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CASTELAR, ARGENTINA

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Argentinean High-Lysine and Modified Starch Corn Hybrids. I. Days and Growing-degree days to silking.

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The duration of the different phenology phases expressed in days vary among environments due to changes in relative humidity, air and soil temperature, sun radiation and photoperiod. Because of the poor correlation between the number of days and the growing-development of the plants it is not possible to obtain acceptable results when the genotypes are classified according to the number of days to flowering though it must be admitted its utility as guidance. Most part of the variation in days to flowering and maturity may be explained thru differences in temperatures amongst locations and years, so it is evident that this is the main factor affecting the development rate of maize. The effect of the temperature over the development rate can be described using the concept of thermal time (e.g.= *growing-degree days or GDD*). Consequently, the duration of the vegetative cycle of maize may also be defined by the sum of temperatures or thermal time (TT) required to reach silking (R_1).

Use of diverse foundationals as well as obtain new crosses between adapted genotypes and exotic materials introduced from other research centres made it possible to count on enough initial genetic variability since new inbred lines were developed and these were later used to give raise to the single and double crosses tested in the field.

The hybrids tested may be grouped according to their grains characteristics within four types or categories= **I.** *materials with modified starch* (MS) by action of the single mutant genes *waxy* and/or *amylose-extender*, **II.** *double mutant genotypes with starch and protein modified by the action of the mutant genes waxy and opaque-2 and/or its variant opaque-5* (DR), **III.** *materials with high-lysine content or high quality proteins by action of the genes opaque-2 or its allele opaque-5* (HL) and **IV.** *the flint hybrids ACA 929 and ACA 2000 used as testers*.

The cycle to flowering of thirty single and double-crosses was field evaluated in the Instituto de Genética Dr. E.A. Favfret (IGEAF-INTA Castelar) and the results are shown in Table 1 and the basic statistics estimated for the different groups of hybrids are shown in Table 2.

The single-crosses reach silking in average at 54.3 ± 3.0 days from emergence and after accumulating 693.6 ± 43.7 °C (*ranges= 50 to 59 days* and *631.2 to 759.9 °C; see* Table 1). Some very precocious genotypes to R_1 were detected among these materials, as for example the *waxy* hybrids HC52 and HC98 and the double mutant HC55. These single-crosses must be included within the class FAO 200 because they reach R_1 as soon as they accumulate 630.0 to 660.0 °C. In average, double-crosses reached silking after 56.1 ± 2.3 days from emergence (*range= 51 to 59 days*) and their

mean heat requirement to the same phase was 713.1 ± 22.8 ºC (*range= 645.2 ºC to 759.9 ºC*). The double-mutants HC67, HC80, HC82 and HC95 stand out amongst them due to their high degree of precocity (class FAO 200). Some other double-crosses (*e.g.*= HC72, HC73, HC90, HC92, HC93, HC94, HC96 and HC97) belong to class FAO 300-400 because they reach silking after piling up 689.7 to 721.8 ºC from emergence. The single-crosses HC50 and HC58, the same as the double-crosses HC69, HC70, HC75, HC77, HC78, HC83, HC85 and HC91 must be included within the classes FAO 5OO and FAO 600. Consequently, these latter hybrids are considered as non-precocious and have an intermediate or complete cycle to flowering like the testers ACA 929 and ACA 2000.

The mean contrasts ($t_{Student}$), revealed that the MS hybrids do not differ statistically from double mutants in the number of days or thermal time necessary to reach silking (*± t= 1.7 n.s. for both physiological traits*). Nevertheless, highly significant differences were observed between the MS materials and both testers ACA 929 and ACA 2000 (*±t= 3.6 and 3.7 for days and thermal time respectively; p≤ 0.01*). Likewise, the double mutant hybrids (DR) differ in a highly significant way from the testers ACA 929 and ACA 2000 both in the necessary number of days and thermal time to reach R_1 (*±t= 2.7 and 2.9 respectively; p≤ 0.01*).

A very strong correlation between the number of days and the thermal time necessary for silking was found in the hybrids evaluated in Castelar (*r= 0.99*; *p≤ 0.01*).

The results obtained show a great degree of precocity in the materials studied. Due to their degree of precocity, 7/30 hybrids could be recommended for late sowings in the Northern Pampa zone and also in the argentinean Corn Region VI. Likewise, due to the length of their evolutive cycle, *-measured in number of days or thermal requirements-*, the precocious genotypes could be used indifferently in the Western or Southern Pampa areas, characterized by having a shorter period free of freeze than other areas of the argentine corn region. A higher degree of precocity helps adaptation to areas with short summers and humid falls making possible a further increase of the culture surface of this species but in this case making use of specialty germplasm suitable for diverse industrial and feeding purposes.

Table 1= *Evolutive cycle to flowering of the single and double-crosses tested in the IGEAF-INTA Castelar during the growing season 20010/11*

HYBRID	CROSS	TYPE	DAYS TO R_1	GDD (°C) R_1	FAO CLASS
HC49	*single*	*MS (wxae1)*	*54*	*689.7*	*300-400*
HC50	*single*	*MS (wx)*	*59*	*759.9*	*500*
HC52	*single*	*MS (wx)*	*50*	*631.2*	*200*
HC55	*single*	*DR (wxo2o5)*	*52*	*659.5*	*200*
HC57	*single*	*HL (o2o5)*	*54*	*689.7*	*300-400*
HC58	*single*	*MS (wx)*	*57*	*737.6*	*500*
HC59	*single*	*DR (wxo2)*	*56*	*721.8*	*300-400*
HC66	*doble*	*DR (wxo2/Oh43)*	*59*	*759.9*	*500*
HC67	*double*	*DR (wxo2)*	*51*	*645.2*	*200*
HC69	*double*	*DR (wxo2)*	*59*	*759.9*	*500*
HC70	*double*	*DR (wxo2o5)*	*57*	*737.6*	*500*
HC72	*double*	*DR (wxo2/Oh43)*	*56*	*721.8*	*300-400*
HC73	*double*	*DR (wxo2)*	*56*	*721.8*	*300-400*
HC74	*double*	*DR(wxo2o5)*	*56*	*721.8*	*300-400*
HC75	*double*	*DR (wxo2)*	*58*	*748.1*	*500*
HC77	*double*	*DR (wxo2/Oh43)*	*58*	*748.1*	*500*
HC78	*double*	*DR (wxo2)*	*59*	*759.9*	*500*
HC80	*double*	*DR (wxo2)*	*52*	*659.5*	*200*
HC82	*double*	*DR (wxo2)*	*53*	*674.0*	*200*
HC83	*double*	*DR (wxo2/Oh43)*	*59*	*759.9*	*500*
HC85	*double*	*DR (wxo2o5)*	*57*	*737.6*	*500*
HC90	*double*	*MS(wxae1)*	*54*	*689.7*	*300-400*
HC91	*double*	*DR (wxo2)*	*58*	*748.1*	*500*
HC92	*double*	*MS (wx)*	*55*	*706.0*	*300-400*
HC93	*double*	*DR (wxo2o5)*	*56*	*721.8*	*300-400*
HC94	*double*	*MS (wx)*	*56*	*721.8*	*300-400*
HC95	*double*	*DR (wxae1)*	*53*	*674.0*	*200*
HC96	*double*	*DR (wxo2o5)*	*56*	*721.8*	*300-400*
HC97	*double*	*DR (wxo5)*	*56*	*721.8*	*300-400*
HC98	*single*	*MS (wx)*	*52*	*659.5*	*200*
ACA2000	*single*	*Flint or vitreous*	*59*	*759.9*	*500*
ACA 929	*three way*	*Flint or vitreous*	*62*	*794.1*	*600*

Table 2= *Basic statistics calculated for the different groups of hybrids evaluated in the IGEAF-CNIA Castelar (growin season 20010/11)*

	Days to R_1		
	average ± s.d.	*variance*	*variance/n*
MS	*54.4 ± 2.7*	*7.3*	*0.8*
Vítreous (Testers)	*60.5 ± 2.1*	*4.5*	*2.2*
DR	*56.2 ± 2.5*	*6.1*	*0.3*

	Thermal time (ºC) to R_1		
	average ± d.s.	*variance*	*variance/n*
MS	*696.6 ± 39.8*	*1583.9*	*176.0*
Vítreous (Testers)	*777.0 ± 24.2*	*584.8*	*292.4*
DR	*722.5 ± 35.8*	*1278.2*	*63.9*