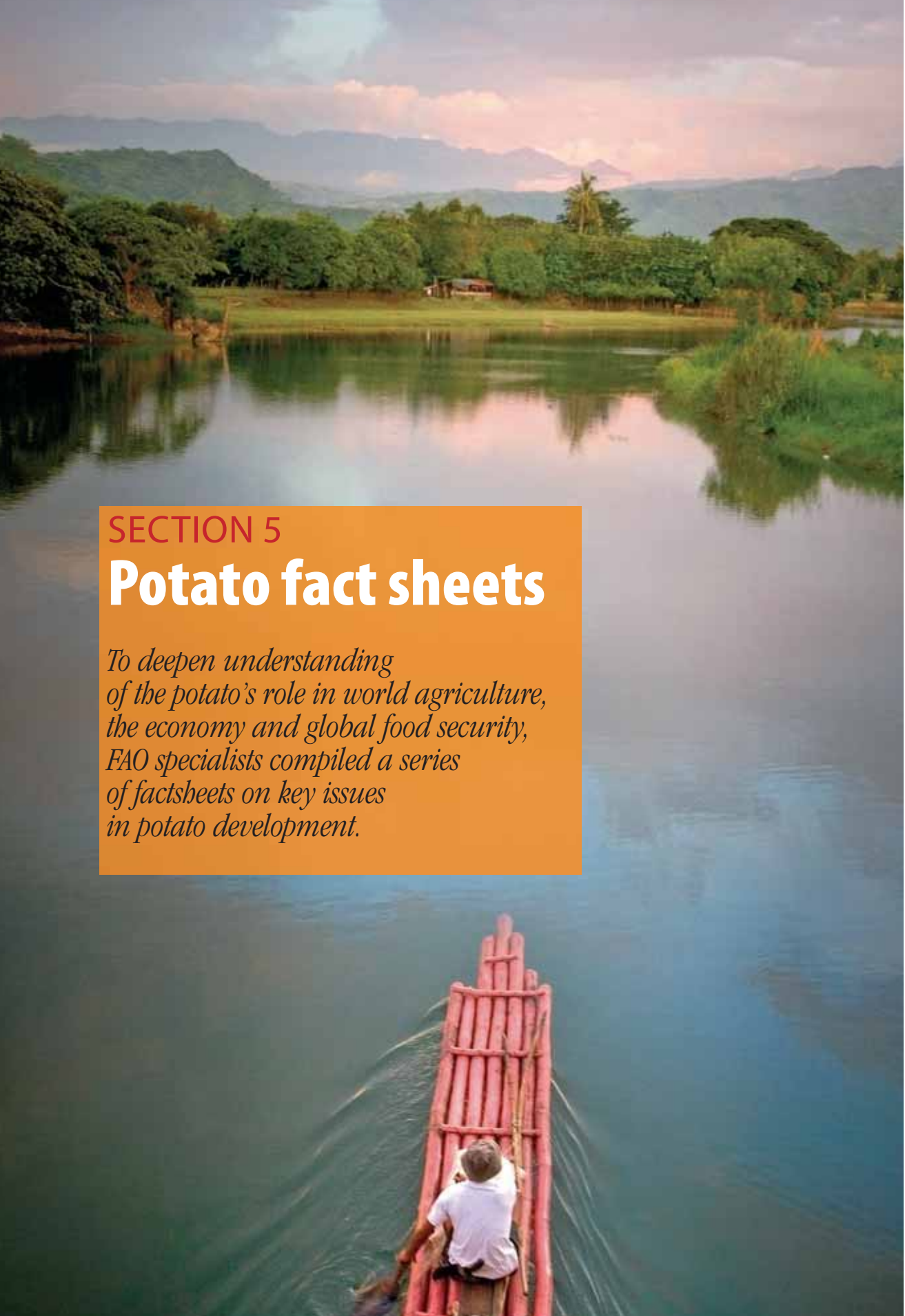

SECTION 5

Potato fact sheets

To deepen understanding of the potato's role in world agriculture, the economy and global food security, FAO specialists compiled a series of factsheets on key issues in potato development.

International Year of the Potato 2008

Potato and biodiversity

By conserving – and utilizing – the potato genetic diversity developed by their ancestors, small farmers in the Andes are helping ensure world food security

Key points

- Potato farming systems need a continuous supply of new varieties drawn from the entire potato gene pool.
- Potato biodiversity is under threat – ancient varieties cultivated for millennia have been lost and wild species are threatened by climate changes.
- Smallholder farming systems in the Andes encourage cross-pollination of potato flowers, vital to sustaining the diversity of local, farmer-developed varieties.
- With CIP support, Andean communities have created a "potato park" holding some 1 200 traditional varieties of potato.

The history of the potato provides a grim warning of the need to maintain genetic diversity in our staple food crops. In the 19th century, Ireland was heavily reliant on only a few varieties of potato, and those types contained no resistance to the devastating disease known as late blight. When late blight destroyed the 1845-1846 potato crop, widespread famine followed. An estimated one million people starved to death and more than a million were forced to migrate abroad.

To combat pests and diseases, increase yields, and sustain production on marginal lands, today's potato-based agricultural systems need a continuous supply of new varieties. That requires access to the entire potato gene pool. But potato biodiversity is under threat: ancient varieties cultivated by Andean peoples for millennia have been lost to diseases, climate change and social upheaval.

Species and crop-associated diversity

While most varieties of potatoes belong to a single species, *Solanum tuberosum*, about 10 other *Solanum* species have been cultivated, and 200 wild species have been recorded. Climate change may threaten the survival of those wild relatives: it is forecast that as many as 12 percent will become extinct as their growing conditions deteriorate. If climate changes drastically, the area where wild potatoes grow naturally could be reduced by as much as 70 percent.

Since potatoes mostly propagate vegetatively, most commercial varieties of potato have a reduced ability to flower and breeders do not select for traits that make the flower attractive to pollinators. However, natural potato pollination remains important to sustaining the diversity of land races (farmer-developed varieties that are adapted to local environmental conditions). Fortunately, the diverse smallholder farming systems in the Andes harbour a variety of flowering plants that do attract pollinators, such as honeybees and bumblebees, which promote cross-pollination of potato flowers, thus increasing seed production and sustaining diversity.

Farmers sort varieties at Peru's "potato park". Photo: © CIP

Centre of origin

In the Andean region, generations of farmers have domesticated thousands of potato varieties. Even today, farmers cultivate up to 50 varieties on their farms. In the biodiversity reserve of the Chiloé archipelago in Chile, local people cultivate about 200 varieties of native potato. They use farming practices transmitted orally by generations of mainly women farmers.

International Treaty

The potato is included in the multilateral system established under FAO's International Treaty on Plant Genetic Resources for Food and Agriculture.

The Treaty, which entered into force in 2004, aims at the conservation and sustainable use of crop plant diversity and the fair and equitable sharing of benefits derived from their use.

Conserving potato biodiversity in the Andes

Having lost many of their traditional potato varieties, Peruvian farmers in the Andes are now taking measures to conserve and sustainably use those that remain. A pact has been signed by six Quechua communities with the International Potato Center that recognizes the rights of the communities over potato strains they have developed.

Under the agreement, the Center's genebank returns potato genetic resources – and knowledge associated with them – to the communities, which have established a "potato park" (*Parque de la papa*) in a conservation area where they grow and manage the plants. This repatriation of biological diversity effectively keeps control of genetic resources local. The 15 000 ha park is a "living library" of potato genetic diversity, holding some 1 200 varieties of potato cultivated in the highlands. A long-term goal is to re-establish all the world's 4 000 known potato varieties in the valley, allowing the park to function as a second centre of origin for this vital staple crop.

Inside CIP's gene bank. Photo: © CIP

Diversity conserved in trust

The International Potato Centre in Peru maintains the world's largest bank of potato germplasm, including some 1 500 samples of about 100 wild species collected in eight Latin American countries, and 3 800 traditional Andean cultivated potatoes. The collection is maintained and managed under the terms of an agreement with the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture and, like all collections eligible for funding from the Global Crop Diversity Trust, is available to plant breeders worldwide upon request.

Credits:
Information provided by the Global Crop Diversity Trust and the Plant Production and Protection Division, FAO.

About IYP 2008

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Production of disease-free seed tubers

A simple, low-cost technology can help developing countries produce the healthy seed tubers farmers need for sustainable potato production

Key Points

Potato diseases can dramatically reduce both tuber yields and quality.

Tissue culture of plantlets *in vitro* for production of disease-free seed tuber requires expensive technology and highly trained staff.

A low cost alternative is the use of cuttings - a single-node, leaf-bud or other type of very small plant cutting - for propagation of plantlets under non-sterile conditions.

The cuttings root easily and produce plantlets as efficiently as *in vitro* propagation – each cutting can yield up to 100,000 progeny within six months.

Tissue culture and micropropagation

Elementary methods of tissue culture were developed in the 1950s, and micropropagation has been used commercially for multiplying stock plant material since the late 1960s.

The annual volume of plants micropropagated from tissue culture is estimated at hundreds of millions of plants, representing tens of thousands of varieties.

Commonly micropropagated plants include flowers, strawberry, ornamental shrubs and forestry trees.

Potatoes are susceptible to a variety of diseases that lower yields and tuber quality. What's more, pathogens accumulate in successive clonings of tubers and in the soil used to grow them. That is why sustainable potato production depends on a constantly renewed supply of disease-free planting material.

A major innovation for the potato industry in developed countries was the widespread adoption in the 1970s of tissue culture – or micropropagation - as a means of multiplying disease-free plants that can then be used to produce healthy seed tubers for farmers. First, viruses and other pathogens are eliminated by growing potato plants in a controlled environment at high temperature. The disease-free shoot tips of the plants are then placed on a standard nutrient medium in glass containers (*in vitro*) in a completely sterile laboratory environment. The tips develop into plantlets that are then transferred to either a greenhouse or a field protected from insect pests, where they grow at the same rate as normal potato plants but produce smaller tubers (called "mini-tubers").

After harvesting, mini-tubers need to be stored at low temperature. After about 45 days – and for a period of up to seven months thereafter – they can be moved to a warmer environment to induce sprouting. Once planted, they go on to produce normal-size, disease-free seed tubers ready for delivery to farmers. (While growing, the plants need to be protected from insect pests to avoid new disease infections.)

Multiplication *in vivo* (at right) produces disease-free potato plantlets at the same rate as *in vitro* propagation (at left), at a fraction of the cost. Photo: T. Haapala

A low-cost alternative: small cuttings

While the above process does deliver healthy seed tubers, micropropagation of plantlets is costly, requiring sophisticated technology and well-trained staff. In many developing countries, simpler and less expensive ways of propagation are needed. FAO is promoting a promising, low-cost alternative: the use of very small cuttings, i.e. a single-node, leaf-bud or other type of plant cutting of about 1.5 cm, which can be grown to produce plantlets on a commercial scale.

The starter plant material remains a small number of disease-free micropropagated plantlets, which, in regions such as sub-Saharan Africa, are often imported from developed countries. However, they are multiplied not *in vitro* but *in vivo* (i.e. in non-sterile, natural conditions). Cuttings are propagated in a growing room or a shaded greenhouse in a mixture of peat and sand (or other rooting media) in plastic trays placed on metal stands.

The cutting technique takes advantage of etiolation – i.e. growing the plantlets under low light intensity. Etiolated plants retain their juvenile characteristics, producing new shoots for further cuttings that root easily. In addition, the plants remain small, so many can be grown in a limited space

- each tray can hold up to 500 cuttings per square metre. The cuttings grow into new plantlets within three weeks, providing a source for further cuttings. Within six months, a single cutting can yield up to 100 000 progeny.

Once the plant material is multiplied to the quantity needed, plantlets can be transferred to an environment free of insect pests (in a greenhouse or an open field under shade). Planted in deep soil, the plantlets root easily within a week, grow into perfectly normal potato plants and produce mini-tubers.

The technique produces plantlets at the same rate as *in vitro* propagation at a fraction of the cost. However, it is essential that the disease-free starting plant material is kept *in vitro* and all standard phytosanitary measures are followed throughout the propagation process.

The importance of timing

Potato plantlets in a greenhouse, soon to be planted outdoors. Photo: CIP

The cutting technique is suited to developing countries that need simpler and less expensive ways of propagating seed tubers. However, producing good quality starter planting material is only one element in the process of potato seed tuber production. Seed supply schemes can fail because propagation from cuttings and storage of mini-tubers is not coordinated with farmers' cropping calendars. Unless the field and storage phases are well planned and implemented, the benefits of micropropagation may be lost.

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Credits:
This fact sheet was written by FAO's Plant Production and Protection Division. The International Potato Center also contributed.

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International Year of the Potato 2008

Potato pest and disease management

Combating pests and diseases with intensive use of insecticides and fungicides often does more harm than good. An array of alternatives is available...

Key points

- Intensive potato cultivation tends to increase pest and disease pressure, which often leads to intensive use of harmful pesticides.
- Resistant potato varieties and improved cultural practices can reduce or eliminate many common pests and diseases.
- Integrated pest management has helped farmers drastically reduce the need for chemical controls while increasing production.

The use of chemical pesticides on potato is increasing in developing countries, as farmers intensify production and expand cultivation into areas and planting seasons beyond the crop's traditional range. The chemicals used are frequently highly toxic and applied with little or no protective equipment.

The result is alarming levels of pesticide poisoning in farming communities. Insecticide absorbed by soil often penetrates subsequent crops and runs off to contaminate water supplies. Overuse of pesticides even compounds pest and disease problems: in Colombia, outbreaks of a viral disease have been linked to insecticides that wiped out natural predators of the disease's vector.

Increasing potato production while protecting producers, consumers and the environment requires a holistic crop protection approach encompassing a range of strategies – encouraging natural pest predators, breeding varieties with pest/disease resistance, planting certified seed potatoes, growing tubers in rotation with other crops, and organic composting to improve soil quality.

Photo: © FAO

Ecuador: training reduces pesticide poisoning

In Ecuador's Carchi province, a programme supported by CIP and FAO used Farmer Field Schools to drastically reduce high rates of pesticide poisoning. Continuous cropping of potato had produced not only high yields, but highly favourable conditions for insects and fungal diseases, leading to massive applications of insecticides and fungicides. As a result of pesticide exposure, CIP scientists say, 60 percent of people in the area showed reduced neuro-behavioural functions. IPM training enabled farmers to reduce agrochemical application costs – including fertilizer, pesticide and labour costs - by an average of 75 percent with no effect on productivity. Follow-up studies show that the reduced exposure to pesticides was associated with recovery of previously suppressed nervous system functions.

There is no effective chemical control, for example, against bacterial wilt. But planting healthy seed in clean soil, using

Some of potato's main enemies

Diseases	Pests
Late blight: the most serious potato disease worldwide, is caused by a water mould, *Phytophthora infestans*, that destroys leaves, stems and tubers.	***Colorado potato beetle*** *(Leptinotarsa decemlineata)*: a serious pest with strong resistance to insecticides.
Bacterial wilt: caused by the bacterial pathogen, leads to severe losses in tropical, subtropical and temperate regions.	***Potato tuber moth:*** most commonly Phthorimaea operculella, is the most damaging pest of planted and stored potatoes in warm, dry areas.
Potato blackleg: a bacterial infection, causes tubers to rot in the ground and in storage.	***Leafminer fly*** *(Liriomyza huidobrensis)*: A South American native common in areas where insecticides are used intensively.
Viruses: disseminated in tubers, can cut yields by 50 percent.	***Cyst nematodes*** *(Globodera pallida and G. rostochiensis)*: serious soil pests in temperate regions, the Andes and other highland areas.

tolerant varieties in rotation with non-susceptible crops, and other sanitation and cultivation practices can lead to significant reduction of the disease. Incidence of potato tuber moth can also be reduced by preventing soil cracking that allows moths to reach the tubers.

Both the International Potato Center (CIP) and FAO advocate Integrated Pest Management (IPM) as the preferred pest control strategy during production. IPM aims at maintaining pest populations at acceptable levels and keeping pesticides and other interventions to levels that are economically justified and safe for human health and the environment.

FAO has promoted IPM in many developing countries using Farmer Field Schools, which centre around a "living laboratory" where farmers are trained to identify insects and diseases and compare results on two subplots – one using conventional chemical pest control and the other using IPM. On the improved management plot, participants strive to improve ecosystem health by cutting pesticide use while increasing productivity through management intensification. Farmers experiment with a variety of techniques, such as weevil traps, different strains of potatoes and targeted applications of lower toxicity pesticides.

In Peru's Cañete River valley, CIP entomologists designed an IPM package to help growers protect their crops against the leafminer fly, which had become a major problem after massive use of insecticides exterminated its natural enemies. The IPM programme included traps to lure and kill adult flies and reintroduction to the valley of parasitic wasps. Participating growers were able to reduce spraying from 12 times per season to only one or two carefully timed applications of insect growth regulators.

Virus control

Because virus-infected potato plants cannot be cured, CIP is working to incorporate into new varieties resistance to the three most common potato viruses. Some virus resistance is now available in about a quarter of CIP-bred genotypes.

Beating late blight

The mould responsible for late blight has consistently overcome resistant cultivars and mutated into strains that survive spraying with powerful fungicides. The Global Initiative on Late Blight, a network of scientists, technologists and agricultural knowledge agents in 72 countries, is exploring new control strategies, including "organic management" using improved sanitation in storage, risk forecasting and genetic resistance.

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Potato and soil conservation

Mulch planting and the "no-till" potato can help reduce the soil degradation, erosion and nitrate pollution often associated with potato production

Key Points

- Land preparation, weeding and harvesting of potato often involve intensive soil disturbance.
- Cover crops sown before planting and as the crop matures protect the soil and facilitate harvesting.
- Cultivation of potato without tillage helps restore soil, produces good yields and reduces the need for fertilizer and fuel.

Potato cultivation usually involves intensive soil tillage throughout the cropping period, which often leads to soil degradation, erosion and leaching of nitrates. During soil preparation, the entire topsoil is loosened and - particularly on sticky soils - pulverized into small aggregates to avoid the formation of clods in the potato beds. Mechanical weeding and mechanized harvesting also involve intensive soil movement. Conservation agriculture – a resource-saving crop production system – offers several useful techniques for soil conservation in potato production.

Mulch planting for potatoes

In conventional, tillage-based potato cropping systems, the risk of soil erosion and nitrate leaching can be reduced using the mulch planting technique. The potato beds are prepared well in advance of planting - if potato is to be planted in spring, the beds would be prepared before winter – and seeded with a green manure cover crop. The potato is later planted into the beds which, by then, are covered by the dead mulch of the manure crop.

For mechanical planting, planters are equipped with special discs that cut through the mulch and split the potato beds. The mulch protects the soil from erosion during the first weeks of the crop. As the potato plants grow, the reshaping of the beds incorporates the mulch. A second green manure crop can be seeded towards the end of the potato crop, as the potato plants are drying off. The cover crop helps to dry out the potato beds, contributing to healthier tubers with reduced risk of damage during harvest. The green manure is separated from the potato by a mechanical potato harvester and is left as a mulch cover after harvest, protecting the soil from erosion.

Mulch planting is being used for potatoes in parts of Germany and Switzerland, particularly in watersheds where drinking water sources might be prone to nitrate pollution from conventional cultivation methods. Nevertheless, while mulch planting of potatoes reduces the risk of erosion and nitrate leaching, it still involves major soil movement.

The 'no-till potato'

Soil conservation can be enhanced further using a basic CA technique, "no-till" cultivation. The "no-till" potato is pressed into the soil surface, then covered with a thick layer of mulch - preferably straw, which is fairly stable and does not rot quickly. (Potatoes need to be kept in the dark to avoid the formation of chlorophyll, which renders the tubers green, bitter and toxic.)

The advantages of conservation agriculture

Conservation agriculture (CA) aims at enhancing natural biological processes both above and below ground. It is based on three principles: minimum mechanical soil disturbance, permanent organic soil cover, and diversified crop rotations for annual crops and plant associations for perennial crops. By minimizing soil disturbance, CA creates a vertical macro-pore structure in the soil, which facilitates the infiltration of excess rainwater into the subsoil, improves the aeration of deeper soil layers, and facilitates root penetration.

In some cases - for example in dry areas under drip irrigation - black plastic sheets can also be used as mulch. Holes are punched in the plastic to allow the potato plant to grow through it. The young potato tubers form under the mulch but above the soil surface. During harvesting, the sheets are removed and the potatoes are simply "collected". Currently, the "no-till" potato is only grown in small fields using manual labour - for example, in Peru under plastic covers and in the Democratic People's Republic of Korea under rice straw.

No-till potato in the Democratic People's Republic of Korea

Farmers in the Democratic People's Republic of Korea are using conservation agriculture in rice and potato production in order to restore degraded soils and achieve good potato yields with reduced need for fertilizer and fuel. The potato-rice crop rotation system produces two crops in a relatively short growing season, resulting in higher overall food production when compared to output from a single main crop. The seed potato is inserted into the soil under a mulch cover formed by the residues of the preceding rice crop. The potatoes grow through the rice straw and are harvested within three months. Immediately afterward, "no-till" rice is transplanted as the main summer crop. Per hectare, the system can produce 25 tonnes of potatoes and 7.5 tonnes of rice, and in cold storage and transport infrastructure.

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Potato and water resources

Agriculture faces a double challenge: to grow enough food for the world's expanding population while reducing its share of the Earth's freshwater resources. The potato can help...

Key Points

- Agriculture must significantly improve its volume of production per unit of water used.
- The potato produces more food per unit of water than any other major crop.
- From the same amount of water, the potato produces more dietary energy than rice, wheat and maize.
- Tailoring the timing and depth of water applications to specific stages of the potato's growth cycle can help reduce water usage.

To reduce potato's water needs, scientists are developing varieties that are drought-resistant with longer root systems. Drawing: CIP

Over the past century, human appropriation of fresh water has expanded at more than twice the rate of population increase. An estimated 3 830 cubic km (or 3 830 trillion litres) of water are now withdrawn for human use each year, with the lion's share – some 70 percent – being taken by the agricultural sector.

An irrigated potato field in Cape Verde.
Photo: ©FAO/Marzio Marzot

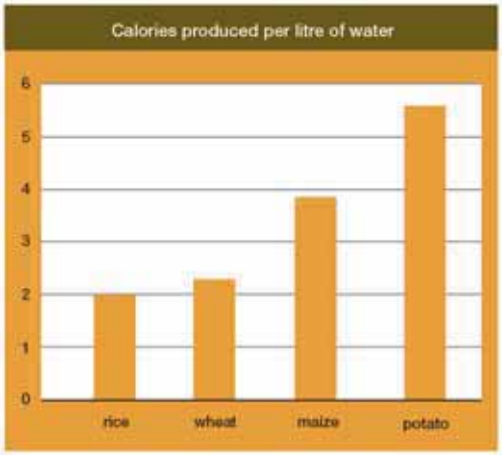
But agriculture's thirst is not sustainable in the long term. Facing intense competition from urban and industrial users, and mounting evidence that human use of water is jeopardizing the efficiency of the Earth's ecosystems, the sector must significantly improve the volume of production per unit of water used.

Nutritional productivity

The potato stands out for its productive water use, yielding more food per unit of water than any other major crop. Along with groundnut, onion and carrots, its "nutritional productivity" is especially high: for every cubic metre of water applied in cultivation, the potato produces 5 600 calories of dietary energy, compared to 3 860 in maize, 2 300 in wheat and just 2 000 in rice. For the same cubic metre, the potato yields 150 g of protein, double that of wheat and maize, and 540 mg of calcium, double that of wheat and four times that of rice.

An increase in the proportion of potato in the diet would alleviate pressure on water resources. Currently, producing the foods – especially animal products – consumed in the average diet in the developed world requires water withdrawals estimated at 4 000 litres per capita per day (it takes, for example, around 13 000 to 15 000 litres of water to produce 1 kg of grain-fed beef). But one recent study estimated that a balanced diet based on potato, groundnut, onion and carrot would require per capita water consumption of just 1 000 litres per day.

While a potato-based diet is impractical – 4 kg would be needed to cover per capita daily energy and protein requirements – increased consumption of processed potato products and extraction of potato's nutrients offer a water-efficient means of meeting nutritional needs.



Potato's water requirements

Modern potato varieties are sensitive to soil water deficits and need frequent, shallow irrigation. A 120 to 150 day potato crop consumes from 500 to 700 mm of water, and depletion of more than 50 percent of the total available soil water during the growing period results in lower yields.

To reduce potato's water needs, scientists are developing varieties that are drought-resistant with longer root systems. But significant water savings can be made in cultivation of today's commercial varieties by tailoring the timing and depth of water applications to specific stages of the plant's growth cycle.

In general, water deficits in the middle to late part of the growing period – during stolonization and tuber initiation and bulking – tend to reduce yield, while the crop is less sensitive during early vegetative growth. Water savings can also be achieved by allowing higher depletion toward the ripening period so that the crop uses all available water stored in the root zone, a practice that may also hasten maturity and increase dry matter content.

Some varieties respond better to irrigation in the earlier part of tuber bulking, while others show a better response in the latter part. Varieties with few tubers are usually less sensitive to water deficit than those with many tubers.

While soil should be maintained at a relatively high moisture content to maximize yield, frequent irrigation with relatively cold water may reduce the soil temperature below the optimum value for tuber formation (15 to 18°C), thus affecting yields. Also, wet and heavy soils can create soil aeration problems.

The most common irrigation methods for potato use furrow or sprinkler systems. Furrow irrigation has relatively low water use efficiency and is suitable when water supply is ample. In areas with water scarcity, sprinkler or drip irrigation is preferred, especially on soils with low water retention capacity.

For every unit of water, the potato produces twice as much protein as wheat and maize. Photo: ©FAO/Giulio Napolitano

Tuber quality and yield

Water supply and scheduling have important impacts on tuber quality – frequent irrigation reduces the occurrence of tuber malformation. Water deficit in the early phase of yield formation increases the occurrence of spindled tubers (more noticeable in oval than in round tuber varieties) and, when followed by irrigation, may result in tuber cracking or tubers with "black hearts".

Using good agricultural practices, including irrigation when necessary, a crop of about 120 days in temperate and subtropical climates can yield 25 to 40 tonnes of fresh tubers per hectare.

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Potato and food price inflation

The potato is a highly recommended food security crop that can help shield low-income countries from the risks posed by rising international food prices

Key Points

Prices of cereals are rising faster than those of potato and other root crops.

Countries with low levels of dietary diversity and high dependency on cereal imports could benefit greatly from expanded potato cultivation.

Potato flour can be blended easily with wheat flour, providing countries with a means of reducing costly wheat imports.

Potato is increasingly a valuable source of cash income for low-income farm households

Intense competition for reduced international supplies of cereals and other agricultural commodities is driving worldwide food price inflation, which brings with it the risk of food shortages and social unrest in low-income countries. One strategy that could help reduce the risk is diversification of food production to nutritious and versatile staple crops that are less susceptible to the vagaries of international markets. One such crop is potato.

Unlike rice, wheat and maize, the potato is not a globally traded commodity and its prices are determined usually by local supply and demand. A recent FAO survey in more than 70 of the world's most vulnerable countries found that inflation in potato prices is much lower than that for cereals. The potato is, therefore, a highly recommended food security crop that can help low-income countries ride out turmoil created by food price increases.

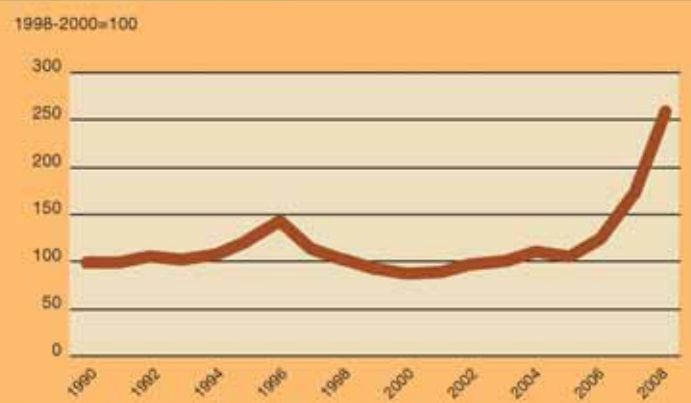
Potato for nutrition – and income

In many developing countries, the poorest and most undernourished farm households depend on potatoes as a primary or secondary source of food and nutrition. These households value potato because it produces large quantities of dietary energy and has relatively stable yields under conditions in which other crops might fail.

The potato is highly adaptable to a wide variety of farming systems. With its short vegetative cycle – high yields within 100 days – it fits well into double cropping systems with rice, and is also suitable for intercropping with maize and soybeans. Potatoes can be grown at altitudes of up to 4 300 m and in a variety of climates, from the barren highlands of the Andes to the tropical lowlands of Africa and Asia.

Potato is also rapidly becoming a valuable source of cash income – a primary requisite of food security - for many small scale producers. In many developing countries, growth in urban populations and incomes and the diversification of diets have led to rising demand for potatoes from the fast food, snack and convenience food industries. The structural transformation of agriculture-based economies into more urbanized societies opens up new market opportunities for potato growers

FAO Cereal Price Index



Rising prices of maize, wheat and rice pose a threat to low-income countries

and to their trading and processing partners in the value chain.

Investing in potato production

With its adaptability to a wide range of uses, the potato has a potentially important role to play in the food systems of developing countries. However, policy makers have traditionally focused on cash crops for export and on cereals, leaving potato and other root crops at the periphery of agricultural development efforts. Redressing this imbalance is important if potato sectors are to thrive.

Investment in potato production should be considered as insurance against international market turbulence and as a food security safeguard. In the current climate of high food prices, it is often forgotten that until recently international prices for cereals had reached historic lows when adjusted for inflation. A boom followed by bust in cereal prices could easily undermine investments in the potato sector if consumers revert back to purchasing cheap, subsidized imported cereals.

Strengthening the potato 'value chain'

In developing countries, potatoes are often sold through fragmented marketing chains with little co-ordination and a lack of market information, giving rise to supply disruptions and high transactions costs. Many small scale farmers are excluded from markets owing their low yields, and inadequate storage and transport. Inefficient and unfair pricing discourages them from making on-farm investments in production.

Enhancing the value chain requires substantial public and private investment, especially in breeding programmes and in infrastructure to support and co-ordinate activities along the chain.

Production initiatives can be strengthened by research focused on specific end uses, rapid multiplication of good quality planting material, and varieties with pest and disease resistance. Producers of potato seed tubers need to offer yield-improving and input-saving technologies that boost yields and reduce costs. The formation of producer groups would help farmers share expertise and strengthen their bargaining power. Production would also benefit from improvements in the supply of irrigation water and chemical fertilizers, and in cold storage and transport infrastructure.

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