

Scientific Cultivation of White and Yellow Gladiolus Varieties: A Highly Remunerative Venture

Gladiolus is one of the most valuable cut flowers in India, known for its vibrant colours and majestic spikes. It is cultivated in regions such as Kalimpong, Srinagar, and Nainital, covering 11.85 thousand ha and producing approximately 106 crore cut flowers annually. The white (60%) and yellow (20%) varieties are especially preferred for floral arrangements and religious ceremonies. These varieties, well-suited to Indian growing conditions, command premium prices due to their long-lasting spikes, thereby offering significant economic benefits to farmers and showcasing high entrepreneurial potential.

THE global floriculture industry contributes significantly to the world agricultural economy. Gladiolus (*Gladiolus* spp.), often referred to as the “Queen of Bulbous Flowers,” is one of the most valuable monocot cut flower crops. In India, it is cultivated in regions such as Kalimpong (West Bengal), Srinagar (Jammu & Kashmir), Ghaziabad (Uttar Pradesh), and Nainital (Uttarakhand), covering 11.85 thousand ha and producing approximately 106 crore cut flowers annually. Gladiolus ranks third in area and production among all cut flowers in India and is renowned for its wide range of colours and majestic flower spikes.

Among the various mono and multi-coloured gladiolus genotypes, white (60%) and yellow (20%) varieties are the most popular for floral arrangements, bouquets, and decorations at weddings, religious ceremonies, and festivals. Their long vase life and premium market prices offer significant economic opportunities to Indian farmers and entrepreneurs engaged in floriculture as an agribusiness. Market surveys have shown that white and yellow varieties are in higher demand and command

better prices. Therefore, growers are encouraged to select these varieties for improved profitability.

Choice of varieties

Floriculture institutions in India have developed several improved gladiolus varieties, with white and yellow varieties being the most popular due to their superior performance under diverse agro-climatic conditions. Some of these improved gladiolus varieties, along with their sources of procurement, are listed in Table 1.

Availability of planting material planting materials: (corms) can be sourced from institutions such as ICAR-IARI (New Delhi), ICAR-IIHR (Bengaluru), ICAR-IHBT (Palampur), MPKV (Pune), YSPUHF (Solan), SKUAST (Srinagar), and from progressive farmers producing gladiolus corms (e.g., P.J. Abraham, Lakshminarayana, Chang Deo More). Private suppliers like M/s Sheel Biotech, M/s Chadha Farms, M/s Unid Florist, and M/s Argosy Ltd. in Delhi, Pune, and Uttar Pradesh also provide planting material.

Table 1. White and yellow floret gladiolus varieties and their source of availability

Public Institution	White type	Yellow type
ICAR-IARI, New Delhi	<i>Pusa Shanti, Pusa Shubham, Pusa Kiran and Pusa Shweta</i>	<i>Chandini, Dhanvantari</i>
ICAR-IIHR, Bengaluru	<i>Meera</i>	<i>Poonam</i>
CSIR-NBRI, Lucknow	<i>Manisha, Mohini</i>	<i>Manhar</i>
GBPUA&T, Pantnagar	<i>Shubhangini</i>	
PAU, Ludhiana	-	<i>Punjab Lemon Delight</i>
MPKV, Pune	-	<i>Phule Ganesh</i>
BHU, Varanasi	-	<i>Malviya Kundan</i>
Exotic (Private nurseries)	<i>Snow Princess, White Prosperity, White Friendship, Snow Dust, Sancerre, American White and White Goddess</i>	<i>Yellow Stone, Ratna's Butterfly, Jester, Jackson Ville gold, Vink's Glory, Novalux, Gold Dust, Yellow Star and Eastabonita</i>



White coloured gladiolus varieties, namely, White Prosperity, Pusa Shanti, Pusa Kiran and Shubhangini

Scientific cultivation practices

Climate: Gladiolus thrives in mild climates, with ideal temperatures ranging from 20°C to 25°C. Temperatures below 6°C may cause frost damage, while soil temperatures above 10°C are essential for proper plant growth. Bright sunlight, with at least 80% light availability, is critical for optimal flowering. Insufficient light, especially during winter, can lead to flower spike abortion and prolonged vegetative growth.

Choice of soil: Gladiolus grows best in deep, well-drained, friable soils rich in organic matter, with an optimal pH of 5.5–6.5 to ensure nutrient availability. Cormel sprouting is hindered at pH levels above 7.8, and plant growth declines when soil electrical conductivity (EC) exceeds 2.0 dS/m or chloride levels surpass 110 mg/L. Incorporating well-rotted farmyard manure (FYM), pig manure, or poultry manure (50 t/ha) into ploughed soil helps reduce soil pH and improve yield.

Site selection and field preparation: Gladiolus requires full sunlight, adequate soil moisture, and protection from strong winds for optimal growth. Shaded planting sites lead to weak plants and poor-quality flower spikes. Field preparation begins two months before planting by incorporating 300 quintals of FYM per hectare during the first ploughing. Green manure crops such as sun hemp, daincha, lupins, moong, or winter rye are sown and incorporated one month after germination. A second ploughing is then done to achieve fine tilth and weed removal. Beds should be 1.6–2.0 meters wide with 60 cm spacing for irrigation channels. Crop rotation helps

prevent Fusarium wilt and reduce pathogen buildup. Soil solarization during summer minimizes wilt incidence.

Selection of corms and planting methods: Healthy corms (5–6 cm in diameter) should be selected and treated in a 0.2% Captan or carbendazim (Bavistin) solution for 60 minutes to prevent fungal infections. Planting is done using 50,000–60,000 corms per acre (1.25–1.50 lakh/ha). The flatbed method is suitable for sandy soils, ridge planting for sandy loam, and raised beds for heavy soils. Corms should be planted with buds facing upwards, in rows spaced 45 cm (single row) or 60 cm (double row) apart, with 15 cm between plants. Treated corms should be planted at a depth of 5–8 cm and covered with at least 4 cm of soil.

Time of planting: In northern India, planting generally begins in early October and is staggered every 10–15 days until mid-December. In hilly regions, March to April is ideal, while in Bengaluru and Pune, the planting season extends from June to October and into November.

Irrigation: Watering should be regular but must avoid waterlogging. Sandy soils require irrigation every 7–10 days, whereas heavier soils need watering every 10–15 days. The first irrigation at the 2–3 leaf stage is crucial for plant establishment. Drip irrigation systems with appropriately sized main and sub-main pipes are recommended for efficient water use. Fertigation tanks facilitate the delivery of balanced liquid fertilizers through drip lines. A discharge rate of 2 liters of water or nutrient solution per hour, with 30 cm drip spacing, ensures optimal distribution.

Nutrient management: For optimal growth, apply 120 kg N, 150 kg P₂O₅, and 150 kg K₂O per hectare in split doses. The basal application includes 60 kg N and the full dose of P₂O₅ and K₂O. The remaining N is applied as a 30 kg/ha foliar spray at the 4-leaf stage, followed by 30 kg/ha as a soil application at the bud stage. Foliar sprays of 0.5% FeSO₄, 0.25% ZnSO₄, and 0.4% boric acid promote vegetative growth, flowering, and corm production. For cut flower production, a spray of 5 g/L yeast extract with 100 ppm seaweed extract (*Ascophyllum nodosum*) is recommended. For enhanced cormel production, apply 7 g/L yeast extract plus 100 ppm seaweed extract.

Integrated nutrient and biofertilizer management: An integrated nutrient management (INM) approach includes applying 75% of the recommended fertilizer dose (RDF), 1 kg/m² FYM, 0.5 kg/m² vermicompost, bio-inoculant-treated corms, and bio-control agents such as *Pseudomonas fluorescens* and *Trichoderma* (0.5 kg/m²). It also includes nitrogenous and phosphatic biofertilizers (*Azotobacter*, *Azospirillum*, and phosphate-solubilizing bacteria at 0.5 kg/m²). This combination improves plant height, leaf count, spike initiation, spike length, florets per spike, and vase life. The application of humic acid (3.0 mL/L) with a balanced NPK (17:17:17) fertilizer enhances bud sprouting, flower and spike traits, and cormel yield.

Intercultural operations: Staking is necessary for tall-spike varieties to prevent lodging. Earthing up to 7–10 cm when plants are 15 cm tall or during spike elongation ensures stability and reduces damage from wind and rain. Mulching helps conserve soil moisture and suppress weeds. Effective mulching materials include straw, grass,



Yellow coloured gladiolus varieties, namely, *Dhanvantri*, *Chandini*, *Pusa Shubham* and *Yellow Stone*

sawdust, peat, husk, bark, and polyethylene strips placed between rows.

Physiological disorders

- **Blindness:** Caused by unfavourable climatic conditions or fluctuating light intensity, resulting in healthy vegetative growth but no flowering.
- **Topple and bud rot:** Linked to calcium deficiency; leads to weakened stems and rotting buds. Managed by spraying 0.2–0.3% calcium carbonate solution.
- **Negative geotropism:** Caused by uneven auxin distribution, resulting in abnormal upward growth against gravity.
- **Fluoride injury:** Characterized by leaf scorch, often caused by atmospheric fluorine or excessive superphosphate use. Managed with a 5% lime or magnesium sulfate spray.

Pest and disease management

Common insect pests and diseases affect gladiolus and can be managed through integrated pest management (IPM) strategies.

Weed management

Weed control should begin 1–2 months before planting by irrigating the field to stimulate weed seed germination, followed by removal using a cultivator. Typically, 2–3 manual weedings are required at 20–30-day intervals.

- **Pre-emergence herbicides:** Pendimethalin (650 ml/acre), diuron (0.9 kg/ha), linuron (3.0 kg/ha), alachlor/metolachlor (4.5 kg/ha), atrazine (4.0 kg/ha), and oxyfluorfen (0.5 kg/ha).
- **Post-emergence weed control:** Application of 2,4-D (1.5–3.0 kg/ha) and manual weeding as required.

Table 2. Pest and disease management

Pest	Control methods
Cutworm	Summer ploughing exposes pupae to predators. Use poison bait (Carbaryl @ 0.1%, wheat bran, molasses). Spray 0.05% methyl parathion or 0.05% quinolphos every two weeks.
Bulb mite	Hot water treatment is very effective. Ensure sanitation during corm digging, storing and planting. Managing mite population with 0.05% methyl parathion, 0.012% fluvalinate or 0.4% Diazinon.
Aphids and thrips	Spray acephate 0.1% 2–3 times at 10-day interval or systemic insecticides (Methyl demeton 25 EC 2 ml/L + Rogor 2 ml/L). Store the infested corms at 2°C for 6 weeks, followed by hot water treatment (46°C) to kill the thrips.
Root-knot nematode	Hot water treatment of corms at 57.8°C for 30 minutes, along with the application of furadan (8–10 q/acre), carbofuran or phorate (1 g/m ²), and crop rotation with marigold is recommended. Tri-treatment (salicylic acid + <i>Purpureocillium lilacinum</i> + <i>Hirsutiella hirsutissima</i>) reduced nematode juveniles by 80.2%. Bulb soaking in carbosulfan 25 EC @0.2% for 6 hours followed by soil application of <i>P. lilacinum</i> (2.5 kg/ha) and neem oil cake (1.0 t/ha).
Disease	Control method(s)
Corm rot	Hot water treatment (38–40°C) with benlate and captan (2.5 g/L) for 30 min. Application of <i>Trichoderma harzianum</i> spray for biological control.
Fusarium wilt	Practicing crop rotation, and ensuring proper corm curing. Treating corms with hot water (38–40°C) + benlate and captan (2.5 g/L each). Soil drench with 0.2% carbendazim biweekly. Destroying infected corms. Deep ploughing and solarization of soil during summer months.
Botrytis grey mould	Spray Kavach™ or Dithane M-45 @ 0.2%.
Curvularia blight	Spray mancozeb @ 0.2% weekly or every 10 days.
Leaf spot	Spray 0.3% copper oxychloride or carbendazim (1 g/L) or mancozeb (2 g/L).
Storage rot	Treat with benomyl (0.2%) and ensuring proper corm curing.

Harvesting, grading, and packing of spikes

Gladiolus spike production takes 60–120 days. Harvesting is recommended in the morning or evening to ensure that at least four leaves remain on the plant to support proper corm and cormel development. Spikes should be cut using sharp knives or secateurs to prevent crushing the base.

- After harvesting, spikes should be re-cut 2–3 cm underwater.
- **For local markets:** Harvest when 1–2 basal florets are open or when 5–7 florets show colour.
- **For distant markets:** Harvest when 1–5 basal florets show colour.

Grading is based on spike length, the number of florets per spike, straightness, and freedom from pest or disease infestation. Gladiolus spikes are categorized into different grades, including:

Grade	Spike length (cm)	No. of florets
Fancy	>107	16
Special	96–107	14
Standard	81–96	12
Utility	<81	10

Twenty spikes are bundled and packed in a single layer in CFB (corrugated fiberboard) cartons measuring 107–130 cm × 33 cm × 33 cm. These CFB boxes are used during handling and for storage in cold rooms. Spikes are also packed in mesh bags.

Post-harvest handling: Post-harvest handling involves essential steps to preserve spike quality:

- **Pre-cooling:** Carried out at 4–5°C for 24–48 hours.
- **Pulsing treatments:** Sucrose (15–20%) and 8-HQC

(200 ppm) for 24 hours at 4–6°C.

- **Vase solutions:** Contain 4% sucrose with either aluminium sulfate (300 ppm) or sodium hypochlorite (50 ppm).
- **Storage:** Spikes are stored either wet (at 4–5°C for 7–10 days) or dry using suitable materials, and kept in a vertical position to prevent geotropic bending.
- **Transportation:** After storage, spikes are transported in refrigerated vans or under ambient conditions to retail markets.

Lifting and storage of corms: lifting: Corms should be lifted 6–8 weeks after spike harvest and curing. Irrigation should be withheld for 2–3 weeks prior to lifting, although light irrigation just before lifting is beneficial.

- **Cleaning and drying:** After lifting, corms must be cleaned, air-dried in shade for 15 days, and treated with a 0.2% Captan solution to prevent fungal infection, followed by an additional month of drying.
- **Storage:** Air-dried corms are stored in cold storage (3–7°C) for up to 3 months or treated with 1,000 ppm ethrel, dipped in 100 ppm GA₃, or 500 ppm thiourea for 2 hours to break dormancy.

Expected yield of spikes and corms: The yield of flower spikes and corms in gladiolus depends on the variety, corm size, planting density, and management practices:

- **Flower spike production:** 2.0–2.5 lakh/ha, with 1–2 spikes per plant.
- **Corm yield:** 2.5–3.0 lakh/ha, averaging 2 corms per plant.
- **Cormel production:** 15–20 lakh/ha, with 10–20 cormels per plant.

Economics of cultivation: Gladiolus cultivation is highly remunerative. The economics of cultivation is presented in Tables 2 and 3. The benefit-to-cost ratio has been estimated at 2.55.

Table 3. Details of cultural operations and their costs in quality gladiolus production

Particulars of operations	Cost (₹/ha)
Ploughing with disc cultivator 3 times at ₹ 3,500/ha	10,500
Ploughing with rotovator at ₹ 4,000/ha	4,000
Field levelling and execution of layout and preparation of beds and channels, 80 labourers ₹400 per labour	32,000
Application of fertilizers (120:150:150 NPK kg/ha) at ₹ 13,800/ ha, FYM 300 quintals ₹ 45,000/ ha and biofertilizers	1,08,800
Number of corms/ha and their cost (1,60,000 at ₹ 5/corm)	8,00,000
Planting of corms by manual 50 labourers at ₹ 400/labourer	20,000
9 Irrigations at ₹ 800/irrigation including labour cost	7,200
Hand weeding, hoeing and earthing up (twice), 60 labourers at ₹ 400/labour	24,000
Weedicide spray (once), 4 labourers at ₹ 400/labour	1,600
Weedicide: pendimethalin 1.5 litre	945
Plant protection	
i. Rogor 1 litre at ₹ 560/litre	560
ii. Fungicide, Bavistin 2 kg/ha at ₹ 1,350/kg	2,700
iii. 10 labourers at ₹ 400/labour	4,000
Spike harvesting, 15 labourers at ₹ 400/labour	6,000
Digging of corms and packing, 50 labourers at ₹ 400/labour	20,000
Miscellaneous	10,000
Total	10,52,305

Table 3. Average economics of gladiolus cultivation

Yield (No. of corms / ha)	Number of spike/ ha	Income of corms (₹/q) (A)	Income of spike (₹) (B)	Total gross income (₹/ ha) (A+B)	Total cost of production. (₹)	Net profit (₹)	Benefit: cost ratio
2,55,673.30	2,01,166.70	12,78,366.50	14,08,166.90	26,86,533.40	10,52,305	16,34,228.40	2.55

Rate of corm: ₹5, Rate of spike: ₹7

Floriculture Project Funding Agencies: In India, key agencies supporting floriculture projects include the National Horticulture Board (NHB), the Mission for Integrated Development of Horticulture (MIDH), NABARD, the Small Farmers' Agribusiness Consortium (SFAC), and APEDA. Financial aid is also available through various development schemes sponsored by State Horticulture Departments, with subsidies ranging from 30% to 50%. Several nationalized and private banks, such as the State Bank of India, ICICI, Punjab National Bank, and HDFC, also fund such commercial projects.

CONCLUSION

White and yellow gladiolus varieties offer significant economic potential for farmers and entrepreneurs,

especially given their growing demand in both local and international markets. By adopting improved cultivation practices, proper post-harvest handling, and integrated nutrient management strategies, farmers can maximize their returns from white and yellow gladiolus cultivation. This lucrative venture not only enhances farm income but also contributes to the growth of India's floriculture industry.

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SUSTAINABLE DEVELOPMENT GOALS RELATED TO FRUITS AND VEGETABLES



SDGs 2 3

Health benefits of fruit and vegetables
Harness the goodness

Fruit and vegetables have multiple health benefits. They strengthen the immune system, combat malnutrition and help prevent non-communicable diseases.



SDGs 2 3

Diversified diet and a healthy lifestyle
Live by it, a diverse diet

Adequate amounts of fruit and vegetables should be consumed daily as part of a diversified and healthy diet.



SDGs 2 3

Food loss and waste
Respect food from farm to table

Fruit and vegetables are worth more than their price. Maintaining their quality and assuring their safety across the supply chain, from production to consumption, reduces losses and waste and increases their availability for consumption.



SDGs 2 3

Highlighting the role of family farmers
Growing prosperity

Cultivating fruit and vegetables contributes to a better quality of life for family farmers and their communities. It generates income, creates livelihoods, improves food security and nutrition, and enhances resilience through sustainably managed local resources and increased agrobiodiversity.



SDGs 1 2 3 4 5 8 11 12 15

Sustainable value chains
Foster sustainability

Sustainable and inclusive value chains can help increase production, and help to enhance the availability, safety, affordability and equitable access to fruit and vegetables to foster economic, social, and environmental sustainability.



SDGs 1 2 3 4 5 8 11 12 15

Source: Fruit and vegetables – your dietary essentials, FAO background paper, FAO, Rome

















