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Residual Fertility Effect of Pigoen Pea *(Cajanus cajan L.)* on Sweet Corn *(Zea mays rugosa L.)* Productivity

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Abstract

The study was conducted to determine the residual fertility effect of pigeon pea planted area on the productivity of hybrid sweet corn. The following treatments laid out in Randomized Complete Block Design were used in the study: T1 - Control (without fertilizer); T2 - Inorganic fertilizer, 100% of the Nitrogen recommended rate; T3 - Inorganic fertilizer , 80% of the N recommended rate; T4 - Inorganic fertilizer, 60% of the N recommended rate; and T5 - Inorganic fertilizer, 40% of the N recommended rate.

The result of the study revealed that there was a significant difference only during the 4th to 7th week after emergence on the plant height, ear height, ear weight without husk, and ear diameter. Highly significant differences were found in ear weight with husk and biomass yield but not in ear length and yield of green corn.

Since the results of the study showed that the yield of T2 (100% of the N recommended rate) is statistically the same with T4 (60% of the N recommended rate), the application of 60% of the nitrogen requirement for sweet corn in an area previously planted to pigeon pea is recommended.

Keywords: *Residual fertility, fertility effect, pigeon pea, sweet corn productivity,*

1. Introduction

Corn (*Zea mays rugosa L.*) is the second most important crop in the Philippines next to rice. Almost three million hectares are devoted to the cultivation of this crop annually, however, current production remains inadequate to meet the local needs due to low yield. Since 2005, the corn importation in the Philippines has been rapidly increasing.

One of the identified challenges in maize production in the small holder sector is low soil fertility[1]. Increasing human population has led to continuous cropping on same pieces of land without allowing regeneration of soil fertility through traditional systems such as natural bush fallows. High costs of mineral fertilizers preclude resource poor smallholder farmers from using them to replenish soil fertility. Legumes like pigeon pea can improve soil fertility in two ways. The first is through the conversion of atmospheric nitrogen by nodules in the roots. The nodules form a symbiotic relationship with rhizobia that have the capacity to change atmospheric nitrogen into a plant-useable form in the soil. When the plant dies, the nitrogen in the nodules is left in the soil for use by the following crop. The amount of nitrogen produced by the nodules depends on the state of relationship in the roots and the health of the plant. The second way that legumes improve soil fertility is by accessing nutrients in deep soil layers. Nutrients are washed down through the soil profile by the vertical movement of water. The nutrients that accumulate in the bottom layers are not accessible to most shallow rooted plants like maize. Deep rooted plants such as pigeon pea are able to reach and mine these nutrients for processing again and upon plant death and decomposition, nitrogen is released to the top soil layers. Shallow rooted crops are then able to take advantage of this nutrient recycling from deeper soil layers. A cropping system based on intercropping legumes is therefore capable of being sustainable if well managed.

In general, the study aimed to determine the residual fertility effect of pigeon pea planted area on the productivity of hybrid sweet corn. Specifically it aimed to compare the green corn yield of sweet corn in an area planted with pigeon pea for one year under different treatments and do simple cost and return analysis of sweet corn production under the different treatments.

2. Materials and Methods

Yellow Sweet F1 corn variety was used in the study which was secured at East West Seed Company, a reputable hybrid seeds producer, through their dealers in the locality. The Yellow Sweet F1 is an excellent performing sweet corn hybrid for sub-tropical and tropical growing conditions. Cobs are of excellent quality, medium in size with good tip fill and highly uniform in size. Kernel color is bright yellow and taste is outstanding due to its high sweetness.

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A 225 sq.m. upland area previously planted with pigeon pea was used for the study. The area was thoroughly prepared prior to planting following the recommended spacing of 30 cm between hills and 75 cm between rows. The following treatments were laid out using the Randomized Complete Block Design (RCBD) with three replications each: Treatment 1- control (without fertilizer); Treatment 2- Inorganic fertilizer (100% of the N recommended rate or 210 kg/ha); Treatment 3- Inorganic fertilizer (80% of the N recommended rate or 160 kg/ha); Treatment 4- Inorganic fertilizer (60% of the N recommended rate or 105 kg/ha); and Treatment 5– Inorganic fertilizer (40% of the N recommended rate or 84 kg/ha).

3. Results and Discussions

3.1 Plant Height

Figure 1 shows the mean plant height of sweet corn at weekly intervals starting on the second up to twelve week after emergence. The plant height generally revealed a linear and steady increase in plant height with Treatment 2 exhibiting the highest plant height. Statistical analysis however, revealed that there are significant differences in plant height among the treatments only during the 4th to 7th weeks after emergence (WAE).

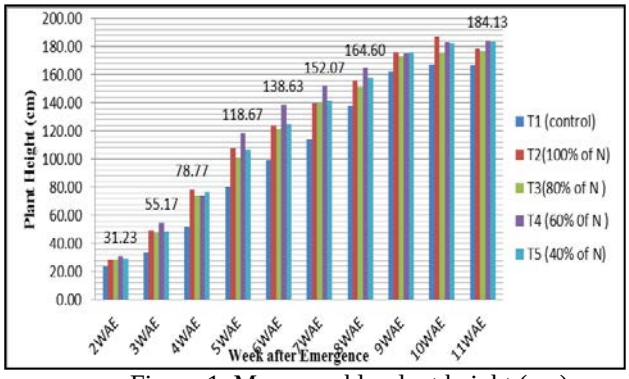
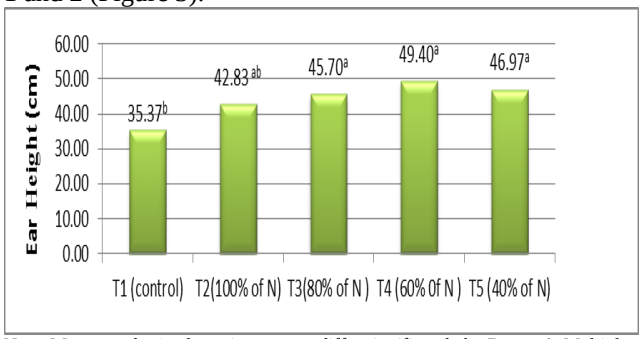


Figure 1. Mean weekly plant height (cm)

3.2 Ear Height

Figure 2 presents the ear height on the 11th WAE. As shown in the figure, the treatment that obtained the highest mean of ear height was Treatment 4 with a mean of 49.40 cm, followed by Treatment 5 with 46.97 cm and Treatment 3 with 45.70 cm; Treatment 2 obtained 42.83 cm while Treatment 1 obtained the lowest with 35.37 cm ear height. Analysis of Variance revealed that there is a significant difference among treatments.

Paired comparison among means (DMRT) showed that Treatments 3, 4 and 5 are not significantly different from each other but are significantly different from Treatments 1 and 2 (Figure 3).



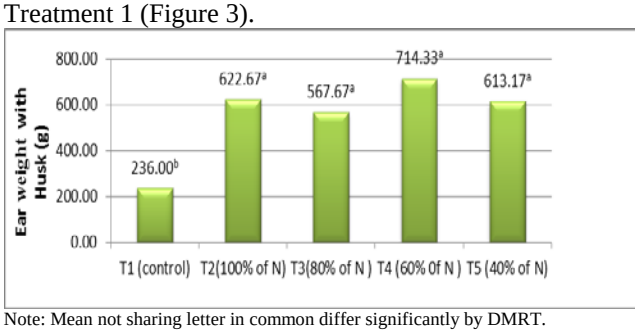
Note: Mean not sharing letter in common differ significantly by Duncan's Multiple Range Test (DMRT).

Figure 2. Mean ear height (cm)

3.3 Ear Weight with Husk

Figure 3 reveals the mean ear weight with husks on the different treatments. As shown in the figure, Treatment 4 obtained the highest mean ear weight of 714.33 grams followed by Treatment 2 (622.67 grams); Treatment 5 (613.17 grams); Treatment 3 (567.67 grams) and the least was Treatment 1 with an mean of 236.00 grams. Analysis of variance showed that there is a highly significant difference among the treatments.

Furthermore, paired comparison among means showed that Treatments 2, 3, 4 and 5 are not significantly different from each other, but are significantly different from Treatment 1 (Figure 3).



Note: Mean not sharing letter in common differ significantly by DMRT.

Figure 3. Mean ear weight with husk (grams)

3.4 Ear Weight without Husk

Figure 4 displays the ear weight without husk under the different treatments. The treatment that obtained the highest mean was Treatment 4 with 288.60 grams followed by Treatment 5 with 245.60 grams, Treatment 2 with 245.47 grams, Treatment 3 with 228.27 grams and the least was Treatment 1 with a mean of 185.40 grams.

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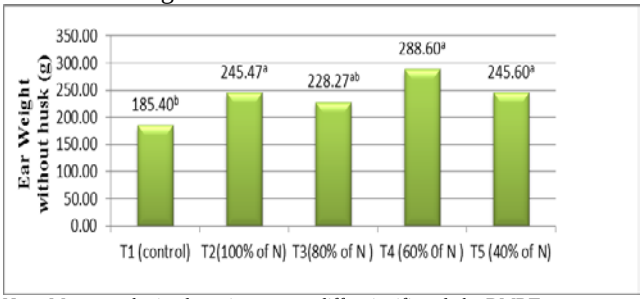
Analysis of variance showed that there is a significant different among the treatments.



Note: Mean not sharing letter in common differ significantly by DMRT.

Figure 4. Mean ear weight without husks (grams)

3.5 ar Length

Figure 5 shows the mean ear length of the different treatments. As presented in the figure, the longest ear length was obtained by Treatment 4 with a mean of 191.57 mm followed by Treatment 5 (185.67 mm); Treatment 2 (183.77 mm); Treatment 3 (182.13 mm) and the shortest was Treatment 1 with 176.93 mm ear length. Although observable differences in ear length were noted statistical analysis disclosed that there is no significant difference among the Treatments. This means that the different treatments did not produced any significant effect on the ear length.

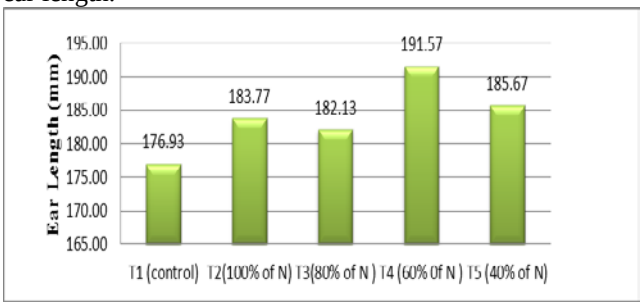
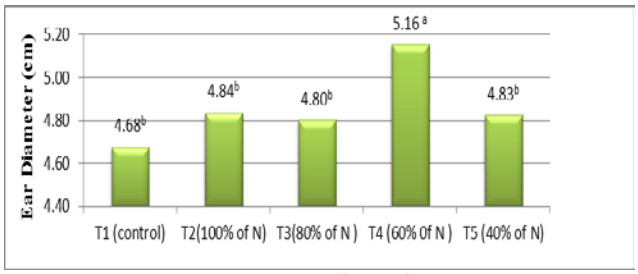


Figure 5. Mean ear length (mm)

3.6 Ear Diameter

As presented by Figure 6, the treatment with the highest mean ear diameter was attained by Treatment 4 with 5.16 cm followed by Treatment 2 with 4.84 cm; Treatment 5 with 4.83 cm; Treatment 3 with 4.80 cm and Treatment 1 obtained the least with 4.68 cm. The analysis of variance revealed that there is a significant difference among the treatments. Paired comparison among means showed that Treatments 1, 2, 3 and 5 are not significantly different from each other, but are significantly different from Treatment 4.

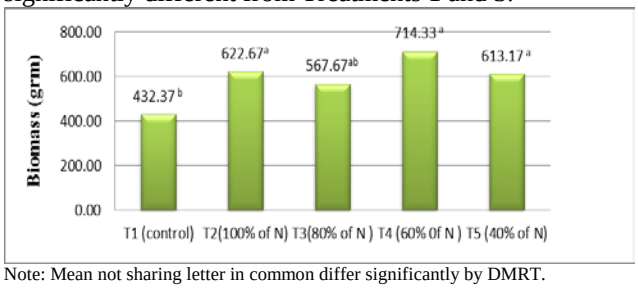


Note: Mean not sharing letter in common differ significantly by (DMRT.

Figure 6. Mean ear diameter (cm)

3.7 Biomass Yield

As presented in Figure 7, the treatment that produced the heaviest biomass weight was Treatment 4 with 714.33 grams followed by Treatment 2 with 622.67 grams; Treatment 5 with 613.17grams; Treatment 3 with 567.67 grams and the least was Treatment 1 with 432.37 grams. Statistical analysis revealed that there was significant difference among the treatments. Paired comparison among means however, showed that Treatments 2, 4 and 5 are not significantly different from each other, but are significantly different from Treatments 1 and 3.



Note: Mean not sharing letter in common differ significantly by DMRT.

Figure 7. Mean of biomass yield (grams)

3.8 Green Corn Yield per Hectare

Figure 9 reveals the yield per hectare of green corn under the different treatments. As presented in the figure, the treatment that obtained the highest yield was Treatment 2 with a mean of 18,980 kgs followed by Treatment 4 with 17,987 kgs; Treatment 5 with 16,398 kgs; Treatment 1 with 16,369 kgs and the least was obtained by Treatment 3 with 16,127 kgs. Statistical analysis however showed that there was no significant difference among the treatments. This means that the different treatments did not produced any significant effect on the green corn yield per hectare.

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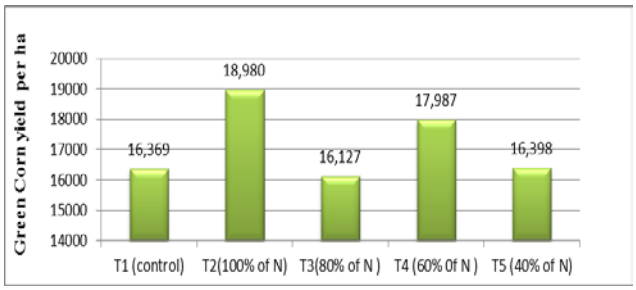

Figure 9. Mean green corn yield per ha (kg)

3.9 Cost and Return Analysis

Table 1 shows the cost and return analysis of sweet corn production for a hectare under the different treatments. As viewed from the table, T1 has the highest return of investment with 1071.25%; followed by Treatment 4 with 745.55%; Treatment 5 with 695.73%; Treatment 3 with 632.80% and the least was Treatment 2 with 621.95%.

Table 1. Cost and return analysis of sweet corn production.

	T1	*T2*	*T3*	*T4*	*T5*
Total Cost of Production	P 31,937.00	P51,870.00	P50,348.00	P48,668.00	P47,145.00
Gross Sales	P374,477.51	P374,477.51	P368,947.78	P411,506.00	P375,149.06
Net Income	P342,505.1	P322,607.51	P318,600.28	P362,838.54	P328,004.06
Return on Investment	1071.25%	621.95%	632.80%	745.55%	695.73%

4. Conclusions and Recommendations

Based on the result of the study, the following conclusions were drawn:

1. Treatment 4 (60% of N recommended rate) produced the best result effect on plant height, ear height, ear weight with and without husk, ear length, ear diameter and biomass.
2. The yield of sweet corn per hectare was highest in Treatment 2 (100% of N recommended rate).
3. As to the return on investment, the highest was obtained by Treatment 1.

Since T4 (60% of the nitrogen rate of fertilizer) has statistically the same yield as T2 (100% of the nitrogen rate), the application of 60% of the nitrogen requirement in an area previously planted to pigeon pea is therefore recommended. However, a follow up study is recommended during dry season to validate the findings of this study.

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