

Introduction

Increasing Awareness of lifestyle and diet-based disorders in humans leads to a rediscovery of new and alternate crops rich in health benefitting nutrients and compounds. In such a list, chia (*Salvia hispanica* L) is an upcoming and highly demanding crop rich in dietary fibre (30-34%), fat (30-35%) and Protein (16-24%). Seed oil is a rich source of Alpha-linolenic acid (Omega-3) fatty acid (55%). High fibre helps in management of type II diabetes, and omega-3 helps with cardiovascular disease. Besides major health benefits, chia is also used in food, cosmetics, and pharmaceutical industries.

Chia is cultivated in Mexico, Guatemala, Columbia, Peru, India, USA, Bolivia, Argentina, Europe, Brazil and Australia. The crop is becoming popular in India and has been adopted as a new crop in most of the states like Karnataka, Maharashtra, Telangana, Tamil Nadu, Madhya Pradesh and Rajasthan.

Botanical description

The chia is a self pollinated and short-day plant that requires less than 12 hours of light for flower induction. Typically, the plant grows more than one meter tall. The main stem and branches are angular which produces spike in their apical tips. The inflorescence (spike) bears numerous small white or blue colored flowers on its rachis. . Each flower, upon fertilization, results in 2-4 black or white tiny seeds. Plants start flowering in 30-75 days.



Figure 1: Black and white seed



Figure 2: Blue and White flower type in chia

Soil: Chia grows in any soil type, ranging from sandy to medium black. In light-textured soils, the crop performs well; in black soils or heavy soils, compaction may create poor emergence and growth. Crop performs well in neutral soils and is sensitive to saline soil and irrigation water.

Climate: Chia is a short-day crop that requires <12 hours of light for flowering. The crop requires a mean RH of 67-75% and a mean maximum temperature of 30-31°C with a diurnal variation of 8-10°C. Evenly distributed rainfall of 250-350 mm during cropping period is most favourable for chia.

Sowing window: The crop can be sown during kharif and early rabi. But sowing from 15th August to 15th September is most ideal in semi-arid regions for achieving higher yield.

Field Preparation and Sowing: Chia requires fine tilth for germination and emergence. Hence, the field should be thoroughly ploughed and harrowed prior to sowing. Seeds can be sown in lines or broadcast in the field. Uniform broadcasting is achieved by mixing seeds with sand or coarse soil of 2 mm particulate size in a 1:10 ratio. After sowing, a large bush of *Lantana* or *Babul* can be drawn to cover the soil gently.

Seed rate: Chia seeds are tiny and 1100-1200 seeds weighs approximately 1g. Seed rate of 1.5-2 per ha is optimum for line sowing and broadcasting. .

Transplanting: Chia can also be grown by transplanting the seedlings which can be raised in the nursery. Raising seedlings in soil is not advisable as they are susceptible to root damage, and uprooting seedlings from soil damages the roots, thereby reducing the survival percentage. Therefore, raising seedlings in plug trays with soil+vermicompost (1:1) media is most suitable. Further, use of 50 cell plug trays is more suitable than 98 cell trays. The ideal transplanting stage to the main field will be 15-20 days after germination.



Figure 3: Chia seedlings ready to transplant

Spacing: For early sowing, July-September, a wider spacing of 60cm×30cm and for late season sowing from October to November, 50×30cm is optimum

Irrigation: Drip irrigation intervals of 6-8 days in shallow basaltic soils and 10 days in black soils may be followed. If the crop is grown purely on irrigated 300-350 mm of irrigation water required. First irrigation should be immediately after sowing and followed by the 6th day of sowing. After 3rd irrigation (40 DAS), watering may be withheld for 15 days to encourage deep rooting, which helps with stress tolerance.

Nutrient: The plant responds well to applied nutrients. Under soils with nutrient deficits, poor nutrition leads to poor growth and small spikes. Therefore, the application of organic manures in resource-poor soil is mandatory. A nutrient dose of 90:60:75 kg of N, P₂O₅ and K₂O is applied for one hectare. At the time of sowing, a basal dose of 45 kg N, 60 P₂O₅ and 75 kg of K₂O may be applied either by seed cum fertilizer drill

or manually. The remaining nitrogen may be applied 30 and 45 days after sowing in equal split application.

Intercropping: Leafy vegetables like fenugreek, coriander and dill can be intercropped with chia in 1:2 ratio. Leafy greens harvested after 30-45 days and chia crop allowed to grow till maturity (100-110 days).



Figure 4: Fenugreek and coriander as intercrop in chia at 30 days after sowing

Pest and diseases: The chia crop is tolerant to pests and diseases. However, a few insect pests like Bihar hairy caterpillar (BHC) and aphids, can be observed during the cropping season.



Figure 5: Infestation of BHC and aphids in chia

Harvesting: Early season sowing in July or August crop matures after 130 days. In contrast, delayed sowing in January leads to early maturity 60-70 days after sowing. The crop maturity can be identified when plants turn yellow, inflorescence shows partially dried spikes, and some remain yellow. The crop is harvested by pulling the entire plant or cutting the stem with a sickle. The harvested crop can be left in the field for drying in open condition for 4-5 days.



Figure 6: crop ready for harvest

Threshing: After drying in an open field, the crop is threshed by beating with sticks and separated by winnowing. Mechanical threshing by tractor-operated thresher with appropriate sieve, which are suitable for threshing any minor millets, can be employed for quick and efficient threshing.

Yield: The crop yield may vary depending on sowing time and the type of chia grown. Among black and white seed types, black seed variety yields more (564 kg/ha) than white variety (509 kg/ha). Depending on sowing date and management practices, 400-850 kg seeds can be harvested. The highest seed yield of 811 kg/ha can be obtained by sowing between 1st August and 1st September.

Economics

Seed yield	817 kg/ha
Price of produce (seed)	Rs. 150/kg
Gross returns	Rs. 1,22,550/ha
Cost of cultivation	Rs. 47,337/ha
Net returns	Rs. 75,213/ha
B:C ratio	1:2.58

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Package of practices for chia (*Salvia hispanica* L) cultivation



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