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Response of corn (Zea mays L.) to Planting
Dates in Puerto Rico*

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SUMMARY

Twenty seven corn cultivars from the PCCMCA (Central America Cooperative Improvement Program) test were planted at two dates during 1982-83 at Isabela, Puerto Rico. The combined analysis of variance showed that there were significant differences between planting dates for grain yield, midbloom, leaf area index and rust reaction. Differences among cultivars were observed for all traits except test weight. Cultivar TICO V-6 from Costa Rica produced the highest grain yield (over 6 tons ha⁻¹) at both planting dates.

Twenty seven corn cultivars from the PCCMCA (Central America Cooperative Improvement Program) test were planted at two dates during 1982-83 on a Coto clay at Isabela. Yield potential, test weight, midbloom, leaf area index, plant height, ear height, ear length, ear diameter and rust reaction (Puccinia spp.) were evaluated. The combined analysis of variance showed that there were significant differences between planting dates for grain yield, midbloom, leaf area index and rust reaction but not for plant and ear height, test weight, ear length and ear diameter. Differences among cultivars were observed for all traits except test weight. Cultivar x planting date interactions were obtained for grain yield, midbloom, leaf area index and rust reaction. At first planting cultivar TICO V-6 produced the highest grain yield (6,215 Kg ha⁻¹), although not significantly different than those of HF-16, PNIA HB-1 and SIATSA H-1, while at second planting, TICO V-6 again produced the highest grain yield (6,599 Kg ha⁻¹), significantly surpassing the remaining cultivars. For both planting dates combined TICO V-6 grain yield was also significantly superior (6,407 Kg ha⁻¹). The

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leaf area indices of TICO V-6, TICO V-7 and Híbrido SIATSA H-1 were significantly higher than those of the remaining cultivars (3.7). Differences among cultivars were observed in plant height, ear length, ear diameter, ear height, mid-bloom and rust reaction, but not for test weight. Highly significant correlations were obtained between grain yield and leaf area index, plant height, ear length and ear diameter.

INTRODUCTION

Corn is the third most important grain crop of the world after rice and wheat and the United States is responsible for almost half of the total world production of about 402.7 million tons (Sotomayor-Ríos and Weibel, 1983). Although corn is not grown commercially in Puerto Rico it is an important component of local animal feeds. Imports of corn to Puerto Rico yearly are valued at more than \$33 million (Sotomayor-Ríos, 1979).

In Central America, corn is mostly grown for the preparation of the traditional "tortillas" and other human foods and as feed for animals. Based on the 1982 FAO Production Yearbook, of the Central American countries, Panamá was the lowest corn producer in 1981, followed by Costa Rica, Nicaragua, Honduras and El Salvador with 68, 88, 250, 338 and 487 thousand million tons, respectively.

The PCCMCA organization covers most fields of agricultural research and its annual meetings provide a forum at which research workers from Central America and some Caribbean countries exchange information. Following each annual meeting, delegates from the respective countries select their best corn varieties for the uniform test (Ensayo Uniforme de Maíz del PCCMCA). The results of this test are forwarded to CIMMYT (International Maize and Wheat Improvement Center), in Mexico for statistical evaluation. The PCCMCA uniform corn variety trials could be an excellent source of germplasm for use in our breeding program, and the planting and evaluation of these trials yearly in Puerto Rico could provide valuable information.

Limited research has been done in Puerto Rico to study the response of corn to planting dates, although extensive studies were reported on fertilization and cultivars responses to different soil and climatic conditions (Badillo-Feliciano et al., 1979; Fox et al., and Vázquez, 1961). Sotomayor-Ríos

(1979) conducted field trials with 12 corn cultivars on a Coto clay at Isabela. First, second and third crops of the same cultivars were planted on the same land to complete one full year of cropping. After the first crop, yields diminished although annual yields of more than 13 tons ha⁻¹ were reported.

This study was conducted to evaluate the yield potential and other agronomic and plant traits of 27 corn cultivars from the 1982 PCCMCA test at two plantings in Puerto Rico. The information obtained from these tests should permit comparison with similar trials in different regions of Central America, giving a good indication of which cultivars are the most promising for Puerto Rico.

MATERIALS AND METHODS

The experiments were conducted at the Isabela Experiment Farm on the Tropical Agriculture Research Station (TARS), USDA-ARS, on a Coto clay (Tropeptic Haplorthox, clayey, kaolinitic, isohyperthermic), pH 5.1 to 5.8. The farm is 128 m above sea level, ambient temperatures ranging from 18° to 31°C. The two planting dates were October 21, 1982 and March 23, 1983. The experimental design was a 6 x 6 lattice with four replications. Plots consisted of four rows 6 m long spaced at 1 m. Plants were thinned to 32,292 ha⁻¹ after emergence. Phosphorous and K were applied prior to planting at 100 Kg ha⁻¹ of K₂O and P₂O₅, respectively. Nitrogen as ammonium sulfate was applied at 100 Kg ha⁻¹ four weeks after planting. For the control of insects and nematodes, Furadan (2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate) was applied at 30 Kg ha⁻¹ one week after planting.

Immediately after planting, propazine (2-chloro-4,6-bis(isopropylamino)-s-triazine) was applied at 2.5 Kg ha⁻¹ active ingredient (a.i.). The corn was hand-harvested (10 m²) from the 2 inner rows of each plot. Ears harvested were dried to a uniform moisture content. Ear length and diameter were measured on 10 ears plot⁻¹. Test weight (expressed as Kg hl⁻¹) and grain yields were adjusted to 15.5% moisture. Prior to harvest, plant height (soil surface to the tip of the tassel), ear height (soil surface to the top-most ear bearing node), days to midbloom and rust severity (*Puccinia* spp.) were measured. Rust severity on a scale of 0 (no lesions) to 6 (37% or more of leaf area covered with lesions) was measured on a plot basis. Leaf area was

determined with a machine and leaf area index (LAI) as the ratio of upper leaf surface to ground surface. Data were subject to analysis of variance, correlation and significant differences identified with Duncan's multiple range test. All plots were irrigated when necessary. A description of the 27 cultivars, origin, seed color, and type is shown in Table 1. These cultivars are from the corn National Programs of Guatemala, Honduras, El Salvador, Panamá, Costa Rica and Mexico as well as three experimental hybrids from the DeKalb Hybrid Company.

RESULTS AND DISCUSSION

The F values for the combined analyses of grain yield and other traits are shown in Table 2. Significant differences among planting dates were observed for grain yield, midbloom, LAI and rust reaction, but not for plant height, ear height, test weight, ear length and ear diameter. Differences among cultivars were observed for grain yield and other traits except test weight. The interaction cultivars x planting date was significant for grain yield, midbloom, LAI and rust reaction but not for plant height, ear height, test weight, ear length and ear diameter.

First planting

The data in Table 3 show the means for grain yield and other traits in the 27 corn cultivars when planted on October 21, 1982 at Isabela (first planting). Grain yields ranged from 6,215 to 3,606 kg ha⁻¹. The most productive entries, in descending order were TICO V-6, HE-16, PNIA HB-1 and Híbrido SIATSA H-1. The yields of these four cultivars ranged from 6,215 to 6,039 Kg ha⁻¹, respectively and were significantly higher than those of the other countries except HE-102, TICO V-7, H-5, and HB-33. Cultivar TICO V-6 significantly exceeded the previous four corn cultivars in grain yield.

The LAI, which express the ratio of upper leaf surface to ground surface, is a useful index of potential plant interception of radiant energy. Brown et al. (1970), suggests that cultivar performance might be better compared with a constant LAI of 3.5, that seems to be optimum over most situations. The LAI ranged from 3.8 to 2.4. The highest LAI, in TICO V-7 (3.8) was significantly different from those

of the remaining cultivars. The next highest LAI were those of TICO V-6, Híbrido SIATSA H-1, HB-33 and H-5, all had 3.7.

Plant height ranged from 249 to 236 cm. Cultivar H-5 had the greatest ear height, but not significantly different from those of PNIA HB-1, HE-102, TICO V-7 and HB-33.

Ear length ranged from 19.1 to 14.2 cm. The greatest ear length in Híbrido SIATSA H-1, was significantly different from those of the other cultivars except TICO V-6, PNIA HB-1 and TICO V-7.

Ear diameter ranged from 5.48 to 4.65 cm. The highest ear diameters, in TICO V-6, HE-16, PNIA HB-6, Híbrido SIATSA H-1, HE-102, TICO V-7, H-5 and HB-33 were significantly different from those of the remaining cultivars.

Test weight ranged from 77 to 75 Kg. hl^{-1} . With respect to this trait, there were no significant differences among cultivars.

Ear height ranged from 125 to 118 cm. Twelve cultivars having ear height ranging from 125 to 123 cm were significantly superior to the others.

Midbloom or time to midsilk ranged from 57 to 51 days. Los Diamantes was the last to reach midsilk, significantly later than the other cultivars.

Rust ratings ranged from 5.0 to 2.25. The best eight cultivars for rust resistance were HE-16, La Máquina 7843, EX 811, Sintético Hondureño, H-3, H-9, Alajuela 1 and TICO V-6, with ratings ranging from 2.88 to 2.25.

Second planting

The data in Table 4 show the mean for grain yield and other traits in the 27 corn cultivars when planted on March 23, 1983 at Isabela (second planting). The grain yield ranged from 6599 to 3429 Kg ha^{-1} . Cultivar TICO V-6, as in the first planting, had the highest grain yield, significantly superior to the remaining cultivars. In relative terms, the yield of TICO V-6 was 6% higher than that obtained at first planting. The lowest producer was Alajuela-1.

The LAI ranged from 3.75 to 2.38. The greatest LAI in TICO V-6 was significantly different from those of the remaining cultivars, except H-5, TICO V-7 and Híbrido SIATSA H-1.

Plant height ranged from 2.49 to 2.36 cm. Cultivar H-5 was tallest, although not significantly different from TICO V-6, TICO V-7, Híbrido SIATSA H-1 and HB-33.

Ear length ranged from 19.3 to 14.3 cm. The greatest ear length in PNIA HB-1 was significantly different from those of the other cultivars, except TICO V-6.

Ear diameter ranged from 5.4 to 4.63 cm. The values of cultivars TICO V-7, HE-16 and HE-102 were significantly superior to those of the other cultivars, except TICO V-6, PNIA HB-1, H-5, Híbrido SIATSA H-1 and HB-33.

Test weight ranged from 77 to 75 Kg hl⁻¹ and no significant differences were observed among cultivars for this trait.

Ear height ranged 126 to 117 cm. The greatest ear height was that of Alajuela-2 but not significantly different from those of 12 other cultivars.

Time to midbloom ranged from 55 to 53 days. No significant difference among cultivars were observed for this trait.

Rust ratings ranged from 3.75 to 1.75, 16 cultivars having statistically the same rust rating. TICO V-6 had the lowest rating, as in the case of the first planting.

Planting dates combined

The means for grain yield and other traits for the 27 corn cultivar across planting dates are shown in Table 5. Cultivar TICO V-6 produced the highest grain yield (6,407 Kg ha⁻¹, significantly superior to the remaining cultivars. The high yields of TICO V-6 are comparable to those reported by various researchers from studies conducted at Isabela with commercial hybrids (Badillo-Feliciano et al. 1979; Sotomayor-Ríos et al., 1980; Talleyrand and Lugo-López, 1976). Cultivars TICO V-6, TICO V-7 and Híbrido SIATSA H-1 exhibited the highest LAI (3.7). Plant height ranged from 249 to 237 cm. Similar plant heights have been reported on commercial corn hybrids at Isabela in various studies reported by Badillo-Feliciano et al. (1979) and Sotomayor-Ríos et al. (1980). Ear length ranged from 19.1 to 14.2. Quiles (1983), reported that the mean ear length of three commercial hybrids⁻¹ grown at Isabela, at a population density of 40,000 plants ha⁻¹ and with the application of 120 KgNha⁻¹, was 15.9. Spain et al. (1982) reported mean ear lengths inferior to these

reported in this study. Ear diameter was statistically similar for the top eight grain yielders and all had a mean value of 5.4 cm. Quiles (1983) reported that the mean ears diameter of three commercial hybrids grown at Isabela was 4.7 when the plants were grown at a population density of 40,000 plants ha⁻¹.

The test weight for all 27 corn cultivars was statistically similar and ranged from 77 to 76 Kg ha⁻¹. These results are in contract with those reported by Sotomayor-Ríos (1979), who evaluated 12 corn cultivars harvested three times on the same site and in the same year at Isabela. Ear height ranged from 125 to 116 cm. Cultivars H-5, Alajuela-2 and Los Diamantes 8043 exhibited the greatest ear height, but not significantly from those of TICO V-6, PNIA HB-1, HE-16, HB-33, HE-102, HG-82 and HA-44. Very similar results for ear height have been reported by various authors (Quiles, 1983; Sotomayor-Ríos et al., 1980). Midbloom or days to midsilk overall means was 54.0. Quiles (1983) reported similar results with three commercial hybrids grown at Isabela at a population density of 40,000 plants ha⁻¹.

Rust ratings ranged from 2.3 to 3.8 and did not coincide with yield potential. Correlation coefficients between grain yield of the 27 corn cultivars and LAI, plant height, ear length and ear diameter across planting dates are shown in Table 6. The high yields obtained were related to LAI, plant height and ear diameter. The consistent influence of these traits on grain yield could make them useful criteria in the improvement of corn for the tropics.

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Table 1 - Origin, seed color and type of 27 corn cultivars planted at Isabela, Puerto Rico ^{1/}

Cultivar	Origin	Seed	
		Color	Type
1. HA-44	Guatemala	Yellow	Dent
2. HB-33	Guatemala	White	Dent
3. HB-67	Guatemala	White	Dent
4. ICTA-B1	Guatemala	White	Dent
5. La Máquina 7843	Guatemala	White	Dent
6. ICTA T-101	Guatemala	White	Dent
7. Sintético Hondureño	Honduras	White	Dent
8. Híbrido SIATSA H-1	Honduras	White	Dent
9. PNIA HB-1	Honduras	White	Dent
10. H-3	El Salvador	White	Dent
11. H-5	El Salvador	White	Dent
12. H-9	El Salvador	White	Dent
13. HE-16	El Salvador	Yellow	Dent
14. HE-102	El Salvador	Yellow	Dent
15. UNP 1	Panamá	Yellow	Dent
16. Tocumen 80A	Panamá	Yellow	Dent
17. Tocumen 7428	Panamá	Yellow	Dent
18. B-555	DeKalb	White	Dent
19. EX 815	DeKalb	Yellow	Dent
20. EX-811	DeKalb	White	Dent
21. Los Diamantes 8043	Mexico	White	Dent
22. Alajuela-1	Costa Rica	White	Dent
23. Alajuela-2	Costa Rica	White	Dent
24. TICO V-1	Costa Rica	White	Dent
25. TICO V-6	Costa Rica	Yellow	Dent
26. TICO V-7	Costa Rica	White	Flint
27. HG-82	Guatemala	Yellow	Dent

^{1/} Uniform corn test, PCCMCA - 1982.

Table 2 - F values for the combined analyses of grain yield, midbloom, plant height, height of the first ear, leaf area index, test weight, ear length, ear diameter and rust of 27 corn cultivars across planting dates at Isabela, Puerto Rico

	Grain Yield	Mid bloom	Plant Height	Ear Height	Leaf Area Index	Test Weight	Ear Length	Ear diameter	Rust
Planting dates	7.8**	7.6**	0.4	0.1	12.5**	1.6	1.0	0.3**	13.0**
Cultivars	252.4**	2.9**	35.5**	18.1**	469.8**	1.0	642.8**	28.6**	2.3**
Cultivar x planting dates	7.8**	2.5**	1.5	1.1	3.6**	0.9	1.2	0.5	2.0**

** Significant at the 0.01 probability level.

Table 3. Mean grain yield, leaf area index, plant height, ear length, ear diameter, ear diameter, test weight, ear height, midbloom and rust of 27 corn cultivars planted October 21, 1982 at Isabela, Puerto Rico 1/

Cultivars	Grain		Leaf area		Plant		Ear		Test		Ear		Midbloom		Rust ^{2/}		
	yield kg/ha		index	height cm	length cm	diameter cm	weight kg/hl	height cm	days	55 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
TICO V-6	6215 a		3.73 ab	246 bc	18.9 ab	5.38 a	76 a	124 ab		55 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
HE-16	6076 ab		3.48 cd	243 def	18.3 cd	5.48 a	75 a	123 ab		55 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
PNIA HB-1	6062 ab		3.44 d	247 abc	18.9 ab	5.35 a	76 a	124 ab		55 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
HBrido SIATSA H-1	6039 ab		3.74 ab	246 bc	19.1 a	5.45 a	76 a	123 ab		55 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
HE-102	5956 b		3.54 c	247 abc	18.7 b	5.43 a	75 a	125 a		55 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
TICO V-7	5946 b		3.76 a	248 ab	18.8 ab	5.45 a	76 a	123 ab		55 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
H-5	5919 b		3.66 b	249 a	18.6 bc	5.38 a	76 a	125 a		55 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
HB-33	5857 b		3.67 ab	248 ab	18.2 d	5.38 a	76 a	124 ab		55 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
HG-82	5447 c		3.28 e	242 fg	15.7 f	4.80 bc	77 a	124 ab		53 fghij	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
Tocumen 7428	5273 cd		3.29 e	243 def	16.9 e	4.90 bc	76 a	122 cd		53 fghij	56 abc	54 bcdef	56 abc	54 bcdef	56 abc	54 bcdef	56 abc
Alajuela-2	5102 d		3.15 f	245 cde	15.5 f	4.93 bc	76 a	124 ab		51 jk	55 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef
La Máquina 7843	5099 d		3.16 f	243 def	14.8 hi	4.85 bc	76 a	122 cd		54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef
EX 811	4898 e		3.00 g	245 cde	15.2 g	4.73 c	75 a	121 def		54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef
HA-44	4843 e		3.13 f	241 fgh	16.7 e	4.80 bc	76 a	123 ab		52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk
VNP-1	4619 f		2.99 f	243 def	15.6 f	4.78 bc	76 a	124 ab		57 a	55 bcdef	55 bcdef	55 bcdef	55 bcdef	55 bcdef	55 bcdef	55 bcdef
Los Diamantes 8043	4354 g		2.96 g	242 fg	14.7 hi	4.75 c	76 a	124 ab		55 bcdef	56 abc	56 abc	56 abc	56 abc	56 abc	56 abc	56 abc
ICTA-T-101	4278 gh		3.02 g	243 def	14.9 gh	4.88 bc	76 a	121 def		55 bcdef	56 abc	56 abc	56 abc	56 abc	56 abc	56 abc	56 abc
B-555	4229 ghi		2.63 ij	239 hijk	14.8 hi	4.83 bc	76 a	119 g		56 abc	56 abc	56 abc	56 abc	56 abc	56 abc	56 abc	56 abc
EX 815	4176 ghi		2.72 hi	238 ijk	14.9 gh	4.78 bc	76 a	119 g		55 bcdef	55 bcdef	55 bcdef	55 bcdef	55 bcdef	55 bcdef	55 bcdef	55 bcdef
Sintético Hondureño	4119 hi		2.41 l	238 ijk	14.2 j	5.03 b	75 a	119 g		51 jk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk
H-3	4092 hi		2.58 jk	238 ijk	14.9 gh	4.80 bc	76 a	120 efg		52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk
ICTA-B1	4083 hi		2.79 h	238 ijk	14.7 hi	4.65 c	77 a	116 h		56 abc	56 abc	56 abc	56 abc	56 abc	56 abc	56 abc	56 abc
HB-67	4079 hi		2.45 l	236 l	14.8 hi	4.80 bc	77 a	118 g		54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef
TICO V-1	4050 ij		2.49 kl	239 hijk	14.6 hi	4.80 bc	77 a	119 g		54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef	54 bcdef
Tocumen 80A	3871 j		2.40 l	240 ghi	14.8 hi	4.68 c	77 a	118 g		53 fghij	53 fghij	53 fghij	53 fghij	53 fghij	53 fghij	53 fghij	53 fghij
H-9	3651 k		2.57 jk	237 kl	14.5 i	4.68 c	76 a	118 g		52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk	52 hijk
Alajuela-1	3606 k		2.42 l	2.38 ijk	14.5 i	4.84 bc	77 a	120 efg		54	54	54	54	54	54	54	54
X	4,886		3.06	242	16.15	4.98	76	121		2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14
C.V. (%)	2.81		2.09	060	1.34	3.21	1.28	090		22.43	22.43	22.43	22.43	22.43	22.43	22.43	22.43

1/ Means followed by a letter in common do not differ significantly (P .05) according to Duncan's multiple range test.
 2/ Rating scale: 0 (no lesions) to 6 (37% of leaf area covered with lesions).

Table 4. Mean grain yield, leaf area index, plant height, ear length, ear diameter, ear diameter, test weight, test weight, ear height, midbloom and rust of 27 corn cultivars planted March 23, 1983, at Isabela, Puerto Rico 1/

Cultivars	Grain yield kg/ha	Leaf area index	Plant height cm	Ear length cm	Ear diameter cm	Test weight kg/hl	Ear height cm	Midbloom days	Rust ^{2/}
TICO V-6	6599 a	3.75 a	248 ab	19.1 a	5.43 a	76 a	124 ab	54 a	1.75 c
PNIA HB-1	6362 b	3.46 c	246 bc	19.3 a	5.38 a	76 a	125 ab	54 a	3.25 ab
H-5	6350 b	3.68 ab	249 a	18.7 b	5.38 a	77 a	124 ab	55 a	3.50 ab
TICO V-7	6080 c	3.72 a	247 ab	18.8 b	5.45 a	76 a	122 bcde	52 a	2.38 bc
Híbrido SIATSA H-1	5706 d	3.72 a	248 ab	19.2 a	5.40 a	76 a	120 cdef	53 a	3.13 abc
HB-33	5590 d	3.61 b	247 ab	18.3 c	5.35 a	76 a	123 abc	54 a	2.88 abc
HE-16	5574 d	3.36 d	243 cde	18.2 c	5.45 a	77 a	123 abc	55 a	2.38 bc
HE-102	5844 d	3.43 cd	248 ab	18.6 b	5.45 a	76 a	124 ab	54 a	2.38 bc
HG-82	4989 e	3.17 e	242 efg	15.7 f	4.60 g	76 a	123 abc	54 a	2.88 abc
La Máquina 7843	7843 e	3.08 fg	242 efg	14.8 hijk	5.00 bc	76 a	123 abc	53 a	2.50 abc
UNP-1	4861 e	3.05 g	242 efg	15.5 fg	4.80 bcdefg	76 a	123 abc	53 a	3.38 ab
Tocumen 7428	4817 e	3.15 ef	243 cde	16.6 d	4.88 bcdefg	77 a	123 abc	54 a	2.38 bc
EX-811	4759 ef	2.95 i	242 efg	15.3 g	4.65 efg	76 a	123 abc	53 a	3.50 ab
B-555	4751 ef	2.79 k	240 efgh	14.9 hi	4.78 bcdefg	76 a	120 cdef	54 a	3.13 abc
Alajuela-2	4729 ef	2.96 hi	245 bcd	15.6 f	5.00 bc	77 a	126 a	53 a	3.25 ab
HA-44	4542 fg	3.04 gh	242 efg	16.4 e	4.78 bcdefg	76 a	122 bcde	53 a	2.50 abc
EX-815	4505 fgh	2.72 kl	237 hi	14.9 h	4.90 bcde	76 a	119 ef	54 a	2.38 bc
Sintético Hondureño	4396 ghi	2.43 no	239 fghi	14.3 l	5.03 b	76 a	119 ef	53 a	2.50 abc
Los Diamantes 8043	4275 hij	2.88 j	239 fghi	14.8 hijk	4.75 cdefg	76 a	125 ab	52 a	3.25 ab
ICTA-T-101	4161 ijk	3.05 g	243 cde	14.9 hij	4.95 bcd	76 a	120 cdef	54 a	2.63 abc
ICTA B-1	4115 jk	2.74 kl	239 fghi	14.7 hijk	4.73 defg	76 a	120 cdef	54 a	3.88 a
Tocumen 80A	3896 k	2.48 n	240 efgh	14.9 hi	4.63 fg	76 a	119 ef	54 a	3.38 ab
HB-67	3976 k	2.38 o	239 fghi	14.6 jk	4.70 defg	76 a	117 f	52 a	3.00 abc
H-3	3951 k	2.69 l	240 efgh	15.3 g	4.65 efg	77 a	118 f	54 a	3.25 ab
TICO V-1	3921 k	2.43 no	240 efgh	14.7 ijk	4.65 efg	77 a	118 f	53 a	2.63 abc
H-9	3593 l	2.58 m	236 i	14.6 kl	4.68 efg	75 a	117 f	55 a	3.25 ab
Alajuela-1	3426 l	2.42 no	237 i	14.5 kl	4.85 bcdefg	76 a	118 f	53 a	3.75 ab
\bar{X}	4829	3.03	242	16.2	4.97	76	121	53	2.93
C.V. (%)	3.47	1.78	082	1.10	3.15	1.25	170	3.59	28.23

1/ Means followed by a letter in common do not differ significantly (P .05) according to Duncan's multiple range test.

2/ Rating scale: 0 (no lesions) to 6 (37% of leaf area covered with lesions).

Table 5. Mean grain yield, leaf area index, plant height, ear length, ear diameter, test weight, ear height, midbloom and rust of 27 corn cultivars across planting dates at Isabela, Puerto Rico 1/

Cultivars	Grain yield Kg/ha	Leaf area index	Plant height cm	Ear length cm	Ear diameter cm	Test weight Kg/hl	Ear height cm	Midbloom days	Rust ^{2/}
TICO V-6	6407 a	3.74 a	247 b	19.0 a	5.4 a	76 a	123 abcde	54 ab	2.3 d
PNIA HB-1	6212 b	3.45 cd	246 bc	19.1 a	5.4 a	76 a	124 abc	55 a	3.4 ab
H-5	6134 bc	3.67 b	249 a	18.7 b	5.4 a	76 a	125 a	53 bc	3.6 ab
TICO V-7	6013 cd	3.74 a	247 ab	18.8 b	5.5 a	76 a	122 cdef	53 bc	2.9 abcd
Híbrido SIATSA H-1	5873 de	3.73 a	247 ab	19.2 a	5.4 a	76 a	121 efg	54 ab	3.3 abc
HE-16	5825 e	3.42 d	243 def	18.2 c	5.5 a	76 a	123 abcde	55 a	2.3 d
HB-33	5724 e	3.64 b	247 ab	18.2 c	5.4 a	76 a	123 abcde	55 a	3.1 abcd
HE-102	5720 e	3.48 c	247 ab	18.6 b	5.4 a	76 a	124 abc	55 a	3.1 abcd
HG-82	5218 f	3.23 e	242 efg	15.7 f	4.7 efg	76 a	123 abcde	53 bc	3.4 ab
Tocumen 7428	5045 g	3.22 e	243 def	16.7 d	4.9 bcde	77 a	122 cdef	55 a	2.8 abcd
La Máquina 7843	4987 gh	3.12 f	242 efg	14.8 ijk	4.9 bcde	76 a	122 cdef	54 ab	2.4 cd
Alajuela-2	4916 gh	3.06 g	245 cd	15.6 f	5.0 bc	77 a	125 a	52 cd	3.2 abcd
EX-811	4828 hi	2.98 h	243 def	15.2 g	4.7 fg	76 a	122 cdef	54 ab	2.9 abcd
UNP-1	4740 i	3.02 gh	243 def	15.6 f	4.8 cdefg	76 a	122 cdef	53 bc	3.8 a
HA-44	4692 i	3.08 fg	241 fghi	16.5 e	4.8 cdefg	76 a	123 abcde	52 cd	3.0 abcd
B-555	4490 j	2.71 j	240 ijk	14.9 ijk	4.8 cdefg	76 a	120 hi	55 a	3.3 abc
EX-815	4341 jk	2.72 j	2.38 lmmo	15.0 hi	4.8 cdefg	76 a	119 hij	54 ab	3.8 a
Los Diamantes 8043	4315 k	2.92 i	241 fghi	14.7 jkl	4.8 cdefg	76 a	125 a	55 a	3.3 abc
Sintético Hondureño	4257 kl	2.42 m	239 klmm	14.2 n	5.0 bc	76 a	119 hij	52 cd	2.4 cd
ICTA-T-101	4220 kl	3.04 gh	243 def	14.9 ijk	4.9 bcde	76 a	120 hi	55 a	3.3 abc
ICTA B-1	4099 lm	2.77 j	239 klmm	14.7 jkl	4.7 fg	76 a	120 hi	53 bc	3.8 a
HB-67	4027 mn	2.41 m	237 no	14.7 jkl	4.8 cdefg	77 a	116 k	54 ab	3.1 abcd
H-3	4022 mn	2.64 k	239 klmm	15.1 gh	4.7 fg	77 a	119 hij	53 bc	2.9 abcd
TICO V-1	3985 mn	2.46 m	240 ijk	14.7 jkl	4.7 fg	77 a	118 ijk	53 bc	2.9 abcd
Tocumen 80A	3928 n	2.44 m	240 ijk	14.9 ijk	4.7 fg	76 a	119 hij	54 ab	3.5 abcd
H-9	3622 o	2.57 l	237 no	14.5 lm	4.7 fg	76 a	118 ijk	54 ab	2.9 abcd
Alajuela-1	3516 o	2.42 m	237 no	14.5 lm	4.9 bcde	76 a	119 hij	53 bc	3.3 abc
X	4858	3.04	242	16.2	5.00	76	121	54.00	3.12
C.V. (%)	3.15	1.95	072	1.23	3.19	1.27	136	2.95	25.19

1/ Means followed by a letter in common do not differ significantly (P .05) according to Duncan's multiple range test.

2/ Rating scale: 0 (no lesions) to 6 (37% of leaf area covered with lesions).

Table 6 - Correlation coefficients between grain yield and leaf area index, plant height, ear length and ear diameter of 27 corn cultivars across planting dates at Isabela, Puerto Rico

	Leaf area index	Plant Height	Ear Length	Ear diameter
Grain yield	0.95**	0.91**	0.93**	0.86**

** Significantly different from zero at P 0.01.