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 An estimated 3,830 cubic km (or 3,830 trillion litres) of water are now withdrawn for human use each year, with the lion’s share – some 70 percent – being taken by the agricultural sector.

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.
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.

**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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**About IYP 2008**

The International Year of the Potato, to be celebrated throughout 2008, aims at raising global awareness of the potato’s key role in agriculture, the economy and world food security.


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