



## SDC SWISS AGENCY FOR DEVELOPMENT AND COOPERATION – EAST ASIA DIVISION

## EDITORIAL

*The Asia Briefing Paper Series aims at informing development practitioners and the (Swiss) public about new developments, results and impacts of Swiss development cooperation in Asia. It shall particularly highlight past and present efforts to achieve aid effectiveness through partnerships among Swiss agencies and with local partners. Discussion and learning from these experiences shall further enhance our motivation and efforts to halve poverty in Asia by 2015.*

*Walter Meyer, Head East Asia Division*

RESULTS OF THE SWISS PARTNERSHIPS WITH  
ASIAN POTATO PRODUCERS

Switzerland recognized the potential of potato improvement for development in Asia in the 1970s. It therefore initiated partnerships supporting the national potato sector in various countries. The lack of healthy seed and appropriate varieties were identified as major constraints. The Swiss partnerships with potato programs in Nepal, Mongolia, the Democratic People's Republic of Korea (the DPR Korea), and Bhutan built on the potential of this crop to improve food security and generate income, especially for small farmers in remote areas. In these four low-income countries together, potato production has increased from 640'000 tons in the 1960s to 4.2 million tons in 2006 (FAO). For example, in Bhutan's Bumthang district, a potato growing area where the Swiss partnership was active for several years, the income from potato production was CHF 360 per household in the year 2000 and made up about one-quarter of total household income.

The introduction of new varieties combined with better seed quality doubled yields in Mongolia and tripled yields in Nepal. Particularly in remote areas, it was important to complement efforts on seed quality and improved varieties with interventions in the policies on environment and marketing, along with improvements in production techniques. Potato production can be harmful to the environment, as it is highly susceptible to erosion and demanding in terms of crop protection. Therefore, efforts of the potato partnerships to minimize any potential damage of the expanding potato production to the environment were crucial to making improvements sustainable. Crop diversification, advocating intercropping, developing proper crop rotations, resistance breeding, and training in integrated crop management were the means used to achieve this.

In the Swiss partnership countries, the potato production has made impressive progress: In Nepal, potato production has increased more than six times since 1970s; and in Bhutan, even by a factor 20 since the 1960s. The potato sector is recovering after a collapse in the early 1990s in Mongolia. The DPR Korean government's commitment to potato cultivation led to a 275% increase in per capita consumption within 10 years.



*Farmers in Nepal discussing yields of new potato varieties*

Having partnerships in different countries made it possible to learn lessons regarding potato seed improvement within and across the different countries. Rather than building comprehensive seed schemes providing large quantities of seed potatoes, a few central units are promoted that produce small quantities of excellent seed. This seed is then injected at strategic points into existing seed flows. This way the distribution of potato seed among farmers and/or into newly established, decentralized seed production groups, required minimal outside intervention and sustainable potato seed systems could be built up.

The Swiss partnerships on potatoes had a significant impact and made a substantial contribution to alleviating poverty. This is shown by countrywide increases in potato yields, the expansion of the potato production area, and qualitative indicators such as better housing in Bhutan, increased market participation of small farmers in the mountains of Nepal, the emergence of thousands of new, smallest-scale potato growers in Mongolia, and a fourfold higher production in the DPR Korea. This was achieved through creating or strengthening national institutions working on potatoes and linking them effectively with other development actors (development agencies, NGOs, international research institutions, etc.). Of course the context of such successes was favourable, as the Swiss interventions coincided with a time of dramatic increases in potato production throughout the entire continent.

Post-harvest aspects, such as processing and marketing, were primarily addressed for seed potatoes. Considerable potential still exists for improvements in the consumer potato value chain. Such improvements in processing, packaging and marketing can benefit poor producers, consumers, and intermediaries, and are currently being addressed by the Swiss partnership in Mongolia.

# SIX-FOLD INCREASE OF POTATO PRODUCTION

## POTATOES – A CROP HEADING EAST

Potatoes have been the most important staple in Europe and North America over the last two centuries. Also cultivated in most Asian countries, potatoes have never reached the importance of rice. Still, production has tremendously increased over the past 40 years, from 20 million tons in the early 1960s to almost 120 million tons in 2001-03 (Figure 1). Asia presently consumes almost half of the world potato supply, even if this leaves per capita consumption at a rather modest level – at 25 kg compared to the world average of 34 kg. Almost a third of all potatoes produced worldwide are harvested in China and India.

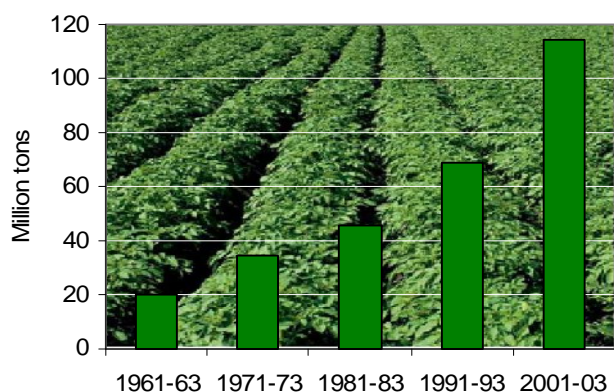


Figure 1: Development of potato production in Asia between 1961 and 2003 (source: FAO)

Potatoes are comparatively more important in some smaller countries. In Mongolia, Bhutan, Nepal and the DPR Korea, the consumption is significantly higher than the Asian average (Figure 2). This is largely due to the cool climate prevailing in parts of those countries where rice cannot be cultivated.

While potatoes were seen as the “food for the poor” in Europe, their consumption increased with the growth of income in Asia. Swiss Partnerships for potato improvement have contributed to both food security and poverty alleviation in the four Asian countries mentioned above. Today, potatoes are crucial for food security in the DPR Korea. Potatoes are often the best-suited crop in the harsh climatic conditions of the high altitudes in Nepal and Bhutan. Thanks to their high content in vitamin C and good quality protein, potatoes contribute to a more balanced diet.

The first promising results of the Nepali - Swiss partnership (1974 to 2001), where healthy seed of new potato varieties yielding three to four times more than the farmers’ own seed in the Nepalese mountains, encouraged Swiss development cooperation to start a similar initiative in Bhutan (1981 to 1994). The Swiss partnerships with the DPR Korea (1997 to 2004) and Mongolia (since 2004) built on experiences in the Himalayas and the Andes. The four countries asked for support in establishing and strengthening their national potato programs. The Swiss partnerships succeeded in establishing effective links to the International Potato Centre (CIP, Lima, Peru) and to potato research centres in neighbouring Asian as well as

European and American countries. Presently, the national partners in Bhutan, the DPR Korea, Mongolia and Nepal are successfully addressing newly emerging problems and opportunities on their own or in international networks, an impressive example of institutional empowerment. While the nature of the Swiss partnerships has changed over time, the focus has remained the same: supporting seed supply systems that provide quality seed to farmers, and improving cultivation methods to ensure sustainable production over time.

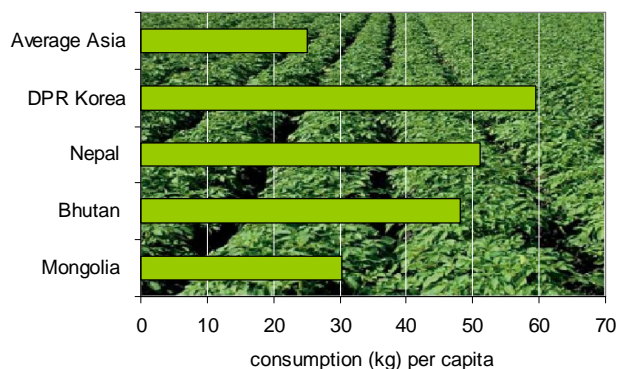


Figure 2: Annual per capita potato consumption in Mongolia, Bhutan, Nepal and the DPR Korea in 2005 (source: FAO)

Swiss partnership investments into potato research and extension triggered country-wide yield increases (144% in Nepal, 66% in Bhutan according to FAO). Higher yields made potato cultivation more profitable and led farmers to expand the area under potato cultivation (198% in Nepal, 275% in the DPR Korea). As Ram Chandra Adhikari of the Nepal Potato Program put it: “Our arable land cannot be expanded any more. The only way to further increase agricultural production is to grow high productivity crops like potatoes, especially interesting in the hills and mountains.”



Potato harvest in the DPR Korea

# POTATOES IN ASIA'S COOL REGIONS

## NEPAL – THE FOOD SECURITY CROP IN THE HILLS

Potatoes were mentioned for the first time in Nepal in 1793, but remained a minor crop until the 1960s. From 1980 on, potato production increased from about 300'000 to almost 2 million tons in 2006. The potato has become the second staple food crop in Nepal (after rice) in terms of per capita consumption, which reached 51 kg in 2006. Potatoes are grown in a wide range of altitudes, from the lowland Terai, to 4000 m above sea level. In the cool high hill areas (1800 to 3000 m), the potato is more productive than rice or maize. Here, seed is also produced for sale to those living in lower altitudes. The crop is grown predominantly by small farmers. Of the 150'000 hectares of potatoes in Nepal, 20% are grown in the high hills, 50% in the mid-hills, and 30% in the Terai.

The Nepali - Swiss partnership was crucial for the creation of a national potato program. Staff of the Integrated Hill Development Project (a Swiss partnership aimed at general development from 1974-1990) established contacts with Mexican potato breeders to try their new varieties. The idea was to find varieties tolerant to late blight and to start the production of healthy seed with this new material. Farmers in Nepal had not renewed their seed stocks for a long time; therefore, the local seed was expected to be highly contaminated with seed-borne diseases.



Results of variety tests in Nepal: From top left, Clivia and Désirée (Europe), Kufri Jyoti (India), Local white, Local Red (Nepal) and Rosita (Mexico)

The best clones from Mexico also happened to be tolerant to wart and hail, two further problems important for Nepal's highland growers. They yielded 3 to 4 times as much as the local varieties. Nepal's Ministry of Agriculture asked the International Potato Center CIP (Centro Internacional de la Papa in Lima, Peru) and Switzerland to support the development of a potato program focusing on variety development, seed production and extension. Presently, several varieties introduced from India, Latin America, and Europe make up the lion's share of production. The first Mexican varieties are still grown by small farmers in the high hills, although they have not officially been released.

### The virtues of the small brown tubers

Potatoes produce the highest amounts of edible energy and cash revenue per hectare and day among all basic food crops. As they grow and mature quickly, they can cope well with the harsh environment of mountainous or cool climates, producing stable yields even under adverse conditions. Small farmers can grow potatoes with virtually no equipment. In cool areas, potatoes often complement rice, maize or wheat as main staples. In the lowland tropics, potatoes are a hardy vegetable or even a luxury food. One medium-size tuber provides half the daily vitamin C requirement and the protein quality is comparable to that of milk.

### ... and their vices

Potatoes are susceptible to a number of diseases and pests. The most devastating worldwide is late blight (*Phytophthora infestans*), a fungal disease first destroying the foliage and later infecting the tubers, leading to rot. Late blight, if unchecked, may completely destroy a crop. It caused severe famines in Ireland in the 1850s.

The Nepali - Swiss partnership increasingly focused on collaboration with women in seed production and small-scale cultivation of potatoes as men migrated from the hills to urban centres in search of jobs. Women are deriving additional income from rural markets and from home processing of smallest grade potatoes for curries and snacks. The boom of potato production in the highlands for sale countrywide was facilitated by the construction of new roads and bridges in the 1980s (see Asia Briefs on Trail Bridges and on Roads, [www.deza.ch](http://www.deza.ch)). Trading centres emerged, which later developed into market outlets for vegetables. In the Terai, potato production has triggered private investment; about 20 large-scale cold stores were built over the past 20 years for ware and seed potatoes.

## BHUTAN – THE FIRST CASH AND EXPORT CROP

In the Bumthang district, the heart of the Himalayan kingdom of Bhutan, a lot of new farmhouses were built, often having glass windows and a modern "bukari" (wood oven) – two distinct signs of wealth. Local people say that these mainly belong to potato farmers. Before the 1960s, potatoes were produced in small areas and for home consumption only. The economy of Bhutan was mostly based on bartering dairy products, yak meat and buckwheat against handicrafts and rice. The situation changed when, in the early 1960s, the first roads were constructed, opening the way to markets on the southern border with Assam and West Bengal. Farmers living close to these roads could sell their potatoes and rapidly expanded their area, as Indian traders were eager to buy Bhutanese potatoes, even at high prices. For the small-scale farmers, on average growing less than 0.4 ha of potatoes, living in a hilly, difficult-to-access country, potatoes were the first crop that allowed them to generate a cash income and to participate in the cash economy.

Potatoes exported to India are not only appreciated as food - preferred as off-season fresh produce over the cold-stored Indian potatoes - but are also used as seed since the tubers grown above 2000m are healthy and of

high quality. Potatoes from the highlands can thus fetch higher prices than cold-stored Indian potatoes. This exceptionally good marketing opportunity makes potatoes an important cash crop for Bhutanese farmers, who sell more than 70% of their production - one-fifth for local consumption and four-fifths for export. Today, an estimated 11'000 households annually produce approx. 60'000 tons of potatoes on about 3'800 ha. With the potato farm gate price from 2007, this corresponds to a total value of CHF 19 million or about 2% of the Bhutanese Gross Domestic Product (GDP).



*Trucks waiting for unloading in the auction yard of Phuntsholing at the border to India. 70-80% of Bhutan's potatoes dedicated for export are traded here*

The Bhutan-Swiss partnership helped to make this opportunity pay off for small highland farmers. It developed sustainable potato cultivation techniques and established a seed-supply system, offering farmers a reliable source of healthy (basic) seed and introducing new, well adapted varieties. But basically, it built on a development triggered by a new market opportunity, which the farmers took into their own hands.



*Preparing Desiree seed for planting in Durguri (Jalpaiguri district, India). Good quality potato seed is precious; cutting potatoes is therefore a common practice to save seed.*

With the increase of production, home consumption of potatoes also steadily increased, adding many nutritious dishes like "kewa datzi" to the Bhutanese kitchen. Within 30 years, home consumption increased from an estimated

5 kg per person per year to more than 40 kg today. Potatoes are now the most popular vegetable in Bhutan (rice being the staple food) besides chilli.

### DPR KOREA – THE NATIONAL PRIORITY CROP

In the DPR Korea, several natural disasters in 1995 triggered an acute famine. This caused the government to ask for humanitarian aid and later for development cooperation as well, including potato production. To improve food self-sufficiency, the government declared potatoes a national priority in 1999, aiming at an area expansion from 50'000 ha to 200'000 ha within a few years. As agricultural production in the DPR Korea follows central planning and is organized in large state or cooperative farms, a potato area of 190'000 ha was already reached in 2006 and per capita consumption had increased from 16 kg (1993) to 60 kg. Even though this corresponds to only 6% of the energy and 9% of the protein related to human consumption, it is an important contribution to food security. This rapid intensification also had some negative aspects such as depleted soils and erosion problems. Moreover, yields remained low in many areas due to a lack of fertilizer and pesticides, and the absence of healthy seed potatoes.

The DPR Korean-Swiss partnership joined the efforts of the DPR Korean government to improve potato seed and cultivation methods as a contribution to solving the food shortage in the country. Daehongdan (Ryanggang Province) in the north of the country, an area where seed potatoes were traditionally produced, was chosen as pilot-area. The climate for potato production in this province is harsh; continental summers alternate with cold winters, the frost-free period often being less than 120 days.



*The DPR Korean-Swiss partnership introduced simple, but effective storage techniques*

The DPR Korean-Swiss partnership had considerable impact on crop management and yields. Starting out with in-kind contributions of machines and healthy potato seed, it introduced new management and post-harvest methods (storage and starch-processing), and trained local staff in seed production and multiplication techniques. The impact in the pilot-area was tremendous: yields quadrupled and remained at a high level (40 t/ha). The new storage facilities introduced by the project presently serve as prototypes for the construction of further stores. There is potential for up-scaling this success to at least 25% of the DPR Korea's potato area, which could increase production by another 500'000 tons.

In the south of the country, spring potatoes are now grown before planting rice in summer. The early potato harvest in June helps to bridge the food gap before the harvest of rice and maize in autumn. A collaborative breeding effort with the CIP International Potato Center identified new varieties for spring planting and is presently targeting late blight.



*In-vitro lab in the DPR Korea: This method allows rapid multiplication of pathogen-free seed and promising varieties*

### **MONGOLIA – THE SMALL FARMERS CROP**

Mongolia used to be an important potato producer with a production rising from 20'000 tons in the 1960s to 120'000 in the 1980s. However, during Mongolia's transition to a market economy in the 1990s, the country passed from a net exporter (mainly to Siberia) to importing about 40% of its potatoes from China. The use of fertilizers declined drastically with yields dropping as a consequence. Large production units disappeared and instead about 35'000 small-scale potato producers emerged. Potatoes became a small farmers crop and an important strategy for rural poor to make a living. Families (often ex-herders who had lost their animals due to natural disasters) could obtain up to 0.5 ha of cropland to grow potatoes and vegetables, and thus started making a living from cropping. Seed stocks were no longer renewed during the 1990s and the production technologies applied during the centrally-planned era - relying heavily on external inputs - were no longer useful for small-scale growing. Potato production dropped to 50 thousand tons in the 1990s.

In 2004, a Mongolian-Swiss partnership was launched to revitalise the potato sector in Mongolia. The approach was to work with a broad range of local stakeholders and help them to link with expertise of the CIP International Potato Center, China, and Western countries with similar ecologies. The first focus was on producing healthy seed stocks and evaluating varieties from Europe and North America. In 2007, Mongolia boasted 500 tons of basic seed of three new varieties. In farmer fields, these potatoes yielded about 90 % more than conventional seed. One variety, Impala, was very popular among consumers. The new seed is expected to increase production by 25'000 tons of ware potatoes by 2010, enough to satisfy the needs of half a million consumers. Presently, the program focuses on optimizing the ways in which small farmers can best make use of high quality seed, develop appropriate production methods, and link to more efficient value chains. Prospects are good for finding seed utilization strategies allowing Mongolian potato growers to reap the benefits of healthy seed of new varieties with minimal additional costs of 10 US\$ per ha.



*The challenge for large growers in Mongolia: Fertilizer and quality seed supply collapsed, "You have to plant what you get."*

In the capital Ulaanbaatar, the 1.2 million inhabitants eat 80 kg of potatoes per person and year, which is far above the national average of 30 kg. For them, potatoes are an important staple. Consumption patterns in rural areas are more diverse. Herders, for instance, eat little potatoes during the long winters, as they cannot store them in their yurts (where they would freeze), and regular supply is hampered by large distances and winter conditions. With the newly emerging small-scale growers, there is a potential for decentralized, small-scale potato value chains targeting herders and allowing them to better balance their meat-heavy diet.

The Mongolian-Swiss partnership was initiated to cope with the breakdown of the potato sector following Mongolia's transition to a market economy. First results are encouraging, not only inverting the downward trend of production, acreage and yields, but also achieving this in a more sustainable manner. The partnership has facilitated the transition of the potato from a large-scale, highly mechanized commodity to a small farmer crop for home consumption and income generation in a highly dynamic – and impoverished – society.



*Taking stock: Preparing seed for planting; equipment for large scale production is no longer functional*

# POTATO SEED AS AN ENTRY POINT

In Nepal, Bhutan, Mongolia and the DPR Korea, Swiss partnerships focused on improving the different aspects of seed quality. High quality seed is healthy (low contamination with viral, bacterial and fungal diseases and nematodes), germinates well, and has high varietal purity (see box). Presently, all four countries rely on in-vitro multiplication to produce pathogen-free seed stocks. This and several other seed system innovations were tested and implemented in close collaboration with the CIP. Important lessons were learned along the process.

The Nepali-Swiss partnership is a good example. In the beginning, it aimed at massive seed production, attempting to satisfy the high demand of potato seed in the Terai, where farmers buy seed every year. Farmers were trained and supervised in seed production, storage and marketing. Yet, quality control, handling and marketing of big volumes was very expensive and had to be subsidized. This approach was not economically sustainable and therefore abandoned.

In the 1990s, the Nepali-Swiss partnership started to support farmer groups throughout the country in producing seed. Farmers multiplied improved pre-basic seed 3 to 6 times before selling it to ware potato producers in their locality. The quality seed they produced yielded on average 90% more than farmers' seed of the same variety.

Pre-basic seed is expensive (10-20 US\$ per kg), but after several field multiplications, production costs per kilo fall within a reasonable range (30 to 100% above the ware potato prices). Therefore, the Mongolian-Swiss partnership multiplies the centrally produced mini-tubers over three years with a few formal multipliers. Only then is the resulting basic seed channelled to about 200 decentralized informal multipliers.

The lesson learned in Asia and the Andes was that government interventions are most successful if they limit themselves to supporting central units producing small volumes of high quality seed, which can then be injected into farmer-organized seed systems – existing or new. Here, quality control and planning are best left to farmers and to market forces. Attempts to control and certify quality (e.g., in Nepal in the 1980s) were found ineffective and impracticable.

This practical approach makes it difficult to assess the specific effect of seed improvement as volumes and prices handled by farmer multipliers are largely unknown and the yield advantages of quality seed vary widely as a function of sites, varieties, and farmers, (e.g., ranging from a few percent, to 220% in Nepal). In Mongolia, Bhutan and the DPR Korea, data on yield advantage due to healthy seed alone is scarce.

But there is more to healthy seed than just higher yields as potato seed may carry diseases that survive in the soil for many years (see box). In Nepal, new areas were infected with bacterial wilt and wart in the 1980s, probably because of unofficial movements of seed from one area to another. The partnerships avoided this risk by only moving seed completely free of diseases over larger distances. Once the seed is in the hands of farmers, it will

move along local, time-proven flow paths, and hence the risk of soil contamination with new diseases is limited.

Seed production is closely linked with testing and introducing new varieties. New varieties are usually brought into the country as pathogen-free tubers or in-vitro plants. To have enough material of each variety for testing, multiplication is needed. In order to avoid contamination, this is done in disease-free areas. Here, the seed schemes established in the context of the Swiss partnerships come into play once again. New varieties can be tested and then introduced quickly and safely. The International Potato Center, CIP, was again crucial to providing or facilitating a wide range of varieties to all four countries.

## Potato seed – no peanuts

To plant one hectare of potatoes takes about two tons of seed tubers (as opposed to about 100 kg of rice seed). These tubers may carry diseases, spoil during storage, or get damaged during transportation. The large volume required makes not only the seed tubers themselves, but also their storage and transport expensive. In developing countries, potato seed may make up half the production costs.

Farmers therefore try to save costs by using small tubers from their own harvest as seed, since these small tubers are less valued in the market. If farmers use their own seed stocks for many years, diseases may accumulate in the seed. Several viruses and bacterial wilt represent the most important diseases causing seed “degeneration”, as every year a higher percentage of the seed tubers is infected. As a consequence, yields decline. Farmers are well aware of this and often react by obtaining seed from higher altitudes or other locations famous for their seed quality, where the spread of these diseases is slower. Unfortunately, infected tubers do not look different from healthy ones.

Therefore, most seed-quality improvement programs rely on initially healthy seed stocks produced by tissue culture labs. Central units multiply pathogen-free potatoes in-vitro and produce a few hundred thousand mini-tubers in greenhouses, the so-called “pre-basic seed”, which must be completely free from disease. These small, valuable tubers are then multiplied over several years in the field. Here it is crucial to minimise re-contamination of the seed with diseases, e.g., by growing it in high altitudes or in isolated areas, maintaining good crop rotations, and eliminating the plants that show disease symptoms.



*In-vitro multiplication is used in all four countries*

# CHECKING THE ENVIRONMENTAL RISKS OF POTATO PRODUCTION

The Swiss partnerships put high priority on checking the environmental risks associated with potato cultivation. Due to intensive tillage, erosion may be considerable. Late blight often makes the use of fungicides necessary in commercial production in order to avoid severe yield losses. The threat of diseases increases with the share of potatoes in the rotation, as soil-borne diseases are likely to spread and negatively affect yields in the long run.

However, one objective of introducing new varieties is to increase yields and save pesticide costs through varieties that are more tolerant or resistant to the most detrimental diseases prevalent in a given region. In Nepal, the introduction of late blight tolerant cultivars has significantly reduced the use of pesticides compared to local cultivars. The program also established Farmer Field Schools, where farmers learned about integrated crop management and careful use of fungicides, thus further reducing the negative environmental impact. In Mongolia, where input markets had collapsed, the Mongolian-Swiss partnership succeeded in replacing harmful pesticides with environment-friendly products. In the DPR Korea, a large share of the quadrupled yields was due to the control of late blight with fungicides. In the Swiss partnership pilot region, field workers were trained in integrated crop management, which resulted in a cautious use of fungicides with minimum negative impact on the environment.

Another reason for low yields in the DPR Korea's hilly north was the high share of potatoes in the cropping pattern, causing heavy infestation with soil-borne diseases strongly affecting the production. Hence, one of the first and most important changes introduced in the DPR Korea was crop rotation. The higher yields increased total potato production, while potato cultivation could be reduced on less suitable land.

Due to intensive tillage, potato fields are susceptible to soil erosion, particularly in hilly areas like in Bhutan, Nepal or the DPR Korea. In Bhutan and Nepal, potato production almost entirely relies on small-scale farmers with small plots, a plot structure which is more lightly to prevent erosion than large fields. Farmers plant their potatoes in ridges running across the slope, which slows down water runoff. The Swiss partnerships further promoted erosion control and soil fertility enhancement through: contour terracing (Nepal), hedgerows (Nepal, the DPR Korea), the introduction of green manures in the rotation, less erosion-prone crops on steep slopes, and by diversifying the crop portfolio in general (the DPR Korea). Particularly in Bhutan, legumes in the rotation and the use of farm-yard manure helped to enhance soil fertility and to balance the risks of solely mineral fertilization.

Economically profitable potato production may lead to drastic area expansion. Some farmers in Bhutan planted up to 80% of their arable land with potatoes. Yet, intercropping limits the risks of such poor rotations. 60% of the potatoes are intercropped with maize in Eastern Nepal. In the DPR Korea, intercropping is emerging in some regions as a means of managing the negative effects of potato-heavy rotations.



*Potatoes intercropped with maize, Bhutan*

Potatoes reached Asia via Europe, where the farmers' selection during early introduction strongly narrowed the potato's genetic base. Thus, even if many different varieties were grown traditionally in Nepal, they were all genetically closely related. Over the past 40 years, a large array of varieties from Latin America has been tested in Asia. Although many of these varieties were never officially released, farmers picked them up and continue to plant them. Hence, even though farmers replaced many of their local varieties with a few very successful new ones, paradoxically they may actually have broadened the genetic diversity of the crop.

Potato intensification and expansion in the four Swiss partnership countries, allowed for a spectacular increase in production, but inevitably augmented the potential of a negative impact on the environment. However, the specific contribution of Swiss partnerships was to create favourable conditions for the production of additional food at the lowest possible cost to the environment.

# POTATOES AGAINST POVERTY

Potatoes are a typical small farmers crop, making maximum use of limited land to produce food and income. The Nepali-Swiss partnership was able to boost agricultural productivity in the high hills of Nepal, making potatoes the most important staple and cash crop for small farmers. Another impressive example of the potential of potatoes for small farmers comes from a rather large grower in Mongolia, Yundenbat Sarantuya, a seed multiplier of the Mongolian-Swiss partnership. She grows 17 ha of potatoes, employing dozens of workers to do all the cultivation by hand. "It is more profitable to plant, weed, hill-up and harvest by hand as machinery is expensive to rent and less reliable", she says. This explains why thousands of ex-herders in Mongolia were able to start to make a living by cultivating potatoes and vegetables, basically from scratch and at very small scale, over the past few years. In the Gobi area, a family may grow potatoes on a few dozen square meters, harvesting just two bags to upgrade their diet.

In Bhutan's marginal high-altitude areas where rice production is not possible, potatoes offered an opportunity to generate income and to improve the diet of the rural population. In fact, the potato producers in Bumthang were among the first farmers in Bhutan to be integrated into a cash economy. While the potato revolution in Bhutan was largely initiated by farmers themselves as a response to new market opportunities, the Bhutan-Swiss partnership helped to enhance its sustainability and to make it work for the poor. The introduction of quality seed and improved cultivation techniques made sure that they could fully take advantage of the potential of potatoes for poverty alleviation.

While potatoes offered new opportunities for the poorest farmers in remote areas in Bhutan, Nepal and Mongolia, change did not come about by itself. The Swiss partnerships were crucial to facilitating technological change, support, and a context conducive to pro-poor development. Long-standing commitments, e.g., 27 years in Nepal, allowed partners to better understand development dynamics and target their interventions to the rural poor.



Hard work - small tubers: The starting point in Nepal, 1973

Potatoes are a reliable basic staple or vegetable for home consumption for smallholder farmers. Besides this, the potato crop has become a major cash income for smallholders in the four Swiss partnership countries. Most potatoes are sold fresh on domestic markets, while a small quantity is used for processed products such as chips, e.g., in Bhutan, or potato starch as in the DPR Korea. Potato starch is used for potato noodle production for domestic consumption or sold on the international market. If the market fails, potatoes can be stored and eaten by the family.

The Swiss partnerships also had a positive impact on potato marketing: increased awareness for quality has led to improved sorting (by variety and tuber size). This was found to be important, for instance, in Mongolian supermarkets. Origin is similarly appreciated in Mongolia, where prices for Mongolian potatoes (0.34 \$/kg) are generally double the price of Chinese, and the Mongolian-Swiss partnership is careful to preserve this market segmentation, to the benefit of producers (income) and consumers (taste).

Potato growers living in localities favourable for seed production have realized additional benefits by selling part of their harvest as seed, in most cases without any certification.

So far, Swiss partnerships with the four countries have mainly focused on production. The partnership with Mongolia now also focuses on the entire potato value chain. Improvements in processing, packaging, and marketing show a huge potential for benefiting the poor consumers, producers, and other value-chain stakeholders.



Bhutanese school children eating potato dishes for lunch. The introduction of the potato was strongly influenced by the schools' feeding of comparatively large numbers of boarding students.

## ABOUT THIS PUBLICATION

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