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Research Article

Screening of early hybrids for resistance to striga hermonthica (del.) benth in maize

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Striga spp. are most parasitic weeds affecting maize productivity in Benin. This study aims to assess the agronomic performance of improved varieties with combined resistance and tolerance to Striga hermonthica in endemic area in Benin. Six maize hybrid genotypes developed for Striga resistance at IITA Ibadan and three open pollinated varieties as checks used by farmers in Benin, have been evaluated under Striga and non-Striga conditions. The trials were conducted in a criss cross randomized complete block design (RCBD) with three replications during in two locations during 2018 and 2019 growing seasons. Data were collected on grain yield, its principal components, and Striga adaptive traits and subjected to analysis of variance at α 0.05. The grain yield across the locations under Striga and non-Striga infestation ranged between 3.17 and 4.54 t/ha for hybrids and between 1.38 and 3.29 t/ha for the local varieties used as checks. The grain yield under Striga infestation ranged between 1.07 (DMR ESR-W) and 4.11t/ha (TzdEI 173 x TzdEI 492) at Angaradébou and between 1.04 (TZE COMP3 DTC) and 4.66t/ha (TzdEI 352 x TzdEI 355) at Komkoma. Under non Striga infestation, TZE COMP3 DTC had the lowest yield of 2.70 t/ha as well as at Komkoma (2.72 t/ha), and TzdEI 352 x TzdEI 355 had the highest grain yield of 4.94 t/ha at Angaradébou and genotype TzdEI 173 x TzdEI 280 had the highest grain yield of 4.53t/ha. The high yielding and more stable genotype was TzdEI 352 x TzdEI 355 across the environments, and could be integrated in framers' maize crop systems in northern of Benin.

Keywords: Zea mays L, hybrids, *Striga hermonthica*, maize crop systems, benin

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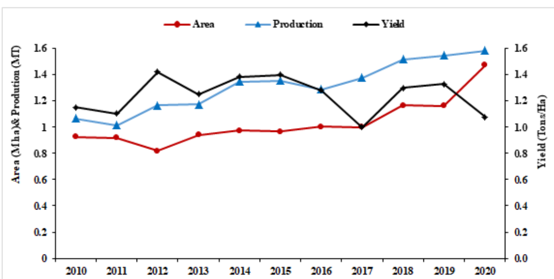
INTRODUCTION

Maize (Zea mays L.) is one of the most important crop that contributes significantly to food security in most SSA countries. In this region, it is the only cereal crop with remarkable potential production and high yield compared to other cereals; and constitute a source of income. In Benin, the average level of maize consumption is estimated at more than 85 kg/inhabitant/year placing the country in first place among maize consuming countries in West Africa. More than 85% of the Beninese population uses maize in its various forms, depending on the regions and food habits of the socio-cultural groups. In addition to being the staple food for the vast majority of Benin's population, maize is traded both within the country and to sub-regional markets. Since 2010, the national production has increased from 1 065 329 tons to 1 580 750 tons (MAEP, 2021). This strong increase in production is associated with the large increase in the area under maize production (59%), rather maize yields (Figure 1).

Figure 1. Maize agricultural statistics in Benin from 2010 to 2020.



The low productivity of maize in several maize-growing countries, compared to global average of nearly 5 tons ha-1, is attributed to various socioeconomic, abiotic, and biotic constraints. Among the biotic constraints, Striga hermonthica is one of the important factors limiting maize production in Benin. In addition, there is the use of "local ecotypes" that have low productivity and very susceptible to the effects of climate change.

S. hermonthica is a root hemiparasitic plant that invades its host and extracts water and essential nutrients from it. Consequently, the host becomes stunted, wilted, chlorotic, poor yielded, and in severe case, dead. In Benin, particularly in northern part, grain yield losses due to S. hermonthica range from 60 to 90% in maize genotypes. In severe cases and unfavorable environmental conditions such as low soil fertility, erratic rainfall patterns and low-input conditions, the grain yield losses can be as high as 100% for susceptible maize cultivars. Presently, integrated Striga management involving a combination of two control methods, is considered as one of the best strategies to control Striga. However, the use of host plant resistance

is the most affordable and environmentally viable for resource-constrained farmers.

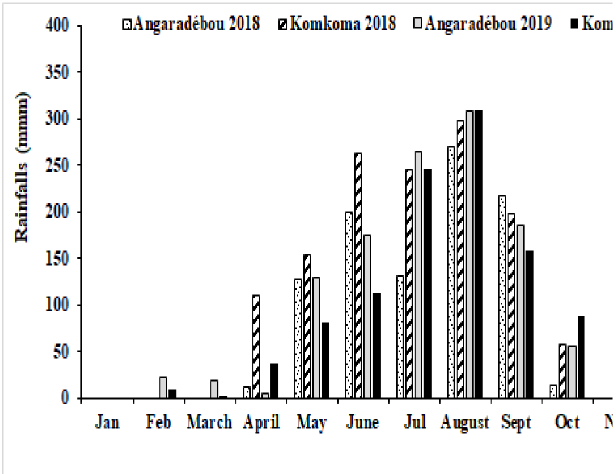
Given the importance of maize in Benin and with the emerging seed companies, there is urgent need to have high yielding and multiple stress tolerant/resistant genotypes such as hybrids. The use of Striga resistant or tolerant hybrids will boost maize production and productivity therefore, improve farmers' income and livelihoods as well as the sustainability of their businesses. Efforts have been deployed at the International Institute of Tropical Agriculture (IITA), to develop maize hybrids, that combine both drought tolerance and Striga resistance/tolerance in collaboration with National Agricultural Research Systems (NARS) in SSA countries, including Benin National Maize Programme. These new materials need to be evaluated for adaptation and maize yield improvement under environmental stress. Keeping in view the grain yield losses due to Striga and the role of hybrids in addressing this problem, the current study was conducted to identify some hybrids with greater genetic potential in boosting maize production and productivity in Striga infested environments in Benin. Therefore, the objectives of this study have been to (i) assess the performance of six best hybrids selected for Striga resistance and agronomic traits (ii) identify higher performers hybrids for dissemination. The hypothesis tested in the study is that there is different reaction pattern to S. hermonthica among maize hybrids.

MATERIALS AND METHODS

The experiments have been conducted at Angaradébou (11° 20' N, 2° 43' E, 256 m above sea level) and Komkoma (09° 21’N, 2° 36’E, 350 m). These sites are located in Sudan and Sudan-Guinean zones of Benin, respectively. The mean monthly rainfalls at the two locations during 2018 and 2019 cropping seasons are presented in Figure 2.

Study sites

Figure 2. Monthly rainfalls for two growing years (2018 and 2019) at Angaradébou and Komkoma.



Plant materials

This study used six early maturing (90-95 days) hybrids combining multiple stress tolerance (Drought, Soil low nitrogen, Striga resistance, and others pests), and three commercial opened pollinated maize varieties (OPV) (Table 1). The hybrids were developed by the Maize Improvement Program (MIP) at the International Institute of Tropical Agriculture (IITA).

Table 2. List of varieties evaluated under Striga and non-Striga infestation at Komkoma (Parakou) and Angaradébou (Kandi) during the two growing seasons (2018 and 2019).

Genotypes	Annotations	Source	Type	Response to *Striga hermonthica*
TzdEI 173 x TzdEI 280	V1	MIP/IITA	Hybrid	Unknown
TzdEI 173 x TzdEI 492	V2	MIP/IITA	Hybrid	Unknown
TzdEI 100 x TzdEI352	V3	MIP/IITA	Hybrid	Unknown
TzdEI 173 x TzdEI 352	V4	MIP/IITA	Hybrid	Unknown
TzdEI 296 x TzdEI 352	V5	MIP/IITA	Hybrid	Unknown
TzdEI 352 x TzdEI 355	V6	MIP/IITA	Hybrid	Unknown
TZE-W pop STR	V7	INRAB	Open pollinated	Resistant
DMR ESR-W	V8	INRAB	Open pollinated	Susceptible
TZE COMP3 DTC	V9	INRAB	Open pollinated	Tolerant

Experimental design and field infestation with S. hermonthica

The hybrids have been evaluated in RBC design with three replicates. Each genotype was planted in infested and uninfected adjacent bands, which was 1.5 m apart, using a criss-cross arrangement described by Pearce (1976). On each strip, each genotype has been planted on a row of 5 m length with 0.80 m inter-row spacing and 0.40 m intra-row spacing. For each genotype, the infested row has been planted directly to the non-infested row in adjacent bands to accurately assess yield losses due to *S. hermonthica* damage.

The field has been treated with ethylene gas two weeks before planting to remove *S. hermonthica* seeds from the soil through suicidal germination. *S. hermonthica* seeds used for artificial infestation were collected from farmers' sorghum fields in the previous planting years. Two maize seeds have been planted in a 6 cm deep hole injected with 8.5 g of sand mixed with Striga seeds. The mixture contained approximately 3,000 germinable striga seeds. Two weeks after planting, all maize plants have been thinned to two plant per hill to attain a population density of 62,500 plants ha^{-1}. Fertilizer has been applied to planting at the rate of 30 kg/ha of

nitrogen, 60 kg. ha^{-1} each of phosphorus and potassium, and an additional 30 kg. ha^{-1} nitrogen has been applied four weeks later as top-dressing fertilizer. Weeds other than Striga have been removed from plots manually throughout the planting season.
Rainfall data were recorded per day during the experimentation. Soil samples were collected at 0 to 30 cm depth at the two locations and analysed in the laboratory for physical and chemical properties.

Field data collection

Data were collected on the number of maize plants per plot two weeks after emergence (survival); days to 50% anthesis and silking. Also, number of emerged Striga was taken at 8 (STRCO1) and 10 (STRCO2) weeks after planting (WAP) in the Striga–infested plots considering the whole plot; Striga damage; Striga damage syndrome rating at 8 (STRRAT1) and 10 (STRRAT2) Week After Planting (WAP) were scored per plot on a scale of 1-9 with 1= no damage and 9= complete collapse plant. Plant height was measured as distance from the base of the plant to the node bearing the flag leaf and ear height measured as distance from the base of the plant to the height of the node nearing the topmost or only ear. The number of ears per plant (EPP) was calculated as the total number of ears at harvest divided by total number of plants at harvest in a plot, plant aspect (PASP) was recorded on a scale of 1 to 5; were 1= excellent plant type and 5= poor plant type, and ear aspect (EASP) was recorded on a scale of 1 to 5; were 1= clean, uniform, large and well filled ears and 5= ears with undesirable features. At harvest, the cobs in each plot were collected, shelled and the grain weight was measured and used to calculate grain yield (YIELD, t/ha) adjusted to 12% moisture content.

Data analysis

The data recorded on ear aspect, plant aspect, emerged Striga counts and Striga damage severity scores have been subjected to logarithm transformation. Data collected on grain yield, ears per plant, Striga damage as well as Striga emergence counts have been tested for normality using Shapiro-Wilk's (W) test before running the analysis of variance (ANOVA). ANOVA has been conducted across research environments using the General Linear Model Procedure (PROC GLM) implemented in the Statistical Analytical System (SAS), version 9.4. The statistical model used for combined analysis is as follows:
$Yijg = \mu + Ei + Rj(i) + Gg + EGig + \varepsilon ijg$, where Yijg is the observed measurement for the gth genotype grown in the environment i, in replicate j; μ is the grand mean; Ei is the main effect of test environments (2 years x 2 localities); Rj(i) is the effect of replicate nested within environment; Gg is the effect of genotypes (hybrids and OPV); EGig is the interaction effect between genotype and environment, and εijkg the error term.
In order to identify outstanding hybrids in terms of high grain and stability under Striga infestation and Striga-free environments, yield across replications were analyzed using the genotype main effect plus genotype × environment interaction (GGE) biplot statistical tool to partition significant hybrid × environment interaction.

RESULTS

Soil chemical and physical properties of the sites

Results of chemical properties and particle size distributions are presented on Table 1. It was noticed that both of soil used at Komkoma (Parakou) and at Angaradébou (Kandi) are poor.

Table 2. Chemical properties and particle size distribution of soil used for evaluation of Striga resistant varieties at Komkoma and Angaradébou, Benin Republic in 2018 and 2019.

Elements	Critical values	Komkoma		Angaradébou	
		Value	interpretation	Value	interpretation
pH (H_2O)	5.2- 8.5	5.43	Moderately acidic	4.53	Strongly acidic
pH (KCl)	5.2-8.5	4.81	Strongly acidic	4.08	Strongly acidic
OM (%)	<0.5	0.52	Low	1.08	Moderate
TN (%)	<0.03	0.03	Low	0.01	Very low
AVP (mg/kg)	<5	6.82	Low	4.62	Very low
Clay (%)		16.4		2.8	
Silt (%)		38.4	Loam	11.2	Loamy sand
Sand (%)		43.91		83.12	

Analysis of variance for grain yield and other measured traits

Results of ANOVA of 9 maize genotypes under Striga-infested showed that genotypes, environment, and genotype × environment effect (G×E) were significant for most of traits measured (Tables 3). Means square observed for environment were not significant for all the traits excepted days to 50% anthesis, days to 50% to silking and ears aspects. The coefficient of variation ranged from 1.94 (Days to 50% silking) to 64.62 (Number of emerged Striga plants at 8WAP), and from 2.41(Days to 50% silking) to 20.08 (Ears aspects) under Striga-infested and non-infested condition, respectively (Table 3).

Table 3: Striga-infested and non-infested condition.

Source	**DF**	**Yield (t/ha)**	**Ears per plant**	**Days to 50% anthesis**	**Days to 50% silking**	**Ear height (cm)**	**Ears aspect**	**Number of emerged Striga plants at 8WAP**	**Number of emerged Striga plants at 10WAP**	**Striga damage at 8WAP**	**Striga damage at 10WAP**
Under Striga											
Genotype (G)	8	4624591.27***	0.01086^{ns}	5.58***	4.12**	300.23***	2.55***	1451.45***	3391.17***	2.29***	6.27***
Environment (E)	3	10275.95^{ns}	0.01026^{ns}	16.67***	60.17***	562.60***	20.17***	16712.97***	81822.30***	24***	115.58***
Replication	2	1201414.57^{ns}	0.01177^{ns}	3.17^{ns}	2.74^{ns}	159.99**	0.18^{ns}	211.13^{ns}	435.5^{ns}	0.39^{ns}	0.96^{ns}
G*E	24	989741.71*	0.00787^{ns}	7.75***	3.29^{ns}	111.84**	0.26^{ns}	892.09***	2370.63***	0.88*	2.41***
Error	64	383027.48	0.0139	1.23	1.23	26.68	0.15	156.68	482.4	0.33	0.45
CV(%)		19.66	11.7381	2.04	1.97	6.74	17.65	64.62	52.85	19.89	18.45
Under non-Striga								Plant aspect			
Genotype (G)	8	2116332.39***	0.01469	10.03***	6.88^{ns}	89.32**	0.72***	1010.17***			
Environment (E)	3	869048.34^{ns}	0.05456^{ns}	9.80*	48.17**	5.14^{ns}	20.78***	21.96^{ns}			
Replication	2	1183281.62*	0.04151^{ns}	3.19^{ns}	4.57^{ns}	134.67^{ns}	0.12^{ns}	108.04^{ns}			
G*E	24	746167.14*	0.01679^{ns}	3.51^{ns}	6.17^{ns}	36.85^{ns}	0.25^{ns}	169.78*			
Error	64	266085.27	0.01867	1.73	4.03	48.21	0.16	71.94			

CV(%)		13.83	12.955 84	2.41	3.58	8.49	20.08	5.02			
*,**,*** respectively significant F-test at 0.05, 0.01 and 0.001 levels of probability; Ns= Not significant; DF = degrees of freedom; CV: Coefficient of Variation.											

Performance assessment of grain yield stability of maize

Presented in Table 4 are the grain yield and other agronomic characters of the 6 hybrids and 3 OPV at Angaradébou and Komkoma. Under Striga infestation at Komkoma, the lowest grain yield of 1.04 t/ha was recorded for variety TZE COMP3 DTC while the highest of 4.66 t/ha was recorded for genotype TzdEI 352 X TzdEI 355. In this location, the grain yield ranged between 2.72t/ha (TzdEI 173 x TzdEI 352) and 4.53t/ha (TzdEI 173 x TzdEI 492) under non Striga infestation (Table 6). Under Striga infestation at Angaradébou, the lowest grain yield of 1.07 t/ha was recorded for DMR ESR-W while the highest yield of 4.11t/ha was recorded for genotype TzdEI 173 X TzdEI 492. Under Striga free condition, grain yield ranged between 2.70t/ha (DMR ESR-W) and 4.94 t/ha (TzdEI 352 x TzdEI 355) at Angaradébou (Table 5). At Komkoma, TZE COMP3 DTC displayed higher number of emerged Striga plant per plot than others at 8 (100) and 10 (166.67) WAP (Table 4). Consequently, highest damage due to Striga infestation was recorded in the same variety at 8 while highest Striga damage were registered for DMR ESR-W a 10 WAP. At Angaradébou, highest number of Striga plant emergence was recorded in the plots for DMR ESR-W at 8 (27) and 10 (86 WAP) and highest Striga damages rating at 8 and 10 WAP (Table 4).

Table 4. Means for measured parameters of maize hybrid varieties evaluated under Striga infestation at Komkoma and Angaradébou in 2028 and 2019.

Genotype	Number of emerged Striga plants at 8WAP		Number of emerged Striga plants at 10WAP		Striga damage at 8WAP		Striga damage at 10WAP		Yield (t/ha)	
	Komkoma	Angaradébou	Komkoma	Angaradébou	Komkoma	Angaradébou	Komkoma	Angaradébou	Komkoma	Angaradébou
TzdEI 173 x TzdEI 280	18.33^{b}	6.10^{b}	39.33^{b}	14.00^{b}	3.00^{ab}	2.00^{bc}	3.67^{c}	2.33^{ab}	4.25^{ab}	2.45^{bc}
TzdEI 173 x TzdEI 492	13.00^{b}	3.33^{b}	65.00^{b}	2.33^{b}	3.33^{ab}	2.00^{bc}	5.00^{a-c}	1.83^{c}	3.53^{bc}	4.11^{a}
TzdEI 100 x TzdEI 352	26.33^{b}	7.67^{b}	53.00^{b}	6.66^{b}	2.67^{ab}	2.33^{b}	4.00^{bc}	2.67^{ab}	3.13^{c}	3.38^{ab}
TzdEI 173 x TzdEI 352	11.67^{b}	5.33^{b}	29.67^{b}	8.33^{b}	3.33^{ab}	1.67^{c}	4.67^{a-c}	1.33^{c}	3.46^{bc}	3.15^{ab}
TzdEI 296 x TzdEI 352	33.00^{b}	11.33^{b}	76.33^{ab}	8.33^{b}	3.67^{ab}	2.00^{bc}	5.33^{a-c}	1.33^{c}	2.57^{c}	3.40^{ab}

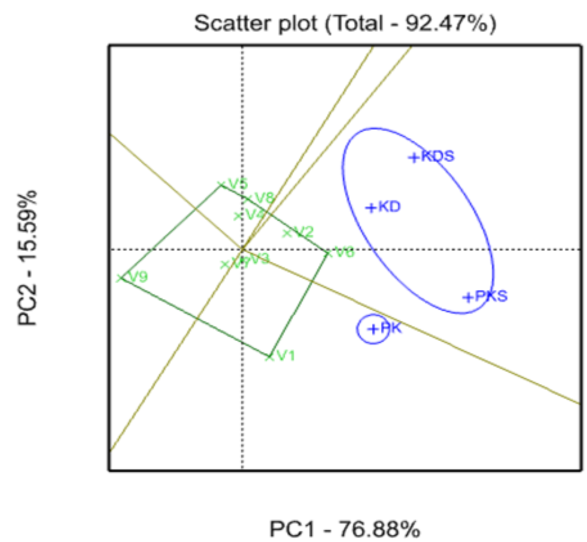
TzdEI 352 x TzdEI 355	36.33^{b}	7.67^{b}	68.33^{b}	4.66^{b}	2.33^{b}	2.00^{bc}	3.33^{c}	1.67^{bc}	4.66^{a}	4.09^{a}
TZE-Wpop STR	58.67^{ab}	21.67^{b}	103.00^{ab}	32.66^{b}	4.33^{a}	2.00^{bc}	6.67^{a}	2.33^{ab}	2.93^{c}	2.82^{ab}
DMR ESR-W	35.33^{b}	27.33^{b}	163.00^{ab}	86.33^{b}	4.67^{ab}	2.33^{b}	6.33^{ab}	3.50^{abc}	1.88^{c}	1.07^{ab}
TZE COMP 3 DTC	100.00^{a}	11.67^{a}	166.67^{a}	15.33^{a}	4.67^{a}	3.67^{a}	4.00^{a}	3.67^{a}	1.04^{d}	1.54^{c}
SE±	26.11	7.58	47.14	24.97	0.8	0.54	1.09	0.81	1.05	0.99
Mean	36.96	11.34	84.92	19.84	3.55	2.22	4.77	2.29	3.05	2.89
Means in the same column followed by the same letters are not significantly different at $p < 0.05$										

Grain yield reduction among maize varieties due to Striga hermonthica infestation

Grain yield under Striga-infested and non-infested environments and percentage yield reduction are presented in Table 5. Overall, hybrids performed better than the checks (OPVs) and reacted better to Striga. The best genotype in terms of grain yield under infestation was TzdEI 352 X TzdEI 355 at Komkoma and TzdEI 173 X TzdEI 492 at Angaradébou. Under non Striga infestation, genotype TzdEI 173 X TzdEI 280 had the highest grain yield at Komkoma while genotype TzdEI 352 X TzdEI 355 gave the highest yield at Angaradébou. The mean grain yield reduction at Komkoma was 16.84 % while at Angaradébou, mean yield reduction of 22.85% was recorded. The old variety (DMR-ESR) had highest yield reduction of 75.40% at Angaradébou (Kandi) while the commercial variety (TZE COMPT 3DTC) showed 61.76% at Komkoma (Parakou). It is noteworthy that genotype TzdEI 173 x TzdEI 352 had higher grain yield under Striga infestation at Komkoma resulting in 21.1% yield increase while genotype TzdEI 100 x TzdEI 352 had slightly higher yield under infestation at Komkoma with 0.59% yield increase.

The significance of G and G × E interaction for grain yield in the research environments necessitated the use of the genotype main effect plus GGE biplot analysis to partition the hybrid × environment interaction for better understanding of the yield performance and the stability of the hybrids in each test environment. The grain yield “stability vs. mean performance” GGE biplots of the hybrids under both research environments are presented in Figure 2. Both the two research environments, the first (PC1) and second (PC2) principal component axes explained 76.88 and 15.59% of the overall variation, respectively; therefore, both principal component axes jointly explained about 92.47% of the overall variation in the yield of the genotypes. The GGE Biplot showed the hybrid TzdEI 352 x TzdEI 355 (V6) was better and had grain yield stability than all other varieties under the two research environments. Genotype TzdEI 173 x TzdEI 280 (V1) was the best under Striga non-infested environment at Parakou (Komkoma) (Figure 3).

Figure 3. GGE biplot showing which variety is the best in which environment.



KDS=Kandi under Striga condition; KD=Kandi under Striga free condition;
PKS=Parakou under Striga condition and PK=Parakou under Striga free condition
V1 = TzdEI 173 x TzdEI 280; V2=TzdEI 173 x TzdEI 492; V3=TzdEI 100 x TzdEI352;
V4 = TzdEI 173 x TzdEI 352; V5=TzdEI 296 x TzdEI 352; V6=TzdEI 352 x TzdEI 355;
V7 = TZE-Wpop STR; V8 = DMR ESR-W; V9 = TZE COMP3 DTC.

Genotype	Angaradébou			Komkoma		
	YR (%)	Non-infested	Non-infested	YR(%)	Non-infested	Infested
TzdEI 173 x TzdEI 280	35.24	3.78	2.45	6.1	4.53	4.25
TzdEI 173 x TzdEI 492	2.86	4.23	4.11	18.75	4.34	3.53
TzdEI 100 x TzdEI 352	-0.59	3.36	3.38	19.28	3.88	3.13
TzdEI 173 x TzdEI 352	20.04	3.94	3.15	-21.1	2.73	3.46
TzdEI 296 x TzdEI 352	12.56	3.88	3.4	9.02	2.83	2.57
TzdEI 352 x TzdEI 355	17.21	4.94	4.09	-4.29	4.46	4.66
TZE-Wpop STR	20.36	3.55	2.82	17.35	3.55	2.93
DMR ESR-W	75.4	4.35	1.07	44.7	3.4	1.88
TZE COMP3 DTC	42.96	2.7	1.54	61.76	2.72	1.04
Mean	22.85	3.86	2.89	16.84	3.6	3.05

DISCUSSION

Striga hermonthica is one of the most important constraint limiting maize production and productivity in Benin. The availability and wide adoption of early maturing maize cultivars could have resulted in tremendous increase in productivity and production of maize, leading to improved farmers' incomes. In this study, maize hybrids have been screened using grain yield and Striga adaptive traits and resistant/tolerant, high-performance hybrids have been identified for integration into Benin maize cropping systems. The significant mean squares obtained for environments (E), Genotype (G) and G × E interaction for most of the measured traits including grain yield under both of research environments signified uniqueness of the tests environments and the significant adequate genetic variability among the genotypes (hybrids and OPV). This facilitated the identification and selection of promising hybrids in the test environments.

The lack significant of E for grain yield and other traits under Striga non-infested conditions indicate that the genotypes (hybrids and OPV) have displayed the same performance in non-stress conditions. These genotypes could be used in these locations under optimal conditions. The significant G × E interaction effects for most measured characters, including grain yield in both Striga-infested and optimal research conditions, indicated a contrasting performance of the hybrids under research conditions. This result emphasized the importance of testing genotypes in various environments, in years, and locations prior to recommendations for commercialization. The higher emerged Striga plants and the higher Striga damage symptoms observed in varieties DMR-ESR-W and TZE Comp3 DTC while the hybrids evaluated showed improved resistance/tolerance to the weeds. The severity of the infestation has been reported to vary among genotypes. The same severity was established in this study.

Previous studies reported grain yield reduction due to Striga. The grain yield reduction varied from 12.56% to 75.40%, and from 9.02% to 61.76% at Angaradébou (Kandi) and Komkoma (Parakou), respectively. It was reported that severe attack of Striga can lead to yield loss of about 60 to 90 % in Southern of Benin. The high grain yield losses observed, the high rate of plant damage syndrome and large number of emerged Striga plants recorded in this study are clear indication of the severe infestation of varieties during in both of the locations. The difference among varieties in yield reduction level could be due to differences in level of tolerance/ resistance of maize genotypes used. These findings indicate that the losses of grain due to Striga depends on ecological conditions and cultivar genetic background. The higher average of grain yields at Komkoma (Parakou) and Angaradébou (Kandi) under none infestation than the average of grain yields at the two locations under S. hermonthica infestation show that low grain yield may be associated with Striga damage and the number of emerged Striga plants. It was reported that these traits are used for indirect selection of genotypes under Striga environments in Benin.

Striga resistance refers to the ability of host plant to stimulate germination of Striga seeds but prevent parasite attachment to its roots or killing the affected parasite while a Striga tolerant genotype supports as many Striga plants as the sensitive or susceptible genotype (DeVries, 200) but produces more dry matter and shows fewer damage symptoms. Striga damage in maize is used as the indicator of tolerance while emerged Striga plants is the indicator of resistance. Hybrids TzdEI 352 X TzdEI 355 and TzdEI 173 X TzdEI 280 at Komkoma (Parakou) and hybrids TzdEI 352 X TzdEI 355 and TzdEI 173 x TzdEI 492 at Angaradébou (Kandi) with very low Striga damage rating and highest grain yield could be deployed as resistant varieties in the respective agro-ecologies. The identification of maize genotypes that combine outstanding levels of resistance and tolerance is a promising breeding strategy and has been recommended

for Striga resistance breeding in several studies. Hybrid TzdEI 352 X TzdEI 355, have supported much less Striga plants and offered a higher yield than a susceptible genotype such as DMR-ESR-W.
The GG Biplot showed TzdEI 352 x TzdEI 355 (V6) was better and had yielding stability than all other varieties under both Striga and Striga free conditions across the two locations. Infestation. This hybrid could be adapted the two agro-ecological zones in Benin.

CONCLUSIONS

This study was conducted to examine the agronomic performance of six hybrids under S. hermonthica infestation. There was significant variability for most traits, especially in yield components and Striga adaptive traits. The best genotype under Striga infestation was TzdEI 173 x TzdEI 492 at kandi and TzdEI 352 x TzdEI 355 at Komkoma (Parakou) while under non Striga infestation, TzdEI 352 x TzdEI 355 was the best genotype at Angaradébou (Kandi) and TzdEI 173 x TzdEI 280 was the best at Komkoma in terms of grain yield. TzdEI 352 x TzdEI 355 was the yielding stable under Striga-infested condition across the two localities. Promotion of the resistant/tolerant and high yielding hybrids identified in this study will help in militating against Striga damages in the regions.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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