Edible quality and its regulation in vegetable soybean (*Glycine Max* (L.) Merr.)

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Introduction

Vegetable soybean [*Glycine max* (L.) Merrill] is large seed soybean harvested at R6-R7 stage when seeds are immature and pods are not turning yellow (Zhang et al., 2010). As a nutritional and healthy food, vegetable soybean is more popular among people who seek healthy lifestyle and thus its consumption is highly demanded all over the world (Bara and Cater, 1993; Messina et al., 2006; Rao et al., 2002; Duppong et al., 2005). Sugar and volatile component in seed are the main chemical substances which determine the edible quality of fruit (Jouquand et al., 2008; Shanmugasundaram et al. 2001), while the agronomic practices would influence vegetable soybean quality.

The objectives of this study were to examine the genotype variation and factors involved in regulating edible quality and its key components, and to investigate how fertilization and planting date inlfuence the edible quality.

Methods

1. 30 vegetable soybean genotypes were grown in field condition for evaluating the edible qulaity and its key components.
2. Three vegetable soybean varieties with different soluble sugar contents were grown field conditions with different fertilization regimes (N and K) and planting dates.
3.Main parameters analyzed: soluble sugar, sucrose, amino acid, protein, fat, four critical enzymes activities (SPS, SS, AI/NI) at R5.5, R6, R6.2, R6.5, and R7 stages according to Min Kuo et al. (1997).

Results

1. **Vegetable varieties differed in scores for edible quality. The cumulative contribution of sucrose, fructose + glucose, raffinose, stachyose, protein, free amino acid and oil to edible quality was 67.8%.**
2. **Edible quality score was positively related to sucrose content (0.864**), but negatively related to protein content (-0.439*).**
3. **The seed sucrose content of vegetable soybean increased in the early seed filling stage and decrease in late seed filling stage. The accumulation peak of seed sucrose appeared on the edible stage, namely 42 days after flowering.**
4. **The variation of these three sugar contents was small, and thus had limited effects on edible and nutritional quality in vegetable soybean.**
5. **The changes of Sucrose Phosphate Synthase (SPS), Sucrose Synthase (SS), Acid Invertase (AI) and Neutral Invertase (NI) activities were consistent to the changes of sucrose content during seed filling satge.**
6. **Variety with higher seed sucrose content constantly had highest key enzymes activities and thus faster sucrose metabolic rate.**
7. **The difference of sucrose synthesis enzyme activities (SPS) and sucrose decomposition enzyme activities (SS+AI+NI) was positively correlated with seed sucrose accumulation (r=0.530**).**
8. **The seed sucrose content paralled the activities of SPS, SS, AI and NI in seed during seed filling stage by N application. Excessive N application not only reduced the fresh pod yield but also decreased vegetable soybean eating quality.**
9. **K fertilizer plus the foliar application increased the content of sucrose and fructose but decreased the protein content and increase the fat content.**
10. **Delaying planting date was not beneficial to the eating quality of vegetable soybean. The seed protein content was increased by 0.8-6.9%, seed sucrose content was decreased by 7.6-45.4% and seed raffinose and stachyose content was slightly increased after delaying planting date from 3 May to 15 May, 27 May and 8 June.**
11. **A synergistic change between the activities of SPS, SS, and NI and seed sucrose content was found, and delaying planting reduced these enzymes activities.**

Results

Table 1 Correlation analysis among main compounds for edible quality in vegetable soybean

components	fructose+glucose	raffinose	stachyose	amino acid	protein	fat	score
sucrose	-0.105	0.282	0.029	-0.182	-0.424*	0.108	0.864**
fructose+glucose		0.132	-0.055	0.258	0.020	-0.175	-0.005
raffinose			0.559**	-0.225	0.040	-0.270	0.202
stachyose				-0.122	0.282	-0.081	-0.035
amino acid					0.312	-0.142	-0.096
protein						-0.147	-0.439*
fat							0.088

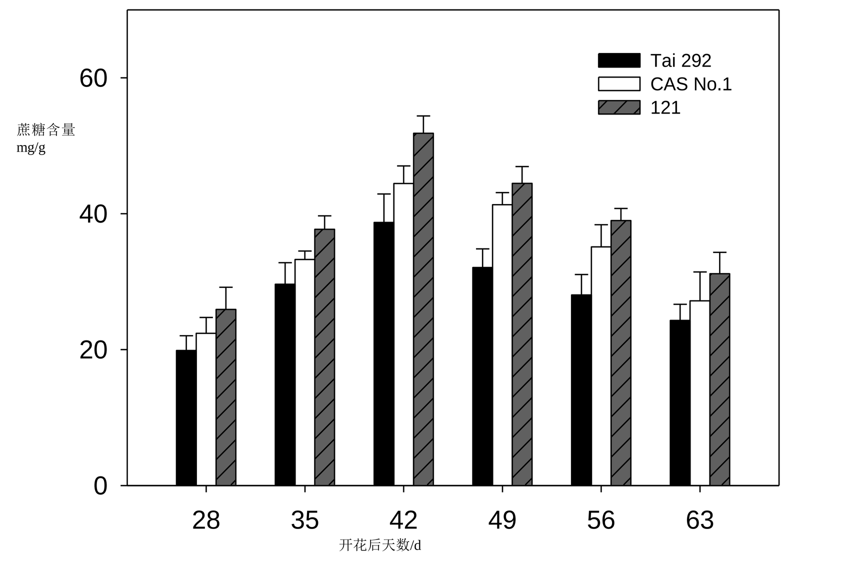
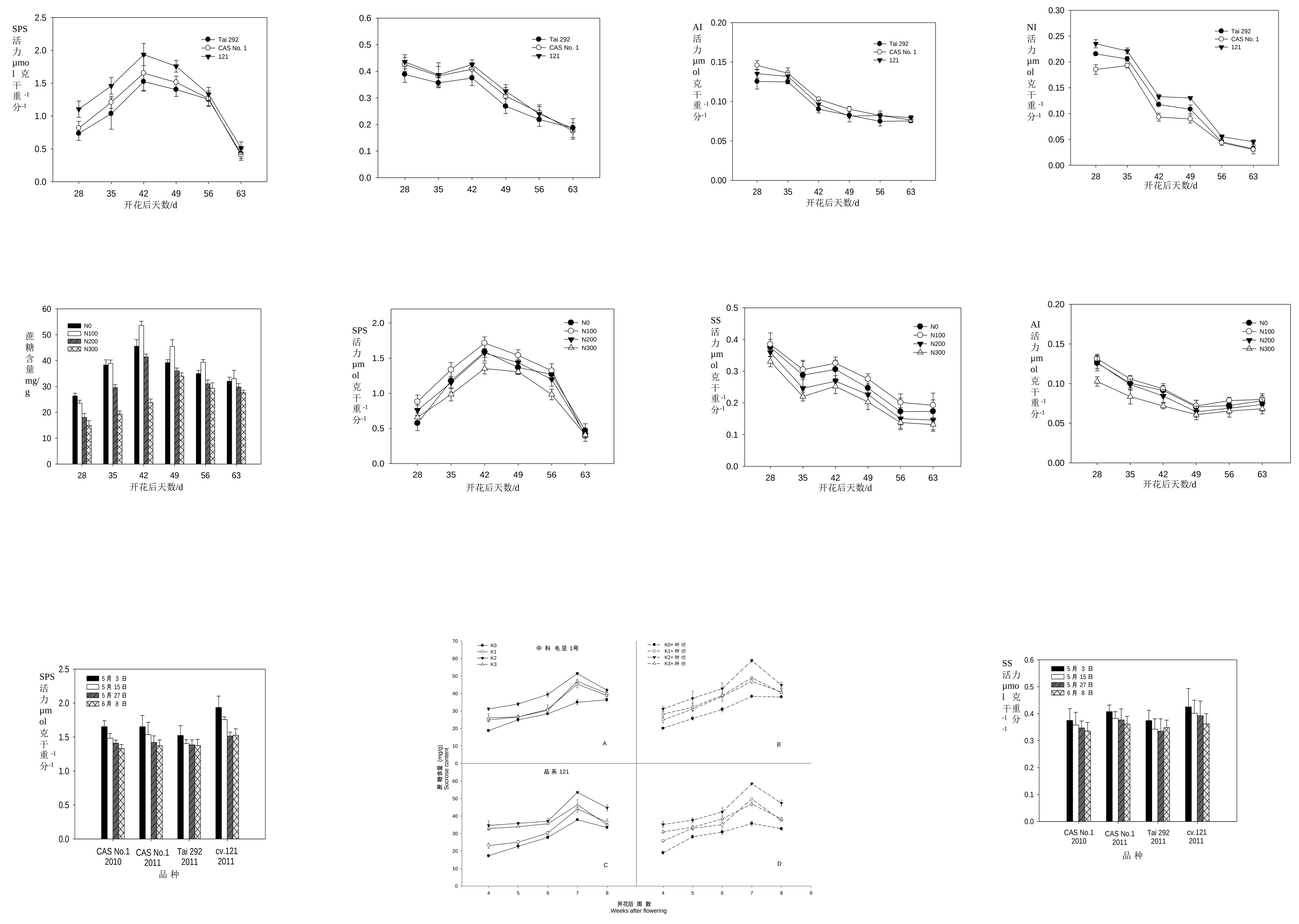


Fig. 1 Dynamic of seed sucrose accumulation during seed filling in vegetable soybeans



Acknowledgments

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