

# POTATO PRODUCTION IN VIETNAM

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## **Introduction.**

The potato was first introduced to Vietnam in the late 19<sup>th</sup> century by the French colonialists. It is locally known as “khoai tây”, which translates to “western root” or “French tuber”. In terms of its importance to national food security and its potential as a staple food crop, the potato ranks third after rice, maize and sweet potato for its high yield potential and nutritional value. As a winter crop, however, the potato is the second most important food crop after maize in the Red River Delta (RRD). At present, some 30,000–35,000 hectares of potatoes are cultivated in the RRD. However, the average yield is only about 12 tons/ha. Nevertheless, there is a common consensus that the potential in terms of both the area cultivated and well as the productivity per hectare, could be greatly improved if better investment can be afforded through improved seed quality and the application of advanced agronomic practices.

This paper is an attempt to briefly describe the current scenario of potato production in Vietnam and to address the major constraints and problems.

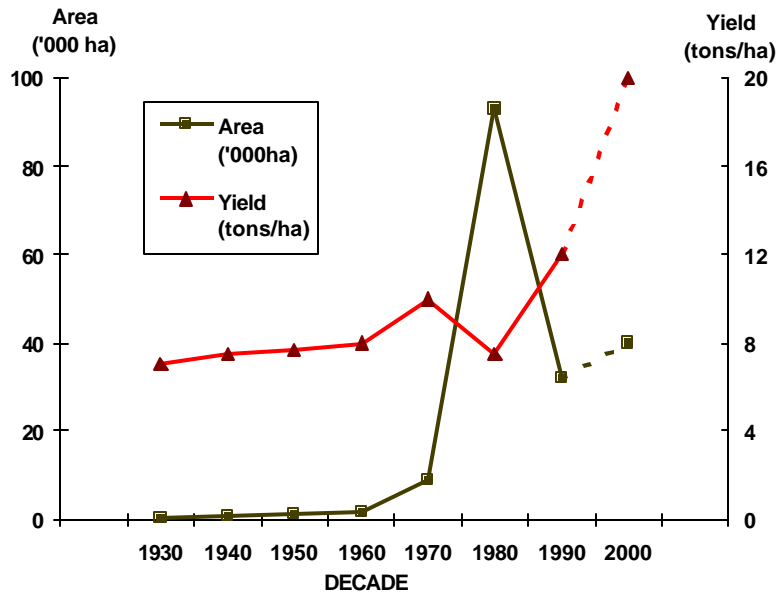
## **Production trend and distribution**

Until the late 1960's, the potato was a minor vegetable crop grown mostly in backyard gardens and/or small upland patches that amounted to no more than 2,000 ha (Figure 1).

However, during the 1970's, an acute food shortage and the need to feed the country's rapidly expanding population, saw the potato elevated to an important food crop. One of the most significant factors facilitating the development of potatoes in the RRD were the changes occurring in the cropping systems after the successful introduction of new short duration rice varieties (both for the spring and summer cropping seasons), which enabled potato to fit into the winter cropping season between the two rice crops. In 1979–1980, the total area in the RRD cropped in potatoes reached a peak of over 93,000 ha. However, since then, the area cultivated declined quickly thereafter and has stabilized at around 30,000 ha.

As over 98 % of the potatoes cultivated in Vietnam are grown in the RRD, the following sections will focus on potato production in the RRD.

**Figure 1. POTATO PRODUCTION IN VIETNAM  
1930 - 2000**



Note: Broken lines indicate projected figures.

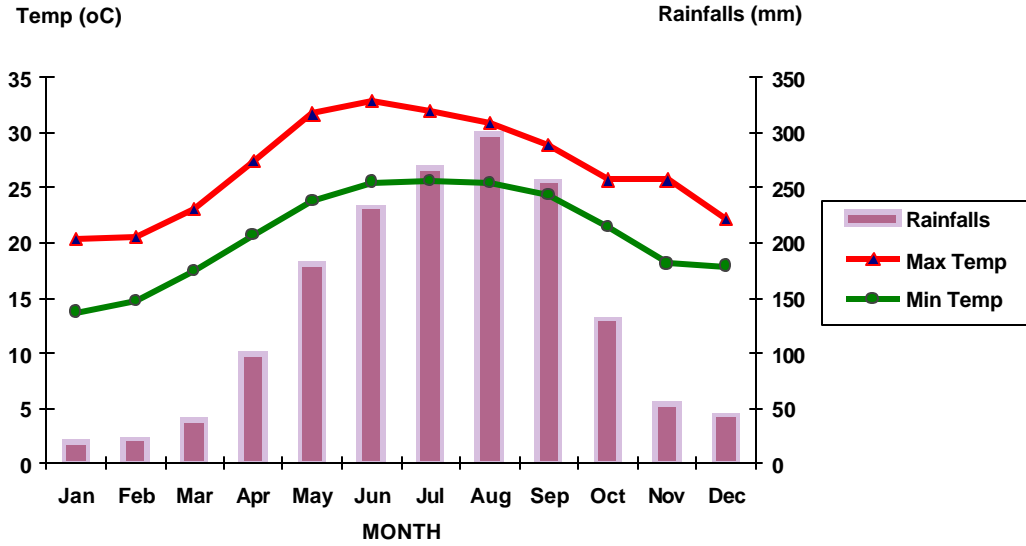
## **Growing conditions and cropping systems.**

### *Planting time and crop duration*

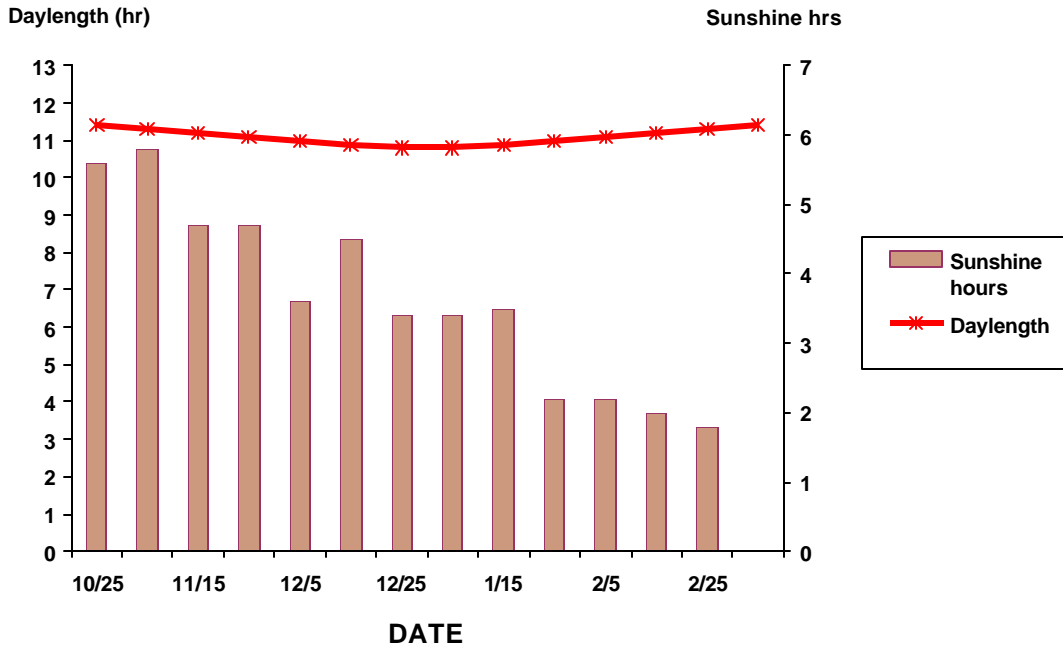
In the RRD, potatoes are grown during the winter season after the summer rice crop, when it is cool, when the heavy rain stops and the rice fields can be prepared. The most suitable planting time for potatoes is during the first half of November. Early plantings may be done in late October. Later plantings are possible during December in the uplands or where a spring rice is not planted, but, in most cases, the potatoes must be harvested and fields available in late January for planting the spring rice crop which is normally transplanted during the first half of February. Therefore, the duration of a typical potato crop in the RRD is usually less than 90 days.

Starting from November, the weather conditions are generally favorable for potato cultivation. Temperatures range from 18-25°C during November and early December which facilitates rapid plant growth after emergence. Lower temperatures and short day conditions (11-12 hrs) during the second half of the season are conducive to rapid tuberization. However, these same conditions are not so favourable for the late plantings in December; the cooler temperatures, coupled with the limited hours of sunshine, tend to limited canopy growth and lead to the onset of rapid tuberization and thus a lower tuber yield. Furthermore, crops planted late December or early January are vulnerable to late blight epidemics that usually occur during February - March (Figures 2 and 3).

**Figure 2. Max, min temperature and fainfalls in the Red River Delta (Hanoi) - Source: Hanoi Meteorological Station**



**Figure 3. Daylength and sunshine hours (20 year mean) during potato growing season in the Red River Delta (Hanoi) Source: Hanoi Meteorological Station**



### *Soil conditions and preparation*

In the RRD, soon after the harvest of the summer rice crop, the soil is ploughed in more or less a wet condition. Under the muddy conditions experienced in the paddy fields, the soil compacts and becomes very cloggy with cultivation. Much effort is then required to reduce the compactness before the potatoes can be planted. Where the soil has a high clay content, it is even more difficult to get the soil properly prepared for planting. Putting some organic matter in the seed bed before planting the seed tuber is a popular practice applied by many farmers to facilitate good emergence. Soil compaction is one of the major constraints limiting yields and tuber size in the RRD.

### *Cropping systems*

In the RRD, most potatoes are cultivated in a cropping system with rice. In this system, the potato is cultivated in winter between the summer and spring rice crops as described in the previous section. In uplands, potato may be cultivated in cropping systems with other spring and summer crops such as corn, mungbean, soya bean, sweet potatoes, vegetables. However, in all cases, the potato remains a winter crop. Typical cropping patterns are: spring corn – mungbean – potato or sweet potato – soya bean – potato.

During the growing season, potatoes are grown in small fields scattered around in patches with fields planted to sweet potato, winter corn and/or other vegetables such as cabbage, tomato, kohlrabi, onion, etc. With potatoes, inter-cropping is not a common practice in the RRD.

## **Common agronomic practices**

### *Fertilizer application*

Manure is normally applied at a rate of 10-15 tonnes/ha before planting. With more compact soils, some ash, rice hulls and/or decomposed rice straw may also be applied to improve soil texture. Liming is applied by some farmers, but is not a popular practice.

Among the chemical fertilizers, urea, super phosphate and potassium chloride or potassium sulfate are the most commonly used. The rates of application in most cases are 100-120 kg N, 80–100 kg P<sub>2</sub>O<sub>5</sub> and 120–150 kg K<sub>2</sub>O per hectare. The use of complex, foliar and micronutrient fertilizers is not common practice among the farmers in the RRD.

### *Irrigation*

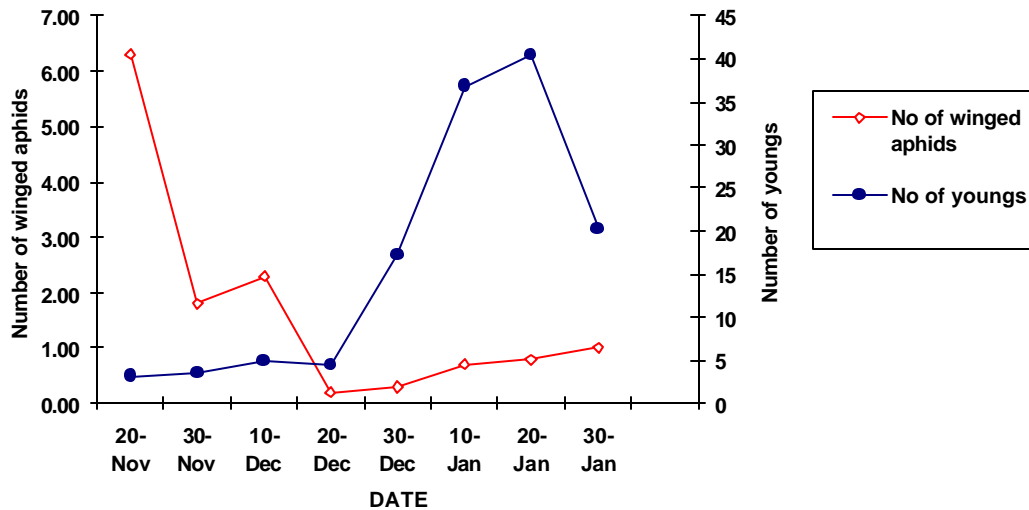
Potato fields are irrigated 2-3 times during the season by furrow irrigation. Water from the canals of the irrigation system of the rice fields is pumped into the furrows and kept there for a day or two for absorption by the soil. Excess water is then withdrawn to let the field dry until the next time, which normally takes place after 2-3 weeks.

## Crop protection

Major diseases and pests that can cause considerable crop losses must be carefully monitored and controlled during the cropping season. Those that are most significant include early and late blights, aphids and mites.

In warm winters, chemical sprays need to be applied soon after emergence and during the early growth stages of the crop to control early blight. A few sprays are needed to protect the crop from infestation by late blight during late December and January, especially during cold and wet winters. Insecticides are sprayed to control aphids and mites which are sometimes plentiful with warm winters. Crops must be monitored immediately after emergence because aphids start to infest very early (Figure 4).

**Figure 4. Green peach aphid population in RRD (Gialoc, Haiduong) during potato growing season 1980 - 81 (Adapted from Viet et al., 1987)**



Owing to the rotation with two rice crops a year, fields are relatively clean. Therefore, except for upland crops, problems with soil pathogens such as bacterial wilt and nematodes do not seem to be so serious. Black scurf or rhizoctonia canker can become important if a particular summer rice field was severely infected with the pathogen and the soil under the potato is kept too wet after emergence. Similarly, bacterial wilt and nematodes may occur if infected seed is used.

## Varieties

Ackersegen has been the traditional variety in the RRD. Introduced by the French, this variety is known locally as "Thuong tin". It has been proven to be well adapted to the growing and storage conditions experienced in the RRD, but it is susceptible to late blight and almost every kind of virus.

Because of the difficulties in obtaining new seed, local seed stocks of Ackersegen have been found to be severely degenerated, due to viral infection. Consequently, yields from this variety have been found to average only 8-9 tonnes per hectare.

Since the early 1970's, a large number of varieties have been introduced through a cooperative project between Vietnam and the Democratic Republic of Germany (GDR). Among these, the varieties, Kardia and Mariella were identified as the best and approved for release in 1979 as Viet Duc 1 and Viet Duc 2, because of their adaptation to the short day conditions and high productivity. These varieties, however, have poor storability under the high ambient temperatures experienced in the RRD. Further, as no viable seed multiplication system has been in operation, they have never been produced at any scale larger than a few dozen hectares.

Later introductions from Europe (Holland, France, Scotland, Germany) and North America (Canada) have seen numerous varieties such as Nicola, Diamant, Liseta, and Provento prove promising. However, these varieties have also encountered similar problems of fast degeneration and poor seed multiplication and supply.

Since the early 1980's, in collaboration with the International Potato Center (CIP), the National Potato Program started a local potato breeding project with the introduction of suitable breeding material from CIP. The major criteria for selection in the RRD has been the adaptation of the material to the short day conditions, early and fast tuber bulking, good storability under high ambient temperatures, resistance to late blight and virus and acceptable eating quality. The varieties P-3, KT-3 and VC 51.6 are among the best clones selected thus far.

### **Seed production and supply**

Vietnam does not yet have a viable system of seed potato production and supply. Consequently, the lack of good quality seed has been considered the most important constraint to improving both the productivity of potato crops and the area of potato crops cultivated in the RRD.

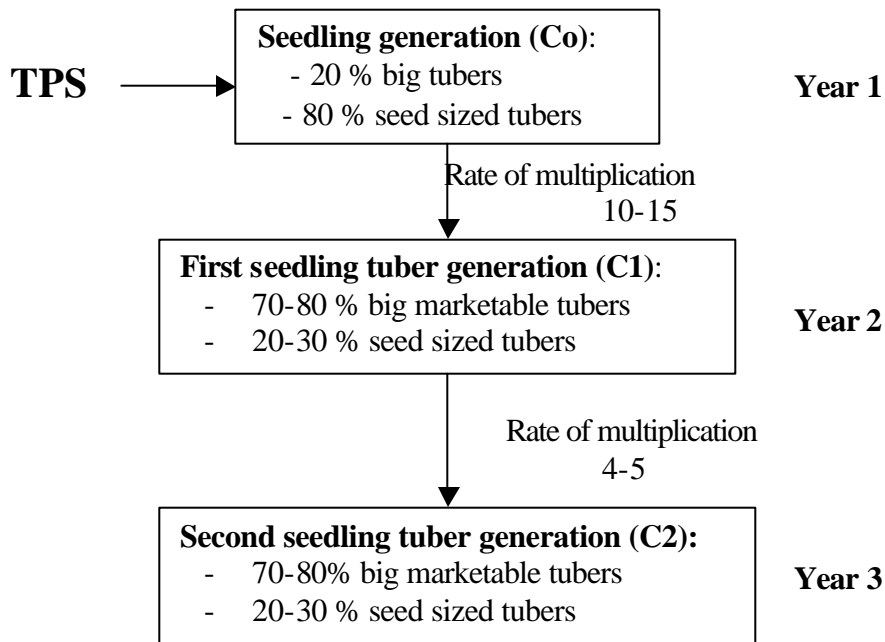
#### *Local multiplication*

There is no registered seed potato producers in Vietnam and, as yet, there is no formal seed certification system. Seed multipliers are farmer-volunteers. Several research institutions such as the Food Crops Research Institute (FCRI) and Vietnam Agricultural Science Institute (VASI), multiply and supply a small amount of good quality seed to the farmers, but the quantity is negligible. In general, most farmers retain and share among themselves, the small sized tubers harvested from the ware crop which are locally regarded as seed tubers. However, this kind of seed is usually degenerated by a variety of viral diseases and plant pathogens.

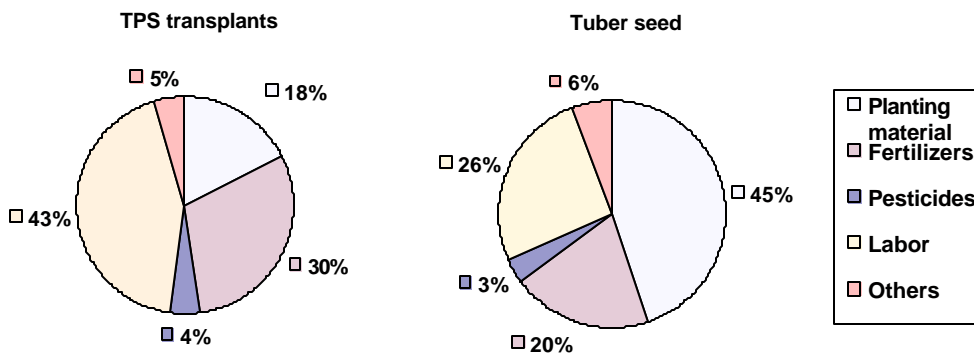
*True Potato Seed (TPS)*

TPS is a promising alternative that suits the current level of production and market demand. The TPS technology has been developed and diffused in the RRD by the FCRI over the last 20 years. With the availability of new CIP hybrid progenies, the area under TPS is presently about 20% of the total (5000–6000 ha). The present use of TPS involves two stages (Figure 5).

**Figure 5. Current method of use of true potato seed for potato production in the RRD**



**Figure 6. Distribution of cost items in potato production using TPS transplants and tuber seed in the RRD**



TPS offers a number of advantages;

- 1) with TPS, there are considerable cost savings on seed transportation and seed storage;
- 2) the cost of initial planting material is significantly cheaper (Figure 6);
- 3) TPS are free of almost all important soil and tuber borne diseases; and
- 4) TPS is the only possible method for a quick renewal of seed lots for large-scale production, which is probably the most attractive advantage under the production circumstances of Vietnam.

However, TPS also has its weaknesses; (i) the tubers lack uniformity; and (ii) the technology is rather labor intensive.

### *Seed import*

Seed imports from Europe (Germany, France and The Netherlands) have been undertaken by several projects since 1975. However, the cost of imported seed remains too high for the vast majority of farmers and the lack of a viable seed multiplication system in-country has proved the major obstacle in further pursuing this alternative. Previous attempts to introduce sophisticated European seed multiplication systems have failed because of both the low level of economic development and ecological conditions.

At present, the Center for Agricultural Technology Application and Development is the only agency officially importing seed from Holland, and only then, because of considerable financial support from a Dutch charity organization. The amount of seed (Class A) imported averages only 100-150 tonnes per year at a cost of VND 10,000 per kg. The agency actively organizes local multiplication and seed distribution among the farmers. After one generation, the seed costs reduces to about VND 5,000 per kg.

During the last few years, a large amount of the so-called "seed potatoes" have been imported from Southern China by various agencies including extension offices, small traders and local seed companies. In 1999, the amount of Chinese seed imported was estimated to be about 10,000 tonnes. However, this seed is little more than the small tubers extracted from the ware crop which might otherwise be used for animal feed. Many seed lots are a mixture of varieties and potentially, there is a high risk of importing a number of diseases and pests including powdery scab or golden cyst nematode. However, the advantage of these "seed tubers" is that they sprout at the right time for planting and are physiologically young and capable of producing a good crop.

With no effective measures for controlling the seed quality available, problems have already been reported with this kind of seed. Crop losses due to rotting and bacterial wilt have been reported in many places. One seed lot comprising more than 30 tonnes was destroyed when it was found to be infected with powdery scab.

## Storage

Most seed potatoes must be stored for 8-9 months from February/March until October under the hot, ambient humid conditions, in diffused light stores (DLS) or household premises. Prolonged storage under such severe conditions causes considerable seed loss and degeneration due to physiological aging. Seed losses may exceed 80% and weight losses of 40-50% are not uncommon, depending on the conditions under which the seed is stored and the particular variety (Table 1).

Table 1. Response of potato varieties to storage in a diffused light store at VASI from February 19 to October 12, 1983. (Adapted from Ho et al., 1987).

Variety	Tuber loss (%)	Weight loss (%)	Sprout per tuber (#)	Sprout length (mm)	Dormancy (month)
Ackersegen	37	30	5.5	10.5	3.7
Mariella	48	24	1.5	15.0	4.3
Kardia	62	31	3.1	16.0	4.0
Bintje	82	38	4.0	15.7	3.3
Atzimba	70	43	3.9	16.7	3.0

Respiration and water loss contribute to the total weight loss, while various diseases and pests are the major cause of the reduction in tuber number. Fusarium dry rots, soft rots, murlu bugs, thrips, mites and rats are the main pests of seed potatoes in diffused light storage.

Cold storage is probably the best method of storing seed potatoes as losses can be minimized and seed pieces kept in a better physiological state for the next planting (Table 2).

Table 2. Effect of seed storage from April 22 to October 12, 1994 under cold store and diffused light store (DLS) conditions on seed loss and the subsequent crop performance of varieties Diamant and Nicola. (Adapted from Hoa et al., 1995).

Variety/storage	Weight loss (%)	Rotten tubers (%)	Days to emergence	# stems/hill	Canopy cover (%)	Yield (tons/ha)	% marketable
Diamant							
- Cold store	4.8	0	11	2.5	78	15.0	81
- DLS	37.3	7.1	9	3.0	75	14.6	59
Nicola							
- Cold store	4.5	0	11	3.0	80	13.9	71
- DLS	30.3	6.1	8.5	3.4	75	13.5	36

Cold stores, however, are still too expensive for most farmers in Vietnam. While some cold stores have been constructed (most of them by research institutions), their total capacity is so small to have any significant influence on the production.

Currently, table potatoes are stored for only a few months in the dark spaces of the farmers home. They must either be consumed or sold when they start sprouting. At this point in time, no research efforts have been directed towards investigating alternative means of storing table potatoes for any long term period.

### **Consumption and marketing.**

Traditionally, Vietnamese people do not eat potatoes. Only if food is scarce will the potato be eaten as a staple food to replace rice. For the sake of national food security, however, potato is strategically considered an important food crop. Nowadays, it is used in most instances as a nutritious vegetable. It is prepared in soups, curries or other Vietnamese recipes. French fries and chips, prepared in restaurants and kitchens, are treated as precious snacks or special dishes at reception dinners and parties. The local market, therefore, is limited until either peoples eating habits can be changed or until such time as processing markets or export markets become available. This situation is probably one of the main reasons limiting the expansion of potato production in the RRD.

In 1998, a small potato chip factory was built in Ho Chi Minh City, but it currently faces problems in obtaining a consistent and reliable supply of raw material as the potato varieties produced locally do not meet the chip processing quality standards. In the past, a number of processing varieties had been introduced and evaluated for adaptation, but none of them has been proven to be suitable for the local production.

Export has been an attractive market and many previous attempts have been made to export potatoes to neighbouring countries. Except for some successful shipments to the former Soviet Union during the early 1980's and a few containers to Singapore in 1997, there has been no significant export of fresh potatoes from Vietnam. Poor product quality as well as plant quarantine regulations are probably the major barriers.

It seems that to meet the quality standards of the processors and the export market, much effort is still required to improve product quality. This would include the use of the right varieties and application of improved agronomic management to ensure high product quality.

As potatoes are harvested in bulk and almost all at the same time, the lack of suitable storage and processing technologies, as well as the unavailability of export markets, contribute to the current oversupply and low prices in the market during January and February.

### **Summary of the production major constraints**

*Lack of quality seed* is probably the most important constraint in attaining an adequate level of production efficiency and profitability. The lack of seed is caused by the absence of *a viable seed multiplication and supply system, a suitable seed storage technology and the very fast degeneration rate of seed lots.*

TPS is an acceptable alternative for the present level of market demand, but TPS cannot satisfy the quality standards of the export and processing markets. An efficient seed multiplication and supply system needs to be developed that should be assured with a continuous supply of initial disease free stocks either imported or produced in-country.

While land potential is still great, the *unavailability of the processing and export market* is a major barrier to further improvement and expansion of production. However, *low levels of agronomic management and inefficient use of production inputs* are also an important obstacle in attaining the product quality necessary to meet those potential markets. These two interrelated problems need to be simultaneously resolved to improve production efficiency and farmer's profitability.

## **References**

Ho, T. V., P. V. Thieu, D. H. Chien, N. T. Thuan & P. Vander Zaag, 1987. Results of seed potato storage experiments in Vietnam during 1983. In: "Potato Research and Development in Vietnam" (A Collaborative Experience from 1982-1987). Ministry of Agric. & Food Industry.

Hoa, N. T., T.T. Hue, T.V. Ho, N. T. Hung, H. Baarveld & J. Brands, 1995. Research results on seed potato storage using a cold store. In: Root Crops Research 1991-1995. VASI. (in Vietnamese).

Viet, N.V., et al., 1987. Mass selection as a means of improving farmer's local seed tubers: results from 1981-1985. In: "Potato Research and Development in Vietnam" (A Collab. Experience from 1982-1987). Ministry of Agric. & Food Industry.