Head Lettuce Variety Performance Matanuska Valley, Alaska, 2000 and 2001

Circular 123, September 2003

UAF Agricultural and Forestry Experiment Station

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Above, lettuce ready for transplanting in the field; at left, head lettuce ready for harvest. Photos by Roseann Leiner.

Introduction

Lettuce is grown and marketed during the summer months in Alaska. Lettuce leaves are eaten fresh in salads as a healthful part of the diet, since lettuce is low in calories. Green leaf, red leaf, and romaine (cos) lettuce are available in season. The most popular lettuce type is head lettuce, popularly known as iceberg, but technically called crisphead. In 2000, lettuce was grown on 70 acres in Alaska and accounted for the third largest acreage of vegetables, after potatoes (860 acres) and carrots (77 acres) (Benz and Roos 2001). The market value of lettuce grown in Alaska was more than $300,000 in both 1999 and 2000.

Lettuce is sold in cartons that usually have 24 heads and weigh approximately 45 lb. Lettuce heads that are too large to fit 24 in a carton or too light to weigh 45 lb. with 24 in a carton are not marketable, and so head size affects the proportion of marketable heads. Varieties that are uniform in size and free of defects and disease are desirable.

Lettuce is susceptible to tipburn, a disorder where the edges of some inner leaves die from a localized lack of calcium that is related to uneven water transport. Water stress can lead to tipburn damage during the long days in June and July in Alaska. Tipburn is unsightly when the head is cut open and difficult to detect and cull because tipburn damage may not be visible externally. Some varieties are more resistant than others (Ryder and Waycott 1998). Tipburn resistance is evident in these variety trials when the susceptible variety Calicel is compared to the standard resistant variety Salinas.

Variety selection is one important management decision for successful crop production; variety trials provide information on which varieties are likely to produce superior crops. Since 1995, head lettuce variety trials have been conducted by scientists (Walworth and others 1997) at the Palmer Research and Extension Center of the Agricultural and Forestry Experiment Station of the University of Alaska Fairbanks. The trials have included varieties common in commercial production and newer varieties that have potential for good production in the cool

Table 1. Percent[1] marketable lettuce heads in 2001 for four plantings in the Matanuska Valley, Alaska.

Harvest Month:	July	July	August	August
Location:	SOUTH	EAST	SOUTH	EAST
Variety	Overall Average[2]			*Over Mature
Alpha	58 (20)	70 (5)	47 (27)	56 (19)	21 (17)
Alpha II	66 (23)	58 (29)	78 (16)	61 (22)	45 (6)
Bayview	46 (29)	23 (13)	51 (33)	65 (24)	5 (4)
Calicel	29 (18)	30 (26)	38 (13)	19 (9)	0 (0)
Cypress	67 (19)	69 (25)	76 (7)	55 (17)	50 (9)
Desert Storm	41 (28)	53 (20)	8 (10)	63 (12)	12 (12)
Jupiter	44 (23)	21 (19)	56 (13)	56 (18)	4 (5)
Lobos	72 (17)	80 (14)	76 (10)	60 (21)	45 (15)
Montemar	66 (15)	64 (19)	77 (9)	59 (10)	23 (17)
Premiere	62 (20)	48 (27)	75 (13)	63 (10)	21 (9)
Ranger	59 (24)	58 (30)	56 (34)	64 (9)	11 (4)
Salinas	62 (18)	54 (23)	67 (10)	65 (21)	20 (4)
Tiber	59 (21)	70 (24)	46 (21)	61 (15)	14 (5)
Venus	60 (26)	30 (11)	71 (16)	78 (16)	21 (11)
Average	56	52	59	59	21

[1] The average percent of marketable heads is calculated from four replicate plots of 20 plants for each harvest date and location. Each average is followed by the standard deviation in parentheses, to indicate variability among replicate plots. Plants were considered unmarketable if they had defects, disease symptoms, weighed more than 2.75 pounds, or less than 1.25 pounds.

[2] This column has the overall average of three plantings in 2001, July south, July east, and August south. It does not include the values for the August east planting because that planting was over mature when harvested. The average is followed by the standard deviation in parentheses, to indicate variability among plots.

temperatures and long days of Alaska summer. When head lettuce variety trials began in 1995, 27 varieties were evaluated at three planting times (Carling and others 1996). Fifteen varieties were selected for further evaluation in 1996 and 1997, because they produced a relatively high proportion of marketable heads and their tipburn ratings were relatively low (Dofing and others 1996, Walworth and others 1997). Alpha and Premiere are varieties commonly planted by commercial growers in the Matanuska Valley. This report presents data from head lettuce trials done in 2000 and 2001, with four plantings each year. The objective of these trials is to compare head lettuce varieties for quality and yield under Alaska growing conditions.

Materials and Methods

We compared 14 varieties of head lettuce in field trials in 2000 and 2001 (tables 1 and 2). Seed of most varieties was provided by Harris Moran Seed Company (San Juan Bautista, CA). Venus and Jupiter were provided by Paragon Seed, Inc. (Salinas, CA), and Tiber was purchased from Vesey's Seeds Ltd. (York, Prince Edward Island, Canada). Raw seed was stored dry at room temperature until planting. The field trials were located on two commercial vegetable farms in the Matanuska Valley near Palmer, Alaska. One farm had fields adjacent to the Inner Springer Loop south of Palmer; the fields on the other farm were adjacent to the Bodenburg Butte Loop east of Palmer. At both farms, the trials were done at midseason and late season. We planted seed in April (18–21) and May (17–19). One seed per cell was planted in plug flats (200 or 310 count), filled with commercial brands of soilless mix, and covered with a thin layer of vermiculite. Seedlings were grown in greenhouses on each farm, watered and fertilized with automatic misting systems, and hardened off by exposure to wind and cool temperatures, like the transplants for commercial plantings.

We transplanted seedlings in May (18-24) and June (15-21), 29 to 35 days after sowing the seeds. Seedlings were transplanted by hand, in plots of 20 plants, in vegetable fields alongside commercial plantings. Conventional procedures for commercial production were used for tillage and fertilization. Plants were spaced 12 inches apart in the rows, and plants of the same variety were planted as borders at both ends of each plot. Replicate plots of each variety were planted in a randomized complete block design, with four replicates in 2001 and two replicates in 2000. The lettuce plots were irrigated with overhead sprinklers and weeded by hand and by mechanical cultivation.

We harvested lettuce heads in July (11-27) and August (16-28), 48 to 68 days after transplanting the seedlings. All plants in a plot were harvested and removed from the field when the majority of plants in a plot felt firm, indicating that the heads were mature. Individual heads were weighed (grams) and measured for diameter (centimeters) perpendicular to the stem. Each head was evaluated for marketability, disease, and tipburn. Plants were considered unmarketable if they had obvious defects or disease symptoms on the marketable portion of the head, or if heads weighed

Table 2. Percent[1] marketable lettuce heads in 2000 for four plantings in the Matanuska Valley, Alaska.

Harvest Month:		July	July	August	August
Location:		SOUTH	EAST	SOUTH	EAST
Variety	Overall Average[2]				
Alpha	75 (13)	79	75	68	80
Alpha II	83 (14)	71	97	85	80
Bayview	49 (27)	15	49	55	78
Calicel	21 (22)	0	13	18	53
Cypress	83 (6)	79	85	85	83
Desert Storm	43 (32)	60	3	63	48
Jupiter	39 (20)	24	26	63	45
Lobos	75 (15)	57	75	80	88
Montemar	68 (10)	69	60	73	68
Premiere	65 (28)	45	68	78	70
Ranger	70 (18)	58	87	60	75
Salinas	71 (13)	74	70	73	67
Tiber	67 (18)	60	63	75	70
Venus	66 (20)	34	69	80	79
Average	63	52	60	68	70

[1] The average percent of marketable heads is calculated from two replicate plots of 20 plants for each harvest date and location. Plants were considered unmarketable if they had defects, disease symptoms, weighed more than 2.75 pounds, or less than 1.25 pounds.

[2] This column has the overall average of the four plantings in 2000. The average is followed by the standard deviation in parentheses, to indicate variability among plots.

more than 2.75 pounds, or less than 1.25 pounds. Defects included loose heads or split inner leaves. Disease symptoms included wet rots: slime caused by soft rot bacteria, white mold caused by the fungus *Sclerotinia sclerotiorum*, or grey mold caused by the fungus *Botrytis cinerea*. Tipburn was recorded on a scale of 0 to 4, in which 0 = no tipburn seen, 1 = tipburn damage less than 0.5 inches, 2 = tipburn damage from 0.5 to 3 inches and no wet rot damage, 3 = tipburn damage more than 3 inches and/or wet rot damage up to 10% of surface, and 4 = tipburn damage more than 3 inches and/or wet rot damage more than 10% of surface. Data are summarized in tables to compare varieties by planting and yearly average. Standard deviations are included to indicate variability among replicate plots.

Results and Discussion

The proportion of marketable heads ranged from 83% to 21%, and most varieties had at least 50% marketable heads (tables 1 and 2). Many varieties performed as well as Alpha and Premiere, which are planted by commercial growers in the Matanuska Valley. For example, Alpha and Lobos both had 75% average marketable heads in 2000, while in 2001, Alpha had 58% and Lobos had 72%. Standard deviations among replicate plots were often greater than 20%, so small differences among averages can be attributed to random variation among plots. However, large differences among varieties showed that four varieties had consistently lower marketability than the others tested, with yearly average for marketable heads below 50%.

Calicel had less than 30% marketable heads and consistently high ratings for tipburn (tables 3 and 4). Calicel was included in these trials because it is highly susceptible to tipburn. Calicel does not have commercial potential for Alaska, though we observed that the few marketable plants did have a good taste.

Three other varieties, Bayview, Desert Storm, and Jupiter, had between 39% and 49% for yearly average of marketable heads. These varieties were developed for winter growing in the desert regions of California and Arizona, where cool weather with short days limit plant growth. Alaska has cool weather but long days, and the energy from long hours of daylight permit varieties with characteristically large heads to grow too large for packing 24 heads to a carton. The average weight for Bayview, Desert Storm, and Jupiter was greater than two pounds per marketable head, and average diameter was large (tables 7 and 8). Bayview, Desert Storm and Jupiter are not recommended for commercial plantings in Alaska because their head size was often larger than

Table 3. Tipburn ratings[1] for lettuce heads in 2001 for four plantings in the Matanuska Valley, Alaska.

Harvest Month:	July	July	August	August
Location:	SOUTH	EAST	SOUTH	EAST
Variety				*Over Mature
Alpha	1.3 (1.0)	0.5 (1.1)	1.9 (1.6)	2.8 (1.2)
Alpha II	0.9 (0.4)	0.8 (1.3)	1.4 (1.5)	2.2 (1.7)
Bayview	2.9 (1.3)	1.8 (1.5)	1.4 (1.5)	3.0 (1.4)
Calicel	2.9 (1.1)	2.5 (1.3)	2.7 (1.3)	3.6 (0.6)
Cypress	0.9 (0.3)	0.7 (1.3)	1.9 (1.7)	2.1 (1.8)
Desert Storm	1.3 (1.2)	3.4 (1.0)	1.5 (1.3)	2.6 (1.4)
Jupiter	2.8 (1.3)	1.3 (1.4)	2.0 (1.7)	3.3 (1.2)
Lobos	1.2 (1.2)	1.1 (1.4)	1.7 (1.6)	1.9 (1.7)
Montemar	1.5 (1.3)	1.1 (1.1)	1.6 (1.6)	2.3 (1.4)
Premiere	1.5 (0.9)	1.6 (1.1)	1.9 (1.5)	2.7 (1.2)
Ranger	1.0 (0.6)	0.2 (0.7)	1.6 (1.5)	2.7 (1.3)
Salinas	1.8 (1.0)	1.0 (1.3)	1.5 (1.7)	2.5 (1.6)
Tiber	1.2 (1.0)	1.6 (1.5)	1.6 (1.4)	2.1 (1.3)
Venus	1.0 (0.8)	1.5 (1.3)	1.2 (1.5)	2.7 (1.3)
Average	1.6	1.4	1.7	2.6

[1] The average rating for tipburn damage is calculated from 20 plants in each of four replicate plots for each harvest date and location. Each average is followed by the standard deviation in parentheses, to indicate variability among replicate plots. The tipburn ratings were on a scale of 0 to 4:

0 = no tipburn seen,

1 = tipburn damage less than 0.5 inches,

2 = tipburn damage 0.5 to 3 inches and no wet rot damage,

3 = tipburn damage more than 3 inches and/or wet rot damage up to 10% of surface,

4 = tipburn damage more than 3 inches and/or wet rot damage more than 10% of surface.

Wet rot damage often develops when tipburn is present.

marketable, and the proportion of marketable heads was low in these trials.

The tipburn ratings were variable among varieties and plots. In general, the average tipburn ratings were between one and two, indicating some tipburn damage but no wet rot. One planting had higher tipburn ratings; the planting harvested in August 2001, east of Palmer, had average tipburn ratings above two for all varieties. In that planting, the lettuce was over mature at harvest, which was 7-10 days later than adjacent commercial plantings. Data from that planting showing large heads with low marketability illustrate the need to balance between size and quality. The average head size was greater than two pounds for all varieties in that planting, but the quality of heads was low. In the case of Calicel, not a single head of 80 transplanted was marketable. Tipburn, split inner leaves, and disease damage from both slime and white mold were problems in Calicel, and in other varieties to a lesser degree. Also, the effects of tipburn could not be separated from the other problems, probably because damage from tipburn can provide entry for soft rot bacteria and/or the fungus that caused white mold. Although tipburn does not cause disease, it is often associated with higher disease incidence.

Disease incidence has a large effect on proportion of marketable heads. The planting with the lowest disease incidence in 2000, 13%, also had the highest proportion of marketable heads, 70% (planting harvested in August, east of Palmer, tables 2 and 5). Conversely, the planting with the highest disease incidence in 2000, 36%, also had the lowest proportion of marketable heads, 52% (planting harvested in July, south of Palmer). Since white mold was a major disease problem in 2000, the incidence of white mold disease symptoms was recorded in 2001 (Table 6). The planting with the lowest incidence of white mold in 2001, 1%, was harvested early, 48 days after transplanting, and the average head weight was light (planting harvested in July, south of Palmer, tables 6 and 7). In contrast, the planting with the highest incidence of white mold in 2001, 41%, also had the lowest proportion of marketable heads, 21% (over mature planting harvested in August, east of Palmer, tables 1 and 6). That planting was harvested 68 days after transplanting, and the average head weight was over two pounds (Table 7). Early harvest can limit the time for white mold infections to develop. Disease incidence may also be related to amount of white mold inoculum in the soil, and fields with a history of vegetable production may have high levels of inoculum from infections on previous crops. The white mold fungus, *Sclerotinia sclerotiorum*, overwinters as black

Table 4. Tipburn ratings[1] for lettuce heads in 2000 for four plantings in the Matanuska Valley, Alaska.

Harvest Month:	July	July	August	August
Location:	SOUTH	EAST	SOUTH	EAST
Variety				
Alpha	1.0 (1.3)	0.5 (1.0)	1.3 (1.5)	0.4 (1.1)
Alpha II	0.7 (0.9)	0.2 (0.5)	0.9 (1.0)	0.2 (0.7)
Bayview	3.1 (1.4)	1.7 (1.4)	1.7 (1.3)	0.5 (1.2)
Calicel	3.3 (1.0)	3.1 (1.0)	2.6 (1.3)	2.1 (1.6)
Cypress	1.1 (1.5)	0.7 (1.3)	0.7 (1.0)	0.3 (0.9)
Desert Storm	1.5 (1.7)	3.5 (1.1)	1.3 (1.3)	0.5 (1.2)
Jupiter	2.6 (1.8)	2.4 (1.6)	1.6 (1.3)	1.2 (1.7)
Lobos	0.4 (0.9)	0.4 (0.8)	1.1 (1.3)	0.2 (0.8)
Montemar	1.4 (1.2)	0.9 (1.5)	1.3 (1.2)	0.6 (1.2)
Premiere	2.4 (1.5)	1.6 (1.4)	1.7 (0.9)	0.5 (1.2)
Ranger	1.0 (1.4)	0.4 (1.0)	1.9 (1.4)	0.8 (1.3)
Salinas	0.9 (1.1)	1.2 (1.5)	1.2 (1.3)	0.2 (0.7)
Tiber	1.4 (1.3)	0.8 (1.2)	1.4 (1.3)	0.6 (1.2)
Venus	2.6 (1.6)	1.3 (1.6)	0.7 (0.8)	0.5 (1.2)
Average	1.7	1.3	1.4	0.6

[1] The average rating for tipburn damage is calculated from 20 plants in each of two replicate plots for each harvest date and location. Each average is followed by the standard deviation in parentheses, to indicate variability among replicate plots. The tipburn ratings were on a scale of 0 to 4:

0 = no tipburn seen,

1 = tipburn damage less than 0.5 inches,

2 = tipburn damage 0.5 to 3 inches and no wet rot damage,

3 = tipburn damage more than 3 inches and/or wet rot damage up to 10% of surface,

4 = tipburn damage more than 3 inches and/or wet rot damage more than 10% of surface.

Wet rot damage often develops when tipburn is present.

sclerotia in soil. Since disease pressure from white mold can affect proportion of marketable heads, minimizing white mold disease is important for production of all varieties of lettuce.

The choice of varieties is often limited by seed availability. Seed companies will continue to offer new varieties and discontinue varieties that have decreasing market share. The varieties Alpha II, Cypress, and Lobos were added to the trials in 1997 (Walworth et al 1997), and included in replicated trials since 1998. Like Alpha and Premiere, these varieties from Harris Moran have performed well in Alaskan trials, but are no longer sold commercially by Harris Moran. Similar varieties having medium head size and adapted to coastal California conditions are likely to grow well in Alaska. Varieties added in 2000, but being dropped from the Alaska trials, are Bayview, Desert Storm, Jupiter, and Venus. These produced large heads that did not fit well in cartons without bruising, and rapid growth made them susceptible to disease. Similar varieties having large head size and adapted to winter production in desert areas are unlikely to grow well in Alaska.

Table 5. Incidence[1] (percent) of plants with disease symptoms on lettuce heads in 2000 for four plantings in the Matanuska Valley, Alaska.

Harvest Month:	July	July	August	August
Location:	SOUTH	EAST	SOUTH	EAST
Variety				
Alpha	18	10	20	10
Alpha II	3	3	8	5
Bayview	82	41	25	10
Calicel	67	79	43	45
Cypress	21	13	10	8
Desert Storm	35	93	20	15
Jupiter	59	69	30	25
Lobos	5	5	18	5
Montemar	25	20	15	10
Premiere	55	29	15	10
Ranger	25	8	33	15
Salinas	11	23	18	5
Tiber	29	9	23	15
Venus	63	25	8	8
Average	36	30	20	13

[1] The average incidence in percent is calculated from two replicate plots of 20 plants for each harvest date and location.

Table 6. Incidence[1] (percent) of plants with symptoms of *sclerotinia* white mold on lettuce heads in 2001 for four plantings in the Matanuska Valley, Alaska.

Harvest Month:	July	July	August	August
Location:	SOUTH	EAST	SOUTH	EAST
Variety				*Over Mature
Alpha	0	8 (6)	34 (17)	40 (12)
Alpha II	0	16 (18)	24 (17)	43 (12)
Bayview	0	14 (16)	18 (12)	16 (10)
Calicel	1 (3)	21 (2)	43 (12)	59 (21)
Cypress	0	14 (13)	41 (13)	41 (17)
Desert Storm	3 (3)	78 (21)	19 (5)	50 (29)
Jupiter	4 (8)	14 (5)	44 (22)	76 (9)
Lobos	10 (7)	22 (5)	33 (14)	38 (10)
Montemar	0	8 (7)	35 (12)	34 (9)
Premiere	0	14 (7)	35 (15)	44 (6)
Ranger	0	4 (5)	24 (14)	31 (12)
Salinas	0	18 (6)	31 (23)	38 (13)
Tiber	0	28 (13)	33 (12)	29 (9)
Venus	0	19 (7)	18 (13)	41 (18)
Average	1	20	31	41

[1] The average incidence in percent is calculated from four replicate plots of 20 plants for each harvest date and location. Each average is followed by the standard deviation in parentheses, to indicate variability among replicate plots.

Table 7. Size[1] of lettuce heads in 2001 for four plantings in the Matanuska Valley, Alaska.

		WEIGHT IN POUNDS					DIAMETER IN INCHES			
Harvest Month:		July	July	August	August		July	July	August	August
Location:		SOUTH	EAST	SOUTH	EAST		SOUTH	EAST	SOUTH	EAST
Variety	Overall Average[2]				*Over Mature	Overall Average[3]				*Over Mature
Alpha	1.7	1.6	1.5	1.9	2.5	5.9	6.3	5.7	5.7	5.9
Alpha II	1.8	1.5	2.0	1.7	2.2	5.9	6.2	6.1	5.4	5.7
Bayview	2.1	2.0	2.1	2.1	2.5	6.0	6.3	6.0	5.8	6.0
Calicel	1.9	1.7	2.0	2.0	-	5.7	5.4	6.0	5.8	-
Cypress	1.8	1.5	2.0	2.0	2.3	6.0	5.9	6.3	5.7	6.0
Desert Storm	2.3	2.4	2.0	2.3	2.5	6.5	6.7	6.1	6.5	6.3
Jupiter	2.3	2.2	2.3	2.2	2.6	6.4	6.8	6.4	6.2	6.6
Lobos	1.9	1.8	2.1	1.7	2.3	6.2	6.5	6.3	5.6	5.9
Montemar	1.9	1.8	2.0	1.9	2.3	5.8	6.1	5.8	5.6	5.9
Premiere	1.9	1.7	2.0	2.0	2.2	6.0	6.1	6.2	5.7	6.0
Ranger	1.7	1.5	1.5	1.9	2.4	5.8	5.8	5.8	5.7	5.8
Salinas	2.0	1.6	2.2	2.1	2.4	6.0	6.1	6.3	5.8	6.3
Tiber	2.1	1.9	2.3	2.1	2.5	6.2	6.6	6.2	5.7	6.2
Venus	1.9	1.5	2.1	2.0	2.3	5.8	6.2	5.9	5.6	5.7
Average	1.9	1.8	2.0	2.0	2.4	6.0	6.2	6.1	5.8	6.0

[1] The average weight and diameter is calculated from marketable plants, up to 20 in each of four replicate plots for each harvest date and location. Plants were considered unmarketable if they had defects, disease symptoms, weighed more than 2.75 pounds, or less than 1.25 pounds.

[2] This column has the overall average weight of three plantings, July South, July East, and August South. It does not include the values for the August East planting because that planting was over mature when harvested. The standard deviation for averages in this column ranged from 0.3 to 0.4.

[3] This column has the overall average diameter of three plantings, July South, July East, and August South. It does not include the values for the August East planting because that planting was over mature when harvested. The standard deviation for averages in this column ranged from 0.4 to 0.6.

Note: See page 8 for Table 8

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Table 8. Size[1] of lettuce heads in 2000 for four plantings in the Matanuska Valley, Alaska.

		WEIGHT IN POUNDS					DIAMETER IN INCHES			
Harvest Month:		July	July	August	August		July	July	August	August
Location:		SOUTH	EAST	SOUTH	EAST		SOUTH	EAST	SOUTH	EAST
Variety	Overall Average[2]					Overall Average[3]				
Alpha	2.1	1.9	2.3	2.1	2.0	5.6	5.4	5.9	5.7	5.6
Alpha II	1.9	1.7	2.1	1.9	1.7	5.4	5.1	5.5	5.4	5.4
Bayview	2.1	2.4	2.2	2.2	1.9	5.7	5.6	6.0	5.8	5.6
Calicel	2.0	-	1.9	2.0	2.0	5.3	-	5.2	5.3	5.3
Cypress	2.0	2.1	2.2	2.0	1.9	5.6	5.3	5.6	5.6	5.7
Desert Storm	2.3	2.4	2.2	2.4	2.1	5.8	5.5	5.9	6.0	5.9
Jupiter	2.2	2.1	2.3	2.2	2.1	5.8	5.3	5.9	6.0	5.8
Lobos	1.9	1.7	2.1	1.9	1.8	5.4	5.1	5.6	5.5	5.5
Montemar	1.9	1.7	2.1	1.8	1.9	5.2	4.9	5.4	5.1	5.2
Premiere	1.9	2.0	2.1	1.8	1.8	5.4	5.5	5.5	5.3	5.3
Ranger	2.1	1.7	2.1	2.3	2.2	5.5	5.1	5.6	5.5	5.5
Salinas	2.0	1.8	2.1	2.2	1.7	5.6	5.3	5.8	5.9	5.5
Tiber	2.1	1.8	2.3	2.3	2.1	5.7	5.4	5.8	5.8	5.8
Venus	2.0	2.0	2.2	2.0	1.8	5.3	5.2	5.4	5.4	5.2
Average	2.0	2.0	2.2	2.1	1.9	5.5	5.3	5.7	5.6	5.5

[1] The average weight and diameter is calculated from marketable plants, up to 20 in each of two replicate plots for each harvest date and location. Plants were considered unmarketable if they had defects, disease symptoms, weighed more than 2.75 pounds, or less than 1.25 pounds.

[2] This column has the overall average weight of the four plantings. The standard deviation for averages in this column ranged from 0.3 to 0.4.

[3] This column has the overall average diameter of the four plantings. The standard deviation for averages in this column ranged from 0.3 to 0.5.

Acknowledgments

I thank commercial lettuce growers Paula Giauque and Ben VanderWeele for their cooperation and assistance with greenhouse and field cultivation. I thank K. Barton, T. Evers, D. Gossett, G. Smith, and A. Smyth for technical assistance. This research was supported in part by Hatch funds granted to UAF Agricultural and Forestry Experiment Station.

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