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Advances in Production Technology of Marigold and Gomphrena

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Abstract *Tagetes erecta* and *Gomphrena globosa* are important commercial ornamental crops with increasing demand in floriculture, pharmaceutical, and industrial sectors. Recent advances in production technology have significantly improved their yield, flower quality, stress tolerance, and post-harvest performance. In marigold, major advancements include hybrid seed production through genic and cytoplasmic male sterility systems, triploid breeding, marker-assisted selection, mutation breeding, and tissue culture techniques for rapid multiplication of elite genotypes. Improved cultivation practices such as pinching, precision irrigation, artificial lighting systems, integrated nutrient management, biofertilizer application, and the use of plant growth regulators have enhanced productivity and flower quality. Modern post-harvest technologies, including cold chain management and pigment extraction, have further increased commercial value. Similarly, advancements in gomphrena production technology include improved pinching methods, biofertilizer use, high-density planting, and optimized growing substrates for better growth and yield. Advanced drying and dehydration techniques have improved post-harvest quality and color retention of dried flowers. Molecular characterization and variability studies have supported genetic improvement, while plant growth regulators such as GA_3 and NAA have enhanced flowering, vegetative growth, and flower longevity. Overall, the integration of modern breeding, biotechnology, precision cultivation, and post-harvest management has strengthened sustainable and profitable production of marigold and gomphrena.

Keywords Genetic improvement; Hybrid breeding; Micropropagation; Postharvest management; Ornamental horticulture; Sustainable floriculture

1 Introduction

Marigold (*Tagetes erecta* L.) is an important commercial ornamental flower with increasing demand in Nepal due to its cultural, religious, and economic significance. Flower growers are attracted to its cultivation because of its profuse flowering habit, earliness, wide range of attractive flower colours, forms, sizes, and excellent market demand for loose flowers (Datta and Singh, 2008). Marigold (*Tagetes erecta* L.), belonging to the family Asteraceae, accounts for more than half of the global loose flower production (Jyothi et al., 2018). In Nepal, marigold, locally known as *Sayapatri*, remains an integral component of festivals, religious ceremonies, and social events, where flowers are commonly used for garlands and offerings (Gaenszle et al., 2005; Floriculture Association Nepal (FAN), 2023). Beyond its ornamental importance, marigold has gained considerable industrial value owing to its applications in landscaping, pharmaceutical products, cosmetics, poultry feed as a natural source of lutein and xanthophyll pigments, and extraction of bioactive compounds, thereby increasing its commercial significance worldwide.

Globe amaranth (*Gomphrena globosa* L.) is an ornamental species belonging to the family Amaranthaceae, valued for its attractive papery flower heads, long vase life, and excellent suitability as a dried flower crop. The flowers occur in purple, pink, yellow, and white colours and are widely used in landscape gardening, floral arrangements, and ornamental containers. The species thrives under full sunlight and moderately dry soil conditions, making it suitable for cultivation in diverse agroecological environments (Gilman and Howe, 2007). Besides its ornamental value, *G. globosa* has attracted increasing attention as a source of natural pigments and bioactive compounds, including vitamin C, β-carotene, flavonoids, and phenolic compounds with antioxidant, antimicrobial, and