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THE INFLUENCE OF PLANT DENSITIES ON CORN BORER, *OSTRINIA FURNACALIS* (GUENEE), INCIDENCE [1]

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ABSTRACT

Field experiments were conducted during the dry and wet seasons to determine the influence of different plant densities on corn borer incidence in two corn varieties and on the cross-sectional area of tunnel; plant growth and stalk quality were also noted. The plant densities evaluated were 26,666, 33,333, 40,039, 53,333, 66,666, 80,078 and 106,666 plants per hectare.

It was found that plant densities did not influence the growth of plants in both seasons. There was a negative nonlinear relationship between stalk diameter and plant density. Larger stalks were observed on plants grown at lower plant densities. The same relationship was also noted between stalk rind thickness and plant density.

No significant differences in the number of egg masses were observed among various levels of plant density.

A non-linear relationship between entrance holes and plant density was observed at dough stage. Plant densities of 40,039 and 80,078 plants per hectare consistently had the highest number of entrance holes. Both extreme low (26,666 plants/ha) and extreme high (106,666 plants/ha) plant populations, on the other hand, had the lowest entrance hole count. There were no significant differences in the number of entrance holes between HyCorn 9 and IPB Var 1.

A high positive linear relationship was noted between tunnel count at harvest and plant density during the dry season. On the contrary, positive non-linear relationship was observed during the wet season trial. It was shown that 40,039 and 80,078 plants per hectare had the highest tunnel count.

Generally, yield per plant decreased with increasing plant density. The reverse trend was observed in terms of yield per hectare.

There was a positive lineat relationship between cross-sectional area of tunnels with plant density. It was also observed that tunnel area wider than 37 mm^2 resulted to a decrease in yield.

The present observations suggest that planting corn during the dry season at the rate of 106,666 plants per hectare is most productive. In the wet season, planting corn at 53,333 and 66,666 plants per hectare is recommendable in terms of corn borer incidence and also more productive in terms of yield.

Key words: Asian corn borer, *Ostrinia furnacalis* (Guenee), corn plant, borer holes

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INTRODUCTION

The Asian corn borer, *Ostrinia furnacalis* (Guenee), (Pyralidae, Lepiptera) is one of the most destructive insect pests of corn in the Philippines. It could inflict yield reduction of about 20 to 80%. Serious damage occurs when corn plants are heavily infested during the tassel and silking stages of plant growth. Likewise, considerable damage results from larval leaf feeding during the whorl stage.

Among the control methods developed for corn borer, the use of chemicals has received greatest emphasis. Many chemicals are effective, dependable, economical, and adaptable for use in a wide variety of situations. However, the continued use of chemical pesticides often leads to the development of resistance in insect and the unwarranted contamination of the environment. Considering the importance of the pest and the problems associated with the massive use of insecticides, it is highly essential to evaluate precisely the potentials of cultural practices as a method of control for the corn borer.

Cultural methods offer an opportunity to alter the environmental condition of corn plant in ways that may lead to eventual control, if not significant reduction, of the pest population. Moreover, the said control strategy may be used with other control techniques in the suppression of pests.

The current recommended plant density per hectare for corn is 53,333 plants spaced at 75 cm between rows and 50 cm between hills with two plants per hill or 25 cm between hills with one plant per hill (PCARRD 1981). Studies on corn borer population have already been conducted using the recommended plant density per hectare. However, information on pest densities and survival of the corn borer for different plant population levels are generally limited. Therefore, this study was conducted at the University of the Philippines at Los Baños, during the dry (October 1984 to January 1985) and wet (June to September 1985) seasons, specifically: a)to evaluate the effect of different levels of plant densities on corn borer infestation, b) to determine the incidence of corn borer on two selected corn varieties grown at different plant population levels, c) to determine the influence of the different plant densities on the stalk quality of corn, and d) to determine the relationship between tunnel cross-sectional area and corn yield.

MATERIALS AND METHODS

The experiment was a split-plot in randomized complete block design with four replications.

The treatments were the following:

a. main plots
   1. planted to HyCorn 9
   2. planted to IPB Var 1

b. subplots

T 1 - 26,666 plants per hectare
Hill spacing was 50 cm with one plant per hill.

T 2 - 33,333 plants per hectare
Hill spacing was 40 cm with one plant per hill.

T 3 - 40,039 plants per hectare
Hill spacing was 33 cm with one plant per hill.

T 4 - 53,333 plants per hectare
Hill spacing was 25 cm with one plant per hill.

T 5 - 53,333 plants per hectare
Hill spacing was 50 cm with two plants per hill.

T 6 - 66,666 plants per hectare
Hill spacing was 40 cm with two plants per hill.

T 7 - 80,078 plants per hectare
Hill spacing was 33 cm with two plants per hill.

T 8 - 106,666 plants per hectare
Hill spacing was 25 cm with two plants per hill.

Each main plot was comprised of 56 rows of corn; each row was 10 m long. The subplot was seven rows wide by 10 m long.

Crop management

Corn seeds were planted at the rate of three to four seeds per hill. Plants were then thinned to either one or two plants per hill depending on the desired density. During planting, basal application of 14-14-14 fertilizer was applied at the rate of 400 kg/ha. One day after planting, a mixture of pendimethalin (1.25 kg a.i/ha) and atrazine (2.0 kg a.i/ha) was used as pre-emergence herbicides. Hilling-up, hoeing and hand pulling of weeds were done to keep the area free of weeds. Split side dressing of urea at the rate of 75 kg/ha was applied at 22 and 32 days after emergence (DAE).

Gathering of data

To measure plant development, the extended leaf heights of four plants in each plot were recorded at weekly interval, starting 12 DAE until one week before tassel emergence.

Weekly egg mass counts on 10 plants chosen at random in each plot were taken starting 25 DAE until tassel emergence.

Likewise, forty plants from three center rows were observed weekly starting at 25 DAE up to tassel emergence. The number of infested plants were counted to get an estimate of the first generation infestation pressure. For second generation corn borer infestation, 20 plants from two center rows in each subplot were tagged. At dough stage (75 DAE), the number of visible entrance holes in the stalk were counted from the tagged plants. At harvest (110 DAE), the marked plants were dissected and the total number of cavities per plant were counted.

Yield data were taken by harvesting all the ears from 20 tagged plants. The corn ears obtained from each plot were husked in the field and air dried. The cobs were shelled and the corn grains were dried to attain 14% moisture content. The grain yield was expressed in grams per plant and tons per hectare.

After harvesting, 10 third internodes of the stalks were collected from each plot. The sample stalks were cut into two-inch sections and dried for one week at 40^0 C. The thickness of the rind and diameter of the stalks were measured with a vernier caliper. The cross-sectional area of borer tunnels were measured using a planimeter.

Analysis of data

The effect of plant population on the number of egg masses oviposited, percent infested hills, number of entrance holes, and number of cavities were analyzed using analysis of variance. The relationship between entrance holes, cavities, yield, and plant populations were estimated using polynomial regression analysis. The same analysis was used in estimating the relationship between rind thickness and stalk diameter.

RESULTS AND DISCUSSION

Influence of plant density on growth and development of corn

The discussion on the influence of various levels of plant density on plant development is based on mean extended leaf height, diameter of the stalks, and stalk rind thickness.

Plant height. Comparison of the mean extended leaf height measurements of corn at late whorl stage (39 DAE) during the dry season showed no significant difference among treatments ($F = 0.77$, df = 7P> 0.05). However, plants grown at 106,666 plants per hectare were the tallest(112.79 cm) while those grown at 33,333 plants per hectare were the shortest (106.33 cm). In the wet season trial, the tallest (128.54 cm) and shortest (111.12 cm) plants were noted on plots with 80,078 and 26,666 plants per hectare. When these measurements were anlayzed, no significant variation among treatments was detected ($F = 0.77$, df = 7; $P > 0.05$).

Between the two varieties, no significant difference was likewise noted in both seasons. This suggests that the influence of various plant populations on plant height does not differ in the two varieties.

The variation in plant height measurements is important since this may bring about changes in physiological condition and phenotype of the plant. Consequently, this may bring about changes in the behavior of the insect. It was reported that plant height and leaf area were positively related to egg deposition of *Ostrinia nubilalis* (Hubner) (Pyralidae, Lepidoptera) (Patch 1929, Ficht 1932) and *Diatrea grandiosella* Dyar (Pyralidae, Lepidoptera) (Turner and Beard 1950, Stewart and Walton, 1964). Likewise, plant height is positively related to corn borer infestation and corn yield (Van Huis 1981).

Stalk diameter. Figure 1 illustrates the relationship of plant density and stalk diameter. The plot of the estimated equation shows a negative nonlinear relationship($r = -0.76$). Among various plant populations, the plots with 40,039 plants per hectare had the largest stalk with a mean value of 17.87 mm. It appears however that beyond this optimum point, there exists a gradual decrease in stalk diameter. The thinnest stalk (15.45 mm) was noted on plots at 80,078 plants per hectare. The thinner stalks obtained from denser plant populations may be due to competition stress and mutual shading to which the plants were subjected (Daynard et al. 1969). On the other hand, larger stalks from lower plant density may be due to better utilization of light resulting to more efficient photosynthesis.

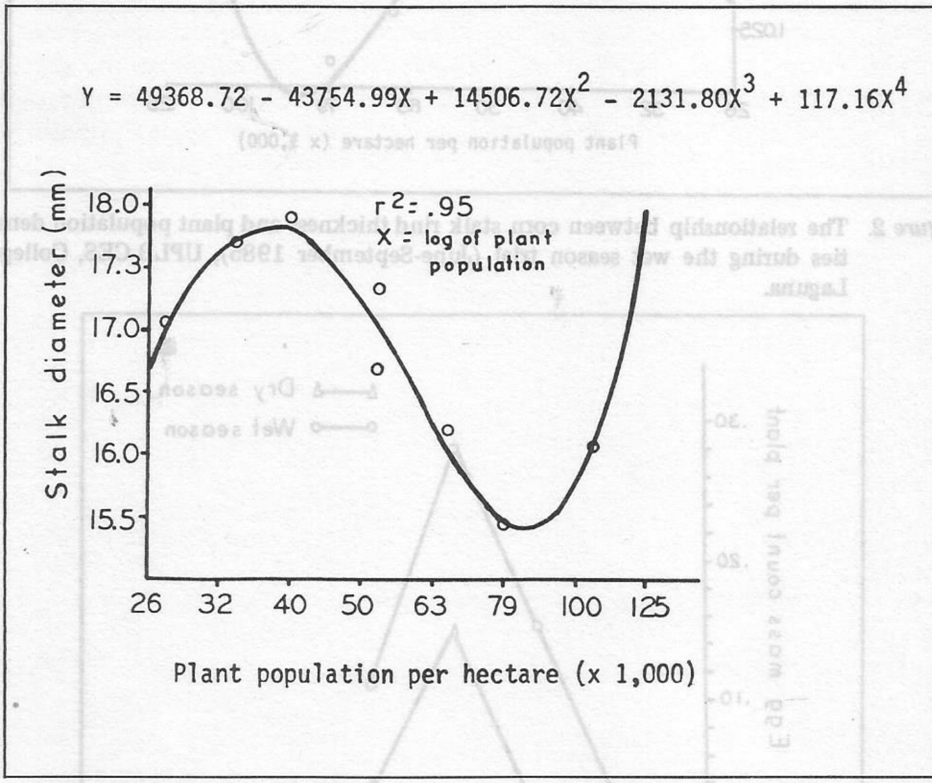

Figure 1. The relationship between stalk diameter and different corn plant densities during the wet season trial *(June-September*

Rind thickness. Figure 2 shows the influence of plant densities on stalk rind thickness. The general trend exhibits a negative nonlinear relationship ($r = -0.42$). The thickest (1.14 mm) and thinnest (1.01 mm) rinds were obtained from plots with 40,039 and 80,078 plants per hectare, respectively. These results support the findings of Zuber and Dicke (1964) that rind thickness decreased as plant population increased from 39,536 to 59,304 per hectare.

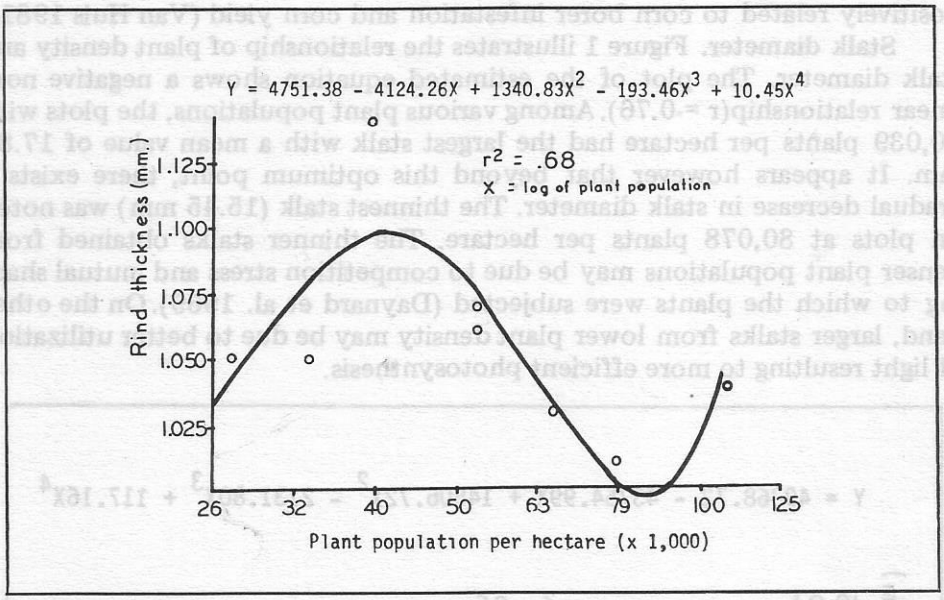

Figure 2. The relationship between corn stalk rind thickness and plant population densities during the wet season trial (June-September 1985), UPLB-CES, College, Laguna.

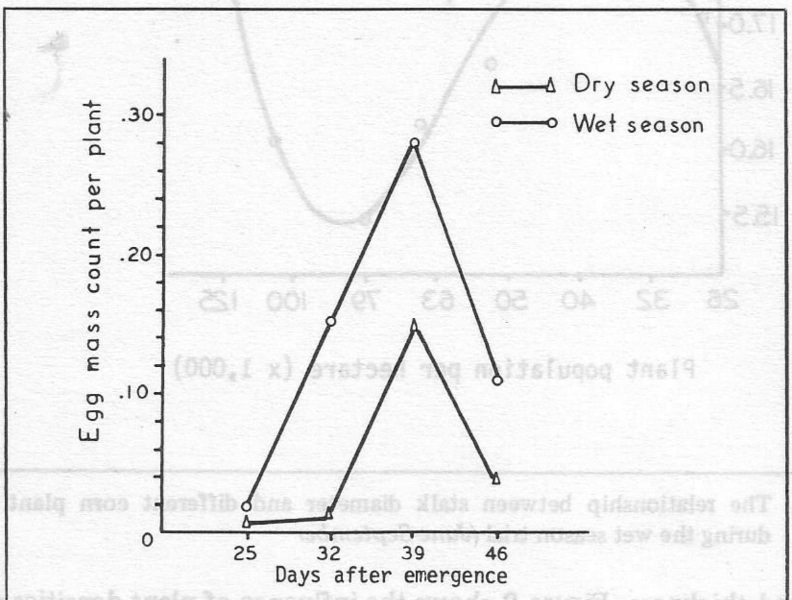

Figure 3. Mean number of corn borer egg masses during the dry (October 1984-January 1985) and wet (June-September 1985) seasons.

Influence of plant densities on corn borer infestation

Influence on oviposition. The oviposition patterns of *O. furnacalis* in four developmental stages of corn during the dry and wet seasons are shown in Fig. 3. During the mid-whorl stage (25 DAE), only a few egg masses were observed. The number of eggs oviposited increased in succeeding stages and reached a peak at late whorl (39 DAE) to early tasseling stage. After tasseling, oviposition declined rapidly.

Statistical analysis revealed no significant variation among plant population levels in both seasons. Nevertheless, maximum egg mass with a mean of 0.32 per plant was observed on plots with 53,333 and 66,666 plants per hectare during the wet season. During the dry season trial, the highest count was noted from plant density of 53,333 plants per hectare with a mean of 0.14 egg mass per plant.

Information about oviposition by the pest in relation to plant densities is essential in developing control methods such as the introduction of egg parasite, the timing of insecticide application, and establishment of economic threshold level. The egg mass count has been used as one of the criteria for determining the economic threshold for *O. nubilalis* (Chiang and Hodson 1952, 1959) because the corn borer larvae are difficult to observe when they are already inside the stalks.

Injury to whorls and stalks. Table 1 summarizes the percent injured whorls as influenced by different plant densities during the dry and wet season.

Table 1. **Percent injured worls and stalks caused by corn borer at different stages of growth. UPLB-CES, College, Laguna.** [1]

Hill spacing (cm)	Plants per hill	Plant population per hectare	Days after emergence 25	32	39	46
				Dry Season (October 1984-January 1985)		
50	1	26,666	12.92cd	11.67a	16.67ab	16.67ab
40	1	33,333	1.66a	10.83a	13.75ab	13.75a
33	1	40,039	10.00bcd	15.83a	21.25ab	21.67ab
25	1	53,333	4.17abc	12.08a	8.33a	14.58ab
50	2	53,333	9.17bcd	15.00a	12.08ab	18.75ab
40	2	66,666	1.66a	15.42a	10.42ab	15.83ab
33	2	80,079	10.83cd	20.00a	13.33ab	20.83ab
25	2	106,666	16.25d	22.92a	27.92b	31.25b
				Wet Season (June-September 1985)		
50	1	26,666	12.19a	16.88a	22.50abc	33.88a
40	1	33,333	15.31a	13.12a	23.12bc	35.75a
33	1	40,039	11.25a	16.56a	29.06c	41.00a
25	1	53,333	10.62a	13.12a	25.94c	32.62a
50	2	53,333	12.50a	10.00a	22.19abc	36.50a
40	2	66,666	8.44a	12.50a	22.50abc	44.25a
33	2	80,079	14.06a	11.56a	16.56ab	34.00a
25	2	106,666	10.62a	9.64a	14.06a	24.75a

[1] In a column for each respective season, any two means having a common letter are not significantly different at 5% level using DMRT.

The results of the dry season trial show that low infestation (1.66% to 16.25%) occurred at mid-whorl stage (25 DAE). On the subsequent stages of plant growth, however, the infestation progressed gradually (13.75% to 31.25%) until the tasseling stage (46 DAE). Statistical analysis revealed significant variation among treatments at mid-whorl stage ($F = 8.25$; $df = 7$; $P < 0.05$). The highest percentage of injured whorls (16.25%) was recorded on the highest plant density (106,666 plants per hectare). On the other hand, 33,333 and 66,666 plants per hectare spaced at 40 cm between hills had the lowest percent infested hills of 1.66%. At tasseling stage (46 DAE), significant variation among plant densities was also exhibited ($F = 2.70$, $df = 7$; $P < 0.05$). Consistently, 33,333 plants per hectare had the lowest percent injured stalks (13.75%). This is significantly different from the highest infestation (31.25%) obtained from the highest plant density (106,666 plants per hectare).

In the wet season trial, significant difference among plant densities was only noted at late whorl stage ($f=3.08$, $df=7$; $P < 0.05$) Highest plant density (106,666 plants per hectare) had the lowest infestation (14.06%). Plant density of 40,039 plants per hectare, on the other hand, had the highest percent injured whorls (29.06%). At tasseling stage, no significant variation was exhibited. However, the highest plant density consistently had the lowest infestation (24.75%). This does not agree with the results obtained during the dry season. The disparity in the results maybe attributed to the existing climatic conditions (i.e. temperature, rainfall, humidity and solar radiation) during the dry and wet seasons. Probably the interaction of these factors with various levels of plant density during the dry and wet seasons had different effect on the survival and colonization of corn borer. Camarao (1976) reported that 12% to 15% of the observed mortalities and 3% to 9% of the changes in the population density of *O. furnacalis* can be attributed to the variation in weather and climate.

Number of entrance holes. In an attempt to explain the relationship between entrance holes and population densities, a fourth degree polynomial regression analysis was fitted into the data. Figure 4 illustrates the relationship between the two factors at dough stage (75 DAE) during the dry and wet seasons.

In the dry season trial, (Figure 4A) the coefficient of determination was low ($r^2 = 0.49$). This implies that various levels of plant density had little influence on the number of entrance holes. Nevertheless, the plot of the estimated equation shows that entrance hole count peaked on plots with 40,039 and 80,078 plants per hectare with 2.17 and 2.13 borer holes, respectively. Fewest borer holes (1.28) were noted on the lowest plant density (26,666 plants per hectare). It is interesting to note that the recommended population (53,333 plants per hectare at two plants per hill) also had lower counts 1.40. Also, fewer entrance holes were noted on plant density of 66,666 plants per hectare.

Between the two varieties, HyCorn 9 had fewer entrance hole count (2.4) than IPB Var 1 (2.54). However, statistical analysis revealed no signition and survival of corn borer. In this study, it appears that planting corn at 33 cm between hills with one and two plants per hill (i.e., 40,039 and 80,078 plants per hectare, respectively) is auspicious to corn borer colonization and infestation. On the other hand, both extreme plant populations (i.e., the low and high level at 26,686 and 106,666 plants per hectare, respectively) do not favor corn borer infestation. It may be suggested that at extreme low plant population, the plants are farther apart thus limiting larval movement between plants. At extreme high plant density, the corn stalks could not satisfy the nutrient requirements of corn borer for higher survival. It has been suggested that plant density influences the general physiology of the plant, vis-a-vis, the development of corn borer larvae (Berger 1951, Hageman et al. 1961).

Tunnel count at harvest. A relatively high coefficient of determination ($r^2 = 0.67$) was noted between different plant densities and tunnel counts during the dry season (Figure 5A). Also, high correlation coefficient (r =

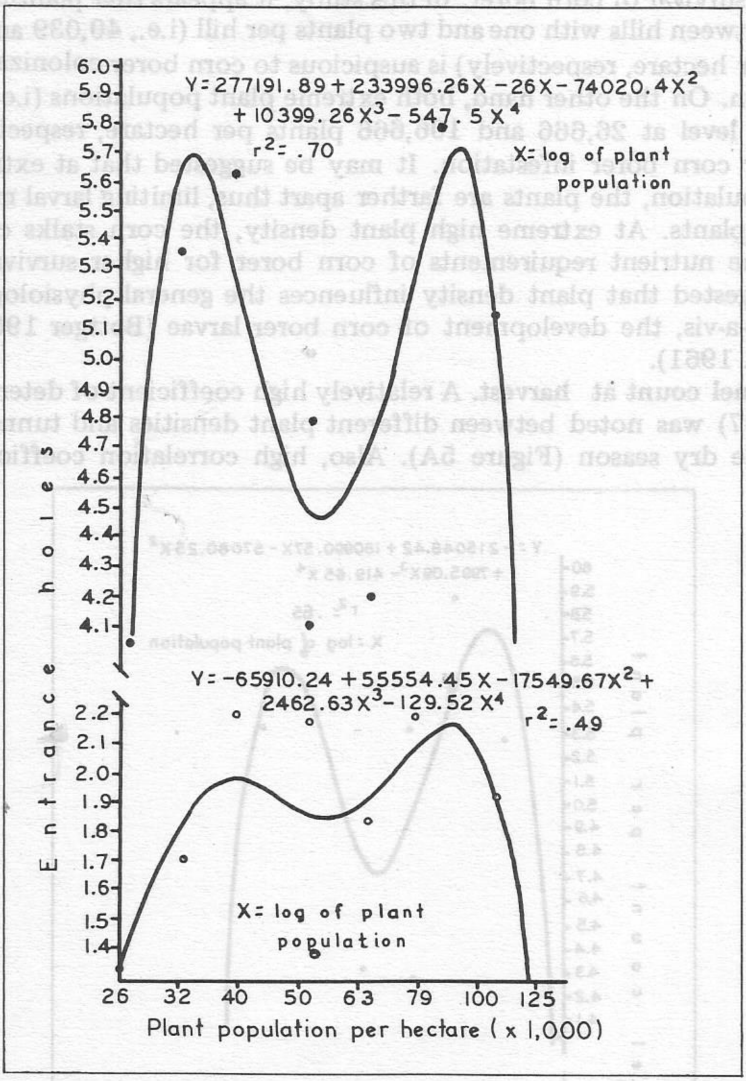

Figure 4. The relationship between corn borer entrance holes and different corn plant densities at dough stage (75 DAE) during(A) the dry season (October 1984-January 1985) and(B) the wet season (June-Sept. 1985) UPLB-CES, College, Laguna.

ficant differences ($F=0.12$, $df=1$; $P< 0.05$).

A relatively high coefficient of determination ($r^2=0.70$) was noted during the wet season (Figure 4B). This implies that 70 percent of the variation in entrance holes can be accounted for by the change in plant density. The plot of the estimated equation shows that sown densities of 40,039 and 80,078 plants per hectare, consistently had the highest entrance hole count with 5.66 and 5.74, respectively.

The above results suggest that plant densities may determine colonization and survival of corn borer. In this study, it appears that planting corn at 33 cm between hills with one and two plants per hill (i.e., 40,039 and 80,078 plants per hectare, respectively) is auspicious to corn borer colonization and infestation. On the other hand, both extreme plant populations (i.e., the low and high level at 26,666 and 106,666 plants per hectare, respectively) do not favor corn borer infestation. It may be suggested that at extreme low plant population, the plants are farther apart thus, limiting larval movement between plants. At extreme high plant density, the corn stalks could not satisfy the nutrient requirements of corn borer for higher survival. It has been suggested that plant density influences the general physiology of the plant, vis-a-vis, the development of corn borer larvae (Bottger 1951, Hageman et al. 1961).

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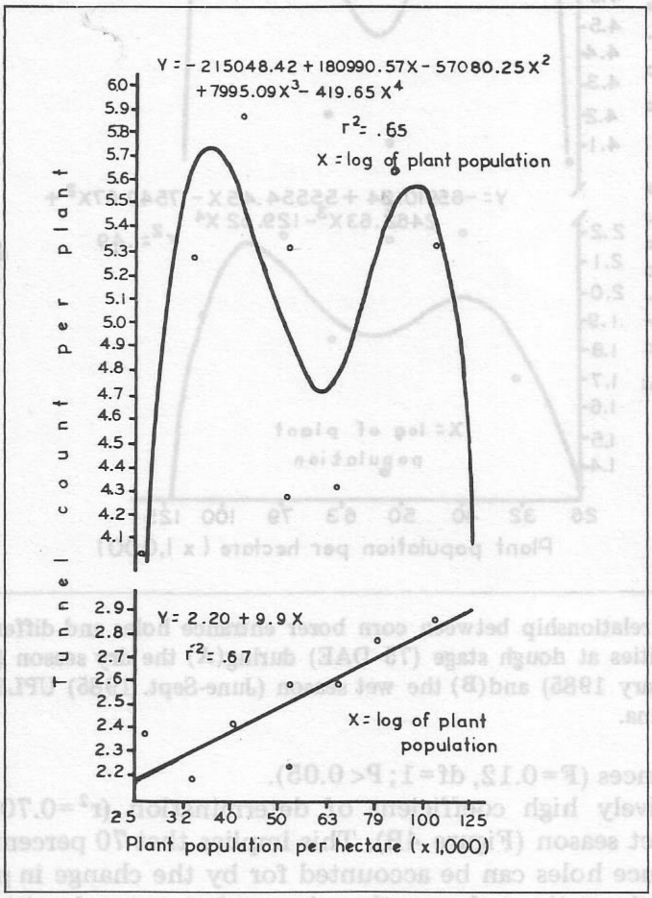

Figure 5. **The relationship between cavities and different plant densities at harvest (110 days after seedling emergence) during(A)the dry season (October 1984-January 1985) and (B) the wet season (June-September 1985), UPLB-CES, College, Laguna'**

0.85) was noted. This indicates that the number of tunnels linearly increases with increasing plant density. The lowest mean tunnel count (2.16) was observed on plots with 33,333 plants per hectare. The highest density (106,666 plants per hectare), on the other hand, had the highest mean count with 2.83 tunnels.

During the wet season trial, low correlation coefficient ($r = 0.15$) was noted. The plot of the estimated equation, consistently peaked at sown densities of 40,039 and 80,079 plants per hectare with 5.87 and 5.65 mean tunnels, respectively (Figure 5B). This was also the pattern observed in the number of entrance holes during the wet season trial (Figure 4B).

On the response of the two varieties, statistical analysis revealed no significant difference in tunnel count in both seasons: ($F=0.69$, $df=1$; $P> 0.05$) for the dry season and ($F=10.14$, $df = 1 P> 0.05$) for the wet season. During the dry season, IPB Var 1 had 2.38 mean tunnels while HyCorn 9 had 2.54. In the wet season trial, HyCorn 9 also had higher mean tunnel count (5.55) than IPB Var 1 (4.46). From these results, it appears that IPB Var I is slightly resistant than HyCorn 9.

Yields. The influence of different plant populations on grain yields during the two seasons was also evaluated.

Regression analysis revealed a relatively high coefficient of determination ($r^2 = 0.67$) and high negative correlation coefficient ($r = -0.94$) between plant densities and yield per plant during the dry season (Figure 6A). This means that yield decreased with increasing plant density. The plots with 33,333 plants per hectare gave the highest yield per plant (52.58 gms). This is significantly different from the lowest yield (33.53 gms) obtained from plots with the highest plant density. In terms of yield per hectare, the trend exhibited was positive linear as indicated by a high correlation coefficient ($r = 0.99$). High coefficient of determination was likewise obtained ($r^2 = 0.97$). This implies that the yield per hectare increased with increasing plant density (Fig. 6B).

In the wet season trial, high negative correlation coefficient ($r = 0.82$) was observed in terms of yield per plant. The plot of the estimated equation shows that yield per plant decreased with increasing plant density (Fig 7A). The highest and lowest mean yield per plant were obtained on 26,666 and 106,666 plants per hectare with 70.97 and 24.74 gms, respectively. On yield per hectare, a slightly significant positive correlation coefficient ($r = 0.55$) was computed using polynomial regression analysis. The plot of the estimated equation shows no specific trend (Figure 7B). However, highest mean yield per hectare (4.02 tons) was obtained on 66,666 plants per hectare. Plant density of 26,666 plants per hectare, on the other hand, gave the lowest mean yield of 1.89 tons.

The linear decrease in grain yield per plant and the linear increase in yield per hectare with increasing density only show the compensatory effect of high plant density per hectare for lower yield per individual plant. It appears then that the observed differences in yield during the dry season may be due to plant competition. On the other hand, the yield difference

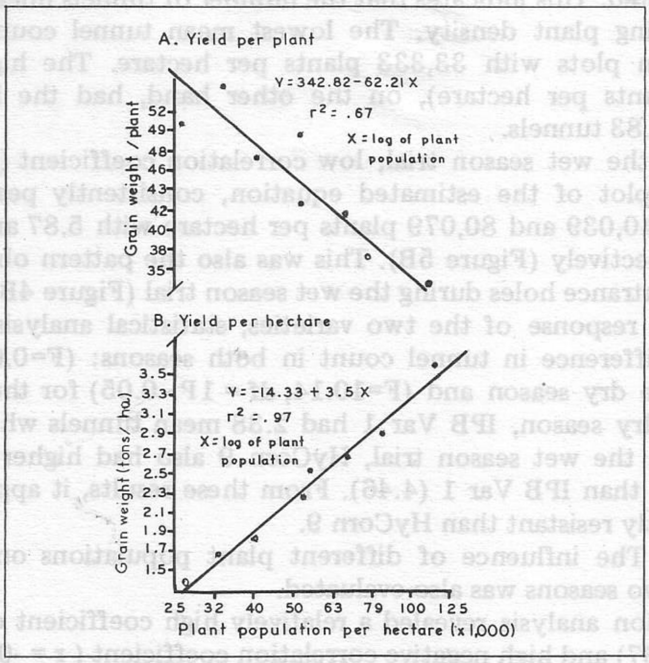

Figure 6. **The relationship between grain yield and different plant densities during the dry season (October 1986 January, 1985), College, Laguna. (A) Yield per plant (B) Yield per hectare.**

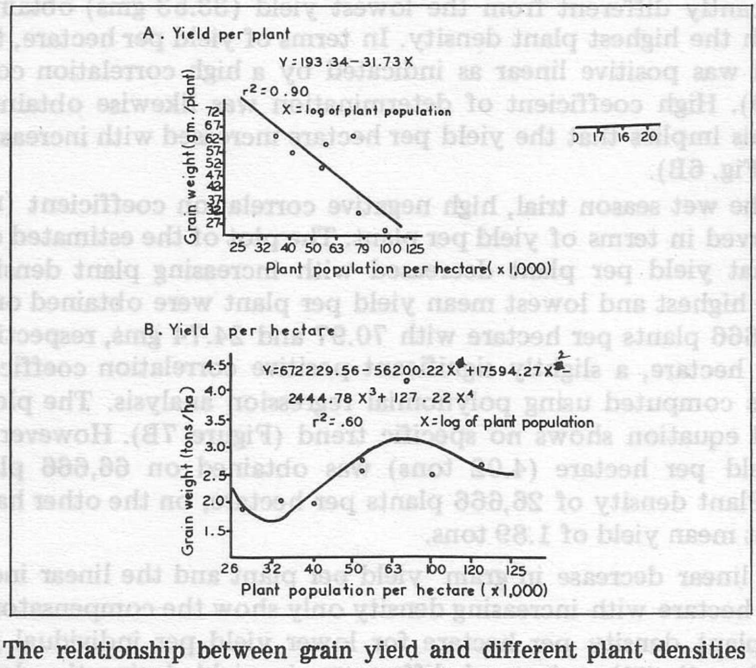

Figure 7. **The relationship between grain yield and different plant densities during the wet season (June-September, 1985) UPLB-CES, College, Laguna.(A) Yield per plant.(B) Yield per hectare.**

observed in the wet season may be attributed to the interaction effect of competition stress and borer injury which is especially evident under heavy corn borer infestation.

The yield response of the two varieties is also presented in Table 2. In the dry season, no significant difference was noted in the yield per plant ($F = 1$, $df = 1$; $P > 0.05$) and per hectare ($F = 1.03$; $df = 1$; $P > 0.05$). However, during the wet season trial, significant variation in yield per hectare was noted between the two varieties ($F = 17.95$, $df = 1$; $P < 0.05$). IPB Var I significantly gave higher yield per hectare (3.06 tons) than HyCorn 9 (2.05 tons).

Table 2 also shows the interaction effect of plant density and variety on the yield of corn. Significant difference in yield per hectare during the dry season trial was noted ($F = 2.27$, $df=7$; $P < 0.05$). Highest mean yield per hectare for the two varieties was obtained on plots with highest plant density. At 106,666 plants per hectare, HyCorn 9 has a mean yield of 3.78 tons while IPB Var 1 has 3.38 tons. This is significantly different from the lowest yield obtained from plots with lowest plant density. During the wet season, significant variation was also exhibited ($F = 3.0$, $df = 7$; $P < 0.05$). IPB Var 1 grown at 66,666 plants per hectare gave the highest yield of 5.70 tons.

Relationship between plant density and tunnel cross-sectional area

The relationship between plant densities and tunnel cross-sectional area was evaluated using polynomial regression analysis. The results show that the relationship was positive linear (Figure 8) as indicated by high correlation coefficient ($r = 0.84$). Likewise, a high coefficient of determina-

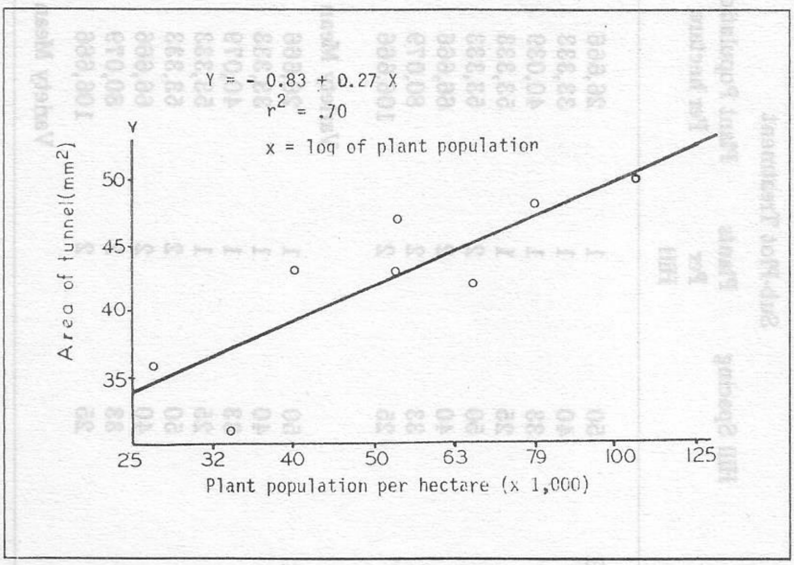

Figure 8. **The relationship between cross-sectional area of tunnels and different plant densities during the wet season (June-September, 1985) UPLB-CES, College, Laguna.**

Table 2. Yield of corn as affected by different plant densities. UPLB-CES, College, Laguna.

Mainplot	Sub-Plot Treatment			Dry Season[1]		Wet Season	
Variety	Hill Spacing	Plants Per Hill	Plant Population Per hectare	Yield Per Plant (gms)	Yield Per Hectare (tons)	Yield Per Plant (gms)	Yield Per Hectare (tons)
Hy Corn 9	50	1	26,666	48.06	1.28 k	64.62	1.72 b
	40	1	33,333	59.52	1.98 ghi	55.79	1.85 b
	33	1	40,039	50.33	2.02 ghi	42.74	1.66 b
	25	1	53,333	45.27	2.41 efg	61.49	2.97 b
	50	2	53,333	52.91	2.82 b-e	35.80	2.16 b
	40	2	66,666	43.43	2.90 a-d	35.29	2.35b
	33	2	80,079	32.65	2.62 c-f	24.36	1.95 b
	25	2	106.666	35.34	3.78 a	16.22	1.73 b
			Variety Mean	45.92	2.48	42.03	2.05 b
IPB Var 1	50	1	26,666	52.67	1.40 k	77.31	2.06 b
	40	1	33,333	45.63	1.51 ijk	54.19	2.22 b
	33	1	40,079	42.31	1.69 h-k	56.75	2.28 b
	25	1	53,333	38.79	2.07 fgh	49.08	2.64 b
	50	2	53,333	41.16	2.20 fgh	56.62	3.02 b
	40	2	66,666	37.57	2.50 def	85.06	5.70 a
	33	2	80,079	40.12	3.17 abc	37.45	2.99 b
	25	2	106,666	31.73	3.38 a	33.26	3.55 b
			Variety Mean	41.15	2.24	56.27	3.06 a

[1] In a column any two means having a common letter are not significantly different at 5% level using DMRT.

tion was noted (r^2 = 0.70). This implies that the tunnel area increases with increasing plant densities. The largest mean (50 mm^2) was noted in plots with 106,666 plants per hectare while the smallest mean (31 mm^2) was observed in plots with 33,333 plants per hectare. The results suggest that higher plant densities stimulate feeding by the corn borer larvae resulting in the production of larger tunnels.

Figure 9 illustrates the influence of tunnel cross-sectional area on grain yield per plant. A fourth degree polynomial regression analysis gave high coefficient of determination (r^2 = 0.82). The trend exhibited was positive non-linear (r= 0.70). The highest yield of 70.97 gms per plant was obtained when the cross-sectional area was 37 mm^2. The area size beyond this resulted to abrupt decrease in yield. The lowest mean yield per plant was recorded with the cross-sectional area of 50 mm^2.

It could be deduced from the above observations that the decrease in grain yield per plant with increasing plant densities obtained during the wet season may be attributed to larger tunnels produced at higher plant densities.

The present observations suggest that planting corn during the dry season at the rate of 106,666 plants per hectare is most productive. This pattern, however, may not be true during the wet season planting. In the wet season, planting corn at 53,333 and 66,666 plants per hectare are recommended in terms of corn borer incidence. The most productive yield per hectare could be obtained at 66,666 plants per hectare; planting density which may exceed this rate appears not recommendable. At denser planting scheme (80,078 plants/ha), a high incidence of corn borer infestation occurs. On the other hand, if we maximize the planting at 106,666 plants per hectare the individual plant tends to have thinner stalks and rind. This will make the plants vulnerable to breakage and lodging most especially during the typhoon season. Lodging and breakage of stalks do not pose a problem during the the dry season.

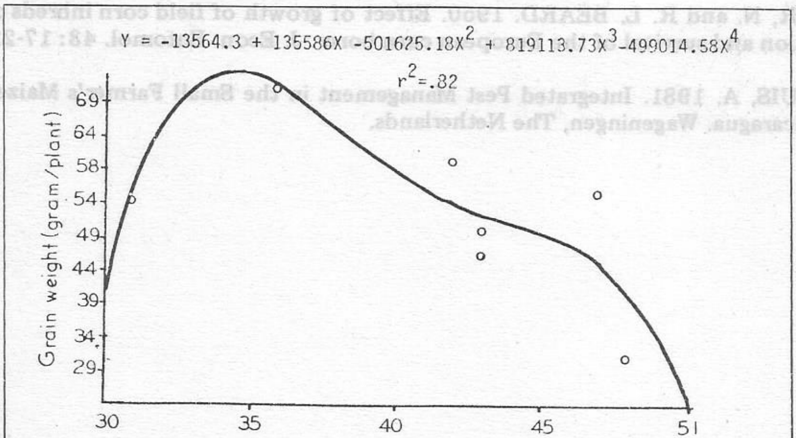

Figure 9. The relationship between yield per plant and cross-sectional area of tunnel during the wet season (June-September, 1985) UPLB-CES, College, Laguna.

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