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A Review of the Medicinal and Industrial Applications of Golden Sweet Potato

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Abstract: *Originating in Latin America, sweet potatoes (Ipomoea batatas) are now grown in the majority of tropical and sub-tropical nations worldwide. This white-fleshed root tuber crop is simple to grow, uses little water and fertilizer, and yields the most food per unit area and time. Its golden-yellow fleshed variety, known as the Orange-fleshed Sweet Potato or Golden Sweet Potato, is high in beta-carotene, minerals, and nutritional qualities. It boosts immunity, has anti-inflammatory, anti-cancer, antioxidant, and vitamin A deficiency-repairing qualities. People are interested in it because of these factors. This review's main objective is to provide a concise synopsis of this plant's cultivation, phytochemical composition, and uses*

Keywords: Medicinal Applications, Industrial Applications, Bioactive Compounds

I. INTRODUCTION

The sweet potato (Ipomoea batatas), a dicotyledonous plant belonging to the Convolvulaceae family, is the eighth most important food crop in the globe.[1] After rice, wheat, maize, and sorghum, it is regarded as the fifth essential harvest (new weight premise) and has the potential to be an energy benefactor.[2] As of right now, more than 115 countries have developed SP [3], and in many developing countries, SP is regarded as an auxiliary staple food that plays a significant role in people's diets.[4] In 2017, 115 countries produced 112.8 million tons of sweet potatoes, with China leading the world in production, followed by Nigeria, Tanzania, Indonesia, and Uganda.[3] The production and use of sweet potatoes has recently increased significantly throughout South America, Asia, Africa, and Caribbean islands. Due to its natural development and consumption by pathetic networks, especially by households led by women, sweet potatoes are praised as a "helpless man's" crop.[5,6] Sweet potatoes are regarded as a crop for food security due to their remarkable returns in a wider range of climatic conditions and their minimal requirements for agribusiness inputs.[7] Lately, it has changed from being a low-yield, low-input harvest to a vital cash crop. It tends to be collected at the site of interest as a continuous crop for food security.[8] It also provides a stable source of food and revenue for tranquil ranchers who are often defenseless against typical harvest damage.

The sweet potato, or Ipomoea batatas, is the world's seventh most important food crop and the second most important root tuber. Even though it is marketed as "famine crop," "starvation crop," or "helpless man's food," it may be able to supplement a food-based strategy to improve food security, lessen poverty, and serve as an optional staple food source for struggling ranchers.[9]

The golden sweet potato is now emerging as one of the major tropical tuber crops. To address the nutritional problem, it has a remarkable chance of being accepted as the standard diet of the consumer's natural hierarchy. It is a remarkable source of β-carotene in addition to being a moderate source of energy.[10] and is often accepted by young children worldwide.[11,12]

II. HISTORY

Perhaps the world's most seasoned root tuber is the sweet potato. It is acknowledged to have been in use for a very long period. According to Peruvian sources, its history dates back to 750 B.C. Native to South America, sweet potatoes have been cultivated there for over 5,000 years. As early as 1200 AD, they were also well-known in Polynesia prior to the arrival of the Spanish. Known by its original name, yam, it was a staple diet of the Maori people in New Zealand at the time. Yams were developed in Spain as early as 1500 A.D., and by the sixteenth century, Spanish travelers brought

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them to the Philippines and East Indies, from where they easily spread to India, China, Africa, Indonesia, and Southern Asia, probably with the assistance of Portuguese brokers.

Christopher Columbus first introduced yams to Europe after his first voyage to the New World in 1492. In order to distinguish the gentler orange-fleshed yam from the harder, white variety, it was known as the "sweet potato" in North America throughout the 20th century. Compared to yam assortments with red, pink, or orange flesh, those with white or light-yellow tissue are less tasty and moist. Yam ranks seventh and fifth among the world's most important crops based on production volume. Native Americans used sweet potatoes to quench their thirst and lose weight that was thought to be caused by diabetes.

Distribution

These crops are said to be indigenous to Central America and are perhaps the most well-known vegetable in the world. Generally speaking, Asia accounts for around 78% of the global region and 92% of the global area under this yield. Along with China, the United States, Brazil, Peru, Mexico, and Thailand, India is a major producer. About 68% of South Asia's total output comes from India, with Bangladesh coming in second with 27% and Sri Lanka with about 5%. The states of Odisha, Uttar Pradesh, West Bengal, Bihar, Karnataka, Tamil Nadu, and Kerala are the primary producers of sweet potatoes in India.[13]

Soil properties

It may be cultivated in a variety of soil types, ranging from sandy to loamy, but it thrives in sandy topsoil soil with excellent seepage structure and high maturity. Avoid growing sweet potatoes in soil that is very light, sandy, and heavy, clayey, since this is not conducive to tuber growth. Soils with a pH between 5.2 and.7 are fantastic. Pox and scurf diseases are welcomed by high pH, which also results in very poor-quality tubers. Sweet potatoes do not grow or produce well in salty or antacid soils. Because it reduces air circulation and tuber growth, water logging is very detrimental.

Temperature range

Natural factors affect sweet potato development and tuber production. According to all accounts, the most fundamental factor influencing tuber growth is night air temperature, most likely due to the increased transfer of sugar from the shoot to the roots during this period. The tuber building was increased between the fifth and thirteenth seven-day stretch of the development period because to a cooler night air temperature (11.3 to 26.4 C) and the resulting water system. A nighttime temperature of 15 to 25 degrees Celsius promotes the growth of tubers. While temperatures over 25 degrees Celsius promote shoot growth, they inhibit tuber development. Photosynthetic apportionment is redirected toward stringy roots rather than tubers at higher temperatures (>28 C). At cold soil temperatures (20 C) as opposed to high temperatures (30 C), the amount of sucrose in the stem and root stays lower. The amount of starch was equal to that of sucrose. At lower soil temperatures, this suggests a more significant conversion of sucrose to starch away from roots, favoring tuber improvement. This explains why tuberization is at its lowest around the middle of the year.

As long as there is no flooding, 750–1,500 mm of widely distributed precipitation is beneficial for its growth as a rainfed crop. It is able to withstand the dry season, but not water logging. Because it halts the growth of tubers and vegetation, temperatures below 10 C are harmful. It is ice-sensitive. There will be a lot of vegetative growth but no tuberization at temperatures over 35 degrees Celsius.

Cultivation technologyLand preparation

For the highest yields, sweet potatoes should be filled in the middle of the day. For the production of high-quality tubers, a fine, sandy topsoil soil that is quite deep and has a sufficient amount of waste is advised. Avoid planting in areas that are prone to floods since excessive soil moisture might accelerate tuber deterioration.

Form board furrows are used to prepare the ground, followed by turners or desi furrows that are dug down to a depth of 15 to 20 cm. At that point, harrows are used to pound the soil. For SP development, the edges and wrinkle planting method is often used. In other locations, the level bed technique is also dug, but afterward earthing is carried out to

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promote tuberization. Though edges and wrinkle method are preferred, the hill technique is often preferred in soil that has been wet.[14]

Selection of planting material

Slips, or stem cuttings, from the previous crop may be used to grow sweet potatoes. Slips may also be removed from small tubers that are utilized to germinate and feed the nursery. Choose slips between two and three months of age. Make use of the flowering's indicators that they are healthy, growing quickly, and free of pests and diseases.

Irrigation

At some point throughout the crop's life, water is desired to keep the soil moist. However, tubers decay due to a lack of proper drainage and an excess of water. Four to five weeks after the slips are planted, tuber initiation occurs, at which time tuberous roots start to develop. As a result, soil moisture is now crucial for encouraging tuber start and development. When the soil begins to dry up after planting, irrigation is applied. It is necessary to cease irrigation before three weeks of harvest. But one irrigation is required before two days of harvesting. Sweet potatoes are sometimes referred to as "famine crops" because of their low water and fertilizer requirements; they need very little irrigation when grown in a rainfed system.[14]

Fertilizer application

By adding vitamins to the soil, fertilizers assist plants to produce higher harvests. Spread the fertilizer along the ridge, between the blooms. Mix the fertilizer with the soil if at all possible. At some time throughout the crop's life, two fertilizer regimens are needed.

At planting or inside three weeks after planting

At eight weeks after planting

Harvesting

After planting, sweet potato tubers develop and are ready for harvesting four to five months later. Harvesting may be done robotically using a harvester or manually with a lawn fork. Harvesting later will increase the likelihood of a pest attack. A well-managed crop may produce between 20,000 and 30,000 kilograms per hectare.

Chemical components

The high β-carotene concentration of orange-fleshed varieties may reach 20–30 mg per 100g.[15] Orange-fleshed candy potatoes are rich in β-carotene and also include large amounts of protein, lipids, carbohydrates, dietary fiber, zinc, potassium, salt, manganese, calcium, magnesium, iron, vitamin C, and a few phytonutrients.[16,17] For younger children, a 100–150 g portion of boiling orange-fleshed sweet potato tubers may provide the daily need of vitamin A, which may prevent blindness.[18] It is also noteworthy that a medium-sized orange-fleshed candied potato may provide around twice as much β-carotene as is required for the recommended daily intake of vitamin A. After being processed, such as by boiling, baking, or creating fried chips, the roots are often consumed.[19] Candy potatoes were chosen as one of the meals studied for long-distance region travel due to their nutritional properties.[20] As a result, Golden Sweet Potato candy is a staple food that might provide people in developing and resource-poor nations with a supply of power and nutrition A.[21,13] In tiny and marginal agricultural communities, it is the most appropriate biofortified crop to combat malnutrition.[22] In addition to being a good source of power, orange-fleshed candy potato tubers are also easy to grow, vegetatively reproduced, and drought-tolerant.[23] Orange fleshed sweet potatoes are a fantastic food protection crop because of their qualities.

Uses

Many writers have reported the usage of Golden Sweet Potatoes (GSP) as both food and medicinal. Many food items that are roasted, fried, juiced, and in various forms are noted as being out of GSP in a handbook on the topic.[24,14,25]

Antioxidant nutrients

Candy potatoes are available all year round in many places, and they are particularly noteworthy as antioxidant meals due to their capacity to provide a vitamin such as beta-carotene.[26] Recent research has shown that phytonutrients included in such plants may reduce the toxicity of heavy metals and free oxygen radicals when they transit through the digestive system.[26, 27] That risk discount is likely crucial today, not only for those who have digestive tract problems

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but for all men and women who want to reduce the possibility that their meal contains heavy metallic residues. Some important antioxidant qualities are also present in the storage proteins, or sporamins, that are present in candied potatoes.[28] Every time sugar potato blooms are exposed to physical injury, these garage proteins are created. Their antioxidant properties are significantly linked to their capacity to help the blooms recover from this damage.[29] Several of the same antioxidant effects may also be obtained while the candy potato is being digested in the gastrointestinal track.[30]

Anti-Inflammatory nutrients

Sweet potatoes' color-associated pigments (carotenoids, anthocyanin, etc.) are also valuable for their anti-inflammatory health effects. In animal studies, it has been shown that consuming sweet potatoes or their color-containing extracts reduces the activation of nuclear factor-kappa B (NF-kB), the activation of cyclooxygenase-2 (COX-2), inducible nitric oxide synthase (iNOS), and the production of malondialdehyde (MDA).[31] Fibrinogen is also impacted by the color-associated phytonutrients in candy potatoes.[32] The body's ability to close wounds and avoid blood shortages depends on having balanced levels of fibrinogen, thrombin, and fibrin. On the other hand, excess amounts of those clotting-related chemicals may sometimes potentially provide a fitness risk. Extra fibrin within the useful worried machine has been linked in animal studies to increased neuronal demyelination and may also result in undesired infection of nerve tissues.[33] Consuming colored extracts of sweet potatoes has been shown in early animal studies to reduce infection and, concurrently, fibrinogen phases.[34, 35]

Hypoglycaemic impact

Despite having a mild glycemic index, these tubers have the potential to raise blood sugar levels in people with type 2 diabetes.[28, 36] Additionally, recent research has shown that extracts from sweet potatoes may significantly raise blood adiponectin levels in both men and women with type 2 diabetes.[32] The body's fat cells create the protein hormone adiponectin, which is a vital modulator of insulin metabolism. These tubers include a lot of fiber, antioxidant vitamins like A, C, and zinc, as well as other minerals like potassium, magnesium, iron, and vitamin B. These help regulate diabetes and prevent many diseases, including heart attacks and strokes.[26]

Anti-diabetic effect

According to some studies, sweet potatoes may have the ability to lower blood glucose levels. Some studies on humans and animals have shown that some types of sweet potatoes may help maintain blood sugar levels and reduce insulin resistance. In Japan, "caiapo," a nutritional supplement and unrefined extract of white-skinned sweet potatoes, has long been used as a diabetic therapy.[37]

Anti-cancer potential

Additionally, extracts from certain sweet potato components have been shown to have antitumor and anticancer effects. In vivo and in vitro, sweet potato extract suppresses proliferation and triggers apoptosis in the majority of prostate cancer cells [38]. This anticancer effect is ascribed to the extract's high polyphenol content. Crimson skinned sweet potato extract was also shown to have an inhibiting effect on the growth of MCF-7 (breast cancers), SNU-1 (gastric cancers), and the majority of cancer cell lines in a recent study.[39] Crimson-fleshed sweet potatoes' capacity to heal has often been ascribed to their high anthocyanin content. Anthocyanins or extracts rich in anthocyanins have been shown to have an inhibitory effect on the growth of the majority of cancer cells.[40] Additionally, a group of researchers said that isolated protein from the sweet potato's garage root encourages dose- and time-based suppression of the majority of human colorectal malignancies, including SW480 mobileular proliferation, migration, and invasion.[41]

Effect on cardiovascular system

Low-density lipoprotein oxidation may cause headaches, which may lead to atherosclerosis, the primary cause of cardiovascular disease.[42] Due to the antioxidant properties of the phytochemicals found in the leaves, sweet potato leaf extract was shown to be able to inhibit low density lipoprotein oxidation both in vitro and in human subjects.[43]

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Crimson-fleshed sweet potatoes are rich in anthocyanin, a phytochemical that has been shown to reduce the risk of coronary heart disease.[42]

Effect on immune system

Extracts from sweet potatoes have also been shown to have modulatory effects on fitness and the immune system. In mice's splenocytes, ethyl acetate fractions of bioactives derived from excellent candy potato cultivars demonstrated immunomodulatory properties in a cultivar-based manner.[44] Hanieh et al. [45] declared that crimson candy potato dietary supplementation enhanced the hens' immune response after vaccination. In a study involving sixteen healthy human adults, consumption of red candy potato leaves also became able to modify T-lymphocyte activities, lytic interest of herbal killer mobile, and antibody production. Research on immunomodulation in candy potatoes has only been reported on cultivars of red skinned potatoes. It has been hypothesized that red candy potato extracts improve immunological disorders, most likely via modifying antioxidant defense mechanisms.[46] Using red candy potato extract as a food supplement increased the activity of the antioxidant enzymes glutathione peroxidase and superoxide dismutase in LP-BM5 murine leukemia virus-induced immune deficiency syndrome in mice.[46] The cooked candied potato leaves also shown immunomodulatory effects when being used by basketball players at some point throughout their educational journey. During this time, the gamers' plasma awareness of polyphenols increased significantly, along with the cytotoxic interest of natural killer cells and the release of interferon (IFN)-γ.[47]

Anti Vitamin-A Deficiency

The ability of golden sweet potatoes to treat vitamin A deficiency (VAD) has been one of its most beneficial applications. VAD affects the majority of Asian and African nations. According to the WHO, 3 million of the 78 million children under the age of five who suffer from VAD have some kind of vitamin A-related eye condition, which may range from night blindness to permanent partial or whole blindness. According to WHO and UNICEF, increasing vitamin-A level might save between 1.3 and 2.5 million deaths annually. In India alone, about 60,000 youngsters lose their sight each year. This disease is especially common in the eastern U.P.[48,49,14] Globally, Golden Sweet Potato (GSP) was awarded the 2016 World Food Prize (also known as the Nobel Prize in Agriculture) in 2016, 2017, and 2018.

Four scientists—Drs. Jan Low, Maria Andrade, Robert Mwanga, and Howarth Bouis—were given the 2016 World Food Prize (de facto Nobel Prize in Agriculture) for their efforts to eradicate vitamin A deficiency in Africa by producing and consuming Orange-Fleshed Sweet Potatoes (OFSP), Golden Sweet Potatoes (GSP), or Sunhari Shakarkand. For assisting OFSP in 26 African nations, the president of the African Development Bank (AfDB) was awarded the same World Food Prize in 2017. One physician and another economist were awarded the 2018 World Food Prize for their support of OFSP's potential to treat vitamin A deficiency (VAD) in Africa. According to data from BRD Medical College in Gorakhpur, 49% of children on average suffer from VAD. According to a PRDF survey conducted in Gorakhpur and Sant Kabir Nagar, VAD in primary schools was 60%. Faizabad could be comparable. Therefore, the prevalence of VAD in the populations of Africa and eastern India is equal. On November 17, 2016, TIME Magazine named the Golden Sweet Potato (GSP), also known as OFSP, one of the top 25 innovations of 2016 that improve the world and save lives.[50]

For good cause, the Golden Sweet Potato was named one of the top innovations by TIME Magazine and won the World Food Prize. The main cause is because GSP is being considered as a cost-effective and sustainable food to help treat Vitamin A Deficiency (VAD) via its production and consumption. At the moment, 24 African nations with VAD as severe as India are encouraging the use of GSP and have robust R&D initiatives in place for it. If India wants to eliminate VAD via biofortification, it must take the same course. There is no cost to the government in eliminating VAD once Golden Sweet Potatoes (GSP) are grown by farmers and consumed by consumers, and corruption and poor management are eliminated.

The prevalence of VAD in eastern Uttar Pradesh varies from 41 to 73 percent, which is greater than in Africa. This causes partial to complete blindness as well as other illnesses in children, pregnant women, and the elderly.[48, 49] Children with VAD under five years old die away within a year because to a number of problems and weakened immunity against encephalitis, malaria, and diarrhea. Blindness, stunted development, weakened immunity, and

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increased mortality are all consequences of vitamin A deficiency (VAD). In India, 60,000 youngsters lose their sight each year, and half of them pass away within a year. It is necessary to raise awareness of its negative consequences and how eating GSP may help.

β-Carotenoids, which are abundant in golden sweet potatoes, are transformed into vitamins when consumed. Thus, Pro-Vitamin A is another name for this.[51] According to at least one Ugandan research, the amount of β-Carotenoids gradually decreases while being stored. Since PRDF created a number of food items with extended shelf lives, it is essential to determine if β-Carotenoids are retained in food products and tubers. Like other chips, Golden Sweet Potato chips are packaged in plastic and will be in stores for months before being eaten. Determining the preservation of β-Carotenoids in food items is so crucial. It is necessary to measure β-Carotenoids in tubers every two weeks since they are eaten months after they are dug.

II. CONCLUSION

One variety of the Latin American-originated white-fleshed sweet potato (Ipomoea batatas) has orange-yellow flesh. This is known as the Golden Sweet Potato or Orange-fleshed Sweet Potato. This crop is known as a "famine crop" because it requires very little water and nutrients. It yields the most food per unit of time and land area. Because of its high mineral content, the Golden Sweet Potato offers anti-inflammatory, anti-cancer, antioxidant, and anti-hyperglycemic qualities. It also helps with vitamin A deficiency and has immunity-boosting properties. People are interested in it because of these factors. These characteristics make the Golden Sweet Potato a promising crop for food and nutrition security. This is reviewed in the current article.

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