Rijk Zwaan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Puccini	Rijk Zwaan	0.7	0.0	0.0	0.0	0.0	0.7	0.7	0.0	0.0
Rubinstein	Rijk Zwaan	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
RZ-12	Rijk Zwaan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RZ-13	Rijk Zwaan	4.7	3.7	3.7	0.0	0.0	1.0	0.0	0.0	1.0
RZ-15	Rijk Zwaan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RZ-17	Rijk Zwaan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stravinsky	Rijk Zwaan	4.3	0.0	0.0	0.0	0.0	4.3	2.0	0.0	2.3
Surya	Rijk Zwaan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wagner	Rijk Zwaan	3.7	0.7	0.7	0.0	0.0	3.0	1.3	0.0	1.7
Merengue	Seminis	3.3	2.3	2.3	0.0	0.0	1.0	1.0	0.0	0.0
Mean		1.4	0.6	0.5	0.0	0.0	0.9	0.3	0.0	0.5
LSD (5%)		3.8	2.7	2.7	0.4	0.2	2.3	1.8	0.4	1.6

^zData are means of three replications (taken from harvests 2, 4 and 6).