

RELAY INTERCROPPING SYSTEMS OF CORN INTO SUNFLOWER

Paulo Regis Ferreira da Silva, Andrea B. da Rocha and Lauro M. Wollmann.
Universidade Federal do Rio Grande do Sul. P.O. Box 776-90001. Porto Alegre
RS - Brazil.

ABSTRACT

With the objective of comparing corn grain yield grown in relay planting into sunflower, in two sowing dates, with that obtained as a sole cropping, a two-year study was carried out in the state of Rio Grande do Sul, Brazil. Four treatments were tested in the 1989/90 growing season: relay planting of corn into sunflower at 19 and 40 days after sunflower anthesis and corn as a sole crop planted in sequence to sunflower in both sowing dates. In 1990/91, two other treatments were added: corn as sole crop planted in sequence to corn sowed at the same dates of sunflower.

The effect of the relay intercropping on corn yield planted 19 days after sunflower anthesis varied with the year. As in the first year corn yield was 33% less in the relay intercropped system into sunflower than sole cropping system, in the second year corn yield was similar in both systems. These differences could be partially attributed to the use of different sunflower cultivars. In the second date of relay planting of corn into sunflower, corn grain yields were similar to those obtained as a sole cropping in both trials.

INTRODUCTION

Multiple cropping is a way of multiple practices of great importance to the warmer parts of the world, mostly used in small farms. Multiple cropping consists in growing crops simultaneously, in the same space dimensions, it can have different sowing and harvesting dates, but growing simultaneously during part of the life cycle of each crop. Among the multiple cropping patterns, there is the relay intercropping, which a second crop is planted after the first has reached its reproductive stage.

In a work developed in the Depressão Central region of Rio Grande do Sul, Silva et al (1989) have the advisability of using the relay intercropping system of soybeans in to sunflower, planted in the physiological maturity of the sunflower. By using this technique, the soybean's sowing has been advanced at least ten days in relation to its introduction in succession to sunflower. Besides soybeans, other summer crops, for example corn, can display potential to participate in this system. Also, is important to verify the possibility of advancing the sowing date of the second crop to a closer recommended date.

The objective of this work was to compare grain yield and plant height of corn, in relay planting into sunflower, in two establishment dates, with their respective sole cropping.

MATERIAL AND METHODS

Two trials were conducted in 1989/90 and 1990/91 at Agronomic Experimental Station, Federal University of Rio Grande do Sul. The soil, where the studies were developed, belongs to São Jerônimo map unit, which is classified as Paleudult. The weather is wet sub-tropical, between Cfa 1 and Cfa 2, according to Köppen classification (Brazil, 1973).

In the first year, the trial was compounded of four treatments: corn in intercropping at 19 and 40 days after the sunflower anthesis and two sole cropping respectively in succession to sunflower, which was cutted with a cutter-shredder in the occasion of corn establishment dates. In the second year, more two treatments were included with sole cropping corn in succession to corn, which was also cutted. During this year, the second corn establishment date was 33 days after the sunflower anthesis. The experimental design used was randomized complete blocks, with four repetitions.

Sunflower hybrids used were Contisol 711 (ICI Seeds) and GR-16 (Rogobras Seeds), respectively in 1989/90 and 1990/91. In the corn crop the SAVE 342A (IPAGRO) and AG 3611 (Agrocerees Seeds) hybrids were used, respectively in the first and second years. Sunflower planting dates were July 28, 1989 and July 26, 1990. Corn sowing dates were November 13 and December 4, 1989; and November 12 and 27, 1990.

Plant densities of sunflower and corn were, respectively, 70.000 and 40.000 plants/hectare, with row spacing of 1,0 meter between rows in the two crops. In the intercropping treatments, the row space between sunflower and corn rows was 0,5 meter. Fertilization was realized for each crop separately in this system.

Irrigation system was used when the soil humidity condictiones were limited. Other practices were kept in levels that would garantee high grain yield.

RESULTS AND DISCUSSION

During the two years of this experiment, corn establishment at 19 days after sunflower anthesis in intercropping system did not reduce the sunflower grain yield in relation to its establishment next to sunflower physiological maturity (TABLE 1). This result was expected, even the earliest date of corn establishment is too early to it has any kind of competition with sunflower either for water, light or nutrients. Low sunflower grain yield levels obtained can be attributed to the fact of being used early hybrids with less potential, planted in early date.

Corn grain yield established next to the physiological maturity of sunflower, i.e., 40 (first year) and 33 days (second year) after its anthesis was similar to that obtained in its sole cropping, during the two years of the experiment (Figures 1 and 2).

The effects of the earliest corn establishment date in relay

intercropping in to sunflower (19 days after anthesis) in grain yield depended on the year and the sunflower hybrid used (Figures 1 and 2). While in the first year there was a reduction of 33% in corn grain yield in intercropping related to its respective sole cropping, in the second year did not have significant differences between the two treatments. Besides the different environment conditions verified among the years, the fact of being used different sunflower hybrids in the two experiments also contributed to this differential response. As a matter of fact, the hybrid Contisol 711, that presents bigger leaf area, higher cycle and sub-period duration of anthesis-physiological maturity than GR 16 (tested in the second year), was used in the first year. In this way, the competition realized by sunflower on corn planted in the first period, in the first year, especially for light, was more accentuated with the utilization of the hybrid Contisol 711. This aspect can be seen at Figures 3 and 4 in which is possible to verify a reduction in the first measurement of corn plant height at the earliest establishment date in relation to its sole cropping, only when was used the hybrid Contisol 711.

The fact that, in the second year, corn grain yield have been higher in the latter sowing date than in the first (Figure 2) is explained by the realization of irrigation more frequently on that time. Also, in relation to the second year of the experiment, is observable that, although is not statistically significant, corn grain yield in sole cropping in succession to corn cutted with a cutter-shredder were numerically lower than that obtained in sole cropping in succession to sunflower cutted with a cutter-shredder, in both establishment dates.

TABLE 1. Grain yield of sunflower in relay intercropping in to corn established at 19 and 40 days after anthesis (1989/90) or at 19 and 33 days after sunflower anthesis (1990/91). Agronomic Experimental Station/UFRGS, Eldorado do Sul, RS.^{1/}

| Corn establishment date | Sunflower grain yield - kg/ha 10% of humidity | |
|--|--|-----------|
| | 1989/90 | 1990/91 |
| 19 days after sunflower anthesis | 1761 n.s. | 1000 n.s. |
| 40 or 33 days after sunflower anthesis | 1635 | 1189 |

n.s. = not significant by Tukey's Test, at the level of 5% of probability.

^{1/}The sunflower hybrids used were Contisol 711 and GR 16, respectively in the first and second year.

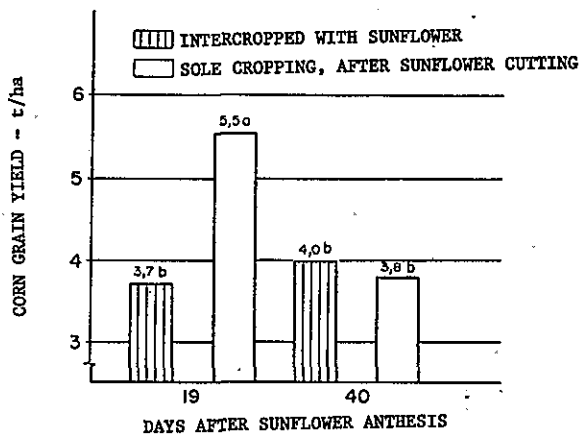


Figure 1. Corn grain yield established in relay intercropping at 19 and 40 days after sunflower anthesis (Hybrid Contisol 711) and in sole cropping. RS/BRAZIL, 1989/90.

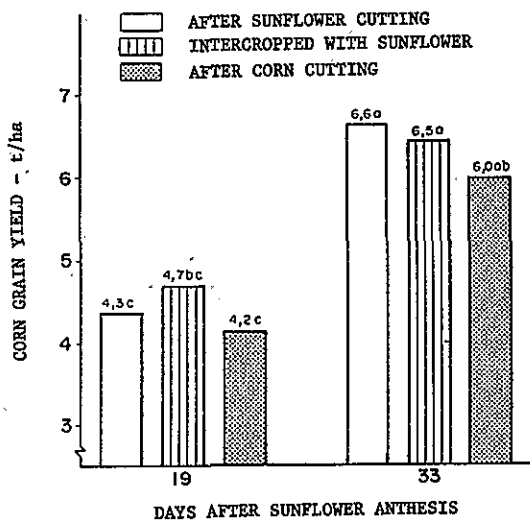


Figure 2. Corn grain yield established in intercropping at 19 and 33 days after sunflower anthesis (Hybrid GR 16) and in sole cropping after sunflower or corn cutting. RS/BRAZIL, 1990/91.

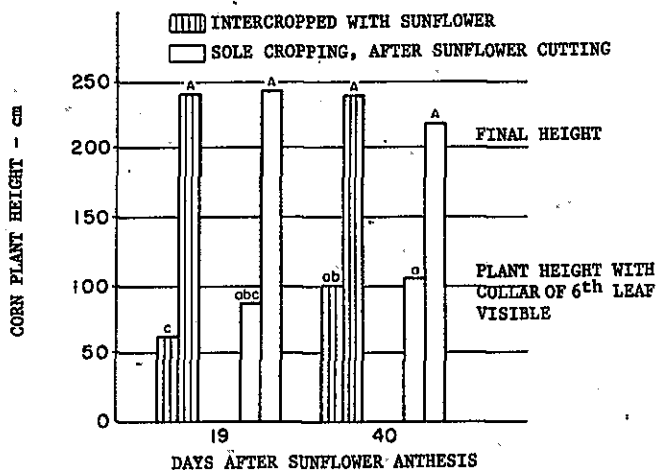


Figure 3. Plant height in two development stages of corn established in relay intercropping at 19 and 40 days after sunflower anthesis (Hybrid Contisol 711) and in sole cropping. RS/BRAZIL, 1989/90.

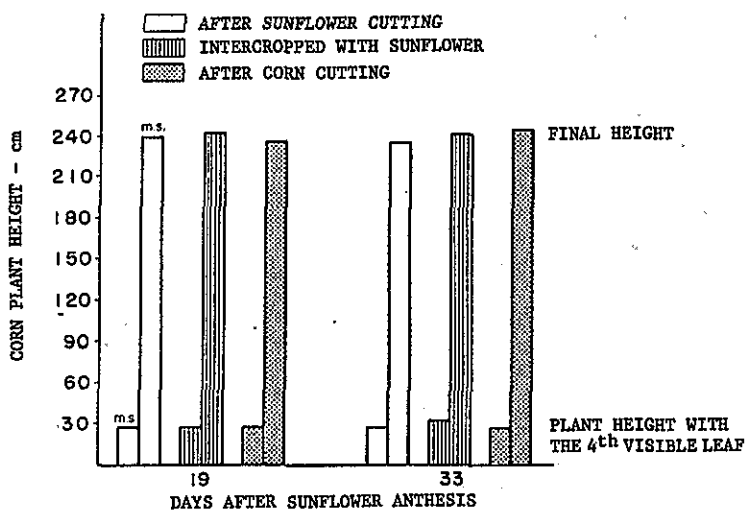


Figure 4. Plant height in two development stages of corn established in relay intercropping at 19 and 33 days after sunflower anthesis (Hybrid GR 16) and in sole cropping after sunflower or corn cutting. RS/BRAZIL 1990/91.

CONCLUSIONS

Corn establishment in relay intercropping next to sunflower physiological maturity is a practicable technique because it permits the advancing of sowing with regard to succession system, and direct corn sowing. Although, it involves in manual sowing of that crop, is been recommended to small farms.

The advancing of corn establishment date to three weeks after sunflower anthesis can result in accentuated reduction of grain yield in relation to its respective sole cropping, depending on the sunflower hybrid used in the intercropping system.

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