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# RESEARCH ARTICLE

## ORIGIN, TAXONOMY, BOTANICAL DESCRIPTION, GENETICS AND CYTOGENETICS, GENETIC DIVERSITY, BREEDING AND CULTIVATION OF SAGE

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## ABSTRACT

Sage or Salvia belongsto the Family: Lamiaceae, Genus: *Salvia,* Species: *Salvia officinalis.* Indian name of spices are in Hindi : Salvia, Sefakus Malayalam : Salvi tulasi Bengali :Bui tulasi Panjabi :Sathi. Foreign name of spices in Arabic : Mayameeah Chineese : Shu wei cao Czech :Salvej Dutch :Salie French :Sauge German :Salbei Italian :Salvia Spanish :Salvia (Indianspices, 2025). Common names are in sage, common sage, Spanish sage, culinary sage. Latin names are in *Salvia officinalis*, *Salvia lavandulaefolia*. Parts used are in leaves, flower buds. Taste are pungent, bitter. Plant properties are in aromatic, astringent, carminative, diaphoretic, antiseptic, blood moving. Plant uses are sore throat, excessive sweating, infections, stagnant digestion, type 2 diabetes, hot flashes, toothache, sore muscles, high cholesterol, Alzheimer's disease. Plant Preparations are in tea, culinary, tincture, tooth powder, facial steam, essential oil. The specific epithet *officinalis* refers to plants with a well-established medicinal or culinary value. *Salvia officinalis* has numerous common names. Some of the best-known are sage, common sage, garden sage, golden sage, kitchen sage, true sage, culinary sage, Dalmatian sage, and broadleaf sage. Cultivated forms include purple sage and red sage. Sage is a distinctive aromatic plant of the mint family. It is used as both a culinary and medicinal herb for digestive problems, skin and mucosal health. It is also a herb that has been well researched for improving cognition, mood and memory. Not currently on risk lists but complete data may be missing on the status of the species. Antihydrotic, Antibacterial, Mood enhancer, Memory and cognition and digestive support. Sage has a distinctive aromatic, pungent taste profile with a mildly astringent after-effect. The smell and taste of sage is both powerful and unique. It is used as a bacteriostatic and astringent in the form of a gargle for laryngitis and inflammations in the mouth and throat. These aromatic antibacterial compounds are very clearly active directly after taking. Sage is a staple herb in various cuisines around the world. It contains antioxidants, which may help promote oral health and brain function. It may also help to lower cholesterol and blood sugar. Sage is also called common sage, garden sage, and *Salvia officinalis* . It belongs to the mint family, alongside other herbs like oregano, rosemary, basil, and thyme. Sage has a strong aroma and earthy flavor, which is why it's typically used in small amounts. It's packed with various important nutrients and compounds. Sage is a natural cleaning agent, pesticide, and ritual object in spiritual sage burning or smudging. This green herb is available fresh, dried, or in oil form — and has numerous health benefits. Salvia officinalis, common sage, garden sage. Sage, (*Salvia officinalis*), aromatic herb of the mint family (Lamiaceae) cultivated for its pungent edible leaves. Sage is native to the Mediterranean region and is used fresh or dried as a flavoring in many foods, particularly in stuffings for poultry and pork and in sausages. Some varieties are also grown as ornamentals for their attractive leaves and flowers. Several other species of the genus *Salvia* are also known as sage. Sage, scientifically known as *Salvia officinalis*, is a versatile herb that has been grown for centuries. Also called common sage or garden sage, this evergreen plant is a member of the mint family and is renowned for its culinary and medicinal uses. The leaves are oblong and grey-green in colour, with a distinctive peppery and savoury flavour. This deliciously scented plant has been used for centuries in medicine and culinary use. It has treated various health concerns, such as asthma, menopause symptoms, diabetes, inflammation, and digestive issues. This herb is also a common spice used in cosmetics and cooking – yum! Common sage has edible leaves with a rough texture and distinctive flavour. Sage has been an indispensable herb for centuries, in both the kitchen garden and the medicine cabinet. Not only that, but many species of *Salvia* are cultivated as spectacular ornamental plants whose blooms also attract a host of pollinators to your garden.



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# INTRODUCTION

Salvia belongsto the Family: Lamiaceae, Genus: *Salvia,* Species: Salvia officinalis (Britannica, 2025; EEB, 2025; Wikipedia, 2025; Wikipedia, 2025a; Wikipedia, 2025b). Indian name of spices are in Hindi : Salvia, Sefakus Malayalam : Salvi tulasi Bengali :Bui tulasi Panjabi :Sathi (Indianspices, 2025). Foreign name of spices in Arabic : Mayameeah Chineese : Shu wei cao Czech :Salvej Dutch :Salie French :Sauge German :Salbei Italian :Salvia Spanish :Salvia (Indianspices, 2025). Common names are in sage, common sage, Spanish sage, culinary sage (Forêt, 2025; NCCIH, 2025**).** Latin names are in *Salvia officinalis*, *Salvia lavandulaefolia* (NCCIH, 2025; NCEGPT, 2025). Parts used are in leaves, flower buds (Forêt, 2025). Taste are pungent, bitter (Forêt, 2025). Plant properties are in aromatic, astringent, carminative, diaphoretic, antiseptic, blood moving (Forêt, 2025). Plant uses are sore throat, excessive sweating, infections, stagnant digestion, type 2 diabetes, hot flashes, toothache, sore muscles, high cholesterol, Alzheimer's disease (Forêt, 2025). Plant Preparations are in tea, culinary, tincture, tooth powder, facial steam, essential oil (Forêt**,** 2025). The specific epithet *officinalis* refers to plants with a well-established medicinal or culinary value. *Salvia officinalis* has numerous common names. Some of the best-known are sage, common sage, garden sage, golden sage, kitchen sage, true sage, culinary sage, Dalmatian sage, and broadleaf sage. Cultivated forms include purple sage and red sage (Wikipedia, 2025). The name *Salvia* derives from Latin *salvia* (sage), from *salvus* (safe, secure, healthy), an adjective related to *salūs* (health, well-being, prosperity or salvation), and *salvēre* (to feel healthy, to heal). Pliny the Elder was the first author known to describe a plant called "*Salvia*" by the Romans, likely describing the type species for the genus *Salvia*, *Salvia officinalis*. The common modern English name *sage* derives from Middle English *sawge*, which was borrowed from Old French *sauge*, from Latin *salvia* (the source of the botanical name). When used without modifiers, the name "sage" generally refers to *Salvia officinalis* ("common sage" or "culinary sage"), although it is used with modifiers to refer to any member of the genus.[8] The ornamental species are commonly referred to by their genus name *Salvia* (Wikipedia, 2025). Popular types of sage include, Common: an aromatic herb with grey-green leaves which works well in many dishes. Golden: a pretty addition to the garden, it is very similar to common sage but with green and gold variegated leaves. Pineapple: a tall, attractive plant with pretty red flowers and edible leaves that really do smell like pineapple! Purple: an ornamental herb whose leaves have a rich sage flavour, and can be slightly bitter. It's not used as widely in cooking as other types (TUI, 2025).

Dalmatian sage is a well-known aromatic and medicinal Mediterranean plant that is native in coastal regions of the western Balkan and southern Apennine Peninsulas and is commonly cultivated worldwide (Rešetnik *et al.,* 2016). It is widely used in the food, pharmaceutical and cosmetic industries. Knowledge of its genetic diversity and spatiotemporal patterns is important for plant breeding programmes and conservation (Rešetnik *et al*., 2016). We used eight microsatellite markers to investigate evolutionary history of indigenous populations as well as genetic diversity and structure within and among indigenous and cultivated/naturalised populations distributed across the Balkan Peninsula (Rešetnik *et al*., 2016). The results showed a clear separation between the indigenous and cultivated/naturalised groups, with the cultivated material originating from one restricted geographical area (Rešetnik *et al.,* 2016). Most of the genetic diversity in both groups was attributable to differences among individuals within populations, although spatial genetic analysis of indigenous populations indicated the existence of isolation by distance (Rešetnik *et al.,* 2016). Geographical structuring of indigenous populations was found using clustering analysis, with three sub-clusters of indigenous populations. The highest level of gene diversity and the greatest number of private alleles were found in the central part of the eastern Adriatic coast, while decreases in gene diversity and number of private alleles were evident towards the northwestern Adriatic coast and southern and eastern regions of the Balkan Peninsula (Rešetnik *et al.,* 2016). The results of Ecological Niche Modelling during Last Glacial Maximum and Approximate Bayesian Computation suggested two plausible evolutionary trajectories: 1) the species survived in the glacial refugium in southern Adriatic coastal region with subsequent colonization events towards northern, eastern and southern Balkan Peninsula; 2) species survived in several refugia exhibiting concurrent divergence into three genetic groups. The insight into genetic diversity and structure also provide the baseline data for conservation of *S. officinalis* genetic resources valuable for future breeding programmes (Rešetnik *et al*., 2016). For thousands of years, people have gathered plant and animal resources for their needs, resulting in changes to genetic structure of populations over the course of cultivation and domestication. This process is particularly manifested in crop species used for food, but is less evident in medicinal and aromatic plants (MAP), which are still harvested primarily from wild populations (Rešetnik *et al.,* 2016). Nevertheless, impacts on MAP intra-specific genetic diversity can occur through overharvesting in natural environments or through population genetic bottlenecks caused by collection of seeds from a limited number of wild plants that are subsequently used to found cultivated populations (Rešetnik *et al.,* 2016). In either case, the need for comprehensive surveys of genetic diversity in natural and cultivated MAP populations is an imperative for efficient conservation efforts, breeding programmes and agricultural production. The reductions of gene diversity in domesticated plants vary across species and have usually been examined in crop plants such as soybean, maize, and wheat (Rešetnik *et al*., 2016). Dalmatian sage (*Salvia officinalis* L.) is an outcrossing, insect-pollinated, perennial subshrubby plant of the family Lamiaceae. The genus Salvia is one of the largest genera in the family, with nearly 1,000 species distributed worldwide (Rešetnik *et al.,* 2016). Recent molecular phylogenetic studies revealed the non-monophyly of the genus and the inclusion of the type species *S. officinalis* within the monophyletic clade I (*Salvia sensu strict)* (Rešetnik *et al*., 2016). *Salvia officinalis* is naturally distributed throughout the coastal region of the western Balkan and central and southern Apennine Peninsulas, where it grows abundantly on dry calcareous rocky soil (Rešetnik *et al.,* 2016). The species is a well-known aromatic Mediterranean plant and has been widely cultivated since ancient times for medicinal, culinary and ornamental purposes (Rešetnik *et al.,* 2016). Extracts of *S. officinalis* have been shown to exhibit antioxidant, anti-inflammatory, fungicidal and bactericidal, virucidal, antispasmatic, antidiabetic, gastroprotective and, anti-obesity activity (Rešetnik *et al.,* 2016). The leaves are broadly used for aromatization in the food industry, and the plant has recently become popular as an ornamental garden plant with several cultivars developed for this purpose (Rešetnik *et al.,* 2016). The highest genetic diversity was found in populations from central part of eastern coast of the Adriatic Sea, while the highest

frequency down-weighted marker values were found in the northernmost populations and the southernmost inland population (Rešetnik *et al*., 2016). Recently, a plastid DNA phylogeographic study based on eight Balkan populations confirmed the natural origin of four disjunct inland populations and revealed the presence of inland and southern coastal lineages (Rešetnik *et al.,* 2016).

*Salvia officinalis* L., *Lamiaceae*, known as Dalmatian Sage or common sage has been gaining popularity in food and drug industries worldwide, recently (Bağdat *et al*., 2017). Even the existence of many sage species on the World, the genus *officinalis* has medicinal common use. Indigestion and inflammation disorders, excessive sweating, including that associated with peri-menopause; relief of pressure spots that result from the use of a prosthesis; and as a flavouring for foods are the main areas where the plant is mainly consumed (Bağdat *et al.,* 2017). Sage essential oil has also been employed as a fragrance in soaps and perfumes (Bağdat *et al.,* 2017). Wide adaptability and non-selective climatic requirements of the plats made it possible to receive high biomass, and several harvests during the same plantation period (Bağdat *et al*., 2017). Common sage or Dalmatian Sage belongs to *Lamiaceae*, an attractive cross pollinated perennial, growing up to 60-100 cm. It has a woody stems, grayish leaves, and blue to purplish flowers. Flowers are clustered by 4 to 8 groups at the end of the stems. Common sage has a long history of medicinal and culinary use (Bağdat *et al.,* 2017). More than 90 sage (*Salvia* sp.) species are found in Anatolian flora of Turkey. Although *Salvia officinalis* is not originally from Turkey, it has been well adapted to Central Anatolian climatic conditions (Bağdat *et al.,* 2017). *Salvia officinalis* and *Salvia fruticosa* are the main species having economic value due to the presence of terpenoids, tannins, bitter substances and essential oil contents (1.0- 2.5%). Drugs collected from natural flora have resulted in the extinction of some *Salvia* species and has let to use of the undesired materials like *Phlomis* species in order to sage (Bağdat *et al.,* 2017). Due to meet increased industrial demands, Turkey commonly import and re-import sage from Balkan countries in some years. New lines and cultivars having acceptable volatile oil contents should be bred; which will help in provision of high quality raw material for industrial use without depending on natural flora (Bağdat *et al.,* 2017). There were limited studies on sage cultivation conducted under Central Anatolian conditions. Common sage has a wide adaptability and drought and cold resistance having high biomass production and regeneration ability. Present research aims to develop multiple clones or lines in common sage adaptable to Central Anatolian climatic conditions having high biomass and essential oil yield, with low thujone content (Bağdat *et al.*, 2017).

Dalmatian Sage or common sage has been gaining popularity in food and drug industries worldwide, recently (Bağdat *et al*., 2017). Even the existence of many sage species on the World, the genus officinalis has medicinal common use. Indigestion and inflammation disorders, excessive sweating, including that associated with peri-menopause; relief of pressure spots that result from the use of a prosthesis; and as a flavouring for foods are the main areas where the plant is mainly consumed (Bağdat *et al.,* 2017). Sage essential oil has also been employed as a fragrance in soaps and perfumes. Wide adaptability and non-selective climatic requirements of the plats made it possible to receive high biomass, and several harvests during the same plantation period (Bağdat *et al*., 2017). Common sage or Dalmatian Sage belongs to Lamiaceae, an attractive cross pollinated perennial, growing up to 60-100 cm. It has a woody stems, grayish leaves, and blue to purplish flowers. Flowers are clustered by 4 to 8 groups at the end of the stems (Bağdat *et al.,* 2017). Common sage has a long history of medicinal and culinary use. More than 90 sage (Salvia sp.) species are found in Anatolian flora of Turkey. Although *Salvia officinalis* is not originally from Turkey, it has been well adapted to Central Anatolian climatic conditions (Bağdat *et al.,* 2017). *Salvia officinalis* and *Salvia fruticosa* are the main species having economic value due to the presence of terpenoids, tannins, bitter substances and essential oil contents (1.0- 2.5%) (Bağdat *et al*., 2017). Drugs collected from natural flora have resulted in the extinction of some Salvia species and has let to use of the undesired materials like Phlomis species in order to sage. Due to meet increased industrial demands, Turkey commonly import and re-import sage from Balkan countries in some years (Bağdat *et al.,* 2017). New lines and cultivars having acceptable volatile oil contents should be bred; which will help in provision of high quality raw material for industrial use without depending on natural flora. There were limited studies on sage cultivation conducted under Central Anatolian conditions (Bağdat *et al.,* 2017). Common sage has a wide adaptability and drought and cold resistance having high biomass production and regeneration ability (Bağdat *et al.,* 2017).

Sage is best known for its fuzzy exterior and intense herbal aroma, which makes it a bold addition to any dish (Master, 2021). Hailing from the Mediterranean, this fragrant herb has transformed from an ancient medicinal tool to a versatile ingredient in dishes ranging from hearty American stuffings to light Chinese herbal teas (Master, 2021). Sage is a perennial herb native to the Mediterranean region, recognizable by its soft, light gray–green leaves. A member of the mint family, sage has an earthy, sweet-yet-savory flavor that makes it the perfect addition to heavy, robust dishes like sausage, stuffing, cured meats, winter squash recipes, and creamy pasta dishes (Master, 2021). The form of sage that's available in most supermarkets and farmer's markets has many names including common sage, culinary sage, kitchen sage, true sage, garden sage, and dalmation sage (Master, 2021). Thought to have originated in the Balkan Peninsula, sage has a culinary and healing history dating back many centuries (Master, 2021). In ancient Rome, sage was used to heal ailments ranging from digestive issues to bleeding wounds (Master, 2021). The plant's reputation was so outstanding that in the Middle Ages the great European emperor Charlemagne ordered the herb to be grown in mass quantities for trade and medicinal purposes (Master, 2021). The Chinese, who imported sage from Europe, used the herb in natural medicine to treat ailments like kidney failure, joint pain, sore throat, typhoid fever, cold, and flu (Master, 2021). Sage became so popular in Asia that the Chinese traded away four pounds of their native tea for every single pound of sage tea (Master, 2021).

With its absolutely gorgeous, herbal aroma and warm, earthy flavor, it's no wonder sage is so common in fall and winter cooking, baking, and drinking (Walczak, 2023). But beyond the cozy comforts of the season, sage has wide culinary applications that shine in savory in sweet ways alike (Walczak, 2023). This nuanced herb has had quite the ride from ancient medicine to the stuffing in your Thanksgiving turkey, the syrup in your old-fashioned, or the sachet of your herbal tea (Walczak, 2023). Sage is an evergreen

shrub within the mint family, accounting for refreshing notes in the herb's aroma and flavor. The leaves are oval-shaped and tapered, with a slightly fuzzy look and feel, reminiscent of soft velvet. The signature grey-green hue is so iconic, that a whole color is named after it (Walczak, 2023). Sage has a cottony, spongy texture when raw, so though it's safe to eat it this way, it's more pleasant when cooked. It has long been used in medicinal, culinary, and ceremonial applications (Walczak, 2023). A few words to describe the taste of sage would be: woodsy, earthy, piney, slightly peppery, yet fresh, with notes of eucalyptus and citrusy mint. The flavor of sage is so unique, that you know immediately when it's in something. It brings a warmth and complexity that's hard to replicate with anything else. Being so nuanced, there are a million ways to describe the taste and aroma (Walczak, 2023). Sage plays nicely with other herbs and lends itself to both sweet and savory applications, though savory is the most common. Deciding when to use it in something sweet takes a little more finesse. For example, you certainly wouldn't make a sage cheesecake, but you'd make a sage caramel to go on top of a plain one (Walczak, 2023). You can use fresh, dried, or ground/powdered sage. The dried version obviously won't be as bright in flavor, and being more concentrated, it may even take on a bitter quality (Walczak, 2023). Put it in a stuffing, don't dust it on top of something. Be sure to add it toward the beginning of the recipe, so the flavor can mellow, whereas fresh sage would be better used toward the end (Walczak, 2023).

The botanical family Lamiaceae, which comprises around 230 genera and 7100 species worldwide, is of great importance for medicine, cooking, cosmetics, and the cultivation of medicinal and aromatic plants. Notable members include Sage, Mint, and Sideritis (Akacha *et al*., 2024). The research emphasizes the antioxidant properties of *S. officinalis* due to its flavonoids and phenolic acids. Both *in vitro* and *in vivo* studies demonstrate its effectiveness against bacterial infections (Akacha *et al.,* 2024). Recent research also suggests that *S. officinalis* has the potential to extend the shelf life of various foods by reducing lipid oxidation, making it an important ingredient in the food industry as a natural food additive (Akacha *et al*., 2024). The findings underscore the potential medicinal applications of *S. officinalis*, including its pharmacological, antioxidant and antibacterial properties, as well as its role in food preservation. Despite existing controversies, *S. officinalis* proves to be a natural and healthier alternative for various applications, in line with today's consumer preferences for natural and sustainable products (Akacha *et al.,* 2024). Since ancient times, people have turned to natural medicine to find ways to cure various diseases. In the beginning, medicinal plants were used instinctively, inspired by the animals, because at that time, there was insufficient information about the causes of diseases, the properties of plants and their medicinal uses (Akacha *et al*., 2024). Over time, the reasons for the administration of some medicinal plants to treat health problems were discovered, and the use of plant species gradually detached itself from the empirical framework and was based on explanatory facts (Akacha *et al.,* 2024). Until the advent of chemistry in the 16th century, plants were the first choice remedies for both treatment and prevention, but also for various disorders. Nowadays, with the decreasing effectiveness of synthetic drugs and an increasing number of contraindications for their use, natural therapies are gaining on importance (Akacha *et al.*, 2024). The genus *Salvia* L., one of the largest genera in the Lamiaceae family (Nepetoidae subfamily), includes over 900 species widespread in the Old and New World's regions (Akacha *et al.,* 2024). The main centers of their speciation are considered to be the eastern Mediterranean, southwest Asia, South Africa, and the Americas (Akacha *et al.,* 2024). Sage is widespread and is mainly found in Croatia, Serbia, Montenegro, Bosnia and Herzegovina, Bulgaria, France, Italy, Spain, the United Kingdom, Turkey, Morocco, Greece, South Africa, the USA, Central and South America, India and Southeast Asia (Akacha *et al.,* 2024). In European countries, the genus *Salvia* is represented by 36 species (Akacha *et al*., 2024). Sage, one of the best-known species of the genus *Salvia*, thrives at altitudes of up to 1800 m and shows remarkable resistance to soils with a pH between 5 and 9 (Akacha *et al.,* 2024). Although it can withstand temperatures as low as −10 °C at maturity, it is advisable for the young plants to be carefully mulched. Its habitat covers a wide range of landscapes, from forests to plains, demonstrating its ecological adaptability (Akacha *et al.*, 2024). *S. officinalis* L., a valued member of the genus, presents as a robust shrub that thrives in clumps and is characterized by lanceolate leaves and delicate inflorescences (Akacha *et al.,* 2024). Revered by the ancient Egyptians for its culinary and medicinal abilities, sage derives its name from the Latin *salvare*, meaning to heal-an attribution that has been echoed throughout the centuries in its many therapeutic uses, from inflammation of the mouth to digestive disorders (Akacha *et al.,* 2024).

Common sage is a small evergreen subshrub, with woody stems, grayish leaves, and blue to purplish flowers that grows in southern Europe and the Mediterranean region (Wikipedia, 2025a). It is much cultivated as a kitchen and medicinal herb, and is also called Garden sage, Kitchen sage, and Dalmatian sage (Wikipedia, 2025a). In southern Europe similar species are sometimes cultivated for the same purpose, and may be confused with the common sage (Wikipedia, 2025a). It likes warm, quite dry soil with some shade but it will grow in almost any garden soil. It can live through winter but after three to five years the plant is past its best and should be replaced (Wikipedia, 2025a). Salvia is a genus in the mint family, Lamiaceae. It is one of three genera commonly referred to as Sage. Sage generally means common sage (*Salvia officinalis*) (Wikipedia, 2025b). This genus includes shrubs, herbaceous perennials, and annuals. Different species of sage are grown as herbs and as ornamental plants. The ornamental species are commonly referred to by their scientific name *Salvia* (Wikipedia, 2025b). *Salvia officinalis*, the common sage or sage, is a perennial, evergreen subshrub, with woody stems, grayish leaves, and blue to purplish flowers (Wikipedia, 2025). It is a member of the mint family Lamiaceae and native to the Mediterranean region, though it has been naturalized in many places throughout the world (Wikipedia, 2025). It has a long history of medicinal and culinary use, and in modern times it has been used as an ornamental garden plant. The common name "sage" is also used for closely related species and cultivars (Wikipedia, 2025). Salvia is the largest genus of plants in the sage family Lamiaceae, with just under 1,000 species of shrubs, herbaceous perennials, and annuals (Wikipedia, 2025). Within the Lamiaceae, *Salvia* is part of the tribe Mentheae within the subfamily Nepetoideae. One of several genera commonly referred to as sage, it includes two widely used herbs, *Salvia officinalis* (common sage, or just "sage") and *Salvia rosmarinus* (rosemary, formerly *Rosmarinus officinalis*) (Wikipedia, 2025). The genus is distributed throughout the Old World and the Americas (over 900 total species), with three distinct regions of diversity: Central America and South America (approximately 600 species); Central Asia and the Mediterranean (250 species); Eastern Asia (90 species) (Wikipedia, 2025).

Sage leaves are full of wrinkles. The herb was long considered a miraculous cure-all. And the fascinating plant with the exceptional flavor is indeed a natural pharmacy (Britannica, 2025). Sage's botanical name salvia derives from the Latin word salvare, which means to cure. "Whoever has sage in their garden, will not die" was a popular belief in the Middle Ages. Monks brought the plant over the Alps and into Central Europe (Britannica, 2025). Long before that, however, the Celts worshipped the herb. Druids believed that it could bring back the dead. In the 17th Century, sage undertook a great journey (Britannica, 2025). The Chinese exchanged their treasured tea for sage leaves. They were convinced that it prolonged life. Today, every child in the world is familiar with the sweet sage drops that sooth sore throats and colds. Sage tea can be used for cold compresses against skin inflammation and acne (Britannica, 2025). The herb's tannins act as an anti-inflammatory. In tea form, on the other hand, sage will ease gastric problems and help against bloating after eating fatty meals. The reason: The leaves are filled with essential oils that protect against bacteria, viruses and fungi (Britannica, 2025). In the kitchen, sage is a real prima donna. Since its powerfully tart, woody taste can easily outperform all other ingredients, it should be used in moderation (Britannica, 2025). The essential oils are the source of its balsamic, savory flavour (Britannica, 2025). The leaves can be subjected to heat without any problems, as they willingly give off their flavor, especially when fried. They are a fine accompaniment to meat, fish, pasta and gnocchi and an excellent way to spice up cream cheese, tomato salad or pizza (Britannica, 2025). Sage is in high demand around the world as a culinary and medicinal herb. There are more than 900 different species. When a leaf is crushed in the hand, it immediately gives off the familiar spicy-fresh aroma. It's no surprise that the leaves used to have yet another application (Britannica, 2025). Either chewed or wrapped around the finger, they served as a natural toothbrush and gum cleaner (Britannica, 2025). Thanks to modern technology, scientists have been able to reveal the secret behind this crude, yet effective dental care. Tannins in the leaf cause the mucous membranes of the mouth and throat to contract, which prevents penetration by viruses and bacteria (Britannica, 2025). Countless glandular hairs protrude from the leaf's surface. They scrub away any contamination, whiten the teeth and ensure fresh breath (Britannica, 2025). In the herb garden, sage can be planted from the middle of May. It likes chalky, not-too-moist soil and sunny to semi-shady spots. The young leaves are the tastiest and can be plucked continuously. In the second year, the shrub will show dense growth and the flavor will develop fully (Britannica, 2025). On sunny afternoons, the essential oil content will be especially high. This is the best time to harvest. In winter, this robust fellow should be wrapped up warm with brushwood and peat (Britannica, 2025). As the story goes, sage will only flourish in the gardens of wise man and women who wear the trousers in their relationships. Thus far, science has been unable to prove this, but it has proved the herb's healing powers. So cultivating sage in the garden should in any event be worthwhile (Britannica, 2025). Also known as: Salvia officinalis, common sage, garden sage common sage or garden sage sage**,** (*Salvia officinalis*), aromatic herb of the mint family (Lamiaceae) cultivated for its pungent edible leaves (Britannica, 2025). Sage is native to the Mediterranean region and is used fresh or dried as a flavoring in many foods, particularly in stuffings for poultry and pork and in sausages (Britannica, 2025). Some varieties are also grown as ornamentals for their attractive leaves and flowers. Several other species of the genus *Salvia* are also known as sage (Britannica, 2025). Sage has slightly stimulating properties; tea brewed from its leaves has been used as a tonic for centuries. In medieval Europe sage was thought to strengthen memory and promote wisdom (Britannica, 2025).

Higher market demands of sage seeds revealed that there was a problem with their production. Ever since the price per seeds has gone up reaching 150-200 €. That was why we started the research aimed at seed components yield with fertility of sage (Hofbauer, 2025). In our study we used Sage (*Salvia officinalis* L.) variety Krajová. Researching the flower biology in detail, we found that most of the flowers of different plant populations do not have fertile pollen and anthers which didn’t crack. From four potential seeds, a flower can create one or no seed at all (Hofbauer, 2025). On the research area, we found a couple of plants which had fertile pollen including cracking anthers (5,7% of plants had a good quality of male generative organs) (Hofbauer, 2025). This was confirmed the following year, when the same plants had the cracking anthers. Next generation plants originated from these plants, produced plants with fertile pollen as well. From the plants with fertile pollen and cracked anthers the mean seed yield was 1,33 pieces per flower (7,5 g/1 plant) (Hofbauer, 2025). On the other side, from the plants without pollen production the mean seed yield was 0,6 pcs. per flower (4,8 g/1plant) (Hofbauer, 2025). The flowers with fertile pollen plants the number of eggs varied from 3 to 7 pieces. Almost 90% flowers had four fully developed eggs (Hofbauer, 2025). We noticed a regression between flower pollination and spacing from plants with fertile pollen (1.5-20 m) (Hofbauer, 2025). We evaluated the best agriculture practice for seed production during the second part of our trials. We recommend pre-emergence treatment with active substance linuron (*e.g.* Afalon 45 SC) (Hofbauer, 2025). It is possible to use a. s. haloxyfop-methyl (Gallant Super), dicamba (Banvel 480 S 0.1 l.ha-1) and bentazone (Basagran Super 1.5 l.ha -1 ) for weed regulations after leaf emergence. The average seed yield (2002-2006) was 176 kg.ha-1 after desiccation and mechanized harvest. Extreme drought period during 2003 decreased the seed yield (Hofbauer, 2025).

Common sage is a fragrant, medicinal herb with a broad range of pharmacological and culinary applications (Ramakrishnan *et al*., 2025). In traditional medicine, *S. officinalis* is highly prized because it has been used for centuries to treat conditions like inflammation, infection, and antioxidants. Furthermore, because of its fragrant leaves, it is a mainstay in cuisines all over the world (Ramakrishnan *et al*., 2025). Sage (*Salvia officinalis*) cultivation requires particular soil types, environmental conditions, and management strategies to maximize yield and quality; however, sage cultivation is still difficult due to its susceptibility to a range of biotic and abiotic stresses (Ramakrishnan *et al*., 2025). Diverse germplasm ensures the availability of the traits needed for environmental adaptation and the development of better cultivars. Enhancement of yield, quality, and stress tolerance have been the primary objectives of genetic development programs for *S. officinalis* (Ramakrishnan *et al.,* 2025). These efforts aim to speed up the development of superior cultivars through a combination of conventional and molecular breeding techniques. Breeding strategies are designed to tackle particular issues like environmental stress, disease resistance, and market demands (Ramakrishnan *et al*., 2025). The integration of genomic tools, marker-assisted selection, hybridization techniques, tissue culture techniques and traditional breeding methods are promising avenues for achieving desired traits in *S. officinalis* cultivars (Ramakrishnan *et al.,* 2025).

The word "sage" refers to many plants in the genus *Salvia.* Sage is used in cooking as a spice **(**NCCIH, 2025**).** Common sage *(S. officinalis)* and Spanish sage *(S. lavandulaefolia)* are two different species of sage that have been used as traditional remedies **(**NCCIH, 2025**).** Both are shrubs native to the Mediterranean region and Middle East. Traditionally, sage was used for digestive, respiratory, and skin problems and other health conditions **(**NCCIH, 2025**).** Today, sage is promoted as a dietary supplement for many purposes, including managing menopause symptoms, enhancing memory, and reducing cholesterol levels **(**NCCIH, 2025**).** Sage is likely safe in the amounts commonly found in foods, and larger amounts have been used safely for up to 8 weeks in research studies. However, some species of sage, including common sage contain a component called thujone that can be toxic if consumed in large amounts; therefore, sage may be unsafe in high doses or if consumed for long periods of time. Sage is likely safe in the amounts commonly found in foods, and larger amounts have been used safely for up to 8 weeks in research studies **(**NCCIH, 2025**).** It may be unsafe to use sage during pregnancy because its component thujone may have harmful effects. If you're considering using sage while pregnant, consult your health care provider **(**NCCIH, 2025**).** Little is known about whether it's safe to use sage while breastfeeding **(**NCCIH, 2025**).** The results of a few small studies suggest that common sage might be helpful in reducing the frequency of hot flashes associated with menopause **(**NCCIH, 2025**).** A few studies suggest that common sage, Spanish sage, or a combination of the two may improve scores on tests of memory or other aspects of cognition in healthy people; however, the amount of evidence is small, and additional research would be needed before definite conclusions could be reached **(**NCCIH, 2025**).** It is uncertain whether sage affects cognitive function in people with Alzheimer's disease because very little research has been done on this topic in people **(**NCCIH, 2025**).** A few studies suggest that sage may have beneficial effects on levels of blood cholesterol and other lipids. There isn't enough evidence to show whether sage has beneficial effects on blood glucose (sugar) **(**NCCIH, 2025**).**

People around the world know and love sage's strong, unique flavor. This pungent herb also goes by the names common sage and garden sage, and its scientific name is *Salvia officinalis* (Webmd, 2025). Sage is a member of the mint family, and its strong flavor means it usually gets used in small amounts. Other members of this family include oregano, rosemary, basil, and thyme (Webmd, 2025). This herb's history of medicinal use goes back centuries, and sage is full of surprising benefits and nutrients you might not expect to find in your spice rack (Webmd, 2025). Sage contains high levels of vitamin K, magnesium, zinc, and copper (Webmd, 2025). Sage does not appear to have any side effects when consumed under normal conditions. But there are a few things to keep in mind about this herb (Webmd, 2025). Animal research has shown that thujone, a compound in common sage but not in Spanish sage, can be toxic to the brain at high doses (Webmd, 2025). That said, there is no evidence to show that thujone is toxic in humans (Webmd, 2025). Drinking too much sage tea or consuming sage essential oils can have toxic effects (Webmd, 2025). You should never consume essential oil of any kind, and limit yourself to 3-6 cups of sage tea per day to be safe (Webmd, 2025).

Sage has long been used to flavor meals and to aid digestion (Forêt, 2025). In recent years it's been shown to be a powerful ally against Alzheimer's disease, imbalanced cholesterol levels, and type 2 diabetes (Forêt**,** 2025). For most people in North America, sage is used just a few times a year as a compliment to the turkey stuffing but sage has a long history of use (Forêt, 2025). The name Salvia comes from the roots of "to save" or "to heal." Maude Grieve writes in A Modern Herbal that sage was even sometimes known as "*Salvia salvatrix*" (Sage the Savior) (Forêt**,** 2025). Grieve reports that in medieval times there was a saying, "Cur moriatur homo cui Salvia crescit in horto?" (Forêt, 2025). There are many sage varieties from around the world that are revered as medicine (Forêt, 2025). In China, the roots of the red sage Danshen (*S. miltiorrhiza*) have been used for thousands of years as blood mover, blood tonic, kidney remedy, and as part of a formula for treating type 2 diabetes (Forêt, 2025). The white sage of California (*S. apiana*) is used extensively in ceremonies, both historically and in the present day. Our common culinary sage, *S. officinalis*, is native to the Mediterranean and southern Europe, and is now cultivated all over the world. It grows anywhere from 1-3' high (Forêt**,** 2025).

It is probable that Sage was used in ancient Egypt to treat stomach ailments, toothache and asthma. It was listed in the Ebers Papyrus (1500 BC) as a remedy for itching (Avogel, 2025). Followers of Hippocrates praised its styptic and strengthening qualities as well as its beneficial effects on menstruation. Under the name of Salvia, the plant was described in the works of the Romans, Plinius, Dioscorides and Galen. They recommended it for warming and contractions, for coughs, hoarseness, for labour pains and ulcers (Avogel, 2025). It is not known which species of Sage was used. The name Salvia comes from the Latin word 'salvare' meaning to heal and 'salvere' meaning to be healthy. The species name officinalis refers to its use in the medicines of the past; it is derived from the Latin word opificina meaning herb store or pharmacy (Avogel, 2025). Common Sage appears in both Charlemagne's "Capitulare de villis" (approx. 790) and that of Ludwig I and was also planted in cloister gardens. Walafrid Strabo (9th century), a monk at the Reichenau cloister in Constance, opened his didactic poem 'Hortulus' which explained the healing properties of cultivated garden plants, as follows: "Sage shines forth in the first instance, is pleasing to the taste, is very powerful and also useful as a drink; it has been found to be helpful in most human illnesses and deserves to enjoy a greener youth (Avogel, 2025). " Sage was to be found in England in earlier times when it was used mainly as a seasoning. Sage was also highly valued in the Middle Ages. The verse "Salvia salvatrix, naturae conciliatrix" – "Sage, thou healer, mediator with nature" – originated from the highly respected Medical School in Salerno (Avogel, 2025). In 1555 Hieronymus Bock wrote: "Of all the bushes, there is scarcely a bush like Sage, as it can be used in medicine, for culinary purposes, cellars, for the rich and poor (Avogel, 2025). Sage wine, or the herb boiled in wine, eases pain in the sides (= enlarged spleen), warms the liver and womb, quickens the senses and aids female illnesses (=menstruation). It helps with colds and flu and rheumatism, not drunk on its own but also by rubbing it into the limbs. A concoction of Sage can be used for dysentery and to clean out the intestines. Sage boiled in water cleans and heals wounds and bites, helps poisonous bites, staunches blood flow and cleans foul ulcers, heals scabs. Rubbing teeth with fresh Sage leaves keeps them firm and clean. Sage boiled in wine and used as a gargle soothes sore throats and gullets (Avogel, 2025). " In 1688 Paullini from Augsburg wrote a 414 page comprehensive monograph on Sage. Strong smelling plants were often used for the purposes of ritual and for protective purposes. Sage was considered to be a magical plant of the highest order and is still enjoyed

by smokers even today (Avogel, 2025). In addition to common sage, *Salvia divinorum* which is considered as sacred particularly in Mexico, and which has hallucinogenic qualities, is used for this purpose (Avogel, 2025). As with many labiates, Sage belongs originally to the flora of Mediterranean countries (Avogel, 2025). It can be found in huge numbers from the Dalmatian mainland (Croatia and Montenegro) to the sunny lime hillsides (Avogel, 2025). In former Yugoslavia, the export of Sage leaves and Sage oil represented a considerable source of revenue (Avogel, 2025). It is cultivated there as well as in Albania, Hungary, Germany and France. Spanish sage, Salvia off. ssp. lavandulifolia, whose volatile oil has a strong eucalyptus smell, comes mainly from Spain (Avogel, 2025). Carnosol acids and bitter substances are not present in Spanish Sage (Avogel, 2025).

Following the current tendency for xeriscaping and considering the ecological, environmental, economic and aesthetic advantages of native plants, clones of native in Greece sage species were evaluated and interspecific crossings were performed (Papafotiou *et al*., 2025). Aim was to obtain hybrids with floricultural characteristics sought on the international market of ornamental herbs, such as compact plant shape, abundant and prolonged flowering, drought resistance, and ease of growth. *Salvia fruticosa* and *S. officinalis* were crossed with *S. pomifera* ssp. *pomifera*, *S. ringens* and *S. tomentosa* and each clone was used both as a pollen and seed parent for all crossings (Papafotiou *et al.,* 2025). Crossability was observed only when *S. officinalis* and *S. fruticosa* were used as seed parent, apart from the cross *S. tomentosa* × *S. fruticosa* that succeeded with *S. fruticosa* as pollen parent too (Papafotiou *et al.,* 2025). Hybrids with desirable characteristics were selected for further experimentation concerning substrate and fertilization and drought tolerance in a green roof. *S. officinalis* × *S. ringens* and *S. officinalis* × *S. tomentosa* developed a compact plant shape and the most lateral shoots. All hybrids survived water stress better than *S. fruticosa*, especially those of *S. ringens*. Germination of all species was highest at 10-15°C, indifferent to photoperiod, however *S. tomentosa* and *S. ringens* in all germination trials showed very low germination ability (less than 20%) and the other three species had an unstable response (Papafotiou *et al.,* 2025).

Sage (*Salvia*) is an attractive, drought-tolerant, easy-to-grow shrubby plant with aromatic, evergreen leaves that are often soft and downy. It also produces pretty flowers in mid- to late summer. This Mediterranean herb likes full sun in a warm, sheltered spot, in pots or free-draining soil, and should live for many years with minimal maintenance (RHS, 2025). There are many different types of sage, some grown as herbs for their edible, aromatic leaves, and others (usually known as salvias) as ornamental plants for their attractive flowers (RHS, 2025). Common sage is the standard culinary sage. It forms a mound of aromatic, downy, olive-green leaves and produces attractive mauve flowers in early to mid-summer. It is hardy and evergreen, so keeps its leaves all year round, and can grow to up to 1 m (3ft) tall and wide. Its flowers are both ornamental and wildlife friendly, providing nectar for pollinating insects (RHS, 2025). There are also many cultivated varieties including the widely grown purple sage (*S. officinalis* 'Purpurascens') with its attractive, dusky purple, year-round foliage. Other varieties offer different aromas and various flower and foliage colours (RHS, 2025). Sage has a robust, peppery flavour that can be used in many dishes, not just in traditional sage and onion stuffing. You can add chopped sage leaves to soups, pasta sauces, sausages, marinades and more. Sage is also said to have many health benefits, and its botanical name Salvia derives from the Latin salvare meaning to heal (RHS, 2025). Rosemary has recently been reclassified as a type of *Salvia* and is grown in a similar way to sage – for more about this popular herb, see our guide to growing rosemary (RHS, 2025). Common sage (*Salvia officinalis*) makes an attractive addition to warm, sunny borders, herb beds and veg plots, and grows well in containers. Being evergreen and hardy, it provides a year-round presence and can be harvested at any time, although the fresh young leaves are best (RHS, 2025). There are several attractive varieties to choose from too, including the popular purple-leaved 'Purpurascens' and yellow-leaved 'Icterina', which adds a bright splash of colour. These three have an RHS Award of Garden Merit, which shows they are easy and reliable to grow. There are more varieties too, with various aromas, leaf colours and flower colours, including tricolour sage, with cream-and-green (RHS, 2025). Variegated means having leaves or other plant parts with streaks, blotches or patches of different colours. Typically, these would be a combination of two colours, such as green and gold or green and white. Variegated leaves tinted with pink (RHS, 2025). You can explore a wide range of herbs, including sage, in all the RHS gardens, so do visit them for more herbal inspiration and growing tips (RHS, 2025). Common sage and purple sage are widely available from garden centres and online plant retailers, usually as young potted plants or rooted A method of growing new plants from parts of an existing plant, such as sections of root, stem, leaf or bud. When prepared correctly and planted in the right conditions, they can produce roots and eventually become independent plants. There is a wide range of different methods for taking cuttings, depending on the plant and time of year (RHS, 2025). Established plants have been in their current location for two or three years and so have well-developed root systems able to support strong growth with healthy foliage and flowers (RHS, 2025). Established plants in bigger pots for most of the year. Other varieties may be available from larger online suppliers and herb nurseries. You can also buy packeted seeds, although generally only of common sage (RHS, 2025). Recommended Varieties: 'Berggarten' (RHS, 2025). A German introduction with a good strong flavour. Leaves... The RHS Award of Garden Merit (AGM) helps gardeners choose the best plants for their garden. Wild bees and other pollinators are in decline. The Plants for Pollinators initiative helps gardeners easily identify plants that encourage them back into the garden Broad-leaved *Salvia officinalis* broad-leaved (RHS, 2025). Another excellent culinary sage with round, aromatic, soft green... The RHS Award of Garden Merit (AGM) helps gardeners choose the best plants for their garden. Wild bees and other pollinators are in decline. The Plants for Pollinators initiative helps gardeners easily identify plants that encourage them back into the garden (RHS, 2025). The classic garden and cooking sage with a strong flavour. Sage-green, the RHS Award of Garden Merit (AGM) helps gardeners choose the best plants for their garden. Wild bees and other pollinators are in decline. The Plants for Pollinators initiative helps gardeners easily identify plants that encourage them back into the garden (RHS, 2025).

Common sage is one of the main species of aromatic plants cultivated in Switzerland. The almost total absence of characterized commercial cultivars, but also the need to have an easy to multiply, high-performance cultivar adapted to cultivation in mountain areas, led us to set up a new breeding program for *S. officinalis* (Simonnet *et al*., 2025). Started in 2010, this work led to the creation of a new cultivar derived from a polycross and named 'Carola'. 'Carola' has been evaluated since 2020 at 2 locations in

Switzerland, in comparison with the former cultivar 'Regula' and the German cultivar 'Extrakta'(Simonnet *et al*., 2025). In the first year of cultivation (1-2 cut), dry yields for this new cultivar ranged from 2.25 to 2.75 t $ha^{-1}$ with no significant difference from the other 2 cultivars (Simonnet *et al*., 2025). In the second year (2 to 3 cuts), 'Carola' is equivalent to 'Extrakta' with an average dry yield of 4.10 t $ha^{-1}$, and slightly higher than 'Regula'. The essential oil content of the leaves of this new cultivar, with 1.9 to 2.5% at the end of summer, is intermediate to the two control cultivars, 'Extrakta' being the lowest (Simonnet *et al.,* 2025).

## ORIGIN AND DISTRBUTION

Native to the Mediterranean region, it has been naturalized in many places throughout the world (Wikipedia, 2025). Sage is a native of Mediterranean area. It grows wild in the Dalmatian region of Yugoslavia. It is cultivated in Yugoslavia, Italy, Albania, Turkey, Portugal, Spain, Cyprus, England, Canada and USA. In India, it is sparingly cultivated in Jammu. Sage thrives well in rich clayey and loamy soil. A hot and dry climate is not suitable for its cultivation (Indianspices, 2025). Sage (*Salvia officinalis*) belongs to the Lamiaceae family, along with other garden herbs such as rosemary and thyme. Although sage has Mediterranean origins, it is now found throughout most parts of the world in both wild and cultivated forms. Common sage forms a perennial, evergreen shrub with many stems that tend to become woody over time. The plant can reach 1m in height and width. Sage bears aromatic leaves of varying size and shape, depending on the species. The leaves are often grey-green but can also be purple, silver or variegated. Sage leaves appear rather velvety, despite the coarse texture on their upper surface where the oil glands are located. A common sage bush flowers in mid- to late summer. It produces racemes of violet-blue blooms, whilst the wide variety of ornamental salvias offer delicate sage flowers in every imaginable hue. You can enjoy their beautiful foliage all year round as many salvia varieties are extremely cold tolerant. Find out more about how to look after sage in winter in our dedicated article (Plantura, 2025).

***Taxonomy:*** *Salvia officinalis* was described by Carl Linnaeus in 1753. It has been grown for centuries in the Old World for its food and healing properties, and was often described in old herbals for the many miraculous properties attributed to it. The binary name, *officinalis*, refers to the plant's medicinal use—the *officina* was the traditional storeroom of a monastery where herbs and medicines were stored. *S. officinalis* has been classified under many other scientific names over the years, including six different names since 1940 alone. It is the type species for the genus *Salvia* (Wikipedia, 2025).George Bentham was first to give a full monographic account of the genus in 1832–1836, and based his classifications on staminal morphology. Bentham's work on classifying the family Labiatae (*Labiatarum Genera et Species* (1836)) is still the only comprehensive and global organization of the family. While he was clear about the integrity of the overall family, he was less confident about his organization of *Salvia*, the largest genus in Labiatae (also called Lamiaceae). Based on his own philosophy of classification, he wrote that he "ought to have formed five or six genera" out of *Salvia*. In the end, he felt that the advantage in placing a relatively uniform grouping in one genus was "more than counterbalanced by the necessity of changing more than two hundred names." At that time there were only 291 known *Salvia* species (Wikipedia, 2025).

### Subdivision

Bentham eventually organized *Salvia* into twelve sections (originally fourteen), based on differences in corolla, calyx, and stamens. These were placed into four subgenera that were generally divided into Old World and New World species:

**Subgenus *Salvia*:** Old World (sections: Hymenosphace, Eusphace, Drymosphace)
**Subgenus *Sclarea*:** Old World (sections: Horminum, Aethiposis, Plethiosphace)
**Subgenus *Calosphace*:** New World (section: Calosphace)
**Subgenus *Leonia*:** Old and New World (sections: Echinosphace, Pycnosphace, Heterosphace, Notiosphace, Hemisphace)

His system is still the most widely studied classification of *Salvia*, even though more than 500 new species have been discovered since his work. Other botanists have since offered modified versions of Bentham's classification system, while botanists in the last hundred years generally do not endorse Bentham's system. It was long assumed that *Salvia'*s unusual pollination and stamen structure had evolved only once, and that therefore *Salvia* was monophyletic, meaning that all members of the genus evolved from one ancestor. However, the immense diversity in staminal structure, vegetative habit, and floral morphology of the species within *Salvia* has opened the debate about its infrageneric classifications (Wikipedia, 2025).

### Selected species and their uses

Many species are used as herbs, as ornamental plants (usually for flower interest), and sometimes for their ornamental and aromatic foliage. Some species, such as *Salvia columbariae* and *Salvia hispanica*, are also grown for their seeds. The Plant List has 986 accepted species names. A selection of some well-known species is below (Wikipedia, 2025):

*Salvia apiana*: white sage; sacred to a number of Native American peoples, and used by some tribes in their ceremonies
*Salvia azurea*: blue sage
*Salvia buchananii*: Buchanan sage; woody-based stoloniferous perennial, deep pink flowers
*Salvia cacaliifolia*: blue vine sage or Guatemalan sage; pure gentian-blue flowers
*Salvia candelabrum*: candelabrum sage; woody-based perennial, violet flowers
*Salvia columbariae*: wild chia; annual plant with seeds that are sometimes used like those of *Salvia hispanica*
*Salvia dianthera* Roth: Bengal sage

*Salvia divinorum*: diviner's sage; sometimes cultivated for hallucinogenic effects; the legality of its use is under review in some US states
*Salvia elegans*: pineapple sage; widely grown as an ornamental shrub or sub-shrub, with pineapple scented leaves
*Salvia farinacea*: Mealycup sage, mealy sage; perennial with flowers ranging from purple to blue, Used as an ornamental plant
*Salvia fruticosa*: Greek sage; commonly grown and harvested as an alternative to common sage
*Salvia fulgens*: Cardinal sage, Mexican scarlet sage; small evergreen sub-shrub, red flowers
*Salvia guaranitica*: hummingbird sage, anise-scented sage; tall perennial, deep blue flowers
*Salvia hispanica*: chia; produces edible seeds high in protein and in the omega-3 fatty acid, α-linolenic acid (ALA)
*Salvia involucrata*: roseleaf sage; woody-based perennial
*Salvia jurisicii*: Ovche Pole sage; a rare, compact "feathery" perennial endemic to North Macedonia, violet flowers
*Salvia leucantha*: Mexican bush sage, woolly sage; ornamental evergreen subshrub, white/pink flowers
*Salvia microphylla*: baby sage: small ornamental shrub from Mexico, widely cultivated with many cultivars
*Salvia miltiorrhiza*: red sage, Danshen; Chinese medicinal herb
*Salvia nemorosa*: woodland sage, Balkan clary; perennial with many ornamental varieties and cultivars
*Salvia officinalis*: sage, common sage; used widely in cooking, as an ornamental, and in herbal medicine
*Salvia patens*: gentian sage; herbaceous perennial, blue flowers
*Salvia pratensis*: clary: herbaceous perennial, violet flowers
*Salvia rosmarinus*: rosemary; woody shrub, blue flowers
*Salvia sclarea*: clary; grown as an ornamental and to some extent for perfume oils
*Salvia spathacea*: California hummingbird sage, pitcher sage; ornamental, fruit-scented with rose pink flowers
*Salvia splendens*: scarlet sage; popular tender ornamental bedding or pot plant.[22]
*Salvia uliginosa*: bog sage; herbaceous perennial, blue flowers

**Phylogenetic analyses**

Through DNA sequencing, *Salvia* was shown to not be monophyletic but to consist of three separate clades (*Salvia* clades I–III) each with different sister groups. They also found that the staminal lever mechanism evolved at least two separate times, through convergent evolution. Clarified this parallel evolution in a later paper combining molecular and morphological data to prove three independent lineages of the *Salvia* lever mechanism, each corresponding to a clade within the genus. It is surprising to see how similar the staminal lever mechanism structures are between the three lineages, so *Salvia* proves to be an interesting but excellent example of convergent evolution (Wikipedia, 2025). To make *Salvia* monophyletic would require the inclusion of 15 species from *Rosmarinus*, *Perovskia*, *Dorystaechas*, *Meriandra*, and *Zhumeria* genera. The three independent origins of the staminal lever indicate that *Salvia* is not the case where 15 species (currently not members of the genus) are actually members of *Salvia* but underwent character reversals—in other words, *Salvia* is paraphyletic as previously circumscribed. In 2017 Drew *et al*. recircumscribed *Salvia*, proposing that the five small embedded genera (*Dorystaechas*, *Meriandra*, *Perovskia*, *Rosmarinus*, and *Zhumeria*) be subsumed into a broadly defined *Salvia*. This approach would require only 15 name changes whereas aintaining the five small genera and renaming various *Salvia* taxa would require over 700 name changes. The circumscription of individual species within *Salvia* has undergone constant revision. Many species are similar to each other, and many species have varieties that have been given different specific names. There have been as many as 2,000 named species and subspecies. Over time, the number has been reduced to less than a thousand. A modern and comprehensive study of *Salvia* species was done by Gabriel Alziar, in his *Catalogue Synonymique des* Salvia *du Monde* (1989) (*World Catalog of* Salvia *Synonyms*). He found that the number of distinct species and subspecies could be reduced to less than 700 (Wikipedia, 2025).

**AGM cultivars (Wikipedia, 2025).**

Numerous garden-worthy cultivars and varieties have been produced, often with mixed or unknown parentage. The following have gained the Royal Horticultural Society's Award of Garden Merit:

*Salvia* 'Amistad': bushy upright perennial, deep blue/purple flowershttps://en.wikipedia.org/wiki/Salvia#cite_note-25
*Salvia* 'Dyson's Joy': small, bushy perennial, bicolor red/pink flowers
*Salvia* 'Hot Lips': bushy evergreen, red/white flowers
*Salvia* 'Jezebel': bushy evergreen perennial, red flowers
*Salvia* 'Nachtvlinder': bushy evergreen perennial, purple flowers
*Salvia* 'Ribambelle': bushy perennial, salmon-pink flowers
*Salvia* 'Royal Bumble': evergreen shrub, red flowers
*Salvia* × *jamensis* 'Javier': bushy perennial, purple flowers
*Salvia* × *jamensis* 'Los Lirios': bushy shrub, pink flowers
*Salvia* × *jamensis* 'Peter Vidgeon': bushy perennial, pale pink flowers
*Salvia* × *jamensis* 'Raspberry Royale': evergreen subshrub, raspberry pink flowers
*Salvia* × *superba* 'Rubin': clump-forming perennial, pale pink flowers
*Salvia* × *sylvestris* 'Blauhügel': herbaceous perennial, violet-blue flowers
*Salvia* × *sylvestris* 'Mainacht': compact perennial, deep violet flowers
*Salvia* × *sylvestris* 'Tänzerin': perennial, purple flowers

**Hybrids:** Many interspecific hybrids occur naturally, with a relatively high degree of crossability, but some, *Salvia fruticosa* × *Salvia tomentosa*, have been intentional. A natural hybrid, *Salvia longispicata* × *Salvia farinacea* has given rise to a series of popular ornamentals such as *Salvia* 'Indigo Spires' and *Salvia* Mystic Spires Blue 'Balsalmisp' (Wikipedia, 2025).

**Ecology:** *Salvia* species are used as food plants by the larvae of some Lepidoptera (butterfly and moth) species including the bucculatricid leaf-miner *Bucculatrix taeniola* which feeds exclusively on the genus and the *Coleophora* case-bearers *C. aegyptiacae*, *C. salviella* (both feed exclusively on *Salvia aegyptiaca*), *C. ornatipennella* and *C. virgatella* (both recorded on *Salvia pratensis*) (Wikipedia, 2025).

***Botanical Description:*** Common Sage is a bush, 1 to 80 cm in height with upright stems and numerous side branches covered in downy hairs. The lower parts of the bush are woody. The aromatic leaves are simple, egg shaped or long and narrow and become narrower in the direction of the stem where they are sometimes auriculated. The leaf edge is delicately toothed. The leaves are greenish to silver grey. On the upper side the young leaves are downy hairs and the older leaves are mostly wrinkled and hairless. The downside is always downy haired. The bright blue to typically bluish purple flowers, with lipped corollas, form 6 to 10 whorls with 6 to 10 flowers, 4 to 8 of which are arranged alternatively one upon the other on the main shoots. The species Salvia is one of the most abundant in the Lamiaceae family and is made up of over 500 species. As well as Salvia officinalis there are various subspecies and numerous cultured varieties. Both subspecies of *Salvia officinalis* L., ssp. minor (GMELIN) GAMS and ssp. major (Garsault) GAMS provide the Sage leaves referred to in medical books and for the production of Dalmatian Sage oil. Sage flowers from May to July (Avogel, 2025).

Cultivars are quite variable in size, leaf and flower color, and foliage pattern, with many variegated leaf types. The Old World type grows to approximately 60 cm tall and wide, with lavender flowers most common, though they can also be white, pink, or purple. The plant flowers in late spring or summer. The leaves are oblong, ranging in size up to 65 mm long by 25 mm wide. Leaves are grey-green, rugose on the upper side, and nearly white underneath due to the many short soft hairs. Modern cultivars include leaves with purple, rose, cream, and yellow in many variegated combinations. The common sage gives its name to the grayish-green color sage, due to the distinctive color of its leaves (Wikipedia, 2025). Sage is a perennial plant that grows about 60 cm tall. The oval leaves are rough or wrinkled and usually downy; the color ranges from gray-green to whitish green, and some varieties are variegated. The flowers are borne in spikes and feature tubular two-lipped corollas that are attractive to a variety of pollinators, including bees, butterflies, and hummingbirds. The flowers can be purple, pink, white, or red and produce nutlet fruits. The essential oil content of sage varies up to about 2.5 percent; the principal components are thujone and borneol (EEB, 2025). https://www.britannica.com/quiz/whats-on-the-menu-vocabulary-quiz. Sage is a perennial shrub in the family Lamiaceae grown for its aromatic leaves which are used as a herb. Sage can be erect or grow along the ground and possesses a dense arrangement of woody stems with broad, elliptical, silvery-green leaves which are arranged alternately on the stems. The plant produces blue, pink or white flowers on a stalk. Sage plants generally grow to 40–70 cm (16–28 in) in height and can live to be 15–20 years old although they are usually replaced after 4–5 years in the garden when they become woody. Sage may also be referred to as common sage and originates from the Balkan peninsula (Plantvillage, 2025). The name *Salvia*, is derived from the Latin “salvere”, meaning to save, in reference to the medicinal properties of the plant. The name *officinalis*, derives from the Latin word “officina” which was the traditional storeroom of a monastery where herbs and medicines were stored. Sage goes by many names in different languages such as *marameeah* (Arabic), *shu wei cao* (Chinese), *sauge* (French), *salbei* (German), *salvia* (Italian, Spanish), and *sathi* (Punjabi) (Mccormick, 2025). Sage (*Salvia officinalis*) is a medium sized perennial shrub that can reach up to 2 feet in height. It has erect stems, hairy green branches, simple elongated light green/silver colored leaves and long blue/purple flowers. The flowers are extremely attractive to butterflies, bees, and hummingbirds. The leaves of the plant are harvested for culinary purposes. Sage is native to the hilly regions of the Mediterranean and prefers cool temperate to subtropical conditions (generally warm and dry weather). Sage is typically planted in the spring season and is ready for harvest after about 60-70 days. The plant is pruned a few times during the season and can have multiple harvests. Most sage is sold in dry form and drying can occur in the sun or through industrial convection drying. Botanically, sage is a member of the *Lamiaceae* (mint) family. There are over 700 species of Salvia. The main culinary species is Salvia officinalis but several others are utilized for culinary purposes (a few of the more common species are listed below). *Salvia officinalis* is native to the Mediterranean and Middle East. Turkey, Russia and southeastern Europe have become the principal producers of sage (Mccormick, 2025).

Salvia species include annual, biennial, or perennial herbaceous plants, along with woody subshrubs. The stems are typically angled like other members in Lamiaceae. The leaves are typically entire, but sometimes toothed or pinnately divided. The flowering stems bear small bracts, dissimilar to the basal leaves—in some species the bracts are ornamental and showy. The flowers are produced in racemes or panicles, and generally produce a showy display with flower colors ranging from blue to red, with white and yellow less common. The calyx is normally tubular or bell shaped, without bearded throats, and divided into two parts or lips, the upper lip entire or three-toothed, the lower two-cleft. The corollas are often claw shaped and are two-lipped. The upper lip is usually entire or three-toothed. The lower lip typically has two lobes. The stamens are reduced to two short structures with anthers two-celled, the upper cell fertile, and the lower imperfect. The flower styles are two-cleft. The fruits are smooth ovoid or oblong nutlets and in many species they have a mucilaginous coating. Many members of *Salvia* have trichomes (hairs) growing on the leaves, stems and flowers, which help to reduce water loss in some species. Sometimes the hairs are glandular and secrete volatile oils that typically give a distinct aroma to the plant. When the hairs are rubbed or brushed, some of the oil-bearing cells are ruptured, releasing the oil. This often results in the plant being unattractive to grazing animals and some insects (Wikipedia, 2025). Sage is the dried leaf of *Salvia officinalis*. It is a hardy sub-shrub. Stems are white, woody, 32-60 cm tall, leaves are greyish green, aromatic, petiolate, oblong, 7-8 cm long. On drying, leaves turns silvery grey with soft velvety texture. The flowers are blue, purple, or white in simple racemes (Indianspices, 2025). Sage is a perennial plant that grows about 60 cm tall. The oval

leaves are rough or wrinkled and usually downy; the color ranges from gray-green to whitish green, and some varieties are variegated. The flowers are borne in spikes and feature tubular two-lipped corollas that are attractive to a variety of pollinators, including bees, butterflies, and hummingbirds. The flowers can be purple, pink, white, or red and produce nutlet fruits. The essential oil content of sage varies up to about 2.5 percent; the principal components are thujone and borneol (Britannica, 2025).

Sage is a genus in the mint family (Lamiaceae). It has a worldwide distribution. There are over 1000 species and many more hybrids and cultivars. Most members of this genus are small, upright shrubs or herbaceous perennials reaching 1 to 3 feet tall and wide. The name *Salvia* is derived from the Latin word *salvare*, which means "to save" and refers to the plant's life-saving medicinal properties. Sages are usually easy to grow. They need to be planted in full sun to partial shade and in well-drained soil. They are drought- and salt-tolerant and resistant to deer and rabbits. Propagate by division, seed, or stem cutting. The sage genus is especially diverse in Turkey and the Mediterranean and in Mexico and adjacent regions. Many of the Mexican species are attractive to hummingbirds, whereas the Old World species are attractive to bees. Many species have showy bracts on the inflorescence. Most species have aromatic foliage, but the flowers lack fragrance. Several species are used as culinary herbs (sage, rosemary, pineapple sage), perfume (clary sage [*Salvia sclarea*]), and medicine (*Salvia miltiorrhiza*). The fruit type of sages is a small, dry, four-lobed fruit that breaks apart into four nutlets (schizocarp). Each nutlet contains a single seed. The schizocarpic nutlets are usually regarded as "seeds" by the non-botanist. Sages are some of the easiest plants to propagate by stem cuttings. The flowers provide excellent color in the border, so sages are welcome additions to the native, butterfly, pollinator, or drought-tolerant gardens. Edible species are also excellent in an herb garden (NCEGPT, 2025).

| | | |
|---|---|---|
|  |  |  |
| **Seeds** | **Seeds** | **Seeds** |
|  |  |  |
| **Plants** | **Leaves** | **Leaves** |
|  |  | |
| **Flowers** | **Sage flowers** | |
|  |  |  |
| **Powder** | **Powder** | **Essential oil** |

**Fig. 1 : Botanical Description**

## Pollination

The defining characteristic of the genus *Salvia* is the unusual pollination mechanism. It is central to any investigation into the systematics, species distribution, or pollination biology of *Salvia*. It consists of two stamens (instead of the typical four found in

other members of the tribe Mentheae) and the two thecae on each stamen are separated by an elongate connective which enables the formation of the lever mechanism. Sprengel (1732) was the first to illustrate and describe the nototribic (dorsal) pollination mechanism in Salvia. When a pollinator probes a male stage flower for nectar, (pushing the posterior anther theca) the lever causes the stamens to move and the pollen to be deposited on the pollinator. When the pollinator withdraws from the flower, the lever returns the stamens to their original position. In older, female stage flowers, the stigma is bent down in a general location that corresponds to where the pollen was deposited on the pollinator's body. The lever of most Salvia species is not specialized for a single pollinator, but is generic and selected to be easily released by many bird and bee pollinators of varying shapes and sizes. The lever arm can be specialized to be different lengths so that the pollen is deposited on different parts of the pollinator's body. For example, if a bee went to one flower and pollen was deposited on the far back of her body, but then it flew to another flower where the stigma was more forward (anterior), pollination could not take place. This can result in reproductive isolation from the parental population and new speciation can occur. It is believed that the lever mechanism is a key factor in the speciation, adaptive radiation, and diversity of this large genus (Wikipedia, 2025).

## GENETICS AND CYTOGENETICS

In addition, it is important to note that both species share the same number of chromosomes (2n = 14) and rely on the same pollinator assemblageIn addition, it is important to note that both species share the same number of chromosomes (2n = 14) and rely on the same pollinator assemblage (Radosavljević *et al.,* 2025).

## GENETIC DIVERSITY

### Include

Dalmatian sage (*Salvia officinalis* L., Lamiaceae) is a well-known aromatic and medicinal Mediterranean plant that is native in coastal regions of the western Balkan and southern Apennine Peninsulas and is commonly cultivated worldwide. It is widely used in the food, pharmaceutical and cosmetic industries. Knowledge of its genetic diversity and spatiotemporal patterns is important for plant breeding programmes and conservation. We used eight microsatellite markers to investigate evolutionary history of indigenous populations as well as genetic diversity and structure within and among indigenous and cultivated/naturalised populations distributed across the Balkan Peninsula. The results showed a clear separation between the indigenous and cultivated/naturalised groups, with the cultivated material originating from one restricted geographical area. Most of the genetic diversity in both groups was attributable to differences among individuals within populations, although spatial genetic analysis of indigenous populations indicated the existence of isolation by distance. Geographical structuring of indigenous populations was found using clustering analysis, with three sub-clusters of indigenous populations. The highest level of gene diversity and the greatest number of private alleles were found in the central part of the eastern Adriatic coast, while decreases in gene diversity and number of private alleles were evident towards the northwestern Adriatic coast and southern and eastern regions of the Balkan Peninsula. The results of Ecological Niche Modelling during Last Glacial Maximum and Approximate Bayesian Computation suggested two plausible evolutionary trajectories: 1) the species survived in the glacial refugium in southern Adriatic coastal region with subsequent colonization events towards northern, eastern and southern Balkan Peninsula; 2) species survived in several refugia exhibiting concurrent divergence into three genetic groups. The insight into genetic diversity and structure also provide the baseline data for conservation of *S. officinalis* genetic resources valuable for future breeding programmes (Rešetnik *et al*., 2016).

An initial investigation was carried out to compare the genetic and metabolic diversity in *Salvia officinalis* grown in Greece and to discern the relationship between the two sets of data. Analysis of inter-simple sequence repeats (ISSR) revealed significant genetic differences among seven sage populations, which were grouped into three main clusters according to an UPGMA ISSR data-based dendrogram and Principle Coordinate Analysis. 80 loci were scored of which up to 90% were polymorphic at species level. According to the composition of their essential oil, the populations were classified into two chemotypes: 1.8 cineole/α-thujone and α-thujone/1.8 cineole. Additionally, a targeted ultra performance liquid chromatography (UPLC-MS/MS) method was used to qualify and quantify phenolic compounds in methanolic extracts of the seven sage genotypes according to which they were districted in six clusters among the sage populations. The main compounds characterizing the seven genotypes were rosmarinic acid and carnosol, followed by apigenin-7-O-glucoside (Ap7glc), and luteolin-7-O-glucoside (Lu7glc). The correlation between matrices obtained from ISSR data and metabolic profiles was non-significant. However, based on the differences in metabolic fingerprint, we aimed to define populations using as main selection criteria the high polyphenol content and desired essential oil composition, using state to the art analytical tools for the identification of parent lines for breeding programs (Bağdat *et al.,* 2017). Thirty-three spontaneous hybrid common sage lines (*Salvia officinalis* L.) were evaluated regarding their biomass production and essential oil characteristics employing 4 different standard sage cultivars and lines. Following yield parameters were recorded as; the plant height was ranged 50.3 to 97.5 cm, canopy diameter was 36.0 to 95.0 cm, fresh herb yield was changed 59.9 to 593.4 g/per plant, drug herb yield was 12.6 to 183.9 g/per plant, drug leaf yield was 16.1 to 74.5 g/per plant and the leaf ratio was around 53.42-67.01%. The essential oil ratio was changed between 0.88 and 2.42%. All the yield parameters of the lines were found statistically significant. α-thujone, 1.8 cineole, borneol, camphor, β-thujone, camphene and viridiflorol were the main components. More than ten lines had less than 20% of α-thujone (Bağdat *et al.*, 2017). Sage plant is widely used in pharmaceutical, food and spice industries and as tea by many people. The fact that the plant may be marketed after being collected uncontrollably from the nature threatens its future. Therefore, it is necessary to put these species under protection and to start breeding projects as well to do genetic characterization of them. For this purpose, in the study, 11 different sage species

from the Eastern Mediterranean region were collected and genetic differences among species were determined using SRAP (Sequence dependent replicated polymorphism) markers. As the result of our experiments, average polymorphism content, allele number and polymorphism information content (PIC) of the species were calculated as 90.91%, 4.2 and 0.91, respectively. The PIC values ranged from 0.04 to 0.99. While the average genetic difference among species was determined as 43.15%, the highest genetic difference, which was between *Salvia aucheri Salvia aramiensis*,was found to be 61.46%. The least genetic difference, on the other hand, was detected between Salvia tomentosa and Salvia hypergeiaspecies with 22.62% similarity. Additionally, according to the observations made through the study, the SRAP markers we used were thought to be reliable for the genetic characterization of sage species. In breeding programs where interspecies dissimilarities are considered, selecting parental species with high genetic differences will increase the success (Cardakli *et al*., 2017).

In the present study, 16 ISSR molecular markers were used in the determination of genetic correlations among 8 sages picked up from forests and mountains in Muğla province in the Aegean region. In this study, the average polymorphism rate was determined as 69.84%; in addition, 44 polymorphic bands, totally 63 bands were obtained. As a result of unweighted pair group method with arithmetical average (UPGMA) analysis, the most distant sages to each other were the ones belonging to the Bodrum and the Yerkesik locations, and the ones nearest to each other were obtained from Bodrum and Marmaris locations. On the other hand, in terms of the genetic variation, Dalyan, Köyceğiz, Marmaris and Bodrum locations constituted the first group, and Göcek, Dalaman and Fethiye locations constituted the second group, whereas the sages belonging to the Yerkesik location formed a group by itself. This study revealed that there was a significant genetic variation among the populations of sages grown naturally in Muğla region (Altindal, 2019). Dalmatian or common sage is an outcrossing plant species native to East Adriatic coast. Random Amplified Polymorphic DNA markers (RAPD) were used to analyze genetic diversity and structure of ten natural populations from the East-Adriatic coastal region. The highest genetic diversity was found in populations from the central and south Dalmatia, while the highest frequency down-weighted marker values were found in the northernmost populations and the southern most inland population. Although analysis of molecular variance (AMOVA) revealed that most of the genetic diversity was attributable to differences among individuals within populations, highly significant F ST values suggested the existence of genetic differentiation among populations. By assuming Hardy-Weinberg equilibrium within populations, the calculated F ST value among population was moderate. Bayesian model-based clustering method revealed that at K = 2 all individuals belonging to two northern populations were assigned to a separate cluster from the individuals belonging to the rest of the population. At K = 3, the newly formed cluster grouped the majority of individuals belonging to populations from central Dalmatia. The high correlation between matrices of genetic and geographical distances showed that isolation by distance may play a considerable role in overall structuring of the genetic diversity (Richter, 2024).

## BREEDING

**Propagation:** Sage is a grows best in a well draining, rich, clay loams with a pH between 6.5 and 7.0. It should be planted in full sun, although some afternoon shade is tolerated. Sage plants require warm temperatures and ample sunlight in order to produce a high essential oil content in the leaves (Plantvillage, 2025). Sage is usually propagated from seed, although both cuttings, divisions and air layering is also successfully practised. The planting site should be warm, dry and protected from wind. Seeds should be sown after all danger of frost has passed leaving 23 cm between seeds. Fertilizer may be added to the soil prior to planting to aid development. Plants should be thinned to a final spacing of 45 cm (Plantvillage, 2025). It's easy to make new sage plants by taking Softwood cuttings are taken from spring to early summer (Apr-Jun), using material from the soft and flexible young shoot tips from this seasons growth, which root readily. Use for hardy and tender perennials, deciduous shrubs, climbers and some trees. Softwood cuttings in early summer or by rooting low branches into the ground – see our guide to layering. Sage plants tend to get rather woody and straggly after four or five years, so it's good idea to propagate new plants regularly as replacements – that way you'll always have attractive and productive sage to enjoy and share with friends (RHS, 2025).

### Conservation

Though it is generally believed that the quality and composition of essential oils in MAP are influenced by various environmental conditions and habitats where the plants are grown and harvested *e.g*., several studies of *S. officinalis* revealed the dependence of variations in essential oil composition on genetic background. Correspondingly, our result of the STRUCTURE analysis, which separates natural populations in three subclusters (A1, A2 and A3), is mostly in accordance with essential-oil composition (chemotypes D, C and A). By comparison of these two studies, we can conclude that there is a high congruence between groupings based on chemical composition and genetic relatedness. Although the boundaries are somewhat blurred, most of the populations in the subcluster A1 are characterised by high content of camphor and β pinene and low content of both cisand trans-thujones, the populations in subcluster A2 by high content of cis- and trans-thujones and camphor, and the populations in subcluster A3 by cis-thujone and camphor and low content of trans-thujone. The presented relationship between the genetic profile and chemical composition of the indigenous populations could be an important step in future breeding programs and cultivation, as indigenous populations represent an indispensable source of genetic diversity that is conspecific with the cultivated gene pool. Wild populations can be utilised to improve cultivated populations by introducing genetic diversity through sexual reproduction and consequently increase the efficiency of artificial selection for desired traits. Although the wild *S. officinalis* cannot be treated as an endangered species because populations are numerous and characterised by high levels of genetic diversity, it is essential to conserve the most diverse natural populations for future breeding programmes through efficient management. Special effort should be taken in conservation of populations identified in this study as containing the highest genetic diversity and having the greatest number of private alleles. Rare alleles are often considered a minor element in genetic conservation programmes but they can be very important for the long-term response to selection and the survival of populations and species. Populations from STRUCTURE

subcluster A2 have the highest reservoir of genetic diversity. Hence, these populations are the most adequate for future breeding programmes. The Genetic Diversity of Wild and Cultivated/Naturalised *Salvia officinalis* contradiction of protection and commercial gathering should be addressed through controlled reproduction of wild individuals following appropriate guidelines and in situ management should take into consideration the results presented here to ensure an efficient way to conserve desirable agronomic traits (Rešetnik *et al*., 2016).

**Breeding**

Sage breeding focuses on developing cultivars with improved traits like increased leaf yield, enhanced essential oil composition, and stress resistance. This is achieved through various methods, including traditional breeding, tissue culture, and molecular approaches. n summary, sage breeding aims to create improved varieties with enhanced yield, desired essential oil composition, stress resistance, and adaptability to diverse environments, using a combination of traditional and modern breeding techniques (Scholar, 2025).

**Breeding Objectives** (Scholar, 2025).

**Increased yield:** Improving the number of leaves, leaf area, and leaf-to-stem ratio.

**Enhanced essential oil quality:** Focusing on desired essential oil composition, including reducing thujone content and increasing the concentration of other beneficial compounds like linalool and sclareol.

**Stress resistance:** Developing cultivars tolerant of biotic (pathogens) and abiotic (environmental) stresses.
**Improved genetic diversity:** Ensuring a wide range of genetic traits within sage breeding populations to facilitate adaptation and improvement.

**Adaptability to diverse environments:** Breeding for different climates and growing conditions.

**Breeding Methods** (Scholar, 2025).

**Traditional Breeding:** This involves selecting and crossing plants with desirable traits, like high essential oil content or disease resistance.

**Tissue Culture:** This allows for faster propagation of superior cultivars and can be used for introducing new traits through methods like mutagenesis.

**Molecular Techniques:** Marker-assisted selection (MAS) and other molecular methods can be used to identify and select plants with specific genes for desired traits, accelerating the breeding process.

**Varieties** (Portland, 2025**).**

*Salvia elegans* 'Honeydew Melon'. Melon scented leaves and red flowers late summer to frost. Tender perennial, bring inside for winter. Growing 24-36” tall and wide
*Salvia elegans* 'Pineapple'. Pineapple scented, pubescent leaves, red blooms on spike, known to attract butterflies. Tender perennial, bring inside for winter. Grows 24-36” tall and wide
*Salvia officinalis* 'Berggarten'. Highly aromatic, lilac colored blooms. Extra large leaves. Grows 20-30” tall and wide
*Salvia o.* 'Bicolor Icterina'. Green and gold variegated leaves, mauve-blue blooms in spring. Grows 12-18” tall and wide. A.K.A Golden Sage. Tolerates part shade. Grows 12-18” tall and wide
*Salvia o.* 'Curly'. Curly, ruffled, grey-green leaves. Grows 12-16” tall and wide.
*Salvia o.* 'Dwarf Green'. Low growing, bright blue blooms, small leaves, good for borders, hedges, containers or rock gardens, compact and bushy habit. Grows 12-18” tall and wide
*Salvia o.* 'Garden Sage'. Blooms for 3-4 weeks in early spring, stunning habit with bloom shoots 3' in the air, great in bouquets.
*Salvia o.* 'Growers' Friend. Citrus scented, green leaves, rose - violet blooms in early spring-mid summer. Birds, bees, and butterflies highly attracted to this variety. Grows 24-34” tall and wide
*Salvia o.* 'Holt's Mammoth'. Vigorus growth habit, larger sage plant that produces very flavorful leaves, great for cooking. Grows 24-36” tall and wide
*Salvia o.* 'Purpurea'. Attractive purple foliage, lilac blue flowers. Grows 12-18” tall and wide
*Salvia o.* 'Tri-color'. triking multicolored foliage, great winter color, rarely flowers. A bit more tender than other varieties. Grows 15-18” tall and wide
*Salvia o.* 'Pink Flower'. Unusual tubular pink-rose bloom on spike, soft savory leaves. Grows 18-24” tall and wide
*Salvia o.* 'White Edged'. Requires sun, silver-green leaves edged in white, rose-purple blooms on spires in summer. Grows 24-30” tall and wide (Fig. 2).

| | | |
|---|---|---|
|  |  |  |
| **Icterina** | **Purpurascens** | **Tricolor** |
|  |  |  |
| **Purple leaf sage** | **'Honeydew Melon** | **Pineapple** |
|  |  |  |
| **Berggarten** | **Bicolor Icterina** | **Curly** |
|  |  |  |
| **Dwarf Green** | **Garden Sage** | **Growers' Friend** |
|  |  |  |
| **Holt's Mammoth** | **Purpurea** | **Tri-color** |
|  |  |  |
| **Pink Flower** | **White Edged** | ***Berggarten*** |

**Continue …**

| | | |
|---|---|---|
|  |  |  |
| ***Icterina*** | ***Purpurascens*** | **Golden sage** |
|  |  |  |
| **Common sage** | ***Salvia farinacea* × *Salvia longispicata* 'Balsalmisp'** | ***Salvia* × *sylvestris* 'Mainacht'** |
| **Fig. 2. Varieties** | | |

**Named cultivars (Wikipedia, 2025).**

'Alba', a white-flowered cultivar
'Aurea', golden sage
'Berggarten', a cultivar with large leaves, which rarely blooms, extending the useful life of the leaves
'Extrakta', has leaves with higher oil concentrations
'Icterina', a cultivar with yellow-green variegated leaves
'Lavandulaefolia', a small leaved cultivar
'Purpurascens' ('Purpurea'), a purple-leafed cultivar
'Tricolor', a cultivar with white, purple and green variegated leaves
'Icterina' and 'Purpurascens' have gained the Royal Horticultural Society's Award of Garden Merit.

**Uses**

Sage is used in Greek, Italian, and European cuisines. It is used to season sausages, poultry, lamb, pork, and fish dishes. Veal saltimoboca is a famous Italian dish that incorporates fresh sage leaves. Fresh sage leaves can be fried to a crispy texture for pasta and gnocchi dishes. In the United States, sage is the classic herb in bread stuffing served at Thanksgiving. Sage also is a main component found in many poultry and Italian seasoning blends. Sage does have a strong taste so beware of using too much (Mccormick, 2025). Fresh sage leaves are thicker than basil leaves with a soft, downy feeling. They're tender and easily torn but are usually chopped or minced before adding to a dish. Dried sage is typically sold rubbed or ground (powdered). Rubbed sage is lighter and less concentrated; 2 teaspoons of rubbed sage is roughly equivalent to 1 teaspoon of ground sage. It is best to add fresh sage towards the end of the cooking process and dried sage towards the beginning so it has time to mellow and blend with other flavors in the dish (Mccormick, 2025). Sage leaves are used as a tea. Sage leaves are used as a spice in sausages, meat, fish and honey. They are also added in cheese, salads and other foods. The Essential oil of Sage has medicinal properties and is used in numerous industries (perfume, cosmetics, personal hygiene, insect repellents, oral mouthwash solutions). Sage is also used as an ornamental in various floral creations. Sage (*Salvia officinalis* L.) is an aromatic and medicinal, evergreen, perennial subshrub. It belongs in the Lamiaceae or Labiatea family, the family of Basil, Lavender and Thyme. The plant is native in Southeastern Europe, in the Mediterranean and in Northern Africa. The scientific name *Salvia* derives from the Latin word ‘salveo’ which means ‘salvation’, ‘to be in good health’, ‘to save’, ‘to heal’. *Salvia officinalis* includes more than 900 cultivars, but only a few are widely cultivated for profit. Common sage leaves are used for centuries in cooking and in traditional medicine. Moreover, sage is widely used as an ornamental plant. *Salvia officinalis* is mostly cultivated in Mediterranean countries (Spain, Italy, Morocco, Greece, Turkey), in the United States, in Poland and Romania and in some countries of the Adriatic (Albania). Generally, *Salvia* sp. is bushy and can grow from 16-60 inches (40-150 cm) depending on the variety. The stem is green during the first year, but it turns woody in the second year. Sage has opposite leaves, simple or pinnate, toothed or wrinkled and little hairy, ranging from gray to gray-green, purple or silver. The leaves can grow up to 5 inches long (12 cm), and are often aromatic. Salvia flowers are short, two-lipped, erect spikes and -depending on the variety- can have a blue, purple, violet, green, red, pink, orange, yellow or white color. In some other cases, they can be multicolored. The flowers have both male and female organs. In most cases, Common Sage flowers bloom in the early summer (May) and they naturally attract many bees, butterflies and sometimes even small birds (Wikifarmer, 2025).

*Salvia officinalis* has been used since ancient times for treating snakebites, increasing women's fertility, and more. The Romans referred to sage as the "holy herb," and employed it in their religious rituals.[9] Theophrastus wrote about two different sages, a wild undershrub he called *sphakos*, and a similar cultivated plant he called *elelisphakos*. Pliny the Elder said the latter plant was called *salvia* by the Romans, and used as a diuretic, a local anesthetic for the skin, a styptic, and for other uses. Charlemagne recommended the plant for cultivation in the early Middle Ages, and during the Carolingian Empire, it was cultivated in monastery gardens. Walafrid Strabo described it in his poem *Hortulus* as having a sweet scent and being useful for many human ailments—he went back to the Greek root for the name and called it *lelifagus*. The plant had a high reputation throughout the Middle Ages, with many sayings referring to its healing properties and value. It was sometimes called *S. salvatrix* (sage the savior). Dioscorides, Pliny, and Galen all recommended sage as a diuretic, hemostatic, emmenagogue, and tonic. *Le Menagier de Paris*, in addition to recommending cold sage soup and sage sauce for poultry, recommends infusion of sage for washing hands at table. John Gerard's *Herball* (1597) states that sage "is singularly good for the head and brain, it quickeneth the senses and memory, strengtheneth the sinews, restoreth health to those that have the palsy, and taketh away shakey trembling of the members." Gervase Markham's *The English Huswife* (1615) gives a recipe for a tooth-powder of sage and salt. It appears in recipes for Four Thieves Vinegar, a blend of herbs which was supposed to ward off the plague. In past centuries, it was also used for hair care, insect bites and wasp stings, nervous conditions, mental conditions, oral preparations for inflammation of the mouth, tongue and throat, and also to reduce fevers (Wikipedia, 2025). In Britain, sage has for generations been listed as one of the essential herbs, along with parsley, rosemary, and thyme (as in the folk song "Scarborough Fair"). It has a savory, slightly peppery flavor. Sage appears in the 14th and 15th centuries in a "Cold Sage Sauce", known in French, English and Lombard cuisine, probably traceable to its appearance in *Le Viandier de Taillevent*.[16] It appears in many European cuisines, notably Italian, Balkan and Middle Eastern cookery. In Italian cuisine, it is an essential condiment for saltimbocca and other dishes, favored with fish. In British and American cooking, it is traditionally served as sage and onion stuffing, an accompaniment to roast turkey or chicken at Christmas or Thanksgiving Day, and for Sunday roast dinners. Other dishes include pork casserole, Sage Derby cheese and Lincolnshire sausages. Despite the common use of traditional and available herbs in French cuisine, sage never found favor there (Wikipedia, 2025).

Sage is an herb with culinary and medicinal uses. A flavourful fragrant herb. Sage has slightly stimulating properties; tea brewed from its leaves has been used as a tonic for centuries. In medieval Europe sage was thought to strengthen memory and promote wisdom (EEB, 2025). In the kitchen, sage leaves are frequently added to meat and fish dishes. Classic combinations also include sage, garlic and white beans or the irresistible sage and pumpkin gnocchi. The flavours of sage leaves are best released by gentle heating in a fat such as butter or olive oil. Sage flowers are also edible and make a great and colourful addition to a salad. Although burning sage during cooking is not recommended, white sage leaves (*Salvia apiana*) are used as a fragrant incense and burnt for their purifying effects around the home. Learn more about this lovely, light variety of sage in our article on how to grow, care for and use white sage. Sage is used in the culinary preparation in the West. The taste is fragrant, spicy, warm, astringent and a little bitter. It is used for flavouring meat and fish dishes and for poultry stuffing. Fresh sage leaves are used in salads and sandwiches. Sage is used as a mild tonic, astringent and carminative. It is diaphoretic and anti-pyretic. Sage oil is used in perfumes as a deodorant. Sage and sage oil exhibit anti-oxidant properties (Indianspices, 2025). Sage is usually used as an herb in cooking. Whole aromatic leaves should be used sparingly for just the right amount of flavor. You can also buy sage dried and ground to use in the dishes you prepare. Teas, extracts, and supplements made from sage are also available (Webmd, 2025). Sage leaves are used fresh or dry as a culinary herb. Oil can be extracted from the leaves and flowers of the plant and is used as a flavoring in alcoholic drinks and as a scent in perfume (Plantvillage, 2025). Sage can be used as a culinary spice (not just for Thanksgiving stuffing!) or simply enjoyed as a tea. However, this delicious and aromatic herb can be used in practically every herbal preparation you can think of. It can be extracted into alcohol to make a tincture. This can be used daily for general benefits, or used diluted in warm salted water as a mouth wash or gargle. Similarly sage can be extracted into vinegar and used as a gargle or as an ingredient in homemade salad dressing. A diluted sage vinegar can be used externally to relieve sunburn pain (1:3 dilution with water works great). This diluted vinegar can also be applied to the scalp to address dandruff. The fresh or dried leaves can be infused in oil and then used to make salves, lotions, and creams. It also infuses well into witch hazel extract, which can be used as a facial toner, on varicose veins, or as a deodorant. A cup of warm sage tea can relieve a sore throat and bring comfort while sick. Using a strong tea as a steam inhalation can also help to break up mucus in the lungs and sinuses. Sage is also commonly used as an essential oil (Forêt, 2025). Common sage is seemed in historical lore and culinary uses. Think of the term “sage advice”. In old times it was associated with old age and preventing memory loss. In the Middle Ages it was used as a cure-all for most ailments. It is still used today in some herbal circles. Sage (Salvia) is the largest genus in the mint family, with over 900 species worldwide. *Salvia officinalis* varieties are herbaceous evergreens and usually have mauve-blue to lilac-purple flowers midsummer. Sage’s colorful leaves and small shrub form add depth and texture to any herb garden, container planting, or flower bed. The rich, large purple summer flowers attract birds, bees, and butterflies. The aromatic compounds of the leaves are highly valued in cooking (dried or fresh leaves). A classic use is in Thanksgiving stuffing. A newer recipe might include frying fresh leaves in butter creating a gourmet garnish. Common sage should not be ingested in large amounts for a prolonged period of time, due to the fact it contains small amounts of the neurotoxin thujone (Portland, 2025**).**

**Parts Used and Where Grown:** Sage is a silvery-green shrub with very fragrant leaves. The most commonly cultivated species of sage originally came from the area around the Mediterranean but now also grows in North America. The leaves of this common kitchen herb are used in medicine as well as in cooking **(**Peacehealth, 2015**).** Sage has one of the longest histories of use of any culinary or medicinal herb. It was used by herbalists externally to treat sprains, swelling, ulcers, and bleeding.[2] Internally, a tea made from sage leaves has had a long history of use to treat sore throats and coughs—often used as a gargle. It was also used by herbalists for rheumatism, excessive menstrual bleeding, and to dry up a mother’s milk when nursing was stopped. It was

particularly noted for strengthening the nervous system, improving memory, and sharpening the senses.[3] Sage was officially listed in the *United States Pharmacopoeia* from 1840 to 1900 **(**Peacehealth, 2015**).**

**How to Cook With Sage:** Thanks to its strong flavor and aroma, sage should be added early in the cooking process, rather than at the end of cooking like many delicate herbs. Frying a strong herb like sage mellows its flavor. Fried sage can be crumbled over a dish to heighten flavor at the last moment. Sage can also be used to add herbaceousness to sauces, compound butters, meat marinades, pastries, and breads. Add fresh sage leaves to cocktails and teas for an instant hit of herbal flavor. In Italy, sage makes an aromatic addition to rich Italian tomato sauces and creamy pasta dishes, while in France chefs use sage in sausage fillings and pair it with other aromatic herbs like flat-leaf parsley, summer savory, bay leaf, and sweet basil in herb bouquets, like bouquet garni. In the United States and Canada, sage is best known as an ingredient in traditional Thanksgiving stuffings and turkey dishes. One of the best, and most common, pairings for sage is browned butter, which makes for the perfect addition to indulgent pasta dishes or simple chicken and vegetable recipes (Master, 2021). To use sage, remove the leaves from the stems, wash them with cold water, and dry them well. Recipes may call for it to be sliced chiffonade, chopped, or minced. Sometimes the leaves, left whole, will be pan fried in a bit of oil, taming the flavor a bit and transforming it into a thin, crispy chip – a tasty garnish on something like brown butter sage ravioli or risotto. It's a beautiful way to showcase the sage and add texture to a dish. Any dish you use sage in needs to be able to stand up to it. It's an assertive herb, with a bit of a mind of its own. Any meat, especially veal, pork chops, and chicken work well, or go the extra mile and grind it into a breakfast sausage or add it to a sausage gravy for an extra punch of flavour (Walczak, 2023). Sage can be used in seafood dishes if the sauce or sides are sturdy enough. All sorts of pasta dishes, especially those utilizing fall and winter produce, pair perfectly with sage. Butternut squash pasta, or something with a cream sauce, for example, would be perfect. Add sage to stuffing or dressing, a vegetable side dish like roasted sage broccoli or beans, or throw some in a fun holiday appetizer like mini pumpkin sage balls. Sage is great for pancakes and scones or baking breads and pastries. Toss it in a slow-simmered soup or stew, make a bouquet garni with it as the French do, or whip up a cozy polenta, or a seasonal cocktail (Walczak, 2023). Sprinkled on soup as a garnish. Chopped and added to tomato sauces. Mixed into stuffing. Used to make sage butter by combining chopped leaves with butter. Served in an omelet with eggs. As a rub for meats. As seasoning for roasted vegetable dishes (Webmd, 2025).

**Sage Nutrition:** Sage contains vitamins A and C, along with several other antioxidants that help reduce the risk of serious health conditions like cancer. It's also rich in vitamin K, which aids the body in clotting blood. Since sage is usually taken in small amounts, it provides a high amount of nutrition without a lot of calories. Nutrients per serving: One teaspoon (0.7 grams) of ground sage contains: Calories: 2, Protein: 0.1 grams, Fat: 0.1 grams, Carbohydrates: 0.4 grams, Fiber: 0.3 grams, Sugar: 0 grams, Vitamin K: 10% of the reference daily intake (RDI), Iron: 1.1% of the RDI, Vitamin B6: 1.1% of the RDI, Calcium: 1% of the RDI, Manganese: 1% of the RDI. Ground sage also contains several vitamins and minerals, with the most prominent being calcium and iron**,** but also iron, volatile oils, flavonoids, and phenolic acids. But because sage is eaten in small amounts, you may only get low levels of them (Webmd, 2025).

**Health Benefits:** With a botanical name coming from the Latin word "salvus," meaning "healing," it's no wonder that sage—and sage essential oil—has a number of health benefits. The herb contains large amounts of vitamin K and B vitamins, and is also rich in vitamin A, iron, calcium, magnesium, manganese, vitamin C, vitamin E, and riboflavin. Sage is also packed with antioxidants, making it an effective antiseptic with the ability to boost the immune system and rid the body of harmful free radicals. It can also be used topically to improve the health and appearance of skin, hair, and nails. Sage oil can be applied to hair or skin in order to cleanse the area and regulate oil production. Become a better home cook with the MasterClass Annual Membership. Gain access to exclusive video lessons taught by culinary masters, including Alice Waters, Chef Thomas Keller, Gordon Ramsay, and more (Master, 2021).

- **High in several nutrients:** Sage packs a healthy dose of vitamins and minerals. One teaspoon (0.7 grams) of ground sage contains; Calories: 2, Protein: 0.1 grams, Carbs: 0.4 grams, Fat: 0.3 grams, Fiber: 0.3 grams, Vitamin K**:** 12 mcg (10% DV), Iron: 0.2 mg (1.1% DV), Vitamin B6**:** 0.02 mg (1.2% DV), Calcium: 12 mg (<1% DV), Manganese: 0.02 mg (<1% DV), As you can see, a small amount of sage packs 10% of your daily vitamin K needs. Sage also contains small amounts (<1% DV) of magnesium, zinc, copper and vitamins A, C and E. What's more, this aromatic spice houses caffeic acid, chlorogenic acid, rosmarinic acid, ellagic acid and rutin — all of which play a role in its beneficial health effects. Since it's consumed in tiny amounts, sage provides only minuscule amounts of carbs, calories, protein and fiber (Raman, 2025).
- **Loaded with antioxidants:** Antioxidants are molecules that help fortify your body's defenses, neutralizing potentially harmful free radicals that are linked to chronic diseases. Sage contains over 160 distinct polyphenols, which are plant-based chemical compounds that act as antioxidants in your body. Evidence from test tube and animal studies suggest that compounds found in sage may have anti-inflammatory, anticancer, and neuroprotective effects. A small, older study found that drinking a little over 1 cup (300 ml) of sage tea twice daily significantly increased blood levels of antioxidant enzymes. It also lowered both total cholesterol and "bad" LDL cholesterol, as well as raising "good" HDL cholesterol (Raman, 2025).
- **May support oral health:** Sage has antimicrobial effects, which may protect against microbes that promote dental plaque. In a 2015 study, a sage-based mouthwash was shown to effectively kill the *Streptococcus mutans* bacteria, which is notorious for causing dental cavities. Another study in 2021 used sage-based mouthwash in late-stage cancer patients. Dental plaque was significantly reduced in the sage group, but plaque was also reduced in the normal saline mouthwash group. In a test-tube study, sage extract was found to kill and halt the spread of both oral bacteria and *Candida albicans*, a fungus that may also cause cavities (Raman, 2025).
- **May ease menopause symptoms:** During menopause, your body experiences a natural decline in the hormone estrogen. This can cause a wide range of unpleasant symptoms. Symptoms include hot flashes, excessive sweating, vaginal dryness

and irritability. Common sage was traditionally used to reduce menopause symptoms. It's believed that compounds in sage have estrogen-like properties, allowing them to bind to certain receptors in your brain to help improve memory and treat hot flashes and excessive sweating. A 2023 meta-analysis of 4 studies using doses ranging from 100 mg to 280 mg per day found that sage supplements significantly reduced the frequency, though not the severity, of hot flashes over 4-12 weeks, compared to a placebo (Raman, 2025).

- **May reduce blood sugar levels:** The leaves of common sage have been used traditionally as a remedy against diabetes. Human and animal research indicates that it may help lower blood sugar levels. In one study, sage extract reduced blood glucose levels in rats with type 1 diabetes by activating a specific receptor. When this receptor is activated, it can help clear excess free fatty acids in the blood, which in turn improves insulin sensitivity. Another study in mice with type 2 diabetes found that sage tea acts like metformin — a drug prescribed to manage blood sugar in people with the same disease. In another animal study, sage leaf extract has been shown to lower blood sugar and improve insulin sensitivity in mice with a similar effect as rosiglitazone, another anti-diabetes drug. uman research is limited, but one meta-analysis of three trials found that sage significantly reduced fasting blood sugar and HbA1c. However, there is still not enough evidence to recommend sage as a diabetes treatment. More human research is needed (Raman, 2025).
- **May support memory and brain health:** Sage can help support your brain and memory in several ways. For one, it's loaded with compounds that can act as antioxidants, which have been shown to buffer your brain's defense system. It also appears to halt the breakdown of the chemical messenger acetylcholine (ACH), which has a role in memory. ACH levels appear to fall in Alzheimer's disease. In one study, 39 participants with mild to moderate Alzheimer's disease consumed either 60 drops (2 ml) of a sage extract supplement or a placebo daily for four months. Those taking the sage extract performed better on tests that measured memory, problem-solving, reasoning and other cognitive abilities. In healthy adults, sage was shown to improve memory in low doses. Higher doses also elevated mood and increased alertness, calmness and contentedness. A 2021 randomized controlled clinical trial found that healthy people who took 600 mg of a proprietary sage extract daily for 2 weeks showed significant improvements in working memory, when compared to a placebo (Raman, 2025).
- **May lower 'bad' LDL cholesterol:** Every 33 seconds, one person in the US dies from heart disease. High "bad" LDL cholesterol is a key heart disease risk factor, affecting over 50% of American adults. In addition, the CDC estimates that 86 million adults over 20 in the US have total cholesterol levels above 200 mg/dL. Sage may help lower "bad" LDL cholesterol, which can build up in your arteries and potentially cause damage. In one study, consuming sage tea twice daily lowered "bad" LDL cholesterol and total blood cholesterol while raising "good" HDL cholesterol after just two weeks. Several other human studies illustrate a similar effect with sage extract (Raman, 2025).
- **May protect against certain cancers:** Cancer is a leading cause of death in which cells grow abnormally. Interestingly, animal and test-tube studies demonstrate that sage may fight certain types of cancer. In these studies, sage extracts not only suppress the growth of cancer cells but also stimulate cell death. hile this research is encouraging, human studies are needed to determine whether sage is effective at fighting cancer in humans (Raman, 2025).
- **Other potential health benefits:** Sage and its compounds are linked to several other health benefits. However, these benefits have not been extensively researched (Raman, 2025).
- **May alleviate diarrhea:** Fresh sage is a traditional remedy for diarrhea. Test-tube and animal studies found that it contains compounds that may alleviate diarrhea by relaxing your gut (Raman, 2025).
- **May combat skin aging:** Several test-tube studies suggest that sage compounds may help fight signs of aging, such as wrinkles (Raman, 2025).
- **Easy to add to your diet:** Sage comes in several forms and can be used in a variety of ways. Fresh sage leaves have a strong aromatic flavor and are best used sparingly in dishes (Raman, 2025).

**Health Benefits (Webmd, 2025)**

Sage is very high in vitamin K, and it also contains vital minerals like magnesium, zinc, and copper.

**In addition, sage can provide other health benefits like:**

**Antioxidant benefits:** Antioxidants help combat free radical molecules in our environment that can damage our cells, leading to cancer. Sage contains antioxidant vitamins A, C, and E in small amounts. It also has over 160 types of polyphenols, another type of antioxidant. Sage has several types of acidic compounds that also act as antioxidants. Chlorogenic acid, caffeic acid, rosmarinic acid, ellagic acid, and rutin have all been linked to benefits such as lower cancer risk, memory improvement, and improved brain function. One study found that drinking tea made from sage both raised antioxidant defenses and lowered LDL or "bad" cholesterol. People in the study who drank two cups of sage tea every day saw these benefits, as well as an increase in good cholesterol levels.

**Oral health:** Sage has been shown to have antimicrobial effects that aid in killing plaque. One study using a sage-based mouthwash showed it successfully killed cavity-causing *Streptococcus mutans* bacteria. In another study, an essential oil made from sage killed *Candida albicans* fungus and stopped it from spreading Sage is also commonly used to treat mouth problems like cold sores, but more data is needed to definitively prove it works in humans.

**May ease symptoms of menopause:** The body naturally experiences a decline in estrogen levels during menopause. That decline causes side effects like hot flashes, excessive sweating, vaginal dryness, and irritability. Sage has been used as a traditional medicine to reduce these symptoms. This may be effective because sage has estrogen-like properties, allowing it to bind to certain

receptors in the brain and ease symptoms like hot flashes and excessive sweating. One study showed a significant reduction in the number of hot flashes experienced by people taking a sage supplement over an 8-week period.

**May help control blood sugar levels:** Sage leaves have been used in traditional medicine as a treatment for diabetes, and some studies do back this up. In one study, rats with type 1 diabetes had reduced blood glucose levels after taking sage extract. The extract activated a receptor in the rats that helps clear excess fatty acids from the bloodstream, increasing insulin sensitivity. Human studies have shown that sage leaf extract can lower blood sugar and improve insulin sensitivity similar to the diabetes drug rosiglitazone. But more testing is needed before sage extract can be recommended as a diabetes treatment.

**Improve cognitive function:** Although the potential for sage tea to support cognitive function (brain skills like memory, attention, and problem solving) isn't yet proven, multiple studies show how sage extract can benefit. In one study, people with mild to moderate **Alzheimer's disease** took sage extract for 16 weeks. The results showed improved cognitive measurements as well as less agitation.

**Antidepressant:** In early research using rats, a study determined that clary sage oil may have an anti-stress effect on the animals. The study's authors proposed that research into clary sage oil may produce promising results for the treatment of depression**,** but it is too soon to know.

**Health Benefits (Forêt, 2025).**

**Using Sage to Support Digestion:** The taste of sage is both bitter and pungent and wonderfully aromatic. When we see these attributes blended together in an herb, we know it can be used to promote digestion. And sage is a wonderful carminative! It eases painful gas and bloating, moves stagnant digestion (which is when you eat food and it feels like you have an immobile rock in your belly), and even relieves painful intestinal cramping. Sage is especially appropriate for people who cannot digest fats well. It can be taken as a tea before or after a meal or simply used as a spice within the meal.

**Sage Strengthens Cognition and Improves Memory:** Sage has grabbed headlines in recent years for its ability to support people with Alzheimer's disease or other memory loss. It appears to work in a very unique way. One explanation is that sage inhibits the breakdown of acetylcholine. Acetylcholine is a chemical in the brain (neurotransmitter) that supports both memory and cognition. In patients with Alzheimer's disease, acetylcholine breaks down too quickly and less of it is produced over time. Both of these actions result in a gradual loss of memory. Sage works as an anti-cholinesterase, inhibiting the breakdown of this important chemical. Sage has been shown to help people with mild to moderate symptoms of Alzheimer's disease. In one study, those taking a sage extract for four months showed a significant improvement in cognitive functions and less agitation as compared with the placebo group. There's no reason to wait until a diagnosis to use sage. Researchers have shown that an extract of sage improves memory and attention in healthy older volunteers. In fact, sage isn't just for the elderly, it's also been shown to improve both memory and mood in younger populations. Herbalists are not surprised that sage can benefit the brain. John Gerard, an English herbalist who lived in the late 16th and early 17th centuries, wrote in his book, *The Herbal*, "Sage is singularly good for the head and the brain, it quickeneth the senses and memory."

**Sage as an Astringent Herb:** Sage is a wonderful astringent herb and can be used to tighten and tone tissues. This important action is used when tissues have become lax, have lost their tone, or have become swollen. It has a special affinity for the mouth and throat and can be used to relieve pain and heal mouth ulcers, canker sores, bleeding gums, spongy gums, and cold sores. Sage is a common ingredient in many tooth powder and mouthwash recipes.

**Sage for Colds and the Flu":** Herbalists have long used sage to soothe a sore throat. The astringent properties can bring relief to swollen tissues and the antimicrobial properties can address the infection. I like to gargle with sage infusion or drink sage tea with some lemon and honey for this purpose. Modern day researchers are catching up to this time honored use of sage. In one human sore throat trial, researchers compared the effects of a sage and Echinacea extract with the effects of a spray made up of the antiseptic chlorhexidine and the anesthetic lidocaine. They concluded that the sage and Echinacea extract showed slightly better results than the chlorhexidine and lidocaine for reducing sore throat symptoms after three days. Another study showed that a fluid extract of sage worked better than placebo in reducing pain due to viral pharyngitis (a viral throat infection). In fact, sage is effective for a variety of discomforts that can accompany a cold or influenza. Taken as a warm tea it acts as a mild stimulating diaphoretic, making it a good choice for fevers when the person feels cold and is shivering. As an herbal steam, it can help to decongest the sinuses and loosen congestion in the lungs.

**Sage Can Move Blood**: The red sage of China is well known for its affinity for the blood, but our Western culinary sage can also be used for a variety of stagnant blood conditions, such as blood clots and varicose veins. In the *Earthwise Herbal*, herbalist Matthew Wood describes using sage on multiple occasions for dissolving blood clots. The term for this action in traditional herbalism is "blood mover." As a blood mover, sage can be used for people with poor circulation resulting in cold hands and feet. Improving the blood flow to all parts of the body, including the brain, could provide us with another explanation of how sage improves cognitive function and can help prevent memory loss.

**Sage for Night Sweats and Hot Flashes**: Sage is commonly used for easing menopausal complaints such as night sweats and hot flashes. Herbalist Phyllis Light says sage is *"...specific for the transition from fertility levels of estrogen to post-menopausal levels. In other words, it helps the adrenal cortex take over the manufacture of sexual hormones as the gonads atrophy. It is*

*specific for symptoms of 'drying out.'"* A human clinical trial in 2011 showed that women who took a tablet of sage leaves saw a significant reduction in the intensity of frequency of their hot flashes.

**Sage Can Improve Imbalanced Cholesterol and Type 2 Diabetes**: In human clinical trials, sage has been shown to have positive effects on blood sugar levels, cholesterol (including triglycerides), and antioxidant defenses. All of these beneficial effects can be especially useful to those with type 2 diabetes.

**Sage for Pain and Injury**: While I haven't seen sage commonly used for pain and injuries by modern herbalists, historically it was used for a variety of painful ailments. Culpepper recommends it for headaches, rheumatic pains, and joint pains. In her book, The Modern Herbal, Maude Grieve lists this sage recipe as a cure for sprains: "Bruise a handful of sage leaves and boil them in a gill of vinegar for five minutes; apply this in a folded napkin as hot as it can be borne to the part affected."

Modern scientific uses of sage have confirmed many of its traditional applications. Studies suggest that sage may offer numerous health benefits as we summarised above – but how? (HO, 2025).

**Cognitive Function:**Sage has shown remarkable potential for supporting cognitive health, particularly for individuals experiencing mild memory challenges. This ancient herb appears to offer natural support for brain function, potentially helping to: Enhance mental clarity. Improve memory retention. Support spatial awareness. Boost overall cognitive performance. For those concerned about age-related cognitive decline, sage presents as an intriguing natural option. While not a cure, it may provide gentle support for maintaining mental sharpness and memory function as we age. The herb's long history of use in traditional medicine, combined with emerging scientific interest, suggests sage could be a valuable addition to a brain-healthy lifestyle. Its potential to support cognitive function makes it an exciting area of ongoing research and natural health exploration.

**Antioxidant Properties:** Sage's potent antioxidant properties stem from its rich composition of polyphenols and flavonoids. These compounds can potentially protect the human brain from oxidative damage. Research has shown that sage extract can modulate oxidative stress in the brain, highlighting its neuroprotective potential.

**Digestive Health:** The herb's traditional use for digestive ailments is gaining scientific backing. Sage's anti-inflammatory properties may help reduce bloating and aid digestion, offering relief for those with gastrointestinal discomfort.

**Menopausal Symptoms:** For women navigating the challenges of menopause, sage may provide a natural alternative for managing hot flashes. Its oestrogenic effects could help alleviate this common and often distressing symptom.

**Blood Sugar Control:** Sage might be good news for people with type 2 diabetes. Recent studies show that sage extract could help in two important ways:

It may help control blood sugar levels.
It might improve cholesterol levels.
This double benefit could make sage a helpful addition to diabetes treatment plans. While it's not a replacement for prescribed medications, sage could be a natural way to support overall health for those managing diabetes.

**Antimicrobial Effects:** Sage essential oil has demonstrated impressive antimicrobial properties, potentially offering a natural alternative to synthetic antimicrobials. This characteristic opens up possibilities for its use in various applications, from food preservation to topical treatments.

**Oral Health:** Sage's antimicrobial properties make it a promising natural option for oral health. It may help reduce harmful bacteria in the mouth, potentially supporting dental hygiene and fresh breath. This could be good news for people looking for natural alternatives to regular mouthwashes. As scientists continue to study sage, we're learning more about its potential health benefits. While the early results are exciting, it's important to remember that we still need more research to fully understand how sage works and how best to use it for health purposes. If you're interested in trying sage for oral health, you might consider making a simple sage mouthwash at home. However, it's always a good idea to chat with your dentist or doctor first, especially if you have any ongoing health concerns.

**Natural Sage Leaf Supplements:** For those looking to harness the benefits of sage in a convenient form, Harrogate Organics offers premium natural sage leaf supplements. These capsules provide a concentrated dose of sage's beneficial compounds, making it easy to incorporate this powerful herb into your daily wellness routine. Whether you're seeking cognitive support, menopausal symptom relief, or general health maintenance, our sage leaf supplements offer a simple way to enjoy sage's potential benefits.

(HO, 2025). If you are still wondering how to use sage, you will find a big clue in its Latin name. *Salvia* comes from 'salvare' meaning 'to heal', whilst *officinalis* indicates the tradition of medicinal and culinary use. Throughout history, sage was believed to heal all manner of curious ailments. Today, much commercially grown sage is used to produce essential oils and supplements. Sage is thought to have anti-inflammatory benefits and to ease respiratory, digestive and menopausal complaints. Try steeping fresh or dried sage leaves in hot water to make a refreshing and invigorating sage tea. The slightly bitter taste indicates its astringent and antiseptic properties, which also make it a soothing gargle for sore throats and a natural mouthwash to support good dental health (Plantura, 2025).

**Recipes With Sage (Master, 2021)**

- Chicken With Sage Browned Butter and Apples: Pan-roasted chicken cooked in sage-infused browned butter with sliced, sautéed apples.
- **Sage Bread Knots:** Herb-laced bread knots made with dried sage. White Bean, Sausage, and Sage Soup: A light tomato-based soup made with sausage, cannellini beans, chicken stock, white wine, fresh sage, and garlic.
- **Classic Holiday Stuffing:** A classic holiday recipe made with sliced crusty bread, butter, onions, celery, fresh sage, chicken stock, and egg.
- **Roasted Acorn Squash:** Sliced acorn squash tossed in olive oil, kosher salt, and black pepper, roasted at 375ºF for 30 minutes.
- **Chicken Pot Pie:** A hearty chicken pot pie made with roast carrots, cauliflower, garlic, and onions in a creamy sauce with chopped sage and rosemary.
- **Pasta With Fried Sage and Pine Nuts:** Fresh pasta served in a sauce of olive oil, browned butter, kosher salt, and black pepper dressed with fried sage, toasted pine nuts, and Parmesan cheese.
- **Roasted Pork With Sage and Rosemary:** Oven-roasted pork tenderloin marinated in olive oil, garlic, minced sage, and rosemary.
- **Gin and Sage Cocktail:** A refreshing herbal cocktail made with gin, lemon juice, simple syrup, sage leaves, and cold water.
- **Pumpkin-Sage Lasagna:** A layered pasta dish with puréed pumpkin, heavy cream, dried sage leaf, ricotta cheese, mozzarella, Parmesan, kosher salt, and black pepper.
- **Butternut Squash and Sage Soup:** A creamy puréed soup made with roasted butternut squash, olive oil, onions, garlic, chicken stock, and sage.

**CULTIVATION**

In favourable conditions in the garden, *S. officinalis* can grow to a substantial size (1 square metre or more), but a number of cultivars are more compact. As such they are valued as small ornamental flowering shrubs, rather than for their herbal properties. Some provide low ground cover, especially in sunny dry environments. Like many herbs they can be killed by a cold wet winter, especially if the soil is not well drained. But they are easily propagated from summer cuttings, and some cultivars are produced from seeds (Wikipedia, 2025). Sage plants should be pruned in early Spring to promote new growth, or after flowering in the summer. In addition to an application at planting, sage will benefit from a side dressing of fertilizer 6 to 8 weeks after planting. Sage will become very woody within 3-4 years of planting and should be replaced with new plants (Plantvillage, 2025).

Choose a planting site in full sun, sheltered from strong winds. The soil should be free-draining and never get waterlogged. If your soil is poorly-drained, plant in a raised bed or a container to provide better drainage. Prepare the ground by removing any weeds, then dig in plenty of well-rotted manure or garden compost. If planting in a container, choose one that is at least 30cm wide and fill it with a peat-free soil-based compost, mixing in lots of coarse grit or Perlite is a naturally occurring volcanic rock which, when heated to high temperatures, expands to produce lightweight, micro-porous granules. It was traditionally added to compost to aid drainage and aeration, however, its manufacture, packaging and distribution has a big environmental impact, so locally-sourced grit or gravel is now preferred. Perlite (up to 25 percent by volume) to improve drainage. Sage should ideally be planted in spring, although potted sage can be planted right through to autumn but avoid hot dry spells. Water it well both before and after planting (RHS, 2025). Sage is very easy to look after – simply harvest sprigs of young leaves regularly to encourage bushy new growth and cut back flowered stems by a third after flowering to keep plants compact. If the weather is dry, water newly planted sage during its first spring and summer until it establishes. Sage is drought tolerant once established and shouldn't need additional watering when growing in the ground. In containers, the Garden compost is a soil improver made from decomposed plant waste, usually in a compost bin or heap. It is added to soil to improve its fertility, structure and water-holding capacity. Seed or potting composts are used for growing seedlings or plants in containers - a wide range of commercially produced peat-free composts are available, made from a mix of various ingredients, such as loam, composted bark, coir and sand, although you can mix your own. Compost can dry out quickly, so check regularly over the summer – aim to keep the compost slightly moist. In winter, excess rain can cause the roots to rot, so move plants in containers to a sheltered spot, such as in the rain-shadow of a wall. Mulch is a layer of material, at least 5cm (2in) thick, applied to the soil surface in late autumn to late winter (Nov-Feb). It is used to provide frost protection, improve plant growth by adding nutrients or increasing organic matter content, reducing water loss from the soil, for decorative purposes and suppressing weeds. Examples include well-rotted garden compost and manure, chipped bark, gravel, grit and slate chippings.

Can refer to either home-made garden compost or seed/potting compost: Garden compost is a soil improver made from decomposed plant waste, usually in a compost bin or heap. It is added to soil to improve its fertility, structure and water-holding capacity. Seed or potting composts are used for growing seedlings or plants in containers - a wide range of commercially produced peat-free composts are available, made from a mix of various ingredients, such as loam, composted bark, coir and sand, although you can mix your own. Deadheading is the removal of flowers from plants when they have faded or died. It is done to keep plants looking attractive and encourage re-flowering. Deadheading after flowering to encourage new shoots with fresh leaves, older plant benefit from an annual hard prune. Prune established sage plants hard in early spring to promote bushy growth and lots of fresh new leaves. If left unpruned, older plants can become straggly and sprawling, with a bare centre problems so control isn't necessary. Simply pick off any affected leaves if you wish (RHS, 2025). A method of growing new plants from parts of an existing plant, such as sections of root, stem, leaf or bud. When prepared correctly and planted in the right conditions, they can

produce roots and eventually become independent plants. There is a wide range of different methods for taking cuttings, depending on the plant and time of year (RHS, 2025). Sow sage seeds in spring into small pots or trays. eed compost is a free-draining compost formulated for germinating seed. It often contains a mix of fine materials including sterilised loam, coir, coarse sand or grit. It contains low levels of nutrients, as high levels could damage seedlings (RHS, 2025). A propagator is a portable, lightweight structure usually plastic, with a vented or unvented lid to provide a humid, slightly warmer atmosphere. It is useful to help seeds germinate and root cuttings. It may have adjustable, thermostatic temperature control. Propagator or cover with a polythene bag on a warm windowsill. Seeds can take up to three weeks to germinate. Pot on into Small individual cells, usually in a tray, used for sowing seeds. The resulting seedlings can be transplanted with minimal root disturbance. Plant young sage plants outdoors once they're about 10cm tall, after all risk of frost is passed. Harden them off first to acclimatise them to outdoor conditions. See below for planting guidance (RHS, 2025).

Sage will grow quickly and easily from seedlings or cuttings taken in summer, but can also be sown from seeds in spring. The best times to plant are early in the morning or late in the day, so the plants aren't exposed to the hot sun straight away (TUI, 2025). Soak seedlings in a bucket of Tui Organic Seaweed Plant Tonic and allow to drain. This will help prevent transplant shock and give your plant a healthy boost. Add a layer of Tui Herb Mix to the planting area. Dig a hole, approximately twice the size of the root ball of your plant. Gently loosen the root ball of your plant and position the plant in the centre of the hole.Fill in with Tui Herb Mix. Press soil gently around the base of the plant. Water your plant well and continue to water regularly while it's young and in summer (TUI, 2025). If your container has no drainage holes, add stones to the bottom of the container to act as drainage. Soak your seedlings in a bucket of Tui Organic Seaweed Plant Tonic before planting and allow to drain. This will help prevent transplant shock and give your herbs a healthy start. Half fill your container with Tui Herb Mix. Gently take the plant from the current container, loosen the root ball and remove any loose or dead plant material and roots. Position the plant in the centre of the new container and fill with Tui Herb Mix up to 3cm from the top. Gently firm mix around the base of the plant. The mix should be at the same level on the plant as it was in the previous container. Water your plant well and continue to water regularly while it's young and in summer (TUI, 2025).

**Harvesting**

Sage is best harvested just before flowering when the essential oil content of the leaves is highest. Sage should be harvested by cutting the top 20 cm of tender growth with a sharp knife. Commercial fields may be harvested by mowing but the highest quality product is achieved by harvesting only the leaves (Plantvillage, 2025). As sage is evergreen, the leaves can be picked at any time of year, but fresh growth in spring and early summer has the best flavour. You can pick whole young shoots or individual leaves as required. To ensure the leaves remain in good condition over winter, protect them from the worst of the weather with A soft, fibrous, translucent material laid over or around plants hastening their growth and protecting them against weather and pests. Heavier grades of fleece give about 2°C of protection from frost. It is usually used without supporting hoops. The leaves are best used fresh, but you can also dry or freeze them. To dry sage, hang up some sprigs in a warm, dark, well-ventilated place. When fully dried, store the leaves in an air-tight jar. Freeze chopped sage leaves in an ice-cube tray, then simply add the cubes to your cooking whenever needed (RHS, 2025). Hardy and robust, sage can be harvested all year round. It's a chicken stuffing staple, but is also a must-have for soups, stews and roasts and a perfect pairing for pumpkin! Regular picking will encourage the sweet new leaves to emerge, while the older leaves pack a punch with more intense flavour and can be used sparingly (RHS, 2025).

**History and Folklore**

Sage has been an important medicinal plant since ancient Egyptian times when it was used as a fertility treatment. The ancient Greek physicians Dioscorides and Galen recommend sage for wound healing, women's health, and as a diuretic. Sage was used during the Middle Ages to treat many maladies including fevers, liver disease, and epilepsy. The herb was used in England to make a tea that was considered a pleasant and healthful beverage. One common belief was that sage strengthened the memory, hence a "sage" (wise man) always had a long memory. In the 9th century, Charlemagne had sage included among the herbs grown on his imperial farms in Germany. During the 17th century, the Chinese exchanged three or four pounds of tea with Dutch traders for one pound of European sage leaves (Mccormick, 2025).

**Nourish:** Feed your herb and they will feed you. Plants use nutrients from the soil as they grow, so replenishing the nutrients ensures they grow to their full potential. Feed your sage with Tui NovaTec Premium fertiliser in spring and autumn. Regular feeding and applications of Tui Organic Seaweed Plant Tonic will help keep your sage healthy as it grows. For supercharged feeding with quick visible results try Tui Vege & Herb Liquid Superfood. Well watered, well nourished herbs will have a better chance of keeping insect pests and diseases at bay (TUI, 2025).

**Preparation:** Bioforce cultivates Common Sage organically. Processed are the leaves. During harvesting, the content of volatile oil is at its highest between 12 pm and 4.00 pm. However this varies considerably according to the conditions of the area in which it is grown. The freshly cut leaves are cut shortly after harvesting and macerated in alcohol to produce a mother tincture. Tablets are produced by concentrating the mother tincture in a vacuum and with the addition of excipients (Avogel, 2025).

**Sage Tea:** To prepare sage tea, boil 1 cup of water and pour it over 1 tablespoon of sage leaves. Leave the leaves to steep until you have reached your desired strength (around 5 to 8 minutes), and then strain the tea. You can prepare sage tea with ground sage, but be extra careful when filtering to avoid a gritty texture (Webmd, 2025).

**Essential oil:** Common sage is grown in parts of Europe for distillation of an essential oil, although other species such as *Salvia fruticosa* may also be harvested and distilled with it (Wikipedia, 2025).

**Essential oil quality (Scholar, 2025):** Different varieties of Salvia officinalis can produce oils with varying compositions, influencing their value in the market.

**Rosmarinic acid and carnosol:** These compounds have potential medicinal properties, and breeding programs may focus on increasing their concentration in the plant.

**Geographical location:** The location where sage is grown can influence the essential oil composition, making it crucial to consider when breeding for specific qualities.

**Pathogen resistance:** Breeding for resistance to fungal and other pathogens is essential for maintaining plant health and yield.

**Potential Risks of Sage Oil:** Essential oils are popularly thought of as safe because they are natural. But many essential oils can contain naturally potent and harmful compounds. Sage essential oil is no exception and can result in the following health risks:

When sage essential oil was administered in clinical trials, it was at low amounts under tight controls for extraction and dilution since ingesting it carries a risk of poisoning. Even very small amounts of sage essential oil, when ingested by children, has been known to cause seizures. Any essential oil carries the risk of causing an allergic reaction. Mild allergy symptoms include itchiness or tingling, shortness of breath, coughing, hives, and lightheadedness. A severe reaction may lead to anaphylaxis, which can be life threatening.

**What Does Sage Taste Like?:** Sage has a pronounced herbal flavor that is earthy, slightly peppery taste with hints of mint, eucalyptus, and lemon. It works well in heavier dishes with rich ingredients that can hold their own against such a bold flavour (Master, 2021).

**Dosage Suggestions:** Sage can be enjoyed in culinary amounts. The therapeutic doses for sage are: As tea (dried): 1 to 2 grams, 2 to 3 times per day. As tincture: 1:5, 30% alcohol, 1.5 to 2 mL, 3 times per day (Forêt**,** 2025).

**Special Considerations:** Sage is generally considered safe for everyone. However, large amounts of sage are contraindicated in pregnancy. It can also dry up the flow of milk during lactation, so should be avoided unless the mother is preparing to wean (Forêt, 2025).

**How to Store Sage:** Sage is best kept in the original container it's sold in. It'll last roughly a week or so in the crisper drawer. If you're not going to use it all in one or two dishes, freeze the sage for long-term storage. Dried sage needs to be in an airtight container away from heat and moisture. It should be of good quality for up to a year (Walczak, 2023).

**How to Freeze Sage:** To freeze sage, lay the leaves individually and spread out on a parchment-lined baking sheet and freeze. Once completely frozen, transfer to a zip-top bag, remove as much air as possible, seal, and store in the freezer. Alternatively, chop fresh sage leaves and pack them into the molds of an ice cube tray. Fill the rest of the way with oil and freeze for a handy sage oil (Walczak, 2023).

**Here are some ways you can add fresh sage to your diet:** Sprinkle as a garnish on soups. Mix into a stuffing in roast dishes. Combine chopped leaves with butter to make sage butter. Add chopped leaves to tomato sauce. Serve it with eggs in an omelet. Dried sage is often preferred by cooks and comes ground, rubbed or in whole leaves. Here are some ways you can use dried sage: As a rub for meats. As a seasoning for roasted vegetables. Combined with mashed potatoes or squash for a more earthy flavor. You can also purchase sage products, such as sage tea and sage extract supplements (Raman, 2025).

**Appearance:** The aromatic leaves are silvery gray in color. Dried sage is usually sold ground or rubbed. Ground sage is made by grinding the entire leaf into a fine powder while rubbed sage is made by rubbing dried whole sage leaves to create a light and fluffy mix (Mccormick, 2025).

**Flavor Characteristics:** Bitter, earthy, green/grassy, medicinal, minty, and woody (Mccormick, 2025).

**Tasting Notes:** The main flavor of sage comes from the aromatic compounds “α-thujone”, “1,8-cineole”, “camphor”, and “borneol”. Sage has a powerful and dominant flavor with some similarities to rosemary. Dalmatian type sage is considered by many to have the best flavor (Mccormick, 2025).

**The Versatility of Sage in Cooking**

**Sage:** Often referred to as 'the saviour' in culinary circles, has been a staple in kitchens since ancient times. Its uses extend far beyond the traditional sage and onion stuffing:

**Savoury dishes**: The herb is perfect for seasoning poultry, pork, and in cold sage sauce.

**Pasta**: This herb pairs wonderfully with butter and squash in autumnal dishes (and it makes your kitchen smell great too!).

**Herbal teas**: It creates a soothing and aromatic infusion. Interestingly, sage is mentioned in "Le Viandier de Taillevent", one of the earliest French cookbooks, highlighting its long-standing importance in culinary traditions (HO, 2025).

**Side effects may include**

**Seizures**: Excessive consumption of sage extracts or essential oils may trigger seizures in susceptible individuals.

**Pregnancy concerns**: Sage during pregnancy should be avoided, as it may stimulate uterine contractions.

**Lowered blood sugar**: While beneficial for some, sage's ability to lower blood sugar could be problematic for those on diabetes medications.

**Interactions with medications**: Sage may interact with certain drugs, including those for memory and attention or diabetes management.

**Skin irritation**: Topical use of sage essential oil may cause skin irritation in some people. It's worth noting that culinary use of sage, such as the grayish-green leaves used in kitchen sage preparations, is generally safe. However, medicinal use, particularly of concentrated extracts or essential oils, should be approached with caution (HO, 2025). Sage is generally considered safe, but concentrated sage oil or other sage supplements can have side effects, and should not be used during pregnancy or lactation, or by children. The NIH states in one 2023 case report that prolonged use of sage oil or sage alcohol tincture may cause serious adverse effects in some, including vomiting, nausea, diarrhea, hypertension, elevated heartbeat, or convulsions. In addition to this, an older case report from 2011 documented that a new born and a toddler experienced seizures after exposure to sage oil. Some people are concerned about thujone, a compound found in common sage. Animal research has found that high doses of thujone may be toxic to the brain. That said, it's unclear how much thujone would need to be consumed to have toxic effects in humans. What's more, it's nearly impossible to consume toxic amounts of thujone through foods. However, drinking too much sage tea or ingesting sage essential oils — which should be avoided in any case — may have toxic effects. To be on the safe side, limit sage tea consumption to 3–6 cups a day. Otherwise, if you are concerned about thujone in common sage, then you can simply consume Spanish sage (Salvia lavandulaefolia) instead, as it does not contain thujone (Raman, 2025). While sage is known for its many health benefits, it's important to be aware of potential side effects, especially when consumed in large amounts or for extended periods. Sage species, including common sage (Salvia officinalis), Spanish sage (*Salvia lavandulaefolia*), and Greek sage (*Salvia fruticosa*), contain a compound called thujone, which can be toxic in high doses (HO, 2025).

**Nature's Versatile Wellness Companion:** Sage emerges as a remarkable herb that bridges traditional wisdom and modern scientific understanding. From its culinary delights to its potential health-supporting properties, sage offers a holistic approach to wellness that has stood the test of time. Harrogate Organics invites you to explore the rich world of sage – a herb that truly embodies the perfect blend of flavour, tradition, and potential health benefits. Whether you're seeking a natural addition to your kitchen, a supportive wellness supplement, or simply curious about this extraordinary herb, sage continues to prove why it has been revered for centuries. As we continue to uncover its secrets, one thing remains clear: sage is more than just an herb – it's a testament to the incredible healing potential of nature (HO, 2025).

**Diseases (Plantvillage, 2025)**

***Crown gall* Agrobacterium tumefaciens:**

**Symptoms:** Galls of various sizes on roots and root crown below the soil line; galls may occasionally grow on the stems; galls are initially light colored bulges which grow larger and darken; galls may be soft and spongy or hard; if galling is severe and girdles the stem then plants may dry out and die.
**Cause:** Bacterium

**Comments:** Disease enters through wounds on plant

**Management:** Only plant disease-free material; plant sage in well-draining soils; avoid wounding the plants as much as possible

***Mint rust*** Puccinia menthae:

**Symptoms:** Small, dusty, bright orange, yellow or brown pustules on undersides of leaves; new shoots may be pale and distorted; large areas of leaf tissue die and leaves may drop from plant

**Cause:** Fungus

**Comments:** May spread to or from nearby mint plants; remove infected plants

**Management:** Infected plants and rhizomes should be removed to prevent spread; heat treatment of roots may help to control the disease; roots should be immersed in hot water at 44°C for 10 minutes, cooled using cool water and then planted as usual

As a Mediterranean plant, sage will thrive in sheltered, dry and sunny conditions, and in nutrient-poor soil. Overwatering will lead to wilting, root rot and yellow leaves in sage plants. To maintain enough air around the roots of your potted sage, use a free-draining compost, such as our Plantura Organic Herb and Seedling Compost. It has a loose structure and a lower nutrient value than other composts and will help to prevent waterlogging. To learn more about correct sage care, read our specialist article (Plantura, 2025). Rosemary beetle (*Chrysolina americana*) and capsid bugs (Miridae) have been known to cause minor leaf damage to salvias but this can usually be controlled by simply pinching off the affected leaves. When it comes to disease, mildews can occasionally be a problem for sage. Mildews are quite common in herb and vegetable gardens, and symptoms and control methods are similar. We explain how to identify and treat white mould in our in-depth article on powdery mildew in courgettes. Overall, sage is a delightfully low-maintenance herb and rarely suffers from pests or disease. Sage and courgettes share something else in common. They both have flowers that you can eat! Find out what other flowers you can eat in our article on edible flowers (Plantura, 2025).

**What is special about sage:** Sage is a versatile herb with a rich history in both culinary and medicinal use. It's prized for its distinctive flavour and aroma, as well as its potential health benefits. Sage contains powerful antioxidants and has shown promise in supporting cognitive function, digestive health, and managing menopausal symptoms (HO, 2025).

**What are the benefits of sage for the skin:** Sage's antimicrobial and anti-inflammatory properties make it beneficial for skin health. It may help soothe skin irritations, reduce acne, and promote a healthy complexion. Some people use sage in natural skincare products for its potential to cleanse and tone the skin (HO, 2025).

**What are sage leaves used for:** Sage leaves have a wide range of uses: Culinary: As a flavouring in various dishes, particularly with poultry and in stuffings. Medicinal: In traditional and modern herbal medicine for various health concerns. Aromatherapy: The essential oil is used in diffusers and massage oils. Tea: Brewed as a soothing and healthful herbal infusion. Skincare: In natural beauty products for its potential skin benefits. Oral health: As a natural mouthwash or gargle (HO, 2025).

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