Registration of Four Multigerm Sugarbeet Germplasms Resistant to Rhizoctonia Root Rot: FC716, FC717, FC718, and FC719

Sugarbeet (*Beta vulgaris* L.) germplasms FC716 through FC719 (Reg. no. GP-143 to GP-146, PI 574627 to PI 574630) were developed by the USDA-ARS in cooperation with the Beet Sugar Development Foundation. Each of these germplasms was developed from genetically different and distinctive sources. These lines should provide resistance to root-rotting strains (AG-2-2) of *Rhizoctonia solani* Kühn and potential pollinators with combining ability for yield. They were released in 1992.

FC716 resulted from interpollination of 38 mother roots selected for resistance to rhizoctonia from three commercial hybrids, HH32 (66%), ACH-139 (24%), and 70MSH386 (10%). HH32 is a rhizoctonia-resistant Holly Sugar Corp. hybrid, ACH-139 is a rhizoctonia-resistant American Crystal Sugar Co. hybrid, and 70MSH386 is a rhizoctonia-resistant hybrid from the former Great Western Sugar Co. This initial population underwent five cycles of mass selection for rhizoctonia root rot resistance. FC716 has excellent rhizoctonia root rot resistance when tested under strong disease pressure (4). There were no significant differences between FC716 and resistant controls in disease index (DI) (2) or the percentage of healthy plants (4) (Table 1). It has low to medium resistance to cercospora leaf spot (caused by *Cercospora beticola* Sacc.) and is susceptible to curly top virus. FC716 is diploid, multigerm, and easy bolting and has medium sucrose content. It segregates for green hypocotyls (88%). All plants have the cytoplasmic factor for male sterility (CMS); ≈80% of the plants are pollen fertile (non-O-type) and 20% CMS. The fertile plants include Type 2, Type 3, and Type 4 pollen fertile plants. Nonetheless, it is a good pollen producer. It should have a low frequency of segregates for monogerm and O-type. Because FC716 originated from productive hybrids, it should have potential as a source of rhizoctonia-resistant germplasm with high combining ability for sugar yield. Isolation plots had excellent seed set, and FC716 could function as a pollinator or a source population from which to select pollinators, O-types, or CMS females. It was released in 1992 as seed production 911028.

FC717 was derived from a cross between FC708 and ACH14. FC708 is a rhizoctonia root rot resistant, monogerm O-type (3) and ACH14 is an American Crystal hybrid. Starting with the F_2 population, four cycles of mass selection for rhizoctonia resistance were made.

FC717 has excellent rhizoctonia root rot resistance when tested under strong disease pressure (Table 1); it has low to medium resistance to cercospora leaf spot and is susceptible to curly top virus. FC717 is diploid and multigerm, and has medium sucrose content. It segregates for green hypocotyl (17%). FC717 should have a low frequency of monogerm and O-type segregates; it has normal cytoplasm, and is a good pollen producer. There are no combining ability data on FC717, but the line may have potential as a source for selection of resistant pollinators and/or monogerm O-types. It was released in 1992 as seed production 911031.

FC718 resulted from the interpollination of rhizoctonia resistant selections from four USSR open-pollinated populations: Ramonsk 06 (5 plants), Ramonsk 100 (2 plants), Verkhynyachsk 072 (1 plant), and Vladovsk 20 (1 plant). Ramonsk 06 has high sugar yield and wide adaptation. Ramonsk 100 was bred for high sugar content and clear juice purity. Verkhynyachsk 072 was bred for resistance to storage rot. Vladovsk 20 was bred for high root yield and resistance to powdery mildew (caused by *Erysiphe polygoni* DC.). The initial population of FC718 underwent eight cycles of mass selection for rhizoctonia root rot resistance. FC718 has excellent rhizoctonia root rot resistance when tested under strong disease pressure (Table 1). FC718 is unrelated to any other FC releases. The resistance seems to be quantitative and reacts with the pathogen in the same manner as resistant germplasm from U.S. sources. It is susceptible to cercospora leaf spot and curly top. FC718 is diploid and multigerm. It has relatively low sucrose content and segregates for green hypocotyl (27%). FC718 is relatively vigorous and heterogeneous. It may have potential as a source from which to select pollinators with high combining ability for sucrose content and root yield. It was released in 1992 as seed production 911032.

FC719 resulted from a cross between Polish 2x-4-73 and Syn OP (FC702-5/FC701-5, F_2). Polish 2x-4-73 is a monogerm selection from the high-sucrose Polish line $PZHR_4$. FC701-5 and FC702-5 are breeding lines further selected for rhizoctonia root rot resistance out of Fort Collins lines FC701 and FC702 (1). The F_2 population underwent five cycles of mass selection for rhizoctonia root rot resistance. FC719 has excellent rhizoctonia root rot resistance when tested under strong disease pressure (Table 1), but it has little resistance to cercospora leaf spot or curly top. FC719 is diploid and multigerm. It is relatively high in sucrose content and segregates for green hypocotyl (71%). Because half of the genes in the source were from a high-sucrose Polish population unrelated to most U.S. germplasm, FC719 should have diverse variability for sugar yield combining ability. It was released in 1992 as seed production 911037.

Breeder seed of FC716, FC717, FC718, and FC719 is maintained by the USDA-ARS and will be provided in quantities sufficient for reproduction upon written request to the corresponding author. We ask that appropriate recognition be made of the source when this germplasm contributes to a new cultivar.

Table 1. Disease index and the percent of healthy sugarbeet plants after infection by *Rhizoctonia solani* in an artificially created epiphytotic.

Entry	1990		1993	
	DI†	Healthy‡	DI	Healthy
		%		%
FC716	1.5	77.5	1.2	87.5
FC717	2.0	61.6	1.0	90.0
FC718	1.3	76.5	1.1	90.0
FC719	1.5	73.7	1.2	90.0
Highly resistant (FC705-1)	1.3	75.5	1.3	90.0
Moderately resistant (FC703)	1.9	64.6	1.2	90.0
Susceptible (831044)	4.8*§	13.0*§	3.0*§	70.0*§

* Significant differences ($\alpha = 0.05$) occurred in all cases between the susceptible checks and each of the other lines.

† A scale of 0 to 7 was used, with 0 = no apparent infection and 7 = plant dead. A disease index (DI) was calculated for each plot from individual root ratings.

‡ Plants in Class 0 and 1 were considered healthy and were used to calculate the percentage of healthy plants.

§ There were no significant differences among the resistant checks and the other lines. Values for % healthy were transformed to arcsine square roots for analysis.

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Registration of Soybean Germplasm Lines Resistant to Stem Canker and Phytophthora Rot: D85-10404 and D85-10412

Soybean [*Glycine max* (L.) Merr.] germplasm lines D85-10404 (Reg. no. GP-170, PI 578246), and D85-10412 (Reg. no. GP-171, PI 578247) were developed by the USDA-ARS, Stoneville, MS, in cooperation with the Mississippi Agricultural and Forestry Experiment Station, Stoneville, and released July 1993. D85-10404 and D85-10412 have individual genes *Rdc1* and *Rdc2*, respectively, controlling resistance to the disease stem canker [caused by *Diaporthe phaseolorum* (Cooke & Ellis) Sacc. f. sp. *meridionalis* Morgan-Jones] (4). These lines provide valuable diagnostic tools for the identification of additional genes for resistance to this important soybean disease.

D85-10404 and D85-10412 were selected in the F_5 generation from the cross 'Tracy-M' × J77-339. Tracy-M (1) is a highly productive, multiple pest-resistant Maturity Group VI cultivar. J77-339 is a breeding line originally selected for resistance to soybean cyst nematode (*Heterodera glycines* Ichinohe), and closely related to the cultivar 'Bedford' (2); it was later identified as being highly susceptible to stem canker. D85-10404 and D85-10412 were originally part of a population of 40 F_3 lines uniformly resistant to stem canker. Genetic studies (3) have clearly indicated that the two lines are homozygous for different dominant alleles at two loci responsible for resistance to stem canker from Tracy-M. Concurrent greenhouse inoculations indicated that D85-10404 (*Rdc1*) also has the major genes *Rps1-c* and *Rps3*, and D85-10412 (*Rdc2*) has the gene *Rps1-b* controlling resistance to the disease phytophthora rot (caused by *Phytophthora sojae* M.J. Kaufmann & J.W. Gerdemann). Pedigree selection method was used to advance the lines from the F_3 to the F_5 generation. D85-10404 and D85-10412 were harvested as bulk F_5 rows. Seedlings from each line were again evaluated for resistance to stem canker and phytophthora rot to verify uniformity. D85-10404 and D85-10412 both have a determinate growth type, white flowers, tawny pubescence, tan pods, and yellow seeds with black hila. They are of Maturity Group VI, with D85-10404 having a maturity date similar to Tracy-M, with D85-10412 being ≈4 d earlier.

A sample of 50 seeds for research purposes will be available for at least 5 yr from the corresponding author.

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Registration of Two Wheat Germplasms Resistant to Russian Wheat Aphid: KS92WGRC24 and KS92WGRC25

KS92WGRC24 (Reg. no. GP-410, PI 574489) and KS92-WGRC25 (Reg. no. GP-411, PI 574490) are Russian wheat aphid (RWA) [*Diuraphis noxia* (Mordvilko)] resistant winter wheat (*Triticum aestivum* L.) germplasms developed and released by the Kansas Agricultural Experiment Station (KAES), Manhattan, KS.

The pedigree of KS92WGRC24 is Yilmaz-10/2*KS84-HW196 and that of KS92WGRC25 is Yilmaz-10/KS84HW196//'Dodge'. Both are increases of F_4 head selections. Yilmaz-10, the RWA-resistant parent, is a landrace selection from Eastern Turkey. It has hard white seed and is very tall and late maturing under Kansas conditions. We have been unsuccessful in reproducing seed of Yilmaz-10 under any environment except the greenhouse. The RWA resistance in KS92WGRC24 and KS92WGRC25 has been verified in both seedling greenhouse and field tests. One of the adapted parents in the pedigree of these germplasms, KS84HW196, is a hard white winter wheat germplasm (1) released in 1992 and developed cooperatively by the KAES and the USDA-ARS.

KS92WGRC24 is a white-seeded, awned, white-glumed, semidwarf hard winter wheat. It was tested in the 1992 Preliminary Yield Nursery (PYN) at Hays, KS. KS92WGRC24 was 2 d later and 2 cm shorter and had a coleoptile length 3 cm longer than 'TAM 107'. The yield of KS92WGRC24 was ≈10% less than that of TAM 107. The mixing strength (as measured with the mixograph) of this line was slightly stronger than that of 'Larned', and its grain protein content was one percentage point higher than that of TAM 107.

KS92WGRC25 is a red-seeded, awned, white-glumed, semidwarf hard winter wheat. It also was tested in the 1992 Hays PYN. KS92WGRC25 headed 5 d earlier, was 2 cm taller, and had a coleoptile length 1.5 cm longer than TAM 107. Its grain yield was similar to that of KS92WGRC24. The mixing strength of KS92WGRC25 was equal to that of Larned, and its grain protein was one percentage point higher than that of TAM 107.

The disease and insect resistance of these two lines are similar. They are resistant to stem rust (caused by *Puccinia graminis* Pers.:Pers.), but susceptible to leaf rust (caused by *P. recondita* Roberge ex Desmaz.), soilborne mosaic virus, wheat streak mosaic virus, and Hessian fly [*Mayetiola destructor* (Say)].

Small quantities (15 seeds) of KS92WGRC24 and KS92-WGRC25 are available upon request. Appropriate recognition of source should be given when these germplasms contribute to research or development of new cultivars. Seed stocks will be maintained by the Kansas Agricultural Experiment Station at the Fort Hays Branch Agricultural Experiment Station.

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References and Notes

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