Biology and biotechnologies

Selection of early ripe corn hybrids of universal use

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Abstract. The expansion of the northern zone of corn-sowing in the Russian Federation, the increase in demand for corn hybrids capable of maturing in zones with a short frost-free period, forming a high yield of grain and green mass, adapted to various soil and climatic zones, requires intensification of breeding work for early maturity. **The purpose** of the research is the creation of a new early-ripening corn hybrid of universal use, characterized by adaptability to various soil and climatic conditions. The research was carried out at the Agricultural Research Center "Donskoy" and research institutions in Russia in 2018–2021. **Methods.** The main method of creating hybrids is the method of interline hybridization using heterosis in the first generation. Topcross crosses were used to obtain hybrid combinations. **Object of the study** are early ripe corn hybrids. A new early-ripening corn hybrid Vityaz' MV of universal use was created jointly by the ARC "Donskoy" and the Federal State Budgetary Scientific Institution of the National Grain Center named after. P. P. Lukyanenko. It is included in the State Register of Breeding Achievements and approved for use in the production of the North Caucasian, Central, Central Black Earth and Middle Volga regions for grain and silage. According to the research **results**, the new hybrid is distinguished by high grain yield and plasticity. In the environmental test of research institutions in Russia, located in different soil and climatic conditions, the grain yield was 5.03–10.30 t/ha. In the ARC "Donskoy", the average grain yield, including dry years, was 4.31 t/ha, which is significantly (by 0.36 t/ha) higher than that of the Krasnodarskiy 194 MV standard. The yield of green mass – 28.2 t/ha, dry matter – 9.41 t/ha. The new hybrid is drought-resistant, resistant to lodging and bunt smut, and is characterized by low harvest grain moisture content (14.0 %). **The scientific novelty** should be considered the creation of a new early-ripening corn hybrid Vityaz' MV of universal use, adapted to various soil and climatic zones of the Russian Federation.
Keywords: hybrid, self-pollinated line, early ripeness, grain harvest moisture, yield, ecological test.

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Селекция раннеспелых гибридов кукурузы универсального использования

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Аннотация. Расширение северной зоны кукурузосеяния в Российской Федерации, возрастание спроса на гибриды кукурузы, способные вызревать в зонах с коротким безморозным периодом, формирующие высокий урожай зерна и зеленой массы, адаптированные к различным почвенно-климатическим зонам, требует усиления селекционной работы на раннеспелость. **Цель исследований** – создание нового раннеспелого гибрида кукурузы универсального направления использования, отличающегося адаптивностью к различным почвенно-климатическим условиям. Исследования выполнены в ФГБНУ «АНЦ «Донской» и научно-исследовательских учреждениях России в 2018–2021 гг. **Методы.** Основной метод создания гибридов – метод межлинейной гибридизации с использованием гетерозиса в первом поколении. Для получения гибридных комбинаций использованы топкроссные скрещивания. **Объект исследования** – раннеспелые гибриды кукурузы. Новый раннеспелый гибрид кукурузы Витязь МВ универсального использования соз-

дан совместно ФГБНУ «АНЦ «Донской» и ФГБНУ НЦЗ им. П. П. Лукьяненко. Он внесен в Государственный реестр селекционных достижений и допущен к использованию в производстве Северо-Кавказского, Центрального, Центрально-Черноземного и Средне-Волжского регионов на зерно и силос. По **результатам** исследований новый гибрид отличается высокой урожайностью зерна и пластичностью. В экологическом испытании научно-исследовательских учреждений России, расположенных в различных почвенно-климатических условиях, урожайность зерна составила 5,03–10,30 т/га. В ФГБНУ «АНЦ «Донской» средняя урожайность зерна, включая засушливые годы, составила 4,31 т/га, что существенно (на 0,36 т/га) выше, чем у стандарта Краснодарский 194 МВ. Урожайность зеленой массы – 28,2 т/га, сухого вещества – 9,41 т/га. Новый гибрид засухоустойчив, устойчив к полеганию и поражению пузырчатой головней, характеризуется низкой уборочной влажностью зерна (14,0 %). Научной новизной следует считать создание нового раннеспелого гибрида кукурузы Витязь МВ универсального использования, адаптированного к различным почвенно-климатическим зонам Российской Федерации.

Ключевые слова: гибрид, самоопыленная линия, раннеспелость, уборочная влажность зерна, урожайность, экологическое испытание.

Introduction

In the Russian Federation, maize hybrids of different maturity groups are cultivated: early-ripening (FAO 100-199), mid-early (FAO 200-299), mid-ripening (FAO 300-399), mid-late (FAO 400-499) and late-ripening (FAO 500-599). Recently, the demand for early-ripening corn hybrids has been increasing. This is explained primarily by the expansion of the northern border of corn sowing.

The creation and introduction of early ripe, cold-resistant corn hybrids capable of withstanding soil temperatures below the biological minimum is a condition for stable production of corn in the northern regions of Russia [1, p. 26].

For the regions of the Russian Federation, located on the border of the northern zone of corn-sowing, ultra-early corn hybrids are needed. Thus, in the conditions of the Omsk region, ultra-early hybrids (FAO 100-150) can be guaranteed to reach the physiological ripeness of the grain. The hybrids created on the basis of local inbred lines, which are characterized by precocity and adaptability to soil and climatic conditions, turned out to be the most adapted to cultivation [2, p. 7].

Agricultural producers place increased demands on the moisture yield of grain during corn ripening, this feature is important for hybrids of different ripeness groups. It should be noted that domestic research institutions lag behind in this area of breeding in comparison with foreign breeding and seed companies. The creation of domestic hybrids of corn of various ripeness groups with a high intensity of grain drying during ripening and, as a result, low harvesting moisture will increase their competitiveness. As a rule, it is the early ripening hybrids that have lower harvest grain moisture compared to other ripeness groups.

The rate of moisture loss by grain depends on the genotype, therefore, hybrids of the same ripeness group, having different moisture yield, differ in the value of harvest moisture [3, p. 55], this also applies to hybrids of the early ripening group [4, p. 19].

Comparison of decreasing rate in grain moisture at different stages of development made it possible to establish significant differences in the intensity of moisture loss in inbred lines of different origin. New self-pollinated lines of Iodent plasma have been created, which can be used in breeding programs to create new corn hybrids with a rapid loss of grain moisture for various regions of Russia and, first of all, for the northern regions of corn-sowing. [5, p. 3].

The results of studying the dynamics of moisture loss in the grain of ultra-early ripe corn hybrids in the conditions of the southern Urals made it possible to conclude that a short vegetation period is a priority trait in corn breeding for the northern corn-sowing zone, and the ability of corn hybrids to quickly lose moisture provides additional technological advantages and guarantees the versatility of using the hybrid in various environmental conditions [6, p. 3].

Information about adaptability is important for making a decision in which ecological zones it is recommended to grow early-ripening hybrids [7, p. 68]. It is necessary to assess the adaptability of early ripening hybrids for each specific region [8, p. 40; 9, p. 50; 10, p. 119].

Particular attention should be paid to the selection of starting material for the creation of early ripe maize hybrids [11, p. 198]. Evaluation of the combination ability of early maturing material – the ability in crosses to produce hybrid offspring with high grain yield and low harvesting moisture content - is one of the necessary steps in the creation of new early maturing corn hybrids of practical interest [12, p. 55; 13, p. 118].

The use of CMS is a condition for the introduction of early ripe corn hybrids into the production and conduct of industrial seed production. To do this, the response of early maturing lines to sterile cytoplasm is preliminarily assessed [14, p. 128].

Breeding for early ripeness of corn is also important for the southern regions of Russia; early ripening hybrids are in demand in the south, since they can be used as a precursor for winter crops. In the arid zones of southern Russia, early-ripening hybrids, as a rule, go through a critical period of plant development (flowering, pollination, seed setting) before the onset of maximum air temperature and dry winds, due to which they can form a crop no less than hybrids of later ripeness groups, while having dry grain [15, p. 33]. The creation and study of a new early ripe source material made it possible to identify hybrid combinations whose critical development phases fall on more optimal weather conditions. Such hybrid combinations formed a high grain yield [16, p. 35].

Breeding for early maturity is relevant not only for Russia, where significant corn crops are located in areas with a short frost-free period. Foreign researchers are also intensively working in this direction. Particular attention is paid to the creation of a new early maturing source material [17, p. 180], expansion of the gene pool for breeding for early maturity [18, p. 302]. Studies have been carried out on the moisture yield of early-ripening corn hybrids [19, p. 536; 20, p. 1526]. It was revealed that the adaptive abilities of a variety or hybrid may depend on the time of flowering (early ripening) [21, p. 153].

Research institutions of the Russian Federation have created and used in production early-ripening corn hybrids. However, given the growing demand for hybrids of this ripeness group, the wide variety of soil and climatic conditions in Russia, the need for early-ripening hybrids for various economic uses, breeding for early maturity is the most important area of maize breeding in the Russian Federation, it is necessary to strengthen work in this area.

The purpose of the research is the creation of a new early ripe corn hybrid of universal use, which is characterized by adaptability to various soil and climatic conditions.

Methods

The studies were carried out at the Donskoy Research Center and research institutions of the Russian Federation in 2018–2021. Ecological testing of corn hybrids was carried out in research institutions located in various soil and climatic zones of Russia: Voronezh branch of the All-Russian Research Institute of Corn (Voronezh region), Belgorod Federal Agrarian Research Center of the Russian Academy of Sciences (Belgorod region), Russian Research and Design Institute of Sorghum and Corn "Rossorgo" (Saratov region), Volga branch of the Federal State Budgetary Scientific Institution of Higher Educational Institutions of Higher Education "Leader" (Volgograd region), Federal State Budgetary Scientific Institution Kabardino-Balkarian Research Center of the Russian Academy of Sciences (Kabardino-Balkaria), Kuban Seed Breeding (Krasnodar Krai), Samara Research Institute of Agriculture (Samara region). The object of research was early ripe corn hybrids. To create new hybrids, the source material of the National Grain Center named after. P. P. Lukyanenko – testers (simple and sister hybrids) and new early ripe self-pollinated lines of the ARC "Donskoy".

The main method of creating hybrids is interline hybridization using heterosis in the first generation (F1). Hybrid combinations were obtained in the system of complete topcross crossings. As maternal forms there were used simple and sister sterile hybrids, and as paternal forms, new homozygous self-pollinated lines were used. The laying of field experiments, measurements, observations were carried out in accordance with the Methodology of the state variety testing of agricultural crops (2019).

The soil of the experimental plot is ordinary calcareous heavy loamy chernozem, the thickness of the humus horizon is up to 140 cm.

The climate of the zone is continental. The average long-term precipitation for the growing season of corn (May – August) is 225.5 mm, for the year 489 mm, the hydrothermal coefficient is 0.7–0.8.

The main factor limiting grain yield in the research area is moisture. All years of the experiment turned out to be dry to varying degrees. The average long-term precipitation (225.5 mm) that falls during the growing season of corn is not enough for the good development of corn plants and the formation of a high grain yield. However, not in all years of research, the amount of precipitation was equal to the average long-term value. So in 2018, only 46.6 % of the average annual norm fell, in 2019–70.8 %, in 2020 and 2021 the amount of precipitation corresponded to the average annual norm, however, their distribution during the growing season was uneven, as a result of which in the second half of the growing season drought was noted. The points of the ecological test were very contrasting in terms of moisture supply and temperature regime, which made it possible to evaluate the adaptability of the new hybrid Vityaz' MV to various soil and climatic zones of the Russian Federation.

Results

The new corn hybrid Vityaz' MV was created jointly by the Agrarian Research Center "Donskoy" and the National Grain Center. P. P. Lukyanenko. The hybrid is included in the State Register of Breeding Achievements of Russia and approved for use in the production of the North Caucasus, Central, Central Black Earth and Middle Volga regions for grain and silage since 2023. The new hybrid belongs to the type of simple modified by the number of its original forms. It was obtained by

crossing a simple sister sterile hybrid KR 742 UM – the maternal form with a self-pollinated line (fertility restorer) KV 215 MV – the paternal form. The maternal form was created National Grain Center named after. P. P. Lukyanenko, paternal – in the Federal State Budgetary Scientific Institution "Agrarian Research Center "Donskoy". The new hybrid was created thanks to the cooperation of institutions for breeding and seed production of corn. A sister sterile hybrid was submitted for inclusion in the crossbreeding program. It was used as one of the testers in the system of topcross crossings with new self-pollinated lines created at the ARC "Donskoy". The hybrid combination KR 742 UM × KV 215 MV was obtained in 2015, isolated in 2016 in the control nursery, studied and singled out as one of the best in 2017 in the preliminary, and in 2018–2020 – in the competitive testing of early ripe corn hybrids.

An environmental test of the hybrid in the institutions of the Russian Federation was carried out in 2018–2021. Based on the results of the competitive testing in 2018–2020, the new hybrid was submitted for State Variety Testing in 2020. Corn hybrid Vityaz' MV

belongs to the subspecies of dentate corn (Zea mays L. indentata). A characteristic feature of the subspecies is a tooth-like grain, elongated, flat. The endosperm on the sides of the caryopsis is horn-shaped, in the center and apex mealy, friable. When ripe, a depression forms at the top. The cob is slightly cone-shaped, the core of the cob is red. The hybrid is characterized by remontance – the preservation of the green color of the leaves after ripening (Fig. 1).

The hybrid is early ripe (FAO 170), the duration of the growing season is 95–100 days. The plant is medium-sized (185–200 cm), non-bushing, well leafy (14–15 leaves), with a high attachment of the lower economically suitable cob (65–70 cm).

The ear is medium (120–130 g), 16–18 cm long, rows of grains 14–16, grain yield during threshing 76–78 %. The grain is yellow, the weight of 1000 seeds is 220–230 g.

The average grain yield for 3 years of the competitive test (2018–2020) was 4.37 t/ha, exceeding the Krasnodarskiy 194 MW standard by 0.36 t/ha (9.0 %) (Table 1).

Fig. 1. Plant, cob and grain of corn hybrid Vityaz' MV

Table 1

Economic and biological characteristics of the corn hybrid Vityaz' MV (ARC "Donskoy", 2018–2020)

Signs	Unit of measurement	Vityaz' MV	Krasnodarskiy 194 MV, standard	± to standard
Grain yield at 14% moisture	t/ha	4.37	4.01	+0.36
Grain moisture	%	14.0	14.2	–0.2
Length of the growing season	day	96	96	0
Lodging	%	1.1	2.0	–0.9
Bladder smut injury	%	2.0	5.9	–-3.9
Plant height	cm	185.5	185.0	+0.5
Cob attachment height	cm	67.0	67.0	0
Number of cobs per 1 plant	units	1.1	1.0	+0.1
Seed productivity of the maternal form	t/ha	2.0	2.0	0

Table 2

Elements of the grain yield structure of early-ripening corn hybrids (ARC "Donskoy", 2018–2020)

Hybrid	Number of cobs per 1 plant, pcs.	Weight of 1 cob, g	Weight of 1000 seeds, g	Quantity, pcs.			Grain yield, %
				rows of grains	grains in a row	grains on the cob	
Krasnodarskiy 194 MV, standard	1.0	103	246	15	32	468	80.8
Vityaz' MV	1.1	117	220	16	32	505	77.1
± to standard	+0.1	+14	-26	+1	0	+37	–3.6
S	0.07	10	23	1.2	3	59	3.2

Table 3

Yield of green mass and dry matter of early ripe corn hybrids

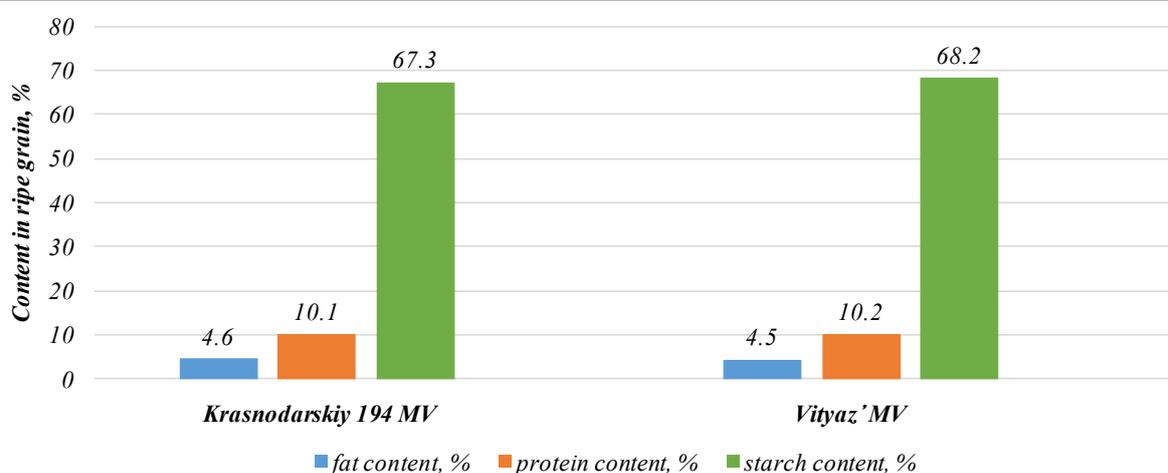| Hybrid	Green mass yield, t/ha	± to standard		Dry matter yield, t/ha	± to standard	
		t/ha	%		t/ha	%
Krasnodarskiy 194 MV, standard	26.4	–	–	8.39	–	–
Vityaz' MV	28.2	+1.8	+6.8	9.41	+1.02	+12.2
$LSD_{0.5}$	1.3			0.59		

Fig. 2. Results of biochemical analysis of grains of early-ripening maize hybrids (ARC "Donskoy", 2019–2020)

The hybrid is characterized by high resistance to lodging and brittleness of the stem, drought-resistant, resistant to damage by dusty, blister smut and southern helminthosporiasis, weakly affected by stem rot.

One of the most important advantages should be considered low harvest moisture content of grain. When sown at the optimal time (mid-late April), it is able to dry on the vine to a standard moisture content (14 %) by early September, that is, grain drying is not required and, as a result, growing costs are reduced. Considering that the new hybrid is ready for harvest in early September, it can serve as a precursor for winter crops. Seed production is carried out on the sterile cytoplasm of the Moldavian type CMS according to the fertility restoration scheme. The maternal form is characterized by high seed productivity, and the paternal form is characterized by good pollen formation ability. Sowing on the site of hybridization of the paternal and mother forms at the same time, at the same time. The yield of seeds from the hybridization site averages 2 t/ha.

The results of the structural analysis indicate that the increase in grain yield in the new hybrid Vityaz' MV compared to the Krasnodarskiy 194 MV standard occurred due to various productivity traits. Thus, the new hybrid had the indicator "number of cobs per 1 plant" – 1.1 pcs., that is, there were no barren plants in the crops of the new hybrid, moreover, and every tenth plant had 2 full ears, which is a very good indicator for arid conditions. The standard hybrid also did not have barren plants, but the value of the trait "number of cobs per 1 plant" was lower (1.0 pcs.). The hybrid Vityaz' MV was characterized by a cob weight (117 g), 14 g more than that of the Krasnodarskiy 194 MV standard. In addition to this, the new hybrid had a high value (505 pcs.) of the trait "number of grains on the cob" – by 37 pcs. more than the standard (Table 2).

According to the results of biochemical analysis of grain, the Krasnodarskiy 194 MV standard revealed an average starch content (67.3 %), a low protein content (10.1 %) and an average fat content (4.6 %). The new hybrid Vityaz' MV had no significant differences from the standard in terms of the biochemical composition of the grain: the starch content was average (68.2 %), protein was low (10.2 %), fat was average (4.5 %) (Fig. 2).

The possibility of universal use of the Vityaz' MV hybrid was studied: for grain and silage (Table 3).
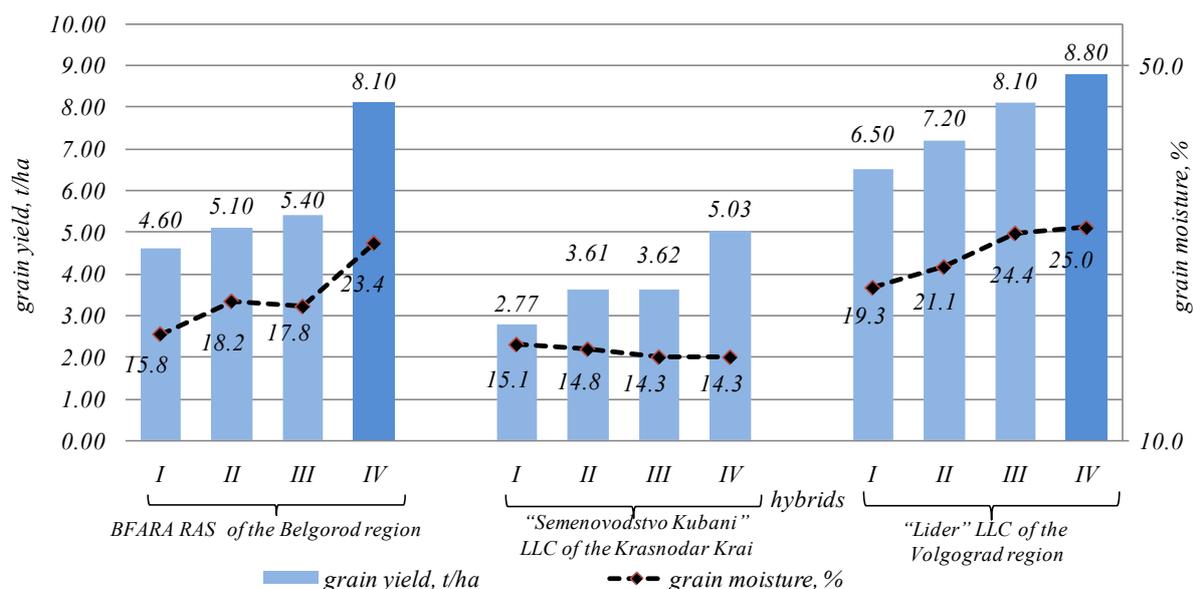
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Fig. 3. Yield and harvesting moisture content of grain standards and early-ripening maize hybrid Vityaz' MV at various points of ecological testing (Belgorod region, Krasnodar Krai, Volgograd region), 2018
I – Katerina SV, II – Ross 140 SV, III – Krasnodarskiy 194 MV, IV – Vityaz' MV

Table 4
The results of the ecological test of the corn hybrid Vityaz' MV, 2019

Test point	Hybrid	Grain yield, t/ha	± to the best standard, t/ha	Harvesting grain moisture, %
Samara Research Institute of Agriculture (Samara region)	Baykal MV, standard	4,87	–	26,0
	Vityaz' MV	6,26	+1,39	26,6
Volga branch of the All-Russian Scientific Research Institute of Irrigated Agriculture (Volgograd region)	Ross 140 SV, standard	4,70	–1,20	17,4
	Baykal MV, standard	5,30	–0,60	20,6
	Krasnodarskiy 194 MV, standard	5,90	–	21,3
	Vityaz' MV	6,10	+0,20	20,9
"Lider" (Volgograd region)	Ross 140 SV, standard	7,50	–1,20	22,4
	Baykal MV, standard	8,20	–0,50	21,3
	Krasnodarskiy 194 MV, standard	8,70	–	23,6
	Vityaz' MV	8,80	+0,10	24,3

The yield of green mass in the Vityaz' MV hybrid on average for the study period (2019–2021), including dry years, was 28.2 t/ha, which is significantly (by 1.8 t/ha or 6.8 %) higher than than the hybrid Krasnodarskiy 194 MV, which was adopted by the State Commission as an early ripening standard when studying for silage. The dry matter yield of the new hybrid was 9.41 t/ha, which is also significantly 1.02 t/ha (12.2 %) higher than that of the standard.

An environmental test of the new early ripe hybrid Vityaz' MV was carried out in institutions of the Russian Federation in 2018–2021. The test was carried out in order to determine the adaptability of the hybrid to the conditions of various soil and climatic zones of Russia. The number of test points and the list of points depended on the number of seeds of the hybrid in the years of testing, as well as on the possibilities of conducting such an experiment by research institutions. The best domestic early-ripening corn hybrids in-

cluded in the State Register of Breeding Achievements of the Russian Federation were used as standards in the experiments: Katerina SV, SV, Baykal MV (All-Russian Research Institute of Maize), Krasnodarskiy 194 MV, Ross 140 (National Grain Center named after P. P. Lukyanenko) and early maturing hybrid Mas 10 A (MAS Seeds).

In 2018, a new hybrid at three points of ecological testing ("Lider" LLC of the Volgograd Region, "Semenovodstvo Kubani" LLC of the Krasnodar Krai, BFARC RAS of the Belgorod region) formed a high grain yield (5.03–8.80 t/ha), significantly exceeding all standards, including the best in every test item. The excess over the standards was: Katerina SV – 2.26 - 3.50 t/ha (35.4–81.6%), Ross 140 SV – 1.42–3.00 t/ha (22.2–58, 8%), Krasnodarskiy 194 MV – 0.70–2.70 t/ha (8.6–50.0 %). In "Semenovodstvo Kubani", the harvest moisture content of grain was 14.3 %, which is at the level of the best standard (Fig. 3).

Table 5
The results of the ecological test of the corn hybrid Vityaz' MV, 2020–2021

Test point	Grain yield, t/ha				
	Vityaz' MV	*Ross 140 MV, standard*	*Baykal MV, standard*	*MAC 10A / Krasnodarskiy 194 MV, standard*	*± to the best standard*
2020					
"Lider", Volgograd region	8.80	5.60	6.20	6.00*	+2.60
Volga branch of the All-Russian Scientific Research Institute of Irrigated Agriculture (Volgograd region)	5.10	3.10	4.20	3.50*	+0.90
Belgorod Federal Agrarian Research Center of the Russian Academy of Sciences (Belgorod region)	10.30	10.40	6.40	7.70*	–0.10
Kabardino-Balkarian Scientific Center of the Russian Academy of Sciences (Kabardino-Balkarian Republic)	8.15	3.81	–	6.83**	+1.32
2021					
"Lider" (Volgograd region)	9.60	6.30	7.00	8.50*	+1.10
Kabardino-Balkarian Scientific Center of the Russian Academy of Sciences (Kabardino-Balkarian Republic)	6.45	–	4.64	4.04**	+1.81
"Rossorgo" (Saratov region)	5.80	3.78	2.98	4.69*	+1.11
Voronezh branch of the All-Russian Research Institute of Corn (Voronezh. region)	6.34	4.64	5.17	4.75*	+1.17

*Note. * MAC 10A. ** Krasnodarskiy 194 MV.*

In 2019, the new corn hybrid Vityaz' MV was equal in terms of grain yield to the best standard (Krasnodarskiy 194 MV) in two study points (Volga branch of the All-Russian Scientific Research Institute of Irrigated Agriculture and "Lider" LLC). There was a slight excess over the standard (0.1–0.2 t/ha). However, in the same areas, the other standards (Ross 140 SV and Baykal MV) were significantly higher by 0.5–1.4 t/ha or by 6.1–29.8 %. In terms of harvesting grain moisture (20.9 % and 24.3 %), the new hybrid in these points was equivalent to the best standard Krasnodarskiy 194 MV (21.3 % and 23.6 respectively).

In the Samara Research Institute of Agriculture, where one standard, Baikal MV, was sown, the excess was significant (1.39 t/ha or 28.5 %), with approximately the same harvesting grain moisture content (26.0 % for the standard and 26.6 % for the new hybrid).

In 2020–2021, the ecological study of the corn hybrid Vityaz' MV was continued in points located in different regions of the Russian Federation. The best early-ripening hybrids of domestic selection (Ross 140 MV and Baykal MV) and foreign early-ripening hybrid MAS 10A were taken as standards. In Kabardino-Balkarian Research Center of the Russian Academy of Sciences, the Krasnodarskiy 194 MV hybrid was used instead of MAS 10A (Table 5).

In 2020, at three points ("Lider", Volga branch of the VNIIOZ, Institute of Agriculture of the Kabardino-Balkarian Scientific Center of the RAS), the Vityaz' MV hybrid exceeded the best standard in terms of yield by 0.90–2.60 t/ha. In the Belgorod Federal Agrarian Research Center of the Russian Academy of Sciences, it was equivalent to the best standard Ross 140 MB (10.40 t/ha), forming a grain yield of 10.30 t/ha.

In 2021, the Vityaz' MV hybrid at four points ("Lider" LLC, Institute of Agriculture of the Kabardino-Balkarian Scientific Center of the RAS, ROSNIISK "Rossorgo", Voronezh branch of the All-Russian Research Institute of Corn) significantly exceeded the best standard in terms of grain yield (by 1.10–1.80 t/ha).

The maximum yield of a new early-ripening corn hybrid Vityaz' MV was obtained at Belgorod Federal Agrarian Research Center of the Russian Academy of Sciences and amounted to 10.3 t/ha. The results of the ecological test indicate a high potential yield. High grain yield, exceeding the standards in various soil and climatic conditions indicates the high plasticity of the new corn hybrid. Due to the high plasticity, the new hybrid received a wide area of zoning – four regions of the Russian Federation.

Discussion and Conclusion

A new simple corn hybrid was created jointly by the ARC "Donskoy" and the Federal State Budgetary Institution of National Grain Center named after P. P. Lukyanenko, thanks to the exchange of source material and its inclusion in crossbreeding programs. The hybrid is

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characterized by high values of the main economically valuable traits: the yield of grain and green mass, high drought resistance, resistance to lodging and damage to blister smut. One of the most important advantages of the hybrid should be considered the ability to dry on the vine to standard humidity (14 %), the ability to use it as a predecessor for winter crops due to the early release of fields in southern Russia. Due to the short vegetation period (95–100 days), the hybrid is suitable for cultivation in the northern regions of Russia with a short frost-free period. The new hybrid showed high plasticity – it formed a high grain yield (5.03–10.30 t/ha) in the environmental test of institutions of the Russian Federation located in various soil and climatic zones. The corn hybrid Vityaz' MV is distinguished by its versatility of use: for grain and silage. It is included in the State Register of Breeding Achievements and approved for production for grain and silage in the North Caucasus, Central, Central Black Earth and Middle Volga regions of the Russian Federation.

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