C A R I B B E A N F O O D C R O P S
S O C I E T Y
(C F C S)
XIV th Meeting

Quatorzième Congrès
de la

SOCIETE INTERCARAIBE POUR LES PLANTES ALIMENTAIRES

Guadeloupe — *27 - 29 Juin*

Martinique — *30 Juin - 2 Juillet 1977*

Sponsored by
Organise par

L'INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE (I.N.R.A.)

with the aids of
Avec les aides
de la

DELEGATION GENERALE A LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE (D.G.R.S.T.)

and of the
et des

CONSEILS GENERAUX
CHAMBRES D'AGRICULTURE
DE LA GUADELOUPE ET DE LA MARTINIQUE

with the technical assistance of the following organisms
avec le concours technique des organisations suivantes

ORSTOM - IRFA - IRAT - CTGREF - DDA -

And the participation of Institutions of 15 Caribbean territories
Et la participation des Institutions de 15 pays de la Caraïbe

SOUS le PATRONNAGE de MM. LES PREFETS de la GUADELOUPE et de la MARTINIQUE

Hôtel Arawak
Gosier - Guadeloupe

Hôtel Méridien
Trois Ilets - Martinique

Nouv. agron. Antilles-Guyane, 3, 3/4, 659-667, 1977.

AGRONOMIC STUDIES ON WHEAT CULTIVATION IN THE DOMINICAN REPUBLIC

Par Frederico CUEVAS-PEREZ (°)

INTRODUCTION

Wheat has been always grown in temperate regions, but consumed worldwide. Tropical regions, such as the Dominican Republic, depend on importation for their needs. Wheat importation has increased during the period from 1954 to 1974 from 15,600 tons with a value of US $ 1.8 millions (1) to 86,500 tons with a value of US $ 21,8 millions (2). Due to lower temperatures during the winter months in some important cropping zones of the country, wheat cultivation merited investigation in order to reduce such imports. It also had potential as another crop in the limited rotation cycle of the winter months. Some attempts have been made to yield test wheat in the Dominican Republic (Vloeberg, 1963 ; Pérez, 1968) and to study its physiological characteristics in the tropics (Midmore, 1976).

Vloeberg (1963) studied wheat cultivation in three different altitudes; 400 mts., 600 to 700 mts., and 1,200 mts. in the Dominican Republic during three years. He observed higher yields with an increase in altitude, and that autumn was the best planting season. Midmore (1976) studied the effects of temperature, irradiance and day length on various aspects of wheat growth in four tropical sites in Mexico ranging in altitude from sea level to 2,640 mts. during the winter. He observed that high temperature accelerated all morphogenetic processes and concluded that although growth was faster, yield was lower in hotter sites.

MATERIALS AND METHODS

Ten wheat varieties (Table I) were planted on November 24 and December 23, 1975 ; January 22, November 23, and December 22, 1976 in a fine silty, mixed, isohypothermic, typic haplustoll soil at La Herradura (altitude : 160 mts. ; latitude 19, 27'N), Santiago, Dominican Republic. The first three planting dates were considered as first year and the last two as the second year. A randomized block design with three replications was used, except for the November 1976 planting when only two replications were recorded. Plots were 9 rows, 20 cms. apart, 1,5 mts. long, harvesting 1.0 square meters in the center of the plot. Seed was planted at 100 kg/ha and fertilization was 50 kg P_2O_5/ha and 50 kg N/ha at sowing and 50 kg N/ha four weeks after sowing. Irrigation was applied for germination and at periods ranging from 10 to 15 days. Insect control was done by spraying commercial insecticides (Sevin and Azodrin) ; no important diseases were observed.

Yield, number of fertile spikelets per ear, number of plants per square meter at harvest, plant height, days to 50 % flowering days to 50 % maturity, and 100 grains weight were recorded for all planting dates. Yield was expressed in grams per square meter ; ten plants were randomly taken to calculate plant height and number of fertile spikelets per ear.

(°) Instituto Superior de Agricultura

(1) Comercio Exterior, 1954

(2) Estado de Situación, Instituto Nacional de Estabilización de Precios (INESPRE), 1974

Tillers were counted weekly in the November and December 1976 plantings, starting 4 weeks after sowing until 50 % flowering. The percentage of tiller survival was calculated by dividing number of tillers at harvest by the highest recorded tillers number in the weekly counts.

TABLE I

Name and origin of wheat (*Triticum aestivum,L*) varieties planted during two years and five planting dates at La Herradura, Santiago, Dominican Republic.

Variety Name	Source
Tcl Beagle	CIMMYT
Sonora 64	CIMMYT
Tcl Yoreme	CIMMYT
7 Cerros 66	CIMMYT
Ciano Jn	Dr Robert Cheaney
Anza	CIMMYT
INIA 66	Dr Robert Cheaney
Pitic 62	CIMMYT
Mengavi 8156	CIMMYT
Trigo de Egipto	Dr Robert Cheaney

An analysis of variance for experiments repeated in time and space, using planting dates in place of locations, was used to analyse yield variations. Correlation coeficients on number of plants per square meter at harvest percentage tiller survival and 100 grains weight-yield were calculated. Data is discussed in relation to temperature and rainfall.

RESULTS AND DISCUSSION

Data recorded on each planting date is presented in Tables II,III. Observed differences among planting dates are thought to be due to temperature and rainfall variations (Table IV). Higher temperatures affected yield negatively, because they hastened metabolism, thus decreasing dry matter accumulation (Midmore, 1976).This effect can be observed through higher tiller mortality in varieties with higher tillering capacity, meaning more tillers with an increase in mortality due to competence (TableVI). It was also observed that flowering period was shorter and grains lighter with an increase in temperature during their period of expression. Yield differences among varieties and between the two studied years were highly significant (Table V) . Varieties Tcl. Beagle, Sonora 64, Tcl. Yoreme, and 7 Cerros yielded aroung250 grams/m2 (2.50 ton/ha) which is higher than those reported by Vloeberg (1963). His best planting date in the altitude of 400 mts. had a maximum yield of 2.15 tons/ha. Furthermore these varieties were as high yielding as his for 600 to 750 mts. of altitude where his best variety yielded 2.48 tons/ha. These yields are about one third of those of temperate zones, (CIMMYT, 1976), but under tropical conditions the crop cycle is about half as long.

Since there was a highly significant difference between the two studied years, varieties for the tropics should be tested for at least two years. Even though there was no statistically significant difference between the November and December planting dates, December plantings were the most consistent in yield,250 grs/m2

in the first year and 202 grs/m2 in the second. These correspond with 299 grs/m2 in the first year and 119 in the second for November plantings.

Tiller survival (Table VI) tended to be higher when the temperature during tillering period became lower. Thus, the maximum number of tillers was lower and as a result there was less competition among tillers. Correlation estimates on yield components (Table VII) showed plants per square meter to be significantly correlated with yield in the tropics. These results agree with those of Midmore (1976). He also pointed out the high significance of high tiller survival associated with high yields for tropical sites. In this study there was not such significant correlation. Difference may well be due to his counting schedule (6 weeks after sowing, which tended to reduce maximum tiller number in early varieties. By counting early varieties at 6 weeks, already the date of maximum tiller number had passed, and the effects of tiller competition had already started. Since these early varieties also happened to be the highest yielders in his data, this explains his finding of high tiller survival correlated with high yield.

From these data it can be assumed that wheat has the potential to yield a reasonable crop under tropical, low altitude conditions. Wheat could be considered as an economic alternative in crop rotation for use during winter months in the Dominican Republic. The rather unsophisticated agronomic requirements of this crop suggest it could be adapted by small and medium size farmers since it promises to increase incomes without implying a great deal of change in their farming systems. The selection of varieties adapted to the cropping systems. The solution of agronomic questions (weed control, harvesting, etc.) and government support are the next steps before wheat can be commercially grown in the Dominican Republic.

ABSTRACT

Ten (10) wheat, *Triticum aestivum (L.)*, varieties were planted in November, December and January 1975-1976 and November and December 1976 at La Herradura (altitude : 160 mts.), Santiago, Dominican Republic, to study wheat as a potential winter crop. Yield, number of plants per square meter, number of fertile spikelets per ear, 100 grains weight, days from sowing to flower, and days to 50 % maturity, and percentage of tiller survival were recorded. Although no statistical difference was observed between November and December plantings, December plantings were the most consistent in yield. Yield varied from 259 to 127 grams per square meter. There was a highly significant difference in yield between the two years which is thought to be due to differences in temperature and rainfall. Number of plants per square meter was significantly correlated (r=0.66) with yield. It was observed that flowering was shorter and grains lighter with an increase in temperature during their period of expression. Varieties with higher tillering capacity had a lower percentage of tiller survival especially when planted at higher temperatures. It is clear from these findings that there is some potential for wheat as a winter crop in La Herradura, Dominican Republic and other parts of the country with cool winters.

Variety (1)	PLANTING DATE					Mean
	November 1975	December 1975	January 1976	November 1976	December 1976	
Tcl Beagle a	338	245	284	162	264	259
Sonora 64 ab	397	335	229	101	188	250
Tcl Yoreme ab	397	359	160	104	225	249
7 Cerros 66 abc	335	318	187	155	224	243
Ciano Jn abc	353	323	180	137	163	227
Anza bc	279	282	228	143	194	211
INIA 66 c	281	249	188	143	194	211
Pitic 62 d	223	232	128	103	210	179
Mengavi 8156 d	212	115	167	90	205	158
Trigo de Egipto e	176	120	118	67	155	127
Mean	299	258	187	119	202	

TABLE II

Yield (grams per square meter) of 10 wheat varieties planted in five different planting dates at La Herradura, Santiago, Dominican Republic

(1) Varieties with the same letter do not have significant difference.

Varieties	Plant height (cms.)	Days to flowering	Days to maturity	Plants/m2	Fertile spikelets per ear	100 grains weight (grs.)
Tcl Beagle	95	70	105	243	27	3.8
Sonora 64	67	52	85	370	16	3.3
Tcl Yoreme	76	52	85	336	18	3.4
7 Cerros 66	71	53	92	312	17	3.1
Ciano Jn	69	53	85	390	16	3.1
Anza	71	60	104	388	17	2.9
INIA 66	74	57	99	350	18	2.9
Pitic 62	75	72	112	272	20	3.1
Mengavi 8156	58	85	120	323	19	3.0
Trigo de Egipto	83	93	117	291	18	3.3

TABLE III

Plant height, data on cycle and yield components recorded on 10 wheat varieties planted over 5 planting dates at la Herradura, Santiago, Dominican Republic

Temperature	1975		1976				1977				
	Nov.	Dec.	Jan.	Feb.	March	Apr.	Nov.	Dec.	Jan.	Feb.	March
Maximum	29.39	25.54	27.36	27.52	29.07	29.87	30.76	30.51	28.28	31.34	31.42
Minimum	18.38	17.43	16.36	17.64	17.83	18.93	20.44	18.54	17.77	19.14	18.77
Average	24.38	21.48	21.86	22.58	23.58	24.40	25.60	24.52	23.02	25.24	25.09
Rainfall (mms)	219.40	162.80	39.80	63.30	17.00	79.3	10.7	16.6	36.30	9.2	1.0

TABLE IV

Meteorological data recorded during the experiment

TABLE V

Analysis of variance for yield combined over 2 years and 3 planting dates

Source	D.F.	MC
Total	139	
Planting dates (PD)	2	19954.00 °
Years (Y)	1	204300.55 °°
Y x PD	2	58689.27 °°
Reps in Exp.	13	
Error (a)	7	2026.14
Varieties (V)	9	3275.62 °°
V x PD	18	3117.62 N.S.
V x Y	9	8961.33 °°
Error (b)	85	2353.48

° Significant at the 0.05 level.

°° Significant at the 0.01 level.

TABLE VI

Maximum tiller number and per cent tiller survival recorded during two planting dates at La Herradura, Santiago, Dominican Republic

Variety	November 1976		December 1976	
	Maximum tiller number	Tiller survival (%)	Maximum tiller number	Tiller survival (%)
Tcl Beagle	555	36	683	39
Sonora 64	447	86	659	38
Tcl Yoreme	786	36	497	53
7 Cerros 66	738	42	517	64
Ciano Jn 512	512	72	479	53
Anza	780	53	626	49
INIA 66	842	45	566	56
Pitic 62	949	22	631	53
Mengavi 8156	894	24	748	60
Trigo de Egipto	1042	18	853	44

TABLE VII

Correlation coeficients (r) between yield and yield components

	Yield
Number of plants/m2	0.66 (°)
Number of fertile Spidelets/ear	0.57 N.S.
Grain weight	0.19 N.S.
Tiller survival	0.25 N.S.

(°) Significant at the 0.05 level.

REFERENCES

- Centro Internacional de Mejoramiento de Maiz y Trigo. (1976), CIMMYT Review 1976, El Batân, Mexico.
- Midmore, D.J. (1976), "Growth, Development and Yield of Wheat *(Triticum aestivum L.)* in the Tropics". PhD Thesis, Department of Agricultural Botany, University of Reading, England
- Pèrez, R. (1968). Dominican Republic Secretariat of Agriculture. Centro Nacional de Investigaciòn, Extension y Capacitaciòn Agropecuaria , "Personal Communication".
- Vloeberg, A. (1963), "Contribution à l'étude du Comportement des variétés de Blé Tendre et leurs Qualités en Climat Tropical". L'agrono - mie Tropicale 18 (4) ; 381-425.