

Overview on tomato production and tomato varieties in Vietnam

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Introduction

As an important source of minerals, vitamins and health acids, tomato (*Lycopersicon esculentum Mill*) is one of the most important vegetable crops of *Solanaceae* grown universally. According to FAO, tomato area is approximately 3.58 million ha and a production of 90,895,577 tons in 2000 worldwide (FAO database statistics, 2000). The top four producers of processing tomatoes in 2002/03 are the United States (10.1 million tons), Italy (4.7 million tons), Spain (1.45 million tons), and Turkey (1.45 million tons). Other key producers include Brazil, Portugal, and Chile.

In terms of nutrition, a hectare of tomato gives similar calories but higher protein compared to a hectare of rice. More importantly, increasing tomato cultivation creates many more job opportunities as compared to rice. Besides, tomato production is reported to give relatively high benefit compared to vegetables and other crops (Villareal 1980).

Tomato was first cultivated about 100 years ago in Vietnam. Because tomato is one of the target vegetable for export together with other kinds of vegetables such as cucumber, corn, and bean, tomato area has been increasingly expanded in recent years. Tomato area is approximately 15,000-17,000 ha annually with a yield of 15 – 17 tons/ha and more than 30 tons/ha in some intensive farming areas. Although tomato yield of Vietnam is equal to 65% of the world's average, the number is comparatively high in the region (for instance, in Thailand, the Philippines, Bangladesh, Indonesia and Malaysia, tomato yield is 9.8, 8.3, 7.2, 7.9 and 3.2 tons/ha, respectively (Institute of Vegetables and Fruits, 2000)).

In Vietnam, fresh tomato is commonly used, probably due to the dietary habit. Therefore, a potential market and the need of input in processing industry have promoted the development of tomato cultivation. The establishment of a project of manufacturing processing tomato for domestic use and export was approved by the government in 2000. Its objective is to produce 240,000 tons of tomato for export by 2010 of which 33,000 tons are concentrated tomato. The concentrated tomato factory was built in Hai Phong and tomato planting area is planned in an area of 1,200 – 1,500 ha in the Red River Delta. (Nguyen Thanh Minh, 2003). Tomato area throughout the country is shown in Table 1.

Table 1. Tomato area, yield and productivity in Vietnam from 2001 to 2003

Location	Area (ha)			Yield (ton/ha)			Production (ton)		
	2001	2002	2003	2001	2002	2003	2001	2002	2003
Red River Delta	5,676	6,719	7,773	17.95	18.378	17.713	101,852	123,483	137,687
North Eastern	1,267	1,672	1,862	16.3	14.195	14.037	20,709	23,734	261.36
North Western	86	118	184	6.84	6.695	7.141	588	790	1,314
North Central	655	756	752	9.12	8.713	8.965	5,975	6,587	6,742
South Central	850	910	1,014	5.25	5.76	6.698	4,463	5,242	6,792
Tay Nguyen	1,124	3,811	5,303	22.46	22.838	20.466	25,242	87,035	108,531
South Eastern	359	870	1,432	13.43	10.047	9.161	4,821	8,741	13,119

Table 1 (continued---

Location	Area (ha)			Yield (ton/ha)			Production (ton)		
	2001	2002	2003	2001	2002	2003	2001	2002	2003
Mekong River Delta	1,475	4,012	3,308	10.92	14.099	16.483	16,105	56,566	54,525

Source: Hoang Bang An (2005)

Problems in tomato production in Vietnam

Tomato is highly sensitive to several biotic and non-biotic stresses. Fungal diseases (especially early blight, late blight and Fusarium wilt), bacterial diseases (bacterial wilt, bacterial spot, etc.) and virus diseases (tobacco mosaic virus, leaf curl, spotted wilt, etc.) are a serious problem in several countries. Tomato is sensitive to a number of environmental stresses, especially extreme temperature, salinity, drought, excessive moisture and environmental pollution, and there is a need to develop varieties that can withstand such environmental stress. Apart from environmental stresses, tomato yield is also affected by breeding techniques, varieties, growth habit, etc.

Biotic stress

High temperature and humidity in summer are favorable conditions for pathogens to develop, lowering tomato yield in Spring-Summer season. Furthermore, these factors promote the development of virus-related diseases. Diseases on tomatoes found in a case study in Luongno village, Donganh district, Hanoi by Nguyen Van Dinh (2003) are presented in Table 2.

Table 2. Diseases on tomatoes in Luongno village (Dong Anh district, Ha Noi)

Scientific name	Season of occurrence
<i>Rhizoctonia solani</i> Kiihn	Early, late
<i>Phytophthora infestans</i> (Mont.) de Bary	Main season, late
<i>Botrytis cinerea</i> Pers	Early, main, and late
<i>Stephylum solani</i>	Early, late
<i>Xanthomonas vesicatoria</i> Dowson	Early, late
<i>Macrophoma solani</i> Ell et Mart = <i>Alternaria solani</i>	Early, late
<i>Sclerotium rolfsii</i> Sacc	Spring-Summer, early
<i>Fusarium oxysporum</i> fs. <i>lycopersici</i> (Wr. Et Rg.) Schlecht	Spring-Summer, Early, Main, Late
<i>Cucumber Mosaic Virus – CMV</i>	Spring-Summer, Early, Late
<i>Tomato Yellow Leafcurl Virus – TYLCV</i>	Spring – Summer, Early, main, Late
<i>Ralstonia solanacearum</i> Smith	Spring-Summer, Early, Main, Late
<i>Bacterium lycopersici</i> Smith	Early, Late
<i>Meloidogyne incognita</i> Kofoid et White, 1919/Chitwood, 1949	Spring-Summer, Early, Main, Late
Unclear physiological disorder	Spring – Summer, Early

Source: Nguyen Van Dinh and others 2003.

Of the above diseases, bacterial wilt and virus-related diseases are of the most critical factors affecting of the tomato yield by causing serious damage at the time from flowering to the initiation of ripening. Late blight causes extreme damage at the end of winter and during spring seasons. In order to protect tomatoes from these diseases, tomato grafting technique was applied and obtained good results (Nguyen Van Dinh, 2003).

In a monitor conducted in winter 2003 in Sondu village of Donganh district, there were seven diseases observed on tomato crop, of which *Phytophthora infestans* was most commonly observed. It appeared with a high frequency (49.7%) towards the end of winter season. There are not effective control measures available for this disease at farmers level. *Ralstonia solanacearum* appeared with a frequency of 7,9% and tomato

virus with a frequency of 17%, were other important intractable diseases encountered by farmers (Nguyen Thi Kim Oanh and others 2004) (see Table 3).

It was observed that plants infected with one of the above-mentioned diseases failed to produce any harvest. Poor farming practices such as flood irrigation, non-treatment of infected plants are the possible cause of disease spread.

Table 3. Proportion and incidence of diseases on tomato

Disease	Winter season	
	<i>Pp</i> *± <i>SE</i> **	<i>Inc</i> ***± <i>SE</i>
<i>Phytophthora infestans</i>	62.97±5.4	49.7±2.99
tomato virus	20.54±2.67	17.03±3.8
<i>Ralstonia solanacearum</i>	8.98±5.14	7.93±4.9
<i>Sclerotium rolfsii</i>	5.2±2.1	4.75±2.1
<i>Meloidogyne sp</i>	+	+
<i>Alternaria solani</i>	+	+
<i>Fusarium oxysporum</i>	+	+

Pp* – proportion; *SE* – standard error of mean; ****Inc* – incidence

+ pests appeared at the monitoring time, but took low effect

- pests not appear at the monitoring time

Given a highly sensitivity of tomato to biotic stress, tomato is considered as one of the most difficult-growing plant, especially in unfavorable seasons such as spring and summer, though with a high economic value. As our survey conducted in Donganh district – the biggest vegetable producing area in Hanoi, only few experienced farmers take adventure on tomato production. This partly is owing to inadequate techniques that our farmers are applying that will be presented more in lower part of this paper. That is why when a disease appears, it easily expands through out the field causing a fail of total crop.



Picture 1. a tomato field is heavily damaged by diseases, and thus abandoned by farmer

Not only facing many types of disease, tomato farmers are also plagued by numerous insect-pests. 20 insect species were found in a case study by Nguyen Van Dinh (2003) as shown in table 4.

Table 4. Insects on tomato in Luongno village 2002-2003

Scientific name of insect	Scientific name of insect
<i>Liriomyza sativae</i> Blanchard	<i>Heteropternis respondens</i> Walker
<i>Heliothis armigera</i> Hubner	<i>Atractomorpha chinesis</i> Bolivar
<i>Heliothis assulta</i> Guenee	<i>Epicauta gorhami</i> Marseul
<i>Spodoptera litura</i> Fabr.	<i>Phyllotreta striolata</i> (Fabricius)
<i>Agrotis ypsilon</i> Rott.	<i>Epilachna vingitiotopunctata</i> (Fabricius)
<i>Bemisia tabaci</i> Gennadius	<i>Thrip palmi</i> Karny
<i>Chalciope hyppasia</i> Cramer	<i>Nephotettix bipunctata</i> Fabricius
<i>Cletus trigonus</i> (Thunb.)	<i>Aphis gossypii</i> Glover
<i>Leptocoris acuta</i> (Thunb.)	<i>Tetranychus cinnabarinus</i> (boisduval)
<i>Nezara viridula</i> (Lin.)	<i>Polyphagotarsonemus latus</i> (banks)

In other case studies in Sondu and Tangmy villages in Donganh district, Hanoi, problems on insect-pests on tomato are also among significant findings. Four PPU (primary production unit) were monitored for whole winter season, a total of seven insect-pests were monitored, out of which *Bemisia tabaci* appeared in highest frequency (36,7%). This is a serious phloem-feeding insect and a common vector for the deadly TYLCV (Tomato Yellow Leaf Curl Virus). *Liriomyza sativae* appeared next to the *Bemisia tabaci*. These pests usually have a serious effect on tomato at the mature stage. Two fruit borers species of tomato, *Spodoptera litura* and *H. armigera* did appeared and caused heavy loss of flower-buds and newly formed fruits affecting on tomato at the flowering stage (Nguyen Thi Kim Oanh and others 2004) (see Table 5).

Table 5. Proportion and incidence of major pests on tomato in Sondu

Pest	Winter season	
	Pp*±SE**	Inc***±SE
<i>Bemisia tabaci</i>	43.1±1.4	36.7±0.9
<i>Liriomyza sativae</i>	22.4±3.9	19±3.0
<i>Spodoptera litura</i>	16.4±6.8	14.4±6.3
<i>H. armigera</i>	15.2±3.5	12.8±2.8
<i>Thrips palmi</i>	+	+
<i>T. cinnabarinus</i>	+	+

*Pp – proportion; **SE – standard error of mean ; ***Inc – incidence;

+ - pests appeared at the monitoring time, but took low effect

- - pests not appear at the monitoring time.

Environmental stress

Hot and humid climate limits or prevent tomato production and can depress yields during summer in Vietnam. The most serious effect of high temperatures is reduction or prevention of fruit set. Owing to these, tomato is less produced in summer season compared to other seasons (Pham Dong Quang and others 2004). Table 6 summarizes the principle processes that may limit fruit set under high temperatures.

Table 6. Factors limiting heat tolerance of tomato

Limiting factor	Underlying mechanism
Photosynthesis	RUBP case tolerance
Translocation	Reallocation of carbohydrates, sucrose translocation, sieve tube obstruction with callus
Flower production	Allocation of photosynthate
Ovule viability	
Pollen viability	
Pollen production dehiscence	Endothecian formation
Flower morphology	Style elongation/stigma exsertion

Source: Stevens and Rick (1986).

Low temperature: Tomatoes in the North of Vietnam suffer chilling injury in winter when exposed to temperatures of about 10°C or less. At temperatures below 13°C, fruit set is inhibited (Picken, 1985) (10). For optimum production, therefore, new genotypes could be earlier, more adaptable, require less irrigation and higher yields of better fruits could be produced.

Flooding: Tomato fields might suffer from flooding due to frequently heavy rains from April to October. Nguyen Van Dinh (2003) found that ungrafted plants from MV1, HT7 varieties were wilting after 3 days flooding whereas grafted plants between MV1, HT7 and EG203 were not.

Inadequate production techniques

Observations learned that poor quality of seedlings and/or transplantation often causes many tomato plants death before reaching to harvesting stage, lengthening growing time, and then total production. Poor quality of seedlings may be resulted from poor seed, seedling production techniques (no specific area for seedling production. Farmers often use a small bed in the corner of the field for seed spraying. Soil is not treated that may even have pathogen residues from previous of solanaceae crops) and/or seedling uprooting (seeds are often spayed in small and flat soil, then seedling are uprooted for transplantation that may break small roots).



Picture 2. Many tomato plants were death before reaching mature stage

Given the high rainfall annually, farmers do often apply “flow” irrigation (meaning water is moving freely within the cropping field). This is a problem since water flow can bring with it many types of pathogens around the field, causing a quick expansion of diseases throughout the field.

Besides, poor knowledge on pests and diseases as well as biocides makes farmers passive in taking controls quite sometime. This results in numerous pesticide types (even improper ones), high spraying times, and high volumes of pesticide uses on the crop (see Table 7)

Table 7. Pesticides used on tomato observed in whole year production cycle in Donganh district, Hanoi

Village	Types of trading pesticides used	Spraying times/crop	Volume of (finished) pesticide used (kg/ha/crop)	5 types of most used Ai (acc. to spraying time)
Sondu	33	6.05	13.83	Zineb
				Trichlorfon (Chlorophos)
				Abamectin
				Thiosultap
				Na
Tangmy	22	6.14	18.24	Zinep
				na
				na
				Na
				Cypermethrin

Note: na – not applicable (often Chinese pesticides with no information on Ai)

Source: extracted from NUTMON database of VEGSYS project (see www.vegsys.nl)

Marketing problem

Often that in winter season whose condition favors tomato, Vietnamese farmers produce surplus of tomato that induces to low to very low market price of tomato. In a certain time, farmers did not even want to harvest tomato since their labor is more costly than what they can get from selling harvested tomato. By contrast, tomato in summer season is with very high market price. Thus, in this season, if farmers can manage even 50 – 60% of tomato plants alive at harvesting stage, they would get more benefit than that from tomato grown in winter season even with 100% of plants alive. However, summer tomato is often at risk that discourages farmers to grow. Thus, domestically produced tomato often can not meet market demand in this season. As a result, Vietnam quite sometimes has to import tomato from China in this period.

Hot-tolerant tomato varieties for summer production

Given the difficulties in tomato production especially in summer season in terms of both biotic and non-biotic factors, new and/or improved varieties which can resistant and/or tolerable to the aforementioned unfavorable factors, are often paid most attention. Thus, besides varieties or initial materials imported, Vietnamese scientists do also create many new varieties and improved ones which are often considered as the most important strategy in improving tomato production in Vietnam. This helps to lift up number of varieties available in Vietnam at the present. In a survey of Pham Dong Quang and others (2004), 115 tomato varieties are found to be grown in Vietnam in fall-winter and winter season, and 95 in winter-spring and spring season.

Tomato varieties developed by the Institute of Foodgrains and Foodstuffs Crops include C95 from a cross between NN325 and No. 7, and VT3. C95 is characterized by fairly short growing time (90 – 100 days), semi-limited growth rate, small plant (80-85 cm), and uniformly ripening process, abundance of fruits (17-22 fruits/plant), fruit ovate or pyriform and thick flesh, Brix degree of 4.8-5.0%. These characteristics make C95 a qualified product for processing. Moreover, C95 gives a yield of 40-45 tons/ha in winter and 28-30 tons/ha in Spring-Summer season. C95 was officially recognized by the Ministry of Agriculture and Rural Development in 2004. C95 is expected to plant in an area of 200 – 300 ha per year in the Red River Delta and nearby provinces.

VT3 has good growth capacity, early ripening process and good resistance to pests and diseases. Its growing time is 120 – 130 days. VT3 brings a very stable and promising yield (40 – 45 tons/ha in early winter, 60-62 tons/ha of the main crop in winter, and 30-32 tons/ha in Spring-summer season). VT3 has round shape fruit, Brix degree is 4.5-4.6% which make it suitable for fresh consumption. Trial production of VT3 has been conducted in the Red River Delta and given a yield of 51-58 tons/ha.

Area of C95 and VT3 in some locations in the Red River Delta is presented in Table 8.

Table 8. Development of C95 and VT3 in some locations in the Red River Delta in the period of 2002-2004

Varieties/Location	Area (ha)			Yield (tons/ha)
	2002	2003	2004	
C95				
Nam Dinh	5	210	186	45-47
Hai Duong	26	46	38	44-46
Ha Nam	4	15	20	42-44
Hai Phong	3	25	16	43-45
Thai Binh	6	28	25	40-42
VT3				
Nam Dinh	1	16	25	55-58
Hai Duong	6	13	58	56-57
Hung Yen	-	5	18	54-56
Thai Binh	2	9	28	51-53

Source: Nguyen Tan Hinh et al.

To date, numerous cultivars for processing are being produced. Of the current processing cultivars, Hong Loan is commonly used due to its wide adaptability. VL2000, an American F1 crossbred is being popularly grown in North Vietnam as a check for imported and domestic cultivars. MV1 was recognized in 1996 as a good check for heat tolerance in Spring-Summer season. VL2200, an American crossbred, is of favorite varieties in tomato-growing areas.

In the past, cultivars for processing tomato were mainly imported from Poland, Hungary, and the former Soviet Union whose climate conditions are often different from those in Vietnam that made cultivars difficult to

be adaptive to the new conditions in Vietnam. Great efforts have been made by a group of scientists of the Institute of Vegetables and Fruits. As a result, a group of 60 tomato cultivars for processing purposes have been developed based on criteria: yield, resistance, fruit quality (Tran Khac Thi, Duong Kim Thoa, 2001).

Vu Tuyen Hoang, Dao Xuan Thang, Doan Xuan Canh (Institute of Foodgrains and Foodstuff Crops, 1999) successfully created 2 processing tomato varieties C95 and C50 of which C95 is from a cross between NN325 and No.7 and C50 is imported from the US.

Mai Thi Phuong Anh (1998) found 15 processing tomato varieties suitable for the cultivation condition in Vietnam. These are also productive and good quality varieties.

From imported cultivars, Eastwest Seed company, Lotus company and Trang Nong company have selected and hybridized and released many tomato varieties of which TN30, TN24, and TN19 perform a good adaptation to the condition in Vietnam.

Vietnam is characterized by a climate and soil suitable for the growth of many kinds of vegetables. The winter in the North of Vietnam is a favorable condition for developing tomato without affecting the major food crop – rice. However, a hot summer and flooding frequencies make it difficult for sensitive tomato cultivars to grow. Optimum temperature for tomato growth is 27/20°C (day/night) (Went and Coser 1945). In a study by Nguyen Thanh Minh (2003), data on temperature fluctuation indicates that temperature difference between day and night in March and April resulted in higher tomato stems in Spring-summer season compared to those in winter. The study by Nguyen Thanh Minh (2003) also showed that unlimited genotypes produced higher stems (135.4 cm – CLN1351G) compared to semi-limited and limited varieties (90-100cm and 70-80 cm, respectively). Furthermore, nitrate fertilizer is used more effectively in the spring-summer season relative to winter due to the effect of temperature. Total growing time in winter season ranges from 135 – 150 days with longer time for unlimited varieties compared to semi-limited and limited varieties. Total time for spring-summer growing season ranges from 109-115 days.

The 10 most commonly grown tomatoes in Vietnam are presented in Table 9.

Table 9. Tomato varieties with the largest cultivation areas in the whole country in 2003-2004.

2003 (Fall-Winter, Winter)			2004 (Winter-Spring, Spring)		
Varieties	Area (ha)	%	Varieties	Area (ha)	%
M386	1,432	10.14	M386	2,082	26.89
French tomato	1,358	9.62	French tomato	594	7.67
TN005	1,046	7.41	Red crown 250	471	6.08
American F1	911	6.45	Hong Loan	424	5.48
Poland	860	6.09	TN005	400	5.16
VL2000	750	5.31	F1-607	271	3.50
TN002	628	4.45	VL2920	247	3.19
Red crown 250	419	2.97	American tomato	216	2.79
Persimmon tomato	361	2.56	Mogas T11	201	2.06
T42	349	2.47	M385	200	2.58
Total	8,113	57.47	Total	5,105	65.93

Source: Pham Dong Quang et al. (2004).

Recently, Center for Research and Development of High Quality Vegetable Varieties under Hanoi Agricultural University has introduced to farmers hybrid varieties such as HT7 (in year 2000) and HT42 (in year 2004). These two are now expandingly produced by farmers especially those in the North, up to hundreds of ha. These are with following characteristics:

- ★ Tolerable to hot condition, thus can be grown in cropping seasons a year especially summer, early and/or late summer season.
- ★ Short growing time. From transplantation to first harvest takes only 55 – 64 days. High yield of 40 – 56 tons/ha.
- ★ Average weight of HT7 fruit is of 70 – 80 gram. In the hot condition, fruits still have red color when mature.
- ★ Fruits are little sweet, nice taste. Brix of 4.6 – 4.8. Low acidity. With hard characteristic, HT7 fruits can be transferred in long distance and long storage which can even be Ok for 70 – 80 days after harvest in natural condition (that farmers can totally be able to store fruits themselves with very simple techniques which are also developed by the Center called “Post-harvest storage technology in natural condition.” This will help lessen a pressure to rely on tomato imported from China).
- ★ Plants of low height that is convenient for farmers in pesticide application.
- ★ HT42 can resistant to *Bacterial Wilt*. However, HT42 fruits can not stored as long as those of HT7. (handout of the varieties 2004).

Techniques for tomato production

Crop rotation

This is considered as an ecological way to lessen pest and disease pressure for tomato as well as to enrich soil properties especially in terms of trace minerals. As rice being still considered as staple food crop in Vietnam, farmers do often rotate tomato with rice (Hoi and others 2002). Besides, farmers may also rotate tomato with other crops even eggplant and hot pepper as influenced by market forces though it is not recommended to do so.

Cropping calendar

Traditionally, farmers usually have 3 tomato production seasons such as (1) early season - seeds are sown in July/August, and crops planted in August/September, harvested at the end of October or December; (2) main season - seeds are sown from the middle of September to end of October, crops are planted in November, and harvested in February or March; and (3) late season - seeds are sown in November, crops are planted in December, and harvested in March or April. However, in the recent decade, owing to increasing market demand on tomato, spring-summer and summer-autumn season tomato have been developed in which seeds are sown from early January to February and July to August; first harvests will be done in May/June and October/November, respectively. For tomato in these seasons, farmers have to adopt special cares.

Spring-summer season:

- ★ Low temperature that causes low germination. Farmers have to cover seeds by rice straw and/or plastic.
- ★ At the flowering stage, both temperature and humidity increase that cause development of diseases. Farmers thus often periodically spray pesticides on tomato.

Summer – autumn season:

- ★ Sunny, hot and humid condition makes seedling production very difficult. Small plants are often damaged by root disease. Farmers often spray pesticides to protect seedlings though with low effectiveness.
- ★ Owing to high rainfall, farmers have to make higher beds so tomato plants can escape negative effect of too-much water. Besides, tomato is also much affected by diseases that may totally destroy the crop quite sometimes.

Fertilization and irrigation

Farmers do usually basal and follow-up applications of fertilizers. For basal application, often 15 – 20 tons of decomposed muck, 400 – 500 kg of SSP, 195 – 200 kg of potassium, and 70 kg of urea are used per ha. These fertilizers are mixed and applied into hallow where seedling will be transplanted into, and covered by soil. There are 2 rows in a plot with row width of 70-80 cm to make a population of 30,000 to 32,000 plants

per hectare for segment tomato and a row width of 30-40 cm with population of 35,000 to 40,000 plants/ha for persimmon tomato.

Irrigation is often done to maintain the field's moisture of 60%. This is remained up to the time when fruits are formed. During fruiting period, special care should be taken to keep leaves from wilting.

Additional fertilizing is done 4 to 5 times. Total amount of additional fertilizer is 10 tons of decomposed muck, 130-200 kg urea fertilizer. Additional fertilizer application starts to be done after the roots develop, when the plant has flower buds and fruits.

In order to give better development of the fruits, soil is disturbed and piled up by adding soil from row middles to the base of the tomato plant. For a better yield with current tomato varieties, it is necessary to build stake and frame for plants. The stake's length is about 1.2 m. Plants are tied to the stake when it is 30 cm tall. Plants should be retied every 5 or 7 days and trimmed to maintain 2 main branches. Dead leaves should also be abandoned.

As a crop that requires higher initial investment especially in summer season compared to other vegetables, tomato is often paid special attention by farmers except when market price is too low (only sometimes in winter season). They do often keep a watch on situation of tomato plants and take pesticide application when pests and diseases are observed. Quite sometimes when tomato can produce high economic value, farmers even remain periodical pesticide application especially when they aware that the climate condition favors for development of pests and diseases such as hot and humid.

Conclusion

Tomato has long been important vegetable of Vietnamese people. Its production area has been increasing in recent decade owing to increasing market demand as well as availability of hot-tolerant varieties. Yield of tomato in Vietnam is relatively higher than that in other southeast countries.

Tomato is highly sensitive to biotic and non-biotic factors such as pests, diseases, climate conditions, soil properties and soil condition etc., It thus make farmers difficult to grow tomato in summer season whose condition is unfavorable for tomato and thus often discourages farmers to do so. Owing to its characteristics, tomato is preferred by consumers for year around. Thus, Vietnam has quite sometimes to import tomato from China in summer season.

Most important technique for year-around tomato production has been paid attention by Vietnamese scientist is to create hot-tolerant varieties which can be grown in summer condition. To date, many varieties have been created and/or improved with the hot-tolerant characteristic. Many of these new varieties are being increasingly grown by farmers in certain areas of Vietnam in summer season that produce very good harvests especially MV1, HT7 and HT42. A part from hot-tolerant characteristic, HT7 and HT42 fruits can even be stored for long time in natural conditions that is also helping farmers gradually lessen market pressure on tomato in summer.

A part from adoption of hot-tolerant varieties, in summer season farmers do also apply simple techniques such as using mulch, plastics to cover seedlings in unfavorable conditions as well as taking special cares for their tomatoes in hot and humid condition of summer.

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