5. Fischer, R.A., and R. Maurer. 1978. Drought resistance in spring wheat cultivars: I. Grain yield responses. Aust. J. Agric. Res. 29:897–912.
6. Vaughn, K.M., C.M. Rush, and M.D. Lazar. 1994. Effects of common root rot on wheat cultivars and breeding lines closely related to TAM 107. Phytopathology 84:1101.
7. M.D. Lazar, C.D. Salisbury, and K.B. Porter, Texas A&M Univ. Agric. Res. and Ext. Ctr., 6500 Amarillo Blvd. West, Amarillo, TX 79106; W.D. Worrall, Texas A&M Univ. Agric. Res. and Ext. Ctr., P.O. Box 1658, Vernon, TX 76384; L.W. Rooney, M.E. McDaniel and N.A. Tuleen, Dep. of Soil and Crop Sci., Texas A&M Univ., College Station, TX 77843-2474; D.S. Marshall, Texas A&M Univ. Agric. Res. and Ext. Ctr., 17360 Coit Rd., Dallas, TX 75252-6599; L.R. Nelson, Texas A&M Univ. Res. and Ext. Ctr., Drawer E, Overton, TX 75684. Registration by CSSA. Accepted 31 Oct. 1995. *Corresponding author (Email: m-lazar@tamu.edu).

Published in Crop Sci. 36:818–819 (1996).

Registration of FC725, FC726, and FC728 Sugarbeet Germplasms Resistant to Rhizoctonia Root Rot and Moderately Resistant to Cercospora Leaf Spot

Sugarbeet (*Beta vulgaris* L.) germplasms FC725, FC726, and FC728 (Reg. no. GP-167 to GP-169, PI 591334 to PI 591336) were developed by the USDA-ARS, Fort Collins, CO, in cooperation with the Beet Sugar Development Foundation, Denver, CO, and were released in 1995. Each of these germplasms was developed from genetically different and distinctive sources. These lines should provide excellent resistance to root-rotting strains (AG-2-2) of *Rhizoctonia solani* Kühn and moderate resistance to cercospora leaf spot (caused by *Cercospora beticola* Sacc.). They have potential as pollinators or as populations from which to select pollinators with combined disease resistance.

FC725 is multigerm (*M_*), non-O-type, and self-sterile; it segregates 44% green hypocotyls. The F_2 population of 25 individuals from the cross C37 (1) × FC 707/2 was random-mated, followed by four cycles of mass selection for resistance to rhizoctonia root rot. In each cycle, population size was maintained at 32 or more plants. The rhizoctonia-resistant parent (FC 707/2) is a superior sib line of FC 707 (2). C37, the parent from the USDA-ARS sugarbeet breeding program at Salinas, CA, combines resistance to bolting, curly top virus, and beet yellows virus. FC725 has excellent resistance to rhizoctonia root rot when tested under strong disease pressure (3). There were no significant differences between FC725 and rhizoctonia-resistant controls in disease index (DI) ratings, and FC725 was significantly better than the susceptible control (Table 1) in both 1995 and 1994. FC725 also shows some resistance to cercospora leaf spot when tested in an artificial epiphytotic (4). When tested in 1995 and 1994, it was significantly better than the susceptible control (Table 1). FC725 shows little tolerance to the curly top virus (Table 1). FC725 should be tested as a pollinator for making hybrids resistant to rhizoctonia root rot and cercospora leaf spot, or could be used as a source population from which such pollinators can be selected.

FC726 is multigerm (*M_*), non-O-type, self-sterile, and segregates 46% green hypocotyls. FC726 resulted from the cross FC 703/3 × Peramano. FC 703/3 is a superior sib line of the rhizoctonia-resistant line, FC 703 (5). Peramano is a light-red-fleshed fodder beet with relatively high sucrose (for a fodder beet) and medium rhizoctonia root rot resistance (detected in the exotic germplasm screening program of R.J. Hecker). White-fleshed roots were selected in the F_2 generation, followed by one generation of mass selection for resistance to rhizoctonia and three generations of simultaneous mass selection for resistance to rhizoctonia and high sucrose concentration (top 27%). Population size ranged from 17 to 41 roots. Peramano was chosen as a parent because of its diverse origin (fodder beet, not sugarbeet) and its relatively good rhizoctonia resistance. Peramano represents a different source of resistance to rhizoctonia root rot, and crossing with the rhizoctonia-resistant parent FC 703/3 could lead to transgressive segregants for rhizoctonia resistance. This has not been tested; however, progress toward rhizoctonia resistance has been rather rapid. FC726 has low sugar, but it has considerable vigor and represents a unique source of genetic diversity within sugarbeet. FC726 has excellent resistance to rhizoctonia root rot when tested under strong disease pressure (3). There were no significant differences between it and the rhizoctonia-resistant controls in DI ratings, and FC726 was significantly better than the susceptible control (Table 1) in both 1995 and 1994. When tested in 1995 and 1994 in an artificial epiphytotic of cercospora leaf spot (4), it was significantly better than the susceptible control (Table 1). FC726 does not show tolerance to the curly top virus (Table 1).

FC728 is primarily multigerm (*M_*), non-O-type, and has sterile cytoplasm. It segregates 26% green hypocotyls. FC728 resulted from a population derived of 90 F_1 plants from each of three crosses: Mono-Hy A4 × FC 708 (6), Mono-Hy D2 × FC 708, and Mono-Hy 309 × FC 708. True hybrids were selected with hypocotyl color as a marker. These F_1's were interpollinated and underwent five generations of mass selection for resistance to rhizoctonia root rot. FC728 has a low frequency of segregants for monogermity (*mm*) and O-type. It has less than 15% fully male-sterile plants. FC728 is vigorous and has moderate sucrose. Population size was maintained at 28 plants or higher throughout each cycle of selection. No combining ability data are available, but, because of the productive hybrids as parents, FC728 should be a good source population from which to produce parents with high combining ability. Because of the genetic background, it also should be possible to isolate monogerm and CMS genotypes. When tested under strong disease pressure (3), FC728 has excellent resistance to rhizoctonia root rot. There were no significant differences between it and rhizoctonia-resistant controls in DI ratings. FC728 was significantly better for DI rating than the susceptible control (Table 1) in both 1995 and 1994. FC728 shows moderate resistance to cercospora leaf spot, and when tested in 1995 and 1994 in an artificial epiphytotic of cercospora leaf spot (4), it was significantly better than the susceptible control (Table 1). FC728 does not show tolerance to the curly top virus (Table 1).

Table 1. Disease index (DI) ratings of sugarbeet germplasms tested in artificial epiphytotics of curly top virus (Kimberly, ID), rhizoctonia root rot (Fort Collins, CO), and cercospora leaf spot (Fort Collins, CO) for 2 yr.

	1994 DI			1995 DI		
Germplasm	Curly top†	Rhizoc-tonia‡	Cerco-spora§	Curly top	Rhizoc-tonia	Cerco-spora
FC725	7.0	1.36	3.75	5.2	1.59	4.50
FC726	7.7	1.46	3.75	5.3	1.54	4.50
FC728	7.3	1.65	3.50	5.7	1.57	4.33
Checks						
Resistant¶	5.2	1.80	3.25	3.8	1.79	3.50
Highly resistant#	—	1.42	—	—	1.43	—
Susceptible††	—	4.94	4.50	—	3.41	6.17
LSD (α = 0.05)	0.94	0.80	0.60	0.87	0.80	0.67

† Disease index is based on a scale of 0 (= healthy) to 9 (= dead).
‡ Disease index is based on a scale of 0 (= healthy) to 7 (= dead).
§ Disease index is based on a scale of 0 (= healthy) to 10 (= dead).
¶ The resistant check for curly top was Beta G6040; for rhizoctonia root rot, FC 703; for cercospora leaf spot, FC 504CMS/FC 502-2//SP6322-0.
# For rhizoctonia only, the highly resistant check was FC 705-1.
†† The susceptible check for rhizoctonia root rot was FC 901/C817//413; for cercospora leaf spot, SP351069-0.

Breeder seed of FC725, FC726, and FC728 is maintained by the USDA-ARS and will be provided in quantities sufficient for reproduction upon written request to the corresponding author. Genetic material of this release will be deposited in the National Plant Germplasm System where it will be available for research purposes, including development and commercialization of new cultivars. We request that appropriate recognition be made of the source when this germplasm contributes to a new cultivar.

L. W. PANELLA* AND E. G. RUPPEL (7)

References and Notes

1. Lewellen, R.T., E.D. Whitney, and I.O. Skoyen. 1985. Registration of C37 sugarbeet parental line. Crop Sci. 25:375.
2. Hecker, R.J., and E.G. Ruppel. 1979. Registration of FC 702/4, FC 702/4 (4X), FC 705, FC 706, and FC 707 sugarbeet germplasm. Crop Sci. 19:935.
3. Ruppel, E.G., C.L. Schneider, R.J. Hecker, and G.J. Hogaboam. 1979. Creating epiphytotics of rhizoctonia root rot and evaluating for resistance to *Rhizoctonia solani* in sugarbeet field plots. Plant Dis. Rep. 63:518–522.
4. Ruppel, E.G., and J.O. Gaskill. 1971. Techniques for evaluating sugarbeet for resistance to *Cercospora beticola* in the field. J. Am. Soc. Sugar Beet Technol. 16:384–389.
5. Hecker, R.J., and E.G. Ruppel. 1977. Registration of diploid and tetraploid FC 701/4 and FC 703 sugarbeet germplasm. Crop Sci. 17:678.
6. Hecker, R.J., and E.G. Ruppel. 1981. Registration of FC 708 and FC 708 CMS sugar beet germplasm. Crop Sci. 21:802.
7. Sugarbeet Research, USDA-ARS Crops Research Lab., 1701 Center Ave., Fort Collins, CO 80526-2081. A joint contribution of USDA-ARS and the Beet Sugar Development Foundation. Registration by CSSA. Accepted 31 Jan. 1996. *Corresponding author (Email: lpanella@lamar.colostate.edu).

Published in Crop Sci. 36:819–820 (1996).

Registration of Nine Cotton Germplasm Lines Resistant to Root-Knot Nematode

Nine cotton (*Gossypium hirsutum* L.) germplasm lines (Reg. no. GP-619 to GP-627, PI 592508 to PI 592516) with resistance to root-knot nematode [*Meloidogyne incognita* (Kofoid & White) Chitwood] were released by the USDA-ARS and the Mississippi Agricultural and Forestry Experiment Station in 1989.

The germplasm designation, registration number, PI number, and recurrent parent of each line are given in Table 1. The germplasm lines were developed from crosses of Auburn 634 RNR (5), a source of high resistance to root-knot nematodes, with different recurrent parent cultivars. The crosses were followed by at least two backcrosses, with selection, to each respective recurrent parent.

In resistance tests, seedlings were grown in pots infested with 10 000 root-knot nematode eggs. After 40 d, the number of eggs recovered on the lines ranged from 400 to 1600 per plant, compared with 81 000 to 122 500 on the susceptible check cultivars Stoneville 825 and Deltapine 41. Yield and agronomic performance of these germplasm lines and the two check cultivars were determined over a 3-yr period (1986–1988) in a field relatively free of root-knot nematodes. The germplasm lines produced seed cotton yields equal to the check cultivars (or, in the case of M-240 RNR, 14 to 22% superior). Lint percentage of the lines ranged from 36.1 to 40.5% and was significantly lower than that (42.6%) of Stoneville 825. Boll size, 50% span length, and fiber elongation of these lines did not differ significantly from Stoneville 825. The lines M-240 RNR and M-315 RNR had shorter 2.5% span fiber length than Stoneville 825, while M-120 RNR and M-240 RNR had 21 and 8%, respectively, greater fiber strength than the check. Lines M-120 RNR, M-155 RNR, M-249 RNR, M-272 RNR, M-331 RNR, and M-725 RNR displayed a significantly lower micronaire reading (0.5–0.8 units) than did Stoneville 825 (5.2 units).

Table 1. Nine germplasm lines of cotton resistant to root-knot nematode, their identification numbers, and their recurrent parents.

Release no.	Reg. no.	PI no.	Recurrent parent
M-92 RNR	GP-619	PI 592508	Stoneville 213
M-120 RNR	GP-620	PI 592509	Coker 201
M-155 RNR	GP-621	PI 592510	Coker 310
M-240 RNR	GP-622	PI 592511	Deltapine 61
M-249 RNR	GP-623	PI 592512	Stoneville 213
M-272 RNR	GP-624	PI 592513	Stoneville 213
M-315 RNR	GP-625	PI 592514	Deltapine 61
M-331 RNR	GP-626	PI 592515	Auburn 56 (7)
M-725 RNR	GP-627	PI 592516	Coker 310

Root-knot nematode damage reduces water and nutrient uptake efficiency and greatly increases susceptibility to seedling disease (caused by numerous microorganisms) (1) and fusarium wilt [caused by *Fusarium oxysporum* Schlechtend.:Fr. f. sp. *vasinfectum* (Atk.) W.C. Snyd. & H.N. Hans.] (6). The line M-315 RNR is currently being used as the resistant check in the Regional Wilt Screening Nursery at Tallassee, AL. The line M-315 RNR has two major genes conferring resistance (4). Root penetration by juvenile root-knot nematodes into M-315 RNR was equal to the susceptible line M-8. However, postpenetration development was slower, fewer juveniles developed into adult females, and root galls were fewer and smaller on M-315 RNR than on M-8 (2,3).

These nine lines constitute a germplasm pool with high root-knot nematode resistance in a broad genetic base and should be useful in cotton improvement programs. Because this germplasm pool is genetically diverse, but uniform for root-knot resistance, breeders can make crosses within it to develop resistant cultivars without extensive screening for resistance during the breeding process. Resistant cultivars developed using these germplasm lines should outperform susceptible cultivars on root-knot nematode infested soils and could be comparable or superior to them on non-infested soils.

Ten grams of seed of each line will be provided upon written request to the corresponding author. These germplasm lines will be deposited in the National Plant Germplasm System. Appropriate recognition of the source is requested when this germplasm contributes to the development of a new cultivar or line.

R. L. SHEPHERD, J. C. MCCARTY, JR.,* J. N. JENKINS, AND W. L. PARROTT (8)

References and Notes

1. Cauquil, J., and R.L. Shepherd. 1970. Effect of root-knot nematode–fungi combinations on cotton seedling disease. Phytopathology 60:448–451.
2. Creech, R.G., J.N. Jenkins, B. Tang, G.W. Lawrence, and J.C. McCarty. 1995. Cotton resistance to root-knot nematode: I. Penetration and reproduction. Crop Sci. 35:365–368.
3. Jenkins, J.N., R.G. Creech, B. Tang, G.W. Lawrence, and J.C. McCarty. 1995. Cotton resistance to root-knot nematode: II. Post-penetration development. Crop Sci. 35:369–373.
4. McPherson, G.R. 1993. Inheritance of root-knot nematode resistance in cotton as determined by combining ability, generation mean, and Mendelian analyses. Ph.D. diss. Mississippi State Univ., Mississippi State (Diss. Abstr. Int. 93-31639).
5. Shepherd, R.L. 1982. Registration of three germplasm lines of cotton (Reg. nos. GP 164 to GP 166). Crop Sci. 22:692.
6. Shepherd, R.L. 1982. Genetic resistance and its residual effects for control of the root-knot nematode–fusarium wilt complex in cotton. Crop Sci. 22: 1151–1155.
7. Smith, A.L. 1964. Registration of Auburn 56 cotton (Reg. no. 45). Crop Sci. 4:446.
8. R.L. Shepherd (retired), J.C. McCarty, Jr., J.N. Jenkins, and W.L. Parrott (retired), USDA-ARS, Crop Sci. Res. Lab., P.O. Box 5367, Mississippi State, MS 39762. Contribution of the USDA-ARS in cooperation with the Mississippi Agric. and Forestry Exp. Stn., Mississippi State, MS. Registration by CSSA. Accepted 31 Jan. 1996. *Corresponding author.

Published in Crop Sci. 36:820 (1996).