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CULTIVAR RELEASE

BRSGO Serra Dourada: upland rice cultivar for family agriculture in the State of Goiás

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Abstract - *The release of rice cultivar BRSGO Serra Dourada was based on favorable results from evaluation trials and units of observation implemented in farmers' properties. These farmers preferred the new cultivar, mainly due to its grain quality, resistance to lodging and blast (*Magnaporthe grisea*) and good productive potential*.

Key words: *participatory breeding, lines, grain yield.*

INTRODUCTION

The upland rice is performed almost in all regions of Brazil with wide diversity of crop growing, from crops with high-end techniques to subsistence agriculture, which is quite used by small farmers and has a very important social role. The advance obtained from the genetic breeding of this culture led to the development of more productive and precocious cultivars with erect leaves, which are quite responsive to the environment improvement and to the good quality of grains. This enables to expand crops throughout the country, which makes them more competitive in many agricultural systems. The limitations to expand cultivation in other environments start to appear when small farmers use modern cultivars, so the productive potential of these genotypes is not reached due to the handling method chosen. These farmers cannot afford to invest in technologies, so they use regions with low potential for fertility and with hydric deficiency.

The sustainability of upland rice cultivation in small farms has required cultivars with features that are compatible with a type of agriculture involving low investments on inputs. In general, these cultivars are more efficient on the use of soil nutrients, and have more initial strength, more ability to compete with plant pest and are more resistant to diseases. In the state of Goiás, for example, about 70% of rural establishments are family agriculture in which production of uplands rice appears as its main activity (IBGE 2006). Out of 120 thousand hectares of paddy fields in the state, about 80 thousand hectares are community crops.

The situation diagnosed along with family agriculture in the state of Goiás, similar to other regions of the country, requires new strategies to respond to this segment. In this context, the Federal University of Goiás (UFG), Emater-GO and Embrapa Arroz e Feijão, presented in 2004 a proposal for intervention in small producers land in order to develop, validate, and disseminate, in a participative way, new upland rice cultivars. Also to acquire more specific knowledge, which leads to the sustainability of rice cultivation as an economic activity. The BRS Serra Dourada cultivar represents the first actual work from this partnership.

METHOD FOR IMPROVEMENT

BRSGO Serra Dourada resulted from a biparental cross that was made in 1995 at Embrapa Arroz e Feijão, involving Katy, an American irrigated rice line, as female genitor, and Confiança, a Brazilian upland rice cultivar, as male genitor. Confiança resulted from IAC 164 and Rio Verde crossing, both known by their high level of drought resistance. Katy is highly known by its high quality grains. In 1995/96 agricultural year,

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the F_1 generation of the above mentioned crossing was planted, and all plants were harvested together. In the next year, the F_2 seeds were planted in uplands in 20 lines of 5 m, in low density from 15 seeds m^{-1} and 40 cm between lines. After germination, the plants underwent thinning and were placed individually to ease selection of plants in plain maturation phase. The population was promising and 132 single-plant were selected. The $F_{2:3}$ generation was advanced in the off season of 1997 at the city of Formoso do Araguaia, state of Tocantins. In 1997/98 growing season, the families $F_{2:4}$ were evaluated in Santo Antônio de Goiás with sowing in November, in plots of four lines of 5 m. The selection among families was made obtaining the better $F_{2:5}$ families, which were sought in November of the following year (1998/1999), in plots of eight lines with 40 cm of space with low density. In maturation phase, the selection of single-plant was performed in each family, which progenies were evaluated in line observation trial (EOL) in 2000/2001. The line represented by progeny of plant 2, selected in family CNAx6629-M-74-B-M-M, was, among others, identified as promising.

In 2001/02, line selected in EOL of previous year were evaluated in a preliminary trial of productivity in which line CNAx6629-M-74-B-M-M-2 was identified as BRA01653 and remained with this identification along the other trials. In 2002/03 growing season, BRA01653 was evaluated in Regional Trials of Yield (RTY) of upland rice, which was performed by Embrapa in the states of Goiás, Mato Grosso, Rondônia, Pará and Piauí. In the next agricultural year, BRA01653 was integrated in a participatory breeding of upland rice, conducted with a partnership among UFG, EMATER-GO, and Embrapa Arroz e Feijão. In 2003/04, 2004/05 and 2005/06, BRA01653 was included in Value for Cultivation and Use (VCU) trials performed in Goiás by the three institutions. In this last agricultural year, units of evaluation were integrated and introduced in properties of small farmers in Rubiataba and at settlement Canudos, which includes cities of Guapó, Palmeira de Goiás, and Campestre. In these units, BRA01653 was one of the most requested lines by the farmers, who were previously trained to implement evaluations by using their own procedures of participatory breeding. In 2006/07, the genetic seeds were concluded, and detailed studies about grains quality and resistance to blast were developed. These studies were essential to consolidate the choice for BRA01653, out of other three, as the line to be released as cultivar for family agricultures in the State of Goiás.

Performance characteristics

The results from 11 Value for Cultivation and Use (VCU) trials of BRSGO Serra Dourada are shown in Table 1, in comparison with BRS Primavera (Soares et al. 2001) and Caiapó controls. The new cultivar is distinguished from the controls for being lower, and for presenting higher whole grains percentage than the ones from BRS Primavera, and similar whole grain percentage to the ones from Caiapó. Its lower plant height is similar to BRSMG Curinga (Soares et al. 2005) and it must be in accordance to its good resistance to lodging. In any experimental unit (trials or small crops) lodging was observed in new cultivar. In relation to the whole grains percentage, the sector prefers cultivars with high values, once it can offer better prices to its suppliers according to rice development that is bought taking into account this characteristic.

Table 1. Mean of grain yield (GY), days to flowering (FLO) and plant height (PH) of rice cultivars evaluated in 11 environments in 2003/04, 2004/05 and 2005/06 and whole grain percentage (G_{int}) in three locals in 2003/04, in the State of Goiás

Cultivars/Lines	**GY** (kg ha^{-1})	**FLO** (day)	**PH** (cm)	**G_{int}** (%)
BRS Primavera	3659	76.0	103.6	49.5
Caiapó	3488	89.8	115.9	59.9
BRSGO Serra Dourada	3500	76.8	98.0	56.0
CV (%)	18.24	1.71	4.51	-

BRSGO Serra Dourada resistance to blast compared to BRS Primavera was observed in a study made in 2008/09, at Embrapa Arroz e Feijão (Table 2). The plot of each line was subdivided in six subplot of sowing time with an interval of 15 days. This way, blast occurrence in a determined subplot of a line empowers, in a growing way, the incidence of diseases in subplots that were posteriorly cultivated, thus evaluation becomes more rigorous.

Table 2. Blast aggravation in leaves, in panicles and smudged grains in BRSGO Serra Dourada and BRS Primavera in five periods of cultivation

Cultivation period	**Leave Blast** (0-9)[1]		**Panicles blast** (%)		**Spot grais** (1-5)[2]	
	BRSGO Serra Dourada	**BRS Primavera**	**BRSGO Serra Dourada**	**BRS Primavera**	**BRSGO Serra Dourada**	**BRS Primavera**
11/04/08	0	7	0.08	77.10	0.48	1.43
11/21/2008	0	8	5.10	79.51	1.17	0.78
12/09/08	0	8	13.90	76.0	2.20	2.16
12/23/2008	2	7	16.20	87.6	1.29	2.09
01/08/09	3	8	-	-	-	-

[1] 0: without blast incidence; 9: more than 75% of foliar area attacked.
[2] 1: grains without spot or slightly spotted; 5: grains totally spotted.

It was observed a discrete incidence of blast in BRSGO Serra Dourada leaves only in the last cultivation periods; it did not occur in the first three periods, but in BRS Primavera, high severity of disease in leaves was observed in the first period of cultivation (Table 2). In this period, blast incidence in new cultivar panicles was worthless. The second period had discrete intensity and in the third and fourth periods, aggravation was around 15%. However, in all periods, blast aggravation in BRSGO Serra Dourada panicles was inferior to the one observed in BRS Primavera, which indicates that this cultivar presented good resistance to this disease. In relation to spot grains, both cultivars had similar levels of resistance. In the fifth period, strong water deficit occurred in the end of the cycle and it damaged the evaluation of blast aggravation in panicles and in spot grains in both cultivars.

Both evaluations regarding grain characteristic and productivity of entire grains with cultivation price indicate high quality of BRSGO Serra Dourada grains because it not only has good quality of BRS Primavera grains (Table 3), which are the preferred grains in the market, but also overcome sector productivity (Table 1). This advantage was confirmed in evaluations of grains sample harvested in production fields of genetic seeds from 20% to 22% of humidity, as Silva and Fonseca (2006) recommended. The average of entire grains in these evaluations was 62,3%. It is similar to results considered as favorable that was obtained with elite cultivars of irrigated rice that were planted according to best practices of management (Cordeiro and Medeiros 2010)

Table 3. Characteristics of BRSGO Serra Dourada and BRS Primavera grain quality evaluated in grain quality laboratory of Embrapa Arroz e Feijão

Cultivars	amylose content (%)	Gelatinization temperature	Cooking time (min)
BRS Primavera	26	Intermediate	19
BRSGO Serra Dourada	25	Intermediate	21

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Strategies of participative management were very important to select this cultivar because farmers participated in the whole process, since trials implementation to harvest. So, it is possible to obtain cultivars adapted to specific environments and with characteristics that meet farmers' demand since they work with community, researches of several areas, extension agents and farmers' association. A lot of information is managed and the higher number of environments, the better. Much of this information is different from the ones normally used for conventional improvement (Vernooy 2003). Other advantage resulted from this form of work is the increase of adaptation levels of this cultivar generated by improvement.

TECHNICAL RECOMMENDATION AND SEED PRODUCTION

BRSGO Serra Dourada resistance to lodging and to blast enables farmer to have more safety and good harvesting. It is necessary to assure good practices of use to empower these genetic characteristic of cultivar. Thus, in fertile soils it is necessary to use narrow spaces, for example, 30 cm between lines and avoid elevated doses of nitrogen manuring. In any situation, the density of cultivation must be around 200 seeds per m^2, which corresponds to 53 a 60 kg per hectare in case of germination varying from 90% to 80%.

In 2007/08, the multiplication of seeds was performed at Embrapa Arroz e Feijão and around 1.5 t of genetic seed was obtained. The production of basic seed of new cultivar was performed by EMATER - GO in 2008/09.

The category C1 seeds were certified in 2009/2010, and will be available in the next year to small producers associations and to community crops managed by EMATER.

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