Cell Death Patterns in Stalks of a “Supersweet” Sweet Corn Cultivar

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Additional index words. senescence, cell death rating, planting date, *Zea mays*

Dead pith tissue in split dent corn stalks (*Zea mays* L.) is white and fluffy (Pappelis and Williams, 1966), and it is easily colonized by fungal pathogens, especially *Fusarium moniliforme* Sheldon (Foley, 1962). In sweet corn, *F. moniliforme* produces metabolites toxic to plant and mammalian systems (Zummo and Scott, 1992). This fungus asymptotically and systemically colonizes sweet corn tissues, including kernels (Bacon et al., 1992). Infection through nodes can result in colonization of ears if tissue subtending the inflorescence and shank are in advanced stages of senescence. Dent corn cultivars have some resistance to diplodia, gibberella, or fusarium stalk rots before silking, but they differ in susceptibility later (Koehler, 1960).

Sweet corn cultivars are different from dent corn because they contain endosperm mutant genes controlling kernel sweetness (Courter et al., 1988). Planting later delays cell death in dent corn stalk internodes (Pappelis and Boone, 1966). Whether stalk cell death patterns in ‘Florida Staysweet’ sweet corn, an *sh2* (*shrunkn-2*) genotype, are similar to those in dent corn is unknown. Neither senescence rates nor causes that contribute to senescence in supersweet corn are well known. Our experiment was designed to determine if planting date affected senescence in stalk tissues in ‘Florida Staysweet’.

On 18 May 1990 in Wilburton, Okla., and on 15 June and 17 July 1990 in Lane, Okla., seeds were sown with 0.23-m in-row spacing in single rows on beds with 0.9-m centers. Plantings were replicated four times. Fields were fertilized with ammonium nitrate (34N–0P–0K), P_2O_5 (0N–46P–0K), and K_2O (0N–0P–60K) to bring nutrient levels to (in kg·ha⁻¹) 100N–134P–134K. The principal water source was precipitation, but additional water was supplied weekly from tassel emergence through kernel filling by drip irrigation equivalent to 50 mm of precipitation per application. Beginning at the late whorl stage (collar of twelfth leaf present, ≈43 days after planting) and con-

tinuing through harvest, five stalks per replication were chosen at random and cut at the soil surface. Stalks were measured for total length and were split longitudinally. Beginning with the first internode above the brace roots, nodes and internodes were rated for cell death at each developmental stage using the system of Pappelis et al. (1975; see footnote Table 1). We performed an analysis of variance on data using the general linear models procedures (SAS Institute, Cary, N.C.), and means were separated with Duncan’s multiple range test.

Stalk length increased through harvest, but the number of expanded internodes did not change after tasseling (Table 1). For all planting dates, cell death was advanced by tassel formation. In Wilburton, the cell death ratings through harvest for the first internode closely resembled those for subsequent internodes, which may be due to the longer time between planting and harvest. In Lane, cell death ratings for the first internode through harvest were lower than for other internodes. Younger internodes in the lower stalk likely would be a barrier to fungal colonization originating from infected seed.

Internodes subtending the inflorescence

for all planting dates were almost completely senescent by silking. Plants were in the ground for ≤88 days, and there were instances of senescence, judging by the cell death rating, spreading from internodes to nodes (rating 5; see footnote Table 1). Senescent tissue presumably is more susceptible to colonization by disease organisms entering at nodes. If stalk tissues are in a juvenile state of systemic infection, especially that originating from infected seed or through root tissue, the tissue likely would be retarded. The planting date at Lane had no effect on onset of senescence, and unlike dent corn in Illinois (Pappelis and Boone, 1966), planting ‘Florida Staysweet’ earlier may not delay cell death. Other cultural methods might be used to slow cell death.

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Table 1. Planting location, developmental stage, days after planting, stalk length, number of expanded internodes and cell death ratings for first, 2nd to 4th, 5th to 11th, and overall internodes for developmental stages of ‘Florida Staysweet’ sweet corn planted at Wilburton and Lane, Okla.

Location	Planting date	Developmental stage	DAP ^y	Stalk length (cm)	No. expanded internodes	Cell death rating ^z			
						No. internodes			
						1	2–4	5–11	Overall
Wilburton	18 May	Late whorl	48	97 c ^x	4.7 b	0.0 c	0.0 b	0.0 c	0.0 c
		Tassel	59	147 ab	9.9 a	2.5 b	3.6 a	2.2 b	2.6 b
		Silk	69	140 b	9.6 a	3.6 a	4.0 a	4.0 a	4.0 a
		Mature silk	76	154 a	9.3 a	3.4 a	4.0 a	4.0 a	3.9 a
		Harvest	88	156 a	9.3 a	3.6 a	3.9 a	3.9 a	3.9 a
Lane	15 June	Late whorl	40	172 c	9.8 b	1.6 d	2.5 b	0.2 b	0.9 b
		Tassel	46	208 b	10.8 a	2.9 b	4.0 a	3.4 a	3.5 a
		Silk	54	217 a	10.8 a	2.2 c	3.9 a	3.9 a	3.8 a
		Mature silk	61	213 ab	10.4 a	2.1 c	3.9 a	4.0 a	3.8 a
		Harvest	68	208 b	10.5 a	3.4 a	4.0 a	4.0 a	3.9 a
	17 July	Late whorl	42	131 b	7.5 b	0.8 b	1.9 c	0.0 b	0.7 c
		Tassel	53	136 b	10.5 a	1.3 ab	3.3 b	3.9 a	3.3 b
		Silk	58	154 a	9.9 a	3.0 a	3.7 a	3.7 a	3.6 a
		Mature silk	66	157 a	9.9 a	2.9 a	3.9 a	3.9 a	3.8 a
		Harvest	71	146 ab	9.3 a	3.1 a	3.9 a	3.8 a	3.7 a

Received for publication 6 Dec. 1993. Accepted for publication 22 Feb. 1994. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

^zScale rates percentage of senescent tissue: 0 = 0%, 0.5 = less than 1%, 1 = 1% to 12%, 2 = 13% to 25%, 3 = 26% to 50%, 4 = 51% to 75%, 5 = 76% to 100%. Senescent areas in internodes linked by senescent (white) tissue in nodes; 6 is like 5, but there is no green in leaves or rind of stalk (Pappelis et al., 1975).

^yDAP = days after planting.

^xMean separation within columns by Duncan’s multiple range test ($P \leq 0.05$).