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CULTIVAR RELEASE

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SCS121 CL: Rice cultivar resistant to herbicides of imidazolinone chemical group

Moacir Antonio Schiocchet[1], Jose Alberto Noldin[1], Rubens Marschalek[1], Ester Wickert[1], Gabriela Neves Martins[1], Domingos Savio Eberhardt[1], Eduardo Hickel[1], Ronaldir Knoblauch[1], Klaus Konrad Scheuermann[1], Juliana Vieira Raimondi[2] and Alexander de Andrade[1*]

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Abstract – SCS121 CL is a second-generation Clearfield® rice cultivar with resistance to herbicides of the imidazolinone group. The cultivar has modern plant type, lodging resistance, late maturity cycle, high yield potential, long grains and good cooking quality. The cultivar is recommended to all rice-producer regions of Santa Catarina, Brazil.

Key words: Oryza sativa*, clearfield, imazethapyr.*

INTRODUCTION

Rice (*Oryza sativa* L.) is among the most widely consumed grains in the world, and controlling weed infestation is especially difficult in paddy rice. The main limiting factor to rice yield is weed rice, particularly red rice, which can severely reduce rice yield worldwide. The use of imidazolinone-resistant rice cultivars improve weed control, mainly spontaneous rice, reducing costs and labor associated with manual removal of red rice. Herbicide-resistant rice is particularly useful where rice is direct-seeded. *Clearfield*® cultivars (CL) are resistant to inhibiting herbicides in the acetohydroxyacid synthase (AHAS) mode of action, providing an efficient opportunity to control red rice infestations. This technology is an important alternative for controlling the main weeds in irrigated rice fields.

SCS121 CL imidazolinone-resistant rice cultivar was developed by Epagri Rice Breeding Program with collaboration of Basf S.A. Industrial tests carried out with this cultivar showed that grains are suitable for parboiled and milled rice. The cultivar is recommended to all rice-producer regions of Santa Catarina, including the pre-germinated crop system.

PEDIGREE AND BREEDING METHOD

SCS 121CL was derived from a single cross in 2001 between PCW16 line and Epagri108 cultivar. PCW16 line carries genes for resistance to herbicides of the Imidazolinones chemical group, such as Kifix®. In 2002, backcrossing was carried out with SCH01-743 line, being Epagri 108 the recurrent parent; the F_1 resulting was named SCH01-1024. In the following year (2003), another backcross was carried out between SCH01-1024 and Epagri 108, giving rise to SCH02-1157. The seeds obtained in the last backcross of F_1RC_2 population were sown to form the F_2 population. F_2RC_2 generation plants showed genetic variability. From that, the process of selection started for phenotypic traits of interest, such as plant type, height, yield, grain type, grain number, panicle type, and especially resistance to herbicides of the Imidazolinones group. Seeds of plants selected in this population formed the F_3RC_2 generation, which, in turn, originated the F_4RC_2 generation. At this point, agronomic evaluations (potential of yield) and confirmation of resistance to herbicides of the Imidazolinones group were carried out. Seeds of the plants selected in F_4 formed lines routed to the preliminary assessment, F_5. During these stages, populations were subjected to favorable conditions for the occurrence of blast (*Pyricularia oryzae*), in order to select genotypes with disease tolerance. In the F_6 generation (2011/2012), the line received the name SC 742, and was evaluated for

[1] Epagri, EEI, C.P. 277, 88.318-112, Itajaí, SC, Brazil. *E-mail: alexanderdeandrade@epagri.sc.gov.br
[2] Universidade Federal de Santa Catarina, RGV, 88.034-001, Florianópolis, SC, Brazil

yield potential, lodging resistance, plant height, tolerance to iron toxicity, blast incidence and grain quality (Marschalek el al. 2008). SC 742 line was considered promising, and was registered in Epagri's linebank. Moreover, it was included in trials for assessing the Value for Cultivation and Use (VCU), carried out for two seasons (2012/13 and 2013/14) in Itajaí, Araranguá and Mirim Doce. Statistical analysis was carried out using the Scott-Knott test at 5%. SC 742 line showed uniformity, good milling yield and yield performance, it was suitable for milled rice and parboiled rice. Besides, it presented lodging resistance, and moderate resistance to blast. Based on the performance in VCU trials, SC 742 line was released in 2014, as SCS121 CL.

Table 1. Agronomic characteristics of SCS121 CL cultivar, observed in VCU trials (Itajaí, Araranguá and Mirim Doce), in 2013/2014

Plant trait	Description
Leaf color	Green
Leaf pubescence	Medium
Flag leaf angle	Upright
Tillering	High
Cycle to maturity	141 days
Plant height	85 cm
Lodging	Resistant
Disease resistance to	
Leaf blast	Moderately resistant
Panicle blast	Moderately resistant
Brown spot	Moderately resistant
Iron toxicity tolerance	Moderately resistant
Glumella color	Golden
Apex color at maturity	White
Awns	Absent
Shattering	Intermediate

PERFORMANCE

SCS121 CL is a rice cultivar of second-generation with resistance to Kifix®, which is a herbicide of the Imidazolinones chemical group. This technology enables the control of most weeds present in rice fields with a single application of the herbicide, reducing the use of agrochemicals in rice fields. The agronomic characteristics of SCS121 CL cultivar are listed in Table 1. The assessments were based in Embrapa (1977). SCS121 CL is a modern plant type with late maturity life cycle (141 days), high tillering capacity, and hairy leaves. The cultivar is resistant to lodging, a trait considered essential to the water-seeded system that is commonly used in the states of Santa Catarina and Rio Grande do Sul. The cultivar also presents intermediate abscission, moderate resistance to iron toxicity and moderate resistance to leaf and panicle blast disease. SCS121 CL presented in VCU trials (in Itajaí, Araranguá and Mirim Doce) mean yield of 8.51 t ha^{-1}, which is higher than the control groups (Table 2). SCS121 CL showed good processing performance and excellent characteristic regarding industrial performance. Due to its herbicide resistance, associated with good agronomic, industrial and sensory performance, this cultivar is recommended to all rice-producer in the region of Santa Catarina.

OTHER CHARACTERISTICS

SCS121 CL has long and translucent grains with good milling quality and good cooking characteristics. Milling yield was 71.0% (Table 3). The evaluations for the industrial grain traits showed that the cultivar is suitable for the parboiling process, and that both milled rice and parboiled

Table 2. Mean grain yield (t ha^{-1}) of SCS121 CL, Puitá INTA-CL, and SCS117 CL, in VCU trials (Itajaí, Araranguá and Mirim Doce), in 2012/2013 and 2013/2014

Cultivars	Itajaí		Araranguá		Mirim Doce		Means
	2012/13	2013/14	2012/13	2013/14	2012/13	2013/14	
	t ha^{-1}						
SCS121 CL	10.40	7.70	8.50	7.20	8.10	9.2	8.51 a
Puitá INTA-CL	7.70	6.80	9.70	7.50	4.60	8.1	7.40 b
SCS117 CL	8.40	7.80	6.50	5.60	5.10	7.8	6.86 b

Means followed by the same letter are not significantly different by the Scott-Knott's test at 5% probability.

Table 3. Physical and chemical grain characteristics of SCS121 CL rice cultivar compared to SCS117 CL and Puitá INTA-CL

Cultivars	Characteristics				Grain size (mm)				
	Total	AC	GT	WB	L	W	T	L/W	Grain classification
SCS121 CL	71.0	A	I/H	2	7.5	2.2	1.80	3.48	long-thin
SCS117 CL	70.0	A	H	1	7.1	2.3	1.70	3.10	long-thin
Puitá INTA-CL	69.0	A	I	1	7.1	2.3	1.74	3.38	long-thin

Total: Total percentage of grain milled; AC: Percentage of amylose content; GT: Gelatinization temperature (I: intermediate, H: high); WB: White belly; L: Grain length; W: Grain width; T: Thickness; and L/W: Length width ratio.

grains presented glassy appearance. Cooking tests confirmed the excellent quality, since grains remain loose with soft texture, good aroma and normal taste. Sensory evaluation resulted in good consumer acceptance, both as parboiled and milled rice.

SEED MAINTENANCE AND DISTRIBUTION

SCS121 CL is protected by the Ministério da Agricultura, Pecuária e Abastecimento -MAPA (Ministry of Agriculture, Livestock and Supply) under the registration number 20150071. Genetic seed stock is kept in Epagri, at Itajaí Experiment Station, located at Rodovia Antônio Heil, n.6800, Itaipava, P.O. Box 277, CEP 88301-970, Itajaí, SC, Brazil. This cultivar is licensed to Basf and seed production by Acapsa (Santa Catarina Rice Seed Producers Association).

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