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'HARLEY BLACKWELL' A NEW CHIP STOCK POTATO VARIETY FOR FLORIDA

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Abstract. **'Harley Blackwell' is an internal heat necrosis (IHN) resistant chip stock potato (*Solanum tuberosum* L.) variety recently released by the USDA. It was tested at the University of Florida's Plant Science Research and Education Unit during eight seasons from 1999 to 2005 originally under the selection number B0564-8. Production practices followed standard IFAS BMP recommendations. 'Harley Blackwell' tubers are consistently described as having a tan to buff skin color with a netted texture. Tuber flesh color is white to cream. Tuber shape is rated as 'mostly round' to 'round to oblong' with an eye depth of intermediate to shallow. External tuber appearance is noted as fair to good. 'Harley Blackwell' plant architecture is 'spreading to upright' with a good canopy. Early plant vigor (size) is similar to 'Atlantic', as well as, early plant maturity rating. Total and marketable yields of 'Harley Blackwell' averaged approximately 10% less than 'Atlantic' over all seasons evaluated. In addition, specific gravity averaged approximately 0.005 lower than that of 'Atlantic' although still at an acceptable level for Florida chip potatoes. 'Harley Blackwell' tubers exhibited on average no internal heat necrosis compared to 'Atlantic' at up to 0.68%.**

Potato is an important crop for Florida growers. Over a three year period from 2003-2005, the annual industry value was $114 million (NASS-USDA, 2006). The crop was planted on average on over 32,000 acres across the state in each year. Florida farmers produce a winter and spring potato crop filling this niche in the marketplace for well over a century. The current standard chipping potato variety for Florida production is 'Atlantic'. 'Atlantic' was released by the USDA in 1978 (Shumaker et al., 1977). The variety has good yield potential but tubers are susceptible to the physiological disorder, internal heat necrosis (Henninger et al., 1979). Internal heat necrosis causes the tuber tissue to turn brown resulting in unmarketable tubers under severe circumstances. 'Harley Blackwell' is reported to be resistant to internal heat necrosis.

The objective of this project was to evaluate the production and quality of 'Harley Blackwell' compared to 'Atlantic'. Yield and the incidence were recorded over six seasons of production at the university of Florida potato research farm.

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Materials and Methods

Trials were conducted at the Plant Science Research and Education Unit-Hastings Farm in Hastings, Fla. The soil at the field site is classified as Ellzey fine sand (sandy, siliceous, hyperthermic Arenic Ochraqualf; sand 90-95%, <2.5% clay, <5% silt).

Potatoes in the Tri-County Agricultural Area around Hastings, Florida are grown in 16-row, 60 ft wide beds. Rows are raised with a 40 inch between-row spacing (center to center). A clay layer is present 3 to 4.5 ft below the top of the row. Plots were irrigated with seepage irrigation. Perched water table depth is managed at 19 to 25 inches below the top of the row.

Potatoes were planted following a sorghum/sudan grass summer cover crop (*Sorghum bicolor* (L.) Moench × *S. arundinaceum* (Desv.) Stapf var. SX17, Dekalb). Cover crop was incorporated into the potato beds in Sept. prior to the potato season.

Potato seed (var. 'Harley Blackwell') was obtained from the USDA potato breeding program in Beltsville, Md. or the Maine Farmers Exchange (MFX, Presque Isle, Maine). 'Harley Blackwell' was classified before release as B0564-8. Seed tubers were produced on the USDA potato research farm in Presque Isle, ME the season before planting in Florida or on contract growers' farms in Maine. Potato seed tubers were hand cut (approx. 2.5 oz) and hand planted on 8-inch in-row spacing. Dates of planting for the six years reported were 11 Feb. 1999; 15-16 Feb. 2000; 28 Jan. 2002; 27 Jan. 2003; 27 Jan. 2004, and 25 Jan. 2005. No 'Harley Blackwell' was planted at the research farm in 2001. Potato plots were replicated four times in each year as part of either the round white-fresh market trial or the chip trial at the research site. Means of the four replicates are presented in Tables 1 and 2.

Potato seed pieces were dusted with fludioxinil and mancozeb (Maxim MZ) prior to planting. Aldicarb (Temik 15G, 20 lb product/A) and azoxystrobin (Quadris, 5.0 oz product/A; in years 2002, 2003, 2004, and 2005) were applied in-furrow at planting following label requirements. A combination of metolachlor (Dual Magnum, 1.0 pint product/A) and/or metribuzin (Sencor DF, 1.0 lb product/A) was broadcast at hilling for weed control following extension and label recommendations for a sandy soil. Fungicides were applied on a schedule during the season based on extension recommendations (Hutchinson et al., 2005).

Prior to planting, 715 lb of 14-6-12 (N-P-K) was incorporated in the row. When plants were six to ten inches tall, another 715 lb of 14-0-12 (N-P-K) was applied to row shoulders. In 2003 and 2004, an extra 30 lb N/A was applied at side dress because of heavy rainfall between planting and side dress applications.

Potatoes in plots were harvested with a single-row commercial potato harvester and graded on 1 Jun. 1999; 1 Jun. 2000; 9 May 2002; 11 May 2003; 10 May 2004; and 10 May 2005. Culls were removed and remaining potatoes were separated into either five or six size classes: Class (wt)/(total yield (wt) – culls (wt)) depending on the year and weighed (C = 0.5 to 1.5, B = 1.5 to 1 7/8, A1 = 1 7/8 to 2.5, A2 = 2.5 to 3.25, A3 = 3.25 to 4, A4 >4 inches). Culled tubers were sunburned, rotten, growth cracked, and/or misshaped.

Table 1. Summary of total yield, marketable yield, percentage of yield by grade, size distribution, percent culls, and specific gravity of 'Harley Blackwell', a chipping potato variety.

Year	Total yield (cwt/A)	Marketable yield[z] (cwt/A)	Marketable yield[z] % of 'Atlantic'[y]	Size distribution by size class (%)[x] C	B	A1	A2	A3	A4	Size class range (%) A1-A3	A2-A3	Specific gravity[w]
1999	384	342	97	—	6	79	10	0	0	89	10	1.065
2000	290	254	74*	—	6	41	33	20	1	94	53	1.073
2002	256	235	83	—	7	55	32	7	0	94	39	1.076
2003	429	372	89	7	5	38	33	18	0	88	50	1.074
2004	380	310	94	10	8	50	27	6	0	82	32	1.087
2005	339	290	102	1	13	69	15	2	0	86	17	1.083
Mean	346	301	90	6	8	55	25	9	0	89	34	1.076

[z]Marketable yield: Sum of size classes A1 to A3.
[y]"*" marks a significant difference between 'Harley Blackwell' and 'Atlantic' marketable yield in the variety report ($p \leq 0.05$).
[x]C = 0.5 to 1.5, B = 1.5 to 1 7/8, A1 = 1 7/8 to 2.5, A2 = 2.5 to 3.25, A3 = 3.25 to 4, A4 > 4 inches; Class (wt)/(Total Yield – culls).
[w]Tuber specific gravity for 'Atlantic' (standard variety) in the same trials from 1999 to 2005 averaged 1.081.

Specific gravity was measured on a random tuber sample from each plot using the weight-in-air/weight-in-water method. Specific gravity samples were combined for each replication and tubers were rated for external tuber characteristics by one to three raters depending on the year. Rating scores were averaged over the number of raters following the guidelines in Table 3. Internal tuber characteristics were rated on a 20-tuber sample from each of four plots. Tubers were cut into quarters and rated on the incidence of the disorder.

In 2002, 2003, and 2005, a 20 lb sample of potatoes was shipped on potato trucks in the area to either Wise Foods, Inc. (Kennesaw, Ga.) or Utz Quality Foods, Inc. (Hanover, Pa.). Potatoes were chipped, fried, and rated for internal appearance on the following scale: 1 = outstanding, no blemish or color variation; 2 = very good, minimal blemish or color variation; 3 = good, near minimal blemish/color variation; 4-marginal acceptance, borderline defects and/or color variation; and 5 = not acceptable, high defect level or color variation (Gould et al., 1995). Company personnel rated the fried samples and returned the data.

Results and Discussion

'Harley Blackwell' has good yield potential and a relatively high specific gravity compared to 'Atlantic', the standard variety (Table 1). Over six seasons of evaluation, 'Harley Blackwell' marketable yield was 10% lower than 'Atlantic' in the same trials. Approximately 34% of 'Harley Blackwell' tubers fell into the A2-A3 size class range. In the same trials, 'Atlantic' tubers averaged 52% of its tubers in this range (data not shown). The lower yield in 'Harley Blackwell' is partially explained by the smaller tubers at harvest.

'Harley Blackwell' is a white to cream fleshed, mostly round-shaped, chipping potato. It has a netted, tan to brown-colored skin with intermediate to shallow eye depth. 'Harley Blackwell' and 'Atlantic' are very similar in external and internal appearance (Table 2). Over all years tested, the percent culls for 'Harley Blackwell' were in an acceptable range. By approximately 100 d after planting, plant maturity at harvest was rated generally as "yellow and dying" on the plant maturity scale (Table 2). Plant maturity or season length is similar to 'Atlantic'. 'Harley Blackwell' potatoes averaged a 2.3 chip rating over the six production seasons. In the same trials, 'Atlantic' averaged a 3.7 chip color rating (data not shown).

Although total tuber yield and specific gravity of 'Harley Blackwell' are slightly lower than 'Atlantic', 'Harley Blackwell' is an internal heat necrosis resistant variety. In the six trials in this study, 'Harley Blackwell' tubers did not express internal heat necrosis. However, the percent of 'Atlantic' tubers with IHN was 0.7% (Table 2). From 1999 to 2005, 'Harley Blackwell' and 'Atlantic' were grown in 23 and 70 research and grower variety trials, respectively. On average, the percent of 'Harley Blackwell' and 'Atlantic' tubers exhibiting internal heat necrosis was 0 and 3% (data not shown). Although this

Table 2. Percent total culls, vine maturity at harvest, tuber external characteristics, and internal defects of 'Harley Blackwell', a chipping potato.

Year	Total culls (%)	Vine maturity[z]	Tuber external characteristics[y] IFC	SC	ST	TS	ED	APP	Tuber internal defects (%)[x] HH	BR	CRS	IHN
1999	5	—	—	8.0	5.0	2.0	4.0	6.0	0	0	0	0
2000	8	—	—	6.3	4.7	2.3	6.3	5.7	0	0	0	0
2002	2	1.5	1.5	6.5	5.8	2.0	6.5	7.0	0	0	0	0
2003	2	3.3	1.3	6.3	5.0	2.3	6.3	6.7	8	0	0	0
2004	1	3.5	1.3	6.7	5.0	2.0	7.3	7.0	0	0	0	0
2005	0	6.3	1.0	6.3	5.0	2.0	6.5	6.7	0	0	0	0

[z]Vine maturity was rated at harvest using the following ratings 1.0 (completely dead), 3.0 (yellow and dying), 5.0 (moderately senesced), 7.0 (starting to senesce), 9.0 (green and vigorous).
[y]See rating system outlined in Florida Rating Code Table (Table 3).
[x]HH = hollow heart, BR = brown rot, CRS = corky ring spot, IHN = internal heat necrosis. Percent HH and IHN averaged 2.6 and 0.7 in 'Atlantic' in the same trials.

Table 3. Rating codes for potato external tuber characteristics.

Rating code	Internal flesh color	Skin color	Skin texture	Tuber shape	Eye depth	Overall appearance
1	white	purple	partial russet	round	very deep	very poor
2	cream	red	heavy russet	mostly round	—	—
3	light yellow	pink	moderate russet	round to oblong	deep	poor
4	medium yellow	dark brown	light russet	mostly oblong	—	—
5	dark yellow	brown	netted	oblong	intermediate	fair
6	pink	tan	slightly netted	oblong to long	—	—
7	red	buff	moderate smooth	mostly long	shallow	good
8	blue	white	smooth	long	—	—
9	purple	cream	very smooth	cylindrical	very shallow	excellent

incidence may seem low, any incidence is bad as it adds to the defect restrictions allowed by processors.

'Harley Blackwell' is an acceptable chipping potato for Florida production. 'Atlantic' should be planted for early production when contract prices are generally higher and maximal yield is important. 'Harley Blackwell' should be planted for late contracts when quality can become an issue with 'Atlantic'.

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