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Fresh Market/Slaw and Kraut Cabbage Germplasm Evaluation Results in 2002

Information on the Effects of Planting Date and Genotype on Fresh Market/Slaw and Kraut Cabbage Yield and Head Traits in Ohio in 2002

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Seed for the genotypes tested in these studies was provided by the following companies:

American Takii
Bejo
Harris Moran
Reed's Seeds
Rijk Zwaan
Seminis
Stokes
Tokita
Vilmorin

The Grower's Section

A complete description of this study and our findings begins on page 1. The "Grower's Section" is offered for quick reference.

What Did We Do?

We planted a total of twenty-two varieties and experimental lines of fresh market/slaw- and kraut-type cabbage at the OARDC Vegetable Crops Research Branch in Fremont, OH on May 28 and June 25, 2002. Replicated field plots were used (this was not an un-replicated strip trial). Plots and heads were examined regularly throughout the season and at harvest. Post-harvest evaluations of quality were also completed in the lab.

Why Did We Do This Project?

This project was undertaken to assist the Ohio cabbage industry in identifying varieties with desirable traits. Head traits (e.g., size, weight, density, freedom from physiological disorders, core size, etc.), marketable yield, and resistance to biological and environmental stresses and other variety traits influence the return from cabbage production. To be successful, the Ohio cabbage industry must have available varieties adapted to the state's production and market conditions. Because cabbage varieties often differ in traits which impact profit, scientifically measuring and documenting the performance of varieties under varied, local conditions is important. Reliable information from an unbiased testing program is useful in variety selection.

What Did We Find?

Fresh Market/Slaw Study

1. Yield. See Table 4 for more information. In the spring, total and marketable yield averaged 25.1 and 17.5 ton/A, respectively. But, in the summer, total and marketable yield averaged 31.3 and 24.6 ton/A respectively. Matsumo had the greatest marketable yield in the spring while GZG 239 had the greatest marketable yield in the summer planting. The marketable yield of four of fifteen entries listed in Table 8 was different following planting in May and June.

2. Head and Core Traits. See Tables 6 and 7 for more information. Head weight and size tended to be greater in the June- versus May-planting. However, the percent of the head's volume taken up by the core tended to be greater in the spring versus summer planting. Head density tended to be unaffected by planting date. Among all genotypes, head weight and size were frequently impacted by planting date (Table 8).

Kraut Study

1. Yield. See Table 11 for more information. In the spring, total and marketable yield averaged 27.2 and 21.4 ton/A, respectively. Total and marketable yield averaged 36.4 and 31.6 ton/A, respectively, in the summer planting. Octoking variety had the greatest marketable yield in both plantings. The marketable yield of two of seven entries listed in Table 14 was different following planting in May and June.

2. Head and Core Traits. See Tables 12 and 13 for more information. Head weight, density and size tended to be greater in the June- versus May-planting. However, the average percent of the head volume found in the core was greater in the spring planting. Head weight of five of seven entries was different following planting in May and June (Table 14).

What Were The Best Performers?

Based on an analysis of objective and subjective information from the studies, the following varieties performed the best overall:

Fresh market/slaw -- Bronco, Rotunda, Thomas. These varieties ranked above average for yield and head traits and had a low incidence and/or severity of tip burn and damage due to black rot or thrips.

Sauerkraut -- HMX 0221, HMX 0222. These varieties ranked above average for yield and head traits and had a low-moderate incidence and/or severity of tip burn and damage due to black rot or thrips.

The varieties listed above were identified using the ranking system for yield, head weight and density, tipburn, black rot, and thrips described in the Project Details section of this report. Rank-sums for individual varieties were compared to the average rank-sum for yield and head weight and density. Information on the incidence and severity of tip burn and damage due to black rot and thrips was also evaluated. Varieties not listed above ranked below average for yield-head weight-head density and/or showed a high incidence and/or severity of quality defects (tip burn, black rot, thrips) in either the spring or summer planting.

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Project Details

Materials and Methods

See Table 1 for a list of the genotypes examined in the fresh market/slaw and kraut studies. See Table 2 for a summary of seasonal temperature and rainfall for the experimental site.

Transplant Production. Entries were solicited from cooperating seed companies in winter 2001-2002. Transplants were seeded in spring, allowed to develop 2-4 true leaves in the greenhouse, and hardened-off before planting into the field.

Plot Establishment. A randomized complete block design was used in each study. Each study contained four replications per entry per planting and two planting dates (May 28 and June 25). The fresh market/slaw study included fifteen genotypes and the kraut study included seven genotypes. Two-row plots were established with a Holland finger transplanter. Each row was 15 ft. long with 30 in. between rows and 11 in. (fresh market/slaw) and 18 in. (kraut) between transplants. A 150 lb. of 18-46-0 fertilizer was used to supply N and P_2O_5, 350 lb. of 0-0-60 fertilizer was used to supply K_2O, and 125 lb. of 45-0-0 fertilizer was broadcast to supply additional N on May 5, 2002 and later incorporated before planting. A nutrient starter solution (0.7 qt. 10-34-0/50 gal. water) was delivered next to the transplants.

Plot Maintenance. Dead transplants were replaced (if possible) within one week of initial planting. Standard pest management strategies based on scouting, thresholds, and applications of labeled pesticides were employed. Overhead irrigation (1.5 in.) was applied to both studies on July 15, 2002.

Data Collection (at Harvest). Harvest readiness for individual entries was estimated from published maturity information and visual examination of the four plots per entry. At maturity, all heads were collected from within the center 10 ft. of both rows in each plot. Heads were scored as marketable or unmarketable (too small, split, rotten, or containing evidence of blackrot or tipburn) and weighed as a group. Five marketable heads were then selected at random from the harvested group for further evaluation. Five outer leaves were removed from each head before they were re-weighed individually. Heads were then cut in half longitudinally and the core length and base width as well as the head polar and equatorial diameters of each head were recorded. Half of the head was then cut longitudinally a second time with a quarter head weighed, dried, and re-weighed for percent dry weight calculation.

Statistical Analysis. Head density was estimated through calculation using head weight and average diameter values. Likewise, the percent of the head volume contained in the core was estimated through calculation using head average diameter and core length and base width. Replicate averages were calculated and used in means analysis. Main effects and interactions of planting date, entry, and replicate were analyzed with fully specified model statements in SAS (alpha = 0.05). Fisher's Least Significant Difference test (alpha = 0.05) was used to analyze the effect of planting date, replicate and genotype.

Results

Both Studies. The planting date-x-genotype interaction was significant (alpha = 0.05) for the majority of head and core traits (Tables 3, 9). Core volume tended to be slightly less than 1% of head volume and less in June than May-planted crops (Tables 4, 10). Planting on May 28 versus June 25 tended to result in smaller and lighter heads with larger cores.

Fresh Market/Slaw Study. Data are contained in Tables 3-8. Marketable yield was greater in June- versus May-planted crops (Table 4). Marketable yield in the May planting ranged from 7.7 ton/A to 24.6 ton/A and from 14.2 ton/A to 33.3 ton/A in the June planting (Table 5). Average head weight ranged from 1130 g (2.5 lb) to 1983 g (4.4 lb) in the May planting and from 1556 g (3.4 lb) to 2660 g (5.9 lb) in the June planting (Table 6, 7). Average head density ranged from 0.670 g/cm^3 to 0.953 g/cm^3 in the May planting and from 0.592 g/cm^3 to 0.900 g/cm^3 in the June planting (Table 6, 7). Marketable yield of eleven of fifteen entries listed in Table 8 was statistically similar following planting in May and June. And, among all genotypes, head size and weight were more frequently impacted than head density (Table 8). In two entries, only one of the ten traits studied were impacted by planting date while in nine entries, 5-7 of the ten traits were effected by planting date (Table 8).

Kraut Study. Data are contained in Tables 9-14. Marketable yield in the May planting ranged from 15.7 ton/A to 26.7 ton/A (Table 11). Marketable yield in the June planting ranged from 26.5 ton/A to 41.0 ton/A (Table 11). Average head weight ranged from 1760 g (3.9 lb) to 2485 g (5.5 lb) in the May planting and from 2193 g (4.8 lb) to 3790 g (8.3 lb) in the June planting (Table 12, 13). Average head density ranged from 0.740 g/cm^3 to 0.857 g/cm^3 in the May planting and from 0.797 g/cm^3 to 0.897 g/cm^3 in the June planting (Table 12, 13). Marketable yield for five of seven entries was similar after planting in May- versus June planting and head density and core base width were similarly unaffected by planting date in six entries and seven entries, respectively (Table 14). In four entries, at least five of the ten traits were affected by planting date (Table 14).

Ranking the Varieties.

Varieties were ranked from high-low for total and marketable yield and average head weight and density following spring and summer planting in 2002. Then, the rankings for each variety were added for a total score. Like a golf score, the lower the value, the better the rank. Rankings were based on information contained in tables found later in this report. Obviously, cabbage varieties should be chosen based on a number of factors, including the ones used to rank the varieties as described above. Depending on their market, growers and processors also need to consider maturity, appearance, flavor, resistance to diseases and insects, and other factors in selecting varieties. Observations on a number of these factors from the evaluations are provided below.

Conclusions

The following varieties had the best (i.e., lowest) total rank-sum score for marketable yield, average head weight, and head density (spring, summer data combined):

Fresh market/slaw:	Bravo, Matsumo, Golden Dynasty, GZG 239
Sauerkraut:	Octoking, HMX 0222, Oriental Supercross

Fresh Market/Slaw-type Evaluation

Varieties showing no symptoms of black rot:

Spring planting: Artost, ATX-151, BC99042, Blue Lagoon, Red T-690
Summer planting: Artost, ATX-151, BC99042

Varieties showing a low incidence and/or severity of black rot:

Spring planting: Bravo, Bronco, Charmed Dynasty, Golden Dynasty, HMX 0228, Rotunda, Savoy, Thomas
Summer planting: Blue Lagoon, Bronco, Charmed Dynasty, Golden Dynasty, GZG 239, Rotunda, Savoy, Thomas

Varieties showing a high incidence and/or severity of black rot:

Spring planting: GZG 239, Matsumo
Summer planting: Bravo, HMX 0228, Matsumo

Incidence and/or severity of tip burn:

Spring planting: low (ATX-151), high (Savoy)
Summer planting: none

Varieties showing a low incidence and/or severity of damage due to thrips:

Spring planting: ATX-151, BC99042, Blue Lagoon, Matsumo, Savoy, Thomas
Summer planting: Bronco, Charmed Dynasty, Golden Dynasty, GZG 239

Varieties showing a high incidence and/or severity of damage due to thrips:

Spring planting: Charmed Dynasty, Golden Dynasty, GZG 239
Summer planting: ATX-151, Savoy

Sauerkraut-type Evaluation

Varieties showing no symptoms of black rot:

Spring planting: Hinova, HMX 0224
Summer planting: none

Varieties showing a low incidence and/or severity of black rot:

Spring planting: Geronimo, HMX 0221, HMX 0222, Oriental Supercross, Octoking
Summer planting: Hinova, HMX 0221, HMX 0222, HMX 0224, Octoking

Varieties showing a high incidence and/or severity of black rot:
Spring planting: none
Summer planting: Geronimo, Oriental Supercross

Incidence and/or severity of tip burn:
Spring planting: none
Summer planting: none

Varieties showing a low incidence and/or severity of damage due to thrips:
Spring planting: HMX 0222, HMX 0224, Oriental Supercross
Summer planting: Hinova, HMX 0221, HMX 0224

Varieties showing a high incidence and/or severity of damage due to thrips:
Spring planting: Geronimo, Hinova, HMX 0221, Octoking
Summer planting: Geronimo, Octoking

Table 1. Number of days to harvest (DTH) for twenty-two genotypes of fresh market/slaw-and kraut-type cabbage planted on May 28 and June 25, 2002 at the OSU Vegetable Crops Research Branch in Fremont, OH.

Study	Entry Name	Entry #	Company	May 28 DTH	June 25 DTH
Fresh Market/Slaw					
	Artost	1	Bejo	69	84
	ATX-151	2	American Takii	62	63
	BC99042	3	Reed's	99	100
	Blue Lagoon	4	Stokes	70	84
	Bravo	5	Harris Moran	90	100
	Bronco	6	Bejo	90	100
	Charmed Dynasty	7	Seminis	70	84
	Golden Dynasty	8	Seminis	70	93
	GZG 239	9	Rijk Zwaan	112	107
	Savoy	10	Stokes	99	93
	HMX 0228	11	Harris Moran	83	93
	Matsumo	12	Bejo	90	93
	Rotunda	13	Bejo	90	93
	Red T-690	14	American Takii	83	79
	Thomas	15	Bejo	83	107
Kraut					
	Geronimo	1	Bejo	91	107
	Hinova	2	Bejo	112	107
	HMX 0221	3	Harris Moran	107	107
	HMX 0222	4	Harris Moran	107	113
	HMX 0224	5	Harris Moran	107	107
	Oriental Supercross	6	Tokita	91	93
	Octoking	7	Vilmorin	91	100

Table 2. Climatic data for fresh market and kraut cabbage studies planted at the OSU Vegetable Crops Research Branch in Fremont, Ohio in 2002.

Fresh Market and Kraut Studies	---- Avg. temp. (F) ----		---------- Precipitation (in.) ----------		
	High	Low	Actual	Normal	-/+ Normal
Planting 1 (May 28)					
May 28 - June 21 (25 days)	80.4	56.4	2.41	3.33	-0.92
June 22 - Aug. 10 (50 days)	87.6	63.2	5.10	6.02	-0.92
Aug. 11 - Sept. 4 (25 days)	84.1	60.2	3.38	2.67	0.71
Total			10.89	12.02	-1.13
Planting 2 (June 25)					
June 25 - July 19 (25 days)	88.2	63.8	1.14	3.26	-2.12
July 20 - Sept. 7 (50 days)	87.6	60.5	6.48	5.48	1.00
Sept. 8 - Oct. 2 (25 days)	84.1	52.1	3.67	2.40	1.27
Total			11.29	11.14	0.15

Fresh Market/ Slaw-Type Study

Table 3. Analysis of variance results for an experiment studying the impact of planting date and genotype on fresh market/slaw-type cabbage yield and head traits in Ohio in 2002.

			Head				Core			
	Yield (ton/A)				diameter					
Source	total	marketable	weight (g)	density (g/cm^3)	polar (cm)	equatorial (cm)	length (cm)	base width (cm)	percent of head volume	percent dry weight
	Pr > F									
Planting Date (PD)	<0.0001	<0.0001	<0.0001	0.0274	<0.0001	<0.0001	<0.0001	0.0858	<0.0001	0.0140
Genotype (G)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
PD x G	0.2504	0.4186	0.0393	0.0032	0.0002	0.2453	0.0081	0.0310	0.0987	0.0001

Table 4. Influence of planting date on yield and head traits for twenty-two genotypes of fresh market/slaw-type cabbage planted on May 28 and June 25, 2002 in Ohio.

			Head				Core			
	Yield (ton/A)				diameter					
Planting Date	total	marketable	weight (g)	density (g/cm^3)	polar (cm)	equatorial (cm)	length (cm)	base width (cm)	percent of head volume	percent dry weight
5/28/02 (N=60)	25.1 b	17.5 b	1547 b	0.80 a	15.2 b	15.6 b	6.0 b	3.3 a	0.90 a	6.3 a
6/25/02 (N=59)	31.3 a	24.6 a	2053 a	0.78 a	16.9 a	17.2 a	6.7 a	3.3 a	0.71 b	6.4 a
LSD $_{(0.05)}$	2.00	2.76	73.8	0.015	0.23	0.26	0.22	0.07	0.354	0.17

Table 5. Average yield of fifteen genotypes of fresh market/slaw-type cabbage planted on May 28 and June 25, 2002 at the OSU Vegetable Crops Research Branch in Fremont, OH.

		Planting Date (2002)			
		May 28		June 25	
Entry		Yield (ton/A)			
Name	#	total	marketable	total	marketable
Artost	1	25.4	23.0	31.6	27.1
ATX-151	2	19.4	15.6	25.6	19.9
BC99042	3	24.8	11.2	28.0	23.6
Blue Lagoon	4	17.2	7.7	25.0	18.0
Bravo	5	29.4	22.9	33.3	27.2
Bronco	6	24.7	12.6	34.3	28.3
Charmed Dynasty	7	18.4	9.0	28.4	14.2
Golden Dynasty	8	25.7	23.1	41.7	25.7
GZG 239	9	32.0	18.6	37.1	33.3
Savoy	10	25.8	16.1	25.6	23.7
HMX 0228	11	27.8	22.8	30.7	22.2
Matsumo	12	31.3	24.6	38.3	29.3
Rotunda	13	28.8	22.9	32.6	29.9
Red T-690	14	23.0	15.7	22.5	15.0
Thomas	15	23.7	17.0	35.1	32.4
CV		19.7	40.0	19.2	33.2
Pr > F		**	**	**	**
$LSD_{(0.05)}$		7.06	9.97	8.58	11.64

** denotes significance at alpha = 0.05.

Table 6. Head and core traits for fifteen genotypes of fresh market/slaw-type cabbage planted on May 28, 2002 at the OSU Vegetable Crops Research Branch in Fremont, OH.

		Head					Core			
				diameter		height/		base	percent	percent
Entry		weight	density	polar	equatorial	width	length	width	of head	dry
Name	#	(g)	(g/cm^3)	(cm)	(cm)	ratio	(cm)	(cm)	volume	weight
Artost	1	1348	0.825	14.5	14.6	0.99	5.2	3.1	0.78	5.1
ATX-151	2	1188	0.670	15.6	14.4	1.09	4.8	3.0	0.63	-----
BC99042	3	1625	0.798	16.0	15.4	1.04	5.8	3.1	0.73	7.2
Blue Lagoon	4	1179	0.808	14.2	13.9	1.02	5.4	3.1	0.94	5.5
Bravo	5	1825	0.834	15.2	16.9	0.90	6.5	3.5	0.94	7.4
Bronco	6	1678	0.902	14.8	15.7	0.94	5.6	4.0	1.24	7.0
Charmed Dynasty	7	1130	0.764	15.0	13.3	1.13	5.1	3.7	1.21	6.5
Golden Dynasty	8	1638	0.767	15.9	16.0	1.00	5.9	3.3	0.81	4.9
GZG 239	9	1983	0.727	18.0	16.5	1.09	6.6	3.8	0.91	8.0
Savoy	10	1375	0.693	14.0	17.1	0.83	7.1	3.1	0.90	7.3
HMX 0228	11	1753	0.953	15.1	15.7	1.00	6.3	3.1	1.10	4.9
Matsumo	12	1790	0.904	14.0	17.2	0.82	4.8	3.4	0.79	5.4
Rotunda	13	1733	0.750	16.1	16.6	0.97	7.5	3.2	0.87	6.9
Red T-690	14	1403	0.899	14.8	14.8	0.94	5.8	3.0	0.89	5.7
Thomas	15	1563	0.777	15.5	15.5	1.02	7.3	3.5	1.16	6.4
CV		12.5	5.5	4.5	4.2	3.8	10.0	5.7	11.5	8.7
Pr > F		***	***	***	***	***	***	***	***	***
LSD $_{(0.05)}$		275.1	0.6270	0.98	0.93	0.054	0.85	0.27	0.148	0.80

*** denotes significance at alpha = 0.01.

Table 7. Head and core traits for fifteen genotypes of fresh market/slaw-type cabbage planted on June 25, 2002 at the OSU Vegetable Crops Research Branch in Fremont, OH.

Entry		Head					Core			
				diameter		height/		base	percent	percent
Name	#	weight (g)	density (g/cm^3)	polar (cm)	equatorial (cm)	width ratio	length (cm)	width (cm)	of head volume	dry weight
Artost	1	1953	0.756	17.0	16.8	1.02	6.0	3.3	0.66	5.8
ATX-151	2	1635	0.592	17.9	16.8	1.07	5.5	3.1	0.51	4.9
BC99042	3	1863	0.855	16.1	16.0	1.01	5.7	3.3	0.73	7.4
Blue Lagoon	4	1783	0.814	16.3	15.8	1.03	6.5	3.3	0.84	6.2
Bravo	5	2660	0.859	17.2	19.0	0.91	6.7	3.5	0.68	6.8
Bronco	6	2185	0.840	17.3	16.7	1.04	5.8	3.9	0.88	7.4
Charmed Dynasty	7	1815	0.705	18.3	15.6	1.18	7.1	3.6	0.96	6.1
Golden Dynasty	8	2285	0.772	17.8	17.9	0.99	7.7	3.0	0.61	5.3
GZG 239	9	2293	0.743	18.5	17.6	1.05	6.6	3.5	0.69	7.6
Savoy	10	1556	0.655	14.7	18.4	0.80	8.4	2.7	0.69	6.9
HMX 0228	11	2162	0.808	16.9	17.5	0.97	7.5	2.9	0.61	5.9
Matsumo	12	2440	0.900	15.5	19.0	0.82	5.4	3.4	0.60	5.5
Rotunda	13	2281	0.798	17.3	17.9	0.97	7.9	2.9	0.62	6.3
Red T-690	14	1643	0.830	15.3	15.8	0.97	6.0	3.0	0.70	6.6
Thomas	15	2300	0.823	17.6	17.3	1.02	7.5	3.5	0.88	7.6
CV		10.5	5.0	3.5	4.2	3.8	8.8	5.7	11.9	5.2
Pr > F		***	***	***	***	***	***	***	***	***
$LSD_{(0.05)}$		311.1	0.0568	0.86	1.04	0.054	1.04	0.27	0.123	0.48

*** denotes significance at alpha = 0.01.

Table 8. Influence of planting date on yield and head traits of fifteen genotypes of fresh market/slaw-type cabbage planted on May 28 and June 25, 2002 at the OSU Vegetable Crops Research Branch in Fremont, OH. An asterisk (*) indicates that planting date had a significant effect on the variables listed within the genotype according to the Fisher Least Significant Difference test (alpha = 0.05). Analysis based on the mean of four replicates per planting.

Entry		Yield (ton/A)		Head				Core				# of 10 traits
						diameter (cm)						
Name	#	total	marketable	weight (kg)	density (g/cm3)	polar	equatorial	length (cm)	base width (cm)	% of head volume	percent dry weight	effected by planting date
Artost	1					*						1
ATX-151	2	*		*	*	*	*					5
BC99042	3		*									1
Blue Lagoon	4	*		*		*	*	*				5
Bravo	5			*		*	*			*	*	5
Bronco	6		*	*		*				*		4
Charmed Dynasty	7	*		*	*	*	*	*		*		7
Golden Dynasty	8	*		*		*	*	*			*	6
GZG 239	9		*							*		2
Savoy	10								*	*		2
HMX 0228	11			*	*	*	*	*		*	*	7
Matsumo	12			*		*	*	*				4
Rotunda	13			*		*	*		*	*	*	6
Red T-690	14			*	*	*	*			*	*	6
Thomas	15	*	*	*	*	*	*					6
number comparisons of 15 significant		5	4	11	5	12	10	5	2	8	5	

Kraut-Type Study

Table 9. Analysis of variance results for an experiment studying the impact of planting date and genotype on kraut-type cabbage yield and head traits in Ohio in 2002.

			Head				Core			
					diameter			base	percent	percent
	Yield (ton/A)		weight	density	polar	equatorial	length	width	of head	dry
Source	total	marketable	(g)	(g/cm^3)	(cm)	(cm)	(cm)	(cm)	volume	weight
	Pr > F									
Planting Date (PD)	<0.0001	<0.0001	<0.0001	0.0170	<0.0001	<0.0001	0.0115	0.8955	<0.0001	0.0186
Genotype (G)	0.0002	0.0045	<0.0001	0.0097	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
PD x G	0.6000	0.8018	0.1063	0.0223	0.0050	0.3481	0.0011	0.1952	0.0772	0.0145

Table 10. Influence of planting date on yield and head traits for seven genotypes of kraut-type cabbage planted on May 28 and June 25, 2002 in Ohio.

			Head				Core			
					diameter			base	percent	percent
Planting	Yield (ton/A)		weight	density	polar	equatorial	length	width	of head	dry
Date	total	marketable	(g)	(g/cm^3)	(cm)	(cm)	(cm)	(cm)	volume	weight
5/28/02 (N=28)	27.2 b	21.4 b	2091 b	0.82 b	16.4 b	17.2 b	6.1 b	3.6 a	0.828 a	7.5 a
6/25/02 (N=28)	36.4 a	31.6 a	2899 a	0.85 a	17.6 a	19.5 a	6.4 a	3.6 a	0.661 b	7.2 b
LSD $_{(0.05)}$	3.05	3.77	211.5	0.020	0.40	0.70	0.28	0.10	0.0502	0.28

Table 11. Average yield of seven genotypes of kraut-type cabbage planted on May 28 and June 25, 2002 at the OSU Vegetable Crops Research Branch in Fremont, OH.

		Planting Date (2002)			
		May 28		June 25	
Entry		Yield (ton/A)			
Name	#	total	marketable	total	marketable
Geronimo	1	27.4	24.4	41.6	28.5
Hinova	2	22.6	15.7	30.0	28.2
HMX 0221	3	24.3	16.9	31.0	28.7
HMX 0222	4	30.3	25.5	35.9	32.5
HMX 0224	5	23.7	15.9	30.2	26.5
Oriental Supercross	6	30.4	24.8	42.3	35.9
Octoking	7	31.6	26.7	43.1	41.0
CV		19.8	39.2	16.3	19.4
Pr > F		NS	NS	**	**
$LSD_{(0.05)}$		7.91	11.40	8.71	9.01

NS, ** denote not significant and significant at alpha = 0.05, respectively.

Table 12. Head and core traits of seven genotypes of kraut-type cabbage planted on May 28, 2002 at the OSU Vegetable Crops Research Branch in Fremont, OH.

		Head					Core			
				diameter		height/		base	percent	percent
Entry		weight	density	polar	equatorial	width	length	width	of head	dry
Name	#	(g)	(g/cm^3)	(cm)	(cm)	ratio	(cm)	(cm)	volume	weight
Geronimo	1	2165	0.848	16.0	17.7	0.91	5.8	3.5	0.74	6.3
Hinova	2	1760	0.842	16.3	15.3	1.08	7.2	3.2	0.91	9.1
HMX 0221	3	1865	0.835	16.8	15.6	1.08	6.1	3.8	1.02	8.8
HMX 0222	4	2250	0.816	17.6	17.2	1.02	5.5	3.9	0.81	8.0
HMX 0224	5	1850	0.836	16.6	15.6	1.06	6.0	3.9	1.07	8.3
Oriental Supercross	6	2485	0.857	12.9	22.2	0.58	6.3	3.5	0.71	5.7
Octoking	7	2263	0.740	18.7	17.0	1.11	5.7	3.2	0.52	6.4
CV		16.2	4.2	4.1	6.7	4.2	7.9	4.1	10.2	8.7
Pr > F		NS	**	***	***	***	**	***	***	***
LSD $_{(0.05)}$		501.6	0.0511	1.00	1.73	0.061	0.71	0.22	0.126	0.80

Table 13. Head and core traits of seven genotypes of kraut-type cabbage planted on June 25, 2002 at the OSU Vegetable Crops Research Branch in Fremont, OH.

		Head					Core			
				diameter		height/		base	percent	percent
Entry		weight	density	polar	equatorial	width	length	width	of head	dry
Name	#	(g)	(g/cm^3)	(cm)	(cm)	ratio	(cm)	(cm)	volume	weight
Geronimo	1	2973	0.865	18.0	19.4	0.93	6.3	3.5	0.61	7.2
Hinova	2	2193	0.875	16.9	16.8	1.01	6.5	3.1	0.67	8.3
HMX 0221	3	2618	0.880	17.6	18.1	0.98	6.6	4.0	0.94	7.7
HMX 0222	4	2678	0.897	17.3	18.2	0.96	5.0	4.1	0.74	8.0
HMX 0224	5	2438	0.839	17.4	17.6	1.00	6.0	3.6	0.75	7.7
Oriental Supercross	6	3790	0.797	15.7	25.9	0.61	7.6	3.4	0.50	5.3
Octoking	7	3605	0.828	20.4	20.3	1.01	6.8	3.2	0.42	6.4
CV		12.5	5.6	3.7	5.5	4.7	8.0	6.1	14.1	6.8
Pr > F		***	NS	***	***	***	***	***	***	***
LSD $_{(0.05)}$		538.0	0.0715	0.97	1.60	0.064	0.77	0.32	0.139	0.73

NS, **, *** denote not significant and significant at alpha = 0.05 and 0.01, respectively.

Table 14. Influence of planting date on yield and head traits of seven genotypes of kraut-type cabbage planted on May 28 and June 25, 2002 at the OSU Vegetable Crops Research Branch in Fremont, OH. An asterisk (*) indicates that planting date had a significant effect on the variables listed within the genotype according to the Fisher Least Significant Difference test (alpha = 0.05). Analysis based on the mean of four replicates per planting.

Entry		Yield (ton/A)		Head				Core				# of 10 traits
Name	#	total	marketable	weight (kg)	density (g/cm3)	diameter (cm) polar	diameter (cm) equatorial	length (cm)	base width (cm)	% of head volume	percent dry weight	effected by planting date
Geronimo	1	*		*		*						3
Hinova	2	*	*	*			*	*		*	*	7
HMX 0221	3	*		*			*	*			*	5
HMX 0222	4											0
HMX 0224	5									*		1
Oriental Supercross	6			*		*	*	*		*		5
Octoking	7	*	*	*	*	*	*					6
number comparisons of 7 significant		4	2	5	1	3	4	3	0	3	2	