J. Agric Sci. Mansoura Univ., 27(1): 27 - 32, 2002.

EFFECT OF PLANT DENSITY AND HARVESTING DATE ON EAR AND KERNELS ROTS IN MAIZE

Amer, E.A. *; A.A. El-Shenawy *; S.A. Tolba ** and A.A. Motawi *

***   Field Crors Ins., Agric. Res. Center, Egypt.**

**** Plant Path. Ins. Sakha Agric. Res. Satation.**

ABSTRACT

Maize genotypes reactions against ear and kernels rots causal organisms studied under natural infection at two plant density and different harvest dates at Sakha Agricultural Research Station. Field experiments were designed in split plot design in four replications during summer Season of 1999 and 2000. The main finding could be summarized as follows:

The results showed that single crosses 107 and 122 gave the lowest degree of infection by ear and kernel rot disease under the low plant density (20,000 plants/fed). The single cross 120 and Bashaier-13 gave intermediate reaction, while the open pollinated varieties Giza-2 and Bush gave the highest degree of infection by all tested disease at both low and high plant densities. Moreover, *Fusarium moniliforme* was predominated on/in the maize grains. Its frequency percentage tended to high in all tested cultivars grown at all harvest dates, and its infected the kernels before any other agents of kernel or ear rot. On the other hand, Pen*icillium Sp., Aspergillus flavus and Aspergillus miger* caused high infection in only late harvest date (135 days after planting).

Generally, increasing plant density from 20,000 to 30,000 plants/fed. has significantly increasing for the ear and kernels rot disease, while the ear length, ear diameter, number of kernels/row and number of rows/ear were decreased. The optimum plant density was 20,000 plants/fed, which gave the low degree of infection and high production of grain yield production.

INTRODUCTION

Maize considered one of the most important food grains, ear and kernel attack by several fungi in field and storage. King (1981) reported that *Fusarium moniliforme* appeared to be an early colonist of preharvested maize ears, infecting the kernels before Penicillium and other molls. Camtone *et al.* (1983) found that differences among hybrids were most as great as between inbreds and hybrids, since the inbreds were generally more susceptible than the hybrids when they were inoculated by corn storage fungi under the condition of three different environments. None of the tested genotypes expressed immunity against the invasion of storage fungi. Gamal El-Din *et al.* (1987) showed that the most dominant fungi in maize grains could be arranged descendingly as *Fusarium moniliforme, Nigrospora oryzae, Fusarium graminearum, Penicillium Sp., Aspergillus miger, Aspergillus flavus, Rhizopus Spp., Mucor Spp. and Alternaria Spp.* Singh *et al.* (1988) found that infection by all parts of seed, however the percent of infection depended on the severity of the seed infection. The pathogen infected the pedicel and based ovary after myceial clumps produced in between the ovary wall and aleurone layer entered into the endosperm and embryo directly. Payne *et al.* (1988) added that sporulatin of the fungus *Aspergillus flavus* in the field was associated with injured kernels and relationship between aflation contamination and insect injury has been shown. Direct infection by *Aspergillus flavus* has significant role in epidemiology of the critical factors affecting the infection process. Wicklow (1988) illustrated that eleven common maize infecting fungi grew out from surface-disinfected maize kernels from North Carolina and plated on malt extract agar. Each of these fungi was known to infest maize ears preharvest. *Fusarium moniliforme* was the most common fungus grew on 52% of the kernels. *Aspergillus flavus* and *Aspergillus miger* were the two fungi commonly associated with preharvest maize and grow out from 19 and 36 % of the kernels, respectively and other fungi observed included Acremonium strictum (7%) Alternaria Alternata (5%), Trichoderma viride (3%) and *Rhizopus Sp* (2%). Diab *et al.* (1989) pointed out that the lateness of sowing date has greatly increased the maize ear rot disease. Moreover, Tolba (1991) found that the late sowing date (20 June) and the late sampling date (130 days after sowing) caused high rate of rot and reduced seed germination. He also added that *Fusarium moniliforme* predominated on/in the grains. Its frequency percentage tended to be high in all sowing and harvest dates and it infected the kernels before any other a gents of kernel or ear rots.

The objective of this study was to determined the infection percentage for several ear and kernel rot diseases in maize under two plant densities at different harvesting dates and their affecting on yield performances and other attributes.

MATERIALS AND METHODS

The experiments were carried out at Sakha Agricultural Research Station in 1999 and 2000 Seasons under natural infection to determine the reaction of Six maize cultivars i.e. S.C. 107, S.C. 120, S.C. 122, S.C. Bashaier-13, Giza-2 and Bush for ear and kernels rot disease under two plant densies. The experiment arranged in split split plot design with four replications. The main plot was the six maize cultivars. The sub plot was accopied with he two plant densities of 20,000 and 30,000 plants/fed i.e. 25 and 17.5 cm between hills, respectively. Three harvesting dates was designed in sub-sub plot i.e. 105, 120 and 135 days. The plot size was four rows, 6 m long, 70 cm apart (16.8 m^2). All the cultural practices were applied at the proper time and as recommended. The samples (20 ears/cultivar) were taken at random from each plot after 105, 120 and 135 days. These samples were subjected to determine the involved fungi by using PDA media. Microscopic examination was performed to confirm the indensity of the existing fungi. At harvest (120 days after planting), ear length, ear diameter, number of kernels/row, number of row/ear and grain yield (ard/fed) were recorded.

Data of the two Seasons were subjected to the proper statistical analysis as the technique of analysis of variance of split plot design as mentioned by Gomez and Gomze (1984). Treatments means were compared using least significant differences at S% of probability. Combined analysis of both Seasons was done using the procedures outlined of MSTATC by Freynd and Littell (1981).

RESULTS AND DISCUSSION

Data presented in Table (1) showed that significant were observed between the two densities in all studied characters. Since, ear length, ear diameter, number of rows/ear and number of kernels/row were high in case of low density (20,000 plants/Fed), the reverse was true as for as infection by tested fungi, it was high in case of high density (30,000 plants/fed). Mean squares for years, density, harvest date; variety and interaction between them are given in Table (1). Mean squares for years were significant for all studied characters except infection percent by *F. m*oniliform*e, Penicillium sp, A. fungi* and other fungi. Also, the mean squares for densities were significant for all studied traits. It is related to relative humidity, which were high in case of high plant density (30,000 plants/fed), this climatic condition around the plants with high density were suitable and case the infection of ear and kernel rot organism. On the other hand, the mean square for harvest date were also significant in Table (1) for all traits with exception of few cases, this also may be due to the moisture contents in maize grain during harvest date, the humidity content was high in grain during early harvest (105 days after sowing), and was suitable for infection by *F. moniliforme* (parasite fungus), while, the late harvest (135 days after sowing) was suitable for infection by *Penicillium sp., A. niger* and *A. flavus* (saprophyt fungi). Data herein a greed with what obtained by King (1981), Payne *et al.* (1988) and Tolba (1991). Varieties mean squares were significant due to the responsibility of the divergent genotypes to the infection by fungi.

The results in Table (2) indicated that the single crosses 107 and 122 have less infection percentage by fungi comparing with other genotypes, while, the single cross Bashaier-13 as well as open pollinated varieties Giza-2 and Bush had high percent of infection by the fungi. On the other hand, ear length and diameter, number of rows/ear and number of kernels/row were high in the two single crosses, the reverse was true in case of open pollinated varieties i.e. Giza-2 and Bush. These results were agreed with those reported by Camtone *et al.* (1983).

As for harvest date, data presented in Table (3) revealed that *F. moniliforme* predominated on/in the grains. Its frequency percentage tended to be high in all tested harvest dates and it infected the kernels before any other a gents of kernel or ear rots, i.e. *Penicillium sp., A. niger*and *A. flavus,* the later pathogens infected the kernels at late harvest date (135 days after sowing). Such results agree with those reported by Tolba (1991).

1

2,3

REFFERENCES

Camtone, F.A.; J. Tuite; L.F. Bauman and R. Stroshine (1983). Genotypic differences in reaction of stored corn kernels to attacg by selected *Aspergillus* and *Penicillium spp*. Phytopathology, 73: 1250-1255.

Diab, M.M.; M.A Awad; S.Younis; and S.A. Mohamed (1989). Factors affecting grain rot of maize. Munifiya, J. Agric. Res., 14(2): 1440-1452.

Freynd, R.J. and R.C. Little (1981). SAS for Linear nodels. SAS Institute Inc. Cary. N.C.

Gamal El-Din, L.F.; K.G.M. Ahmed; R.M.M. Mahdy and E.E. Mervat Abdel-Wahab (1987). Studies on some fungi causing deterioration of maize grains during storage. Proc. 5 th Cong. Phytopath. Soc., Giza.

Gomze, K.A. and A.A. Gomze (1984). Statistical Procedures for Agricultural Research 2nd Ed. pp. 680, John Willey and Sons. Inc. New York.

King, S.B (1981). Time of infection of maize kernels by *Fusarium moniliforme* and *Cephalosporium acremonium*. Phytopathology, 71: 810-816.

Payne, G.A.; D.L. Thompson; I.B. Lallchor; M.S. Zuber and C.R. Adkins (1988). Effect of temperature on the preharvest infection of maize kernels by *A. flavus.* Phytopathology, 78: 1376-1379.

Singh, D.P., V.K.; Agarwall and R.K. Khetarpal (1988). Etiology and host-pathogen relationship of grain mold of sorghum. Indiana Phytopathology, 41(3): 389-397.

Tolba, S.A.E. (1991). Studies on some rot disease of *Zea mays* in Egypt. M. Sc. Thesis, Fac. Agric. Tanta Univ., Egypt.

Wicklow, D.T. (1988). Patterns of fungal association within maize kernels harvested in North Carolina. MPlant Disease, 72: 113-115.

تأثير الكثافة النباتية وميعاد الحصاد على اعفان الحبوب والكيزان فى الذرة الشامية

عصام عبد الفتاح عامر* - عباس عبد الحى الشناوى* – صبحى عبد العزيز طلبة – عاصم عبده مطاوع***

*** معهد المحاصيل الحقلية – مركز البحوث الزراعية**

**** معهد أمراض النبات – محطة البحوث الزراعية بسخا**

أثر التركيب الوراثي للذرة الشامية على الاستجابة لاعفان الحبوب والكيزان ودراستها تحت العدوى الطبيعية لكثافتين نباتيتين ومواعيد الحصاد المختلفة بمحطة البحوث الزراعية بسخا. وتم تنفيذ التجربة فى تصميم القطع المنشقة مرتين فى أربع مكررات خلال الموسمين الصيفيين ١٩٩٩ و ٢٠٠٠ ويمكن تلخيص النتائج المتحصل عليها كما يلى :

١ - أوضحت النتائج بان اقل عدوى باعفان الحبوب والكيزان كانت للهجينين الفرديين ١٠٧ ,١٢٢ تحت الكثافة النباتية المنخفضة ٢٠,٠٠٠ نبات/فدان وكان الهجين الفردي ١٢٠ وبشاير-١٣ متوسطة للإصابة باعفان الحبوب وكان الصنف جيزة-٢ وبوش أعلى إصابة باعفان الحبوب والكيزان تحت الكثافة النباتية العالية والمنخفضة.

٢ – أشارت النتائج أن الفطر *Fusarium moniliforme* هو السائد في أو على الحبوب وكان هو الأكثر تواجدا مع جميع مواعيد الحصاد وعلى الجانب الأخر *Penicillium sp., Aspergillus flavus*, Aspergillus miger كانت تظهر فقط في المواعيد المتأخرة من الحصاد (١٣٥ يوم من الزراعة).

٣ - زيادة الكثافة النباتية من ٢٠,٠٠٠ إلى ٣٠,٠٠٠ نبات/فدان تحدث زيادة معنوية فى الإصابة باعفان الحبوب والكيزان.

٤ - يتناقص طول الكوز وعدد الحبوب بالسطر وعدد السطور بالكوز بزيادة الكثافة النباتية حتى ٣٠,٠٠٠ نبات/فدان.

٥ - الكثافة النباتية ٢٠,٠٠٠ نبات/فدان كانت اقل عرضة لأعفان الحبوب وكذلك كانت الأعلى فمحصول الحبوب.

Table (1). Combined analysis for eleven traits over all two years 1999 and 2000.

S.O.V	D.F	Monsiture	Ear lengtth	No. of kernels/row	No. of rows/ear	Ear diameter	Fsarium moni.	Pencilliu m sp%	A. niger %	A. flavus %	Other fungi %	Grain yield (ard/fed)
Years (Y)	1	85.26**	149.789**	393.869**	15.171*	0.361*	3.936	0.001	11.576	298.270**	0.165	3314.40**
Error	6	5.710	2.837	23.425	1.567	0.051	37.047	1.520	2.691	3.160	1.774	31.73*
Density (D)	1	1.758	681.728**	2244.5**	5.147**	4.651**	14431.16**	128.561**	155.379**	49.162**	64.885**	64.30*
YD	1	0.043	2.513	0.001	0.004	0.009	65.104	0.453	0.941	0.282	2.513	16.26
Error	6	1.868	1.227	7.737	0.253	0.034	13.750	0.531	0.827	0.755	2.641**	5.19
Harvest date (h)	2	2056.681**	34.524**	9.977	0.841	0.626*	87.626*	2281.040**	2190.848**	934.755**	25.938	45.44**
YH	2	235.609**	26.074**	51.802	1.643*	0.353*	133.206**	49.217**	24.331**	237.664**	2.101	162.35**
DH	2	4.936	7.146	5.932	0.009	0.011	79.101*	14.071**	15.598*	6.732*	2.129	14.05
YDH	2	2.753	51.255**	130.502*	1.845	0.393*	24.706	0.696	2.400	1.155	1.170	10.35
Error	24	4.470	3.575	28.750	0.404	0.076	16.163	2.741	2.951	1.418	1.877	5.18
Variety (V)	5	188.210**	201.710**	1026.954**	47.228**	6.267**	5922.886**	322.312**	236.199**	114.588**	40.935**	2341.56**
YV	5	24.752**	5.362*	25.028*	0.298	0.214*	56.648**	25.550**	27.787**	22.574**	1.298	135.23**
DV	5	1.730	3.079	16.865	0.617	0.226**	27.371	3.652	1.302	2.724*	0.629	10.02
YDV	5	3.579	2.357	5.527	0.549	0.079	16.531	2.278	1.675	1.619	0.645	11.82
HV	10	18.795**	3.345	24.587**	0.538	0.138**	37.894*	43.826**	39.712**	24.733**	6.119**	53.14**
YHV	10	13.938**	3.532	18.939*	0.348	0.050	34.607*	18.132**	15.323**	15.304**	3.076**	48.65**
DHV	10	3.872	3.836	3.835	0.471	0.065	15.146	5.037**	3.605*	2.247	2.114	5.55
YDHV	10	1.151	3.242	14.266	0.565	0.056	20.561	0.951	2.096	1.547	1.944	6.68
Error	180	4.075	2.050	10.687	0.524	0.047	16.560	1.790	1.712	1.163	1.254	9.03

Table (2). Mean combined of both Seasons of six maize varieties for eleven traits.

Factors		Monsiture	Ear length	No. of kernels/row	No. of rows/ear	Ear diameter	Fusarium moni.	Pencillium sp%	A. niger %	A. flavus %	Other fungi %	Grain yield (Ard/Fed)
variety	S.C. 107	27.79	19.44	39.40	13.19	4.55	20.51	1.36	1.74	1.13	1.59	22.31
	S.C. 120	26.31	20.77	43.25	13.37	4.80	28.31	5.28	5.52	3.70	2.87	28.77
	S.C. 122	25.94	20.19	45.06	13.63	4.85	24.55	3.13	2.99	1.79	2.41	31.40
	Bashaier-13	28.15	21.20	44.89	12.63	4.99	41.62	6.92	6.48	4.71	3.50	30.11
	Giza – 2	26.56	19.17	37.02	13.77	5.05	40.94	7.12	6.47	4.39	3.79	19.93
	Boch	22.58	15.50	33.72	15.54	5.62	48.39	8.02	7.31	4.58	4.02	13.00
	L.S.D. 0.05	0.80	0.6	1.3	0.3	0.08	1.62	0.53	0.52	0.43	0.44	1.20

Table (3). Means of eleven traits with years, densities and harvest dates.

Factors		Moisture	Ear length	No. of kernels/row	No. of rows/ear	Ear diameter	Fsarium moni.	Pencillium sp%	A. niger %	A. flavus %	Other fungi %	Grain yield
Years	1999	26.76	18.66	39.39	13.46	4.94	34.17	5.30	5.29	4.40	3.05	20.94
	2000	25.68	20.10	41.73	13.92	5.01	33.94	5.31	4.89	2.36	3.00	27.73
	F - test	**	**	**	*	*	N.S.	N.S.	N.S.	**	N.S.	**
Density	20,000	26.14	20.92	43.35	13.82	5.10	26.97	4.64	4.35	2.97	2.55	23.86
	30,000	26.30	17.84	37.76	13.55	4.85	41.13	5.97	5.82	3.79	3.50	24.81
	F - test	N.S.	**	**	**	**	**	**	**	**	**	*
Harvest days	105 days	31.34	19.97	40.37	13.62	5.05	32.95	1.04	0.79	0.31	2.43	24.83
	120 days	24.98	19.40	40.37	13.79	4.99	34.55	4.27	4.24	3.29	3.39	23.55
	135 days	22.34	18.77	40.93	13.65	4.89	34.66	10.62	10.23	6.55	3.26	24.63
	F – test	**	**	N.S.	N.S.	**	*	**	**	**	N.S.	**