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Yield and economic returns of peanut and sweetcorn as influenced by timing of planting the crops in an intercropping scheme

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ABSTRACT

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This study was conducted to evaluate the growth and yield of peanut and sweet corn as influenced by timing of planting the crops in an intercropping scheme; determine the appropriate timing of planting peanut and sweet corn in an intercropping scheme for optimum land productivity; and determine the economics of growing peanut in combination with sweet corn as influenced by timing of planting the crops.

Most of the agronomic characteristics, yield and yield components of peanut and sweet corn were significantly affected by timing of planting the crops. Sweet corn planted 2 and 3 weeks ahead of peanut gave higher total yield in tons per hectare than sweet corn planted later than peanut.

Planting sweet corn 3 weeks ahead of peanut (T_3) gave the highest land equivalent ratio (LER) of 1.62, which means that such practice was 62% more productive than growing peanut or sweet corn as monocrop. It also gave the highest gross margin of PhP 52,157.00 per hectare.

Keywords: peanut, sweet corn, intercropping, timing of planting

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INTRODUCTION

Because of rapid population growth, food availability is becoming one of the major problems in developing countries today. In the Philippines, the massive dwindling of prime agricultural lands and the high prices of agricultural inputs make it difficult for the government to meet the food requirement of the fast growing population. Extensive and mechanized farming can not be done in the country because most of the farmers have small landholdings and limited farm resources. This situation calls for the use of a well planned multiple cropping system which allows maximum crop production per unit area per unit time (Beets, 1982).

One of the methods of multiple cropping is intercropping. This refers to the growing of two or more crops in the same piece of land at the same time in a fixed pattern (Gomez and Gomez, 1983). It has been reported that plants, when grown under intercropping system, can better utilize the environmental resources like light, soil nutrients and water than when grown in mono cropping scheme. Also, yield advantages are achieved without the need of costly inputs. For instance, the intercrop can suppress the growth of weeds through shading. Thus, lesser expenses for weeding can be incurred. Also, the standing crop can serve as a nurse crop because it provides shade for the transplanted seedling and keeps the soil moist during dry season (Cereligia, 1995).

In the Philippines, peanut and sweet corn are some of the most important crops grown by the farmers under monoculture system. Peanut (*Arachis hypogea* L.) is one of the most important legumes with remarkable characteristics of producing underground fruits called pods. The seeds are widely used as human food for it contains high quality protein and has high digestibility. It is an excellent source of high quality oil (40-48%) used either for food shortening or for other industrial products (Cagampang and Lantican, 1979).

On the other hand, sweet corn is grown by Filipino farmers as a cash crop. Its sweet kernels contain higher proportion of sugar than starch (Baterna, 1981) thus, it is especially suited for boiling in green form which commands reasonable price in the local market. Since it matures early, it can provide income to farmers in a relatively shorter time.

Even though optimum yield is obtained from peanut and sweet corn planted as mono crop, the total income derived from these two crops is lower

due to the high cost of production inputs for each crop. Also, under mono cropping there is a possibility of insect and disease build up due to continuous growing of the same crop throughout the year making the control measure expensive. In addition, the absence of crop cover between the rows promotes high degree of soil erosion and soil run off when impact of heavy rains occurs resulting in soil fertility depletion as a whole (De la Rosa, 1979).

These problems can be minimized when intercropping is employed. The fresh stover of sweet corn, for instance, can be used after harvest to cover the soil. When it is decomposed, it can be used to improve the organic matter of the soil (Baterna, 1981). On the other hand, the peanut can fix atmospheric nitrogen and incorporates it in the soil, thus improving soil fertility.

It should be noted, however, that for an intercropping practice to be successful, several factors must be taken into consideration. One of these factors is the timing of planting the crops. If timing is not appropriate, the growing of two crops in combination can lead to a great competition on the utilization of the environmental resources such as light, moisture and soil nutrients which results in the reduction of the yields of both main crop and the intercrop (Luyuhan, 1996).

Planting the crops at different time may help minimize the competition effect because it helps insure that the peak of crop demand for the same growth will not fall at the same time.

This study was conducted to evaluate the growth and yield of peanut and sweet corn as influenced by timing of planting the crops in an intercropping scheme; determine the appropriate timing of planting peanut and sweet corn in an intercropping scheme for optimum land productivity; and determine the economics of growing peanut in combination with sweet corn as influenced by timing of planting the crops.

MATERIALS AND METHODS

This study was conducted at the experimental area of the Department of Agronomy and Soil Science in Leyte State University, Philippines from January to May 2000. An area of 1,058.5 sq. meters was laid out in Randomized Complete Block Design (RCBD) with 3 replications. Each plot measured 5 x 5 m consisting of 5 rows of peanut and 4 rows of sweet corn.

Alleyways were provided to facilitate cleaning and data gathering. Also drainage canals were constructed at the center and both sides of the experimental area to remove excess water during heavy rains.

The treatments considered in this study were: T_1 - sweet corn planted 1 week before planting peanut; T_2 – sweet corn planted 2 weeks before planting peanut; T_3 – sweet corn planted 3 weeks before planting peanut; T_4 – sweet corn and peanut planted at the same time; T_5 – sweet corn planted 1 week after planting peanut; T_6 – sweet corn planted 2 weeks after planting peanut; T_7 – sweet corn planted 3 weeks after planting peanut; T_8 – peanut monocrop; and T_9 – sweet corn monocrop.

Before planting, soil samples were collected randomly from the experimental area to determine the soil pH, OM and extractable P. On the other hand, K content was not analyzed due to instrument breakdown. After harvest, soil sampling was again done in each treatment plot to analyze the same soil parameters mentioned above.

Peanut seeds (UPLPn2) were sown on ridges at 3 seeds per hill, while sweet corn seeds were sown in furrows at 2 seeds per hill. Sowing distances for both crops were 1.0 m between rows and 0.20 m between hills. Thinning was done five (5) days after crop emergence leaving two (2) seedlings for peanut and one (1) seedling for sweet corn.

Complete fertilizer was applied to peanut at planting (30 kg N, 30 kg P_2O_5, 30 kg K_2O per hectare) based on peanut fertilizer recommendation. On the other hand, 90 kg N, 60 kg P_20_5 and 60 kg K_2O per hectare were applied to sweet corn, based on sweet corn fertilizer recommendation. Two thirds (2/3) of N and all P_20_5 and K_20 were applied at planting. The remaining one third (1/3) was applied at 40 days after planting.

At planting, Furadan 3G (16.7 kg/ha) was applied to both peanuts and sweet corn to control insect pests and diseases. To control the build up of corn stem borer, Karate (1.5 tbsp per 16 li. of water) was applied at two weeks interval during vegetative stage up to tasseling stage of sweet corn. To control rats, Racumin rat killer (35 packs/ha) was applied during pod and grain development up to maturity of peanut and sweet corn.

Cyperus rotundus, Rottboella cochinchinensis and *Ageratum conyzoides* L. were the most predominant weed species associated with the crops. However, the effect of these weeds was minimal since weeding operation was done at the early stage of the crop growth.

RESULTS AND DISCUSSION

Soil Components and Plant Growth

Results of the initial soil analysis (Table 1) revealed that the experimental area was very slightly acidic (soil pH was 6.40) but had adequate organic matter content (8.09 %) and high extractable phosphorus (18.51mg/kg) (FAO, 1990).

After harvest, soil samples from each treatment plot were again analyzed. Results showed that soil pH and organic matter (OM) content decreased in all treatments. However, an increase in extractable phosphorus (P) was observed in all treatments except in T_8 (peanut monocrop).

At the early stage of crop growth, both peanut and sweet corn exhibited uniform and vigorous growth. This might be due to the amount of fertilizer materials applied during planting and the adequate amount of soil nutrients present in the soil (Table 1).

During the late vegetative stage, both crops exhibited less vigorous growth with longer and thinner leaves. This might be due to the decrease in soil pH and OM contents in the soil. Brady and Weil (1999) stated that as organic residues decomposed, organic and inorganic acids are formed thus, render the soil to become acidic. During tillage the organic residues were incorporated to the soil; decomposition process took place, and eventually caused the decrease of soil pH. On the other hand, the decrease in OM contents might be attributed to the continuous tillage done in the experimental area. According to Brady and Weil (1999) tillage enhances the accessibility of microorganism responsible for the decomposition of organic matter present in the soil thereby making nutrients available for plant growth. Moreover, during harvesting of the experimental plants, all the herbage of both crops were removed from the area because it was used to gather data and some were utilized for animal feeds. This resulted in the total decline of the soil organic matter.

On the other hand, the slight increase of phosphorus in all treatment plots except T_8 (peanut monocrop) might be due to the high amount of P initially present in the soil and application of phosphorus-containing fertilizer during planting of the crops. Also, the decomposition of mungbean residues (previously

Table 1. Initial and final analyses of soil samples from the experimental area in ViSCA, Baybay, Leyte.

Treatment	Soil pH (water)	Organic Matter (%)	Extractable P (mg/kg soil)
Initial	6.40	8.09	18.51
Final			
T_1	6.25	5.58	19.62
T_2	5.95	5.45	19.62
T_3	5.90	5.62	18.78
T_4	6.00	5.59	19.30
T_5	5.90	5.75	25.03
T_6	5.90	5.59	20.15
T_7	5.95	6.64	20.07
T_8	6.05	6.05	17.09
T_9	5.95	5.75	22.84

T_1 – Sweet corn planted 1 week before planting peanut
T^2 – Sweet corn planted 2 weeks before planting peanut
T^3 – Sweet corn planted 3 weeks before planting peanut
T_4 – Sweet corn and peanut planted at the same time
T_5 – Sweet corn planted 1 week after planting peanut
T_6 – Sweet corn planted 2 weeks after planting peanut
T_7 – Sweet corn planted 3 weeks after planting peanut
T_8 – Peanut mono crop
T_9 – Sweet corn mono crop

planted in the area) and the presence of other humus in the soil might have enhanced the availability of P in the soil.

In T_8 (peanut monocrop), phosphorus in the soil slightly decreased probably because peanut consumes more of the said nutrient during nodule formation and pod dev lopment. Cereligia (1995) revealed that mungbean consumes more amount of phosphorus during nodule formation.

Agronomic Characteristics of Peanut

Of the agronomic characteristics of peanut, only plant height was not

significantly affected by the timing of planting sweet corn. The other parameters such as the number of days from planting to emergence, flowering, pegging, and maturity; number of nodules per plant, leaf area index and fresh herbage yield were markedly influenced by the treatments (Table 2).

Peanuts planted at 1, 2 and 3 weeks ahead of sweet corn (T_5, T_6 and T_7, respectively), those planted at the same time with sweet corn (T_4) and those planted as monocrop (T_8) emerged, flowered, pegged and matured earlier than the peanuts planted at 1, 2 and 3 after sweet corn (T_1, T_2 and T_3) (Table 2).

The early emergence of peanut in T_5, T_6, T_7, T_4 and T_8 could be attributed to the favorable condition of soil for seed germination. There was enough rainfall during the first six days of the experimental period (Table 3), the time when the peanuts in the said treatments were sown. This condition resulted in good soil tilth and adequate soil moisture, which favored early seedling emergence. Since the seeds emerged earlier, the resulting plants in T_5, T_6, T_7, T_4 and T_8 also flowered, pegged and matured earlier than those plants that germinated later.

In T_1, T_2 and T_3, delayed seedling emergence could be attributed to the heavy rains that occurred after seeds were sown. The excess water, even if it was drained immediately, caused soil compaction and poor soil aeration. According to Brady and Weil (1999) when soil aeration is poor, the availability of oxygen in the root zone is insufficient to support optimal growth of the plant. In this study, poor soil aeration was experienced and this resulted in the delayed seedling emergence from the soil surface, which in turn resulted in the delayed flowering, pegging and maturity of the plants in T_1, T_2 and T_3.

The above results are in consonance with the finding of Hassan (1980) that cereals and legumes planted in a marginal area during rainy season emerged and matured later than those planted in the same area during dry season.

Peanuts planted 3 weeks ahead of sweet corn (T_7) and those planted as mono crop (T_8) had significantly more nodules per plant compared to the peanuts planted in the other treatments. Peanuts planted 3 weeks after sweet corn (T_3) had the least number of nodules per plant, followed by those planted 2 and 1 week after sweet corn (T_2 and T_1), respectively. These results could be attributed to the fact that in T_7 and T_8, there was lesser competition among

Table 2. Agronomic characteristics of peanut (UPL Pn 2) as influenced by timing of planting sweet corn in an intercropping scheme.

Treatments	Days from Planting to				Number of Nodules per Plant	Leaf Area Index (LAI)	Plant Height (cm)	Fresh Herbage Yield (t/ha)
	Emergence	Flowering	Pegging	Maturity				
1	7.00 A	32.66 BC	40.00 B	98.00 B	90.66 D	1.86 C	82.05	5.71 C
2	7.00 A	33.33 AB	40.33 B	98.00 B	79.33 DE	1.89 C	86.52	5.48 C
3	7.33 A	34.00 A	41.66 A	98.66 A	66.00 E	1.81 C	84.19	5.54 C
4	6.00 B	32.00 C	38.66 C	96.00 C	120.66 C	2.00 BC	89.96	5.62 C
5	6.33 B	30.00 D	37.00 D	96.00 C	156.33 B	2.26 AB	92.61	6.18 BC
6	6.00 B	30.33 D	37.33 D	96.00 C	162.00 B	2.33 AB	89.12	6.53 BC
7	6.00 B	30.66 D	36.66 DE	96.00 C	172.33 AB	2.33 AB	84.68	7.29 B
8	6.00 B	30.00 D	36.00 E	96.00 C	182.66 A	2.54 A	88.53	9.58 A
CV (%)	4.63	1.31	1.25	1.21	8.45	8.29	5.75	15.13

Treatment means within the same column followed by the same letter(s) are not significantly different at 5% level, DMRT.

T_1 – Sweet corn planted I week before planting peanut
T_2 – Sweet corn planted 2 weeks before planting peanut
T_3 – Sweet corn planted 3 weeks before planting peanut
T_4 – Sweet corn and peanut planted at the same time
T_5 – Sweet corn planted 1 week after planting peanut
T_6 – Sweet corn planted 2 weeks after planting peanut
T_7 – Sweet corn planted 3 weeks after planting peanut
T_8 – Peanut mono crop

Table 3. Total weekly rainfall (mm) and minimum and maximum temperature (°C) from planting up to harvesting of peanut and sweet corn (January to May, 2000).

Weeks	Weekly Rainfall (mm)	Weekly Temperature (°C)	
		Minimum	Maximum
1	4.5	24.5	31.4
2	8.4	23.7	30.0
3	11.3 **	23.5	30.3
4	17.4	24.8	30.1
5	19.5	24.8	30.2
6	23.2	24.9	30.0
7	8.0	23.4	29.9
8	23.0	24.0	30.3
9	11.0	25.6	30.4
10	18.6	23.8	29.3
11	6.4	25.7	32.6
12	17.5	24.8	31.4
13	9.8	24.8	30.0
14	3.0	25.4	31.2
15	3.0	25.8	31.6
16	2.7	26.4	31.5
17	17.4	25.9	31.4
18	2.2	26.7	32.3
19	7.0	24.8	31.7
20	6.1	23.8	31.4
Total	214	497	612
Mean	10.7	24.8	30.6

Based on the data obtained from LSU Agrometerological Research Station, LSU, Visca, Baybay, Leyte.

** Start of planting

plants and thus, more efficient utilization of existing climatic and soil resources especially during crop establishment stage. This condition caused the peanuts to grow vigorously resulting in the production of more adventitious roots and the development of more nodules. According to Cereligia (1995), legumes plants having extensive root and shoot systems can take advantage in utilizing the growth factors thus, produce more lateral roots and nodules.

In the treatments where peanuts were planted later than sweet corn (T_1, T_2 and T_3), there was already competition among plants in terms of utilizing soil and climatic resources. The peanuts had to compete with more established and taller corn plants, thus, the former were not able to grow vigorously resulting in the development of lesser number of nodules. This result conforms with the finding of Gomez and Gomez (1983), that competition effect is more pronounced in intercropping or relay cropping. They said that the intercropped species compete not only for sunlight and carbon dioxide in the air (above-ground competition) but also for water and soil nutrients (below-ground competition).

Higher leaf area index was noted when peanut was planted ahead of sweet corn (T_5, T_6 and T_7) and those planted as monocrop (T_8) than when it was planted later than sweet corn (T_1, T_2 and T_3). These could be because when peanut was planted ahead of sweet corn it was able to develop its roots and absorb more nutrients from the soil. This resulted in rapid development of more and bigger leaves and, consequently, gave higher leaf area index. These results are similar to the finding of Militante (1997) that sweetpotato grown ahead of sweet corn had higher leaf area index than those planted later. She explained that sweetpotato planted ahead had the advantage to utilize more nutrients present in the soil and to intercept and absorb light needed for the development of vegetative parts.

The lower leaf area index in peanut planted later and at the same time with sweet corn could be attributed to the fact that peanut being a short plant with smaller leaves can not compete with the taller sweet corn plants in terms of light interception and absorption of more nutrients from the soil.

High fresh herbage yield was observed in peanuts planted as monocrop (T_8) followed by peanuts planted 3 weeks ahead than sweet corn (T_7). This was because the peanut in the said treatments were subjected to lesser competition for growth factors. This condition promoted the production of

more branches and bigger stem and leaves resulting in high fresh herbage yield.

The lowest fresh herbage yield was obtained in peanut planted 1, 2 and 3 weeks after sweet corn (T_1, T_2 and T_3) and those planted at the same time. This may be due to the severe competition for growth factors experienced by the crop, resulting in thinner stems with fewer branches and leaves. According to Casuco (1988) intercrop planted at the same time and later than the main crop suffers greater competition with the main crop in terms of soil nutrients, moisture and other growth factors needed by plant. Thus, it cannot grow well, resulting in low herbage yield.

Yield and Yield Components of Peanut

All the yield and yield components of peanut except the harvest index, were significantly influenced by timing of planting sweet corn (Table 4). Peanuts planted as mono crop (T_8) produced the highest number of pods and seeds per plant, followed by peanuts planted 3 and 2 weeks ahead of sweet corn (T_7 and T_8), respectively. The least number of pods and seeds per plant were obtained in T_1 up to T_5. These results indicate that peanut plant is very sensitive to severe competition during pod formation.

These findings conform with those of Olita (1984) that when peanut was planted 1 week before corn, it produced more filled pods. But when peanut was planted simultaneously with corn, it produced more unfilled pods. Olita (1984) said these results could be attributed to shading, which affects photosynthetic activities of the crops thereby influencing their growth and yield.

Effects of the treatments on the weight of 1000 seeds and fresh pod yield followed the same trend. Peanuts planted as monocrop (T_8) gave heavier weight of 1000 seeds as compared to the rest of the treatments. Generally, these findings suggest that minimizing crop competition for light, space, moisture, temperature and other growth factors could enhance the development of more pods and seeds per plant with heavier weights. According to Gomez and Gomez (1983), competition effect is more pronounced in intercropping than in monocropping scheme. The intercropped species compete not only for sunlight and carbon dioxide (CO_2) in the air (above-ground competition) but also for water, space and soil nutrients (below-ground competition). Moreover,

Table 4. Yield and yield components and harvest index of peanut (UPL Pn 2) as influenced by timing of planting sweet corn in an intercropping scheme.

Treatments	Number of Pods per Plant	Number of Seeds per Plant	Weight of 1000 seeds (grams)	Fresh Pod Yield (t/ha)	Harvest Index (HI)
1	10.66 C	19.60 D	332.71 BC	1.72 BC	0.19
2	11.25 C	21.84 CD	328.54 BC	1.52 B	0.19
3	10.41 C	20.65 CD	319.43 C	1.34 C	0.20
4	13.69 C	27.45 CD	329.78 BC	1.68 BC	0.22
5	13.23 C	26.01 CD	331.74 BC	1.71 BC	0.23
6	14.93 BC	30.76 BC	337.03 B	2.04 B	0.23
7	18.62 B	37.52 B	345.31 B	1.93 BC	0.23
8	26.42 A	54.41 A	386.01 A	3.07 A	0.23
CV (%)	17.89	18.88	2.58	18.40	8.28

Treatment means within the same column followed by the same letter(s) are not significantly different at 5% level, DMRT.

T_1 – Sweet corn planted I week before planting peanut
T_2 – Sweet corn planted 2 weeks before planting peanut
T_3 – Sweet corn planted 3 weeks before planting peanut
T_4 – Sweet corn and peanut planted at the same time
T_5 – Sweet corn planted 1 week after planting peanut
T_6 – Sweet corn planted 2 weeks after planting peanut
T_7 – Sweet corn planted 3 weeks after planting peanut
T_8 – Peanut monocrop

Ebcas (1992) as cited by Luyuhan (1996) revealed that bush beans planted 1 to 2 weeks before corn produced more pods than those planted simultaneously with corn. He said the competition between corn and bush beans for sunlight and other growth factors was not severe and shading effects of corn was minimized, thus bush beans was able to give better yield.

Agronomic Characteristics of Sweet Corn

Table 5 shows the agronomic characteristics of sweet corn as influenced by timing of planting peanut in an intercropping scheme. Analysis of variance revealed that the timing of planting peanut did not significantly affect the number of days from planting to emergence and the number of days from planting to harvesting of sweet corn. On the other hand, the other parameters such as the number of days from planting to tasselling and silking, plant height, leaf area index and fresh stover yield were significantly influenced by the treatments.

Sweet corn planted as monocrop (T_9) and those planted 1, 2 and 3 weeks ahead of peanut (T_1, T_2 and T_3) tasselled and silked earlier than the sweet corn planted later than peanut (T_5, T_6 and T_7). These results show that sweet corn is more competitive when it is planted ahead of peanut. According to Cereligia (1995) the plants' morphological characteristics contribute to the variation in the exploitation of growth factors. Since sweet corn has taller canopy than peanut, it can intercept greater share of light than the latter. If sweet corn is planted ahead of peanut, it can establish earlier thus, it will be more competitive in terms of exploiting growth factors.

On the other hand, sweet corn planted 3 weeks ahead of peanut (T_3) and those planted as monocrop (T_9) were shorter but had higher leaf area index and more fresh stover yield than the other treatments. These results suggest that when sweet corn was planted 3 weeks ahead of peanut or when it was planted as monocrop, it experienced minimal competition in utilizing the available growth factors. Thus, it had a chance to develop bigger stem and more leaves which greatly favored dry matter production resulting in shorter plant height but higher leaf area index and greater fresh stover yield. This is similar to the results of the study of Cagasan (1990) which showed that peanut plants weeded at 2, 4 and 6 weeks after planting were shorter than the unweeded plants. He explained that early removal of weeds resulted in lesser

Table 5. Agronomic characteristics of sweet corn as influenced by timing of planting peanut in an intercropping scheme.

Treatment	Days from Planting to				Plant Height at Maturity cm)	Leaf Area Index (LAI)	Fresh Stover Yield (t/ha)
	Emergence	Tasselling	Silking	Harvesting			
1	4.00	49.33 BC	55.33 C	70.00	271.21 BC	2.93 B	18.53 BC
2	4.00	48.33 C	55.00 C	70.00	266.08 BC	3.28 AB	20.94 A
3	4.00	48.66 C	55.33 C	70.00	245.61 D	3.45 A	20.38 AB
4	4.00	50.33 B	57.66 B	70.00	270.54 BC	3.19 AB	18.23 BC
5	5.00	53.33 A	59.33 A	72.00	267.15 BC	2.95 B	18.70 BC
6	5.00	53.33 A	58.00 AB	71.00	271.76 B	2.36 C	17.00 C
7	5.00	53.33 A	57.66 B	72.00	293.84 A	2.20 C	17.29 C
8	4.00	48.66 C	56.66C	70.00	255.27 CD	3.54 A	19.04 AB
CV (%)	1.00	1.19	1.35	0	3.15	8.70	6.24

Treatment means within the same column followed by the same letter(s) are not significantly different at 5% level, DMRT.

T_1 – Sweet corn planted 1 week before planting peanut
T_2 – Sweet corn planted 2 weeks before planting peanut
T_3 – Sweet corn planted 3 weeks before planting peanut
T_4 – Sweet corn and peanut planted at the same time
T_5 – Sweet corn planted 1 week after planting peanut
T_6 – Sweet corn planted 2 weeks after planting peanut
T_7 – Sweet corn planted 3 weeks after planting peanut
T_8 – Peanut monocrop

crop-weed competition and promoted the production of more branches rather than the elongation of the main stem.

Sweet corn planted 2 and 3 weeks later than peanut (T_6 and T_7) were the tallest but had the least leaf area index and the lowest fresh stover yield. This may be because the sweet corn planted later than peanut had to grow taller so that it could intercept enough light. Also, because it was planted later it received lesser amount of nutrients because of greater competition resulting in longer but thinner stems and smaller leaves. Again, this result is similar to that of Cagasan (1990) which showed that unweeded plants grew taller than those in the weeded treatments because of mutual competition especially for light, causing the crop to grow upward with thinner and lesser branches.

Yield and Yield Components of Sweet Corn

The number of ears per plant, average ear diameter, weight of ears (marketable and non-marketable) were not significantly affected by timing of planting peanut in an intercropping scheme. The only parameters that were significantly influenced by the treatments were ear length and total ear yield (Table 6).

Sweet corn planted 3 and 2 weeks ahead of peanut (T_3 and T_2, respectively) had the highest total ear yield and ear length as compared to sweet corn planted as monocrop (T_9) and sweet corn planted 1 week before planting peanut (T_1), planted at the same time (T_4) and planted 1 and 2 weeks ahead to peanut (T_5 and T_6, respectively). This result can be attributed to the benefits derived from peanut as an intercrop. Similarly, Angot (1997) revealed that corn planted 1 week before planting sweetpotato gave the highest ear yield.

Several studies revealed the advantages derived from intercropping scheme. Poencelot (1986) found that peanut and mungbean added an average of 45 kg N per hectare per annum to the soil. On the other hand, Alhawat *et al.* (1981) claimed that when legumes are planted, the inorganic N fertilizer required for the succeeding crop is reduced by 70 percent. This is because of the ability of legumes to improve the total N status of the soil.

The lowest total ear yield was obtained from sweet corn planted 3 weeks later than peanut (T_7). This might be due to the severe competition

Table 6. Yield and yield components and harvest index of sweet corn as influenced by timing of planting peanut in an intercropping scheme.

Treatment	Number of Ears Per Plant (cm)	Ear Length (cm)	Average Ear Diameter (cm)	Weight of Ears		Total Ear Yield (t/ha)	Harvest Index (t/ha)
				Marketable	Non-marketable (t/ha)		
1	1.06	13.09 BC	4.04	4.78	0.71	5.49 BC	0.22
2	1.03	14.78 A	3.53	5.01	1.10	6.11 AB	0.23
3	1.13	13.70 B	4.10	5.34	1.09	6.43 A	0.23
4	1.06	12.53 C	3.96	4.49	0.91	5.40 BC	0.23
5	1.10	13.46 B	4.07	4.15	1.09	5.24 BC	0.23
6	1.06	13.74 B	3.86	4.20	1.08	5.28 BC	0.22
7	1.03	13.30 BC	3.86	3.69	0.79	4.48 C	0.19
8	1.13	12.29 C	3.85	4.16	1.00	5.16 BC	0.21
CV (%)	7.67	5.26	5.59	13.51	30.25	11.97	9.01

Treatment means within the same column followed by the same letter(s) are not significantly different at 5% level, DMRT.

T_1 – Sweet corn planted I week before planting peanut
T_2 – Sweet corn planted 2 weeks before planting peanut
T_3 – Sweet corn planted 3 weeks before planting peanut
T_4 – Sweet corn and peanut planted at the same time
T_5 – Sweet corn planted 1 week after planting peanut
T_6 – Sweet corn planted 2 weeks after planting peanut
T_7 – Sweet corn planted 3 weeks after planting peanut
T_8 – Sweet corn mono crop

between sweet corn and peanut plants in terms of utilizing available nutrients and other growth factors. Since the sweet corn was planted later than peanut, it was able to establish later and thus, less competitive than peanut. This condition resulted in lower dry matter production (as indicated by low LAI value), least number of ears and narrow ear diameter which led to lower total ear yield.

Land Equivalent Ratio

Land equivalent ratio is a measure of the total land productivity. It is usually expressed as the sum of the fractions of the yield of a crop in mixture to that of monocrop. In this study, it was computed using the formula:

$$LER = \frac{Xi}{Xj} + \frac{Yi}{Yj}$$

Where:

Xi and Yi - represent the yields (t/ha) of peanut (Xi) and sweet corn (Yi) planted under intercropping scheme

Xj and Yj - represent the yields (t/ha) of peanut (Xj) and sweet corn (Yj) planted under monocropping scheme

An LER of more than 1.0 means that the practice of intercropping is more productive than sole cropping. On the other hand, an LER of less than 1.0 indicates that monoculture is more advantageous than intercropping scheme. An LER of 1.0 means that the practice of intercropping has no comparative advantage to that of sole cropping.

Statistical analysis showed no remarkable differences in land equivalent ratio (LER) among treatments (Table 8). But numerically, the highest LER values (1.62 and 1.60) were obtained in sweet corn planted 3 and 2 weeks ahead of peanut (T_3 and T_2), respectively. These values indicate that T_3 is 62% and T2 is 60% more advantageous than monocropping in terms of total land productivity. Lowest LER value (1.45), on the other hand, was noted when sweet corn was planted 3 weeks later than peanut (T_7). However, the

Table 7. Gross Margin analysis for peanut and sweet corn per hectare as influenced by timing of planting the crops in an intercropping scheme.

Treatment	Yield (freshly harvested(kg/ha)		Gross Return (pesos)		Total Return (P)	Total Variable Expenses (P)	Gross Margin (P)
	Sweet corn	Peanut	Sweet corn	Peanut			
T_1	4,780	1,720	57,360	25,800	83,160	32,023	51,137
T_2	5,010	1,520	60,120	22,800	82,920	32,023	50,897
T_3	5,340	1,340	64,880	20,100	84,180	32,023	52,157
T_4	4,490	1,680	53,880	25,200	79,080	32,023	47,057
T_5	4,150	1,710	49,800	25,650	75,450	32,023	43,427
T_6	4,200	2,040	50,400	30,600	81,00	32,023	48,977
T_7	3,690	1,930	44,280	28,950	73,230	32,023	41,207
T_8	–	3,070	–	46,050	46,050	22,643	23,407
T_9	4,160	–	49,920	–	49,920	23,735	26,185

Total return was based on the current farm gate price of sweet corn (P12.00/kg) and freshly harvested peanut (P15.00/kg)

T_1 – Sweet corn planted I week before planting peanut
T_2 – Sweet corn planted 2 weeks before planting peanut
T_3 – Sweet corn planted 3 weeks before planting peanut
T_4 – Sweet corn and peanut planted at the same time
T_5 – Sweet corn planted 1 week after planting peanut
T_6 – Sweet corn planted 2 weeks after planting peanut
T_7 – Sweet corn planted 3 weeks after planting peanut
T_8 – Peanut mono crop
T_9 – Sweet corn monocrop

Table 8. Land equivalent ratio of peanut and sweet corn as influenced by timing of planting the crops in an intercropping scheme.

Treatment	Land Equivalent Ratio (LER) *NS*
T_1	1.56
T_2	1.60
T_3	1.62
T_4	1.57
T_5	1.52
T_6	1.50
T_7	1.45

NS – Not significant
T_1 – Sweet corn planted I week before planting peanut
T_2 – Sweet corn planted 2 weeks before planting peanut
T_3 – Sweet corn planted 3 weeks before planting peanut
T_4 – Sweet corn and peanut planted at the same time
T_5 – Sweet corn planted 1 week after planting peanut
T_6 – Sweet corn planted 2 weeks after planting peanut
T_7 – Sweet corn planted 3 weeks after planting peanut

value was higher than 1.0 , indicating that it was still advantageous to grow these two crops together rather than growing each as monocrop.

Gross Margin Analysis of Peanut and Sweet Corn

The gross margin analysis of peanut and sweet corn as influenced by timing of planting the crops in an intercropping scheme is presented in Table 6. Among the intercropping schemes tried, T_3 (sweet corn planted 3 weeks ahead of peanut) gave the highest gross margin of PhP 52,157.00 per hectare. It was followed by T_1 (sweet corn planted 1 week ahead of peanut) with a gross margin of PhP 51,137.00 per hectare and T_2 (sweet corn planted 2 weeks ahead of peanut) with PhP 50,897.00 per hectare.

On the other hand, T_7 (sweet corn planted 3 weeks later than peanut) gave the lowest returns of PhP 41,207.00 per hectare. It was followed by T_5 (sweet corn planted 1 week later than peanut) with PhP 43,427.00 per hectare and T_4 (sweet corn planted at the same time with peanut) with PhP 47,057.00 per hectare.

Under monocropping scheme, sweet corn gave a slightly higher gross margin of PhP 26,185.00 per hectare as compared to peanut with PhP 23,407.00 per hectare. The slight differences in gross margin of the two crops could be attributed to the differences in crop yields and the market prices per kilo of the crops.

CONCLUSION

Based on the results of this study, it can be concluded that:

1. Timing of planting can significantly affect majority of the growth and yield parameters of peanut and sweet corn.

2. Considering land productivity, planting sweet corn and peanut together regardless of timing of planting can be considered better than monocropping as it gave an LER value of more than 1.0.

3. Considering the economic return, T_3 (planting sweet corn 3 weeks ahead of peanut) could be considered the best treatment as it gave the highest gross margin of PhP 52,157.00 per hectare.

RECOMMENDATIONS

1. To maximize land productivity and to get higher economic returns from peanut and sweet corn, it is recommended that the two crops should be planted together in an intercropping scheme.
2. Farmers who want to plant the two crops together in an intercropping scheme, can plant peanut and sweet corn regardless of the timing of planting.
3. Similar study should be conducted especially for dry season trial.

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