agricultural crops according to the zone more favorable for their cultivation and choose cultivars that have a stable, high-quality grain production.

The State Register recommended 47 winter wheat cultivars, including 24 (51%) selected by the SPI ARRIGC for the Rostov region for 2010. Thirty-nine of the cultivars (83%) are strong and valuable wheats according to their quality, including 23 cultivars (48.9%) selected by the SPI ARRIGC. The most important priorities for wheat selection in the Don area, together with an increase in potential productivity and ecologic stability are greater protein, gluten, baking, and macaroni properties. As a result of purposeful selection, the high-quality, drought resistant, highly productive winter wheats with a potential productivity of 8–10 tons/ha were Zernogradka-10, Zernogradka-11, Rostovtchanka-3, Konkurent, Tanais, and Rostovtchanka-5 for predecessors of black pairs and Don 93, Ermak, Stanitchnaya, Don 105, and Don Surpriz for nonpair predecessors.

Lately, an interes durum winter wheat has grown. The greatest achievement of domestic selection for macaroni/cereal usage were the cultivars Don Jantar, Aksinit, Gelios, and Kurant, being highly productive with a potential productivity of 7.0–9.0 t/ha, drought resistant, and winterhardy. These cultivars may help solve the deficit of durum grain in the North-Caucasus region.

Cultivars selected by the SPI ARRIGC are able to realize a high level of productivity and quality only when recommended cultivation technology is followed, such as use of fertilizer; feeding during the vegetative period; protection from diseases and pests including insects and the harmful tortoise; and timely harvest. Using quality winter wheat cultivars and the best cultivation technologies will allow agricultural producers to increase the production of high-quality grain.

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Necrotic genotypes in winter bread wheat in the Russian Federation.

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The hybrid necrosis genes (*Ne1* and *Ne2*) are valuable tools for comparing wheat species and their groups within the genus and evaluating anthropogenic influence on genetic erosion. Hybrid necrosis genes interact by a complementary mechanism (Kostyuchenko 1936). Both genes are located in the B genome. The *Ne1* gene is located on chromosome 5BL and the *Ne2* gene on chromosome 2BS. Allele series for each gene have been demonstrated. The alleles of the *Ne1* gene are *w*, *m*, and *s*, and the alleles of the *Ne2* gene are *w*, *wm*, *m*, *ms*, and *s* (Hermsen 1960, 1963; Chu et al. 2006). Knowledge of the necrotic genotype is also important for selection and evaluation of the original material during breeding of wheat and triticale. About ten new cultivars of common wheat recommended for commercial use are registered in the Russian Federation. Although the data on yield, vegetation period, and resistance to main phytopathogens are available, information concerning genes, and hybrid necrosis genes in particular, is missing. Our work analyzes the distribution of hybrid necrosis genes among wheats of Russia and other countries (Pukhalskiy 1996; Pukhalskiy et al. 2000, 2003).

Here we present our data on necrotic genotypes in 53 cultivars of winter bread wheat (Table 1, pp. 221-222). Most were produced after 2000. The following cultivars were used as testers: Felix (*ne1ne1Ne2Ne2*), Co725082 (*Ne1sNe1sne2ne2*), Mironovskaya 808 (*ne1ne1Ne2msNe2ms*), Nemchinovskaya 52 (*ne1ne1Ne2msNe2ms*), and Berthold (*ne1ne1Ne2mNe2m*). Crossings were conducted in the field by a twel-procedure. Hybrids were grown in the field. Necrotic symptoms were evaluated at different ontogeny stages. Pedigree analysis was conducted with an analytical GRIS system.

Table 1. Necrotic genotypes in 53 cultivars of winter bread wheat from the Russian Federation.

Cultivar	Pedigree	Year of release	Genotype
Zamena	Rubin/Krasnodarskaya 46	1987	*ne1ne2*
Bezostaya 2	Lutescens 314h147/Krasnodarskaya 46	1973	*ne1ne2*
Istok	Pavlovka/Donskaya ostistaya	1988	*ne1ne2*
Novoukrainka 83	Ukrainka/Marquis	1945	*ne1ne2*
Pavlovka	(S)Krasnodarskaya 39	1982	*ne1Ne2m*
Polukarlikovaya 49	Mironovskaya Yubileynaya Yubileynaya 50/Krasnodarskii karlik 1	1979	*ne1ne2*
Severokubanka	Krasnodarskaya 39/Krasnodarskaya 6	1980	*ne1Ne2m*
Sharada	KH-4333-9-1001/Obrii	2006	*ne1ne2*
Bat’ko	Lutescens 4217-G-25908-4228/Lutescens 5126-p-58-51//Lutescens 51	2003	*ne1ne2*
Krasota	AD206 (Tritikale)/Rubin//KH-17-t-3 (Tritikale)	2002	*ne1ne2*
Prikumskaya 140	Spartanka 10/Colt//Spartanka 10	2003	*ne1Ne2ms*
Stanichnaya	BP-566-86/BP-1302-82	2002	*ne1Ne2m*
Fortuna	Lutescens –1985-t-124/Soratnitsa	2006	*ne1ne2*
Fisht	Skifyanka *2/3/Tr.MI//Kavkaz	2004	*ne1Ne2ms*
Bezenchukskaya 616	Bezenchukskaya 380/Volgodar//Bezenchukskaya 380	2005	*ne1Ne2s*
Volzhskaya 100	Khar’kovskaya92/Unknown	2004	*ne1Ne2s*
Volzhskaya K	Kinel’skaya 4/Unknown	2004	*ne1Ne2s*
Omskaya 4	Mironovskaya 25(M)/Saratovskaya 8	2001	*ne1Ne2s*
Kazanskaya 560	(S) Meshinskaya 2	2002	*ne1ne2*
Levoberezhnaya 1	Krasnodarskaya 39/Donskaya ostistaya//Donskaya bezostaya/3/Ershovskaya	2003	*ne1ne2*
Mafe	86-KPM-684/KH-4636-h-202-56//KH-4336-h-202-56	2006	*ne1ne2*
Pionerskaya 32	Albidum 114/Bogarnaya 56//Dneprovskaya 521	2006	*ne1ne2*
Omskaya 5	(S) Sibirskaya niva	2004	*ne1Ne2s*
Svetoch	Chaika/Kavkaz//Don 85	2004	*ne1Ne2s*
Tau	NS-175-2// Lutescens 2002/Mironovskaya 808/3/Velutinum 4880	2001	*ne1ne2*
Veda	Leda//Polovchanka/Rufa	2005	*ne1Ne2ms*
Vostorg	Tr.MI/Kavkaz//4473- h-144-10	2005	*ne1Ne2s*
Basalt	Donetskaya 79/Albidum 114	1993	*ne1Ne2ms*
Odesskaya 200	Yubileynaya 75/Al’batros Odesskii	2006	*ne1ne2*
Petrovchanka	Erytrospermum G-124080/Yubileynaya 75	2007	*ne1ne2*
Prikumskaya 141	Donskaya bezoskaya/Lutescens G-102649	2004	*ne1Ne2m*
Stepchanka	Lutescens- G-95506/ Eritrospermum G-72134// BP-1648-KB	2006	*ne1Ne2m*
Chernozemka 88	Chernozevka 96/Ershovka 6//Odesskaya 75	2003	*ne1ne2*
Ariadna	Odesskaya 138/Ol’viya//Odesskaya 51/4/Odesskaya 51//Mironovskaya 808	2008	*ne1ne2*
Biruza	Lutescens 1985-h-331/Lutescens 4523-h-42//Zimorodok/6687-12	2008	*ne1Ne2m*
Bogdanka	M 508-97/Volzhskaya 16	2009	*ne1Ne2m*
Volzhskaya C 3	Khar’kovskaya 92/Unknown	2006	*ne1Ne2m*
Galina	Obrii/Pamyati Fedina//Inna	2005	*ne1ne2*
Gratsia	Kupava/ BP=90-178-a-20-5	2008	*ne1ne2*
Gubernator Dona	Erytrospermum 1122-93/Ukrainka Odesskaya	2008	*ne1ne2*
Deviz	Rostovchanka/Avrora	2008	*ne1Ne2m*
Dzhangal	Donskaya bezostaya /Khar’kovskaya 63/Bezostaya 1/Ershovskaya 3	2008	*ne1Ne2m*
Don 105	Don93/Dimetra	2008	*ne1Ne2m*
Kamyshanka 3	Lutescens 332/Khar’kovskaya 92	2009	*ne1Ne2m*
Korund	Apollo/Zentos//Zentos	2008	*ne1Ne2m*

Table 1 (continued). Necrotic genotypes in 53 cultivars of winter bread wheat from the Russian Federation.

Cultivar	Pedigree	Year of release	Genotype
L'govskaya 4	L'govskaya 77//Yubileynaya 58/3/L'govskaya 167/Polukarlikovaya	2008	*ne1ne2*
Moscovskaya 56	Mironovskaya poluintensivnaya/Inna//Moskovskaya 39	2008	*ne1Ne2m*
Nemchinovskaya 24	Donshchina/Inna	2006	*ne1Ne2m*
Odesskaya 267	Odesskaya 51/Inia 66//Bezostaya 1/Mironovskaya 808/3/World Seeds	2001	*ne1Ne2m*
Odesskaya 267	Odesskaya 51/Inia 66//Bezostaya 1/Mironovskaya 808/3/World Seeds	2001	*ne1Ne2m*
Rodnik Tarasovskii	Partisanka/Zirka//Belotserkovskaya 18/Zirka/3/Donskaya Yubilewy-naya	2003	*ne1ne2*
Resurs	Lutescens 1956-225/Al'batros Odesskii	2008	*ne1ne2*
Rostovchanka 5	Skorospelka 35/Mironovskaya 264	2008	*ne1ne2*
Yunona	Eika/ Lutescens 5573-h-16	2008	*ne1Ne2m*

Thirty cultivars (56.6%) had the *ne1ne1Ne2Ne2* genotype and 23 (43.4%) possessed the *ne1ne1ne2ne2* genotype. The data obtained clearly demonstrate the elimination of *Ne1*-carriers, but there is no definite explanation for this phenomenon (Pukhalskiy et al. 2008), especially taking into account that practical breeders have no information on hybrid necrosis genes during selection. For still unknown reasons, the *ne1ne1Ne2Ne2* genotype has selective advantage over the *Ne1Ne1ne2ne2* genotype. The *ne1ne1ne2ne2* genotype has a certain selective advantage.

In 27 cultivars, the strength of hybrid necrosis alleles was determined. Among them the moderate *m* alleles prevailed (63%), four cultivars possessed the allele *ms* (14.8%), and six carried the allele *s* (22.2%).

A pedigree analysis of the distribution of hybrid necrosis genes (Table 2, pp. 222-223) showed that, in most cases, the donors of the dominant allele of the *Ne2* gene in *ne1Ne2*-carriers are the cultivars Mironovskaya 808 and Kras-

Table 2. A pedigree analysis of the distribution of hybrid necrosis genes in cultivars of winter bread wheat from the Russian Federation.

Cultivar	Genotype	Presumed donor	Presumed source
Zamena	*ne1ne2*	Bezostaya 1	Bezostaya 1
Bezostaya 2	*ne1ne2*	Bezostaya 1	Bezostaya 1
Istok	*ne1ne2*	Donskaya ostistaya	Bezostaya 1
Novoukrainka 83	*ne1ne2*	Marquis or Ukrainka	Ukrainka or Hard Red Calcutta
Pavlovka	*ne1Ne2m*	Krasnodarskaya-39	Gostianum 237
Polukarlikovaya 49	*ne1ne2*	Krasnodar. karlik 1	Bezostaya 1
Severokubanka	*ne1Ne2m*	Krasnodarskii-39	Gostianum 237
Sharada	*ne1ne2*	Obrii	Odesskaya-51
Bat'ko	*ne1ne2*	Donskaya ostistaya	Bezostaya
Krasota	*ne1ne2*	Bezostaya 1	Bezostaya 1
Prikumskaya 140	*ne1Ne2ms*	Spartanka	Krasnodarskaya 39
Stanichnaya	*ne1Ne2m*	Donskaya polukarlikovaya	Mironovskaya-808
Fortuna	*ne1ne2*	Soratnitsa	Odesskaya 66 or Partizanka
Fisht	*ne1Ne2ms*	Skifyanka	Krasnodarskaya-39
Bezenchukskaya 616	*ne1Ne2s*	Bezenchukskaya 380	Mironovskaya-808
Volzhskaya 100	*ne1Ne2s*	Khar'kovskaya92	Mironovskaya-808
Volzhskaya K	*ne1Ne2s*	Kinel'skaya 4	Mironovskaya-808
Omskaya 4	*ne1Ne2s*	Saratovskaya 1	Lutestsens 230
Kazanskaya 560	*ne1ne2*	Chernomorskaya	Bezostaya 4
Levoberezhnaya 1	*ne1ne2*	Donskaya ostistaya	Bezostaya 1
Mafe	*ne1ne2*	Donskaya ostistaya	Bezostaya 1
Pionerskaya 32	*ne1ne2*	Al'bidum 114	Al'bidum 11
Omskaya 5	*ne1Ne2s*	?	
Svetoch	*ne1Ne2s*	Don 85	Mironovskaya 808

Table 2 (continued). A pedigree analysis of the distribution of hybrid necrosis genes in cultivars of winter bread wheat from the Russian Federation.

Cultivar	Genotype	Presumed donor	Presumed source
Tau	*ne1ne2*	Mironovskaya 808	Mironovskaya 808
Veda	*ne1Ne2ms*	Zernogradka 6	Mironovskaya 808
Vostorg	*ne1Ne2s*	Pavlovka	Krasnodarskaya 39
Basalt	*ne1Ne2ms*	Mironovskaya 808	Mironovskaya 808
Odesskaya 200	*ne1ne2*	Yubileynaya 75 or Al'batros Odesskii	Odesskaya 51
Petrovchanka	*ne1ne2*	Yubileynay 75	Odesskaya 51
Prikumskaya 141	*ne1Ne2m*	Donskaya bezostaya	Mironovskaya 808
Stepchanka	*ne1Ne2m*	Pavlovka	Krasnodarskaya 39
Chernozemka 88	*ne1ne2*	Odesskaya 51	Ukraika and/or Zemka
Ariadna	*ne1ne2*	Odesskaya 51	Ukrainka and/or Zemka
Biruza	*ne1Ne2m*	Krasnodarskaya 39, Zimorodok	Krymka and/or Gostianum 237
Bogdanka	*ne1Ne2m*	Volzhskaya 16	Mironovskaya 808
Volzhskaya C 3	*ne1Ne2m*	Khar'kovskaya 92	Mironovskaya 808
Galina	*ne1ne2*	Odesskaya 51	Ukrainka and/or Zemka
Gratsia	*ne1ne2*	Leda (Odesskaya 51)	Ukrainka and/or Zemka
Gubernator Dona	*ne1ne2*	Odesskaya 51	Ukrainka and/or Zemka
Deviz	*ne1Ne2m*	Don 85, Kolos Dona	Mironovskaya 808
Dzhangal	*ne1Ne2m*	Donskaya bezostaya, Ershovskaya 3	Mironovskaya 808 and/or Lutestsens 230
Don 105	*ne1Ne2m*	Demetra, Don 93	Mironovskaya 808
Kamyshanka 3	*ne1Ne2m*	Khar'kovskaya 92	Mironovskaya 808
Korund	*ne1Ne2m*	Carstens VIII, Trumpf, Apollo	Krymka and/or Noe and/or Red Fife and/or Prince Albert
L'govskaya 4	*ne1ne2*	Yantarnaya 50, Zarya Bezostaya 1	?
Moscovskaya 56	*ne1Ne2m*	Mironovskaya poluintensivnaya	Mironovskaya 808 and/or Noe
Nemchinovskaya 24	*ne1Ne2m*	Donshchina	Mironovskaya 808
Odesskaya 267	*ne1Ne2m*	Mironovskaya 808, Inia 66	Mironovskaya 808, Frontana
Rodnik Tarasovskii	*ne1ne2*	Belotserkovskaya 198, Partizanka	Ukrainka and/or Autonomia
Resurs	*ne1ne2*	Al'batros Odesskii, Odesskaya 51	Ukrainka and/or Zemka
Rostovchanka 5	*ne1ne2*	Tarasovskaya 29, Peresvet, Odesskaya 51	Mironovskaya 264 and/or Ukrainka
Yunona	*ne1Ne2m*	Yugtina	Mironovskays 808 and/or Siete Cerros

nodarskaya 39. In the latter cases, the source of the dominant *Ne2* allele is Gostianum 237, an old cultivar of the Saratovskaya region. The donors of the recessive genotype *ne1ne1ne2ne2* in most instances are Bezostaya 1 and Odesskaya 51, which originate from Bezostaya 1. The donor of recessive alleles is the old cultivar Ukrainka.

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Ascorbate peroxidase induction in wheat lines infected by Heterodera avenae.

The cereal cyst nematode (CCN) (*Heterodera avenae* Woll.) is the most widely distributed and damaging species on cereals cultivated in less temperate regions. This nematode species has been detected in many countries and it is responsible for yield losses in wheat of up to 30%. The CCN induces syncytial feeding sites in the roots of its hosts. Infective, second-stage juveniles (J2) enter the plant roots at the level of the differentiation zone and penetrate intracellularly towards the vascular cylinder. Here, they select and pierce with their stylet a single cell where they release oesophageal secretions. In the following hours, the affected plant cells start to develop the feeding structures (Das et al. 2008). Plants defend themselves from nematodes using a variety of mechanisms, including rapid induction of localized necrosis at the site of infection (the hypersensitive response: HR), increased expression of defense-related proteins, production of antimicrobial compounds, lignin formation, and oxidative burst. Among the altered biochemical pathways are those involving peroxidases, which comprise a large group of enzymes that use different peroxides (ROOH) as electron acceptors. According to Welinder (1992) these enzymes in plants are classified into three classes (I, II, and III). Class-I enzymes are intracellular and are known as ascorbate peroxidase (APX, EC 1.11.1.11). Reactions catalyzed by APX and the cycle-coupled of AsA–GSH prevent the accumulation of toxic levels of H_2O_2 in photosynthetic organisms. APX activities are located in chloroplasts (chAPX), cytosol (cAPX), peroxisomes, or microbodies (pAPX) and mitochondria, each cellular compartment possessing one or several APX isoforms. In *Arabidopsis*, the same protein is dually targeted to mitochondria and chloroplast stroma (Chew et al. 2003).

Changes in APX enzyme activity in response to nematode *H. avenae* attack were studied in roots of three hexaploid wheat lines carrying *Cre2*, *Cre5*, and *Cre7* resistance genes and the susceptible *T. aestivum* cultivar Anza. Spectrophotometric analysis to study these changes was carried out with root extracts of infected and uninfected plants 4, 7, 11, and 14 days after nematode infection. APX induction in all infected resistant genotypes was higher than in the susceptible control. We analyzed whether this increase of activity was related to an increase of APX gene expression. This study was performed with the introgression wheat–*Ae. ventricosa* H-93-8 line, carrying *Cre2* gene, using its parental H-10-15 as susceptible control. APX genes of cytosolic location were induced in roots of plants attacked by the nematode. This induction took place earlier and with more intensity in the resistant line than in the susceptible one, and it was bigger in the root area where the nematode was settled down. Our results suggest that APX present in wheat roots could play a role in *Cre*-mediated resistance to *H. avenae*, either directly or indirectly. They also demonstrated that the biochemi-