

Ashwagandha: Most of desired COVID-19 immunobooster medicinal plant

Ashwagandha (*Withania somnifera* (L.) Dunal) belongs to family Solanaceae, and is one of the popular and highly valued medicinal herbs in Ayurveda, classified as a *rasayana* (rejuvenator) in various Ayurvedic classical texts. Various parts of the plant are used in the preparation of different Ayurvedic formulations and home remedy recipes to increase health and longevity. This herb is always on demand, however, demand has risen further due to its immunoboosting capacity which would be a great therapy for fighting COVID-19 like situation. The word Ashwagandha has been derived from Sanskrit name “Ashwa” meaning horse and “gandha” meaning smell and thus given to this plant due to the smell of the roots resembling a sweating horse. Root is the economic part of this crop. The roots are frequently used for therapeutic purposes and is a constituent of over 200 formulations in Ayurveda, Siddha and Unani medicines. There are several reports to establish its immune-modulatory, anti-inflammatory, anti-stress, memory enhancing, anti-parkinsonian, hypolipidemic, antibacterial, cardiovascular, antioxidant, antitumor and adaptogenic properties. Ashwagandha plants are multiplied through seeds. Some significant work has been carried out by ICAR-DMAPR, Anand on seed germination and crop improvement including developing chemotypes.

Withania species

Ashwagandha belongs to the genus *Withania*, family Solanaceae. Considering all the medicinal properties, the species of genus ‘*Withania*’ are also of great medicinal value. The Solanaceae family comprises 84 genera that include about 3,000 species, scattered throughout the world. Members of this family are generally annual shrubs. The genera *Withania* and *Physalis* play an important role in the indigenous medicine of South East Asia, e.g. in the Unani and Ayurvedic systems. The 23 known species of genus *Withania* are widely distributed in the drier parts of tropical and sub-tropical zones, ranging from the Canary Islands, the Mediterranean region and northern Africa to Southwest Asia. Among them, only two species, *W. coagulans* Dunal and *W. somnifera* Dunal are found in India and are economically and medicinally significant, as being used in medicine. It is cultivated in several regions of India.

Area and production

India is one of the few countries where almost all the known medicinal plants can be cultivated in one or the other part of the country. India has about 2,000 species of medicinal plants and a vast geographical area with high production potential under the varied agro-climatic conditions.

Withania somnifera (L.) Dunal is known as Winter

Cherry or Indian Ginseng in English and Ashwagandha in Hindi by which it is commonly known in India. Ashwagandha is indigenous to the Middle-East Asia and North Africa. It is widely distributed in India, Pakistan, Sri Lanka, South Africa, Iraq, Iran, Syria and Turkey. It is also grown in North America and other temperate climate including dry parts in sub-tropical regions.

Ashwagandha is cultivated over an area of 10,780 ha with a production of 8,429 tonnes in India. Based on the current trend, the demand of Ashwagandha would be around 12,500 tonnes. It is cultivated in many states in India, but Madhya Pradesh, Gujarat, Haryana, Maharashtra, Punjab, Rajasthan and Uttar Pradesh are the major Ashwagandha producing states. In Madhya Pradesh alone it is cultivated in more than 5,000 ha in Manasa, Neemuch and Jawad talukas of Mandasaur district. Neemuch and Mandasaur markets of Madhya Pradesh are popular for Ashwagandha.

Being hardy and drought tolerant species with enormous bio-compounds, the use of Ashwagandha has enjoyed monopoly in many parts of India. The herb has been identified by the National Medicinal Plants Board of India as one of the 32 selected priority medicinal plants, which are in great demand in domestic and international markets. Since the production is lesser than its consumption, there is a need necessitating the increase in its cultivation and higher production.

Medicinal uses

Ayurveda, the traditional system of medicine practised in India can be traced back to 6000 BC (*Charak Samhita*). Ashwagandha is one of the most important medicinal plants required in allopathic, ayurvedic and unani system of medicines. It is considered to be one of the best rejuvenating agents. Withanine and somniferine are the two important alkaloids of Ashwagandha. The total alkaloid content of its roots has been reported to vary from 0.13 to 0.31%. Its root drug boosts immune system and finds an important place in treatment of rheumatic pain, inflammation of joints, nervous disorders and epilepsy. Dried roots are used as a tonic for hiccup, cold, cough; as a sedative; in care of senile debility; ulcers; etc. It is a drug used as anti-cancer, anti-stress, anti-depressant, in endocrine and cardio vascular activities. It is also used to control Parkinson and Alzheimer. The fresh leaves are applied for the treatment of carbuncles, inflammation and swellings. Leaf juice of Ashwagandha is useful in treating conjunctivitis and bark decoction is taken to control asthma and applied locally to bed sores. Green berries are used for treating ringworm infection, animal sores and horse's girth galls. Different parts of the plant possess activities such as amoebicide, anodyne, abortifacient, bactericide, contraceptive, diuretic, emmenagogue, fungicide, narcotic, pediculicide, sedative, spasmolytic, adaptogenic and tonic. Ashwagandha and its extracts are used in preparation of herbal tea and are available in the form of powders, tablets and syrups as herbal tonic. The leaves are bitter and are recommended in fever and painful swellings. The flowers are astringent, depurative, diuretic and aphrodisiac. The seeds are anthelmintic and combined with astringent and rock salt to remove white spots from the cornea. Ashwagandharishta prepared from seed is used in hysteria, anxiety, memory loss, syncope, etc. It also acts as a stimulant and increases the sperm count.

The different formulations involving Ashwagandha available in market are Ashwagandhadi Churna, Ashwagandha Rasayana, Ashwagandha Ghrit, Ashwagandharishta, Ashwagandha Powder, Ashwagandha Capsule.



Botanical description

Ashwagandha is an erect, branching undershrub growing in dry and sub-tropical regions. It grows up to 150-170 cm height. The roots are stout, fleshy and whitish brown. Leaves are dull green; simple, petiolate, elliptic-ovate to broadly ovate, entire, ex-stipulate, opposite and up to 10 cm long, those in the floral region are smaller. Flowers are bisexual, inconspicuous, greenish or lubrid-yellow, pedicellate, 4-6 mm in diameter, axillary, umbellate cymes occurring in 5-25 clusters. Berries are small, globose, bright orange-red when mature, 5 mm in diameter, enclosed in the persistent calyx and contain numerous seeds. Seeds are small, smooth, yellow, reniform, 2 mm long, 1.5-2.0 mm wide and 0.5 mm thick.

Chemical compositions

The plant roots consist of 0.13 – 0.31% alkaloids, 40-65% starch, and minor quantity of oil. The major chemical constituents in Ashwagandha are:

Alkaloids – Withanine, withanoline, somniferine, etc.

Steroidal lactones – Withaferin A, withanolides A- Y, withasomniferin A, withanone, withasomniferols A-C, etc.

Saponins – Additional acyl group - Sitoindoside VII and VIII.

Withanolides – with a glucose at carbon 27- Sitoindoside IX and X.

Withanolide glycosides – Withanosides I, II, III, IV, V, VI and VII.

Pyrazole derivatives – Pseudo withanine and ashwagandhine.

Apart from these contents, plant also contains chemical constituents like withaniol, acylsteryl glucosides, starch, reducing sugar, variety of amino acids and high amount of iron.

Cultivation

In India, cultivation of Ashwagandha is distributed from 23°N -33°N, from 600-1500 m altitudes. The plant grows well in sandy loam or light red soil having pH 7.5-8.0 with good drainage. Black soils or such heavy soils are suitable for cultivation. The semi-arid tropical areas receiving 500-750 mm rainfall are suitable for its cultivation as rain-fed crop. It requires relatively dry season during its growing period. Temperature between 20° and 35°C is most suitable for cultivation. One or two late winter rains are conducive for the proper development of roots.

Ashwagandha is propagated by seeds. The crop can be sown by broadcasting or in lines in well ploughed and pulverized land. Line to line method of sowing is preferred for performing intercultural operations properly. The seeds are usually sown in late *kharif* about 1-3 cm deep and should be covered with light soil. The distance between plants is 10-15 cm and that in between the row is 30 – 45 cm. Two weeding are required to keep the field free from weeds. The first weeding is done within 25-30 DAS and the second weeding is done after 60 DAS. The crop does not require heavy doses of manures and fertilizers. It responds well to organic manures. Addition of 10 t FYM or 1 vermicompost/ha is recommended. Application of 15 kg of nitrogen and 15 kg of phosphorous per hectare



is beneficial for higher production. Excessive rainfall or water is harmful for the crop. Life-saving irrigation is given as and when required. Under irrigated conditions, the crop can be irrigated once in 15-20 days to encourage good crop growth and to produce high root yield.

Flowering and bearing of fruits start from December onwards. The crop is ready for harvest in January – March at 150-180 DAS. The maturity of the crop is judged by drying out of leaves and yellow–red berries. There should be moisture in soil at the time of digging of roots. The tap root should be carefully pulled out not damaging even the small lateral roots. The entire plant is uprooted and the roots are separated from the aerial portion by cutting the stem 1-2 cm above the crown. The roots are washed, either cut transversely into 7-10 cm small pieces or dried as such in the sun to 10–12% moisture content. The dried roots are beaten to remove soil and to break off thin, brittle, rootlets. Lateral branches, root crown and stem remains are carefully trimmed with a knife. About 650–800 kg roots can be obtained from 1 ha and on drying it becomes 350-435 kg. Berries are hand plucked separately. They are dried and crushed to take out the seeds. The crop produces 200-500 kg seeds/ha.

Roots of ashwagandha are sorted out into the following grades, as per its length and thickness (Table 1).

Table 1. Ashwagandha root grades

Grade	Root properties
A grade	Root pieces up to 7 cm in length, 1-1.5 cm in diameter, solid cylindrical with smooth external surface and pure white from inside.
B grade	Root pieces up to 5 cm in length, 1cm or less in diameter, solid, brittle and white from inside.
C grade	Solid root pieces up to 3-4 cm in length, 1cm or less in diameter.
D grade	Small root pieces, semi- solid or hollow, very thin, yellowish inside and less than 1 cm in diameter.

Varieties developed

Arka Ashwagandha: Arka Ashwagandha was developed by ICAR-IIHR, Bengaluru in 2012. It is a high yielding variety developed from pure line selection with double the dry root yield (1,195 kg/ha) and total withanolide content (0.580%) compared to check Jawahar Ashwagandh-20

(527 kg/ha and 0.320%). The other significant features of the variety are good establishment, early vigour, field tolerance to bacterial wilt, late blight diseases and pests viz. *Epilachna* beetle, mites and aphids. Variety matures in 180 days and is characterized by pencil thickness roots and desired root depth of around 30 cm. The variety Arka Ashwagandha is also recommended for release in Zone 6 and 7 by AICRP on MAP and Betelvine. This variety is licensed to the pharmaceutical company Natural Remedies Pvt. Ltd, Bengaluru.

Jawahar Asgand-134: Jawahar Ashwagandha-134 was developed and released through ICAR-AICRP on medicinal and aromatic plants (ICAR-AICRPMAP) from the College of Horticulture, Mandsaur, JNKVV, Jabalpur, Madhya Pradesh, in 1998. It is a selection from JA-20 and wild types of Ashwagandha. JA-134 is erect, tall and leaf are chordates, dark green colour, surface is hairy, berries are yellow or yellowish brown. It takes about 150-175 days for maturity and average dry root yield is about 4 to 6 q/ha.

Jawahar Asgand-20: Jawahar Asgand-20 (JA-20) has been developed and released through ICAR-AICRP on Medicinal and Aromatic Plants (ICAR-AICRPMAP) from the College of Horticulture, Mandsaur, JNKVV, Jabalpur, Madhya Pradesh in 1989. It is a pure line selection. JA-20 is a spreading type, medium and leaves are ovate yellow green, surface non-hairy, berries colour are yellow. It takes about 135-150 days for maturity and average dry root yield is about 6 to 7 q/ha.

Gujarat Anand Ashwagandha-1: This variety was released by All India Coordinated Research Project on Medicinal and Aromatic Plants, Anand Agricultural University centre. It is resistant to *Alternaria* leaf blight. The root cortex is white and thick. The calyx is bigger. The variety is tall and has dark green foliage colour. The branches possess profusely stellate tomentose. The roots are dark brown and comparatively thick, long and having more girth. Average yield is 650 kg/ha.

NMITLI-118: The variety NMITLI-118 was developed jointly by CSIR-CIMAP and NBRI and was released in September 2009. The variety has uniform crop canopy, non-spreading plant architecture (more plant/unit area), high root yield and high withanolide yield per unit biomass, and phytochemically uniform and is the first pharmacologically validated variety. It has withanolide A and withanone in roots and high content of withaferin A (up to 2%) and no withanone in leaves. The variety is reported to give dry root yield of about 15 q/ha.

Poshita: The variety Poshita of Ashwagandha developed by CSIR-CIMAP has the potential of producing dry root yield of 14 q/ha with total alkaloids and withanolide content (steroidal lactones) which are the major group of secondary metabolites of medicinal interest containing 1.292 and 3.469 kg/ha, respectively. The fresh and dry leaf yields are also high up to 2.83 and 0.50 q/ha with high withaferin content in dry leave 0.528%.

Rakshita : This variety was developed by CSIR-CIMAP. It was selection from wild. The Berry colour is red and total alkaloid content: 0.5%. It takes about 180-200 days for maturity. The total yield of root is 800-1,000 kg/ha.

Vallabh Ashwagandha: Vallabh Ashwagandha was recommended for release in 2017 through ICAR-AICRP MAP for cultivation in all Ashwagandha growing areas of the country. The variety has 589.4 kg/ha dry root yield which is significantly higher than JA-20, JA-134 and RVA100. Higher root yield with marker character orange coloured berries are its special characters for easy identification.

Contributions of ICAR-AICRP-MAP&B

All India Co-ordinated Research Project on Medicinal and Aromatic Plants & Betelvine (AICRP-MAP&B) is an important research program of ICAR for location specific research. There are 26 centres under AICRP-MAP&B working on more than 40 species. The research on Ashwagandha is being taken up in Mandasaur, Anand, Udaipur and Raipur centres and supported by other centres for MLT experiments. A total of 590 accessions of Ashwagandha are being maintained at ICAR-DMAPR, Anand and 658 at its different AICRP centres.

Seed germination

Seed germination is erratic at times in Ashwagandha. Under laboratory condition carried out at ICAR-DMAPR, Anand, a temperature of 25°C recorded the mean lowest days of germination initiation in 4.8 days and complete germination was achievable in 10.2 days with mean germination time (MGT) of 8.10 followed by 5.5 days, 11.3 days and MGT of 8.51 at 30°C and 5.8 days and 12.4 days with MGT of 9.35 at 20°C in genotypes WS-134 and WS-20. Maximum mean germination of 83.8% was at 25°C followed by 75.5 at 30°C and minimum at 62.2% at 20°C in genotype WS-134. When individual



Gujarat Anand Ashwagandha-1

treatment was considered, seeds treated with gibberellic acid (GA_3) gave the maximum germination (85-94%) with minimum days for onset of germination and completion of germination with minimum MGT as compared to 40-58% germination in control in WS-134 and 38-51% in WS-20. Genotype WS-134 performed better than WS-20. It could be concluded that under controlled condition seeds treated with GA_3 would definitely give enhanced germination at a given temperature as compared to a very negligible germination of 40-58%.

Cost of cultivation and economic viability analysis

An example was illustrated by NMPB, Ministry of AYUSH (Kumawat *et al.* 2020, *Medicinal Plants* 12(2):161-168) wherein a broad spectrum of cultivation cost of Ashwagandha is given. It clearly shows that farmers incurred on an average, a total cost of ₹ 112,282/ha. Cost on material inputs was ₹ 28,637 i.e. 25.5% of the total cost while human labour investment was around 74.5% (₹ 83,645). The hired labour cost was ₹ 63,975/ha and ₹ 19,670/ha in respect of cost of involvement of family members.

Market

Neemuch market in Madhya Pradesh is the biggest ashwagandha market in India. Other markets include Shivpuri in Madhya Pradesh, Amritsar in Punjab, Kolkata and Siliguri in West Bengal, Mumbai in Maharashtra, Dhamtari in Chhattisgarh, Jaipur in Rajasthan and Berhampur in Odisha. The price of root varied from ₹ 170-350/kg depending upon the quality of the root. The fibrous roots are priced low as compared to the roots with higher starch content. Quality seeds of few recently developed varieties could be made available on indent basis and on priority from ICAR-DMAPR, Anand, Gujarat. Training on ashwagandha cultivation is imparted by the same institute.

The available scientific data support that Ashwagandha is a real potent regenerative tonic (Rasayana of Ayurveda), due to its multiple pharmacological actions like anti-stress, neuroprotective, antitumor, anti-arthritis, analgesic and anti-inflammatory, etc. It is useful for different types of diseases like Parkinson, dementia, memory loss, stress induced diseases, malignoma and others. Ashwagandha is used as a household remedy by Indians, who consider it as the best tonic for old people and children, and as aphrodisiac by young people. It is one of the best nervine tonics of Ayurveda, the most ancient system of Medical Sciences. However, large scale studies are needed to prove its clinical efficacy in stress related disorders, neuronal disorders and cancers. It has been widely accepted due to its medicinal and commercial importance with further acceptability in post Covid-19 situation as it boosts immune system.

For further interaction, please write to:

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