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The Beautiful Science of Bonsai: An Ever-Evolving Art

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Abstract:
One magnificent art form in the category of plants native to China is bonsai. Over a century, this art evolved in Japan and later was divided based on its growth habits. In the 13th century, the Japanese developed a culture of collecting naturally dwarf forest trees and using some training practices to reduce the size of those trees to make them more aesthetic and pleasing for pot culture. Hence, these plants were present in nature only but gracefully grafted by the Japanese people. The term "bonsai" has its origin in Japan only, wherein "bon" means a shallow pan/tray/vessel and "Sai" means tree/plant making the whole meaning a "pot or tray of plants". The older trees are considered more suitable as a bonsai owing to their more prominent rounded canopy and drooping branches resulting in an aged, graceful appearance. A typical bonsai ranges from 5 to 30 inches in height.

Introduction

Also known as a Living Japanese Art, bonsai means a miniaturized tree grown in a pot that exhibits all its natural characteristics. There are two schools of thought in Japan - one upholds that Bonsai is a modification of a potted plant that has its roots in India, cultivated by the sages (medicinal practitioners) and this art is referred to in the Ayurveda as "Vamanathanu Vrishadi Vidya" - meaning the science of dwarfing the plant. This art was taken to China by the Dyan Buddhist Monks who later traveled to Japan. However, the indisputable fact is that the Japanese mastered the art of Bonsai to the present day, in a mature state. Now Bonsai is almost identical to Japan. The other school advocates that Bonsai is from Japan.

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Bonsai is simple to cultivate if one is familiar with the growing technique, and has a passion for plants along with compassion, patience, and time. Almost any tree and shrub with tap or primary roots can grow as bonsai. However, the trees that are more suitable or excellent for bonsai should have attractive trunk lines with a good arrangement of branches, beautiful bark color, and compact, fine-textured foliage with small leaves, flowers, and fruits.

Keshitsubo	1 to 3 inches ("fingertip")	Smallest category of miniature trees (used to create intricate landscapes/scenes like forests, mountains, waterfalls.
Shito	2 to 4 inches ("thumb")	Also known as thumb bonsai because they can be held in the palm of a hand, often grown in shallow pots/trays.
Mame	2 to 6 inches ("one-hand")	These miniature trees can be held in one hand, requires delicate care and attention.
Shohin	5 to 8 inches ("one-hand"	Word Shohin means: smallgoods in Japanese, small enough to be held in one hand.
Katade -Mochi	10 to18 inches ("two-hands")	Most popular and versatile category of bonsai. It can be held with 2 hands and is easier to care for than smaller ones.
Chiu or Chumono	10 to 36 inches ("two-hands")	The subcategory of the medium bonsai range displays more characters and clout than the smaller bonsai.
Dai or Omono	30 to 48 inches ("four-hands")	The large-size bonsai category, requires four hands for lifting and often displays in large spaces or outdoors. Also known as "garden bonsai" or "landscape bonsai".
Hachi-uye	40- 60 inches ("six-hands")	One of the largest categories of bonsai, displayed on the floor or on low stands and requires 6 hands to move. They are considered as the most impressive and majestic bonsai specimens.

Types of Bonsai (based on height)
Mini Bonsai: up to 5 cm;
Mame Bonsai: 5 to 15 cm
Medium Bonsai: 30 to 60 cm
Large or Big Bonsai: 60 to 100 cm
Small Bonsai: 15 to 30 cm

Before creating this successful and beautiful miniature, the most vital step is the selection of plants.

Although many of the plants or shrubs can be shaped into bonsai with much time and patience, some of the species are considered best due to their growth habits, leaf size, and adaptability to training and pruning practices. The key factors for selecting plants are:

Selection Criteria for Plants:

1) **Growth Habit:** the selected plant should have a vigorous growth habit, show a good response to training and pruning operations, and develop itself as a good replica of the normal plant.

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2) **Hardiness:** the plant selected should be hardy, possesses a strong,
3) **Size of the leaves:** smaller leaved species are perfect for bonsai
4) **Easy maintenance:** Although bonsai requires more attention and care, some species also require less maintenance.

Suitable Plants for Bonsai in Indian Climate:

Botanical name	Common name
Ficus bengalensis	Banyan tree
Ficus riligiosa	Pipal
Ficus carica	Anjeer
Mangifera indica	Mango
Bouhinia varigata	Kanchan
Acacia nilotica	Babool
Auracauria cuci	Christmas Tree
Gravellia robusta	Silver Oak
Citrus lemon	Lime
Bambosa species	Bamboo
Pinus sylvestris	Pine

Final Thoughts :

As a living sculpture, bonsai is a representation of any kind of tree ranging from lone to thick forests. This unique field of study is the art of miniaturization that combines the aspects of philosophy, painting, sculpture, architecture, and gardening. To create such a piece on a living plant, the artist should lead by the basic rules of aesthetics which include simplicity, asymmetry, suggestibility, and a sense of beauty. Bonsai is a work of art that amazes anyone quickly and makes them thick trunk with a good natural appearance instantly happy. One of the oldest bonsai is thought to have lived for more than 800 years. Hence, if anyone acquires bonsai today, it could end up being a heritage, passed down through the family, and treasured by future generations.

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Garlic: The Nectar of Life

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Abstract:
Garlic (*Allium sativum L.*), a member of the Amaryllidaceae family, is a widely cultivated and nutritionally rich bulb crop with significant health benefits. Known for its high polyphenolic and organosulfur content, garlic has been valued since ancient times for both culinary and medicinal uses. It is a potent source of essential macro- and microelements, vitamins, and bioactive compounds, contributing to its antioxidant, anti-inflammatory, and lipid-lowering properties. The presence of sulfur-containing compounds, particularly allicin, enhances its therapeutic potential against various diseases. Garlic has been extensively studied for its role in reducing the risk of cardiovascular diseases, hypertension, diabetes, and certain cancers. It also strengthens immune function and aids in detoxification processes. This article explores the nutritional composition, health-promoting properties, and medicinal benefits of garlic, highlighting its potential as a natural remedy for preventing and managing several chronic diseases.

Introduction

Garlic (Allium sativum L.) is a member of the Amaryllidaceae family which is an important vegetable crop that is cultivated all over the world and contribute constituents significantly affecting human health. It is a polyphenolic and organosulfur enriched nutraceutical spice consumed since ancient time. It is the second most important bulb crop after onion in India is used for flavoring and seasoning vegetables and dishes. It has a higher nutritive value and flavor of its clove is more strong than other bulb crops. Although it has medicinal properties too such as anticarcinogenic and antitumorogenic that's why considered as "nectar of life".

Nutritional composition of garlic

Garlic is a good source of macroelements and microelements, especially potassium, calcium ,magnesium, phosphorus, ferrous, manganese, selenium, vanadium, copper and zinc. Ascorbic acid content is very high in green garlic.The cultivation of garlic in varied climatic conditions leads to a significant change in the content of various eleme

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Particulars	Fresh peeled garlic cloves	Dehydrated garlic powder
Moisture (%)	62.80	5.20
Protein (%)	6.30	17.50
Fat (%)	0.10	0.60
Mineral matter (%)	1.00	3.20
Fibre (%)	0.80	1.90
Carbohydrates (%)	29.00	71.40
Energy Kcal	145.00	--
Calcium (%)	0.03	0.10
Phosphorus (%)	0.30	0.42
Potassium (%)	--	0.70
Magnesium (mg/100 g)	71.00	--
Iron (%)	0.001	0.004
Niacin (%)	--	0.70
Sodium (%)	--	0.01
Copper (mg/100 g)	0.63	--
Manganese (mg/100 g)	0.86	--
Zinc (mg/100 g)	1.93	--
Chromium (mg/100 g)	0.02	--
Vitamin A (IU)	0.40	175.00
Nicotinic acid (mg/100 g)	0.40	--
Vitamin C (mg/100 g)	13.00	12.00
Vitamin B (mg/100 g)	16.00	0.68
Riboflavin B_2 (mg/100 g)	0.23	0.08
Thiamine (mg/100 g)	0.06	--

Health benefit of garlic

Garlic is one of the best disease preventive foods because of its potency and widespread effect. The unique flavor and health-promoting functions of garlic are generally attributed to its rich content of sulfur-containing compounds, i.e., alliin, γ-glutamylcysteine, and their derivatives. It is widely used in preparation of ayurvedic medicines. In ancient time, garlic was used as a remedy for intestinal disorder, flatulence, respiratory infection, wounds, aging and other ailments. Garlic and its secondary metabolites have shown excellent health-promoting and disease-preventing effects on many human common diseases, such as cancer, cardiovascular and metabolic disorders, blood pressure, and diabetes, through its antioxidant, anti-inflammatory, and lipid-lowering properties It is also aids in the reduction of risk factors for cardiovascular diseases and cancer, stimulation of immune function, enhanced foreign compound detoxification, restoration of physical strength, resistance to various stresses and potential antiaging effects. The bulbs of garlic contain an amino acid, allicin which is a colourless, odourless and water-soluble amino acids. When the bulbs of garlic are crush, the enzyme allinase gets break down into allin to produce allicin of which the principal ingredient is odoriferous diallyl disulpide. Garlic contains about 0.1% volatile oil. The chief constituents of oil are diallyl disulfide (60%), diallyl trisulfide (20%), allyl propyl disulfide (6%), a small quantity of diethyl disulfide and probably diallyl polysulfide. Diallyl disulfide possesses the true garlic odour.

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Properties of garlic

- **Antioxidant property**
  It has strong antioxidant properties due to its nutritional and phenolic compounds. The antioxidant properties of aged garlic extract (AGE) decrease reactive oxygen species, which are produced through increased metabolism or chronic inflammation. Garlic with its antioxidant properties can be used to prevent oxidative stress-mediated diseases.
- **Anti - inflammatory property**
  Various chronic diseases, such as cancer and cardiovascular diseases, are related with inflammatory processes; in these conditions, different types of therapeutic and natural tools have been used to prevent them. Garlic has shown to exert potent anti-inflammatory effects by decreasing the inflammatory biomarkers. Immune cells are responsible for the anti-inflammation effect; aged garlic contains various compounds that can improve immune systems by modulating cytokine production.
- **Lipid lowering property**
  Garlic has shown promising lipid-lowering effects on hyperlipidemic patients through the reduction of serum cholesterol concentration. The consumption of garlic extract increases high density lipoprotien (HDL) which is also called good cholesterol as it absorbs cholesterol and carries it back to the liver which then remove it from body and decreases low density lipoprotein (LDL) or bad cholesterol.

Garlic as a cure to disease

- **Cancer**
  Garlic can provide symptomatic relief of various cancer conditions, including breast, colorectal, colon, gastric, lung, and pancreatic cancers. It has functional phytochemicals, such as allyl sulfur compounds or allicin which provide high amounts of antioxidants. Numerous mechanisms have been recommended to explain the chemo-preventive effects of garlic, including the inhibition of DNA adduct formation, the inhibition of mutagenesis by blocking metabolism, through its free-radical scavenging, or by decreasing cell proliferation and tumor growth.
- **Cardiovascular disease**
  Garlic can significantly reduce the risk of atherosclerosis, hypertension, diabetes, hyperlipidemia, myocardial infarction, and ischemic stroke due to the synergistic effects of its nutritional and phytochemical components. Atherosclerosis and vascular inflammation are usually accompanied with oxidative stress, endothelial dysfunction, and inflammatory cytokines and garlic has the potential role in the prevention and treatment of atherosclerosis and myocardial infarction.
- **Hypertension**

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Garlic act as a hypertensive remedy by regulating high cholesterol levels and stimulating the immune system through antihypertensive effect by lowering systolic blood pressure.

- **Diabetes**
  Oxidative stress is responsible for promoting diabetes and garlic's active organosulfur compounds reduced hyperglycemia by improving the status of antioxidant. Also, the garlic component acts as hydrogen sulfide donors which control type 2 diabetes. Recently, few meta-analyses demonstrated that garlic may decrease lipid profile and glucose parameters such as fasting blood glucose concentrations and hemoglobin A1c (HbA1C) in diabetics patients.

Conclusion

Garlic (*Allium sativum L.*) is a nutritionally and medicinally significant crop with a long history of use in both traditional and modern medicine. Its rich composition of polyphenols, organosulfur compounds, vitamins, and minerals contributes to its numerous health benefits, including antioxidant, anti-inflammatory, and lipid-lowering properties. Scientific research has validated its effectiveness in preventing and managing various chronic diseases such as cardiovascular disorders, hypertension, diabetes, and cancer. The bioactive compounds in garlic, particularly allicin and other sulfur-containing compounds, play a key role in its therapeutic potential. Given its extensive health benefits and widespread availability, garlic can be considered a valuable functional food that supports overall well-being. Further research and clinical studies can help in better understanding its mechanisms and optimizing its use for disease prevention and treatment.

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Production technology of Underutilized Cole crops

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Abstract:
Cole crops, belonging to the *Brassica oleracea* species, are among the most widely cultivated temperate vegetables. This group includes cauliflower, cabbage, broccoli, Brussels sprouts, kale, and knol khol. These crops are nutritionally rich, providing high levels of vitamin C, carotene, and essential minerals. Their characteristic flavor is attributed to volatile sulfur compounds, some of which also have cancer-preventive properties. The domestication of cole crops is believed to have originated in the Mediterranean or North Atlantic regions, with linguistic and literary evidence supporting ancient Greek and Latin influences. Cole crops thrive in cool-season conditions and require well-drained, humus-rich soil with a pH of 6.0-7.5 for optimal growth. The cultivation process involves nursery raising, proper spacing, transplanting, fertilization, irrigation, and weed management. With appropriate agricultural practices, high yields can be achieved, making cole crops a vital component of global vegetable production and human nutrition.

Introduction

Cole comes from the word Caulis meaning Stem. Originated from *Brassica oleracea var.* sylvestris. Protogyny and Genetic male sterility found in Cole. Sprouting broccoli having highest cross pollination 95%. Sporophytic self-incompatibility is found in cole crops.

Cole crops are one of the largest groups of temperate vegetables, comprising important crops like Cauliflower (*Brassica oleracea* var. *botrytis*), Cabbage (*B. oleracea* var. *capitata*), Sprouting Broccoli or Broccoli (*B. oleracea* var. *italica)*, Brussels sprout (*B.*

oleracea var. *gemmifera*), Kale (*B. oleracea* var. *acephala*), and Knol Khol (*B. oleracea* var. *gongylodes*).

Nutritional Importance

Cole crops are rich in vitamin C and they are good sources of minerals. Broccoli and kale are rich in carotene (provitamin A). Several volatile sulphur compounds are responsible for the characteristic flavour of

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the Cole crops. Dimethyl trisulfide has been indicated as the major aroma component in cooked Brassicaceous vegetables. These vegetables contain compounds known as indoles and Di-thiol-thiones which have been linked with the prevention of cancers of the colon, rectum, and breast.

Sinigrin toxic compound present in cole crops. Cauliflower has the Highest sulphur content. Cole crops have medium level of Inbreeding depression. Cabbage and broccoli are used raw in salads. Cabbage is used steamed or boiled alone, or in a mixture of other vegetables as main dishes with meat or in casseroles. Sauerkraut is the main processed product from Cabbage. Some Cabbage is dried after blanching and also pickled. Cauliflower is cooked or steamed. It is used in a mixture with other vegetables for the preparation of curry and fried rice in the Orient. It is also pickled along with other vegetables.

Origin and Domestication of Cole Crops

Linguistic and Literary Considerations. Various attempts have been made to locate the area of domestication of *Brassica oleracea* crops. Contrasting hypotheses suggest either a North Atlantic or a Mediterranean origin. In the absence of archaeological proof, linguistic and literary considerations can offer some insight into this issue.

Expressions indicating a deep-rooted knowledge and use of these crops are present in early works of ancient Greek and Latin literature, while no trace of cole crops has been found in documents from ancient Egyptian or other Fertile Crescent civilizations. Most cole crop terminology used in modern European languages can etymologically be traced to ancient Latin or Greek roots, particularly those terms indicating the most obvious morphological feature of the primitive domesticated forms, i.e., the solid upright stem (kaulos, *caulis*). Celtic tradition is not documented earlier than the Christian era, other than in stone inscriptions, and there is no clear evidence of a "Cole tradition" among the Celts. This paper gathers information from the linguistic, literary, and historical points of view that are compatible with the domestication of *B. oleracea* in the ancient Greek-speaking area of Central and East.

Inflorescence Type

Cole crops, which belong to the Brassica oleracea species, typically have a racemose type of inflorescence. However, cauliflower is an exception—it has a cymose type of inflorescence. In racemose inflorescences, flowers are borne on the main stem and its branches. The slender pedicels (flower stalks) are usually only 1.5-2.0 cm long.

Flowering and Bolting

The mechanism of Bolting (transition from vegetative growth to reproductive growth) and flowering in Cole crops usually occurs on mature vegetative plants. This can happen either in-situ (in the field) or ex-situ (after transplanting) at temperatures around 5-10°C—a process known as vernalization. Vernalization helps trigger the flowering process, ensuring that cole crops produce flowers and eventually seeds.

Soil

Cole crops prefer well-draining soil that allows excess water to flow away. Soil will rich in Organic Matter Soil P^H: Aim for a soil P^H between 6.0 and 7.5. Cole crops prefer slightly acidic to neutral soil. Cole crops grow well on a wide variety of soils,

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but humus rich well-drained loamy soils are most desired.

P^H is higher than 7.0, availability of boron is reduced resulting in browning of curds Light sandy soils though enhance maturity but tend to produce small and loose curds. Low P^H (acidic soil) affects nutrient availability and can lead to Clubroot disease.

Climate

These are cool-season crops. Can tolerate very cold conditions and even frost to some extent, particularly at younger stages of growth. Mild and moist climates with average temperature of 15-20 °C are quite suitable for their growth.

Thermosensitive crops. Optimum mean temperature for growth ranges from 15°C-25°C. Optimum temperature for seed germination 12-16° C Optimum temperature growth of young plant 23°C later it may vary from 17-20°C The tropical cultivars can be grown even at temperature of 35 °C. Tropical Cauliflower group forms curds at 20-25°C and the temperate group at 10-16°C

Very low temperature during Curd development causes elongation of internodes and open heads induce flowering at 4-8° C for 40-60 days. The early varieties require High temperature and longer days whereas, the late varieties respond to low temperature and short days.

Sowing Time

Plant Cole crops in early spring for a summer harvest or in late summer for a fall harvest. Start seeds indoors 4-6 weeks before your last frost date.

Alternatively, directly sow seeds into the garden when the soil temperature reaches around 50°. Seeding to harvest takes 60 to 100 days, depending on the variety-

For Northern and Eastern Regions:

Temperate Cultivar Sowing: October to November

Tropical Cultivar Sowing: July to August and January to February

For Southern and Western Regions:

Cole crops can be grown year-round

Seed Rate and Spacing

Crops	Seed rate (gm)	Spacing(cm)
Kale	350-400	45 ×60
Knol-Khol	1-1.5 Kg	30×30
Brussel Sprout	500	45×60
Red Cabbage	375-500	45× 45

Nursery raising:

Soil of nursery bed should be well prepared and free from weeds and disease organisms. Farm Yard Manure or Compost 2-3kg/m2 be added to the seed beds. Raised seed beds of 8.5×1.0m size with 15-20cm height. Seeds are sown 1-2cm deep by dropping at 4-5cm in rows 10cm apart. Seeds are gently covered with the mixture of fine manure and soil. A regular and good moisture supply is needed for rapid germination and optimum growth of seedlings.

Spacing:

Row to row: 30-45 cm, Plant to plant: 30-45 cm

Transplanting:

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Generally, 4-6 weeks old healthy seedlings with 4 or 5 leaves are selected for transplanting in the main field. Transplanting of seedlings be done in the afternoon for better establishment.

Manure and Fertilizer

For cole crops, apply farmyard manure (FYM) at a rate of 10–15 tons per hectare. Use fertilizers with the following NPK ratio: 130:110:100 (N: P2O5:K2O) per hectare. Specifically, apply urea (283 kg/ha), single super phosphate (SSP, 687 kg/ha), and muriate of potash (MOP, 167 kg/ha). The nutrients promote healthy growth and help achieve optimal yields

Irrigation

Provide the first irrigation soon after transplanting seedlings, and continue irrigation for the next 7 days. Subsequent irrigations can be applied at 10–12 days intervals, depending on soil moisture availability.

Weed Control and Earthing Up

Adequately control weeds, as they compete with the crop for nutrients, moisture, and light. Use physical, mechanical, or chemical methods to manage weeds, followed by earthing up.

Harvesting and Yield

Crops	Harvesting stage	Yield (t/ha)
Kale		10-25 t/ha
Knol-Khol	Diameter attain of 5-7 cm	12-30 t/ha
Brussel Sprout	120 days after transplanting	10-16 t/ha
Red Cabbage	Compact head	50-75 t/ha

Conclusion

Cole crops are an essential part of modern agriculture due to their nutritional benefits, adaptability to diverse climatic conditions, and economic significance. Their rich composition of vitamins, minerals, and bioactive compounds makes them valuable for human health. Proper cultivation techniques, including suitable soil preparation, nutrient management, irrigation, and pest control, are crucial for maximizing productivity. The historical significance and widespread adoption of cole crops across cultures highlight their importance in sustainable agriculture. Further advancements in breeding, disease resistance, and climate adaptation will ensure their continued contribution to food security and human well-being.

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Significance role of Agroadvisories in managing climate risks for agricultural crops in hilly region

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Abstract:
Agroadvisory services integrate weather-based information with crop management strategies to enhance agricultural productivity, particularly in hilly regions where vegetable cultivation holds economic significance. These services provide timely weather forecasts and crop-specific recommendations based on growth stages, helping farmers mitigate climate-related risks. Weather forecasting plays a crucial role in agricultural decision-making, with predictions categorized into nowcasting, short-range, medium-range, and long-range forecasts. Each type of forecast aids in planning sowing, irrigation, pest control, and harvesting. Extreme weather events, including drought, heavy rainfall, high winds, and temperature fluctuations, significantly impact crop growth and yield. Agroadvisory services bridge the gap between scientific knowledge and practical farming, equipping farmers with actionable insights to optimize productivity. Future advancements in technology and data analytics will further strengthen these services, making agriculture more climate-resilient and sustainable.

Introduction

Agroadvisory services integrate weather-based information with crop management strategies, offering significant potential to boost productivity in mixed cropping systems. Vegetables crops are particularly well-suited to hilly regions, enhancing the area's economic prospects due to their high market value. However, extreme weather events can directly affect crop production and development, threatening sustainable farming practices. Agroadvisories provide essential weather forecasts for the next five days every tuesday and friday, including alerts for severe weather conditions and warnings. They also deliver crop-specific recommendations on the basis of growth stages covering fundamental cultivation practices, suitable crop varieties for specific locations, and guidelines for different crop growth stages.

Given the strong connection between horticultural production and weather patterns, market dynamics are also weather-dependent. Agroadvisory services have become an effective medium for transferring climate-related information and technology to farmers. By providing timely and accurate weather forecasts

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alongside essential agricultural recommendations, Agro Advisory Services (AAS) help farmers make informed decisions, manage climate risks, and achieve sustainable and profitable agricultural outcomes.

Role of Weather Forecasting in Agriculture

Agriculture and vegetable crops play a vital role in hill's economy. Crop growth and development are closely linked to weather conditions. Weather is an important factor for determination of yield. The different growth phases of crops are significantly impacted by prevailing weather conditions. In the prospective of hilly regions the importance of weather in horticultural and agricultural production is particularly well-recognized. By effectively utilizing agrometeorological advisories, farmers can enhance crop production and prevent losses or crop failures. These services are essential during various crop growth and development stages.

Weather forecasts are typically provided at three levels: short-term, medium-term, and long-term. Agroadvisories are developed to help minimize agricultural and horticultural losses while increasing farmers' incomes through the adoption of modern technologies. However, the lack of timely, reliable, and accurate agrometeorological information remains a significant barrier to efficient farm planning and management.

Types of Weather Forecasting

(i) Nowcasting:

Nowcasting refers to weather predictions for periods of less than 12 hours. It primarily focuses on local weather events such as thunderstorms, dust storms, cyclones, and extreme temperature variations like heat and cold waves.

(ii) Short-Range Forecasting (SRF):

Short-range forecasts provide weather predictions and warnings valid for up to 36-72 hours along with an outlook for the following two days. These forecasts include information on cloud cover, rainfall distribution, heavy rainfall, extreme temperature, cyclones, hailstorms, frost, and wind speed. Issued twice a day based on synoptic conditions, they are useful for weather-based agricultural decisions.

(iii) Medium-Range Forecasting (MRF):

Medium-range forecasts provide predictions for 3 to 10 days. They cover weather elements such as cloud cover, rainfall, temperature variations, wind speed, wind direction. The center focuses on generating medium-range forecasts and disseminating them for agrometeorological advisory services. Agriculture related forecasting comes under this category.

(iv) Long-Range Forecasting (LRF):

Long-range forecasts predict weather conditions beyond 10 days to crop season include monthly and seasonal forecasts. The India Meteorological Department (IMD) resumed issuing long-range monsoon forecasts in 1988, typically by the end of May. These forecasts help anticipate trends in food grain production before the kharif season, as agricultural output largely depends on monsoon rainfall and its distribution.

Additionally, these forecasts aid in stabilizing food grain prices through government interventions. In years of surplus rainfall, the government may purchase excess produce, while in deficit years, it can release stocks to manage supply and demand. This approach promotes price stability, reduces financial losses, improves food distribution, and supports effective import-export policies.

Impact of Weather on Production

Farmers rely on favorable weather conditions to successfully cultivate crops. Excessive rainfall can lead to plant decay

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while insufficient rainfall makes it challenging to grow crops and sustain livestock.

Factors Affecting the Growth and Development of Agricultural and Horticultural Crops

(i) Drought:
Prolonged periods of no rainfall can result in water shortages, causing crops to wither and die, ultimately reducing yields and cause dryness in the field and lost several minerals from the field.
(ii) Heavy Rainfall:
Excessive rain can cause flooding cause difficulty for farmers to manage their crops and get good yield. If heavy rainfall occurs during planting or sowing periods, it may delay these activities and subsequently postpone harvests. Heavy rainfall can degrade soil structure, wash away nutrients, and promote fungal and mold infestations due to high humidity.
(iii) High Winds:
Strong winds can erode the healthy soil and damage plants by tearing leaves. Generally weaker or smaller plants may be uprooted. Severe storms accompanied by high winds can flatten crops, cause soil erosion, and damage farming infrastructure.
(iv) Low Temperature or Chilling Injury:
Cold temperatures pose challenges for growers. Sudden drops in temperature can damage sensitive crops, particularly during critical growth phases such as flowering and fruiting. Livestock may also require adequate shelter, food, and water during cold spells.
(v) Heatwaves:
Extended periods of extreme heat can stress plants, reduce crop yields, and potentially lead to crop failure, especially when combined with drought conditions.
(vi) Hailstorms:
Hail can physically damage crops by shredding leaves, bruising fruits, and breaking stems, resulting in reduced crop quality and yield.
(vii) Tornadoes:
Tornadoes can cause localized but severe damage by uprooting plants, destroying fields, and scattering debris.
(viii) Wildfires:
Wildfires can directly destroy crops, while the resulting smoke and ash may further harm crops and contaminate produce.
(ix) Landslides:
Triggered by heavy rainfall or seismic activity, landslides can bury agricultural fields under debris, rendering them unusable for cultivation.

Future of Agroadvisory Services

The future of agroadvisory services is promising, driven by advancements in technology, data analytics, and growing awareness of the importance of climate-smart agriculture. These services will continue to play a crucial role in improving agricultural productivity and ensuring sustainable farming practices. Future agroadvisories will involve farmers in data collection and decision-making processes, ensuring that recommendations are practical and context-specific.

Training and awareness programs will empower farmers to make better use of agroadvisory services and adopt modern agricultural techniques. In conclusion, the future of agroadvisory services lies in their ability to leverage emerging technologies and deliver precise, actionable, and timely information to farmers. These advancements will be essential for achieving sustainable and climate-resilient agricultural systems.

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Walnut: A Nutritive Fruit Nut

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Abstract:
Walnut (*Juglans regia* L.) is one of the most widely cultivated tree nuts globally, valued for its nutritional, economic, and medicinal significance. It is primarily grown in temperate regions, with China leading global production. In India, walnuts are predominantly cultivated in Jammu and Kashmir, contributing nearly 90% of the country's total production. Walnuts are rich in proteins, essential fatty acids, vitamins, and minerals, making them highly beneficial for health. They provide numerous health benefits, including antioxidant properties, cardiovascular support, diabetes management, improved metabolism, and brain health enhancement. Additionally, walnuts have anti-inflammatory and anti-cancer properties and contribute to better digestion, bone health, and skin nourishment. Their diverse applications range from culinary uses in bakery and confectionery industries to industrial applications such as timber production and oil extraction. Given their nutritional profile and wide-ranging benefits, incorporating walnuts into the daily diet promotes overall well-being and disease prevention.

Introduction

The walnut (*Juglans regia* L.) is the most widespread tree nut in the world. It belongs to the genus Juglans and family Juglandaceae. The fruit is not a true botanical nut but a drupe with the edible seed (nut) enclosed in a shell within a thick husk. It is commonly called as the Persian walnut, white walnut or common walnut. It believed to have originated from the region of Persia to Kashmir. The major walnut growing countries are China, Iran, USA, Turkey, Ukraine, Mexico, France, India, Romania and Chile.The world production of walnut is 3.26 million metric tonnes and China is the largest producer of walnut in the world. In India, it is commonly known as akhrot and is grown in northern parts of the country under temperate agroclimatic condition. In India, the area under walnut cultivation is 1.5 lakh hectares with an annual production of 2.84 lakh metric tonnes. Jammu and Kashmir is the principal walnut growing state. This state contributes 83600 hectares land and yield 2.25 lakh tonnes nut. It produces about 90% of the total production in India with an average productivity of 2.69 mt per ha. The other walnut growing states are Himachal Pradesh, Uttarakhand and Arunachal Pradesh. The major importing countries of walnut from India are United Kingdom, Egypt, Netherlands, Germany, USA, Australia and Taiwan.

Importance and uses of walnut

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Walnut is very rich in proteins, fats and minerals and is a concentrated source of energy. It contain good amount of vitamin B_6 among all the other nuts. A high amount of Omega-6 and omega-3 PUFA, which are essential dietary fatty acids are present in walnut. Both immature fruits and green hulls of walnut are very rich sources of ascorbic acid containing about 2-2.5% and 0.4-0.8% on fresh weight basis, respectively. The fruit has excellent flavour and is mainly consumed as a dry fruit for table purposes. Kernels are widely used in confectionary and bakery industries in the preparations like cake, pastries, chocolate, candy and ice-cream. Edible oil is extracted from the kernels and used for edible purposes, artist's oil colours, varnishes and soap making. The oil cake being rich in protein is feed to cattle. Immature fruits of walnut can be utilized for the preparation of various products like pickles, chutneys, marmalades, press juice and syrups.

The kernels are also taken as snacks between regular meals. Walnut shell flour is extensively used as an ingredient in plastic fillers, battery cases, moulding resin forms, industrial tile and as an insecticide spreader. The tree yields valuable timber, which is most suitable for carving, making furniture and butts of guns.

Health benefits of walnut

1. Rich in antioxidants
2. Heart healthy
3. Support good body composition
4. Good for diabetes
5. Boost metabolism
6. Good for bones
7. Good for digestion
8. Beneficial for brain
9. Induce sleep
10. Improve fertility
11. Good for skin and hair
12. Helpful in pregnancy
13. Helps in male reproductive health
14. Good source of omega-3 fatty acid
15. Anti-inflammation
16. Anti-cancer properties including breast, prostate and pancreatic cancer.
17. Supports weight control
18. Widely available and easy to add to your diet

Table 1. The chemical structure of walnut

Constituents	Nutritional value / 100 grams
Energy	655 kcal
Carbohydrates	13.71
Protein	15.23
Starch	0.05
Sugars	2.60
Lactose	0.00
Dietary fibre	6.70
Total fat	65.20
Saturated fat	6.13
Polyunsaturated fat	47.17

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Conclusion

Walnuts can truly be called as nutritive fruit nut as they are optimal healthful food for a human being. One should consume walnut daily to increase heart and brain health and to prevent disease.