

Production technology of safed musli

Herbal products are a valued gift from nature to humankind. *Chlorophytum borivillianum* herb is commonly known as safed musli and has therapeutic applications in Ayurvedic and Unani systems of medicine. Safed musli is among the 20-odd species of native medicinal plants that enjoy extensive therapeutic applications and an expansive global market. It possess spermatogenic property and helps cure impotency as it is rich in glycosides. Its fasciculated roots contain saponins and are used as a health-promoting drug or tonic in the Ayurvedic medicinal system. However, due to its aphrodisiac properties, it is called 'Nature's wonder drug', 'Natural Viagra', 'Divya Aushad', and 'White gold' as well as is considered an alternative to Viagra. Safed musli is cultivated on a small scale in different parts of India. Over the past twenty years, extensive research has been conducted in India including its conservation biology, cytology, chemistry, plant genetic resources, micropropagation, crop management, and nutrition aspects as well.

SAFED musli (*C. borivillianum*), also known as 'Divya Aushad' belongs to the family *Liliaceae*. It is highly valued for its medicinal properties and is grown primarily for its fasciculated tubers/roots. Safed musli is a perennial herb with up to 16 in number, narrow, sessile and linear-

ovate leaves measuring 13-23 cm × 1-2.5 cm, imbricately arranged at the base, and zygomorphic, pedicellate white flowers arranged alternately in groups. The plant produces endospermic 3-12 small, black, angular seeds inside green-yellow coloured, loculicidal capsule triquetrous. The roots are tuberous brown to black-skinned, white after peeling, possessing characteristic odour, tasteless, 3-20 in number, fasciculated, and 8-25 cm long.

Tropical and Subtropical Africa are the probable centers of origin of the *Chlorophytum* genus. The genus *Chlorophytum* is made up of around 300 species of rhizomatous plants that are mostly found in tropical and subtropical forests up to 1,500 meters above mean sea level. It has been reported that 40 species of *Chlorophytum* are distributed in Asia, tropical Africa, America, and Australia. In India, 13 species of *Chlorophytum* have been reported, of which 6-7 are used in indigenous medicine. The species *C. borivillianum*



Safed musli plant



Fruiting capsule

became well-known in the late 1980s. It was introduced to India from South Africa. In India, it is naturally distributed in the hilly areas of Gujarat, Rajasthan, Madhya Pradesh, and Maharashtra. It is a widely growing species and an integral part of Ayurvedic, Unani, Homeopathic, and Allopathic systems of medicine at a global level. It has gained a well-established Indian and International market for being the herbal alternative to ‘Viagra’ without any side effects. The roots fetch an attractive market price of ₹ 1600-1800 per kg of dry peeled fasciculated roots. Because of its high value and demand in the ayurvedic system, generally, the roots of *C. borivilianum* are mostly unscrupulously collected from their wild habitats in India.

Due to its overexploitation in an unscientific manner by unskilled labour and the destructive nature of harvesting (the tuber being the economic organ, the whole plant is removed), shy flowering behaviour, poor seed formation, low seed germination and high seed as well as tuber dormancy have resulted in *C. borivilianum* being an threatened species. Therefore, conservative strategies and some innovative ideas should be initiated to protect *C. borivilianum* from becoming endangered. Hence, sustainable conservation, cultivation, and utilization of these species is highly essential and of utmost importance. Presently commercial cultivation is happening only in the traditional area or else wild sources. As a commercial crop, it is positioned to provide unbeatable returns. To bring out these species under commercial cultivation, there are a lot of institutions at the National and International level that have done plenty of work on its conservation, botany and genetics, crop improvement, and standardization of good agricultural practices for the sustainable and economic viable production technology of safed musli. The National Medicinal Plants Board has recognized safed musli as the sixth important herb to be protected and promoted.

Importance in Ayurveda

In the Ayurvedic literature, safed musli is celebrated as a Divya Aushad with unparalleled medicinal properties. It is a chief ingredient in the preparation of numerous Ayurvedic formulations to treat conditions such as joint pain, diabetes, and diarrhea. Safed musli is also gaining importance and acceptance as a vitalizer and health-giving tonic, a curative for pre-natal and post-natal problems, a restorative for immunity improvement, and a remedy for diabetes and arthritis. The roots are utilized in Vajikaran Rasayana, a rejuvenating and aphrodisiac formulation. It is also an important component of Chyawanprash, a widely consumed ayurvedic herbal jam. It is believed to have immunomodulatory effects and is associated with preventing premature ejaculation. Consuming the dried root powder with warm milk is an effective remedy for male sexual disorders and for promoting overall health and purifying the blood.

The primary saponin found is called saponin glycoside, or chlorophytoside A. Safed musli is a nutrient-rich plant known for its medicinal properties and potential health benefits. Its nutritional composition may vary slightly based on factors like cultivation conditions and processing

methods. Typically, it contains carbohydrates, proteins, fibre, saponins, alkaloids, and various vitamins (Table 1). Carbohydrates provide energy, proteins support tissue repair and physiological functions, while dietary fibre aids digestion and regulates blood sugar levels. Roots have high saponin content which contributes to its aphrodisiac and immune-strengthening effects. Additionally, safed musli provides trace amounts of essential vitamins and minerals like calcium, potassium, iron, and magnesium.

Table 1. Constituent elements present in safed musli

Composition	Share (%)
Carbohydrates	42
Proteins	8.9
Fibre	34
Saponins	2-17
Alkaloids	25

Production technology

Soil and climate: It grows naturally in most of the parts of tropical and sub-tropical climatic regions of India with altitudes up to 1500 meters, and can grow successfully in a day temperature range of 30 to 35°C and rainfall up to 500-1500 mm. Well-drained sandy loam and loam soil rich in organic matter with good porous nature with a 6.0 to 8.0 pH range are most suited for its fasciculated root development. Thorough land preparation is essential to eradicate the perennial and seasonal weed population and also to make soil porous to facilitate fasciculated root development. Based on the slope and rainfall pattern, suitable-sized raised beds/ridges should be prepared. In high rainfall areas, planting on raised beds (10-15 cm height) is suggested for quick drainage of excess water.

Propagation: Safed musli can be propagated



Sprouted fasciculated roots ready for planting

sexually (seeds) as well as asexually (fasciculated roots containing some portion of disc where buds are located). Micropropagation is also successful in safed musli and helps in the production of uniform (homogenous) plants which becomes more important, in the absence of any improved variety available for cultivation. Due to low germination and heterozygous nature, it is preferable to adopt the vegetative means of propagation for commercial cultivation in safed musli. The asexual propagation is done by the fasciculated roots stored from the previous year's harvest. During last year's harvest as per the planting material requirement for next year, whole or a portion of fasciculated roots after digging of roots in March-April are stored. The storage of the planting material fasciculated roots in a 2-5 kg capacity container/box covering an equal proportion of sand or sawdust at a cool and humid place



Ridge planting system of safed musli Sprouts planting of safed musli

still starts sprouting in May-June month. Before planting, sprouted material is taken out from the stored container, and kept outside for some days at room temperature to allow the buds on the disc to sprout. The finger-containing buds and some portions of the disc are separated with the help of a sharp blade/knife. Splitting of a disc is done in such a way that each disc or sprout contains 1-3 fasciculated roots and each should weigh at least 5 g of each sprout.

Method of planting: Planting is a very important operation in ensuring higher yield in safed musli. It can be done usually on raised beds or ridges, or flat beds depending upon the soil texture and amount of rainfall. If the soils are heavy in nature with more rainfall and drainage is poor, then crops should be grown on raised beds or ridges. The planting should be done on rainy days preferably the first or second rain of monsoon arrival, as it will help to improve the rate of survival herbs. Single or double planting should be followed in ridges or raised beds. Mostly spacing should be kept about 30 cm row-to-row and 10 or 15 cm plant-to-plant which may accommodate around 3.33 lakh plants per hectare. For planting in a one-hectare area, 600 to 1000 kg planting material (roots) is required and the planting material rate varies with the spacing followed.

Irrigation: The drip irrigation with raised bed planting system is found economic and viable for the commercial cultivation of safed musli. However, it is cultivated during the rainy season, and irrigation is needed when the monsoon fails or delay in setting after a few showers. As it needs a regular supply of water even after the stage of fall of leaves, thus as per the pattern of the rain, at least 6-8 irrigations are needed at the interval of 10-15 days.



Flower nipping



Hand weeding

Manuring: Usually, 10-15 tonnes/ha of well-dried, decomposed cow dung at the time of land preparation may be applied for a good result. Green manuring is vital to improve the fertility of the soil. The ideal sources of green manure are sesbania, cow pea, sun hemp, lablab, etc. for improving productivity by minimizing iron deficiency. Organic amendments like bone meal and poultry manure are preferred for growing safed musli. Nutrients may also be supplemented, 50:40:40 kg NPK per hectare is optimum for obtaining a good yield of musli.

Intercultural operations: Two to three hand weeding cum hoeing are required during the crop growth time. In the rainy season, earthing up is also required to avoid the exposure of fasciculated roots which often occur when a crop is grown on raised beds or ridges. Regular nipping of inflorescence should be done whenever it appears, inflorescence nipping practice can increase the yield of fasciculated roots by 35%.

Cropping system: Safed musli has short stature, low water requirement, and is found growing in open as well as in partial shade in natural habitats, indicating the ability of musli to tolerate a certain degree of shade. Hence, there



Spray of bio-fungicide

can be good possibilities of intercropping safed musli with rainy season crops, pigeon pea, cowpea, green gram, tomato, ashwagandha, and black gram, etc. which do not offer much competition to other plant species growing associations.

Pest and disease management

No serious diseases and pests have so far reported in safed musli, however, the leaf-eating caterpillar is a pest and leaf spot/leaf blight also occurs. Due to continuous and heavy rain showers, there is a chance of leaf rotting in safed musli, thus leaf has to be protected from any diseases and pests to harvesting optimum yield. Also, care should be taken to provide proper drainage to avoid damage to tubers by waterlogging. Majority of the time disease should be managed by the application *Trichoderma* spp. at the time of sowing or at the time of intercultural operations.

Harvesting and Post-harvest management: Harvesting and postharvest management are critical stages in ensuring the quality and shelf-life of safed musli. Plants start withering after four to four and half months from planting. However, harvesting should be done from November to December. There should be a time gap from leaf withering to root maturation. The roots should be harvested carefully by digging from December to January for the process and sales in the market. Before harvesting the roots, apply light irrigation before digging the roots. If the roots will be used as planting material for the coming season, then roots can be harvested in the month of March-April. After the digging of roots, shade drying needs to be done for 3 to 4 days to remove the moisture and adhered soil. For sale as a raw material for drugs, the washing and peeling of roots skin should be done immediately after harvest by mechanically scraping with a knife. Thereafter, it should be dried in partial shade at 35-40°C for 3-4 days in a uniform thin layer with occasional stirring so that it retain its white colour and can fetch a premium price. After drying, musli must be packed in poly bags to prevent the entry of moisture and properly labeled with all details.



Withering of leaves

Storage of planting material: The fasciculated roots after harvest are kept in the shade for about a week so that root bunches lose excess moisture. Two methods are majorly used for the storage of roots, one is that roots should be mixed with dry sand and kept in a plastic or wood container or else perforated plastic bags of 5 to 10 kg capacity under the shade at room temperature with less than 60% humidity of room while in second case, roots can be mixed with dry sand kept in pits 15-20 cm deep in soil under the shade.

Yield and economics

The fasciculated root yield of safed musli may vary significantly according to growing conditions. However, an average of 2-3 tonne fresh root yield can be obtained from a one-hectare crop under favourable growing conditions. This yield gives about 0.4-0.6 tonne marketable dry root yield. The net return from the safed musli depends mainly on the crop yield per unit area and the market price at the time of sale. However, on average, dry root yields up to 400 to 600 kg/hectare, and the current selling price is about ₹ 1400/kg of dry root, a gross and net return of ₹ 6.0 to 7.0 lakhs and ₹ 3 to 4 lakhs per hectare respectively, may be obtained.

Marketing and market demand

The raw drug of safed musli in the form of dry roots and root powder is regularly traded in Delhi, Neemach, Jabalpur and Indore, and other local markets. The estimated annual trade of safed musli in India is about 150 to 250 MT. The global markets for safed musli are USA, Britain, Australia, Japan, and European countries. Safed musli has an annual demand of over 50,000 tonnes worldwide which is much higher than present production (<5,000 tonnes). The powder of Safed musli is in great demand as a sexual energy capsule.

For further interaction, please write to:

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