MSU-SHK5: A Somaclonally Derived Fusarium Yellows-resistant Celery Line

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MSU-SHK5 is a somaclonally derived inbred celery [*Apium graveolens* L. f. *dulce* (Mill) Pers] line with enhanced resistance to fusarium yellows disease (causal agent: *Fusarium oxysporum* f. sp. *apii*, race 2). *Fusarium* infection is the major limiting factor for celery production in North America; there have been severe infestations in California, British Columbia, Michigan, Wisconsin, Ohio, and Ontario. Because this disease cannot be controlled by chemical treatments, the production of cultivars with genetic resistance is especially critical. Concerted efforts over the past decade by public and private breeders have led to the recent development of celery lines and cultivars with enhanced *Fusarium* resistance. Most lines have used materials derived from a cross between celery and cele-

riac [*A. graveolens* f. *rapaceum* (Mill.) Gandich.], another cultivated form of *A. graveolens* that is highly resistant to *F. oxysporum* f. sp. *apii* race 2 (e.g., Quiros et al., 1993). Resistance also has been obtained via somaclonal variations (Heath-Pagliuso et al., 1988, 1989; Toth and Lacy, 1991). The exact genetic changes causing increased *Fusarium* resistance in the somaclonal variants are not known, and different lines may be expressing different mutations. The line described in this release statement, MSU-SHK5, was developed via somaclonal variation followed by five generations of selection and field testing to stabilize expression of disease resistance in combination with high yield and good horticultural performance. The resultant line, MSU-SHK5, provides an alternate source of

Fusarium resistance and should be directly useful for commercial production or breeding purposes.

Origin

MSU-SHK5 is a somaclonal variant obtained via regeneration from cell suspension cultures of the parent genotype, Tall Utah 52-70 HK (TU-HK), a celery cultivar with moderate resistance to fusarium yellows. The initial production and primary testing of somaclonal individuals was described by Toth and Lacy (1991). Briefly, apical buds were used to initiate callus and suspension cultures; regenerated plantlets were transferred from agar medium in the laboratory to soil in the greenhouse and then transplanted directly into growers' fields that were heavily infested with *Fusarium*. Individuals without symptoms were selected for vernalization and self-pollination in the greenhouse. Progeny lines (S₁) were screened for response to *Fusarium* in the field, and selected resistant individual were vernalized and self-pollinated in the greenhouse. This process was repeated for five generations. With each successive generation of selection, the resistance became more stable. Selection was imposed concurrently for large size, compact shape, and the absence of detrimental characters, such as pithiness or stem cracking.

Five S₄ families were chosen for further line development. Four to eight individuals from each family were self-pollinated in the greenhouse. The S₅ seed from these individuals then was bulked within a family to form the lines MSU-SHK (somaclonal derivatives of TU-HK) 1 through 5. Each family also was examined to eliminate those with undesirable horticultural characteristics. Families that exhibited disease resistance, high yield, and good horticultural ratings were used for a small-scale commercial seed increase. Half-sib lines were produced via open-pollination in seed production plantings in California (Peto Seed Co., Woodland), and this seed supplied our last field tests (1994). The bulked lines of Michigan-produced seed and the California-produced seed were tested in replicated field-plot trials and in row trials on growers' farms in four or five locations in Michigan per year

Table 1. Performance of *Fusarium*-resistant somaclonal celery line MSU-SHK5 and three commercially available cultivars on fusarium yellows race 2-infested soils in Michigan.

Line or cultivar	Disease rating ^{z,y}		Wt (kg) ^{x,x}		Horticultural characters ^{z,w}		
	1993	1994	1993	1994	Internal	External	Shape
MSU-SHK5	1.4 a	1.2 a ^y	7.48 a	6.48 a	1.2 a	1.0 a	1.1 a
TU-HK ^u	1.9 b	1.8 b	5.94 b	4.90 b	1.0 a	1.0 a	1.3 a
FL683 ^u	4.0 c	3.8 c	0.33 c	0.50 c	---	---	---
Picador ^u	1.2 a	1.1 a	7.67 a	6.94 a	1.0 a	1.1 a	1.5 a

^zEach value is the mean of four replicate plots; 10 plants were sampled per plot.

^yDisease rating scale 1 to 5, where 1 = no vascular discoloration, 2 = trace amount, 3 = moderate amount, 4 = severe vascular discoloration, and 5 = dead or nearly dead plant.

^xMean weight of 10 trimmed plants per plot (only those FL 683 plants that were marketable were weighed).

^wPlants were rated for internal characters (pithiness, brittleness), external characters (growth cracks, pencil striping), and shape (compactness, upright habit, petiole twisting) on a scale from 1 (best) to 3 (worst).

^uMeans followed by the same letter are not significantly different (Student-Newman-Keuls' test at *P* = 0.05).

^uTU-HK is the moderately resistant parental genotype of MSU-SHK5; FL683 is a highly susceptible cultivar; Picador is a recently released resistant cultivar.

^uPlants were too diseased to rate for horticultural qualities.

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in 1992, 1993, and 1994. The farms were located in Kent, Muskegon, Van Buren, Ottawa counties.

Description and performance

MSU-SHK5 is being released based on data from the replicated trials and grower trials in several *Fusarium*-infested celery farms in Michigan. MSU-SHK5 consistently performed well with regard to disease resistance, yield, and horticultural qualities (Table 1). It has a high level of fusarium yellows resistance, with mean disease rating close to 1 (where 1 = symptom free and 5 = dead plant). The mean disease ratings for MSU-

SHK5 in the grower trials were 1.0 to 1.2. Yields also were high, equivalent to those of 'Picador', and higher than those of the moderately resistant parental line TU-HK (Table 1). In each of the grower trials, MSU-SHK5 yields were as high or higher than the grower-planted control cultivar (either 'Picador' or 'Peto 285'). In overall appearance, MSU-SHK5 resembles the parental line TU-HK, but with a somewhat more compact growth habit.

Availability

Small quantities of seed are available on request from M.L.L. or R.G.

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