

Introduction, Distribution, Evaluation and Utilization of Potato Germplasm in North China

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1. Implementation period

1986-1989; 1990-1992; 1993-1995; 1996-

2. Project sites

Zhangbei County, Hebei Province
Wumeng, Inner Mongolia
Hohhot, Inner Mongolia
Wuchuan County, Inner Mongolia
Kesan County, Heilongjiang Province
Datong, Shanxi Province
Yanqing, Beijing

3. Project description

• Background

The potato production in North China is very important in terms of the production area, the effects on potato production in China, and the role of potato in the life of the local farmers. The potato planting area, production and yield per unit area are listed in table 1. However, the production level of potato in this region is very low for many reasons. The main constraints in the potato production are the limited rainfall, degeneration caused by viruses and varieties suitable for different uses. The basic information of potato production and rural economy are listed in table 1.

Table 1 The potato production and rural economy in target regions in 1996

Region	Planting area (1000 ha.) %	Total production (1000 ton) %	Yield (ton/hectare)	Farmer income (Yuan/year)
China	3736.3	5299.7	14.18	1926.07
	100	100		
Inner Mongolia	410.4 11.0	602.5 11.4	14.68	1602.34
Shanxi	286.3 7.7	347.5 6.6	12.14	1557.19
Heilongjiang	232.1 6.2	485.0 9.2	20.90	2181.86
Hebei	166.0 4.4	193.5 3.7	11.66	2054.95

Sub-total	1094.8	1628.5
	29.3	30.9

According to main problems in the potato production in North, this sub-project had been established since the establishment of the CIP Liaison Office in Beijing in 1986. From 1986, the title of this sub-project was “Introduction and Utilization of CIP and Other Germplasm for Selection and Breeding Purpose”. From 1989 to 1997, the title of the sub-project was as what we use now and the code of the sub-project was 1311. The sub-project leaders were changed for many times, at first (from 1986 to 1989), Mr. Li Qiwen, from the Potato Institute of Heilongjiang Agricultural Sciences, was the sub-project leader; then (from 1990 to 1995), Prof. Song Bofu was in charge of this sub-project; after then (from 1996 to 1997), Xie Kaiyun was the sub-project leader.

The sub-project had being carried out in North China, such as Heilongjiang Province, Inner Mongolia Autonomous Region, Shanxi Province, Hebei Province and Beijing. The institutes involved this sub-project were the main potato research institutes in the region, such as Potato Institute of Heilongjiang Academy of Agricultural Sciences, Bashang Agricultural Science Research Institute, Wumeng Agricultural Science Research Institute, Potato and Minor Crop Institute of Inner Mongolia Academy of Agricultural Sciences, Datong Highland Crop Institute of Shanxi Academy of Agricultural Sciences.

- **The sub-project target**

- 1) From 1986 to 1989, the objectives of the sub-project title was “Introduction and Utilization of CIP and Other Germplasm for Selection and Breeding Purpose” and the subproject leader was Li Qiwen, who was a researcher from Kesan Potato Institute of Heilongjiang AAS. The subproject targets were: 1). Evaluation for wide adaptability; 2). Evaluation for extremely early maturity and short dormancy; 3) Evaluation for resistant to major virus diseases, late blight and bacterial wilt; 4) Evaluation for high starch and protein content; suitable for processing
- 2) From 1990 to 1995, the sub-project title was “Introduction, Distribution, Evaluation and Utilization of Potato Germplasm in North China” and the subproject leader was Prof. Song Bofu, former Liaison scientist of CIP Office in Beijing. The research targets were: 1). to introduce, distribute and evaluate potato germplasm; 2). To screen potato germplasm for virus resistance (PLRV and PVY); 3). To screen potato germplasm for drought tolerance; 4). To screen TPS progenies for clonal selection Eradicate PSTVd in national breeding program.
- 3) From 1996 to 1997, the sub-project title was still “Introduction, distribution, Evaluation and Utilization of Potato Germplasm in North China” and the subproject was Dr. Xie Kaiyun, research assistant of CIP Liaison Office in Beijing. The research targets were: 1). To introduce, multiply, distribute and evaluate potato germplasm; 2). To screen potato germplasm for virus resistance (PLRV & PVX+PVY); 3). To screen potato germplasm for drought tolerance; 4). To screen potato germplasm for salt tolerance (stop in 1997); 5). To screen potato germplasm for varieties with both desirable characters suitable for processing and LB resistance

- **The methodology of the sub-project**

- 1) The introduction and multiplication of potato germplasm from CIP. The potato germplasm were introduced from CIP to China at the format of TPS, in-vitro plantlets and tubers. The TPS combinations were sent to different locations to get tuber families, then select good clones, up to select some new varieties or some advanced clones for further breeding. In-vitro plantlets and tubers were first multiplied in collaborating institutes and sent to different location for field evaluation.
- 2) Evaluation for virus resistance. Most of the germplasm were introduced as the format of TPS combinations. In some institutes, the seedlings of each combination were inoculated with PLRV, PVX and PVY after the TPS were sowed in the greenhouse, then transplanted to the fields for the observation of symptoms of different viruses. The plants without viral symptoms were selected for the further evaluation. In some institutes, the first step was to get seedlings in the greenhouse; the second step was to transplant the seedlings into field and to inoculate viruses in the field by natural vendors.
- 3) Evaluation for drought tolerance. The trial materials were selected from both China and CIP. In the beginning, RCBD with two replications was adopted and RCBD with three replications was adopted for the regional trial. In the meanwhile, the local adapted varieties were selected as controls. The indices of roots and tops weight, root pulling resistance and canopy were investigated. At harvest, tuber shape, size, commercial rate and yield were evaluated.
- 4) Evaluation for the processing varieties. The materials were introduced at the format of in-vitro plantlets. After multiplied and got tubers in net house, these materials were evaluated in the field. RCBD with three replications was adopted. One local adapted variety and the variety, Atlantic were selected as the control. During the growth season, the symptoms of viruses and the resistance to LB were investigated. At harvest, the tuber shape, size, yield and commercial rate were recorded. After harvest, the chipping trial was done for the sensible evaluation of chip's quality.
- 5) Evaluation for LB resistance in North China. The materials were from the Population B at the format of TPS in 1995 and were also evaluated in Yunnan and in Hubei in the meanwhile. From 1995 to 1996, the evaluation was carried out in Yanqing and moved to Weichang in 1997. Besides the investigation for LB, the resistance to viruses and other agronomic characters were investigated too.

- **Results and impacts**

- 1) Potato germplasm introduced from CIP to China greatly enriched the potato gene bank. From 1978 to 1986, a total of 1606 potato germplasm was introduced into China. From 1987 to 1997, a total of 2286 potato germplasm was introduced. By the end of 1997, a total of 3892 potato germplasm was introduced to China at the format of TPS, in-vitro plantlets or tubers.
- 2) Some germplasm could be directly used in potato production. CIP 24, I-1085 and CFK69.1 are the excellent samples of direct use of CIP germplasm. Of them, CIP24 has being extended to Hebei, Shanxi, Inner Mongolia, Gansu Ningxia and Yunnan. The total planting area is over 2.27 million hectares and more than US\$ 70 million benefit is made from it. Because of its desirable LB resistance, the

planting area of CIP 24 is increasing year by year. Some CIP processing varieties that had been evaluated for several years performed well in the field and showed good chipping quality.

- 3) CIP germplasm could be used as parents for the breeding. Up to now, several new potato varieties with high yield and LB resistance has been bred. They are Zhongshu 2, Kexin 10, Kexin 11, E-potato 1 and Cooperation 88.
- 4) Many new planting materials has been screened out. Up to now, many advanced clones have been selected by different institutes in different locations. They can be divided to LB resistant advanced clones; BW resistant advanced clones; virus resistant advanced clones; and drought tolerance advanced clones
- 5) Potential impacts are great. With the breeding of new varieties and the selection of suitable CIP varieties, the potato yield will be increased remarkably because some constraints such as diseases or drought will be alleviated by the use of new potato germplasm.

- **Problems**

- 1) The management of CIP germplasm introduced to China. The introduction of potato germplasm from CIP is an important work that has been carried out since the beginning of cooperation between CIP and China. Up to now, about 4000 potato germplasm has been introduced to China at the formats of TPS, in-vitro plantlets and tubers. These germplasm have been distributed to many institutes in different regions. It is a hard work to record where these germplasm have distributed, how these germplasm have performed, what results have been gained from these germplasm.
- 2) Uncompleted system of introduction-distribution-evaluation-utilization. After the germplasm introduced to China and distributed to different regions, the most important thing is to choose the suitable method for evaluation. How many years should new varieties be bred from TPS? How many years should CIP varieties be extended to potato production in China? How to choose the suitable controls?
- 3) Information exchange between CIP and China. For Chinese potato scientists, it is most important for them to know what kinds of germplasm can be introduced to China, who can get CIP germplasm, how to get CIP germplasm? For CIP HQ, the most important is to know how CIP germplasm perform in China, what should be sent more to China?
- 4) How to effectively use and conserve the CIP germplasm introduced to China? By the end of 1997, more than 3000 TPS combinations had been introduced to China. If one new variety could be selected from every 100 combinations, we should get 20 to 30 new varieties. In fact, only several new varieties have been selected from the TPS germplasm. In-vitro plantlets are another important source of CIP germplasm introduced to China and more than 600 kinds of in-vitro plantlets have been introduced to China. Where do these materials be conserved? How many are still kept? How about the performance of these germplasm? How many have been extended.

- **Suggestions**

1) Investigate the CIP potato (including sweetpotato, if necessary) germplasm performance in China? Some advanced clones should become new varieties according to the annual progress reports, but there are only several new varieties that have been released. What had happened for the others? Why? So an investigation should be carried out for the better introduction and utilization of CIP germplasm. The following contents should be included:

- How many institutes have CIP germplasm? How much they have?
- The role of the CIP germplasm?
 - new varieties selected or screen out
 - advanced clones have been selected
 - new varieties with CIP germplasm as parents
 - the final results of some CIP germplasm

2) To complete the system of introduction - multiplication - evaluation - utilization for CIP germplasm.

Introduction: should be very purposeful and special people should be responsible for them from the beginning to the end.

TPS: distribute to different sub-projects or institutes, to trace their progresses

In-vitro plantlets and minitubers: keep in CIP Yanqing Experimental Station

Multiplication

- To multiply in laboratory as soon as they arrive in China
- To transplant them into net-house and harvest tubers

Evaluation: (the controls should keep the same generation with the CIP germplasm)

- Primary evaluation
1st year, 2nd year
- Regional trial
3rd year, 4th year
- Demonstrative trial
5th year

Utilization

- Multiplication of planting materials
5th year
- Extension
6th year

3) Enhance the cooperation between Chinese potato scientists and CIP scientist?

China is one of the largest potato production countries in the world. However, it is not the original place of potatoes and it is short of potato germplasm. This is why the potato breeding progress in China is very slow. Scientists and breeders need the germplasm supports from CIP. What are they doing in CIP? What are they doing in China? How to combine the national research programs with CIP research project in China, especially in potato germplasm?

4. Project documents

- 1) Scientific papers published in Journals both in English and in Chinese
- 2) Scientific papers for national and international conferences
- 3) Annual progress reports every year

5. The sub-project leaders and colleagues

Name	Sex	Title	Institute
Li Qiwen	Male	Associate Prof.	Kesan Potato Research Institute
Song Bofu	Male	Professor	VFI of CAAS
Xie Kaiyun	Male	Assistant Prof.	CIP Liaison Office in Beijing
Shi Juntang	Male	Associate Prof.	Wumeng Agricultural Research Institute
Gao Zhanwang	Male	Senior Agronomist	Bashang Agricultural Research Institute
Ma Hui	Male	Assis. Agronomist	Bashang Agricultural Research Institute
Li Jiuchang	Male	Associate Prof.	Datong Highland Crop Institute
Gong Xoufeng	Female	Associate Prof.	Potato & Minor Crop Insti, Inner Mongolia
Yang Haiying	Male	Associate Prof.	Potato & Minor Crop Insti, Inner Mongolia

