

The planting time of MDH.01 in Phu Yen and Gia Lai begins after 5-7 days of rain (from 25 May to 30 May annually); planting density is 26,667 plants/ha (planting at 75 cm x 50 cm distance) and fertilizer rates: 60N: 60P2O5: 60K2O obtains the highest yield.

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## **8. RESULTS OF APPLYING GAP ON CABBAGE AND WATERMELON PRODUCTION IN NGHE AN AND NORTHERN CENTRAL OF VIETNAM**

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### **ABSTRACT**

During years from 2007 to 2010 under the sponsorship of the CARD program and Ministry of Agriculture and Rural Development, Agricultural Science Institute of Northern Central Vietnam has conducted research

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applying good agricultural practices to produce cabbage and watermelon in the Nghe An province of North Central Vietnam. The main objective of this study was to apply good agricultural practices to reduce pesticide residues; to help farmers access new markets to sell safe and high quality vegetables; and to increase farmers income through the production of higher yield and better quality of vegetable products. The full technical package of production processes of high quality cabbage and watermelons has been transferred to farmers including good varieties, intensive technical process, cultivating practices under GAP guideline and some skills on marketing, commercial promotion of vegetable products and so on. Up to now, farmers at the project sites in Northern Central areas have adopted all the required techniques and they are producing by themselves with good vegetable products, even though the project finished in 2008, and farmers are no longer receiving any subsidy.

**Keywords:** Cabbage, Water melon, GAP, safe and high quality product, farmers' income

## I. INTRODUCTION

Vegetable production is an important sector occupied by 643,970ha (Statistical Head Department, 2006) and providing Vietnam a significant source of income which accounts for 9% of the total crop production including rice. The major vegetables produced in Vietnam are KangKong, brassica's (cabbage, pak choy & kohlrabi) and various cucurbits including melons and cucumbers (Anh, Ali et al. 2004). According to the Statistical Bureau of Nghe An, vegetable growing areas of the province is 24,374 ha in 2008 which increased by 31.4% compared with the data of 2005. However, area under safe production occupied by 8.6% only (Statistical Bureau of Nghe An in 2008; Science and Technology Department of Nghe An, 2009).

The residue of pesticides, nitrate and other toxic are considered major constrains preventing the progress of safe vegetable production in Vietnam and Nghe An as well.. A recent study has shown that up to 22% of vegetables consumed in Vietnam may be unsafe for food because of pesticides residue, heavy metals contamination and high nitrosamine levels. The analysis with vegetable samples also indicated the availability of banned pesticides residue of banned pesticides (Anh, Ali et al. 2004). Other monitoring program conducted in Nghe An also reported that there were up to 14 of total 40 vegetable samples (accounting for 35%) contaminated with pesticides residue (mainly Permethrin and Fipronil activity) exceeding MRL (maximum residue level). (PPSD of Nghe An, 2007). Despite the considerable amount of pesticide has been used, significant proportions of crops yield is lost due to pests and diseases, e.g. 25% of leafy vegetables, 23% of cucurbits and 32% of brassicas (Anh, Ali et al. 2004). The major reason causing contamination of pesticide residue is serious infection of leaf disease due to high humidity (>75%) leading to more fungicides used (Anh, Ali et al. 2004). The widespread use of broad-spectrum insecticides kills beneficial predator which used to be a natural enemies of insect pests, thus increasing pesticide use and resistant of pest to pesticides. In addition nitrate residue in vegetable products is higher than the MRL due to the excessive use of nitrogen fertilizer by farmers.

Beside the contamination of toxics residue, there have been many other factors not fully considerate in safe production of vegetables, thus causing loss of quality during harvesting and supplying product, especially in retail. They may include bad temperature management and exhaustion of ethylene at harvesting, poor packing techniques and transportation. The survey in the wholesale markets indicated that vegetables are mainly handled in cane baskets instead of cartons or any form of purposed container suitably designed for the weight of stacked product. There is a limitation use of well-established preservation technologies at post harvest such as forced-air cooling, refrigerated transport, and cool rooms on farms or at market facilities. In the same manner, there is a difficulty

in attempt to control ethylene emissions around harvested products, which are well known to reduce the quality and storage life of fruits and vegetables. The current handling and marketing system works well if fruit and vegetables are consumed within about 24h after harvest, but it severely limits development of export markets and retail marketing through stores or supermarkets where a longer shelf life is required and consumers expect to purchase high quality products.

Cultural practices of farmers are inadequate capacity to control vegetable productivity, contamination, harmful toxins and consumers are not confident about the safe of vegetable in market, hence leading to the reduction of growers' income. In the above context, the ASEAN-GAP and VietGAP manuals will be useful templates for the development of a GAP manual for brassica's and cucurbit crops in Vietnam.

Marketing is emerging as a key driver of profitability for small holder vegetable farmers in Vietnam. Low market prices and unstableness was identified as a serious socio-economic constraint of vegetable production. At the same time, there is a trend away from the traditional marketing system of crops being purchased by collectors and sold in traditional wet markets to high quality product being sold through supermarkets. A range of supermarkets now sell product including Metro Cash and Carry, BigC, Citimart, CoopMart, Hanoi Minimart, Western Canned Food và Star Bowl, etc. The future will be for these supermarkets to introduce quality standards and then to buy high quality, clean product directly from farmers who meet the Quality Assurance (QA) requirements.

During the period of 2007 to 2009 ,under the sponsorship of the CARD program and Ministry of Agriculture and Rural Development, Agricultural Science Institute of Northern Central Vietnam has conducted research on applying good agricultural practices (GAP) to produce cabbage and water melon in Nghe An and North Central. The main objective of this study is to apply GAP to reduce pesticide residues; to help farmers access new markets for safe and high quality vegetables; and to increase farmers' income through the production of higher yield and better quality of vegetable products.

## **II. MATERIAL, CONTENT AND RESEARCH METHOD**

Integrated methods including participatory skills were applied for the research on cultivation of new vegetable varieties which are resistant to insect pests and diseases. The regular, monitoring of insect pest and disease in the field was also conducted to reduce pesticide usage. Good Agricultural Practice (GAP) and the manual practices were used in training to support advanced methods of insect pest and disease control. The supply chain includes post-harvest technology, sales system and infrastructure for transportation and storage products was developed to facilitate marketing. Training course on using common techniques of post-harvest packaging, compiling a handbook of good agricultural practices for cabbage and watermelon relying on ASEAN-GAP and VietGAP is was handled. Growers were adaptable for the high value retail system through their participation in supplying vegetables to famous supermarkets in Vietnam.

Experiments on variety selection (with emphasis on pest resistance and agronomy characteristics of seed from famous companies in Asia and Vietnam such as Green Helmet cabbage resisted to rot and black spots, CS202 and CN46 water melon etc.), density determination, sowing date and fertilizer were designed with standard method and laid out at Agricultural Science Institute of Northern Central Vietnam, Vinh, Nghe An. The demonstration of varieties and cultivation techniques is designed as on-farm research method in farmer communities.

Semi-production was conducted in farmers’ fields as guideline of good agricultural practice (GAP) and integrated pest management (IPM) to produce safe vegetables and to distribute through supermarkets.

PRA approach and basic survey as well as the FFS and TOT training courses were implemented basing on field experiments. The post-harvest research and sale sectors are applied to consume products.

### III. RESULTS AND DISCUSSION

#### 3.1. Selection of suitable varieties for the production and modelling

Together with production area for commercialization purpose, there was also trial sites at ASINCV (Vinh City) aiming to develop integrated cultural practices.

Nine new cabbage varieties with improved disease resistance and agronomic type are being evaluated at ASINCV, Quynh Luong Commune and the Hung Dong Co-operative in winter crop of 2007. Results presented in Table 1 indicated that SVR11750311 provided the fast growing, highest yield at 40.1 t/ha and good appearance. e, Despite the Green Helmet variety provided lower yield than the control variety in the pilot site, it was shown to be adaptable to local climate condition in large scale production and thus meeting supermarket’s specification. It also proved good resistance to some diseases such as black rot and brought attractive medium size heads weighing 1.2 - 1.4 kg.

Two standard experiments were conducted to evaluate and compare agronomic traits of 13 promising varieties of watermelon at two sites of Quynh Luong and Hung Dong (Vinh city). Participatory methods have been applied. Both farmers and scientists had independent observation and evaluation. Most of farmers paid more attention in high yield, good resistance to insect pests and diseases, but they did not really consider the supermarket specifications and customer preferences. E.g. some farmers selected VN27 and VN38 with large fruit size and high yield. Few farmers selected CS202 and CN46 because their yields were lower than VN27 and VN38 but fruits were better quality with high Brix (11.6) and their characteristics more closely matched the customers’ preference (See Table 2). After discussion farmers decided to chose CS202 and CN46 varieties for planting in next season.

Table 1. Yield and head characteristics of cabbage varieties

No	Variety name	Leaf number		Average head weight (kg)		Salable part (%)	Leaf number		Average head weight (kg)	
		Outer	Inner	Whole	Trimmed		Height	Diameter	Potential	Actual Yield
1	BC76	10.3	40.8	1.90	1.30	0.68	15.2	17.7	47.3	34.4
2	SG129	15.4	37.7	1.20	0.76	0.58	11.5	14.4	26.2	19.2
3	SG130	19.5	36.2	1.56	0.94	0.62	13.5	16.2	34.9	24.6
4	Kilaherb	16.4	41.0	1.87	1.00	0.53	13.0	13.7	35.2	26.8
5	Gloria	16.2	41.7	2.00	1.27	0.63	14.9	15.8	42.8	33.6
6	KKcross (control)	13.8	31.3	1.91	1.30	0.68	11.6	18.6	46.8	37.7
7	SVR11750311	16.4	42.7	2.00	1.50	0.75	12.9	20.2	48.6	40.1
8	PS11190	16.0	41.5	1.75	1.20	0.72	12.5	14.5	43.5	32.4
9	Green Helmet (Sakata)	16.4	41.0	1.57	1.00	0.64	13.9	16.7	40.8	35.3
	LSD $\alpha$ =0.05									2.84

(Source: Comparison experiment of cabbage varieties in the winter season 2007 in Nghe An province)

Table 2. Yield and head characteristics of watermelon varieties

No	Trait name		Fruit weight (kg)	Density (plant ha-1)	Potential yield (ton ha-1)	Actual yield (ton ha-1)
	Variety name/Location					
<b>I.</b>	<b>Hung Dong</b>					
1	HAPPYCN-46		2.6	7400	38.5	29.5
2	SWEET 16		4.2	7400	62.2	35.6
3	WD2503		3.7	7400	54.8	29.2
4	SWEETS ENORITA		2.9	7400	42.9	31.3
5	CS - 202		2.4	7400	40.5	35.1
	LSD $\alpha$ =0,05					3.77
<b>II.</b>	<b>Quynh Luong</b>					
6	VN26		3.47	7400	77.0	66.0
7	VN30		3.12	7400	69.3	66.3
8	VN27		4.09	7400	90.8	90.1
9	VN40		3.22	7400	74.5	71.0
10	VN31		2.85	7400	63.3	58.5
11	VN35		4.34	7400	96.3	73.9
12	VN38		4.77	7400	105.9	95.5
13	VN9		4.68	7400	103.9	82.1
	LSD $\alpha$ =0.05					4.42

*(Source: Comparison experiment of watermelon varieties in the spring season 2008 in Nghe An province)*

**\* Research on farming techniques:**

Trials on planting time, density and nutrition have been set up in ASINCV using plants from the second generation of f Green Helmet seed. The result showed that mid November is optimum planting time with highest yield. But in order to prolong harvesting time to meet market demand, cabbage can be grown from 30 October to 20 December in Nghe An. For density, planting 2 rows on the bed of 1.2 m wide with the distance of 50cm between rows and 40 cm between plants provided the highest yield of 1.2 kg cabbage heads in the Central coastal region. Optimum fertilizer rate was 150kg N+100kg P<sub>2</sub>O<sub>5</sub>+50kg K<sub>2</sub>O ha-1. IPM resulted in adequate control of insects. For watermelon, experiments on evaluation of agronomic characteristics had been conducted with two varieties CN46 and CS202 and the same observation criteria's as cabbage at ASINCV. The result showed that mixing fertilizer NPK13:13:13 such as Binh Dien trade name and planting density of 0.4mx2.5m was optimum application for high yield and income of grower.

**\* GAP application pilots:**

At the same time of conducting technical package experiments, production demonstrations were carried out on semi-commercial pilot at Quynh Luong and Hung Dong. Based on orders from supermarkets, farmers' groups have discussed and divided into small groups to carry out production for four seasons. They developed a planting schedule with Metro Cash and Carry and agreed to plant at 4 times from September to the ending December. The Green Helmet variety was selected because it is good disease resistance, good appearance and meets Metro's specifications. Cabbage product was delivered to Metro via the platform in Hanoi, and then to other areas in Vietnam. The product was free of pesticides residue due to application of Integrated Pest Management (IPM) , hence reducing pesticides use.

In similarity, the watermelon production pilots were conducted in Dien Phong, Quynh Luong Nghe An, and Thach Mon, Ha Tinh. The project team helps farmers negotiating with supermarket

to consume about 100 tons of watermelon before sowing season. The timetable of sowing date and product supply based on supermarket consumption demand which was estimated as 7-10 tons per week within 10 - 12 weeks starting in late May. Two tested varieties CN46 and CS202 were utilized for GAP demonstration pilots in Nghe An. The sowing season was from end of February to May to make it suitable for climate condition in central region of Vietnam. The GAP and IPM were conducted in conjunction with the farmers' field day schools in the field. As a result, hundreds tons of safe cabbage and watermelon were consumed in supermarkets.

### **3.2. Development of Good Agricultural Practice manual**

The project uses a participatory approach to encourage the uptake of good agricultural practices (GAP) by the collaborating Vietnamese Institutes and the stakeholders (farmers, extension staff and commercial partners). The training was implemented at the same time with demonstrations of new varieties and good agricultural practice to facilitate practice sessions in the entire of supply chain such as temperature control, harvesting, packing, storage, transportation and consumption. This activity was combined with intensive training for local extension staff on the vegetable industry. Farmers also began recording their practice activities in notebook to facilitate traceability during marketing stage. The manual was developed collaboratively between Vietnamese and Australian teams for two major annual crop groups: cucurbits and brassicas and a practical guide included information on variety selection and evaluation; water management; crop nutrition; crop scheduling; effective pest and disease management including insect scouting; and proper post harvest handling (i.e. harvest maturity, temperature management, grading, transport and packaging). By the end of 2009 the practice manual under VietGAP for watermelon and cabbage has been finalized and published in two languages: Vietnamese and English.

### **3. 3. Uniting smallholder farmers into a group for safe vegetables production**

In order to have an overview of the current status of production areas and site selection process, general survey in three sites of Nghe An provinces was conducted. 90 households from Hung Dong - Vinh City, Quynh Luu and Hung Nguyen, Nghe An province were interviewed. It was indicated that the suitable sites requires a number of important criteria such as clean soil, suitable climate for vegetables growth, good competence and experience of farmers, market demand and quality improvement demand.

Basing on the survey results and expert's evaluation, two communes of Quynh Luong and Hung Dong which are located near the coast (about 80 km north from Vinh City) and has 140 ha vegetable grown by 1000 farmer householders, were selected to conduct the project because they have enough facilities such as water, good soil and climate, farmer's experiences in planting vegetables (onion, leafy cabbage, tomato, carrot, cucurbits).

Hung Dong commune has 30 ha of vegetables production currently growing sprouts vegetables, leafy cabbage, cucurbits to supply Vinh's market. Local authorities are intending to expand vegetables production area up to 100 ha in future. Farmers at both 2 sites have been growing cabbage and watermelon, but they brought lower income than other short duration vegetables, therefore the area under those vegetables has been reduced recently. Product has been sold to local markets or collectors with low return and unknown quality.

To facilitate safe production program, the commune established an executive committee and farmer group who have the same target to improve income and market from safe vegetable production. They held meeting to discuss on activities and management manner to achieve target of

clean and high quality vegetables production. The farmers group called ‘voluntarily with the same interests’ was selected to conduct the production pilot. Through available data on crop, crop rotation during the year, the project team of ASINCV and Australia developed software to assist farmers on production management and market estimation to ensure sufficient quantities for supermarket weekly or monthly. The software was designed as most simple suitable to farmers’ competence, so that they only need typing such input data as sowing date, number of seeds, etc., the program will calculate and give full results as the request about the area, yield, production, harvest time and inputs quantity.

Through several meetings, farmer group issued their own regulation and activities plan. They also determine the advantages and disadvantages of local production condition and find out solutions to solve. Project team participate as facilitator for their discussion at the farmer meetings. Because the group shares benefit from their product so that they have to show their best effort in producing safe and high quality vegetables under GAP process. The farmers have been trained and practiced to improve their skills in cultivating cabbage and watermelons on their field.

### **3.4. Linking with supermarkets for consumption of products**

The link between Metro Cash, Carry supermarket and farmers was developed with support from Australian marketing experts and Vietnamese scientists. In order to get more confidence with product quality, Metro organized field’s visits for consumers from Hanoi at the project sites in Quynh Luong commune and Vinh. These meetings were very valuable for strengthening communication between Metro and farmers. Up to date, the direct farmer-Metro communication established by project has proved as unique and effective cooperation model in Vietnam.

Farmer representatives have also visited Metro’s Hanoi to get better understanding on how to prepare cabbage and watermelon product suitable for supermarket. The farmer group and Metro’s customers negotiated for supply contract, according to Metro specifications. The team also developed and agreed planting schedule.

The marketing strategy developed for the cabbages involved the promotion in the Metro Cash and Carry magazine as well as in in-store posters and promotions. In addition, each cabbage was stucked with a label to indicate it was produced under the guidelines of safe vegetable production. There was also information provided to Metro staff on how to handle the product in the store and how the crops were produced. At ending of the first cabbage season, an article was published on local newspapers to promote the potential success of this type of supply chain and production system.

The successful marketing and production strategy has facilitated for consumption of thousands tones of cabbage and watermelons through Metro supermarket.

### **3.5. Training of farmers and local agro-extensionist**

Many training courses of farmers’s field school called ‘no school classes’ were held in Hung Dong and Quynh Luong communes. The agro-extension staffs and nodal farmers were trained directly by Australian and Vietnamese experts. Having being trained, the resource trainees continued to transfer adopted techniques to other farmers in the village through agro-extension club. Basic practice conducted on the cabbage and watermelon fields. Cabbage varieties experiments were conducted as demonstrations for farmers’ practice to evaluate results and to conclude themselves. The workshop on integrated pest management and post-harvest techniques have been held.

#### **IV. CONCLUSIONS AND RECOMMENDATIONS**

The on-farm trials at the Quynh Luong commune and Hung Dong co-operative have facilitated the uptake of new farming practices. The results have been applied by growers in the production pilot for commercialization from the beginning to the end of the project.

Production processes of high quality cabbage and watermelons in Quynh Luong and Vinh City, Nghe An as GAP principles has facilitate to establish a very tight linkage between farmers and Metro Cash and Carry in Hanoi to consume safe products. This is a very positive step for developing an alternative supply chain which could be more reliable and profitable than the existing ones of farmers. The application of IPM and the agronomic record books has also been an initial important steps for the adoption of a QA system by growers.

At present, the Vietnamese vegetable industry often fails to meet the requirements of many QA systems such as ASEAN-GAP or EURO-GAP. The practices introduced for the cabbages and watermelon in Nghe An province are the first step for farmers in learning what is required to meet ASEAN GAP or VietGAP standards. These QA systems will only be adopted if there is a financial benefit for the increased effort.

The linkage with supermarket will provide farmers with the financial incentive to encourage them producing clean vegetables as ASEAN or VietGAP standards.

The other important success of project is sustainability. The existing linkages of production and consumption through relationship of farmers and supermarkets will be continued, and strengthened and expanded after project ending. Farmers can well maintain safe vegetable production and even scale up to other crops than cabbage and watermelon and develop relationship with other well known supermarkets than Metro. The project result has been successfully transferred and extended to Thua Thien Hue and Ha Tinh provinces.

The initial successful achievements of this CARD project (021/06VIE) should be published widely to not only cucurbits and brassicas but also other vegetables producers in central coastal part of Vietnam.

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## 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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