

## 9. TRIAL RESULTS OF SOME VEGETABLE SOYBEAN VARIETIES INTRODUCED FROM THE WORLD VEGETABLE CENTER (AVRDC)

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### ABSTRACT

Six promising vegetable soybean varieties (AGS333, AGS356, AGS358, AGS380, AGS398 and AGS399), selected from 18 AVRDC accessions, were trialled for growth ability, yield and yield components during 2006-2007 Fall-Winter and Spring seasons in Gia Lam – Hanoi. The trial results indicated that growth ability of all soybean varieties during the Spring season was much better than that during the Fall-Winter. AGS398 has the highest yield as its pod number per plant and 100-seed weight was higher than those of others. In addition, AGS398 has shorter growth duration, uniform pods, tidy-shaped plant, and good quality. AGS398 can also highly resist to pests and diseases under the open-field conditions.

**Key words:** Vegetable soybean; introduce, trial, yield, quality.

### I. INTRODUCTION

Vegetable soybean (*Glycine max* (L.) Merrill) is a type of soybean selected for fresh or frozen vegetable use at an immature stage, which has similar protein, milder flavor, nuttier texture and is easier to cook when compare with grain soybean (3). Vegetable soybean is popular in China, Japan and Korea for its unique taste and high nutritional value as a source of vitamins A, B1, B2 and C, protein, fat, fiber and other minerals such as phosphorus, calcium, and iron (2). Besides nutritional value, vegetable soybean is considered the most effective crop in soil improvement.

Since 1990s, a number of vegetable soybean varieties have been introduced and trialed and evaluated for yield, quality and adaptability to local conditions. Most of the varieties were from AVRDC - the World Vegetable Center. The trial results showed that the varieties are suitable for local conditions as they have vigorous growth and development, high yield, good quality. The potential for expansion the vegetable soybean in Vietnam is unlimited, especially when being inserted into the winter crop structure in-between two rice crops in the Red River Delta. The main vegetable soybean varieties being grown in Vietnam include AGS346 (from AVRDC), DT02 (locally bred) and some other varieties introduced by foreign seeds companies. Currently, vegetable soybean cultivation area is still limited, just some 70-100 hectares, concentrated mainly in Lam Dong, An Giang, Hai Duong and Hanoi. The domestic consumption and export structure of vegetable soybean is estimated as 40% and 60% respectively. Vietnam's frozen vegetable soybean products are mainly exported to Japan, Taiwan and the U.S. (5).

To diversify the vegetable soybean varieties with good traits and high adaptability to Vietnam's conditions, it's necessarily to trial and evaluate the varieties before releasing to large scale production. This report presents trial results of 6 vegetable soybean varieties introduced from AVRDC - the World Vegetable Center during 2006-2009 periods.

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**II. MATERIAL AND METHODS**

Six most promising vegetable soybean varieties, preliminarily selected from 18 introduced varieties, were trialled and evaluated during the 2006-2007 seasons. The varieties include AGS333, AGS356, AGS358, AGS380, AGS398, and AGS399. The soybean variety AGS346, earlier released for large scale production, was used as check.

The experiments were carried out at the experimental field of Fruit and Vegetable Institute (FAVRI) and laid out in the field using randomized complete block design (RCBD) with 3 replications and plot size of 6m<sup>2</sup> (2 bx 3m). The plants were fertilized with 10 tons of compost, 60 kg of N, 40 kg of P<sub>2</sub>O<sub>5</sub>, 60 kg of K<sub>2</sub>O per ha for the whole crop cycle. The first fertilization was applied right after land preparation with 10 tons of compost and a part equivalent to 20% of N, 100% of P<sub>2</sub>O<sub>5</sub>, 30% of K<sub>2</sub>O of the total amount of fertilizers. Seeds were sown at the density of 3-4 seeds/hill. Thinning to 2 plants/hill was done 10 days after sowing. Two sides - dressings at the rate of 40% of N, 50% of K<sub>2</sub>O and 40% of N, 20% of K<sub>2</sub>O were done at 15 and 30 days after sowing respectively. During the growing seasons watering and insecticides to reduce pest and disease incidence were applied only when necessary. Weeding was done triple for the whole crop cycle.

Horticultural characteristics, yield and yield components, nutrition content, pest and disease incidence were collected and analyzed with IRRISTAT5.0 for Windows.

**III. RESULTS AND DISCUSSION**

**3.1. Agronomic characteristics**

Plant height reflects the growth vigorousness of a plant. Data in table 1 show that variety AGS346 grows more vigorously than others varieties under the same cultivation conditions.

Number of nodes was not significantly different among varieties. A comparison in the number of branches among vegetable soybean varieties is almost similar over different seasons.

Table 1. Agronomic characteristics of vegetable soybean varieties through the different crops

Varieties	Plant height (cm)			Quantity of nodes			Quantity of branches			Days to harvest		
	Fall-Winter 2007	Spring 2008	Fall-Winter 2009	Fall-Winter 2007	Spring 2008	Fall-Winter 2009	Fall-Winter 2007	Spring 2008	Fall-Winter 2009	Fall-Winter 2007	Spring 2008	Fall-Winter 2009
AGS 333	35.03	42.54	36.01	8.80	9.05	8.90	2.50	2.84	2.58	66	79	68
AGS 356	43.43	50.39	43.56	9.43	9.80	9.67	3.10	3.54	2.97	69	77	69
AGS 358	43.74	50.23	44.12	10.54	10.70	10.05	2.67	2.91	2.75	72	82	73
AGS 380	32.92	47.23	33.23	9.65	10.00	9.31	2.80	3.10	2.71	68	82	67
AGS 398	41.55	50.14	43.01	11.70	12.20	11.25	2.80	3.00	2.90	67	80	68
AGS 399	41.72	49.93	40.93	9.50	10.10	10.01	2.30	2.65	2.14	70	80	71
AGS346 (check)	45.36	54.12	48.34	11.10	12.59	11.21	2.95	3.46	2.56	72	84	73

Table 2: The yield components of vegetable soybean varieties in different crops

Varieties	Quantity of pods/plant <sup>1</sup>			Quantity of multiple seeded pods/plant <sup>1</sup>			Quantity of marketable pods/plant <sup>1</sup>			100-seeds weight (gr) <sup>1</sup>		
	Autumn-Winter 2007	Spring 2008	Autumn-Winter 2009	Autumn-Winter 2007	Spring 2008	Autumn-Winter 2009	Autumn-Winter 2007	Spring 2008	Autumn-Winter 2009	Autumn-Winter 2007	Spring 2008	Autumn-Winter 2009
AGS 333	18.85de	23.72d	21.00ab	13.49de	17.82bc	14.61b	10.44d	14.60bc	13.10abc	57.10	59.70	-
AGS 356	19.88cd	24.96c	21.10ab	14.56cd	18.67b	14.37bc	11.70cd	15.24bc	12.35bc	59.60	60.05	-
AGS 358	21.04bc	24.62cd	19.15bc	15.60bc	19.14b	14.08bcd	13.48bc	16.54ab	11.00cd	59.53	60.10	-
AGS 380	19.82cd	23.96cd	17.59c	12.88ef	17.41bc	11.92d	10.20d	13.40c	9.66d	50.39	51.20	-
AGS 398	22.99ab	26.92b	22.81a	16.88ab	21.49a	17.35a	15.41ab	18.88a	14.45ab	60.58	63.60	-
AGS 399	16.97e	21.72e	17.72c	11.32f	15.85c	12.18cd	10.51d	13.38c	9.05d	56.80	57.32	-
AGS346 (check)	24.00a	28.86a	23.41a	18.00a	22.37a	18.28a	16.33a	18.24ab	15.14a	58.95	60.12	
F-test	*	*	*	*	*	*	*	*	*			
CV%	10.50	12.40	7.40	9.30	6.40	11.80	9.40	12.1	10.2			

*Means followed by the same letter (s) are not significantly different at 5% by DMRT. \* = significant*

### 3.2. Yield and yield components

Table 2 indicates that there was significant difference among cultivars in quantity of pods/plant. AGS346 and AGS398 gave the highest pods per plant at 23.41-28.86 and 22.81-26.92 respectively over the different seasons.

The quantity of multiple seeded pods per plant varied from 11.32 to 18.28 (Fall-Winter), and from 15.85-22.23 (Spring). Quantity of marketable pods per plant also varied greatly among varieties, in which the quantity of commercial pods per plant in spring crop was higher than that in the Fall - Winter one. AGS346 and AGS398 gave the highest quantity of marketable pods and the lowest was given by AGS380 and AGS399. Significant differences were found among varieties in both quantity of multiple seeded pods per plant and quantity of marketable pods per plant.

The 100-seeds weight significantly contributes to yield. There is significant difference in the Fall - winter and Spring seasons, but it was significantly different among the varieties. AGS398 had the highest 100-seeds weight in both seasons with over 60 grams.

The days from sowing to harvesting ranged from 66 to 73 days in the Fall-Winter, and 77 to 84 days in the Spring seasons. Most varieties matured earlier than the check one.

Marketable yield and total yield was significantly different among varieties. Total yield ranged from 7.91 to 12.79 t/ha in the Fall-Winter and from 10.33 to 14.80 t/ha in the Spring seasons. Marketable yield was remarkably fluctuated among the varieties. AGS398 achieved the highest marketable yield in three seasons at 7.24 - 8.73 t/ha, as well the highest total yield at 10.33 - 13.86 t/ha, followed by AGS356 with marketable yield of 5.25 - 6.38 t/ha. AGS398 was the only variety reached total yield and marketable yield to be similar to the check one. AGS380 has the lowest marketable yield as well as total yield.

Table 3. Yield of vegetable soybean varieties over different seasons

Varieties	Total yield (ton/ha) <sup>1</sup>			Marketable yield (ton/ha) <sup>1</sup>		
	Fall-Winter 2007	Spring 2008	Fall-Winter 2009	Fall-Winter 2007	Spring 2008	Fall-Winter 2009
AGS 333	8.28 <sup>c</sup>	10.91 <sup>c</sup>	8.98 <sup>cd</sup>	5.04 <sup>b</sup>	5.21 <sup>bc</sup>	4.61 <sup>b<sup>c</sup></sup>
AGS 356	9.11 <sup>c</sup>	11.99 <sup>bc</sup>	9.34 <sup>bc</sup>	5.25 <sup>b</sup>	6.38 <sup>b</sup>	5.98 <sup>b</sup>
AGS 358	9.90 <sup>bc</sup>	11.90 <sup>bc</sup>	9.41 <sup>bc</sup>	5.55 <sup>b</sup>	5.49 <sup>bc</sup>	5.71 <sup>bc</sup>
AGS 380	8.13 <sup>c</sup>	10.67 <sup>c</sup>	8.12 <sup>d</sup>	4.38 <sup>b</sup>	4.44 <sup>c</sup>	4.46 <sup>c</sup>
AGS 398	11.49 <sup>ab</sup>	13.86 <sup>ab</sup>	10.33 <sup>ab</sup>	7.24 <sup>a</sup>	8.73 <sup>a</sup>	7.51 <sup>a</sup>
AGS 399	8.59 <sup>c</sup>	10.30 <sup>c</sup>	7.91 <sup>d</sup>	4.62 <sup>b</sup>	5.41 <sup>bc</sup>	5.00 <sup>bc</sup>
AGS346 (check)	12.79 <sup>a</sup>	14.80 <sup>a</sup>	12.16 <sup>a</sup>	7.81 <sup>a</sup>	8.24 <sup>a</sup>	7.65 <sup>a</sup>
F-test	*	*	*	*	*	*
CV%	8.30	10.40	11.7	11.30	12.20	6.85

### 3.3. Nutritious content

Sugar content is one of the most important criteria to define the product acceptability. Analysis of nutrient content in vegetable soybean seeds showed that seeds of AGS398 and AGS399 had the highest sugar content (more than 5%). Vitamin C and dry matter content were quite high and varied differently among varieties. Difference in Protein and lipid of varieties was not clear enough.

### 3.4. Pests and diseases

From sowing to harvesting, insects such as leaf miner and pod borer infected crop. Pest and disease observation in open field for two seasons showed that leaf miner, occurred at 3 true leaf stage, were mainly army worms and beet army worms; pod borers occurred during flowering, destroying flowers and pods. Higher pest and disease incidence was observed in the Spring season when the weather conditions were more favorable for pest and disease development compared with the Fall - Winter season. All the trialed vegetable soybean varieties were mildly infected by rust and downy mildew at scores 1 and 2. In general, the level of pest and disease infection on vegetable soybean varieties in both seasons was quite low, the damage was minor and it did not significantly reduce yield and pod quality.

Table 5. Level of pest and disease infection of vegetable soybean varieties in different seasons

Variety	Total sugar (%)	Vitamin C (mg%)	Total acidity (%)	Dry matter (%)	Protein (%)	Lipid (%)
AGS 333	4.70	16.18	0.42	35.98	10.36	5.75
AGS 356	4.56	17.80	0.39	33.02	10.18	5.80
AGS 358	4.75	12.26	0.44	36.10	11.02	5.50
AGS 380	3.80	18.20	0.38	29.50	11.20	6.15
AGS 398	5.10	15.20	0.40	34.67	10.87	6.10
AGS 399	5.16	10.44	0.42	39.83	10.40	6.20
AGS346 (check)	4.40	15.05	0.44	32.02	10.56	5.65

*Disease infection evaluated according to AVRDC*

\* Where 1 = no obvious spot on leaves; 2 = slight infection (2-3 leaves showing symptoms); 3 = moderate infection (all leaves showing symptoms except for 2-3 young leaves); 4 = severe infection (all leaves infected).

\*\* Where 1= 1st symptom – 19% leaf area infected; 2 = 20-39% leaf area infected; 3 = 40-59% leaf area infected; 4 = 60-79% leaf area infected; 5 = 80-100% leaf area infected.

#### IV. CONCLUSIONS

Trialed results of the six vegetable soybean varieties showed that AGS398 is the most suitable variety. Although quantity of pods per plants, total yield and marketable yield are not significantly higher than the check, but AGS398 has a number of advantages over the check variety in several agronomic characteristics such as short growth duration, uniform mature pods, tidy-shaped plant, good quality. The AGS398, thus, is highly appreciated and recommended for large scale production in Vietnam.

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## 10. SPRING SOYBEAN PRODUCTION ON ONE SEASONAL TERRACED FIELDS: A NEW MEASURE FOR UPLAND AGRICULTURE IN YENBAI PROVINCE

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#### ABSTRACT

There are hundreds of thousand hectares of terraced fields in the northern mountainous regions in Vietnam, in which one third of them has been used to plant rice in two crop seasons and only autumn rice has been planted on the left area. Land for agricultural production from terrace areas has been fallow while local people lack of food. Hence, the northern mountainous region has potential to develop new crop on one season terraces to improve the living of local people. Yen Bai is one of provinces have the largest area of terrace and most of them were fallow in the spring.

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