ARRHENATHERUM ELATIUS: COMPONENTS OF SEED YIELD AS AFFECTED BY FERTILIZER APPLICATIONS AND ROW SPACING

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ABSTRACT

The objective of this experiment was to determine the effect of fertilizer applications and row spacing over seed yield and its components of fromental (*Arrhenatherum elatius* (L.) Presl.). It was sown in 1994 on a Typic Argiudol soil in Santa Catalina (Buenos Aires, Argentina). Treatments combined two row spacing: **1**=17,5 cm and **2**=52,5 cm with three fertilization timing: **a**=at sowing time in 1994 or at the beginning of the regrowth period in 1995; **b**= when tiller apex became reproductive; **c**=split at sowing or regrowth period and at apex differentiation; **d**=control without fertilization. During 1994, fertilization was 782.5 gr/plot of diammonium phosphate for **a**, 540 gr/plot of urea for **b** and 375 gr/plot of diammonium phosphate when plots were sown and 270 gr/plot of urea at apex differentiation (**c**). During 1995 only urea was supplied using 540 gr/plot as total and 270 gr/plot as split fertilization doses. Seed harvest was carried out for 1994 and 1995, sampling 1 m^2/plot to measure: panicle length (cm) (PL), spikelets per panicle (SPP) and seeds per panicle (SP) , weight of seeds/plot (gr./m^2) calculating seed yield (kg/ha) (SY), and weight of 1000 seeds (W1000). Retention percentage was calculated as SP x 100/SPP. Seed yield during the establishment year was 287% superior to its control (**2.d**) when row spacing was 52.5 cm and complete N fertilization doses was applied at apex transformation. Seed yield were similar for the two row spacing and fertilization treatments applied during 1995, and no relation was detected between seed yield and panicles/m^2.

KEYWORDS

Tall oat grass, *Arrhenatherum elatius*, seed yield, fertilization, row spacing

INTRODUCTION

Arrhenatherum elatius is a perennial, wind-pollinated and allogamus grass (Docousso *et al*., 1990). With lanceolate to oblong panicle, its pedicelled spikelets have 2 flowers: the lower masculine and the upper hermaphrodite. Both fall at maturity stage; the glumes persist over the panicle. (Nicora, 1978). Only one caryopsis (seed) can be obtained from each spikelet. Panicle maturity begins near the apex and progresses towards its base. Seed yield is determined by factors that affect the magnitude and the utilization of potential yield (Hebblethwaite *et al*., 1980). The component that contributes more to seed yield vary with the specie, environment and management (plant distance) conditions. The inflorescence density has the major impact over seed yield in perennial grasses (Langer, 1980). Temperature, light, water and nutrients are the main parameters that affect seed yield components (Scott, 1980). For maximum seed yields not only are total N requirements for growth and development important, but also the timing of the application are equally important. Most investigations conducted on the timing of N fertilizer applications for grass seed crops have revealed that the best response is obtained by spring applications. However, a split application between autumn and spring may be even better (Hebblethwaite *et al*., 1980; Scott, 1980). Our objective was to study the effect of row spacing and timing of fertilization on seed yield and seed components of a population of Arrhenatherum elatius under forage traits study.

MATERIALS AND METHODS

The experiment was carried out on a Typic Argiudol soil in Santa Catalina (Buenos Aires province, lat. 34° 45-48' S, Long. 58° 24-29' W, Argentina). The soil contained 3.9% organic matter, 0.18% nitrogen, 16.2 PPM of phosphorous and had pH 5.6. Blocks with 27 m^2 plots and 300 viable seeds/m^2 were sown in July 1994. Treatments combined two row spacing: 1=17.5 cm and 2=52.5 cm with three fertilization timing: **a**=at sowing time in 1994 or at the beginning of the regrowth period in 1995; **b**= when tiller apex became reproductive; **c**=split at sowing or regrowth period and at apex differentiation; **d**=control without fertilization. During 1994, fertilization was 782.5 gr/plot of diammonium phosphate for **a**, 540 gr/plot of urea for **b** and 375 gr/plot of diammonium phosphate when plots were sown and 270 gr/plot of urea at apex differentiation (**c**). During 1995 only urea was supplied using 540 gr/plot as total and 270 gr/plot split fertilization doses. The trial was not irrigated and only received a matching cut at the beginning of the regrowth period (1995). Seed harvest was carried out for 1994 and 1995 treatment by treatment when the apical spikelets of the panicle were near to fall, sampling 1 m^2/plot. The panicles sampled of each plot were put in paper bags at room temperature (aprox. 20°C at laboratory) until measured. Ten panicles per bag were subsampled to measure: panicle length (cm) (PL) , spikelets per panicle (SPP) and seeds per panicle. (SP). Retention percentage was calculated as SP x 100/SPP. All panicles sampled in each bag were threshed by hand obtaining weight of seeds/plot (gr/m^2) and calculating seed yield (kg/ha) (SY). Four replications of 100 seeds/plot were used to calculate weight of 1000 seeds (W1000) (ISTA, 1993). Values of counting were transformed by šy. ANVA and Least Significant Difference Test (LSD) were applied. Statistical significance was assumed at $P< 0.05$. Correlation coefficients were calculated within each year ($P<0.01$) considering all treatments.

RESULTS AND DISCUSSION

During 1994 ANVA showed ìdistanceî main effects when P was analyzed and 'fertilization' main effects over SP. Row distance of 52.5 cm gave conditions for more P than 17.5 cm. N fertilization when tiller apex became reproductive was responsible for higher SP. Figure 1 shows the averages obtained for seed yield and components considered for 1994. Seed yield during the establishment year was 287% superior to its control (2.d) when row spacing was 52.5 cm and complete N fertilization doses was applied at apex transformation. The relation between response variables can also be pointed out through the correlation coefficients (Table 1): P and SP to SY and LP to SP. Except for w1000 in treatment 1.a., fertilization at sowing time did not differ from control in any other response variable, not enhancing seed yield for our experimental conditions in *Arrhenatherum elatius* establishment year. Environmental conditions changed for 1995 because it was a dry year. ANVA showed the main effect of fertilization on SP. Figure 1b shows the averages obtained for seed yield and studied components. No differences were detected between treatments for SY, P and W1000. For SP control at 17.5 cm was not different from fertilization at beginning of reproductive stage at 52.5 cm. Correlation coefficients of Table 1 also show the different behavior between years. P had no relation with SY. Only SP retained significant correlation to LP. Retention percentage was 76.73 ± 6.04 for both years. It is known that perennial species have lower seed production the establishment year. (Scott, 1980). There was a great variation within response variables of the studied material. This may be because the material is a population without improvement. At harvesting time it was evident that some plants had the great majority of its fertile tillers at panicle maturity stage, and other plants had them at different stages. The influence

of time of tiller origin on fertility and size of the inflorescence has been stated by Scott (1980). The level of soil moisture and soil fertility, particularly with regard to nitrogen, can have a marked effect on seed set and seed weight. When soil moisture is limiting during the critical development phase between head emergence and seed formation, seed yields can be drastically reduced due to the abortion of some fertile florets and also a reduction in individual seed weight. Nitrogen has a big influence on the size of the ear by affecting the number of florets per ear, the number of viable seeds per ear and the seed weight. (Scott, 1980). Despite dry environmental conditions of 1995, and that fertile percentage of spikelets was not measured , retention percentage of 76.73 talks about a high amount of seeds formed. In contrast to other experiments with other grasses, seed yield were similar for the two row spacing and fertilization treatments applied during 1995, and no relation was detected between seed yield and panicles/m^2.

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Table 1

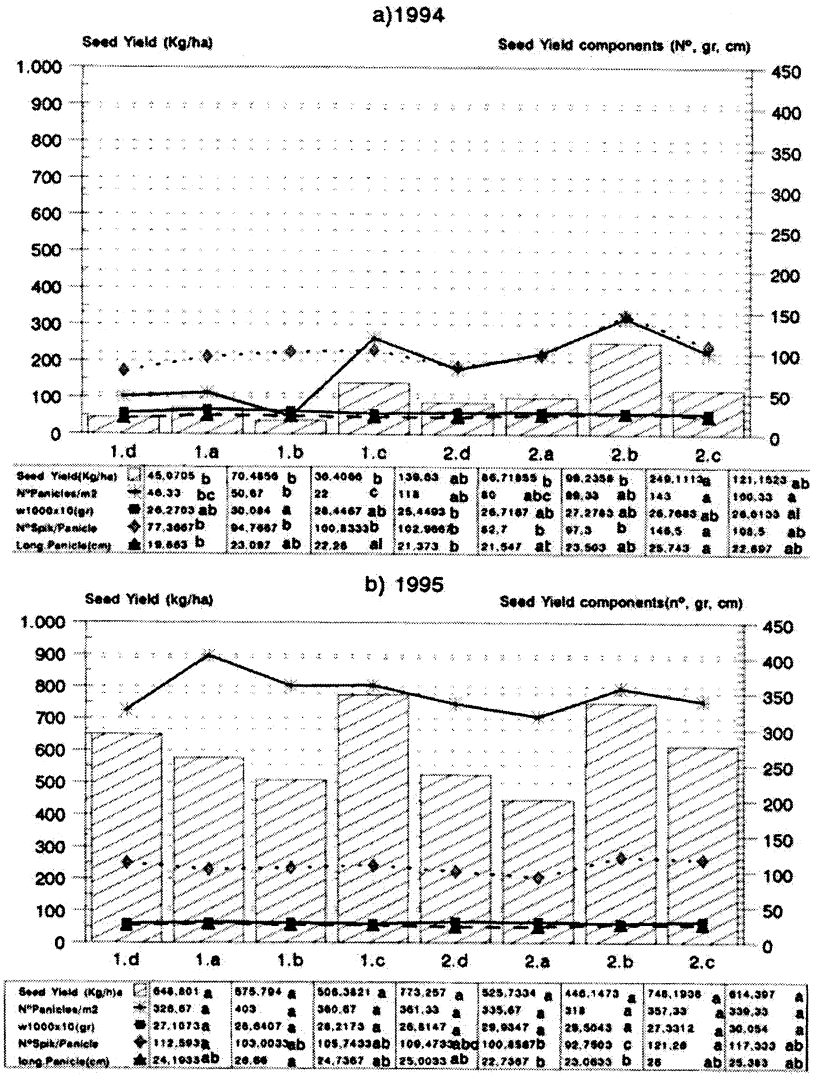
Correlation coefficients for seed yield and its components during 1994 and 1995, considering all treatments.

	YEAR	SP	LP	P	WS
LP	1994	0.813 **			
	1995	0.608 **			
P	1994	0.390	0.116		
	1995	0.035	-0.090		
WS	1994	0.150	0.488 **	0.167	
	1995	-0.293	-0.140	-0.035	
SY	1994	0.582 **	0.249	0.884 **	-0.076
	1995	0.369	0.195	0.365	-0.118

SP: N° spikelets/panicle; **LP**: long panicle (cm); **P**: N° panicles/m^2; **WS**: weight of 1000 seeds (gr); **SY**: seed yield (kg/ha). P<0.01.

Figure 1

Averages of seed yield and its components for all treatments during establishment years (1994) and first year seed production (1996) of *Arrhenatherum elatius*.



Averages on the same line with different letters are different (LSD, P<0.05)
Row spacing: 1=17.5cm; 2=52.5cm; Fertilization: a=at beginning of regrowth period; b=at change to reproductive stage; c= half in a) and half in b); d= control without fertilization.