BEET (*Beta vulgaris*)
Rhizoctonia root rot; *Rhizoctonia solani*

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USDA-ARS sugarbeet germplasm developed in Fort Collins, evaluated for *Rhizoctonia* resistance, 2001.

Forty sugar beet germplasms released over the past 30 years, or under development for resistance to Rhizoctonia root-rot by the USDA-ARS Sugar Beet Research Unit located in Fort Collins, CO, were evaluated for resistance to Rhizoctonia root rot. The trial was a randomized, complete-block design. One-row plots, replicated five times, were planted at the Crops Research Laboratory-Fort Collins Research Farm, CO, on 25 May. Plots were 4.5 m long with 56 cm between rows and 20 to 25 cm within-row spacing. Inoculation with dry, ground, barley-grain inoculum infested with *Rhizoctonia solani* isolate R-9 (AG 2-2) was performed on 20 Jul. Cultivation was performed immediately after inoculation in order to throw soil into the beet crowns. The field was thinned by hand and irrigated as necessary. Beets were harvested 4 through 7 Sep. Each root was visually rated for rot on a scale of 0 to 7 (0 = no damage; 7 = dead). Analyses of variance (PROC ANOVA - SAS) were performed on disease indices (DI), percent healthy roots (undamaged classes 0 and 1 combined), and percentage of roots in classes 0 thru 3 (those most likely to be harvested and taken to the factory). Percentages were transformed using arcsin-square root to normalize the data for analyses ("AP 0-1" and "AP 0-3" in the accompanying table). Both percentages and transformations are given in the table.

There were high temperatures in the summer of 2001 and a moderate inoculum load. The *Rhizoctonia* epidemic progressed quickly, becoming severe by the beginning of September. Differences in DI among entries were highly significant ($P < 0.001$). Mean DI across all tests in the 2001 nursery for highly resistant FC705-1, resistant FC703, and highly susceptible FC901/C817 controls were 1.7, 2.2, and 4.4 respectively. Percentages of healthy roots were 46.5, 34.2, and 10.4% for these controls. Percentages of roots in disease classes 0 thru 3 were 85.9, 74.1, and 29.8, respectively. The highest and lowest DI for the evaluated lines was 6.9 and 1.3, respectively. There was a significant difference between allthe resistant germplasm and the susceptible control with one exception. A 1993 seed increase of FC704 was significantly more susceptible than the susceptible control and a 2000 seed increase of FC704. We are investigating the possibility of seed contamination during this increase. Even though all germplasm performed significantly better than the susceptible control, there were significant differences among resistant germplasm. FC701, the first *Rhizoctonia*-resistant germplasm, released in 1968, was the least resistant.

Germplasm	Seed Source	Year Released – Crop Science (CS) Reference – Comments	DI	% 0-1*	% 0-3*	AP 0-1*	AP 0-3*
FC701	931024	1968 -- PI 590660	3.1	21	56	23.0	49.3
FC701-4	761068H	1976 – PI 590663	2.2	43	81	38.0	72.7
FC701-5	721056	Experimental – 6 cycles of selection from GW 674-56C	2.2	41	83	36.4	69.5
FC701-6	801059H	1983 -- PI 590756	1.5	57	99	49.1	86.9
FC702	681009-0	1968 -- PI 590662	3.0	4	64	5.3	59.3
FC702-2	19991016	1968 – Sugar Beet Research 1968:A3	2.0	38	90	37.8	74.1
FC702-6	811055H	1981 -- PI 590703	1.6	53	100	47.0	90.0
FC703	751080H	1976 – PI 590656	2.6	21	76	21.6	63.6
FC703	19991017	1976 – PI 590656	1.9	50	90	44.4	81.0
FC704	19931021	1978 -- PI 590659 CS 19:934-935	5.7	0	10	0.0	11.9
FC704	20001018	1978 -- PI 590659 CS 19:934-935	2.7	21	75	20.0	64.2
FC705	781066H	1978 – PI 590660	1.8	38	97	37.6	83.5
FC705	20001019	1978 – PI 590660	1.9	40	93	38.9	82.6
FC705-1	831083	1983 – PI 590754	1.6	55	98	47.8	86.0
FC706	20001020	1979 – PI 590701	2.4	27	75	27.7	63.5
FC707	20001021	1979 – PI 590702	1.9	42	89	39.7	73.1
FC708	831085HO	1980 – PI 590845	1.7	44	97	38.2	85.1
FC709	891026H	1987 – PI 518643	1.4	68	98	59.5	86.1
FC709	19991018	1987 – PI 518643	1.6	54	96	47.8	82.5
FC709-2	921024	1999 – PI 599668	1.4	66	100	57.3	90.0
FC710	891033	1990 – PI 542971	1.6	54	97	47.2	83.5
FC710(4X)	971017	Experimental -- FC710 colchicine doubled	2.5	15	87	15.0	79.0
FC711	821087	1982 – PI 590729	3.0	7	69	9.7	58.0
FC711	19991019	1982 – PI 590729	2.7	17	72	21.5	62.3
FC712	881032H	1985 – PI 590766	1.4	62	99	53.0	87.4
FC712(4X)	971018	1982 – PI 590729	1.6	45	100	41.2	90.0
FC715	911026HO	1992 – PI 574625	2.3	39	87	38.5	71.8
FC716	971019	1992 – PI 574627	1.7	48	98	43.0	84.4
FC717	911031	1992 – PI 574628	2.5	24	81	28.3	66.8
FC718	911032	1992 – PI 574629	2.5	18	80	21.2	66.4
FC719	911037	1992 – PI 574630	2.2	25	88	28.8	69.8

Germplasm	Seed Source	Year Released – Crop Science (CS) Reference – Comments	DI	% 0-1*	% 0-3*	AP 0-1*	AP 0-3*
FC720-1	961015	Experimental -- C718/(C718/FC708)	1.7	47	99	43.3	87.4
FC721	931005HO	1997 -- PI 594910	2.3	22	88	24.8	74.6
FC721CMS	931005HO1	1997 -- PI 594911	2.0	26	97	30.0	85.6
FC722-1	961010HO	Experimental -- C718/FC708	2.4	17	85	19.0	72.1
FC722CMS	961010HO1	Experimental -- C718/FC708 CMS	2.4	13	95	16.3	84.0
FC723	951016HO	Experimental -- EL44/FC708 mm	2.1	38	91	37.1	79.3
FC723CMS	951016HO1	Experimental -- EL44/FC708 CMS	2.1	27	93	29.9	74.7
FC724-1	961014	Experimental -- FC702/LSR-CTR	1.7	41	99	38.8	87.2
FC725	921008	1995 – PI 591314	1.4	56	100	49.0	90.0
FC726	931010	1995 – PI 591315	1.9	39	95	37.9	79.8
FC727	951017	1999 – PI 599669	2.1	34	87	34.5	74.5
FC728	921025	1995 – PI 591316	2.0	34	92	34.4	77.5
FC729	921019	FC712/A4, 3 cycles Rhizoc, MM	1.8	45	93	42.1	80.1
FC801	19991015	1971 – W6 17140 F4, FC 901 (LSR-CTR) x SP 631001-0	2.8	14	75	17.2	62.7
	941025	Susceptible Check - (FC901/C817)	4.6	3	23	6.1	24.9
		$LSD_{0.05}$	0.76			16.79	17.96

* DI = Disease Index on a scale of 0 (no damage) to 7 (plant death), % 0-1= percent healthy roots, % 0-3 those roots most likely to be harvested and taken to the factory. AP is the arcsin-square root transformation of percentages to normalize the data for analyses.