Advance Production Technology of

Anise

(*Pimpinella anisum* L.)

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PREFACE

The early Arabic name of anise was anysum from which derived the Greek anison and the Latin anisun. It is one of the oldest known spice plants used both for culinary and medicinal purposes since ancient times-Carminative properties of anises have been known. There is evidence that anise was used in Egypt as early as 1500 B.0 and it was well known to the Greeks, being mentioned by Dioscorides and Pliny and was cultivated in Tuscany in Roman times. In the Middle Ages its cultivation spread to Central Europe.

Aniseed (*Pimpinella anisum* L.), commonly called as anise and vilayatisaunfbelongs to the family Apiaceae. It is used widely to flavour materials, and is also a constituent of traditional medicine. Because of the similarity in seed aroma and flavour, it is confused with fennel (*Foeniculum vulgare* Mill.) and the commodity commonly available in the Indian market under the name of '*Lucknow Sanuf*' is immature dried seed of fennel, whereas 'Indian aniseed' is not fennel but it is anise. Anise is botanically different from fennel and a native of East Mediterranean region. Anise is cultivated both in temperate as well as subtropical or Mediterranean climate.

For culinary, it is used in the same way as fennel to flavour fish, poultry, soups and root vegetable dishes. Numerous alcoholic drinks and cordials are flavoured with aniseed. Medicinally it is a mild expectorant and often being used in cough mixtures and lozenges. It is also an antiseptic, antispasmodic, soporific and a few seeds taken with waterwill often cure hiccups. Its decoction helps to overcome the oxygen deficiency while moving on high altitude. Besides that it also has very good culinary use. The liqueur Anisette added to cold water on a hot summer's day makes a most refreshing drink. Anise is one of the herbs that was supposed to avert the Evil Eye. The oil extracted from the seed is said to prove capital bait for mice, if smeared on traps. It is poisonous to pigeons.

This publication is outcome of research efforts of NRCSS, ICAR research institutes and State Agricultural University working on anise. The information are also collected from books, bulletins, lecture notes, internet and research papers are compiled. Hopefully this publication will bring the logic in the mid of farmers, traders, consumers of anise for its production, export and consumption by removing misconception about fennel (*Saunf*), star anise and anise/aniseed (*Vilayati saunf*) used as synonyms (*patalisuanf, lakhnavisaunf* etc.).

We hope that this technical bulletin will provide relevant information to the anise growers. Any constructive and noble suggestions for its improvement are welcome for future publications/editions.

Ajmer Authors

October, 2010

Introduction

Anise is an annual plant, which grows about 100 to 120 cm high. It has feathery leaves; the lower leaves are broad, toothed and triangular with upper leaves that are smaller, divided and narrow. It has umbrella-like clusters of dainty, creamy-white flowers and thin roots. The seeds are grey-green to brownish, ribbed and ovate, measuring 2 -4 mm (0.08 - 0.16 in) long they have the flavor of licorice and the aroma of sweet fennel. Anise should not be confused with StarAnise (*Illiciumverum*) - used in production of Roche's drug Tamiflu (Oseltamivir Phosphate) -which is said to reduce the severity of avian flu (Plate 1 & 2). Anethole, the principal component of anise oil, is a precursor that can eventually produce2,5-dimethoxybenzaldehyde which can be used in the clandestine synthesis ofpsychedelic drugs.

It is cultivated widely in Bulgaria, Cyprus, Germany, Italy, Mexico, Syria, South America, Turkey, Russia and India. In India, it is grown in smaller areas in Rajasthan, Punjab, U.P., Orissa, M.P. and Delhi as a Rabi crop. However, large-scale commercial cultivation has not been taken up. The crop prefers moderately cool weather. In temperate areas, it is grown as summer crop and in subtropical North Indian plains as winter crop. In India, it is grown as a rabi crop in an estimated area of about 2000 ha with production of 550 metric tones. The major exporting countries are USSR, Poland and Spain.

Botanical description and classification

Anise is an herbaceous annual plant grows 90 to 120 cm tall with an erect branching stem. In temperate regions it also shows the biennial characteristics. The leaves at the base of the plant are simple, 0.52 in (1.35.1 cm) long and shallowly lobed triangular, while leaves on the upper of stems are feathery pinnate, divided into numerous leaves. The flowers are white, approximately 3 mm diameter, produced in dense compound umbels. The fruit is an oblong dry schizocarp, 3 5 mm long. It is these seedpods that are referred to as “aniseed”. The seed is oval in shape, about 5mm long with a short stalk, laterally compressed and having five longitudinal ridges on the pericarp. The two carpels containing the seed are hairy, aromatic greenish brown to grayish. Anise is a cross-pollinated crop and is genetically heterogenous in nature.

Kingdom	Plantae (Plants)
Subkingdom	*Tracheobionta* (Vascular plants)
Superdivision	*Spermatophyta* (Seed plants)
Division	*Magnoliophyta* (Flowering plants)
Subdivision	Angiopermae
Class	*Magnoliopsida* (Dicotyledons)
Subclass	*Rosidae*
Order	*Apiales*
Family	*Apiaceae* (Carrot family/Umbel)
Genus	*Pimpinella*L. (burnet saxifrage)
Species	*anisum*
Botanical name	*Pimpinella anisum* L. (anise Burnet saxifrage)

Cultural requirements:

The Important cultural practices for successful cultivation of Anise are described as under.

Climate

Anise can be cultivated in temperate, subtropical and Mediterranean type of climate and can well grow up to 20-28°C temperatures. However, life zone for better anise production requires 8 to 23°C temperature with 0.4 to 1.7 metres of precipitation. Anise requires a warm and long frost-free growing season of 120 days. A fairly warm weather during sowing is desirable in temperate regions. It requires warmer and sunny weather during seed formation and development stage. The plant needs a slightly hot summer for ripening seeds. Frost in early stage also kills the growing seedlings and higher temperature at the time of seed setting is harmful. To attain the higher seed germination percentage, optimum soil temperature should be 18-21°C. High wind velocity at the time of maturity can cause shattering and hot winds at flowering reduce seed setting. If anise planted too late and hot weather sets in, the plants will be lanky and small, and will forced blooming takes place and produce seeds too quickly. Besides that high wind velocity adversely affect the flowering and after irrigation causes heavy loss by lodging. Cloudy weather during full growth stage invites sucking pests like aphid and disease like powdery mildew. Therefore, climatic conditions are very important for getting good yield and quality of crop.

Soil

The crop is grown on a wide range of soils, ranging from sandy loam to clay loam having pH of 6.0 - 8.5 and of moderate fertility. However, well drained medium textured soil ideal having pH range of 6.3 to 7.3. Anise develops best in deep, rich, well-drained, sandy and calcareous soils. Cold, loamy and moist soils are unsuitable for the cultivation of anise. For high seed yields have been achieved over heavier moderately rich black cotton soil of Malwa region which has a capacity to retain moisture and therefore, protect the crop in dry periods. In such conditions, a poor drainage of land as well as stagnating water damages the crop stand and reduces its yield. For both, higher yield and quality slightly acidic soils are more preferable than neutral to alkaline soil with prolong winter season mainly for the recently developed varieties in India. It can survive under temporary flood conditions, not more than a week.

During germination anise tolerates salinity up to 160µ m NaCl. However, recent study reveals that salinity tolerance for germination depends on crop cultivars and it varies from 6.0 to14.0 EC dSm^{-1} having SAR (Sodium Adsorption Ratio), Magnesium: Calcium ratio and Chloride: Sulfate ration 12.5 (± 0.1), 2.0 (± 0.02) and 1.5(± 0.1), respectively.

Recommended improved varieties:

Anise an important crop, yet it is still in miner seed spices group and very little effort has been made for the development of its varieties. However, National Research Centre on Seed Spices, Ajmer has developed a variety and its detailed description given below-

Ajmer-Anise-1: This variety developed at National Research Centre on Seed Spices and released by AICRP on spices. Flower colour of this variety is white with green sepals. The stamins are longer than petals and seems above them. It is a high yielding variety bears attractive seeds. Plant is medium height and suitable for intercrop with other crops. This variety bears 3.2 percent volatile oil. Variety is suitable for cultivation in semi-arid regions under irrigated conditions. The average yield of this variety is 733 kg had. However, yield potential of this variety 1150 kg ha-' in semiarid conditions with suitable irrigation facility. In the semiarid conditions, it comes up well only in winter season when temperature went down. It can be grown in summer season also in the Himalyan regions at high altitude. Prolong of winter period enhances the crop yield.

Cultural practices:

Preparation of land

It is essential to prepare good seedbeds and to create a good contact between the planted seed and the soil because the seeds are small and have low germination percentage (70%). Therefore, field should be ploughed and harrowed 2-3 times to bring it to fine tilth. Pre sowing irrigation may be given to bring the soil in working condition ensuring better germination of seed. First ploughing should be done by soil turning plough and after ward 2-3 ploughing should be done with harrow. The ploughed field should be made fine and levelled by planking. In order to manage problem of termite Endosulfan 4% or Quinalphos 1.5% or Methyl Parathion 2% dust, @ 25.0 kg/ha may be applied in soil before sowing. In the semi-arid conditions, ants take away the seed from seed bed before germination can also be control by bordering the field using Methyl Parathion dust.

Sowing time

Optimum soil temperature for germination is 18-21^{0}C. The optimum sowing time in north Indian plains is mid October to early November and March-April in temperate areas in hills for better yield. In temperate regions, planting begins when the soil in the beds is warmed. Ripe-fruits seeds germinate relatively quickly. The germination time is 7-14 days. Only seeds from the previous year's harvest germinate well. Long storage quickly reduces germination vigour and seeds stored for five years will no longer germinate. It is reported that Seeds are directly sown at 1 cm depth in late October (Malwa region) to early November (Delhi and western UP) for better crop growth and yield.

Spacing and sowing method

Without knowing the fertility of soil, length of winter season and plant type (biparous/prostrate), spacing recommendations are meaningless. Therefore, seeds should be sown at a line x plant spacing of 45 x 20 cm or 30 x 20 at one cm depth based on the soil fertility and length winter of season ofthe growing areas. Seeds can be drilled directly in rows at a distance of45 cm by dibbling method and transplanting is also possible in anise. Seeds start germinating after seven days and are over in 10 days. Studies made at Indore (M.P. State) showed that the broadcasting of seed has an edge over line sowing but this causes crowding and uneven distribution of plant resultant difficulty in inter-cultural operations. Comparative performance of in-situ direct seeding crop and transplanted crop reported a loss of 55.17 per cent in seed yield from transplanted crop.

Seed rate

About 8 - 20 kg of seed is required for planting in one hectare on the basis of soil fertility, plant type and climatic conditions. Low fertile soil with small span of winter season and small spreading type of cultivar require more seed rate than high fertile soil with long span of winter season area. Light irrigation is given after sowing and optimum moisture should be maintained till germination.

Seed treatment

Soaking the seed for 8-10 hours in water before sowing improves germination. To check the incidence of seed and soil born diseases, the seed should be treated with carbendazim or captan or thiram @ 2.5g per kg of seed before sowing. For the better yield and utilization of water and nutrients, seed treatment with VAM and other biofertilizers is also needed.

Manures and fertilizer

The crop is moderate for its requirement of manure and fertilizer. Under north Indian plains 15-20 tons of well rotten farmyard manure should be applied before sowing. A total of 80 kg of nitrogen, 30 kg of phosphorus and 20 kg of potash is required to raise good crop. At the time of sowing 40 kg nitrogen, 20 kg of phosphorus and 20 kg of potash should be applied as basal dose on lower to medium fertile soils. The remaining nitrogen dose of 40 kg should be given in two splits at an interval of 25-30 days after sowing western plains of India. The micronutrients, magnesium, iron and zinc, have been found useful in increasing the yield and quality under. In northern plains, nitrogen requires 60kg ha^{-1} in sandy loam soil and in heavy soils of Malwa regions needs 40 kg N in two three splits along with 20-30 kg each of K_20 potassium and P_20_5 ha^{-1} under both the

situations. Anise is also responds well to use of certain micro-nutrients have reported beneficial results on use of sulphur, manganese, iron and zinc at the rate of 18.6, 1.2, 2.0 and 5.6 kg/ha. Amongst these, the effect of Fe, Zn and Mn was more pronounced than sulphur in terms of seed and oil yield. Under the integrated nutrient management, 50-75% nutrient supplied through recommended dose fertilizers and 25-50% supplied through organic manures and biofertlizers (Azotobacter, Azospirillum, VAM, PSB etc) for sustainable crop production and better soil health.

It is recommended to apply fertilizers at a rate of 80-100 kg K_2O and 50-75 kg P_2O_5 per hectare in temperate regions. About 50 - 100 kg/ha N is normally enough in these temperate regions. With nitrogen, it is important to be careful, since excessive nitrogen fertilization results in luxuriant vegetative growth with reduced seed yields, and increased vulnerability to lodging. It is reported that application ofN, P and K fertilizers do not affect oil content or its quality.

Irrigation

Keeping in view of the soil and climatic conditions the frequency of irrigation varies. Averages of 4-6 irrigations are required up to full vegetative growth to seed formation. Flowering and grain filling are the crucial stages requiring irrigation. In-general a pre-sowing irrigation is recommended if the soil does not have sufficient moisture for germination. The second irrigation is given at 30 days when the seedlings have established. The third irrigation is given at 50 days, and fourth and fifth irrigation are given at flowering and grain filling stage.

Intercultural operations

The plant develops slowly after germination and for the following few weeks it is necessary to control weeds closely. The field should be kept free from weeds during the initial period of growth. It requires 2-3 weeding and hoeing at an interval of 20-30 days after sowing. Initially two weeding are very crucial and should be done in time. Therefore, first inter-culture operation is done at 25-30 days, just before the irrigation and a second at 45-50 days age; thereafter the crop grows fast and covers the ground. Under integrated weed management, there are some chemicals can be use effectively as pre-emergence application of oxadiargyl @ 75 g ha^{-1} or pendimethalin @ 1.0 kg ha^{-1} or oxyflurofen @150g ha^{-1} along with a mechanical or hand weeding.

Crop rotations and Cropping systems

Generally this crop is cultivated after harvesting of kharif crops like bajra, maize, sorghum and pulses in northern plains and central India. Growing anise in prevailed and sustainable cropping system is the best way to enhance resources use efficiency includes land, water, nutrients and

time. Some medicinal plant based crop rotations were tried using anise in the system. It has been found that the sacred basil (in *kharif*) and anise (*rabi*) or senna-anise combination produced better return than any other rotation. In senna based crop rotation, anise equally performs with methi and with sacred basil also. Its performance is comparable to other seed spices.

Plant protection

Insect-pests

1. Aphids (*Aphis gossypii*):

Aphids suck the sap from the young growing twigs, flower buds & fruits and devitalize the plants. The population start developing on the crop during vegetative stages and develop on the crop up to flowering and fruiting stages. Timely management of aphids is necessary to prevent the crop from economic losses.

Control measures:

- Recommended doses of nitrogenous fertilizers should be applied. Because higher application of nitrogenous fertilizers causes more succulent to the crop.
- Spraying of Neem seed kernel Extract (NSKE) @ 5 % or Neem oil 2% effectively cheek the early population build up of aphids on the crop.
- Application of entomopathogen *Verticillium lecanii* (10^8 spores/g) powder formulation @5.0 g/lire of water gives good result.
- At high aphid population any one of the synthetic insecticides should he sprayed i.eDimethoate 0.03%, Metasytox - 0.03%, Emamectin benzoate @ 10 g ai/ha, or Imidachlorprid - 0.005%.

2. Seed wasp (*Systole albipennis* Walker):

It is also an important pest of Anise. Adult wasp female lays eggs inside the developing seed and larvae feed the seed inside .Adult wasp come out from the seed making exit hole in the seed. Infested seed become hollow, dull coloured and have no germination capacity.

Control measures:

- Spraying of NSKE 5%, Neem oil 2%, Imidachlorprid 0.005%, Thiomethoxam 0.025% at 10 - 15 days intervals successfully control the wasp damage on the crop.

3. Cutworm (*Agrotis* spp.):

Cut worm infestations are generally most serious at early stages of crops. The larvae remain inside the soil near the base of the plant and hide during daytime and come above the soil surface at night. At night the larvae feed on voraciously the leaves and tender stems and branches.

Control measures:

To control this insect regular field inspection should be made to detect the appearance of the pest. Application of Phorate 10 G @ 10kg ha^{-1} or Methyl Parathion dust@ 25 kg ha^{-1} in the soil near the base of the plant can be useful to bring this pest under control.

4. Termites (*Odentotertnus* spp.):

The termite is polyphagous pests and found more serious at sandy soils. This insect damage crop at any stages of plant by cut the plant stem near soil surface and falls down. Initially plant look like lodging but ultimately die. To control this insect regular field inspection should be made to detect the appearance of the pest for it control measures.

Control measures:

Application of Phorate 10 gm @ 10kg ha^{-1} or Methyl Parathion Dust 2% @ 25 kg/ha in the soil near the base of the plant can be useful to bring this pest under control.

Diseases

The diseases of anise have been studied poorly. However, it is affected by number of diseases. The important diseases appeared and reported on anise are described as under.

1. Phyllody:

Phyllody disease appears during flowering stage on foliage. The disease is characterized as transformation of floral organs into leaf like structures, there is excessive number of leaves and branching. Leaves are reduced in size and irregular in shape. The plant turned into bushy shape. The spread of phyllody is limited. The disease has been reported from NRCSS Ajmer.

Powdery mildew:

This disease is caused by ***Erysiphepolygoni*** and appears at flowering stage in cloudy weather during February-March. The disease symptoms appear on the leaves, twigs, stem, and seeds as white powdery mass. Under severe conditions the whole plant is covered with whitish powder. The seeds on infected plants, if developed remain small, shrivelled and lighter than the normal ones.

Control Measures:

- Dusting sulphur 20-25 kg ha^{-1} or spraying of wettable sulphur 0.2% or calaxin 0.05% at an interval of 10-15 days can control this disease.

Root rot:

Root rot disease generally appears on young plants in seedling stage. The infestation is more under waterlogged conditions. The affected plants foliage becomes yellow and the infected plant

ultimately dries. Infected plants show poorly developed roots which turned black and destroyed due to rotting.

Control Measures:

- There is no effective control measures reported so far.

Alternaria leaf blight:

It is one of the important diseases causing serious damage to the crop. This disease causes blighting symptoms on leaves and reduces the yield.

Control Measures:

- Spraying 0.25% of mancozeb twice at 10 days interval controls this disease.

Harvesting and yield

Umbels become ready for harvest in March in northern plains of India. The terminal umbels mature first and lateral ones 15 to 20 days later. When 80-90% fruits begin to turn greyish green in colour, the tops of the plants are cut along with the branches and are tied in bundles. The bundles are stacked in a central place up to two-meter height, keeping the fruiting heads towards the centre. It should be allowed to cure for 4-5 days and then threshed by beating. Seeds are cleaned, dried in shade and stored in gunny bags. Average yield of 700-800 kg per hectare can be obtained. The thousand seeds weight of the part-fruits amounts to 1.5 to 3.0 g and should have a minimum purity of 90% and a minimum germination of 70%. The small white flowers bloom in midsummer, and seed maturity usually occurs one month after pollination in temperate regions.

Cleaning, packaging and storage

After threshing crop, peduncle remains intact with seed require to remove before packaging and storage otherwise it lowers the marketability of anise. This peduncle can be removed by using debearder (an attachment of cleaning and grading machine). Vacuum gravity separator can be used for cleaning of anise. Seeds are stored at 7-8% moisture or lower. Anise has to be stored away from daylight and kept in a dry place in cool conditions. The average loss ofthe content ofthe volatile oil has been calculated at 1% of the original content per month. The content of trans-anethole decreases from 89% to 73% during a storage of six weeks with the influence of sunlight, while the content of *cis*-anethole increases from 0.8 to 4.5% and the content of anisaldehyde from 0.8 to 7.0%. Because of the sensitivity to light and oxidation it is recommended that the volatile oil of anise is stored in well filled and well closed containers (glass or tin, but not plastic) protected against daylight. Moreover, ideal storage demands a temperaturesbelow 25°C. The small

packaging may be 25-100g (Plate 17) and big packaging in 20-25 kg capacity lined seed bag is recommended before storage for sale.

Economics of anise cultivation

There is a need to popularize the knowledge about the anise among farmers for growing right species, traders for marketing right product and consumers for using right product so as to get the right benefits of nutracetical, food and beverage, flavouring and medicine for realizing actual satisfaction of anise rather use of alternatives. This way whole chain will get the benefit from this crop. The detail cost of cultivation and cost of production is analysed at NRCSS, Ajmer given below-

S. No.	Particulars	Value in rupees
1	Cost of production per hectare (Cost A2)	36220.00
2	Gross return per hectare	68580.00
3	Returns over cost A2 per hectare	32360.00
4	Return per rupee of cost A2	1.89

Products

Aniseed has strong flavour and aroma and hydro-distillation yields the "oil of anise", which has now replaced the fruit for medicinal and flavouring purposes. The oil content in the dried fruits is about 2.5%. Anithole is the major component of aniseed oil.

Aniseed is used for flavouring food, confectionery, bakery products, chewing gums and tobacco. It is also used in flavouring alcoholic beverages "aniseed" and "pernod"; is used for flavouring soups, mouthwashes and toothpastes. Aniseed oil also possesses insecticide properties. In medicine, it is used in cough syrups, lozenges and as a carminative. It is used in the preparation of gripe water. The distillate i.e. arak (water of the anise) is sold in Indian market as arak badian and arak saunf and are used in medicine. Fresh leaves can also be used for garnishing and flavouring of salad.

Production of anise oil and its physical properties

Anise oil is steam distilled from the crushed seeds. Steam distillation is the most widely accepted process for the production of essential oils on a large scale. Steam is introduced at the base of the still filled with crushed anise seeds and volatile elements evaporate with the steam. A condensation process turns this vapour-mix into a liquid form of water and essential oil. The essential oil floats on top of the water and is separated off.

The essential oil of aniseed is a colourless to faintly yellow oil which solidifies upon cooling to about 1519°C due to the crystallization of anethole. Oleoresin anise is a yellowish-green to orange-brown fluid oleoresin. Volatile oil content of oleoresin anise is 1518%. The presence of a large quantity of fixed oil in this product limits its shelf-life and the addition of a permitted antioxidant is advised. Anise and anise oil are widely used as flavouring ingredients in all major categories of foods and alcoholic beverages. The highest average permissible levels for anise oil are about 0.06% (570 ppm) in alcoholic beverages and 0.07% (681 ppm) in sweets. Suggested use rate of oleoresin anise is 7.5 to 9%.

Major vernacular names

There are about 69 names of anise in various languages. However, major among them are listed here-

Pharmaceutical	**FructusAnisi**
English	Sweet cumin, Aniseed
French	Anis vert, Boucage
German	Anis
Greek	Glikaniso, Glykaniso, Anison
Hindi	**छोटी सौंफ, पतली सौंफ,सौंफ, विलायती सौंफ, सुव्वा, शोप**
	Chotisaunf, Patlisaunf, Saunf, Saumph, Vilayati saunf, Suvva, Shop
Italian	Anice, Aniceverde
Urdu	Anisuan

Chemistry

The aniseed oil is colourless or pale yellow liquid and yield varied from 1.9 to 3.1%. Seed contains starch, protein, fatty acids and crude fibbers. It has also been reported higher values of oil upto 6% from Syrian type of aniseed. Anithole (70-80%) is the main constituent of aniseed oil. The other constituents are α-pinene (0.17%), camphene (0.07%), β-pinene (0.01%), sabinene (0.01%), myrcene (0.02%), d-3-carene (trace), α-phellandrene (0.09%), α-terpinene (0.025%), β-phellandrene, 1, 8-cineole (0.06%), cis ocimene (0.02), trans-ocimene + gamaterpinene (0.01 %), para-cymene (0.05%), terpinolene (trace), linalool (0.8%), terpinene -4-ol (trace), α-terpineol (0.12%), methyl chavicol (1.22%), trans-β-farnesol (trace), cis anethol (2.29%), saffrol (0.58%), anisaldehyde (0.9%) and anisole (0.4%).

Uses:

Therapeutic: Antibacterial, antiseptic, antispasmodic, carminative, digestant, diuretic, expectorant, insecticide, stimulant, tonic.

Medicinal: ***Internal*** - Anxiety, asthma, difficult breathing, bronchial spasm, colic, dry cough, flatulence, fluid retention, indigestion, migraine nausea, tension vomiting.

External - Asthma, bronchial congestion, coughs, exhaustion, headache, insect bites, sinus problems, stress.

Industry & Household uses: Pharmaceutical uses in cough mixtures, lozenges, to mask odours and flavours in drugs; soft drinks, food flavouring, soaps toothpaste, cosmetics and perfumes. Anise is used by many fishermen to mask the smell of the human body. It helps the fish to bite better. Hunter's use anise oil to hide the smell of the human scent too.

Blends with: Rose lavender, orange, pine and other spice oils.

Cautions: Use in moderation as this oil can slow down circulation. Any essential oils - ingested in large amounts can be fatal. Keep out ofreach of children.

Other Uses: Aniseed is used externally as an insecticide against small insects such as lice, mites and vermin. It also has fungicidal properties.

The seeds are used to flavour curries, sweets, cakes, cookies and biscuits. Anise oil is employed in medicine as an aromatic carminative to relieve flatulence. Being a mild expectorant, it is used as an ingredient of beverages and liqueurs. It is a popular flavouring agent for dental preparations and mouth washes.

Constituents in plant volatile oils are known to be useful in pest control. Various authors have reported that vapours of essential oils extracted from anise were found to be toxic to two greenhouse pests, *viz.* the carmine spider mite, *Tetranychuscinnabarinus* and cotton aphid, *Aphis gossypii*. It indicated that the essential oil of anise had a high residual toxicity to adults of *Triboliumconfusum*, and was the most repellent to *Sitophilus oryzae* adults in food preference tests.

Nutraceutical value

By the development of technology and increase in the importance of time, people have started to consume more processed foods. As a result health problems have increased. Today, there is no universally accepted definition for the word “nutraceutical” and it is mainly used as a marketing term and not for regulatory purposes. Health Canada defines a nutraceutical as a “product isolated or purified from foods that is generally sold in medicinal forms not usually associated with food. A nutraceutical is demonstrated to have a physiological benefit or provide protection

against chronic disease". For example, when flax is ground up and put into pill form it would be classified as a nutraceutical, whereas flax seed or flour incorporated into breads, pastries etc., would be classified as a functional food. A nutraceutical is any substance that is a food or a part of a food and provides medical or health benefits, including the prevention and treatment of disease. Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered designer foods, herbal products, and processed foods such as cereals, soups, and beverages. It is important to note that this definition applies to all categories of food and parts of food, ranging from dietary supplements such as folic acid, used for the prevention of spina bifida, to chicken soup, taken to lessen the discomfort of the common cold. This definition also includes a bio-engineered designer vegetable food, rich in antioxidant ingredients, and a stimulant functional food or pharmafood.

It is reported that the daily mineral intake by consuming herbal teas for a 70 kg person and the reported amounts of minerals per day are 500 mg Ca, 300 mg Mg, 15 mg Fe, 5 mg Al, 2.8 mg Mn, 15 mg Zn, 2.5 mg Cu, 1.6 mg Sr, 1.1 mg Ba, 0.025 mg Ni, 0.05 0,2 mg Cr, 0.04 mg Co, 0.415 mg Pb and 0.057 mg Cd. Ca is the main component of bone and teeth, and its function, in cell membranes, in muscles, by regulation of endo-and exoenzymes and by regulation of blood pressure, has great importance. Anise plants rich in minerals contains 0.01, 419.3, 19.4, 28.7, 18.94, 0.28, 2478.7, 0.02, 0.12, 3.39, 3.27, 320.4, 0.79, 0.44, 4411.9, 1.52 and 949.6 ppm of Ag, Al, As, B, Ba, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, In, K, Li and Mg, respectively on dry weight basis and considered as good nutraceutical herb.

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