Ear demand in Argentinean maize hybrids as affected by plant density and year of release

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INTRODUCTION

Prior studies, conducted in Argentina until 1993, determined that maize grain yields have dramatically increased as a result of increased ear demand. The product of kernel number per square meter and kernel growth rate during effective grain filling period is an indicator of ear demand. The effects of plant density on ear demand and its components remain still not clear.

OBJECTIVE

The objectives of this study were (i) to elucidate whether ear demand continued increasing in current maize hybrids and (ii) to assess ear demand interaction with plant density in maize hybrids released in the last 20 years.

MATERIALS AND METHODS

- An experiment was conducted at Balcarce, during the 2010-2011 growing season. An older hybrid released in 1993 and a newer hybrid released in 2010 with the similar grain filling duration, were grown at three plant densities (5; 9.5; and 14 pl m^{-2}). Kernel growth rate during effective grain filling period, kernel number per plant, kernel weight and grain yield were measured and ear demand calculated as the product of kernel number per square meter and kernel growth rate during effective grain filling period.

- Ear demand and grain yield are presented as a percentage of the presented by the hybrid DK664 at 9.5 pl m^{-2} and 8.5 pl m^{-2} for our data and for previous available information (Echarte et al., 2006), respectively.

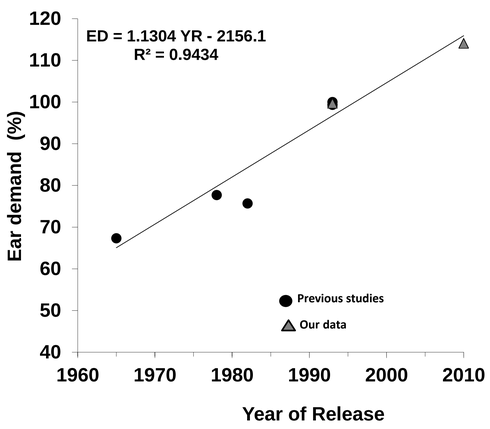

Figure 2. Ear Demand vs. year of release for 7 different Hybrids. Five hybrids for the previous studies seeded at 8.5 pl m^{-2} and 2 Hybrids for our data seeded at 9.5 and 14 pl m^{-2} .We considered 100% the Ear Demand of the hybrid DK 664 8.5 pl m^{-2} (32 gr m^{-2} day^{-1}) for the previous studies and the Ear Demand of the hybrid DK 664 MG 9.5 pl m^{-2} (32.4 gr m^{-2} day^{-1}) for our studies.

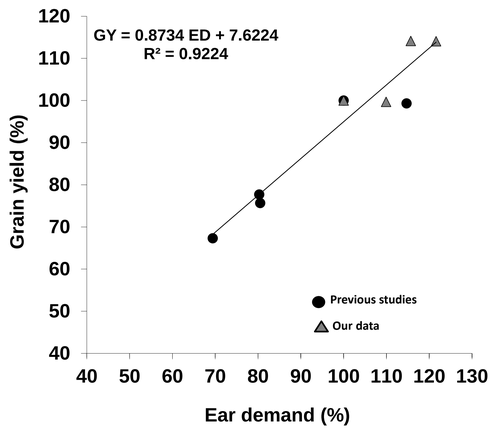

Figure 3. Grain yield vs Ear Demand for 7 different Hybrids. 5 hybrids for the previous studies seeded at 8.5 pl m^{-2} and 2 Hybrids for our data seeded at 9.5 and 14 pl m^{-2} .For previous studies we considered 100% the Ear Demand and Grain Yield values of the hybrid DK 664 8.5 pl m^{-2} and for our studies we considered 100% the Ear Demand and the grain yield values of the hybrid DK 664 MG 9.5 pl m^{-2}.

Table 1. Components of kernel Weight, numerical parameters of Grain Yield, Ear demand and Grain yield for two hybrids with different year of released (1993, 2010) and three Plant Densities (5; 9.5 and 14 pl m^{-2}).

Hybrid	Year	D (pl m^{-2})	KGR (mg day^{-1})	GFD (Days)	KW (mg)	NG #£ (grains m^{-2})	Demand #£ (Gr. Day^{-1} m^{-2})	GY #£ (Kg ha^{-1})
DK 664 MG	1993	5	6.1	51.9	255	3772	23.0	9608
		9.5	6.1	48.1	231	5275	32.4	12201
		14	5.9	46.5	247	5433	32.3	13413
		Average	6.1	48.8	244	4827	29.2	11741
DK 692 MG	2010	5	6.1	45.8	246	4742	28.7	11644
		9.5	6.0	47.2	233	6080	36.9	14115
		14	5.8	42.0	234	6341	36.9	14836
		Average	6.0	45.0	237	5721	34.2	13531

#: Hybrid effect ($p<0.05$) ; £: Density effect ($p<0.05$)

RESULTS

Grain yield and ear demand were significantly greater in the 2010 hybrid across plant densities (Table 1), and both were strongly associated with number of grains per square meter (Figure 1).

Kernel growth rate, duration of effective grain filling period, and kernel weight remained fairly constant across hybrids and plant densities. Also, grain yield, number of grains per square meter and ear demand were greater in 9.5 pl m^{-2} and 14 pl m^{-2} compared to the lowest density, in both hybrids (Table 1).

There was a close association between grain yield and ear demand in hybrids released between 1965 and 2010 (figure 2; figure 3).

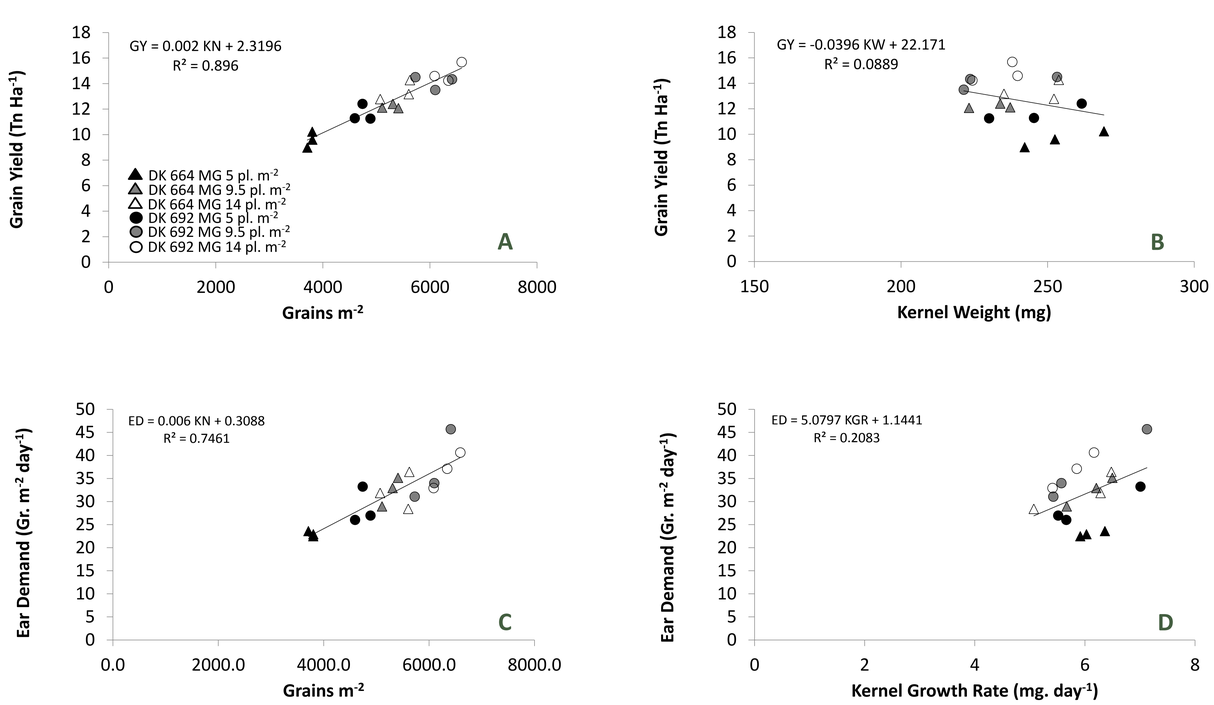

Figure 1. Relationship between Grain yield and their components (Kernel number per square meter (A), Kernel Weight(B)) and Ear demand and their components (Kernel Number per square meter (C) Kernel growth rate (D)), for two hybrids released in different years (1993, 2010) and three Plant Densities (5; 9.5 and 14 pl m^{-2}).

CONCLUSIONS

Ear demand increased at a rate of 1.13% $year^{-1}$ during the last 45 years; and kernel number was the main component influencing such increment.

Ear demand decreased at low plant density in the old and the new maize hybrids; and the reduction was mainly explained by a reduction in kernel number per unit area.