

# MILLÁN-INIA, NEW VARIETY OF HIGH QUALITY EARLY SPRING BREAD WHEAT FOR IRRIGATED SOILS IN CENTRAL-SOUTHERN CHILE

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## ABSTRACT

Millán-INIA is a variety of spring bread wheat (*Triticum aestivum* L.) originating from a cross carried out in the Wheat Plant Breeding Project of the Instituto de Investigaciones Agropecuarias (INIA), in the Centro Regional de Investigación Quilamapu in 1995. This is a spring wheat variety with an early to medium-early head emergence and upright growth habit in the seedling stage. The adult plant is low to medium height and varies between 75 and 90 cm, with a mean of 85 cm. The spike is white with long awns along its full length. The grain is large-sized, white, and vitreous. The weight of 1000 grains varies between 50 and 59 g. It was sown in mid-August at the Santa Rosa Experimental Station (36°31' S; 71°54' W), Chillán. Head emergence occurred 88 to 89 d after sowing, which is 2 to 3 d after Ciko-INIA. On average, Millán-INIA reached a yield similar to that of the var. Ciko-INIA. This line stands out for its good resistance to disease, high protein content (11.5% mean), high sedimentation value, and high W value.

**Key words:** Spring wheat, *Triticum aestivum*, new variety, Millán-INIA.

There are variations within spring varieties as regards precocity. One of the advantages of the earlier varieties is that they can be sown at later dates, including twice in the same season in some zones. Millán-INIA is an early spring variety exhibiting outstanding quality as compared to other spring varieties. It also shows good resistance to the most important diseases and stands out for its large white vitreous grain.

## Origin

Millán-INIA is a spring wheat variety (*Triticum aestivum* L.) originating from a cross in the Wheat Plant Breeding Project of the Instituto de Investigaciones Agropecuarias (INIA), in the Centro Regional de Investigación Quilamapu in 1995. The F<sub>2</sub> to F<sub>8</sub> selection stages were carried out between 1997 and 2003 using the pedigree method. It was evaluated in a preliminary yield trial in 2004 and included in the main yield trial in 2005. Between 2006 and 2008, the standard trial was registered as variety trials in application for Registration of Varieties Suitable for Certification (RVSC), required

by the Ministry of Agriculture through the Servicio Agrícola y Ganadero (Agriculture and Livestock Service). The experimental line for all these trials was identified as QUP 2563-2004.

## Crossing and pedigree

The genealogy of Millán-INIA is:

VS73.600/MRL"S"/3/BOW"S"/YR/TRF"S"/4/CIKO  
C 4026 – 7C – 4C – 4C – 3C – 2C – 1C – 0C.

## Morphological description of the plant

This is a spring wheat variety with an early to medium-early head emergence and an upright growth habit in the seedling stage. The adult plant is low to medium height and varies between 75 and 90 cm with a mean of 85 cm (Figure 1). The leaf sheath of the flag leaf exhibits nil or very weak glaucosity. Stalk medulla is medium-sized and has low to moderate resistance to lodging. The auricle is large and white, the latter owing to the lack of antocyanin.

## Spike and grain characteristics

The spike is compact, pyramid-shaped, approximately 11 to 12 cm long, white, with nil or very weak glaucosity, upright at maturity, and exhibits long whitish awns along its full length. The peak of the lower lemma of the spikelet in the middle third of the stem is straight.

The grain is large, ovate, white, and vitreous. The

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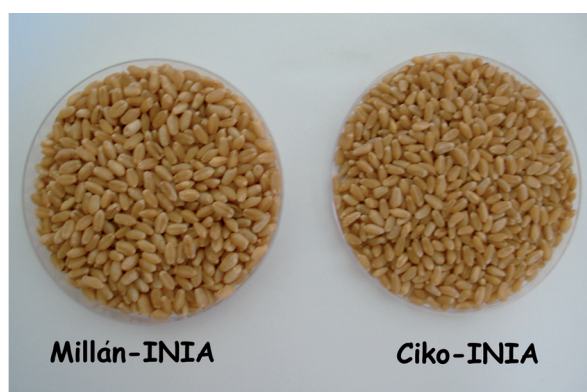
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average percentage weight of seeds retained in a 2.3 mm oblong mesh sieve was 93%, and 1000 seeds weigh 50 to 59 g (Figure 2). It exhibits medium coloration to phenol.



**Figure 1. Adult plant of Millán-INIA planted in Santa Rosa Experimental Station.**



**Figure 2. The grain of Millán-INIA is large, ovate, white, and vitreous. The 1000 seeds average weight is 50 to 59 g. Notice the difference compare with the seed of Ciko-INIA.**

### Agronomic and phytopathological characteristics

Sowing was in mid-August at the Santa Rosa Experimental Station (36°31' S; 71°54' W), Chillán. Heads emerged 88 to 89 d after sowing, 2 to 3 d after head-emergence of Ciko-INIA (Mellado *et al.*, 1989).

Millán-INIA shows resistance to stripe rust (*Puccinia striiformis* West. f. sp. *tritici*), leaf rust (*Puccinia triticina* Erikss.), stem rust (*Puccinia graminis* Pers. f. sp. *tritici* Erikss. and Henn.), and resistance to moderate-resistance to powdery mildew caused by the *Blumeria graminis* DC. f. sp. *tritici* Marchadsl fungus. It did not exhibit leaf blotch (*Mycosphaerella graminicola* (Fuckel) J. Schröt.) in spring sowing (Table 1).

### Grain and quality yield

Millán-INIA was evaluated in standard trials conducted in irrigated soils in the provinces of Ñuble Chillán (36°31' S; 71°54' W) and Yungay (37°08' S; 72°0' W) in Ñuble Province and Humán (37°26' S; 72°14' W) in Bío Bío Province from 2006 to 2008. It reached a mean yield 0.7% higher than that of var. Ciko-INIA in the evaluated locations (Table 2).

Millán-INIA is a wheat variety with a good hectoliter weight and hard texture. Numbers for Zeleny sedimentation, wet gluten, and protein classify it as strong wheat (INN, 2000). It exhibits good bread volume, high W value, and a good P/L ratio. This value is the relationship between dough tenacity and extensibility, a stability index used as a guideline to determine if dough has reduced, balanced, or high extensibility. This line stands out for its high protein content, high sedimentation value, and high W value (Table 3).

### Cultivation area and sowing dates

Data obtained in the standard trials allow recommending

**Table 1. Behavior of cv. Millán-INIA and control cv. Ciko-INIA to stripe rust (*Puccinia striiformis*) and leaf rust (*P. triticina*) in three irrigated locations from 2006 to 2008.**

Location	Year	Millán-INIA		Ciko-INIA	
		Yellow rust <sup>1</sup>	Leaf rust <sup>1</sup>	Yellow rust <sup>1</sup>	Leaf rust <sup>1</sup>
Quilamapu	2006	0	5MS	0	40MS
	2007	5MS	TMS	5MS	5MS
	2008	20MR	5MS	5MS	30MS
Yungay	2006	0	0	0	0
	2007	0	0	0	0
	2008	0	0	0	TMS
Humán	2006	20MR	0	30MS	10MS
	2007	0	TMS	0	5MS
	2008	0	5MS	0	30MS

<sup>1</sup>Values according to modified Cobb Scale (Peterson *et al.*, 1984) where attack intensity can vary between 0 and 100% (T = traces), plant reaction can be: resistant (R), moderately resistant (MR), moderately susceptible (MS), or susceptible (S).

**Table 2. Grain yield of cv. Millán-INIA compared to control cv. Ciko-INIA in standard trials conducted in three irrigated locations from 2006 to 2008.**

Location	Year	Cultivars	
		Millán-INIA	Ciko-INIA
		t ha <sup>-1</sup>	
Chillán	2006	8.67a	9.26a
	2007	5.38a	5.41a
	2008	8.00a	8.71a
	Mean	7.35	7.79
Yungay	2006	9.26a	8.81a
	2007	9.55a	8.99a
	2008	8.79a	9.93b
	Mean	9.20	9.24
Humán	2006	11.16a	10.11a
	2007	7.78a	7.44a
	2008	9.09a	8.42a
	Mean	9.34	8.65

Different letters between cultivars for each year and location are statistically different at  $P < 0.01$ .

**Table 3. Quality characteristics of cv. Millán-INIA compared to control cv. Ciko-INIA.**

Characteristics <sup>(1)</sup>	Cultivars	
	Millán-INIA	Ciko-INIA
Hardness index, % <sup>(2)</sup>	17.2	17.0
Hectoliter weight, kg hL <sup>-1</sup>	85.08	84.66
Zeleny sedimentation, cm <sup>3(3)</sup>	39.29	36.6
Wet gluten, % <sup>(4)</sup>	42.29	45.07
Protein (N x 5.7), %	11.5	10.2
Falling number, s <sup>(7)</sup>	426	459
Work (W) <sup>(5)</sup>	310	218
Tenacity (P)	124	95
Extensibility (L)	95	103
Ratio (P/L)	1.30	0.92
Bread volume, cm <sup>3(6)</sup>	959	906

<sup>(1)</sup>Mean values of trials conducted in Chillán, Yungay, and Humán, from 2006 to 2008.

<sup>(2)</sup>Values of < 20: hard grain; 20-30: semi-hard grain; > 30: soft grain.

<sup>(3)</sup>Numbers from 17 to 26.9 cm<sup>3</sup> soft wheat; 27 to 32.9 cm<sup>3</sup> intermediate wheat, and ≥ 33 cm<sup>3</sup> strong wheat.

<sup>(4)</sup>Values from 18 to 24.9: soft wheat; 25.0 to 29.9: intermediate wheat; ≥ 30: strong wheat.

<sup>(5)</sup>W value (alveogram): < 150: low; 150-200: medium; > 200: good.

<sup>(6)</sup>Bread volume: < 550: low; 550-600: good; > 600: very good (mean value Chillán, Yungay, and Humán in 2008).

Evaluation scale source: INN (2000), Laboratorio Farinología, Instituto de Investigaciones Agropecuarias (INIA) and Granotec.

the sowing of cv. Millán-INIA between June and 15 September in irrigated soils in the central-southern zone of the country.

### Electrophoresis of high molecular weight glutenins and molecular analysis

Millán-INIA exhibits allele 1 in *locus* Glu1A, alleles 17+18 in *locus* GluB, and alleles 2+12 in *locus* Glu1D. In accordance with this classification it attains a value of 8 on a scale of 4 to 10.

This variety does not carry the rye translocation 1BL.1RS and exhibits the Pin-a hardness allele. It does not have aluminum tolerant alleles.

## CONCLUSIONS

Millán-INIA is a new variety of early spring bread wheat with a good yield potential and good hectoliter weight. The grain is large, white, and vitreous. Numbers for Zeleny sedimentation, wet gluten, and protein classify it as strong wheat. This line stands out for its high protein content, sedimentation value, and W value. It exhibits resistance to moderate resistance to stripe rust, leaf rust, stem rust, powdery mildew, and leaf blotch.

Data obtained in the standard trials allow recommending sowing cv. Millán-INIA in irrigated soils of the central-southern zone of the country.

## RESUMEN

**Millán-INIA, nueva variedad de trigo harinero precoz de primavera de alta calidad para suelos de riego de la zona centro sur de Chile.** Millán-INIA es un trigo harinero (*Triticum aestivum* L.) de primavera que proviene de un cruzamiento efectuado en 1995 en el Proyecto de Fitomejoramiento de Trigo del Instituto de Investigaciones Agropecuarias INIA, en el Centro Regional de Investigación Quilamapu. Es un trigo de hábito primaveral, de época de espigadura mediana a precoz, con hábito de crecimiento erecto al estado de plántula. La altura de la planta adulta se considera mediana a baja, y varía entre 75 y 90 cm, con un promedio de 85 cm. La espiga es de color blanco y de barbas largas y presentes en toda su extensión. El grano es de color blanco y aspecto vítreo y de tamaño grande, con un peso de los 1000 granos que varía entre 50 y 59 g. Sembrado a mediados de agosto en el Campo Experimental Santa Rosa (36°31' S; 71°54' O), Chillán, la emisión de espigas ocurre 88 a 89 días después de la siembra, entre 2 y 3 días después que Ciko-INIA. Como promedio en las localidades evaluadas, Millán-INIA tuvo un rendimiento medio similar a la var. Ciko-INIA. Esta línea se destaca por su muy buena resistencia a enfermedades, alto

contenido de proteína (promedio 11,5%), alto valor de sedimentación, y alto valor W.

**Palabras clave:** trigo de primavera, *Triticum aestivum*, nueva variedad, Millán-INIA.

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