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Full Length Research Paper

Comparative evaluation of vertebrate pest damage on some newly developed quality protein maize (QPM) varieties in south-western Nigeria

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Six newly developed Quality Protein Maize (QPM) varieties were subjected to natural vertebrate pest infestation in Ibadan South-Western Nigeria. Data taken were statistically analyzed while probably level was set at p<0.05. Results of the experiment revealed that ILE-1-OB maize variety with the mean yield of 1.3 t/ha recorded the highest rodent damage of 2.77% while ART 98 SW4-OB with 0.74 t/ha recorded a bird damage of 10.73%. OBATAMPA which was the second highest yielding (1.19 t/ha) also recorded the highest bird pest damage of 26.03%. Variety TZPB-OB with mean yield of 1.18t/ha recorded the lowest damage of 5.92%. Maize varieties ART98SW5-OB and ART98SW6-OB with means yield of 0.85 and 0.98 t/ha recorded 17.2 and 10.3% bird damages respectively. Effects of rodent and bird pests were not significantly different from one variety and another among the identified 6QPM lines. Replicate was however significantly different (P < 0.05, 0.01) from one another for bird pest damage. Similarly, the effect of bird and rodent pests was not significantly different on seed and grain yield. The percentage damage were generally more from birds harvoc that from rodents. The vertebrate pests found associated with QPM include bird species such as *Francolinus bicalcaratus* (bush fowl), *Ploceus cucullatus* (weaver birds) and *Lonchura spp* (Bronze marikins), while the rodents include species such as *Xerus enrythropus* (Red legged ground Squirrel), *Mastomys natalensis* (Multimammate rat), *Arvicanthis niloticus* (Nile harsh-furred Rat) *Rattus rattus* (Black grey Rat) and *Mus spp* (Pigmy Mice). Successful QPM production in this region will therefore require effective bird pest control.

Key words: Quality protein maize, vertebrate pest damage, and grain yield.

INTRODUCTION

Maize **(***Zea mays L.***)** damage by vertebrate pests (birds and rodents) is on the increase as agriculture becomes more intensified in Nigeria; due to large hecterage production and utilization potential of maize in the country (Olakojo, 2001). This situation is probably most serious in the tropics (Fiedler, 1994; Bekele and Leir, 1997) as more and more land becomes cultivated in an attempt to provide food for the ever increasing human population. In recent years findings from various studies have revealed that bird and rodent pests appear to be the most serious pest of maize with some peculiar characteristics (Singleton et al., 1999; Olakojo, 2001, Fayenuwo and Akande, 2002; Mwanjabe et al., 2002). Although rodents have been identified as the most important mammalian agricultural pests at the global level (Cuong et al., 2002), birds also damage and/or destroy many crops prior harvesting and the latter are a major pest for grain stored after harvesting. Rodent damage is a serious impediment for agriculture. Its effects in agriculture are also complex because almost all crops are the target of rodent attack (Taylor, 1972; Fiedler, 1988; Singleton, 1999). They are responsible for substantial damage to food and cash crops and play an important role as reservoirs and carriers of zoonotic diseases in Africa. Survey reports in Tanzania, from empirical data have shown that on the average, rodents caused about 15% loss of maize crop annually (Makundi et al., 1991). However in recent years birds as pests in agriculture are attracting more attention

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in developed and developing countries alike. Dramatic rodent out breaks have been reported in many countries where intensive and extensive cultivation of agricultural crops are major activities (Singleton and Redhead, 1990). Such outbreaks are common particularly in cereals such as maize, rice and guinea corn. The resultant effect of this damage is serious losses and widespread of the rodent as well as food shortages (Walker, 1990; Fayenuwo et al., 2000; Amusat et al., 2005). Damage ranges from negligible destruction to total crop loss have been experienced in major maize producing belt of Africa.

Birds and rodents are recognized pests in many agricultural systems and there is need for their control. Earlier reports (Taylor, 1968) on economic losses due to rodents in Kenya indicated 20–30% damage to maize crops, and a 34 - 100% loss during rodent outbreaks. Here in Nigeria, damage to improved maize varieties by these vertebrate pests constitutes a major problem to production reducing quantity and quality of maize. It is therefore necessary to identify the particular pestiferous species, pattern of damages and evaluate their damages on the newly developed Quality Protein Maize varieties (QPM) in order to determine the effect on yield and cost of production in the selected area of maize producing belt. This will enhance the determination of the most effective control measures. The objectives of this investigation were to: evaluate the incidence of bird and rodent pests' damages on QPM. 2. To examine possible factors that might be responsible for the incidence of selective damage and possibly recommend effective control method(s).

MATERIALS AND METHOD

Six Quality Protein Maize (QPM) varieties including a check were selected for evaluation for vertebrate (birds and rodents) pest damage. They included TZPB-OB, ART-98-SW4-OB, ART-98-SW5-OB, ART-98-SW6-OB, ILE-1-OB and OBATAMPA. Each maize variety was planted at a spacing of 75 x 50 cm with two seeds per hole in four-raw plats of 5 x 3 m. The design was randomized complete block (RCBD), replicated three times during the year 2004 cropping season at Moor Plantation Ibadan Nigeria. Moor Plantation is highly endemic with the incidence of vertebrate pest damage.

The trial plots were all exposed to naturally occurring population of bird and rodent pest activities. Actual counts of plants damaged or attacked and most fed upon by the pests were carried out. Trials were kept under strict daily observations of bird and rodent pests activities from planting to harvesting. On the spot field observation of the vertebrate pests vis-à-vis the damaged plant parts, chopped plant parts, pattern of damage, faecal pellets, foot prints and characteristic runways aided the identification of the culprits. Record of their damages and effect of the damage on yield were obtained. Pest damage was measured as the percentage of the total number of seed/seeding, plant parts, cobs/ears killed, disturbed or fed upon by these categories of pests. The data were pooled and statistically computed for analysis of variance (ANOVA) at $p < 0.05$ using SAS 2001 software package 8.0 model.

RESULTS AND DISCUSSION

Ground squirrel (*Xerus erythropus*), smaller rodents: multimammate rat (*Mastomys natalensis*) and nile harsh-furred rat (*Articanthis niloticus*), bush fowl (*Francolinus bicalcaratus*) dug and ate freshly-sown seeds and germinating seedings of QPM. The damaged seedlings caused serious missing stands on the field. This in certain cases may force the farmer to supply the missing stands which invariably resulted in unequal growth of plants, different cob maturation times and harvesting periods as earlier reported by Funmilayo (1973) and Fayenuwo (1999). From cob formation stage to harvesting period the maize varieties were damaged by vertebrate pests including: weaver birds (*Ploceus cucullatus*) and bronze manikin (*Lonchura spp*), ground squirrel, nile harsh-furred rat, black grey rat (*Rattus rattus*), pigmy mice *(Mus spp.).*

Most of the damages caused by vertebrate pests on QPM reflected their feeding habits. All parts of the plant were damaged by vertebrate pests but the parts that were frequently damaged were the stems, cobs and seeds. These indicated that the pests possessed sharp teeth or beak for cutting, tearing or breaking the plant parts. Seeds which were newly planted were dug up and eaten. When feeding on the maize cobs on plants, the weaver birds used their short hard beaks to shred the husk at the top exposing some grains which they pecked. Alternatively, at other times, the husk was left undisturbed but the beak was inserted under it from the top in order to peck the grain. This invariably allows growth of fungal pathogen that may bring about complex diseases of maize. The damage by weaver birds diminished as the cobs matured and the grains hardened up. This was because the birds were unable to crack the dry maize grains.

The species of rodents that dug up and ate planted seeds also ate the seeds from upright, leaning and dislodged plants. The stems of the QPM provided supports for climbing; thus they were easier targets for destruction by some small rats and squirrels. The manner in which the QPM cob was eaten usually revealed the culprit responsible for the damage. As examples: the nile harsh-furred rat (*A. niloticus*) and multimammate rat (*M. natalensis*) climbed upright and leaning maize stems and clean-cut the maize husks in order to eat the grains. The squirrel tore the husk to shreds very profusely from top to base. The small rats and mice ate grains from cobs of the QPM plants which became dislodged or prostrate. Damages on QPM which occurred at planting, seedling and maize ear development stages often lead to opening up of the cobs to pathogen for further damage or reduction in seed quality.

The highest mean yield of 1.377t/ha was recorded for ILE-1-OB maize variety while ART 98 SW4-OB recorded the lowest mean yield of 0.740 t/ha (Table 1). Maize variety OBATAMPA recorded the highest bird damage of 26.033% while the lowest bird damage of 5.923% was recorded for TZPB-OB maize variety. From Table1, ILE-1-OB maize variety with highest mean yield recorded the highest rodent damage percentage of 2.767% follow by

Table 1. Character Means of QPM varieties evaluated for rodent / bird pest reaction.

Variety	Plant Stand	Plant harvest	Ear harvest	% Rodent damage	% Bird damage	Seed yield (Kg/plot)	Yield (t/ha)
ZPB-OB	19.333	10.667	9.00	0.000	5.923	0.500	1.117
ART98SW4-OB	17.333	7.667	7.667	0.000	10.730	0.383	0.740
ART98SW5-OB	20.667	11.000	11.000	0.000	17.200	0.383	0.850
ART98SW6-OB	21.000	11.000	11.000	0.000	10.307	0443	0.980
ILE-1-OB	21.000	14.333	14.333	2.767	12.867	0.603	1.377
OBATAMPA (Check)	19.333	11.667	11.667	1.100	26.033	0.537	1.190
Mean	19.778	11.056	10.778	0.644	13.843	0.475	1.042
CV (%)	26.67	44.64	51.54	303.42	80.35	41.52	43.27
LSD (0.05)	6.785	6.349	7.146	2.515	14.309	0.254	0.580

Table 2. Mean Square (MS) for maize agronomic characters assessed for rodent/bird pests reaction.

	Mean Square (MS)							
	Df	Plant Stand	Plant harvest	Ear harvest	%Rodent damage	%Bird damage	Seed yield (Kg/plot)	Yield (t/ha)
Replicate	2	16.22	27.55	16.72	7.47	696.18**	0.05	0.22
Variety	5	6.08	13.65	15.82	3.82	147.44	0.02	0.16
Error	10	27.82	24.35	30.85	3.82	123.73	0.04	0.62
Total	17							

*, ** Significant at P < 0.05, 0.01 respectively

OBATAMPA with 1.100%, while the remaining four maize varieties recorded zero percentage (0.00%) rodent damage. The percentage damage was generally more from birds harvoc than from rodents (Table 1). Effects of rodent and bird pests were not significantly different from one variety and another among the 6 QPM lines. Replicate was however significantly (F < 0.05, 0.01) different from one another for bird pest damage, probably because of border effect (Table 2). Similarly, the effect of bird and rodent pests was not significantly different on seed and grain yield (Table 2). Funmilayo (1973), Fayenuwo et al. (1999; 2000; 2002; 2005), Olakojo (2001) and Amusa et al., (2005) had earlier reported the activities of bird and rodent pests on maize in South-western Nigeria. Birds and rodents (vertebrate pests) have been reported by Fayenuwo and others to cause total crop failure in cases where the planted seeds were all dug from ground, while damages resulting from birds and rodent damage in some maize farms in humid forest of south-western Nigeria has been reported to have varied between 20 and 60% (Amusa, 2005).

Integrated Pest Management (IPM) has been described as:- the natural control of pests, for example the use of natural enemies; planting of pest resistant / tolerant varieties, selecting maize for desirable characters such as good plant stand, plant height and ear height, as suggested by Olakojo (2001) so as to reduce the vulnerability of maize to pest attack; adapting cultural management and use of trap among others to catch those that can be reared domestically and reduce their population in the wild.

Such Integrated Pest Management should however be ecologically since some vertebrate pests such as bush fowls get used to the control devices after a while.

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