EFFECTS OF JOHNSONGRASS (*SORGHUM HALEPENSE* L. PER.) DENSITIES ON POTATO (*SOLANUM TUBEROSUM* L.) YIELD[1]

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ABSTRACT - The effect of 3 Johnsongrass densities (D1: 17 pl/m^{-2}; D2: 34 pl./m^{-2} and D3: 51 pl./m^{-2}) on potato (*Solanum tuberosum* L.) tuber yield and biomass production was studied. The work was carried out in metalic containers with a loamy soil under high water and nutrient availability. At harvest, crop biomass was reduced 28% for D1, 57% for D2 and 68% for D3. Dry weight of tubers was the parameter most affected by Johnsongrass competition. Tuber weight decreased 80, 85 and 95% at D1, D2 and D3, respectively. Tuber number per plant was reduced 45, 55 and 65% by the same densities. It was evident that the weed generated high competitive conditions that affected all the parameters measured, particularly tuber dry weight.

Index terms: weed competition, tuber weight, tuber number, crop biomass.

EFEITOS DE DENSIDADES DE CAPIM-JOHNSON NA PRODUÇÃO DE BATATA-INGLESA

RESUMO - Foram estudados os efeitos de três densidades de plantas de capim-johnson (*Sorghum halepense* L.), ou seja: D1: 17 pl/m^{-2}; D2: 34 pl./m^{-2}; D3: 51 pl./m^{-2}, na produção e tubérculos e de biomassa de batata-inglesa (*Solanum tuberosum* L.). O experimento foi realizado em recipientes metálicos com solo barrento sob alta disponibilidade de água e de nutrientes. Por ocasião da colheita, a biomassa apresentou solução de 28% na Kl, de 57% na D2, e de 68% na D3. O peso seco dos tubérculos foi o parâmetro mais afetado pela competição do capim-johnson. O peso dos tubérculos diminuiu 80%, 85% e 95% na D1, D2 e D3, respectivamente. O número dos tubérculos por planta foi reduzido em 45%, 55% e 65%, respectivamente na D1, D2 e D3. Evidenciou-se que esse capim gerou condições competitivas que afetaram todos os parâmetros medidos, particularmente o peso seco dos tubérculos.

Termos para indexação: peso de tubérculos, número de tubérculos, biomassa de batata-inglesa.

INTRODUCTION

Johnsongrass is one of the world's worst weeds (Holm 1969), which causes serious losses to summer crops, like cotton, maize, soybean and sugarcane (Beltrano & Montaldi 1979, Williams & Hayes 1984, Ali et al. 1986, Bridges & Chandler 1987). This weed produces deleterious effects due to light, water and nutrient competition. Moreover, Johnsongrass not only exerts competition with the crop, but also produces biologically active substances that affect growth of other species (Abdul-Wahab & Rice 1967, Friedman & Horowitz 1970).

Johnsongrass is a perennial weed, with high daily rhizome production, 1 m.day^{-1}, and a high capacity of seed production, 28,000 seeds.pl^{-1} (Horowitz 1973). As a result, this weed is a strong competitor against crops, especially those that are sown or planted in wide rows. Competition of the weed during all crop cycles reduces soybean yield 88% (Williams & Hayes 1984), cotton yield 84% (Bridges & Chandler 1987) and may reduce maize yield 100% (Bendixen 1986).

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The potato crop is severely affected by weed competition from planting to complete cover of the furrows (Mohamed & Nour 1986) and particularly for graminous species when weed biomass is maximum (Caldíz & Panelo 1986). Nevertheless, little information is available in relation to the effects Johnsongrass may have on tuber yield, although it is an important weed in the potato crop in many different areas of the world.

The objective of this research was to study the effects of different densities of Johnsongrass on potato yield.

MATERIALS AND METHODS

The work was carried out at the Experimental Station of the Faculty of Agriculture and Forestry Sciences, La Plata (SL 34^{O} 58'). To obtain Johnsongrass plantlets, rhizomes sections 5-cm long were placed in growth chambers at 27^{O}C for sprouting. Then they were transfered to plastic pots, 250 cm^3, where they remained until final transplanting. Seed potato tubers of cv. Primicia INTA (early maturity type) were stored in diffuse light for 120 days, showing sprouts of 4+/-1 cm long at planting. The assay was carried out in metallic containers, 0.2 m^3, with a loamy soil. At planting the equivalent of 200 $kg.ha^{-1}$ P2 05 and 200 $kg.ha^{-1}$ urea were added. During the experience the soil was maintained at field capacity by periodical wetting.

Tuber planting and Johnsongrass transplanting were done simultaneously. Johnsongrass densities, normally found in summer crops in Argentina, were: D1: 17 $pl.m^{-2}$; D2: 34 $pl.m^{-2}$ and D3: 51 $pl.m^{-2}$. Potatoes were planted at a density equivalent at 8 $pl.m^{-2}$. Ninety six days after planting, both Johnsongrass and potato plants were harvested. The dry weight of the aerial parts was determined at 70^{O}C till constant weight. For tuber counting and tuber dry weight, only tubers over 3 cm diameter were considered.

A completely randomized design with 5 replications was used and results were compared by Tukey's test (P: 0.05).

RESULTS AND DISCUSSION

It was evident that the weed generated high competitive conditions that affected all the parameters measured. The lowest Johnsongrass density (17 $pl.m^{-2}$ equivalent to 530 $g.m^{-2}$ dry weight, at harvest) produced highly significant negative effects on all the parameters studied. As Johnsongrass biomass increased, 700 and 1400 $g.m^{-2}$ for D2 and D3, respectively, mainly light and nutrient competition also increased, producing a reduction in crop biomass. For D1 crop biomass was reduced 28%, 57% for D2 and 68% for D3 (Fig. 1). Nevertheless, no visual symptoms of nutrient deficiency were observed on the crop.

In potatoes, the net assimilation rate (NAR) is determined by tuber's demand (Collins 1977) and depends on tuber number $plant^{-1}$. Johnsongrass competition reduced tuber number $plant^{-1}$ 45, 55 and 65% for D1, D2 and D3 (Fig. 2). As total tuber yield in potatoes is highly related to tuber number (Sidhu et al. 1980), tuber dry weight was also reduced by competition. Tuber yield decreased 80, 85 and 95% for D1, D2 and D3, respectively, (Fig. 3). Probably, the

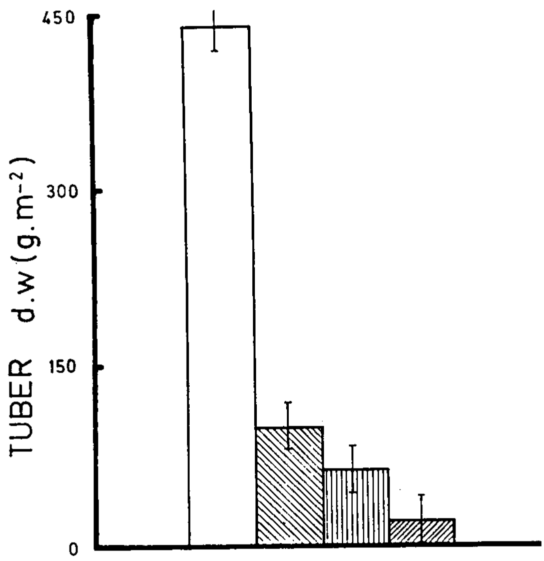

FIG. 1. Aerial biomass of potatoes and Johnsongrass at harvest at different densities of Johnsongrass.
For potatoes: ( ) D1; ( ) D2; ( ) D3; ( ) Control. For Johnsongrass: ( ) D1; ( ) D2 and ( ) D3.
Vertical bars shows LSD at 5% level.

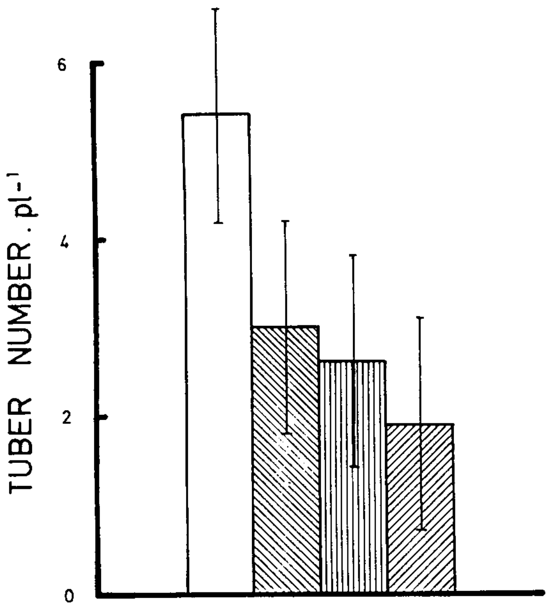

FIG. 2. Tuber number plant^{-1} as modified by Johnsongrass densities.
(☐) Control; (▧) D1; (▥) D2; (▨) D3. Vertical bars shows LSD at 5% level.

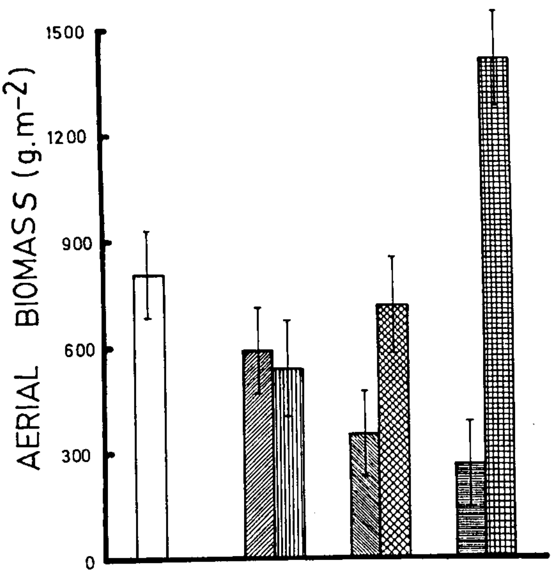

FIG. 3. Tuber dry weight as modified by Johnsongrass densities.
(☐) Control; (▧) D1; (▥) D2; (▨) D3. Vertical bars shows LSD at 5% level.

reduction in NAR also reduced photoassimilates availability to the tubers, causing the severe reductions in tuber yields.

These results are in agreement with Mohamed & Nour (1986), indicating crop sensitivity to high weed competition. The deleterious effects not only affect the actual crop, but may reduce the productivity of the future ones due to allelophatic effects (Abdul-Wahab & Rice 1967, Friedman & Horowitz 1970, Beltrano & Montaldi 1980).

CONCLUSIONS

As in other crops, Johnsongrass competition significantly decreased yield, in this case by reducing both tuber number and tuber weight.

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