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POPULAR ARTICLE



Impact of maize (*zea mays*) silk in medicinal values

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Maize (*Zea mays* L.) Maize is one of the most important crops of world agricultural economy belongs to family poaceae, chromosome numbers $2n=20$ globally, maize is known as 'Queen of Cereals' because of its highest genetic yield potential among cereals. By origin, maize is native to South America and has adapted significantly to temperate condition with much higher productivity. Being a C_4 plant, it is physiologically more efficient and has higher grain yield and wider adaptation over a range of environmental conditions. Due to the growing demand for dairy and meat products in developing countries and the decline in rice production in China and India, maize has been projected to become the most important crop by 2030 (Salviet *al.*, 2007). Maize has a wider range of uses than any other cereals as animal feed, human food and for hundreds of industrial purposes.

World Maize Scenario

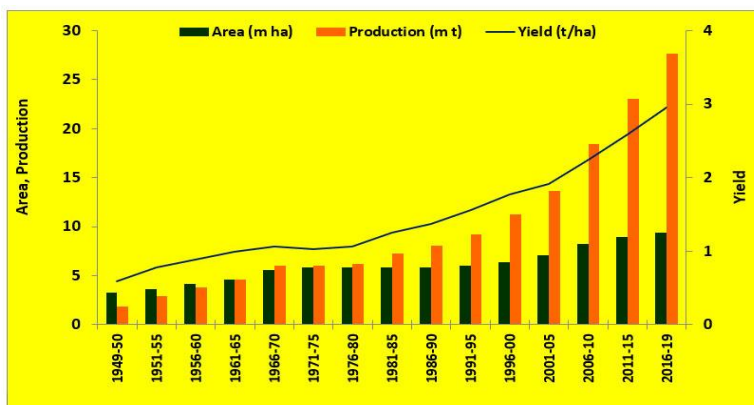
Maize is the second most widely grown crop in the world and cultivated in tropics, sub-tropics to temperate climate and has several types like field corn, sweet corn, popcorn and baby corn. Within field corn, it has several other types like quality protein maize (QPM), waxy maize, high-oil maize etc. Maize is an important crop for billions of people as food, feed, and industrial raw material. Currently, nearly 1147.7 million MT of maize is being produced together by over 170 countries from an area of 193.7 million ha with an average productivity of 5.75 t/ha (FAOSTAT, 2020). The global consumption pattern of maize is: feed-61%, food-17% and industry-22%. It has attained a position of industrial crop globally as 83% of its production in the world is used in feed, starch and bio fuel industries. Further, using maize directly or indirectly more than 3000 products

are being made providing wide opportunity for value addition. Because of its myriad uses, it is a prime driver of the global agricultural economy.

India Maze Scenario

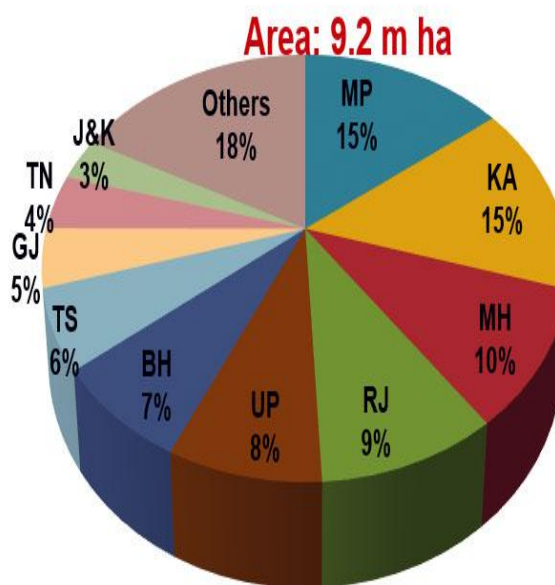
Among the maize growing countries India rank 4th in area and 7th in production, representing around 4% of world maize area and 2% of total production. During 2018-19 in India, the maize area has reached to 9.2 million ha (DACNET, 2020).

During 1950-51 India used to produce 1.73 million MT maize, which has increased to 27.8 million MT by 2018-19, recording close to 16 times increase in production. The average productivity during the period has increased by 5.42 times from 547 kg/ha to 2965 kg/ha, while area increased nearly by three times.

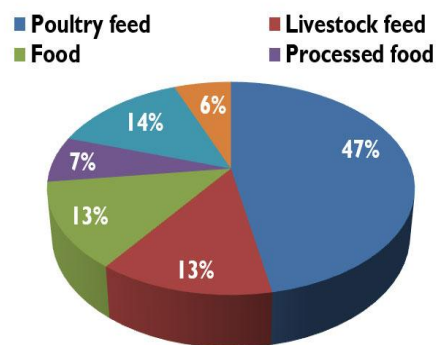


In India, maize is principally grown in two seasons, rainy (kharif) and winter (rabi). Kharif maize represents around 83% and rabi maize around to 17% maize area. Among cereals maize has highest growth rate in terms of area and productivity.

Since 2010 maize productivity in India is increasing @ over 50 kg/ha/year, which is highest among food crops. Among Indian states Madhya Pradesh and Karnataka has highest area under maize (15% each) followed by Maharashtra (10%), Rajasthan (9%), Uttar Pradesh (8%) and others? After Karnataka and Madhya Pradesh Bihar is the highest maize producer. Andhra Pradesh is having highest state productivity. Some districts like Krishna, West Godavari etc. records as high as 12 t/ha productivity.



Bulk of the maize production in India, approximately 47%, is used as poultry feed. Of the rest of the produce, 13% is used as livestock feed and food purpose each, 12% for industrial purposes, 14% in starch industry, 7% as processed food and 6% for export and other purposes.



Maize grains have a high nutritional value, but also a good capitalization of production, L. S. Muntean and others in 2014, mention over 56 uses in various industries of both grain and maize plants. Maize silk is considered to be a byproduct of maize crop, in this context silk is cheap and easily available on a large scale, and due to the medical properties they have, it is of real interest (Zoran Maksimovic et al., 2005).

Khairunnisa Hasanudin et al. in 2012, highlights the importance of corn stigmas from a medical point of view. A plant often used by traditional medicine in countries such as Turkey, India, China, the United States and France, due to the qualities they possess, potentially antioxidant, diuretic agent, reducing hyperglycemia and used as antidepressants or anti-fatigue.

Through this paper we aim to deepen the physiological description, the chemical composition and the medical use of this plant, especially the medical effects and the use of maize silk for medicinal purposes. For medical purposes, maize stigma (*Maidis stigmata*) is used more. Maize stigmas have a pleasant, specific, sweet-mucilaginous taste (L. S. Muntean et al., 2003). The stigmata contain flavonoids (0.1-6.3%), saponins (3%), volatile oils (0.2%), potassium and calcium salts, vitamins C, E, K, carbohydrates and allantoin. They have diuretic action, soothing in chronic cystitis and increase bile secretion, help eliminate water from tissues, favorable in cases of heart diseases and obesity (L. S. Muntean et al., 2016)

Morphology of the plant

Maize is a tall (1 to 4 meters depending upon variety) determinate annual plant producing large, narrow, opposing leaves (8 to 20 leaves), they occur alternately in two opposite rows on the stem. The maize leaf consists of a sheath, ligules, auricles and a blade. The leaf blade is long, narrow and hairy.

Stem

The stem generally attains a thickness (3 to 4 Cm). The stem is cylindrical, solid and is clearly divided into nodes and internodes. It may have 8 to 21 internodes. The ear bearing inter node is longitudinally grooved, to allow proper positioning of the ear head (cob).

Root

Normally Maize plant will have three types of roots, Seminal roots, adventitious roots, Fibrous roots. The roots of the maize plant grow very rapidly and almost equally outwards and downwards. Favorable soils may allow corn root growth up to 60 cm laterally and in depth.

Flower

Maize is a unisexual monoecious plant (Male and female flowers are borne on the same plant as separate inflorescences) male inflorescences (tassels) which crown the plant at the stem apex, and female inflorescences (cobs or ears), which are borne at the apex of condensed, lateral branches protruding from leaf axils.

Corn silk is a common name for *Stigma maydis*, the shiny, thread-like, weak fibers that grow as part of ears of corn (maize).

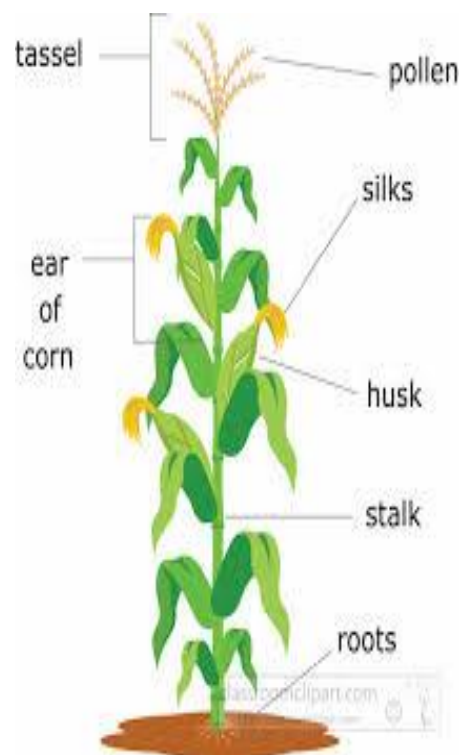
Macroscopic characters of maize stigmas have the form of silky filaments, friable, thin, slightly bent, flat, yellow-gold or brown-red, long at 0.5-20cm and 0.1-0.15mm wide, bifurcated and arched over the last 0.4-3mm (Pharmacopoeia of Romania, 1993).



The ear is enclosed in modified leaves called husks. Corn silk contains a variety of pharmacologically-active compounds, and as such is used in many types of folk medicine, including as a diuretic and as an inhibitor of melanin production

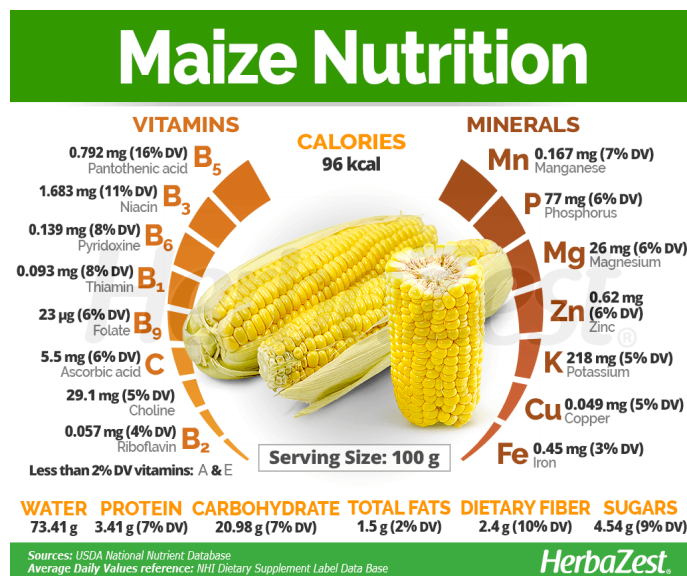
Nutritional value and chemical composition

Worldwide, there is a considerable segment of the population for which the maize is the main source of food. Together with rice and wheat, the maize provides at least 30% of the dietary calories of over 4.5 billion people in 94 countries. By 2025 maize will



become the crop with the largest globally production and also in developing countries, and by 2050, maize demand in developing countries will double (Murdia L.K. et al., 2016).

Maize grains have a high nutritional value and a complex chemical composition. These values may vary depending on the biological material studied. Maize flour is nutritious, tasty, easy to digest, regularly consumed, helps cleanse the colon, helps digestion by reducing stomach acid, consumed as popcorn helps avoid constipation and consumed alongside the rest of the grains helps to reduce the development of certain cancers (Murdia L. K. et al., 2016).



Chemical composition of maize flours by average values per 100 g edible portion

Depending on the genetic material used, the production of silk on cob may differ, results in this sense being published by María L. Mendoza-López in 2017, where in some Mexican maize landrace, with silk of different colors, has obtained between 5-12 g silk /cob. In the composition of dry maize silk, the main components were carbohydrates (65-70%), especially fibers (39-53%). Of this fiber content, insoluble fibers were predominant (36-52%) and soluble fibers were only a small fraction (> 3%).

The chemical composition of maize silk has been studied by Nurhanan Abdul Rahman and Wan Ishak Wan Rosli in a more complex research, made in 2014. According to this study, the immature silk has the following nutritive values: moisture 89.31% fresh and after drying have remaining moisture 4.15%, 1.26% crude lipids, 12.96% crude proteins, 5.28 ash, 27.80% total carbohydrates 48.50% dietary fiber and **mineral content:** calcium macronutrients 1087.08 µg / g, magnesium 1219.17 µg / g, potassium 26218.67 µg / g, sodium 190.67 µg / g and copper microelements 5.60 µg / g, iron 2.17 µg / g, magnesium 32.17 µg / g and zinc 46.37 µg / g.

Uses of maize silk in medical purposes

Corn silk contains a variety of plant compounds that may be responsible for various health effects. In traditional Chinese and Native American medicine, it's used to treat a variety of ailments, including prostate problems, malaria, urinary tract infections (UTIs), and heart disease.

More recent research indicates that it may also help reduce blood pressure, cholesterol, blood sugar, and inflammation. Corn silk may be used fresh but is often dried before being consumed as a tea or extract. It may also be taken as a pill.

Antioxidant effect

Antioxidants are plant compounds that protect your body's cells against free radical damage and oxidative stress. Oxidative stress is one of the major causes of a number of chronic conditions, including diabetes, heart disease, cancer, and inflammation. Corn silk is a naturally rich source of flavonoid antioxidants. Multiple test-tube and animal studies demonstrate that its flavonoids reduce oxidative stress and protect against free radical damage. These compounds may be responsible for many of corn silk's benefits.

Anti-inflammatory properties

Inflammation is part of your body's natural immune response. However, excessive inflammation is linked to a variety of illnesses, including heart disease and diabetes. Test-tube and animal studies have found that corn silk extract may reduce inflammation by suppressing the activity of two major inflammatory compounds. This stringy plant fiber also contains magnesium, which helps regulate your body's inflammatory response. That said, human research is needed.

May manage blood sugar

Some research indicates that corn silk may lower blood sugar and help manage diabetes symptoms. One animal study noted that diabetic mice given corn silk flavonoids had significantly reduced blood sugar compared to a control group. A recent test-tube study also revealed that antioxidants in this corn product may help prevent diabetic kidney disease. Although these results are promising, human studies are needed.

Antidepressant effect

The concentration of phenols and flavonoids contained in maize silk also has an antidepressant effect, as demonstrated by M. Mahmoudi et al, 2009. They have obtained very good antidepressant results using maize silk extract by maceration in ethanol, the product being tested on five groups of Swiss albino mice.

Anti-tumor effect

Cancer is known to be among the greatest medical problems of our days, as well known is the difficulty with which it is treated and the negative effects that the treatments applied have on the immune system. Polysaccharides extracted from maize silk, significantly inhibit tumor growth, prolonging mice survival in the study realized by Jingyue Yang et al. in 2014. The antitumor effect was also studied by Jisun Lee et al. (2012). He followed the evaluation of the potential antineoplastic activity of maysine, an important flavonoid contained in maize silk. The obtained results suggest that maysine obtained from maize silk may have the potential to prevent prostate cancer.

May lower blood pressure

Corn silk may be an effective treatment for high blood pressure. First, it encourages the elimination of excess fluid from your body. As such, it could be a natural alternative to

prescribed diuretics, which are often used to reduce blood pressure. What's more, a recent study in rats discovered that corn silk extract significantly reduced blood pressure by inhibiting the activity of angiotensin-converting enzyme (ACE). In one 8-week study, 40 people with high blood pressure were given increasing amounts of this supplement until they reached a dose of 118 mg per pound of body weight (260 mg per kg). Their blood pressure dropped significantly compared to that of a control group, with those given the highest dose experiencing the greatest reduction. Still, more human research is needed.

May reduce cholesterol

Corn silk may also lower cholesterol. One animal study found that mice given corn silk extract experienced significant reductions in total and LDL (bad) cholesterol alongside increases in HDL (good) cholesterol. In another study in mice fed a high-fat diet, those that received corn silk experienced significantly lower total cholesterol than those that did not get this supplement. Even so, human research is needed.

Corn silk dosage

Because human research on corn silk is limited, official dosage recommendations haven't been established. A variety of factors could influence your body's reaction to this supplement, including age, health status, and medical history. Most available research suggests that corn silk is nontoxic and those daily doses as high as 4.5 grams per pound of body weight (10 grams per kg) are likely safe for most people. That said, most labels for corn silk supplements recommend considerably lower doses of 400–450 mg taken 2–3 times per day. It's recommended to start with a low dose to ensure that your body responds favorably, and then increase it gradually if necessary. If you're unsure about an appropriate dosage, consult your medical provider.

Conclusions

Due to its importance, maize occupies the largest cultivated area of all cultivated crops. This is due to the fact that it realizes high production rates but also to its ratio of investment versus profit. Maize silk, being a byproduct, it does not require any investment for its production; the cost would be just harvesting the material and conditioning it. The content of active principles is different between cultivated hybrids. It would be advisable to deepen the studies on this subject by conducting chemical analyzes of maize silk from the most cultivated hybrids in Romania, so that the silk is harvested from the most valuable biological material.

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