

‘Liberty’ Dry-fleshed Sweetpotato

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The sweetpotato [*Ipomoea batatas* (L.) Lam.] cultivar Liberty was jointly developed by the U.S. Department of Agriculture (USDA), Agricultural Research Service (ARS), and Clemson University, SC Agriculture and Forestry Research System (Bohac et al., 2003). This cultivar is a “dry-fleshed” type with attractive dark red-colored skin (periderm). Vine growth is vigorous with large chordate leaves that form a dense canopy. ‘Liberty’ is highly resistant to nematodes and it has a low level of resistance to soil insect pests and fusarium wilt. ‘Liberty’ makes a large number of uniform, well-shaped storage roots with a scarlet skin color, cream to light yellow flesh color, and good baking quality. ‘Liberty’ is a desirable cultivar for commercial growers that serve markets that prefer a dry, bland-flavored sweetpotato such as the boniato-type ‘Picadito’ grown primarily in Florida in the United States (Lamberts and Olson, 2010). The new cultivar is suitable for organic growers and home gardeners. Bedded ‘Liberty’ seed roots produce a large number of uniform sprouts that transplant well. This cultivar flowers and produces seeds profusely and makes an excellent polycross parent for the development of red-skinned, dry-fleshed cultivars with nematode resistance.

Origin

‘Liberty’ was developed using a recurrent mass selection breeding technique (Jones et al., 1986). This cultivar originated as a seedling of the maternal parent ‘White Regal’ (Bohac et al., 2001) from an open-pollinated polycross breeding block comprised of four randomized replications of 32 parental clones

in 1992. Parental clones in the block were selected for high levels of multiple pest resistance combined with many good horticultural traits. ‘White Regal’ was discovered as a stable somatic mutant from the cultivar Regal (W-152) in 1990 (Bohac et al., 2001). The maternal parent of ‘Regal’, and thus ‘White Regal’, was W-99, whose maternal parent was W-48 (Jones et al., 1985). ‘Liberty’ was designated first as 93-223 when it was tested as a first-year seedling in 1993. In 1997, this genotype was redesignated W-341 for further field testing, and it was released by USDA-ARS/Clemson University as ‘Liberty’ (Bohac et al., 2003).

Description

Leaves of ‘Liberty’ are medium green (Table 1), entire, and have a cordate shape that is acuminate apically (Fig. 1). Larger veins on the lower surface of the leaf blade are purple, especially the midvein where the dark purple color extends for a short distance onto the petiole. The petioles are entirely green after that. Most small to medium leaves have a narrow purple border, and late in the season, the leaf lamina of many small to medium leaves may be mixed with purple (Fig. 1). ‘Liberty’ has green-stemmed vines that are long and vigorous, and the canopy develops rapidly and shades the ground more effectively than ‘Beauregard’. Several years of observation in South Carolina have shown that bedded roots sprout rapidly in the spring, and the production of vine cuttings is sufficient for commercial production. ‘Liberty’ flowers well without grafting and its high seed production makes it a good parent for a sweetpotato breeding program. It has been included in the dry-flesh polycross breeding nursery at Charleston since 2000. The corolla of ‘Liberty’ is large and pale lavender with a deep purple throat (Fig. 1).

In South Carolina, the storage roots of ‘Liberty’ are mostly elliptical and uniformly shaped with a smooth, attractive red skin and cream-colored flesh (Fig. 1). The skin of ‘Liberty’ is dark red, and it has a significantly lower hue angle (h^*) (i.e., deeper red) than other red-skinned cultivars such as Charleston Scarlet (Jackson et al., 2010), ‘Regal’ (Jones et al., 1985), and ‘Ruddy’ (Bohac et al., 2002)

(Table 1). Color saturation chroma (C^*) of ‘Liberty’ skin is similar to ‘Ruddy’, and lightness (L^*) is similar to ‘Charleston Scarlet’ and ‘Picadito’ (Table 1). The flesh of ‘Liberty’ is an attractive cream to light yellow color that is similar to the flesh of ‘Sumor’ (Dukes et al., 1987) but containing more yellow (higher b^* value) than the bright white ‘Picadito’ (Table 1).

The baked roots of ‘Liberty’ are dry with a mild flavor. The dry matter content of ‘Liberty’ is $\approx 28\%$, which in our evaluations was significantly lower than the commercial boniato-type cultivar Picadito and the Chinese industrial-type cultivar Xushu-18 (Lu et al., 1989) but significantly higher than the commercial orange-fleshed, sweet types ‘Beauregard’ (Rolston et al., 1987), ‘Covington’ (Yencho and Pecota, 2007), ‘Evangeline’ (LaBonte et al., 2008), and ‘Ruddy’ (Tables 2–5). Although 28% dry matter is considered high compared with orange-fleshed types grown in the United States, dry matter contents often exceed 30% for common edible varieties grown in many parts of the world, including Africa, Asia, and the Caribbean (Jackson and Bohac, 2006a). Baked ‘Liberty’ roots are consistent in color, low in fiber, and moderately sweet in taste (Table 2). Whereas ‘Picadito’ roots appear grayish and chalky when baked, the baked roots of ‘Liberty’ are an attractive light yellow and do not oxidize quickly like ‘Picadito’ (Ryan-Bohac et al., 2006). ‘Liberty’ also makes excellent fries when cooked at 163 °C (325 °F) (Table 3).

Production

‘Liberty’ is a mid- to late-season cultivar in root maturity with roots ready to harvest about the same time as ‘Hernandez’ (≈ 120 d after transplanting) (LaBonte et al., 1992). ‘Liberty’ roots store well at 12 to 16 °C and maintain quality for up to 1 year in long-term storage. This is in contrast to ‘Picadito’, which has a tendency to soften and rot under long-term storage (Ryan-Bohac et al., 2006).

The yield of ‘Liberty’ is adequate for profitable commercial production. In 2 years of replicated testing in South Carolina, it yielded as well as ‘Beauregard’ and significantly more than ‘Picadito’ (Table 4). ‘Liberty’ also produces more attractively shaped roots graded as number ones than ‘Picadito’. As part of the insect evaluations for the Sweetpotato Collaborators Trials at Charleston, SC, ‘Liberty’ produced better than ‘Ruddy’ and ‘Charleston Scarlet’, but not as well as ‘Covington’ (Table 5). In replicated field plots at Homestead, FL, in 2000, ‘Liberty’ produced 24.4 t·ha⁻¹ (MT·ha⁻¹), whereas ‘Picadito’ produced 23.2 MT·ha⁻¹, and ‘Homestead’ (another local boniato variety) produced 22.1 MT·ha⁻¹. However, these yield means were not significantly different.

Disease Reactions

Resistance of ‘Liberty’ to fusarium wilt [*Fusarium oxysporum* f. sp. *batatas* (Wr.) Snyder & Hans] was determined by a greenhouse

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Table 1. Color coordinates of leaves and storage roots of 'Liberty' compared with seven standard sweetpotato cultivars from three field tests, Charleston, SC, 2007–2009.

Sweetpotato genotype	Color coordinates ^z				
	a* ^y	b* ^x	L* ^w	h* ^v	C* ^u
	<i>Storage root skin color^s</i>				
Liberty	21.1 b ^t	7.8 d	38.5 f	20.2 h	22.5 d
Charleston Scarlet	25.4 a	11.9 c	40.5 ef	25.1 g	28.2 b
Regal	22.1 b	12.6 c	41.5 e	30.1 f	25.5 c
Ruddy	18.7 c	12.9 c	44.5 d	34.5 e	22.9 d
Picadito	14.3 d	12.8 c	40.3 ef	42.7 d	19.3 e
Beauregard	15.7 d	23.2 b	55.7 c	55.9 c	28.0 b
SC1149-19	12.6 e	27.8 a	60.3 a	65.5 b	30.5 a
Sumor	8.5 f	26.4 a	57.8 b	72.2 a	27.7 b
	<i>Storage root flesh color^s</i>				
Liberty	-1.4 d	31.7 e	84.8 ab	92.7 b	31.8 d
Sumor	-2.4 d	28.9 f	86.0 a	94.8 a	29.0 e
Picadito	-1.1 d	20.4 g	84.4 b	92.9 b	20.4 f
SC1149-19	18.4 c	41.4 d	75.5 c	66.4 c	45.4 c
Regal	22.6 b	44.0 b	72.8 d	63.0 d	49.6 b
Ruddy	22.6 b	43.6 bc	70.7 e	62.6 d	49.2 b
Charleston Scarlet	22.7 b	41.7 cd	73.7 d	61.5 de	47.5 bc
Beauregard	28.5 a	49.9 a	68.8 f	60.3 e	57.5 a
	<i>Leaf color^r</i>				
Liberty	-15.3 c	22.9 a	40.4 a	122.8 e	28.4 a
Regal	-13.6 b	19.5 bc	37.1 bc	125.0 d	23.8 bc
Sumor	-14.5 c	20.4 b	38.6 ab	125.5 d	25.0 b
Ruddy	-13.3 b	18.4 bcd	36.8 bc	126.1 cd	22.7 cd
Beauregard	-12.8 ab	16.8 de	35.5 c	127.7 abc	21.1 de
Charleston Scarlet	-12.1 a	15.1 e	36.5 c	128.9 ab	19.3 e
Picadito	-12.2 a	14.8 e	33.5 d	129.6 a	19.2 e

^zMeasured with a Konica Minolta Chroma Meter (CR-400 with 8-mm aperture and 0° viewing angle) using the CIE 1976 L*a*b* and CIE L*C*h color spaces and data were recorded using Color Data Software CM-S100w SpectraMagic NX™ (Version 1.7) (Konica-Minolta, 2007).

^yRed–green axis.

^xYellow–blue axis.

^wLightness (black–white axis).

^vHue angle (calculated as $\tan^{-1} b^*/a^*$).

^uSaturation chroma [calculated as square root ($a^{*2} + b^{*2}$)].

^sMeans in the same column followed by a common letter are not significantly different ($P = 0.05$, Fisher's protected least significant difference) (SAS, 2009); non-significant F value in analysis of variance.

^rFor each genotype, three readings were taken from two roots each year (2007–2009).

^tTen leaves from field plots were measured for each genotype during Sept. 2009.

evaluation in 2008. For this test, four replicates of five terminal, field-grown vine cuttings of 'Liberty' and four standard sweetpotato cultivars were planted in a randomized complete block design into a steam-sterilized soil bench in a greenhouse. Before planting, each cutting was dipped for 1 min in an aqueous suspension of fusarium wilt adjusted to 1×10^6 propagules/mL. After 17 d, plants were rated on a scale of 0 to 5 (0 = no disease to 5 = all plants dead) (Jones et al., 1986).

Resistance of 'Liberty' to the southern root-knot nematode [*Meloidogyne incognita* (Kofoid & White) Chitwood] was determined in greenhouse evaluations in 2007 (six replications), 2008 (four replications), and 2009 (four replications). For these tests, five terminal, field-grown vine cuttings of 'Liberty' and four standard sweetpotato cultivars were planted in randomized complete block designs into steam-sterilized soil benches in a greenhouse. Each cutting was inoculated with ≈ 3000 freshly extracted *M. incognita* eggs (Race 3) at planting. After 57 d (2007), 50 d (2008), or 58 d (2009), roots were dug, washed, and evaluated for gall index and egg mass index. For gall index, plants were rated on scale of 1 to 5 (1 = no galling to 5 = greater than 80% of the root system galled). For egg mass index, plants also were rated on scale of 1 to 5 (1 = no egg masses to 5 = greater than 80% of the root system covered with egg masses) (Jones et al., 1986).

From these experiments, it was determined that 'Liberty' has a low level of resistance to fusarium wilt and a high level of resistance to the southern root-knot nematode (Table 6) (Thies and Jackson, 2009a, 2009b). 'Liberty' also has field resistance to the southern root-knot nematode, *M. incognita* (Ryan-Bohac et al., 2006). In field tests at Homestead, FL, in 2000 and 2001 (25-plant plots, six replications), 60% of the roots of 'Picadito' and 55% of 'Homestead' had visible damage symptoms from root-knot nematodes, whereas 'Liberty' had zero nematode-damaged roots.

Insect Response

In 10 years of field evaluations, 'Liberty' roots were significantly less damaged than the roots of the highly susceptible 'SC1149-19' and 'Beauregard' but significantly more damaged than the roots of three insect-resistant cultivars (Regal, Ruddy, and Sumor) and Picadito (Table 7). Methods of testing and evaluation were previously described (Jackson and Bohac 2006a; Jones et al., 1986). The moderate level of resistance in 'Liberty' was primarily the result of significantly less injury from the Wireworm-*Diabrotica-Systema* (WDS) complex (Cuthbert and Davis, 1971) compared with 'SC1149-19' and 'Beauregard'. In addition, the WDS severity index for 'Liberty' was not significantly different from 'Regal' or 'Picadito' (Table 7). At Charleston, the WDS complex typically includes the southern potato wireworm (*Conoderus falli* Lane), the tobacco wireworm (*Conoderus vespertinus* Fabricius), the banded cucumber beetle (*Diabrotica balteata* Le Conte), the spotted cucumber beetle

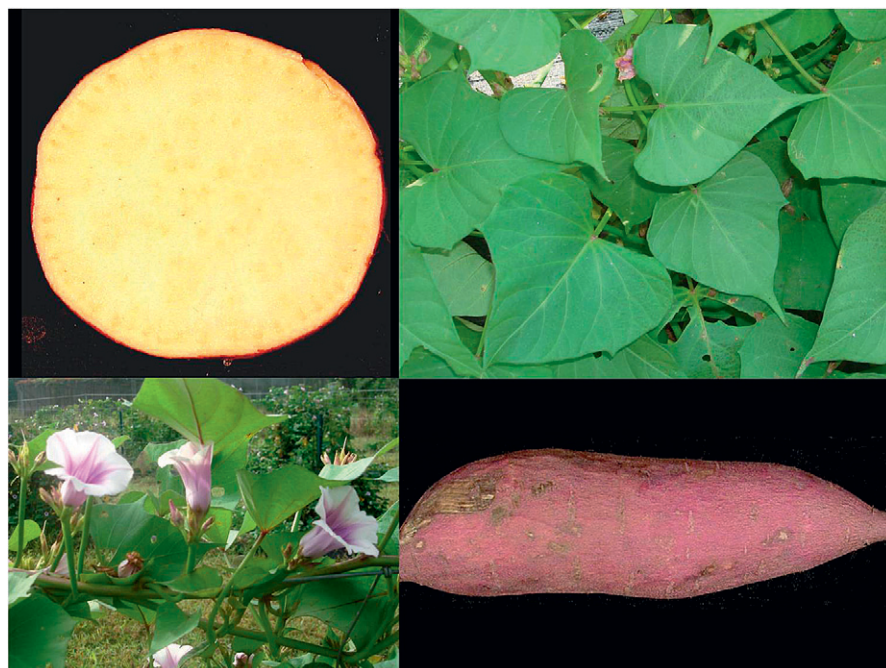


Fig. 1. Clockwise from upper left corner: cut root showing flesh color, leaves, a storage root, and flowers of 'Liberty' grown at the U.S. Vegetable Laboratory, Charleston, SC, 2009.

Table 2. Dry matter content and taste panel evaluations of baked 'Liberty' and six other sweetpotato genotypes, Charleston, SC, 2007–2009.^z

Sweetpotato genotype	Flesh ^y color	Color ^x consistency	Fiber ^w	Flavor ^v (sweetness)	Mouth feel ^u (dryness)	Percent dry wt
Xushu-18	10.0 a ¹	1.7 NS ^s	6.7 a	9.6 a	9.7 a	33.7 a
Picadito	9.5 a	1.8	3.2 bc	4.2 bc	7.7 b	33.1 a
Sumor	8.3 b	2.5	4.2 b	6.3 b	7.2 b	29.0 ab
Liberty	7.7 b	2.0	2.5 bc	4.2 bc	5.3 c	28.7 b
SC1149-19	4.5 c	3.0	2.0 c	3.7 c	3.8 c	26.7 b
Beauregard	2.2 d	1.8	3.0 bc	3.5 c	1.8 d	20.3 c
Ruddy	1.7 d	2.0	1.5 c	2.7 c	2.0 d	21.5 c

^zTaste panel consisted of three individuals who tasted two sweetpotatoes each year, 2007–2009.

^ySubjectively rated 1 (dark orange) to 10 (white).

^xSubjectively rated 1 (uniform) to 10 (blotchy).

^wSubjectively rated 1 (smooth) to 10 (stringy).

^vSubjectively rated 1 (sweet) to 10 (bland).

^uSubjectively rated 1 (moist) to 10 (dry).

¹Means in the same column followed by a common letter are not significantly different ($P = 0.05$, Fisher's protected least significant difference) (SAS, 2009).

^{NS}ns (non-significant) F value, so mean separation was not done.

Table 3. Dry matter content and taste panel evaluations of French fried 'Liberty' and six other sweetpotato cultivars, Charleston, SC, 2008–2009.

Sweetpotato genotype	Pre-cooked ^{z,y} flesh color	Cooked ^x flesh color	Cooked ^w outside color	Color ^v consistency	Fiber ^u	Taste ^t	Greasiness ^s	Overall ^r Impression	Percent dry wt
Beauregard	7.4 a ^q	7.8 a	8.7 a	3.2 NS ^p	1.8 NS	1.6 NS	4.8 b	3.0 a	20.3 c
Ruddy	6.4 a	6.4 b	7.0 b	2.8	1.6	2.0	4.4 b	2.6 abc	21.5 c
SC1149-19	5.0 b	4.3 c	3.7 cd	3.2	1.9	2.4	2.4 c	2.0 bc	26.7 abc
Sumor	2.7 c	2.5 d	2.3 d	2.7	2.0	3.0	2.2 c	2.5 abc	29.1 ab
Liberty	2.6 c	2.9 d	3.3 cd	2.3	2.1	2.8	2.2 c	1.6 c	28.7 ab
Russet Irish Potato	1.9 cd	2.9 d	6.3 b	1.8	1.3	3.0	6.1 a	3.6 a	23.0 bc
Picadito	1.5 d	3.2 cd	4.0 c	3.7	1.7	3.4	2.7 c	2.3 bc	33.1 a

^zTaste panel consisted of four individuals who tasted two sweetpotatoes each year, 2008–2009.

^ySubjectively rated 1 (white) to 10 (dark orange).

^xSubjectively rated 1 (white) to 10 (dark orange).

^wSubjectively rated 1 (light) to 10 (dark).

^vSubjectively rated 1 (uniform) to 10 (blotchy).

^uSubjectively rated 1 (smooth) to 10 (stringy).

^tSubjectively rated 1 (sweet) to 10 (bland).

^sSubjectively rated 1 (not greasy) to 10 (very greasy).

^rSubjectively rated 1 (like) to 10 (dislike).

^qMeans in the same column followed by a common letter are not significantly different ($P = 0.05$, Fisher's protected least significant difference) (SAS, 2009).

^{NS}ns (non-significant) F value, so mean separation was not done.

Table 4. Average yields and dry matter content of 'Liberty' compared with three standard sweetpotato cultivars in two field tests, Bamberg County, SC, 2001–2002.

Sweetpotato ^z genotype	US No. 1 ^{y,x}	Canners ^w	Jumbos ^v	Culls	Total ^u yield	Percent No. 1	Percent dry wt
Liberty	24.2 a ¹	11.2 a	8.1 ab	0.4 NS ^s	43.5 a	55.1	27.7 b
Beauregard	21.1 ab	6.7 b	5.9 b	1.3	33.7 ab	60.3	19.3 c
Regal	16.6 bc	13.0 a	0.7 c	3.1	30.3 ab	49.7	24.7 b
Picadito	12.8 c	2.2 c	11.7 a	0.9	28.7 b	46.4	33.1 a

^zTrials planted in Bamberg County, SC, in a randomized complete block design with three replications, 25 plants per plot, a 30.5-cm spacing between plants and 114.3 cm between rows.

^yYield in metric tons (MT)-ha⁻¹.

^xUS No. 1 = roots 5.2 to 7.6 cm in diameter, length of 7.6 to 22.9 cm, well-shaped, and free of defects.

^wCanner = roots 2.5 to 5.1 in diameter, 5.1 to 17.8 in length.

^vJumbo or oversize = roots that exceed the diameter and length requirements of the above two grades but are of marketable quality.

^uTotal marketable yield (TMY) = sum total weight of roots classified as US #1s, Canners, and Jumbos.

¹Means in the same column followed by a common letter are not significantly different ($P = 0.05$, Fisher's protected least significant difference) (SAS, 2009).

^{NS}ns (non-significant) F value, so mean separation was not done.

Table 5. Average yields and dry matter content of 'Liberty' compared with six standard sweetpotato cultivars over three field tests as part of the Sweetpotato Collaborators Trials for the National Sweetpotato Collaborators Group, Charleston County, SC, 2007–2009.

Sweetpotato genotype	US No. 1 ^{z,y}	Canners ^x	Jumbos ^w	Culls	Total ^v yield	Percent No. 1	Percent dry wt
Covington	26.4 a ^u	6.3 b	4.4 ab	0.9 NS ^t	37.1 a	69.6	20.0 b
Evangeline	24.2 ab	6.5 b	4.4 ab	2.2	35.0 ab	64.9	22.1 b
Beauregard	17.5 abc	6.5 b	4.8 a	1.8	29.7 abc	57.4	20.3 b
Liberty	16.4 bc	5.5 b	1.6 abc	1.9	23.4 bcd	64.7	28.7 a
SC1149-19	12.2 cd	9.9 a	0.3 bc	1.8	22.5 cd	50.2	26.7 a
Ruddy	6.1 d	5.7 b	0.0 c	2.1	15.0 d	55.1	21.5 b
Charleston Scarlet	9.4 cd	5.5 b	0.0 c	2.2	11.8 d	43.8	27.2 a

^zYield in metric tons (MT)-ha⁻¹.

^yUS No. 1 = roots 5.2 to 7.6 cm in diameter, length of 7.6 to 22.9 cm, well-shaped, and free of defects.

^xCanner = roots 2.5 to 5.1 in diameter, 5.1 to 17.8 in length.

^wJumbo or oversize = roots that exceed the diameter and length requirements of the above two grades but are of marketable quality.

^vTotal marketable yield (TMY) = sum total weight of roots classified as US No. 1s, Canners, and Jumbos.

^uMeans in the same column followed by a common letter are not significantly different ($P = 0.05$, Fisher's protected least significant difference) (SAS, 2009).

^tns (non-significant) F value, so mean separation was not done.

Table 6. Reaction of 'Liberty' and standard sweetpotato cultivars to southern root-knot nematode, *Meloidogyne incognita* Race 3, and fusarium wilt in three greenhouse evaluations at the U.S. Vegetable Laboratory, Charleston, SC, 2007–2009.

Sweetpotato genotype	Southern root-knot nematode (Race 3)		Fusarium wilt index (0–5) ^x
	Gall index (1–5) ^z	Egg masses (1–5) ^y	
Liberty	1.07 d ^w	1.07 d	2.93 b
Ruddy	1.06 d	1.05 d	1.43 cd
Charleston Scarlet	1.38 c	1.34 c	2.27 bc
Sulfur	4.57 b	4.43 b	4.70 a
Beauregard	4.86 a	4.79 a	0.55 d

^zGall index. Plants rated on scale of 1 to 5; 1 = no galling and 5 = greater than 80% of the root system galled.

^yEgg mass index. Plants rated on scale of 1 to 5; 1 = no egg masses and 5 = greater than 80% of the root system covered with egg masses.

^xDisease index. Plants rated on scale of 0 to 5; 0 = no disease and 5 = all plants dead.

^wMeans in the same column followed by a common letter are not significantly different ($P = 0.05$, Fisher's protected least significant difference) (SAS, 2009).

Table 7. Injury by soil insect pests on roots of 'Liberty' compared with six commercial sweetpotato cultivars over 12 field tests, US Vegetable Laboratory, Charleston, SC, 1999–2008.

Sweetpotato genotype	Percent uninjured roots	WDS ^a severity index	Percent SPFB ^b injured roots	Percent Grub ^x injured roots	Percent SPW ^w injured roots
Ruddy	78.4 a ^v	0.16 e	2.2 d	4.1 c	1.6 c
Sumor	66.5 b	0.24 de	9.5 bc	5.7 c	2.4 c
Regal	65.6 b	0.28 cd	6.3 cd	4.6 c	2.4 c
Picadito	57.8 c	0.34 cd	13.3 b	10.9 b	3.9 c
Liberty	48.5 d	0.37 c	11.1 bc	16.0 b	11.7 b
Beauregard	33.4 e	0.74 b	11.3 bc	15.9 b	13.9 b
SC1149-19	18.3 f	0.86 a	28.0 a	28.1 a	28.2 a

^aWDS = Wireworm, *Diabrotica*, *Systema* complex. Severity index: 1 = one to five scars, 2 = six to 10 scars, 4 = more than 10 scars, averaged over total number of harvested roots.

^bSPFB = sweetpotato flea beetle, *Chaetocnema confinis* Crotch.

^xPrimarily *Plectris aliena* Chapin.

^wSPW = sweetpotato weevil, *Cylas formicarius* (F.).

^vMeans in the same column followed by a common letter are not significantly different ($P = 0.05$, Fisher's protected least significant difference) (SAS, 2009).

(*Diabrotica undecimpunctata howardi* Barber), and the elongate flea beetle [*Systema elongata* (F.)]. Jackson and Bohac (2006b, 2007a) also reported a moderate level of resistance for 'Liberty' roots in controlled laboratory bioassays with adult and larval cucumber beetles. Although useful, the level of WDS resistance in 'Liberty' does not qualify it as a highly resistant variety, and caution should be taken when using 'Liberty' in an insect-resistance breeding program. Also, the percentage of 'Liberty' roots injured by sweetpotato flea beetles (*Chaetocnema confinis* Crotch), white grub larvae (*Plectris aliena* Chapin and *Phyllophaga ephillida* Say), and sweetpotato weevils [*Cylas formicarius* (L.)] was not significantly different from 'Beauregard'; thus, 'Liberty' should not be considered resistant to these pests (Table 7). Results of field evaluations of 'Liberty' for each year (1998 to 2008) were reported in Insect Management Tests (Jackson, 2010; Jackson and Bohac, 2003, 2004, 2006c, 2006d, 2007b; Jackson et al., 2003a, 2003b, 2003c, 2003d).

Availability

'Liberty' (accession number PI 653844) is available as tissue-cultured plantlets from the Sweetpotato Clonal Repository, Plant Genetic Resources Conservation Unit, 1109 Experiment Street, Griffin, GA 3223-1797 (<http://www.ars-grin.gov/cgi-bin/npgs/html/site.pl?S9>). 'Liberty' is freely available for production or research purposes, including

development and commercialization of new cultivars. We request that appropriate recognition to USDA-ARS be made when this germplasm is used in catalog descriptions or contributes to the development of a new breeding line or cultivar.

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