

Introduction

Cultivating sweeter and milder onions has become popular to satisfy consumers' demand (Boyhan & Torrance, 2002; Lee, Yoo, Jifon, & Patil, 2009) and Vidalia onions are recognized for its sweetness and low pungency (Sellappan & Akoh, 2002).

A higher content of sulfur in soil increases the pyruvic acid in onion, thus generating the typical strong onion flavor (Randle et al. 1992). The mild climate of Georgia (USA) of abundant rain and sandy soil allows sulfur content to leach out of the plant root and contribute to its mild flavor characteristics.

However, while chemical analyses provide objective data, there is little information about the relationship between chemical composition of Vidalia onion and the effect on flavor and consumers preference.

Preliminary data studies of descriptive sensory analyses showed a correlation between Lachrymatory chemical factors (LCF) and Methylsulfonates (MTS) with Lacrymatory (LF) and Pungency flavor character (PBS), respectively. The content of sugars and sweetness taste showed no correlation.

Objective

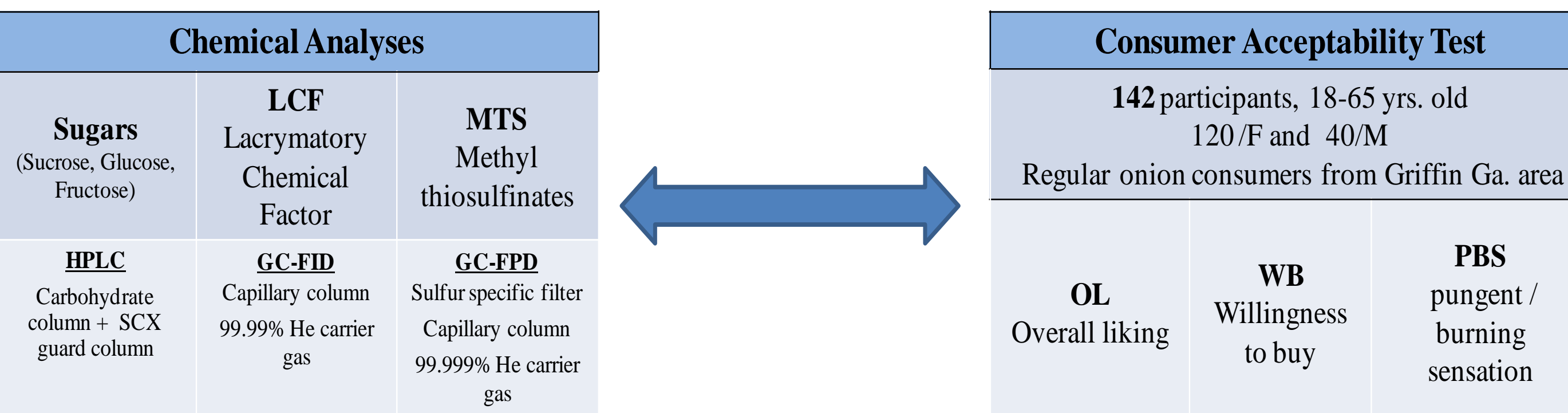
The objective of this study was to evaluate the effect of different levels of soil fertility of Vidalia onion in composition and its relationship with flavor characteristics and consumer preference.

Materials and Methods

Sample Preparation: Two Vidalia onion varieties, **Sweet** (Num 1006 =S), **Hot** (Sapello =H) were grown at three sulfur fertilizer levels: **Low** (S = 0; N = 37.5 kg/ha), **Medium** : (S = 59.4; N = 134.5 kg/ha) and **High** (S = 118.8; N = 190 kg/ha) to produce six flavor intensities:

Sweet Variety:	Hot Variety:
SL (sweet variety, low fertilizer),	HL (hot variety, low fertilizer),
SM (sweet variety, medium fertilizer)	HM (hot variety, medium fertilizer)
SH (sweet variety, high fertilizer)	HH (hot variety, high fertilizer)

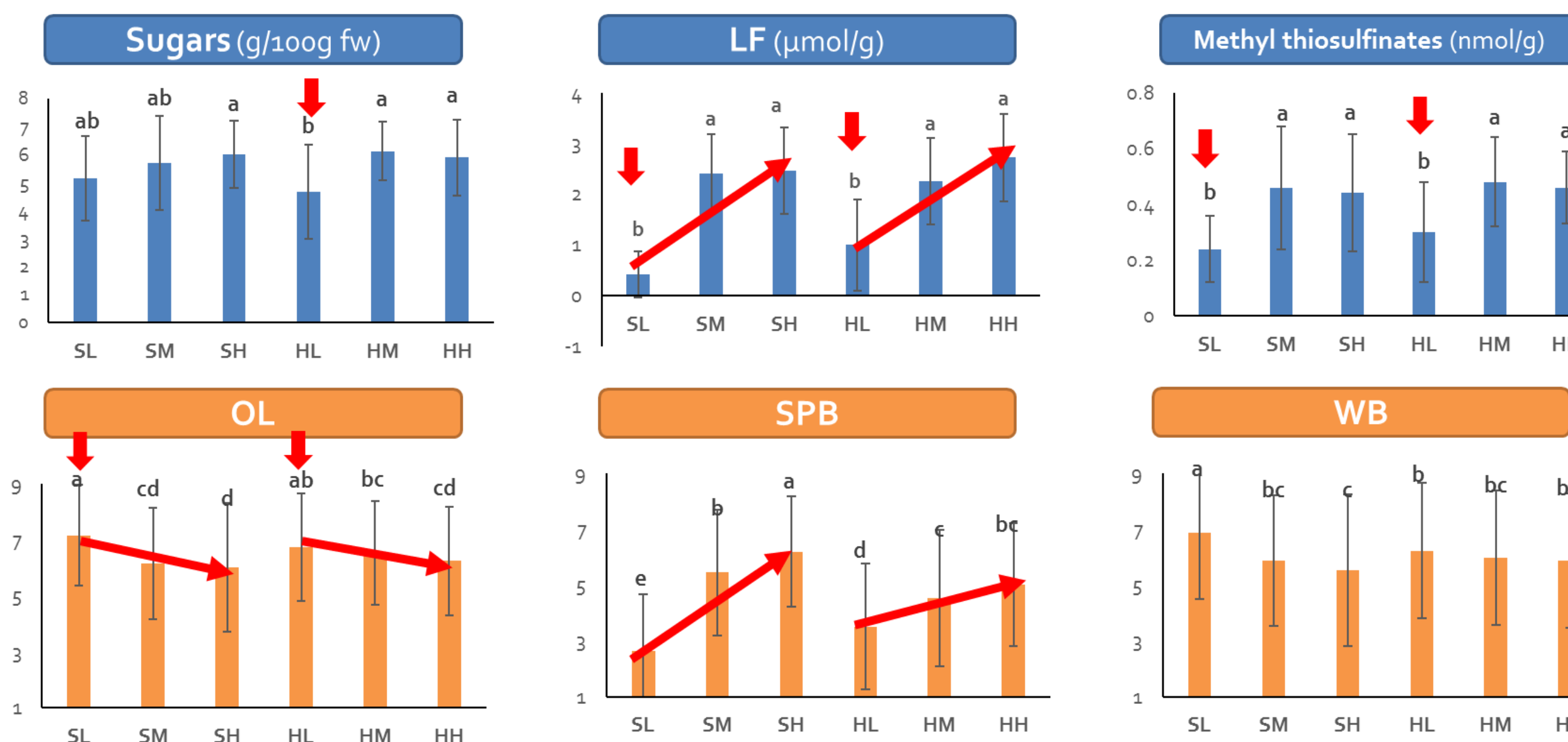
Experimental Design: Each onion was halved vertically through the core; one half was analyzed for chemical composition while the other half was tasted by consumer panel, two onion leaves equidistant from the core and skin were used for both analysis:



For differences among 6 samples, ANOVA, Fisher's LSD; Chemical compound threshold, for consumer acceptability Canonical correlation; Consumer preference pattern, partial least square (PLS) regression. All analyses were performed by XLSATA (Ver. 2015.4.01), Levels of confidence was $\alpha = 0.05$.

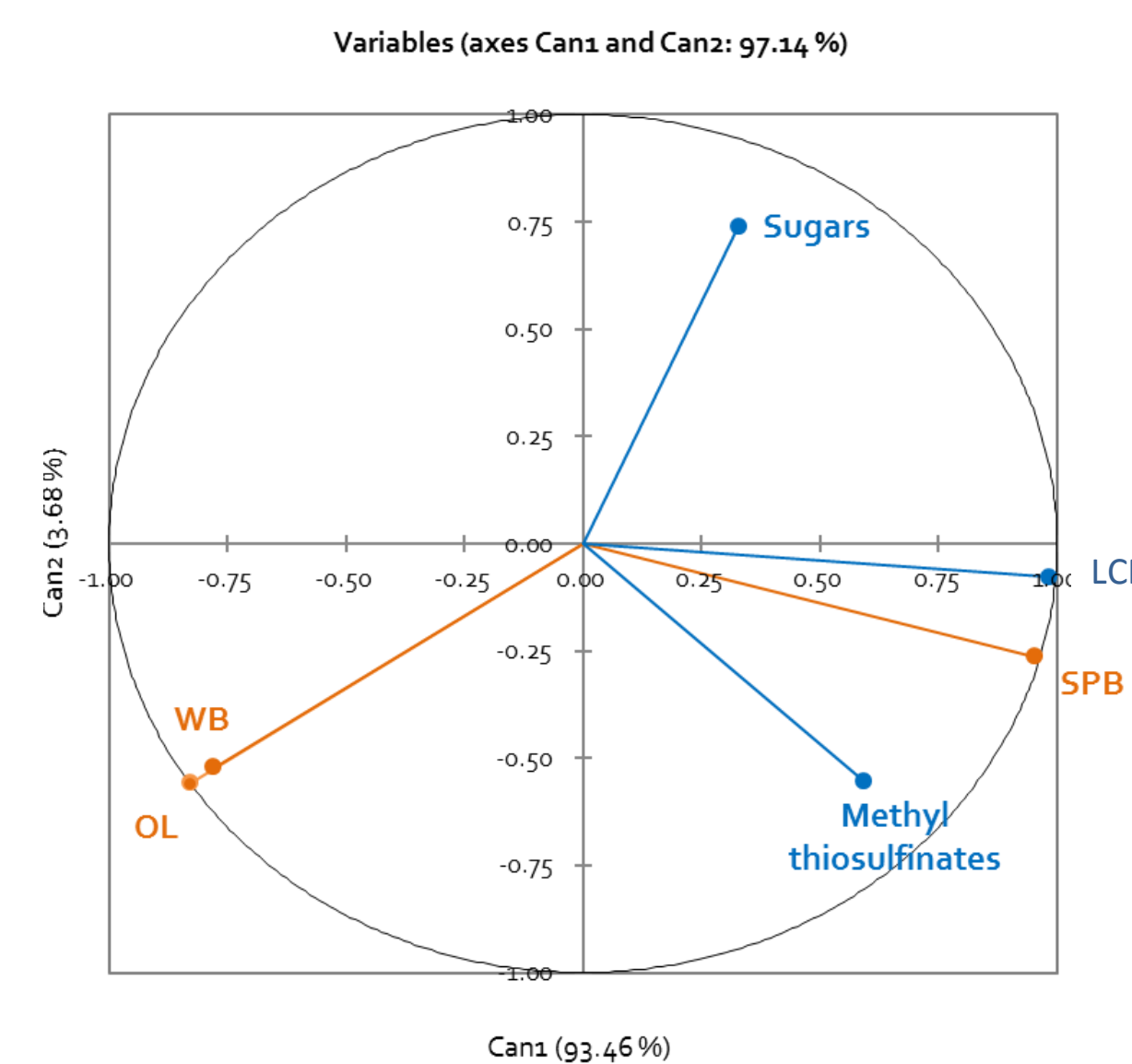
Results and Discussion

Figure 1- Differences in chemical compounds and consumer scores (ANOVA)



Onion samples with SL and HL had lower content of LCF and MTS; higher consumer OL and WB. The data shows that that consumer liking tended to decrease when they perceived higher pungency (SPB).

Figure 2-Correlation between consumer sensory scores and chemical measurements



Canonical Correlation Analysis

- To examine relative importance of chemical parameters on consumer preferences.
- By determining the strength of relationship between the chemical compounds (sugars, LF, methyl thiosulfonates) and consumer sensory scores (OL, SPB, WB).

Model for consumer sensory scores:

$$V_1 = -0.669Y_{OL} + 0.742Y_{SPB} - 0.302Y_{WB}$$

Model for chemical compounds:

$$U_1 = 0.167X_{\text{sugar}} + 0.903X_{\text{LF}} + 0.099X_{\text{thiosulfinate}}$$

LCF and MTFs were correlated with the SPB perception of consumers, and negatively correlated with WB and OL of consumers. The consumer mapping (Fig. 3) shows that the onions cultivated with low fertility levels, in both varieties, were preferred by consumers, and confirm the effect of higher fertility levels cause higher intensity of LF and SPB in the flavor of Vidalia onion.

Figure 3. Consumer Preferences Mapping (PLS regression)

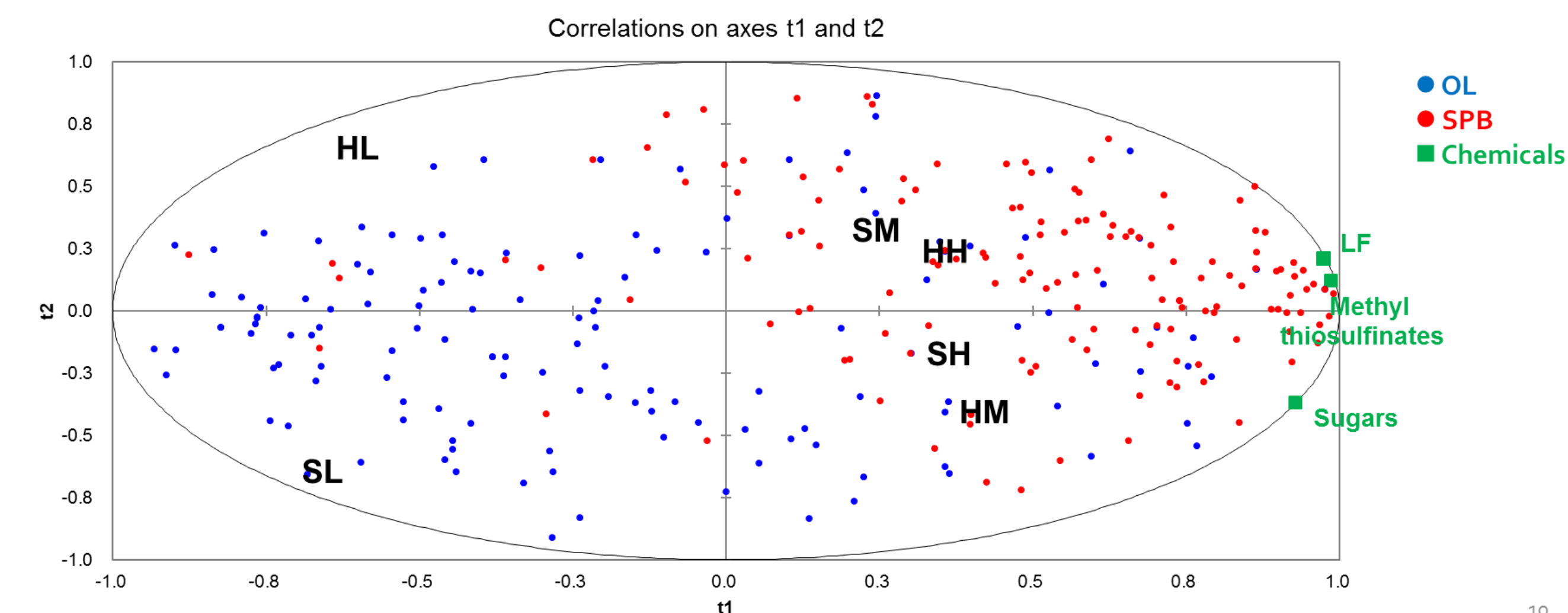
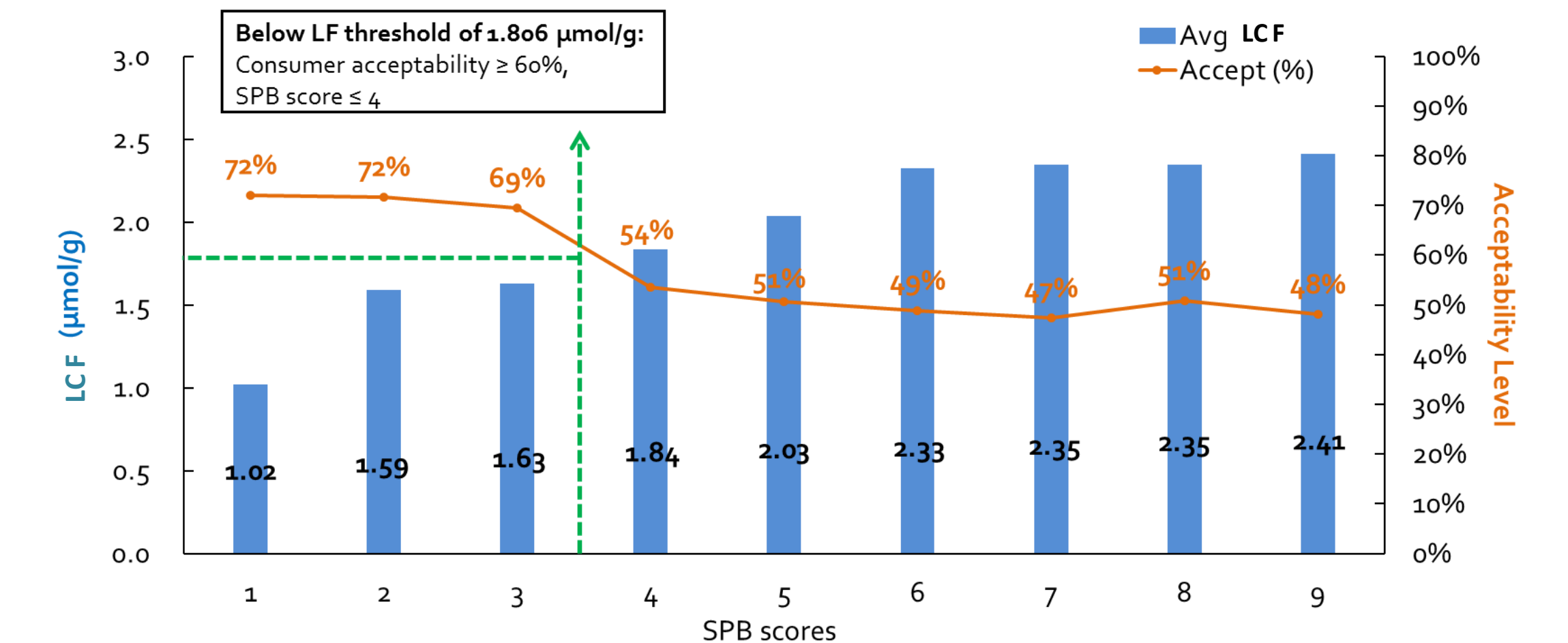


Figure 4.-Desirable LCF threshold for consumer acceptability (Overall Liking ≥ 7) at each SPB score.



Establishing the desirable LCF threshold content for consumer acceptability based in the important factors that determine the Vidalia onion flavor: OL, SPB and LF. The acceptability percentage (%) = $92.12 - 0.091 \cdot \text{SPB} - 15.71 \cdot \text{LCF}$ ($R^2 = 0.83$). Based on the consumer acceptability ($OL > 7$) and mean LCF content at each SPB score (1 to 9)

Conclusions

- The chemical composition of Vidalia onion was correlated with consumer sensory perception and preference.
- Consumer preferences tended to decrease when they perceived higher intensity of pungency and burning sensation in Vidalia onions (SPB).
- It was recommended that the LF content below $1.806 \mu\text{mol/g}$ in Vidalia onions would be desirable to render low pungency and higher acceptability to the majority (60%) of consumers.
- This study demonstrate a potential valuable methodology to influence the flavor of Vidalia onions and may ultimately allow an approach to manage the quality in terms of consumer preferences.