SOWING SEASON OF CORN WITH COWPEA AND CORN INTERCROPPING IN THE WEED CONTROL. I. GREEN EARS YIELD

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Abstract – Green ears yield losses caused by weeds may reach up to 52%. Reducing the use of herbicides is one of agriculture's major goals and several alternatives are currently being investigated, including intercropping. The goal of this work was to evaluate the effects of cowpea sowing season, intercropped with corn, on green ear yield of two corn cultivars. The experiment was carried out as random blocks with four replicates. Corn cultivars AG 1051 and AG 2060 were submitted to the following treatments: no hoeing, two hoeings (20 and 40 days after planting), and cowpea planting (cultivar BR 4, with indeterminate growth) at corn planting and at 5, 10, and 15 days later. Twenty-eight weed species were found in the experiment area. The highest marketable green ear yields were obtained with hoeing, while the lowest were obtained without hoeing. Intercropping with cowpea, especially when done early, provided intermediate results, indicating that the legume controlled weeds to a certain extent, which was, however, insufficient to avoid corn yield loss. The cultivars do not differ with regard to green ear yield. Cowpea yields were nearly null (data not shown).

Keywords: *Zea mays* L., *Vigna unguiculata* (L.) Walp., green corn.

EFEITO DA ÉPOCA DE PLANTIO DO CONSÓRCIO FEIJÃO-CAUPI COM MILHO NO CONTROLE DE PLANTAS DANINHAS. I. PRODUTIVIDADE DE ESPIGAS VERDES

Resumo – As perdas no rendimento de espigas verdes do milho, devidas às plantas daninhas podem ser superiores a 52%. A redução do uso de herbicidas é um dos maiores objetivos da agricultura moderna e diversas alternativas estão sendo atualmente investigadas, inclusive o uso da consorciação. O objetivo do presente trabalho foi avaliar os efeitos da época de plantio do feijão-caupi, em consorciação com o milho, sobre os rendimentos de espigas verdes de duas cultivares de milho. O experimento foi realizado em blocos ao acaso com quatro repetições. Duas cultivares de milho (AG 1051 e AG 2060) foram submetidas aos seguintes tratamentos: sem capinas, duas capinas (aos 20 e 40 dias após o plantio) e plantio do feijão-caupi entre as fileiras do milho por ocasião do plantio do milho e aos 5, 10 e 15 dias depois. Vinte e oito espécies de plantas daninhas ocorreram na area experimental. Os maiores rendimentos de espigas verdes comercializáveis foram obtidos com duas capinas e os menores, na ausência de capinas. A consorciação com feijão-caupi, especialmente quando feita precocemente, proporcionou resultados intermediários, indicando que a leguminosa controlou as plantas daninhas em certo grau que foi, entretanto, insuficiente para evitar perdas no rendimento. As cultivares não diferiram quanto ao rendimento de espigas verdes. Os rendimentos do feijão-caupi foram quase nulos e, por isso, não foram apresentados.

Palavras-chave: *Zea mays* L, *Vigna unguiculata* (L.) Walp., milho verde.

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Introduction

Corn (Zea mays L.) is grown in all Brazilian states, for green ear and grain production. Green corn is a product much appreciated by Brazilians, and is also used in the preparation of typical dishes.

Many cultural practices for weed control, including intercrops, have been studied in the past. The weed-control cultural practices studied in the past have again become interesting (Nalewaja, 1999) and are once again being studied, including intercrops (Abreu, 2004). Reducing the used of herbicides is one of modern agriculture's major goals (Ngouajio et al., 1999) and several alternatives are currently being investigated with this objective (Carruthers et al., 1998). Intercropping with four (Martins, 1994) or seven (Skóra Neto, 1993) legume species, when sown simultaneously with corn, did not decrease weed infestation (Skóra Neto, 1993) and reduced corn grain growth and yield (Martins, 1994). However, intercropped legumes reduced weed populations without affecting corn plants or their productivity when seeded 21 days after corn (Martins, 1994).

The objective of this work was to evaluate the effects of cowpea sowing season, intercropped with corn, on weed control and green ear yield of two cultivars.

Material and Methods

The experiment was carried out at Fazenda Experimental "Rafael Fernandes" (experimental farm), of Universidade Federal Rural do Semi-Árido, located 20 km away from the municipal seat of Mossoró-RN, under sprinkling irrigation.

Planting was carried out on 08.19.2004, and four seeds were used per pit. A spacing of 1.0 m was used between rows, with pits on the same row spaced at 0.4 m. After thinning the programmed population stand in the experiment was 50 thousand plants/ha. A completely randomized block design with split-plots and four replicates was used. Each subplot consisted of three 6.0-m-long rows. The usable area was considered as that occupied by the 5.2 m in the central row. Cultivars AG 1051 and AG 2060 were submitted to the following treatments: no hoeing, two hoeings (22 and 41 days after planting), and cowpea sowing (cultivar BR 14-Mulato, with indeterminate growth) at corn planting or at 5, 10, and 15 days later. The cowpea was planted between the corn rows, in pits spaced at 1.0 m, with two plants per pit. Cultivars were assigned to plots and weed control was assigned to subplots. Weedings were made by hand hoeing, and the same employee was assigned to perform the service in each block.

Results and Discussion

A relatively small number of weeds occurred in the experiment (Table 1) in relation to other study carried out at same area (Silva et al., 2004b). The distribution of weeds in the experiment area was not uniform (Table 2). Weeded plots showed the smallest dry matter weight of the above-ground part of weeds, and plots intercropped 15 days after corn was planted showed the highest weight (Tables 3 and 4).

Table 1. Weed species found at green ear yield assessment in two corn cultivars, grown with or without hoeing and intercropping with cowpea, sown at corn planting or until 15 days later.

Order no.	Botanical Name	Order no.	Botanical Name
1	*Alternanthera ficoideae* (L.) R. Br.	15	*Euphorbia hyssopifolia* L.
2	*Ipomoea Bahiensis* Willd. Ex Roemer et Schultes	16	*Panicum repens* L.
3	*Borreria verticillata* G.F.W. Meyer	17	*Crumenaria decumbens* Mart.
4	*Dactyloctenium aegyptium* (L.) Beauv.	18	*Panicum maximum* Jacq.
5	*Digitaria sanguinalis* (L.) Scop.	19	*Urochloa mosambicensis* (Hackel.) Dandy
6	*Desmanthus virgatus* (L.) Willd	20	*Marsypianthes chamaedrys* Kuntze
7	*Hyptis suaveolens* L.	21	*Chamaecrista* sp.
8	*Phyllanthus nururi* L.	22	*Senna* sp.
9	*Borreria scabiosoides* Cham. et Schlecht	23	*Jacquemontia* sp.
10	*Herissantia crispa* (L.) Briz.	24	*Bauhinia heterandra* Benth
11	*Adenocalymma* sp.	25	*Portulaca mucronata*
12	*Commelina* sp.	26	*Euphorbia hirta* L.
13	*Eragrostis ciliaris* (L.) R.Br.	27	*Mitracarpus selloanus* Cham. Et Schlecht
14	*Schranckia leptocarpa* DC.	28	*Evolvulus ovatus* Fernald

Table 2. Weed species distribution at green ear yield assessment in two corn cultivars, grown with or without hoeing and intercropping with cowpea, sown at corn planting or until 15 days later. Numbers represent order numbers in Table 1.

Blocks	Treatments (in boldface)/weeds[1]											
	AG 2060						AG 1051					
4	11 3,5,7, 9	10 5,7,9, 23	12 3,5,9	8 3,9, 15, 16,22	9 3,9, 16	7 1,3,9, 16	5 3,7,9	4 3,7,9	3 3,7,9, 28	2 3,5,9	1 3,5, 7	6 2,3, 5, 18
	AG 1051						AG 2060					
3	4 3,5,9	1 2,3,5, 9	3 7,9,24	6 7,9	5 3,7,9, 10	2 3	12 3,7,9, 12	10 9,11	11 1,3,7, 9	8 3,9,12	9 3,9	7 3,5, 9
	AG 2060						AG 1051					
2	8 3,9,24	11 3,5,7, 9,23	7 2,3,5, 7,10, 14,17, 19,25	10 1,2,3, 5,6,7	12 3,5,7, 9,20, 27	9 3,5,7, 16	3 1,3,7, 16	6 3,4,9, 16	2 3,6,9, 26	1 1,3,5, 20	4 3,5, 9,20	5 3,5, 9
	AG 2060						AG 1051					
1	9 2,3,7, 11,15	11 1,3,7, 9	8 3,6,9, 16	10 2,3,7, 11,16	7 3,5,7, 11	12 2,3,5, 6,8,16	2 3,5,6, 7,9, 11,16, 24	4 3,5,7, 9,10, 12,16	3 3,5,7, 9,16	1 3,5,7, 14,21	6 2,3, 5,9	5 3,5, 9, 13

[1]Treatments 1 and 7 = "no hoeing", 2 and 8 = "with hoeing", 3 and 9 = "cowpea planted at corn planting, and so on.

Table 3. Plant height and ear height, total and marketable green ear yield of corn cultivars, and dry matter weight of the above-ground part of weeds resulting from weed control (means of four replicates and two cultivars).[1]

Weed control	Plant height (cm)	Ear height (cm)	Total ears ha^{-1}		Marketable unhusked ears ha^{-1}		Marketable husl ears ha^{-1}	
			Number	kg	Number	kg	Number	kg
With hoeing	163 a	80 a	48517 a	11640 a	46305 a	11441 a	36401 a	5163
Simultaneous cowpea and corn planting (PS)	162 a	84 a	46635 a	8126 b	36491 ab	7300 b	24798 ab	2989
Cowpea planted 5 days after PS	161 a	82 a	43930 a	7497 b	33354 ab	6742 b	26503 ab	3093
Cowpea planted 10 days after PS	159 a	81 a	45081 a	7872 b	34880 ab	6836 b	22834 ab	3435
Cowpea planted 15 days after PS	157 a	80 a	46815 a	6748 b	32752 ab	5594 b	15805 b	193
No hoeing	149 a	74 a	43875 a	5601 b	25865 b	4190 b	13407 b	164
CVb, %	9	12	13	29	26	37	35	35

[1]Means followed by the same letter are not different at 5% probability by Tukey test.
[2]Cowpea planted intercropped with corn

Table 4. Plant height and ear height, total and marketable green ear yield of corn cultivars, and dry matter weight of the above-ground part of weeds (means of four replicates and six weed control methods).[1]

Cultivars	Plant height (cm)	Ear height (cm)	Total ears ha^{-1}		Marketable unhusked ears ha^{-1}		Marketable husked ears ha^{-1}	
			Number	kg	Number	kg	Number	kg
AG 1051	159 a	86 a	46575 a	8063 a	34777 a	7025 a	24296 a	2968 a
AG 2060	158 a	74 b	45043 a	7765 a	35104 a	7009 a	22286 a	3115 a
CVa, %	9	16	9	38	32	37	34	30

[1]Means followed by the same letter are not different at 5% probability by Tukey test.

In all characteristics evaluated, except for plant height, ear height, and total number of green ears, where no difference occurred between treatments, the lack of weeding determined the smallest means, while weed control determined the highest (Table 3). In plots where cowpea was sown, intermediate means were obtained for number of marketable unhusked green ears and for number and weight of marketable husked ears. This suggests that cowpea aids in corn weed control when intercropped, especially when it is planter earlier. This observation is verified from the number of marketable ears, both unhusked and husked, and from husked ear weight (Table 3). The following regression equations (obtained considering cowpea sowing season as the independent variable), adjusted for the above-mentioned traits, reinforce this observation: $y = 36253.5 - 812.9\ x^{0.5}$, $R^2 = 67\%$ (number of marketable unhusked ears), $y^2 = 51574100 - 86455.0\ x^2$, $R^2 = 88\%$ (weight of marketable unhusked ears), $y^2 = 683792000.0 - 189100.0\ x^2$, $R^2 = 94\%$ (number of marketable husked ears), and $y^2 = 10287000.0 - 1851.9\ x^3$, $R^2 = 73\%$. Cowpea yields were nearly null (data not shown). Differences among genotypes means were not observed (Table 4).

Conclusions

Higher marketable green ear yields are obtained with hoeing, while lower yields are obtained without hoeing. Intercropping with cowpea, especially when done early, provides intermediate results, indicating that the legume controls weeds to a certain extent, which is, however, insufficient to avoid green ear yield losses. The cultivars do not differ with regard to green ear yield. Cowpea yields were nearly null (data not shown).

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