Assessing the Vegetative, Reproductive, Fruit and Yield Quality Traits of Pepper (Capsicum Sp.) Accessions in two Different Environments

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Abstract
This experiment was set out to evaluate some landrace and exotic collections of hot pepper accessions in the open field and greenhouse environments. Vegetative, reproductive, fruit and yield quality traits were examined among the genotypes to ascertain best performers for production and breeding purposes. Under both environmental conditions, the experimental design used was randomized complete block design (RCBD). Replication was done thrice. There were variations observed for almost all traits studied in relation to genotype, environment and genotype by environment interactions. Generally, genotypes showed almost complete variability in traits under the two different environments. However, performances of traits were better under greenhouse than the open field conditions. For reproductive, fruit, and yield quality traits, the genotypes ICPN16#7, GR 202, Z-607 and Vulcano showed superior and stable performances under both environments and therefore could be used for open field and green house production as well as breeding programs.
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1.0 Introduction

Hot pepper is part of the species of *capsicum* (Al-Snafi, 2015). Its cultivation covers over 3.7 million hectares in a year around the globe (Nsabiyera *et al*., 2013). In food preparations, it is mostly used as spice (Badia, 2017) and has many nutritional benefits to mankind. It is a good source of various essential vitamins and minerals (Lee and Kader, 2000). Hot pepper also contains a very essential chemical component called capsaicin which is part of a group of chemicals referred to as capsaicinoids. Capsaicin gives hot pepper its pungency and hotness. Again, hot pepper species contain carotenoids which are part of the pigments deemed essential in determining the quality of fruits and vegetables (Omayma and Abdel, 2013).

Because of the very usefulness of hot pepper, it is not only highly demanded locally in Ghana, but exported to other countries, especially Europe. As a result, all year-round production is essential. Like in other vegetables, greenhouse production in hot pepper is recently gaining prominence in Ghana. These have made its production potentials appealing to many producers. However, production is being affected with some peculiar challenges. Producers of hot pepper, lack genotypes with desirable qualities that suit producers and consumer preferences. Landraces available to the producers, although hardy, are low yielding and have long maturity periods. Again, some non-indigenous genotypes available to producers have better qualities than the landrace but are however not hardy to the local climate. Hence, production has been characterized with low yields (Quartey, 2014). A study on these two genotypes (the landrace and exotic) would bring out better traits for both production and improvement purposes. More so, in crop improvement programs, agronomic traits as days to flowering and maturity, plant height, fertilizer adaptability, and growth habit have been indicated as desirable traits for breeding (Rakshit & Bellundagi, 2019).

Previous studys on agronomic traits on *capsicum* species seem limited in Ghana. Therefore, to have a clear picture of desirable traits of hot pepper genotypes, this research was generally set out to assess the vegetative, reproductive, fruit and yield quality traits of seventeen (17) hot pepper accessions and their production potentials under the greenhouse and field environments. To achieve these, however, the following specific objectives served as guides;

a. Identify the hot pepper genotypes with the most desirable agronomic traits for production
b. Identify the hot pepper genotypes with superior agronomic traits for pepper (*capsicum species*) breeding improvement programs.
c. Establish the performances of the hot pepper genotypes growth and development traits in greenhouse and open field environments.

2.0 Materials and Methods

2.1 Research Environments

The study was conducted in the greenhouse and open field environments at the University of Ghana Forest and Horticultural Crops Research Centre (FOHCREC) in the Eastern Region of Ghana.

2.2 Soil and Climatic Conditions of the Study Environments

The soil and climatic conditions of the study environments have previous been reported in Ackey *et al*. (2021).

2.3 Experimental Materials and Activities

The hot pepper accessions used for this study have previous been described in Ackey *et al*. (2021**).**

The seedlings were raised under greenhouse conditions. The needed cultural practices were regularly and diligently performed on seedlings until transplanting at four (4) weeks after sowing.

2.4 Experimental Layout and Planting Dimensions

The study in the greenhouse and open field environments were arranged in randomized complete block design (RCBD). Replication was done thrice for each of the seventeen (17) accessions used. By the drawing lots method, accessions were allotted to plots randomly.

Dimensions used for planting under both environments for this study have previously been described in Ackey *et al*. (2021).

2.5 Data Collection on the Traits Studied

Collection of data was done on traits at the vegetative, reproductive as well as the maturity periods. The guide, as provided in the descriptors for *Capsicum* species (IPGRI, AVRDC and CATIE, 1995) was depended on for all data collection. For each plot and trait, measurements were taken on the five (5) tagged plants to determine the means. Data was collected on the following specific traits:

2.5.1 Mean Plant Height (cm)

Plant height of genotypes were measured at first harvest. Measurements were taken from the base to the terminal of the plants with a meter rule in centimeters (cm) for the determination of the means.

2.5.2 Mean Plant Canopy Width (cm)

The widths of the canopies were measured immediately after the first harvest with a meter rule in centimeters (cm). Measurements were taken at the widest point of plants' canopies among the genotypes for calculation of their means.

2.5.3 Mean Stem Girth (cm)

This was measured three (3) centimeters above ground with vernier calipers immediately after the first harvest in genotypes for the calculation of the means.

2.5.4 Days to 50% Flowering

The number of days to 50% flowering was calculated from the day after transplanting to the day when 50% of plants per plot had at least one open flower. The means for each genotype was determined.

2.5.5 Days to Fruiting

Total days to fruiting was recorded as the number of days after transplanting until 50% of plants per plot had mature fruits at the first and second bifurcation. The average number of days was found for each genotype in the three (3) replicated plots to represent the means for each genotype.

2.5.6 Fruit Length (cm)

Ten (10) fruits per genotype were sampled at the second harvest from each plot and the length of each measured with a ruler in centimeters (cm). The averages were taken for the mean fruit lengths of the genotypes.

2.5.7 Mean Fruit Width (cm)

Ten (10) fruits were sampled from the second harvest in each genotype per plot. Their widths were taken at the widest diameter with a caliper (in centimeters). The mean for each genotype was taken as the mean width of that genotype.

2.5.8 Fruit Wall Thickness (mm)

Ten (10) fruits from each genotype were sampled at the second harvest per plot. The wall thickness (in millimeter) was measured on ten (10) fruits per genotype at the point of maximum width with vernier calipers. The means were then calculated for each genotype.

2.5.9 Yield per Hectare (ton/ha)

The total yield per hectare for each genotype was calculated based on the formula below;

$$Yield\ (ton\ \ ha) = \frac{Area\ of\ a\ hectare}{Area\ of\ plot} \times Yield\ per\ plot$$

2.5.9 Number of Leaves

The total number of leaves was counted in the five tagged plants per plot in each genotype at harvest for each replication. The average was taken for each genotype and used to compute mean.

2.5.10 Mean Number of Seeds per Fruit

Ten (10) fruits were randomly selected from the five (5) tagged plants per plot for each genotype. The seeds were extracted and counted, and the averages were taken to represent the mean number of seeds for each genotype.

2.5.11 Chlorophyll Content

The chlorophyll meter was used to measure the chlorophyll content of the five (5) plants per plot at both flowering and harvest stages. The averages were taken to determine the means for each genotype.

2.6 Statistical Analysis of Data

All data from the study at both locations (greenhouse and open field) were analysed using the GenStat Computer Statistical Software (GenStat Computer Statistical Software, 2009) and XLSTAT statistical software (XLSTAT Statistical Software, 2015).

3.0 Results

The combined analysis of variance mean squares were almost significant (P< 0.001 and P≤ 0.05) for all traits studied in relation to genotype, environment and genotype x environment interactions except for stem girth under both environment (**Table 9 and 10**). Generally, performances of all vegetative traits were better among genotypes in the greenhouse environment than observed in the open field. However, the genotypes Del H, Gal, ICPN16#7, Legon 18 and Local Hot Chilli showed consistent superiority under both environments for the trait canopy width (**Table 1 and 2**). For mean chlorophyll content, genotypes in the open field environment showed higher records than the greenhouse environment (**Table 3**). For the reproductive traits, days to 50% fruiting, days to flowering, days to first fruit set, and days to ripening, performances across environments were relatively close**.** The genotype GR 202 outperformed all other genotypes in both greenhouse and the open field environments for the traits; number of days to first fruit set, 50% fruiting, and 50% flowering (**Table 4 and 5**). Also, the genotype Z-607 showed superiority over the others in the trait, days to first fruit ripening under both environments (**Table 5**). Again, genotype ICPN16#7 outperformed all other genotypes in both environments for the traits number of seeds, fruit length, width, and wall thickness (**Table 6 and 7**). In addition, ICPN16#7 obtained the highest yield (tons/ha) among all genotypes and the two environments **(Table 8).**

Table 1: Mean values of plant height and canopy width of genotypes in greenhouse and field environments.

	Plant Height(cm)			Canopy Width(cm)		
	Environment			Environment		
Genotype	Field	Green H	Mean	Field	Green H	Mean
7A	57.20	117.67	87.43	51.50	98.20	74.85
7E	60.93	126.73	93.83	47.47	96.00	71.73
9A	65.63	109.40	87.52	64.33	87.13	75.73
9B	34.57	64.40	49.48	20.03	29.27	24.65
9F	63.43	149.40	106.42	55.5	106.07	74.85
9H	53.17	154.93	104.05	47.43	131.13	71.73
Del H	56.87	156.40	106.63	44.37	44.37	75.73
Gal	57.67	140.33	99.00	40.17	40.17	24.65
GR	64.87	112.07	88.47	55.3	55.3	80.78
ICP	46.27	96.0	71.43	43.63	43.63	89.28
L18	61.23	120.40	90.82	49.37	49.37	93.52
LHC	46.97	138.07	92.52	42.7	42.7	85.22
MF	56.03	110.67	83.35	42.77	97.07	82.45
PM	62.2	163.30	112.75	47.27	113.8	57.42
Sal	59.93	138.40	99.17	55.25	87.6	65.18
Vul	41.13	88.60	64.87	36.5	83.27	71.28
Z-607	48.00	89.80	68.90	46.63	88	69.92
Grand Mean	55.06	122.19	88.63	46.48	97.18	80.53
LSD $_{(0.05)}$	14.33	14.73	9.89	15.55	15.58	10.74

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Table 2: Mean values of number of leaves and stem girth of pepper genotypes in greenhouse and field environments.

	Number of Leaves			Stem Girth (cm)		
	Environment			Environment		
Genotype	Field	Green H	Mean	Field	Green H	Mean
7A	281	244	262	0.96	1.04	1
7E	328	226	277	1.06	0.93	0.99
9A	465	285	375	1.1	0.81	0.95
9B	187	275	231	0.69	0.73	0.71
9F	318	497	408	0.85	2.88	1.86
9H	399	453	426	0.96	1.27	1.12
Del H	219	416	318	0.74	1.06	0.9
Gal	179	531	355	0.71	1.04	0.87
GR	317	289	303	0.86	0.89	0.87
ICP	231	267	249	0.76	0.84	0.8
L18	410	277	344	0.99	0.97	0.98
LHC	421	327	374	0.45	0.89	0.67
MF	254	253	254	0.92	0.93	0.93
PM	362	408	385	0.93	0.98	0.95
Sal	434	264	349	0.91	0.86	0.89
Vul	154	135	144	0.68	1.33	1.01
Z-607	165	250	208	0.71	0.87	0.79
Grand M	301	317	309	0.84	1.08	0.96
LSD $_{(0.05)}$	111.2	34.3	57.5	0.248	1.46	0.716

Table 3: Mean values of chlorophyll content at the reproductive and harvest stages of pepper genotypes in greenhouse and field environments.

	Chlorophyll content at F (nm)			Chlorophyll content at H (nm)		
	Environment			Environment		
Genotype	Field	Green H		Field	Green H	
7A	127.6	43.1	85.3	77.5	93.7	85.6
7E	93.9	36.2	65.1	75.8	76.2	76
9A	65.7	33.7	49.7	29.6	53.8	41.7
9B	71	33.5	52.3	57.1	51.6	54.4
9F	51.6	26.2	38.9	27	33	30
9H	68.2	25.4	46.8	39.8	49.5	44.7
Del H	64.4	25.3	44.8	53.3	57.3	55.3
Gal	80.9	33.2	57	71.1	60.9	66
GR	112.2	42.2	77.2	116.3	79.8	98.1
ICP	63.4	27.6	45.5	54.5	40	47.3
L18	60.6	28.5	44.5	61.3	57.3	59.3
LHC	40.8	18.2	29.5	37.5	21.7	29.6
MF	76.8	30.1	53.5	29.5	54.7	42.1
PM	56.9	22.4	39.6	51.1	34.2	42.7
Sal	52.9	19.2	36	26.7	25	25.9
Vul	96.3	47	71.7	59.7	96.1	77.9
Z-607	102	42.7	72.4	84.2	90.9	87.6
Grand M	75.6	31.4	53.5	56	57.4	56.7
LSD $_{(0.05)}$	16.22	5.61	8.53	31.56	14.12	17.35

F- Flowering Stage, H- Harvest Stage

Table 4: Mean values of number of days to 50% flowering and fruiting of pepper genotypes in greenhouse and field environments.

	Days to 50% flowering			Days to 50% fruiting		
	Environment			Environment		
Genotype	Field	Green H	Mean	Field	Green H	Mean
7A	38	34	36	62	70	66
7E	40	34	37	66	60	63
9A	45	38	41	84	85	85
9B	41	32	36	63	60	62
9F	51	34	42	83	82	82
9H	50	97	73	83	117	100
Del H	33	32	32	64	85	74
Gal	44	71	58	74	91	83
GR	28	28	28	48	49	49
ICP	34	32	33	59	62	61
L18	73	83	78	90	97	94
LHC	48	65	56	85	93	89
MF	32	32	32	64	51	57
PM	43	36	39	83	90	86
Sal	42	39	40	72	100	86
Vul	31	30	31	59	46	53
Z-607	34	32	33	56	55	56
Grand M	41	44	43	70	76	73
LSD $_{(0.05)}$	9.88	6.65	5.87	8.268	7.50	6.07

Table 5: Mean values of days to first fruit set and ripening of pepper genotypes in greenhouse and field environments.

	Days to first fruit set			Days to ripening		
	Environment			Environment		
Genotype	Field	Green H	Mean	Field	Green H	Mean
7A	39	42	40	80	86	83
7E	43	46	44	73	80	77
9A	47	49	48	80	85	83
9B	40	40	40	76	72	74
9F	47	53	50	72	86	79
9H	49	81	65	85	108	97
Del H	32	41	37	64	89	76
Gal	44	66	55	79	96	88
GR	28	27	28	66	77	71
ICP	30	38	34	67	79	73
L18	46	75	61	81	93	87
LHC	62	68	65	81	103	92
MF	31	28	30	61	68	65
PM	47	40	44	73	81	77
Sal	46	57	52	87	102	95
Vul	32	33	33	65	69	67
Z-607	29	32	31	56	57	57
Grand M	41	48	44	73	84	79
LSD $_{(0.05)}$	12.96	11.19	8.37	9.678	12.45	7.87

Table 6: Mean values of fruit length and fruit width of pepper genotypes in greenhouse and field environments.

	Fruit Length (cm)			Fruit Width (mm)		
	Environment			Environment		
Genotype	Field	Green H	Mean	Field	Green H	Mean
7A	9.1	12.5	10.8	0.99	1.38	1.185
7E	6.7	11.8	9.25	0.96	1.35	1.155
9A	2.4	2.4	2.4	1.43	1.33	1.38
9B	2.9	5.9	4.4	0.63	0.74	0.7
9F	2.4	3	2.7	1.2	2.03	1.615
9H	6.9	8.9	7.9	0.95	0.85	0.9
Del H	7.8	12.7	10.25	0.8	1.63	1.215
Gal	6.1	9.8	8	1.03	1.68	1
GR	8.1	14.5	11.3	1.21	1.64	1.4
ICP	10.4	17.1	13.8	1.46	2.24	1.9
L18	5.6	8.4	7.0	0.95	0.97	1.0
LHC	3.3	2.8	3.1	0.49	0.62	0.6
MF	7.3	10	8.7	0.55	1.69	1.1
PM	2.5	4.2	3.4	1.2	1.63	1.4
Sal	2.8	2.4	2.6	1.43	0.87	1.2
Vul	5	12.9	9.0	1.06	2.03	1.5
Z-607	7	13.6	10.3	0.94	1.22	1.1
Grand M	5.7	9.0	7.3	1.0	1.4	1.2
$LSD_{(0.05)}$	1.04	1.48	0.96	0.33	0.58	0.33

Table 7: Mean values of fruit wall thickness and number of seeds per fruit of pepper genotypes in greenhouse and field environments.

	FWT (cm)			Number of Seeds per Fruit		
	Environment			Environment		
Genotype	Field	Green H	Mean	Field	Green H	Mean
7A	0.12	0.21	0.17	68	87	78
7E	0.25	0.24	0.25	58	65	62
9A	0.11	0.06	0.09	39	22	31
9B	0.65	0.12	0.39	26	47	37
9F	0.07	0.06	0.07	36	38	37
9H	0.12	0.20	0.16	42	56	49
Del H	0.12	0.18	0.15	67	73	70
Gal	0.29	0.27	0.28	67	97	82
GR	0.19	0.23	0.21	54	62	58
ICP	0.17	0.28	0.23	69	100	85
L18	0.11	0.31	0.21	61	71	66
LHC	0.06	0.05	0.06	33	31	32
MF	0.11	0.14	0.13	28	83	56
PM	0.12	0.40	0.26	31	20	26
Sal	0.11	0.09	0.10	30	34	32
Vul	0.03	0.24	0.14	56	38	47
Z-607	0.27	0.07	0.17	58	41	50
Grand M	0.17	0.19	0.18	48	57	53
$LSD_{(0.05)}$	0.052	0.212	0.11	9.5	7.53	6.1

FWT- fruit wall thickness

Table 8: Mean values of yield and number of fruits per plant of pepper genotypes in greenhouse and field environments.

	Number of Fruit per Plant			Yield (tons/ha)		
	Environment			Environment		
Genotype	Field	Green H	Mean	Field	Green H	Mean
7A	51	67	59	4.2	17.1	10.7
7E	35	36	36	2.7	6.3	4.5
9A	180	63	122	4.5	1.5	3.0
9B	52	72	62	0.9	3.2	2.1
9F	152	152	152	2.7	5.5	4.1
9H	40	60	50	1.8	5.2	3.5
Del H	45	112	79	2.5	17.3	9.9
Gal	32	94	63	3.5	19.4	11.4
GR	46	80	63	3.9	14.4	9.1
ICP	29	41	35	5.4	23.0	14.2
L18	76	83	80	4.8	8.3	6.5
LHC	136	135	136	1.2	1.8	1.5
MF	38	52	45	1.7	9.3	5.5
PM	161	107	134	2.6	3.6	3.1
Sal	161	101	131	2.2	4.0	3.1
Vul	32	46	39	2.3	10.0	6.2
Z-607	51	83	67	2.9	12.7	7.8
Grand M	77	81	79	2.9	9.6	6.2
$LSD_{(0.05)}$;	102.5	34.7	53.1	2.74	4.100	2.48

Table 9: Mean squares from the analysis of variance of reproductive and fruit quality traits for pepper genotypes (combined)

S. of Variation		Mean	Squares						
	Df	DTF	DtF	FFS	DFR	FL	FW	FWT	NOS
Rep.	2	119.01	11.77	31.53	38.15	2.148	0.07006	0.0134	64.71
Genotype	16	1515.48*	1303.19*	879.70*	706.56*	77.423*	0.6439*	0.0433*	2159.68*
Env.	1	876.48*	155.65▪	1320.48*	3030.75*	280.75*	3.8698*	0.0061	1809.37*
E x G	16	252.83*	345.11*	177.11*	90.41▪	10.36*	0.2996*	0.0482*	561.48*
Residual	68	27.74	25.94	52.83	46.62	0.657	0.07968	0.0089	27.68
Total	101	307.48	280.129	216.060	187.65	17.157	0.24124	0.02052	467.626

*Significant (P< 0.001), ▪ significant (P≤ 0.05), DTF= days to 50% fruiting, DtF= days to 50% flowering, FFS=days to first fruit set, DFR=days to first fruit ripe, FL=fruit length, FW= fruit width, FWT= fruit wall thickness, NOS = number of seeds

Table 10: Mean squares from the analysis of variance of vegetative and yield quality traits for 17 pepper genotypes (combined)

S. of Variation				Mean	square				
	Df	NOF	YTH	NOL	SG	PH	CW	CCF	CCH
Rep.	2	864	3.26	1458	0.287	23.01	9.70	133.22	150.6
Genotype	16	9330*	82.62*	36046*					
					0.401	1701.86*	1459.61*	1490.4*	2881.9*
Env.	1	412	1121.41*	6474	1.46	114885.28*	65550.54*	49764.44*	48.8
E x G	16	3014	54.65*	29270*	0.39	807.48*	851.44*	394.78*	487.1▪
Residual	68	2119	4.65	2489	0.39	73.81	86.84	54.78	226.7
Total	101	3361.5	35.95	12087	0.4009	1584.69	1073.59	828.24	686.81

*Significant (P< 0.001), ▪ significant (P≤ 0.05), NOF = number of fruit per plant, YTH = yield (ton/ha), NOL = number of leaves, SG = stem girth, PH = plant height, CW = canopy width, CCF = chlorophyll content at flowering stage, CCH = Chlorophyll content at harvest

4.0 Discussion

The established fact of higher significant differences (P< 0.001 and P≤ 0.05) recorded in traits among genotypes in both environments proved variations in the locations used for the study. This is an essential finding because the genetic stock of crops can be expressed fully phenotypically through the influence of the most appropriate environmental factors. Therefore, the variations would be a guide for the selection of the best genotypes for production in a better or multi environments, and for improvement and further studies in *capsicum* species.

Genotypes under greenhouse conditions showed higher performances in most traits studied than under field conditions which was consistent with a recent finding (Hasan *et al*., 2014). Hence, the greenhouse conditions proved better for production of the genotypes than the field. The genotype 9B being the shortest under greenhouse conditions makes it more suitable and appropriate for production under this condition. It could also serve as a parent for breeding varieties resistant to lodging (Nkansah *et al*., 2011). The total leaves per plant and its orientation have bearing on the photosynthetic activities and quantity of photosynthates in plants (Lahai *et al*, 2013). Consequently, its impact influences the yield in crops. Generally, genotypes under the greenhouse conditions had averagely more leaves per plant than under field conditions and therefore, reflected in better yields(tons/ha). This trait showed a high genotype x environment interaction which was highly proven in the genotype Galaxy. Higher chlorophyll contents recorded among genotypes under open field conditions could be that the quantum and structural development of chlorophyll in plants on open fields are higher than in the greenhouse environment due to its microclimate (Karpinski *et al*., 1997). Again, higher solar intensity under field conditions than the solar-regulated greenhouse might have contributed to this phenomenon (Ibrahim and Jaafar, 2011). The ranges of chlorophyll contents in both environments were higher than a report from an earlier research (Ibrahim and Jaafar, 2011).

Like all other crops, reproductive traits have direct influence on the maturity duration and yield of hot pepper varieties. In most cases, the longer the duration of flowering, the longer the fruit set and maturity and vice versa (Chowdhury *et al*., 2015). This proved in the genotype GR 202 which had the best performance in both greenhouse and the open field environments for the traits; days to 50% flowering, days to 50% fruiting, and days to first fruit set which were consistent with an earlier finding (Osei, 2013). Also, the genotype Z-607 showed superiority over the others in the trait days to first fruit ripening in both environments. These superior qualities could be linked to higher genetic effect than the environment in the two genotypes (Z-607 and GR 202). These genotypes then could be considered for multi-locational production and be used as parents for breeding for earliness. The traits; fruit width, seeds per fruit and fruit length, influenced the genotype ICPN16#7 best performance in yield (tons/ha) under both environments. This was a better performance than in an earlier finding (Sharma and Kumar, 2017). However, the higher yield (tons/ha) under greenhouse conditions over the field in this genotype indicates a favourable environment for its production in the greenhouse environment than the field and proves essence of genotype x environment interaction as well. The genotype ICPN16#7 could be used for greenhouse production especially in Ghana since production under this environment is increasing in recent times in the country (Elings *et al*., 2015). Again, the dominance of the genotype ICPN16#7 under both environments for the trait seeds per fruit might be from genetic influence (Zewdie and Bosland, 2000). This may be a prove of higher pungency because capsaicin which is responsible for this feature is found in the placenta which is the attachment of seeds to the fruits (Garces-Claver *et al*., 2006). In addition, the higher seeds per fruit found generally in all genotypes in the greenhouse environment than the field could be as a result of the larger width of fruits in genotypes. This could also be attributed to better pollination in the greenhouse environment. More so, the outstanding performance of genotype ICPN16#7 in fruit quality traits in both environments makes it more ideal for commercial production and *capsicum* species' breeding programs.

5.0 Conclusion

The study showed profound variability in the traits studied among the hot pepper genotypes. However, performance of traits among genotypes were generally better under greenhouse conditions than the field. The prove of superior performance in yields (tons/ha) among genotypes in the greenhouse environment than the field suggests suitability and possible profitability of hot pepper genotypes for commercial production under greenhouses in Ghana. The quality and consistent traits found among some genotypes across environments can be used for improvement on inferior traits within genotypes used and other *capsicum* species. The genotype ICPN16#7 showed strong genetic influence and stability for all the fruit quality traits and yield across the environments. The earliness shown in the genotypes GR 202, Z-607 and Vulcano in both environments for reproductive traits make them appropriate parents in breeding for earliness and production for early maturity.

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