

What is the potato?

The potato is a tuber grown underground on a specialized plant part (subterranean stem) known as stolon. Therefore, it is a modified stem in a strict botanical sense. A potato tuber is usually oval to round in shape, although intermediate shapes are also frequently encountered. It consists of an inner flesh and an outer protective cover known as a skin. There is a great variation in flesh colour and skin finish. And these two characteristics broadly, if not completely, determine the consumer preference vis-à-vis acceptability. The eye-shaped depressions on a potato tuber is known as its eyes, and actually these are the dormant buds, which give rise to new shoots under suitable conditions. These white to creamy white or pigmented new shoots are known as sprouts. And that is why the process is known as sprouting. This is a very important process in potato, because a sprouted potato is not acceptable for consumption. But optimum sprouting is a desired attribute when the tubers are used for propagation.

The initiation and development of potato in the plant is known as tuberization. A potato plant tuberizes only when two specific environmental conditions are met with. These are short-day photoperiod (daylight) and cool night temperature. As these conditions are only available during winter in sub-tropical Indo-Gangetic plains, the potatoes are grown in this season. And that is why the potato growing conditions in India are entirely different from those in temperate countries of Europe and North America. Nevertheless, temperate potato growing conditions are also available in Indian hills, and there it is cultivated during summer. But this temperate potato production constitutes only about 8-10 % of the total production. In India, therefore, the potato is regarded as a short-duration crop with an average cropping stand of 90-100 days.

In contrast to most of the major food crops (cereals) which are propagated through seeds (products of sexual hybridization), a potato plant is propagated through tubers. The tubers meant for propagation are known as seed tubers or seed potatoes. For this mode of propagation does not involve sexual hybridization or process, it is known as asexual or vegetative propagation. This type of propagation has advantages and disadvantages as well. The main advantage is that a good potato clone can be maintained with a high degree of genetic purity. It is often colloquial to call a potato plant as a clone, because it is advanced through the generations by clonal propagation, another term of asexual or vegetative propagation. The disadvantage is that many deadly viruses and seed-borne pathogens are progressively accumulated in the tubers and carried over repeated multiplications resulting in the gradual degeneration of a clone. For this reason, successful potato cultivation and production depend upon the availability of disease-free high-quality seed tubers. This is mostly important in tropical and sub-tropical warm climates as in India where there is an abundance of various vectors, e. g. aphids, mites, thrips, white flies, etc. for virus transmission. As a consequence, the cost of good quality seed potatoes alone accounts for about 40-60 % of the total production cost in many countries.

In addition to tubers, a potato plant can also be propagated through botanical seeds, which are known as True Potato Seeds (TPS). In areas where seed potato production is not feasible or economic, TPS is an alternative means of propagation. Potato production through TPS can not only reduce the production cost, but also increase the net profit of the farmers. However, TPS technology is presently not full-proof for a large-scale commercial exploitation due to one or other agro-technical as well as techno-economical problems. Since potato is a bulky perishable commodity and its harvest in sub-tropical conditions as in India is followed by

high temperatures, it requires to be stored at low temperatures. Therefore, the cost of refrigerated storage also adds up to the total cost of potato production before the produce is available either for consumption or for seed propagation. In addition, the potatoes are cultivated in the vast Indo-Gangetic plains under fully irrigated conditions requiring optimum cultural practices for maximum productivity. These all make the potato crop highly input-intensive for cultivation.

What are in a potato?

In a potato tuber, about 80 % is water and the rest is dry matter. A type of storage tissue known as parenchyma comprises the major part of the tuber. The complex carbohydrates, starch grains, are stored as a reserve material inside this tissue. Starch is the major component of the dry matter accounting for approximately 70 % of the total solids. The potato can be distinguished from cereals like rice and wheat for its higher capacity to produce dry matter, which is about 47.6 kg/ hectare/ day. The average raw material composition of a potato tuber is as follows: dry matter (20 %), starch (13-16 %), total sugars (0-2 %), protein (2 %), fibre (0.5 %), lipids (0.1 %), vitamin A (trace/ 100 g fresh weight), vitamin C (31 mg/ 100 g fresh weight), minerals (trace), ash (1-1.5 %), amylose (22-25 %) and glycoalkaloids (< 1 mg/ 100 g fresh weight) as an antinutritional factor. In all the present-day potato varieties, however, the harmful glycoalkaloids are within the permissible limit of human consumption. In recent years, it has been reported that the potatoes contain a very harmful toxic chemical known as acrylamide, which tends to increase when the tubers are fried or processed. However, it is too premature to jump to any conclusion before detailed studies are conducted.

Potato tuber also contains a number of B-group vitamins and high quality dietary fibre. The potato produces more edible protein per hectare per day (about 3 kg) than rice and wheat. And most importantly, the biological value of potato protein is about 71 % that of whole egg, a figure much better than that of wheat, maize, peas and beans and even comparable to milk. Equally impressive is the capacity of the potato to produce the minerals, which is about 4- and 11-times more than that of wheat and rice, respectively. Since a potato tuber is rich in vitamin C as compared to other vegetables like carrot, onions and pumpkins, it can meet the daily vitamin C requirement of a person. Studies have shown that 100 g of freshly harvested boiled potatoes with intact skins can provide 80 % of a child's and 50 % of an adult's daily vitamin C requirement. The potato is a low energy food (97 kcal/ 100 g fresh weight), because it contains low fat (< 0.1 %) and calorie. Therefore, it is a misconception that it causes obesity. Actually, the fat is added to its energy value when the tuber is fried or processed. On the contrary, the potato represents an ideal meal to avoid obesity. It has been shown that a healthy adult can have his daily energy requirement by consuming a little more than 3 kg of potatoes per day. In all, the potato is a highly nutritious, easily digestible, wholesome food. It is a unique food, because it can be consumed as boiled or fried or processed, all with equal culinary delicacy. Perhaps no other food crop has such an inherent capacity as the potato to produce so many different processed products, which can be enjoyed across the generation gap.

How potato came to India?

The potato is not native to India. It originated in the environs of Lake Titicaca high in the Andes of Peru and Bolivia in South America. The archaeological excavations in Peru have discovered the remains of potatoes as early as in 8000-6000 BC. It is assumed that the ancient Andeans, who were forced to migrate to the highlands during that period, were the first to

domesticate the potato around that time. From its earliest recorded domestication, the potato continues to be the food for the masses and the oppressed. To the Andeans and later to the Incas, it was known as papa. For millennia, it was the bread of the great Andean civilization, but remained unknown to the rest of the world.

The potato was shrouded in myths and rituals by the ancient Andeans. Moray Raymi potato festival still celebrated in the potato's birthplace, the Andes (adapted from 'The Potato Treasure of the Andes, From Agriculture to Culture', International Potato Centre, Lima, 2001) Following the discovery of the New World, the potato was introduced into Europe together with other crops like maize and tobacco. The European societies did not accept the potato for a couple of centuries due to one or other misconceptions associated with it. The English branded it as a Spud, an acronym for the Society for the Prevention of Unhealthy Diets (the organization behind this inglorious nomenclature). But once it got the foothold in the European society, it changed everything. The historians agree that the potato enabled and fed the industrial revolution in Europe. The infamous Irish potato famine reminds one of how dangerously the Europeans were dependent on potatoes for their daily sustenance during early to mid 19th century. Even the Bavarian war in 19th century was termed as a 'Potato War', because it continued till the potato stock expired. It reminds one of the Inca period in South America when many a fierce battles between the warring tribes were postponed in order to cultivate the potato fields.