Stability analysis of yield and fruit quality in inbred line of cherry tomato

Junsuda Modnok[1], Jutamas Kumchai[1], Nakarin Jeeatid[1]
[1]Department of Plant and Soil Sciences, Faculty of Agriculture, Chiang Mai University

Introduction

- Cherry tomatoes are popular for consumption due to their sweet taste, beautiful colors, and rich in nutrients.
- Cultivars tend to respond differently to the growing environment; The phenomenon is GXE interactions (GEI).
- GEI was established to be significant; the next step is to identify stable genotypes.
- Eberhart and Russell (1966) proposed a method of stability analysis.

b value than one is unstable and good for a specific adaptation.
b value below one is relatively stable with greater tolerance to environmental changes.

Materials and Methods

- Eleven cherry tomato inbred lines (IL1-IL11) and one commercial (CK1) **(Figure 1).**

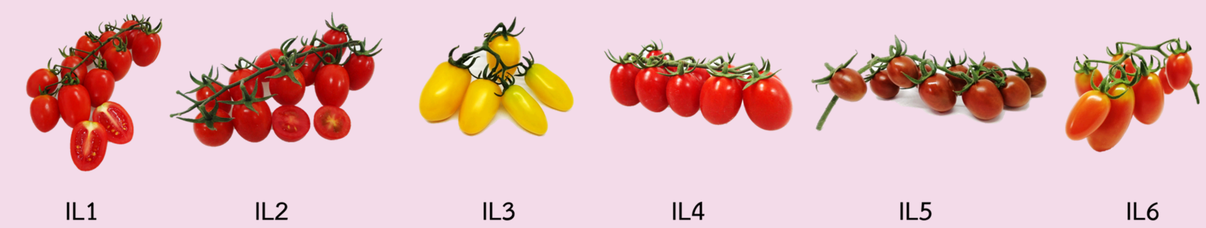

Figure 1. Fruit of twelve cherry tomato varieties

- Cultivated in three different environments : dry season of 2017 and 2018, at Khon Kaen (KKU1 and KKU2) and dry season of 2019 at Chiang Mai (CMU) **(Figure 2)**.

Figure 2. Growing environments. (A) KKU1 (B) KKU2 (C) CMU

- A randomized complete block design with three replications were used.
- Combined analysis of variance was performed for all traits in order to estimate the main effects of genotypes and environment and their interactions. LSD method was used to compare mean differences ($P \leqslant 0.05$).
- Stability parameters were calculated following Eberhart and Russell (1966).

Results and discussion

- Significant differences among genotypes, environments and genotype-by-environment interactions were found for all traits studied (Table 1).
- A large proportion of variation on fruit weight, fruit yield and TSS content was influenced by genotype.
- Our varieties varied significantly in plant growth habits, leaf characteristics, inflorescence, and fruit sizes; thus, genotypes had a greater effect on all traits.

Table 1. Combined analysis of variance for fruit weight, fruit yield and total soluble solids of twelve cherry tomato varieties evaluated in three environments during 2017-2019

Source of variation	df	Mean Square		
		Fruit weight	Fruit yield	total soluble solids
Genotypes (G)	11	121.047 (74.0) **	1188824 (55.4) **	15.7053 (58.6) **
Environment (E)	2	107.478 (12.0) **	2542413 (21.5) **	18.6681 (12.7) **
Error (E x Rep) [a]	6	2.924 (1.0)	13113 (0.3)	0.7994 (1.6)
G x E	22	8.475 (10.4) **	196726 (18.3) **	1.6264 (12.1) **
Error (E x Rep x G) [b]	66	0.729 (2.7)	15643 (4.4)	0.6714 (15.0)
CV (%) [a]		14.51	9.81	9.14
CV (%) [b]		7.25	10.71	8.38

- IL3 had the highest average fruit weight across three environments and produced a high yield relatively consistent across three environments **(Figure 3).**
- IL4 had the highest average TSS content across three environments but was not significantly different from the IL9 at KKU2 and CMU.

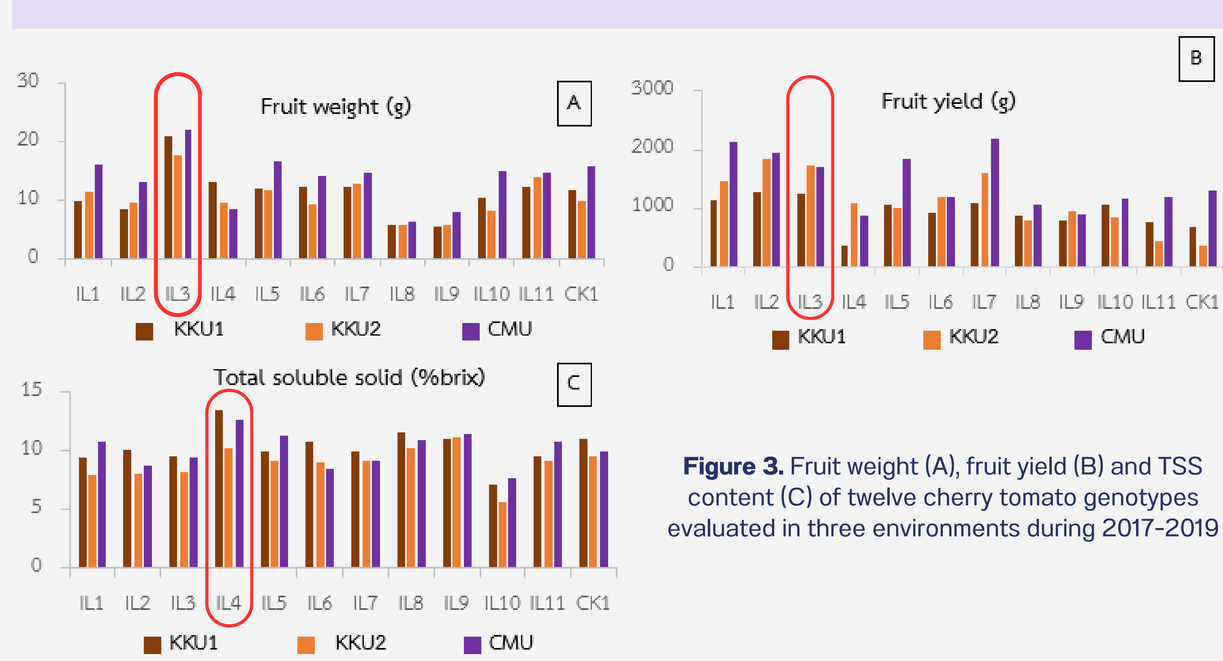

Figure 3. Fruit weight (A), fruit yield (B) and TSS content (C) of twelve cherry tomato genotypes evaluated in three environments during 2017-2019

- IL3 showed good stability for fruit weight, fruit yield and TSS content (b=0.62**, 0.74 and 0.97, respectively) indicated general adaptability for all traits (Table 2).
- IL9 showed high b value for fruit weight and fruit yield (1.31** and 1.52**, respectively) indicated very sensitive to changes in the growing environment.
- IL9 gave a high TSS (11.19 %brix) but showed low b value (0.25**) indicated less responsiveness to environmental changes for TSS.

Table 2. Stability analyses for fruit weight, fruit yield and total soluble solids of twelve cherry tomato varieties evaluated in three environments during 2017-2019

varieties	Fruit weight (g)			Fruit yield (g)			Total soluble solids (%brix)		
	Mean	*b*	Sd^2	Mean	*b*	Sd^2	Mean	*b*	Sd^2
IL1	12.4	0.46**	1.12	1583.9	0.52**	8.42	9.31	0.42**	0.58
IL2	10.3	0.64**	1.10	1681.6	0.62**	200.93	8.95	0.57**	0.61
IL3	20.2	0.62**	1.34	1563.3	0.74	249.89	9.08	0.97	0.06
IL4	10.3	-0.36**	2.14	771.4	0.37**	321.77	12.11	0.43**	0.08
IL5	13.4	0.63**	0.44	1310.4	0.53**	141.64	10.19	0.50**	0.71
IL6	11.9	0.65**	0.92	1103.0	1.26*	262.17	9.39	0.24**	0.95
IL7	13.2	1.23*	1.13	1622.4	0.47**	51.02	9.44	0.92	0.86
IL8	5.9	5.03**	0.49	902.1	1.60**	222.54	10.89	0.94	0.43
IL9	6.4	1.31**	0.71	876.6	1.52**	319.19	11.19	0.25**	1.02
IL10	11.1	0.49**	0.18	1028.6	0.83	321.62	6.86	0.56**	0.45
IL11	13.7	0.85	1.93	790.3	0.52**	257.73	9.81	0.52**	0.79
CK1	12.5	0.57**	0.15	775.4	0.44**	228.38	10.16	0.73	0.63
Mean	11.8			1167.5			9.78		

Conclusion

- IL9 variety had medium yield and high TSS but was sensitive to environmental changes. Therefore, suitable for specific location adaptation.
- IL3 variety had high yield and TSS and was more stable to environmental changes. Therefore, suitable for various environments.
- IL3 and IL9 varieties are suitable for use as parental lines in the production of cherry tomatoes hybrid.

References

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Gomez, K.A., & Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. 2nd ed. John Wiley and Sons, New York. 680 p.