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"Clean enviroment & economic prosperity through floriculture"

Floriculture Association Nepal (FAN)
Jwagal-11, Lalitpur Nepal, Tel: +977-1-5269089, 9768773802
fan_nepal@yahoo.com, fanepal2049@gmail.com, info@fanepal.org.np
www.fanepal.org.np, www.nepalfloraexpo.com.np

Krishna Ram Thapa
Proprietor

Thapa Nursery
Dachhinkali-1, Taudaha, Kathmandu

THAPA NURSERY

TU Gate, Kirtipur, Kathmandu
Contact No.: +977 9769354226, 9818214548
Email: krishnaramthapa2@gmail.com

विभिन्न जातका रुख, फलफुलको बोट, सजावटी विरुवा, मौसमी फुल,
कार्पेट ग्रास र गार्डेन डिजाईनका लागि हामीलाई सम्झनुहोस् ।

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"Clean environment & economic prosperity through floriculture"

Editorial Committee:

Dr. Umed Pun

Rajesh Bhakta Shrestha

Lok Nath Gaire

Janga Bdr. Tamang

Floriculture Association Nepal (FAN)

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नेपाल सरकार

मा. रामनाथ अधिकारी
मन्त्री
मा. कृषि तथा पशुपन्छी विकास मन्त्रालय

सिंहदरबार, काठमाडौं
इमेल: adhikariramnath263@gmail.com
minister@moald.gov.np

शुभकामना

फूल अँफिमा प्रकृतिले दिएको एक सुन्दर उपहार हो । आजको विश्व जगतको रहनसहन साथै दिन प्रति दिन बढ्दै गईरहेको आधुनिक जीवनशैलीले गर्दा फूलको महत्वलाई अझै बढि विशिष्टीकृत गरेको छ । नेपालमा रहेको जातीय, सांस्कृतिक तथा धार्मिक विविधता र त्यससंग सम्बन्धित चाडपर्वले त फूल र फूल खेतीको महत्वलाई झनै बढाएको छ ।

हाम्रो देशको जलवायु र भौगोलिक विविधता पुष्प व्यवसायको लागि निकै उपयुक्त रहेको पाइएको छ। पुष्प खेती तर्फ कृषकहरुको अभिरुची बढ्दै गएको र फूलको आन्तरिक बजार दिनानु दिन बढ्दै गएको छ। पुष्प तथा पुष्पजन्य व्यवसायको विकास विस्तार तथा प्रबद्धन निजी क्षेत्रले महत्वपूर्ण भुमिका खेलेको छ। यसको मुख्य श्रेय फ्लोरिकल्चर एशोसिएसन नेपाललाई जान्छ भन्ने मलाई लागेको छ । नेपालको कृषि पर्यावरणिय विविधता, यहाँ पाइने स्थानीय तथा रैथाने पुष्प तथा पुष्पजन्य प्रजातीहरुको पहिचान, संरक्षण, सम्बर्द्धन र व्यवसायीक प्रयोजनका लागि पुष्पको व्यवसायीक विकासमा नेपाल सरकार कृषि तथा पशुपन्छी विकास मन्त्रालयको सदैव सहयोग रहने छ।

यसै सन्दर्भमा फ्लोरिकल्चर एशोसिएसन नेपालले पुष्प व्यवसायसंग सम्बन्धित विविध लेख रचना सहितको "नेपालीज फ्लोरिकल्चर" बुक, २७ औं संस्करणको रुपमा प्रकाशन गरी पाठक सामु ल्याउन लागेकोमा मलाई खुसी लागेको छ । यो पुस्तिकाले पुष्प तथा पुष्पजन्य व्यवसाय सम्बन्धी अभिरुची राख्ने व्यवसायीहरु, उद्यमीहरु, विद्यार्थीहरु, अध्ययन अनुसन्धानकर्ताहरु सबैलाई उपयोगी हुनेछ भन्ने विश्वास लिएको छु । पुष्पको संस्थागत विकास, विस्तार तथा प्रबर्द्धन साथै पुष्पको परनिर्भरतालाई हटाउँदै आत्मनिर्भर उन्मुख यस व्यवसायको दिगो विकासका लागि सहयोगी बनोस भन्दै "नेपालीज फ्लोरिकल्चर" बुक, प्रकाशन गर्न लाग्नु भएकोमा फ्लोरिकल्चर एशोसिएसन नेपाललाई नेपाल सरकार, कृषि तथा पुशपन्छी विकास मन्त्रालय र मेरो व्यक्तिगत तर्फबाट हार्दिक बधाई तथा शुभकामना व्यक्त गर्दछु ।

मा. रामनाथ अधिकारी
मन्त्री
कृषि तथा पशुपन्छी विकास मन्त्रालय

मितिः २०८१/११/१९

नेपाल सरकार
कृषि तथा पशुपन्छी विकास मन्त्रालय
नेपाल सरकार कृषि तथा पशुपन्छी विकास मन्त्रालय सिंहदरबार, काठमाण्डौं

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फ्याक्स : ४२७११९३५
सिंहदरबार, काठमाण्डौं
नेपाल

पत्र संख्या :
च.नं. :

शुभकामना सन्देश

नेपालको कृषि क्षेत्रमा बागवानी उप-क्षेत्र अन्तर्गतको पुष्पखेतीको योगदान महत्वपूर्ण रहेको छ। पुष्प खेतीतर्फ कृषकहरुको र पुष्पजन्य उपजहरुको प्रयोगप्रति उपभोक्ताको रुचि बढ्दै गएको देखिन्छ। पुष्प र आलांकारिक बोटविरुवाहरुको माग तथा आन्तरिक बजार दिनानुदिन बढ्दै गएको सन्दर्भमा उच्च निर्यात संभावना समेत बोकेको पुष्प व्यवसाय कृषि क्षेत्रको एक उदाउदो व्यवसायका रुपमा देखिएको छ। पुष्प तथा पुष्पजन्य व्यवसायको विकास, विस्तार तथा प्रवर्द्धनमार्फत आन्तरिक रोजगारी तथा आम्दानीका श्रोतहरुको विकासमा सहयोग पुगेको छ। सरकारी निकायका अलावा नीजि क्षेत्र र फ्लोरिकल्चर एशोसिएसन नेपालले पुष्पखेती र यसमा आधारित व्यवसायको विकास, विस्तार र प्रवर्द्धनमा खेलेको भूमिका महत्वपूर्ण र प्रशंसनीय छ।

नेपालको कृषि पर्यावरणीय विविधता र यहाँ पाईने स्थानीय तथा रैथाने पुष्प तथा पुष्पजन्य प्रजातिहरुको पहिचान, संरक्षण, सम्वर्द्धन र व्यवसायीकरणका लागि कृषि तथा पशुपन्छी बिकास मन्त्रालयले निरन्तर रुपमा आवश्वयक सहयोग गर्दै आइरहेको छ। पुष्प प्रवर्द्धन नीति २०६९ को तर्जुमा तथा कार्यान्वयन, पुष्प खेती तथा व्यवसाय प्रवर्द्धनका लागि सरकारी संरचनाहरुको व्यवस्था, स्वदेशी पुष्प व्यवसायको प्रवर्द्धनका लागि बजारीकरण प्रवर्द्धन तथा प्लाष्टिकजन्य र विदेशी फूलहरुको प्रयोगलाई निरुत्साहित गर्ने तथा आयात प्रतिबन्धजस्ता महत्वपूर्ण कदमहरु कृषि तथा पशुपन्छी विकास मन्त्रालयमार्फत अघि बढाइएका छन्।

फ्लोरिकल्चर एशोसिएसन नेपालले २६ औं फ्लोरा एक्स्पो आयोजनाको अवसर पारेर, पुष्प सम्बन्धित विविध लेख रचना सहितको २७औं संस्करणको रुपमा "नेपालीज फ्लोरिकल्चर" बुक, प्रकाशन गरी पाठक सामु ल्याउन लागेकोमा मलाई खुशी लागेको छ। यो पुस्तक पुष्प तथा पुष्पजन्य व्यबसाय सम्बन्धी अभिरुचि राख्ने व्यवसायीहरु, उद्यमीहरु, विद्यार्थीहरु, अध्ययन-अनुसन्धानकर्ताहरु सबैलाई उपयोगी हुनेछ भन्ने विश्वास लिएको छु। मिति २०८१ चैत्र १ देखि ४ गतेसम्म आयोजना गरिने २६ औं फ्लोरा एक्स्पो पुष्प व्यवसायको संस्थागत विकास, विस्तार तथा प्रवर्द्धन तथा यस व्यवसायको दिगो विकासका लागि सहयोगीसिद्ध होस् भन्ने आशा राख्दै "२६ औ फ्लोरा एक्स्पो" को पूर्ण सफलताको लागि हार्दिक शुभकामना व्यक्त गर्दछु।

.....
डा. गोविन्द प्रसाद शर्मा
सचिव
कृषि तथा पशुपन्छी विकास मन्त्रालय
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नेपाल उद्योग वाणिज्य महासंघ
Federation of Nepalese Chambers of Commerce & Industry
FNCCI

P.O. Box : 269
Sahid Sukra
FNCCI Milan Marg, Pachali
Teku, Kathmandu, Nepal
Tel. : 4262061, 4262218, 4266889
Fax : 977-1-4261022, 4262007
E-mail : fncci@mos.com.np
http://www.fncci.org

शुभ–कामना

नेपालको भौगोलिक बनावट सबै प्रकारका फूल उत्पादनका लागि उपयुक्त मानिन्छ। नेपाल उद्योग वाणिज्य महासंघको सदस्य फलोरिकल्चर एसोसिएसन नेपालले हरेक वर्ष आयोजना गर्दै आएको पुष्प मेलाले पनि मुलुकभित्र व्यवसायिक पुष्प खेतीको प्रवर्द्धनका लागि महत्वपूर्ण भूमिका खेल्दै आएको छ। संघकै अनवरत प्रयासका कारण फूलको आन्तरिक खपत वृद्धिका साथै विस्तारै निर्यात समेत हुन थालेको छ।

नेपालमा पनि फूलको माग निरन्तर बढी रहेको छ । आन्तरिक मागको धेरैजसो प्रतिशत स्वदेशी उत्पादनले पुरा गर्न थालेको छ । केही अनुकुल परिस्थिति नभैदिएको भए आन्तरिक मागलाई स्वदेशी उत्पादनले पुरा गर्ने अवस्था बनिसक्ने थियो । कोभिड महामारीदेखिनै थलापरेको पुष्प व्यवसाय अहिलेसम्म पनि राम्रोसंग तङग्री नसकेको यस व्यवसायमा लागेका व्यवसायी साथीहरुबाट सुनेको छु।

स्वदेशी पुष्प व्यवसायलाई फस्टाउने वातावरण बनाउन आन्तरिक उत्पादनको प्रवर्द्धन एवं खपतमा जोड दिनुपर्ने, पुष्प नीतिलाई संघीय संरचना अनुसार परिमार्जन गर्नुपर्ने, पुष्प व्यवसायी कृषकहरूको हकमा भ्याटमा अनिवार्य जानुपर्ने प्रावधान हटाउनुपर्ने लगायतका सुझावहरू संवोधन हुनुपर्नेमा महासंघको पनि जोड छ।

यस वर्ष चैत्र १ देखि ४ गतेसम्म काठमाडौंमा हुने २६ औं फ्लोरा एक्स्पोको अवसर पारेर एसोसिएसनले प्रकाशन गर्न लागेको Nepalese Floriculture Book पुष्प व्यवसाय गर्न चाहना राख्ने सबैलाई महत्वपूर्ण सन्दर्भ सामग्री हुने मेरो विश्वास छ। साथै, पुष्प परनिर्भरता चाँडै हटाई मुलुकका लागि आवश्यक सबै प्रकार र जातका फूलहरू उत्पादन गरी राष्ट्रिय आवश्यकता पुरा गर्न यहाँहरूलाई सफलता मिल्दै जाओस भन्ने शुभेच्छाका साथ यहाँहरूको उत्तरोत्तर प्रगतिको कामना गर्दछु।

अन्त्यमा, **२६ औं फ्लोरा एक्स्पो** र **Nepalese Floriculture Book Volume 27** प्रकाशन कार्यको पूर्ण सफलताका लागि हार्दिक शुभ-कामना व्यक्त गर्दछु।

(चन्द्र प्रसाद ढकाल)
अध्यक्ष

मितिः २०८१ फागुन ९ गते, शुक्रबार।

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Floriculture Association Nepal (FAN)

Ref.:

सन्देश

फ्लोरिकल्चर एशोसिएसन नेपाल (फ्यान) ले समग्र पुष्प व्यवसायी सदस्यहरुको हक हितलाई उच्च प्राथमिकतामा राखि निरन्तर रुपमा पुष्प व्यवसायको बिकास बिस्तार तथा प्रबर्द्धनको कार्य गर्दै आइरहेको छ। विगत वर्षहरुमा सरकारको लगानी बिनानै निजी क्षेत्रको एकल प्रयासबाट नेपाली पुष्प व्यवसायले उल्लेख्य उपलब्धि हासिल गरि सकेको छ। पुष्प प्रबर्द्धन नीति २०६९ लागु भए पछि नेपाल सरकार कृषि तथा पशुपन्छी विकास मन्त्रालय तथा मातहतका निकायहरुसंगको सहकार्यमा पुष्प व्यवसायले झनै फड्को मार्यो। हाल नेपालमा ५२ जिल्लामा २६० हेक्टर भन्दा बढि क्षेत्रफलमा पुष्प व्यवसाय भईरहेको, ११७४ भन्दा बढि पुष्प व्यवसायीहरु संलग्न रहि व्यवसाय गरिरहेको, अनुमानित लगानी रु.८ अर्व ८३ करोड भन्दा बढि रहेको, प्रत्यक्ष तथा अप्रत्यक्ष रुपमा गरि ५१,५०० भन्दा बढि जनशक्तिहरु रोजगार रहेका र पुष्प तथा पुष्पजन्य बस्तुको बार्षिक कारोबार ३ अर्व ६८ करोड भन्दा बढि रहेको छ। हरेक बर्ष १० देखि १५ प्रतिशतको दरले पुष्प तथा पुष्पजन्य वस्तुको बजार माग थपिने गरेको छ। तथापी अझै आन्तरिक बजारको मागलाई स्वदेशी उत्पादनले पुरा गर्न सकिरहेको छैन। पुष्पको बजार माग र आपुर्तिको असन्तुलनलाई सन्तुलित गर्नका लागि फ्यानले सरकार, संघ संस्था एवं उद्यमी व्यवसायीसँग बहस पैरवी र सहकार्य गर्दै आइरहेको छ। यति हुदा हुदै पनि पुष्प व्यवसाय तथा व्यवसायीहरुले बिभिन्न कालखण्डमा विभिन्न समस्या र चुनौतीहरुको सामना गर्नु परिरहेको अवस्था छ। पुष्प व्यवसायमा आइपरेको चुनौती र समस्याहरुलाई सहजिकरण गर्दै आइरहेको छौं।

हालै संसोधित बिउ बिजन नियमावली लागु भएपछि उत्पन्न भएको समस्यलाई समाधान गर्न नेपाल सरकार कृषि तथा पशुपन्छी बिकास मन्त्रालय तथा सरोकारवाला मातहतका निकायहरुमा पहल गरिरहेका छौं। सरकारी प्राथमिक्तामा परेको कृषि बालीहरुः (तरकारी, मसल, धान, दलहन, तेलहन, उखु आदि) लाई जस्तै पुष्प बालीलाई पनि प्राथमिक्ताको सूचिमा राखी नेपाल सरकारको संघिय संरचनामा समावेश गरि यस संघको निर्यात गर्ने नीतिलाई थप सहयोग पुऱ्याउनका लागि पनि हाम्रो पहल जारी रहेको छ। सरकारको प्राथमिकता आ-आफ्नै भएतापनि पुष्प उद्योगको लागि पुर्वाधारको विकास, नीतिगत व्यवस्थापन, जनशक्तिको उचित विकास र प्रविधिको हस्तान्तरणका क्षेत्रमा सरकारको लगानी हुनु आवश्यक छ। यस क्षेत्रमा उच्च प्रविधियुक्त ग्रिनहाउस, थोपा सिंचाई तथा मिष्ट सिंचाई प्रणालीसंगै वाटर सोलुवल फर्टिगेसन सिस्टम, नियन्त्रित (रोग तथा किराको लागि) प्रणाली सहितको नयाँ प्रविधि भित्र्याउनको साथै थप लगानी गर्न अत्यन्त आवश्यक छ। यी प्रबिधीको प्रयोगले आन्तरिक गुणस्तरिय उत्पादनमा बृद्धि हुने साथै गुणस्तरिय उत्पादनबाट अन्तराष्ट्रिय बजारमा प्रतिस्पर्धा योग्य वस्तुको बिकास हुनेछ। यसैको माध्यमबाट विश्व पुष्प बजारमा हामीले आफ्नो पहुच पुऱ्याउन सघाउ पुग्नेछ। पुष्पको छुट्टै बजार बिकास हुन अति आबश्यक छ। बिशेष पुर्वधारयुक्त पुष्पको बजार बिकासका लागि सरोकारवाला मन्त्रालय/निकायबाट सहयोगको अपेक्षा गरेका छौं।

अन्तमा हामीलाई सहयोग गर्ने नेपाल सरकारका अंगहरु, उद्यमी व्यवसायीहरु, विज्ञहरु लगायत पदाधिकारी र कर्मचारी साथीहरुलाई आ-आफ्नो क्षेत्रबाट पुष्प व्यवसाय र एशोसिएसनलाई उपलब्ध गराउनु भएको सल्लाह, सुझाब र सहयोगको लागि हार्दिक आभार प्रकट गर्न चाहन्छु। आगमी दिनहरुमा यहाँहरुको सदैब साथ र सहयोग रहनेछ भन्ने समेत आशा लिएको छु।

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राजेश भक्त श्रेष्ठ
अध्यक्ष

Jwagal-11, Lalitpur Nepal, Tel/Fax: +977-1-5261089
Email: fan_nepal@yahoo.com, fanepal2049@gmail.com, Web: www.fanepal.org.np; www.nepalfloraexpo.com.np

सम्पादकीय

नेपालको पुष्प व्यवसाय प्रर्याप्त सम्भावना बोकेको एक रत्न हो, जसले संवृद्धिको बाटो तय गर्न सक्दछ । आजको विश्व जगतको दिनानुदिन परिवर्तित जीवन शैलीलाई पुष्प तथा पुष्पजन्य वस्तुको उपभोगले थप आनन्दित र उर्जावान बनाउन सहयोग गरिरहेको छ । हामी पनि यहि क्रममै छौ । हालैका वर्षहरूमा नेपाली पुष्प व्यवसायको उत्पादन तथा उपभोगमा उल्लेखनीय बृद्धि भएको छ । नेपालको विविध हावापानी, उर्वर भूमी र समृद्ध जैविक विविधताले विभिन्न प्रकारका फूलहरूको खेती गर्न पर्याप्त आधार प्रदान गर्दछ । यहाँको अनुकुल जलवायुको उपयोग गरी मौलिक तथा रैथाने सम्पदाको बिशाल भण्डारबाट हाम्रा बोट बिरुवाको ब्यवसायिक उत्पादनले स्थानीय तथा अन्तर्राष्ट्रिय बजार दुवैमा प्रतिस्पर्धी बन्ने क्षमता राख्दछ । यद्यपि, पुष्प व्यवसायीक क्षेत्रले अझै पनि धेरै चुनौतीहरूको सामना गरिरहेको छ । अत्याधुनिक पूर्वाधार तथा प्रबिधी र अनुसन्धानमा गरिएको न्यून लगानीले आशातित प्रतिफललाई टाढा पुऱ्याएको छ ।

सरकार र निजी क्षेत्रको समन्वयात्मक लगानी र सहयोगले कुनैपनि उद्योगले आशातित प्रतिफल दिन सक्दछ । पुष्प उद्योगमा निजी क्षेत्रले मेला, महोत्सव, प्रकाशन, समन्वय लगायत दर्जन भन्दा बढी वार्षिक कार्यक्रमहरु संचालन गरीरहदा आक्रमक बजार बिस्तार र उपभोग शैलिमा नाटकिय परिवर्तन संभब भइरहेको छ । यसले उपभोक्ताको रुचि र खपतमा अत्यधिक मोह बढ्न गएको छ । तीन दशक बढी फ्लोरिकल्चर एशोसिएसन नेपालले यसमा निरन्तर नेतृत्व लिई काम गरिरहेको छ । तर सरकारको दायित्व भित्र पर्ने पुष्पको अनुसन्धान र बिकाशमा समय सापेक्ष आबश्यक कार्य अघि बढ्न नसक्नाले आन्तरिक उत्पादन बढ्न नसकि आयातबाट माग पुरा भईरहेको छ र दिन प्रति दिन आयातको आकार भयावह बन्दै गईरहेको छ । सरोकारवाला निकायहरुले बेलैमा यस तर्फ ध्यान दिनु पर्ने आजको आबश्यकता रहेको छ ।

फ्लोरिकल्चर एशोसिएसन नेपाल (फ्यान) ले हरेक बर्ष पुष्प सम्वन्धी लेख, रचना, अध्ययन, अनुसन्धान, सुचना तथा आधुनिक खेती प्रबिधीका बिबिध बिषयहरुलाई समेटी पुस्तक प्रकाशन गर्दै आएको छ । यसै क्रममा यस बर्ष पनि बार्षिक रुपमा प्रकाशन हुदै आएको Nepalese Floriculture पुस्तक २७ औं संस्करणको रुपमा प्रकाशन गरी तपाँईहरु समक्ष ल्याई पुऱ्याएका छौं ।

प्रस्तुत अंकमा, फ्लोरिकल्चर उद्योगमा हालको प्रगति, हरित शहरः पहल र सम्पदा रूखहरू, गुलाब फूलः पोष्टहार्वेस्ट फिजियोलोजी र शारीरिक विकार, सफल नर्सरी व्यवस्थापन, पोटेड बिरुवाहरूः वृद्धि र गुणस्तर सुधार, बहुमुखी मेरिगोल्डः नेपाली संस्कृतिमा परम्परा र उपयोगिताको प्रतीक, फूल प्रसादः विश्वास, स्थिरता र सामाजिक परिवर्तनको यात्रा, बगैंचामा फोहोरः धनकुटा नगरपालिकाको अनुकरणीय कार्य, नेपालका शोभनीय प्रिमुलाहरु आदि जस्ता लेखहरु समेटिएको छ । पुष्प क्षेत्रमा लाग्नु भएका उधमी व्यावसायीहरु, अध्ययन अनुसन्धानमा लाग्नु भएका महानुभावहरु, सरकारी तथा गैर सरकारी संघ संस्थाहरु लगायत सम्पूर्ण पुष्प प्रेमी महानुभावहरुले थोरै भएपनि पुष्प सम्बन्धी सामग्रीहरु प्राप्त गर्नु हुनेछ र यसबाट लाभान्वित हुनु हुनेछ भन्ने आशा लिएका छौं ।

अन्त्यमा यस प्रकाशनमा लेख रचना उपलब्ध गराई सहयोग गर्नुहुने लेखकहरु, विज्ञापन दाताहरु प्रति हार्दिक धन्यवाद ज्ञापन गर्दछौं । आगामी दिनहरुमा पनि यहाँहरुको अमुल्य सुझाब, सहयोग र सद्भावको अपेक्षा गर्दछौ । प्रकाशनका क्रममा भएका कमी कमजोरी औल्याई परिमार्जन सहित यसको स्तर उन्नती गर्न र समय सापेक्ष बनाउन यहाँहरुको सदैब रचनात्मक सहयोगको अपेक्षा गर्दछौं ।

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Recent Advances in Floriculture Industry

Pratikshya Ghimire[1], Nirajan Bhandari[1], Ganesh Lamsal[2], Umed Pun[3]
College of Natural Resource Management, Agriculture and Forestry University, Pakhribas, Dhankuta, Nepal[1]
College of Natural Resource Management, Agriculture and Forestry University, Marin, Sindhuli, Nepal[2]
King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand[3]
Corresponding author email: pratikshyaghimire10@gmail.com

Abstract

The floriculture industry, a vital subsector of ornamental horticulture, has witnessed significant advancements in enhancing sustainability, productivity, and quality. This review paper explores the recent innovations reshaping floriculture, including modified farming methods, soilless cultivation, biotechnology, nanotechnology, blockchain, precision farming, and post-harvest technologies. Techniques such as greenhouse cultivation, vertical farming, and integrated farming are gaining popularity for their ability to improve resource efficiency and meet market demands. Soilless technologies like hydroponics and aeroponics offer advantages in water and fertilizer usage, and high-quality flower production with reduced environmental impact. Genetic engineering and biotechnology, including tissue culture and molecular breeding, are revolutionizing the industry by enhancing flower traits such as color, disease resistance, and post-harvest longevity. Nanotechnology, with applications in flower preservation and disease resistance, is improving shelf life and reducing the need for chemicals. Blockchain technology is fostering transparency and traceability in the supply chain, while precision farming tools, including AI and IoT, are optimizing growing conditions for better yield and quality. Finally, innovations in post-harvest technology are extending the vase life of flowers, minimizing waste, and improving marketability. Despite the potential benefits, challenges such as high costs and technical expertise requirements hinder the widespread adoption of these technologies. Continued collaboration among scientists, growers, policymakers, and consumers is essential for overcoming these barriers and ensuring a sustainable and profitable future for the Nepalese floriculture industry.

Keywords: Floriculture, Quality, Advancements, Sustainability, Technologies

Introduction

Floriculture is one of the most significant subsectors of ornamental horticulture to satisfy aesthetic needs in the market (Kuzichev & Kuzicheva, 2016). From the perspective of product groupings, floriculture can be categorized into four groups bedding/garden plants, pot plants (including pot flowers and pot greens), cut flowers, and cut foliage (Adebayo *et al.*, 2020). The cultivation and marketing of various flower varieties, such as cut flowers, loose flowers, and cut greens, are all included in the field of floriculture (Bodh, 2024). Producing plants for their aesthetic value is a unique form of agriculture that attracts many producers (Altman *et al.*, 2022). But, floriculture is trying to adapt and meet the present challenges of changing consumer preferences, climate change, and market trends. Thus, with time, new and emerging agricultural technologies and their adoption are helping the ornamental business to constantly improve its production, distribution, and marketing procedures (Wani *et al.*, 2023). Through innovations like precision agriculture, remote sensing, biotechnology, digitalized indoor vertical farming, Internet of Things (IoT) intervention, blockchain technology (BCT), information and communication technologies, and big data analytics, nuclear technology, floriculture sector is enhancing the product sustainability, productivity and quality of produce (Boruah, 2024; Chaudhary *et al.*, 2024).

Along with these, molecular marker-assisted breeding and phenotyping to select superior cultivars have brought floriculture production to its peak. Artificial intelligence (AI), robotics, and automation have also been crucial in lowering labor costs and boosting productivity in the flower-growing industry (Wani *et al.*, 2023). The enhanced post-harvest technology and marketing strategy has uplifted the value chain and market transit (Chaudhary *et al.*, 2024). These advancements enable growers to produce high-quality floral crops with sustainability in production. Modified cultural practices like hydroponics, aeroponics, and vertical farming have strongly influenced flower production (Rabiya, 2024). With the application of greenhouse technology in the production of ornamental plants year round cultivation of flower according to market demand has been possible. Adopting the latest technologies and trends enables stakeholders to set themselves up for success in continuously changing market scenarios with support for the long-term growth of the flower industry (Rabiya, 2024). Thus, the emerging technologies in floriculture are revolutionizing the flower industry, enabling producers to produce high-quality plants more efficiently and sustainably according to market needs and demand.

Modified farming methods

Modified techniques of farming like greenhouse cultivation, vertical farming, integrated cultivation, precision irrigation and fertigation, and organic farmingare highly popular for sustainable cultivation. Integrated farming methods combine two or more commodities or enterprises, according to the resources available to sustain and meet as many of the owner's needs as feasible with increased production per unit area and facilitate the effective recycling of agriculture wastes, improved resource use, job creation, risk mitigation, and guarantee sustainability (Maitra & Shankar, 2019). Greenhouse cultivation or protected cultivation is a method of creating an artificial environment where crops can be grown in regulated conditions (Rabiya, 2024). It can improve floriculture cultivation with improved quality, yield, and diversity with year-round production in ideal microclimatic conditions (Rabiya, 2024). Also, it protects plants from pests and diseases with the creation of a barrier between plants and the outside environment (Wani *et al.*, 2023). The current greenhouse climate model was created by measuring the effects of natural ventilation from the roof and sides as well as the transpiration effect of crops on temperature and vapor pressure verified for higher efficacy (Kumar *et al.*, 2010). Plants such as roses, daisies, chrysanthemums, carnations, lilies, cyclamen, and gerberaare highly popular for greenhouse cultivation (Sharma *et al.*, 2024). Along with the greenhouse, several other protected structures as; net houses, shade houses, hotbeds, and cold frames are useful (Slathia *et al.*, 2018). Growing flowers vertically entails layering plants vertically, in controlled settings or indoor environments (Wani *et al.*, 2023). Vertical farming has the potential to transform the flower industry by providing a more sustainable, efficient, and cost-effective way to grow flowers (Wani *et al.*, 2023). It makes precise regulation of the growing climate all day long, which might help floriculture by lessening the impact of sunlight on humidity and temperature (Rabiya, 2024). There are several irrigation methods like drip irrigation, mist irrigation, and irrigation with fertilization which are useful for monitoring water levels easily and efficiently (Nayak *et al.*, 2024). Thus, several modified techniques as mentioned can help to address challenges in floriculture from resource efficiency to market demands.

Soilless Technology

Hydroponics, Aeroponics, Aquaponics, and Substrate culture are among the popular soilless

technologies in floriculture. In comparison to soil cultivation, the soilless technique yields shorter growth times with year-round production and fewer diseases and pests (Bihari *et al.*, 2023). With soilless technology, sustainable use of water and fertilizers can be promoted (Nazim *et al.*, 2023). The use of microorganisms builds up the resistance of plants against pests and diseases, thereby lowering the need for chemicals (Nazim *et al.*, 2024). With hydroponics, environmental factors like pH balance and nutrient levels can be precisely monitored and adjusted, leading to healthier plants and more effective development (Rabiya, 2024). With the elimination of soil, soilless cultivation conserves water and opens opportunities in urban areas, such as residential rooftop farming and indoor plantations (Wani *et al.*, 2023). Substrate culture as cocopeat, and perlite is highly popular in urban areas for indoor cultivation due to its stability and root support. Aeroponics promotes strong, quick root growth which speeds up plant development, enhances nutrient absorption efficiency, and reduces the risk of root disease (Rabiya, 2024). Horticulture and ornamental plants such as cut flowers (chrysanthemum, rose, gerbera), blooming bulbous plants (yellow crocus (Sternbergia lutea), lily, tulip), potted ornamental plants (anthurium, rubber, cyclamen, etc.) were grown in the soilless culture system successfully (Karagoz *et al.*, 2022). The capacity to regulate growing conditions precisely is a major advantage of soilless flower gardening. By regulating the humidity, temperature, and nutrient concentrations of the growing solution, we can optimize plant growth and flower quality (Wani *et al.*, 2023). Thus, soilless technology is one of the innovative methods to solve the problem of land shortage while responsibly growing high-quality crops (Bihari *et al.*, 2023).

Genetic engineering and Biotechnology

Biotechnology and genetic engineering are the revolutionizing techniques in the floriculture industry. Techniques like tissue culture, molecular breeding, genetic modification of crops, genome editing, trans-genetics, and use of genetic markers are popularly used in various ornamental crops to improve and manipulate qualitative and quantitative traits (Wani *et al.*, 2023). With the use of genetic engineering, a desired gene can be easily inserted in floricultural crops although the gene may not be available in the natural gene pool (Chandler & Brugliera, 2011). The combination of biotechnology with conventional breeding methods is used by cut flower breeders to alter the flower color, plant architecture, post-harvest characters, and resistance to disease, pests, and stress of floricultural crops (Azadi *et al.*, 2016). Also, the use of biotechnology helps to reduce post-harvest losses of ornamental crops with improved longevity and quality of produce (Salunkhe *et al.*, 2012). Marker-assisted breeding is popularly used to identify desirable genes and traits in ornamental crops, such as improved color, and longer vase life (Wani *et al.*, 2023). Tissue culture and clonal propagation help in the mass production of plants with desired traits in controlled conditions with uniform quality (Datta, 2019). In vitro propagation has been used not only for the development of large-scale quality produce of new and difficult-to-root varieties but also for hybrid maintenance, chimera management, and acclimatization for the development of new and novel varieties (Datta, 2019). Thus, biotechnology in floriculture opens up exciting opportunities for the florist to fulfill the growing demands of the market and for consumers to explore the quality traits according to their needs and desires.

Nanotechnology

Nanotechnology is being explored for several uses, such as improving flower quality, disease resistance, and shelf life in the flower industry (Wani *et al.*, 2023). Nanoparticles due to their small

size (1-100nm) have atypical physical, chemical, optical, and magnetic properties that make them useful in floriculture for gaining sustainability in production (Rai *et al.*, 2022). In the floriculture industry, postharvest life is greatly affected by the petal senescence and abscission which is the result of microbial growth in the xylem vessels of the flower and heavy ethylene production in the floral organs. So, the antibacterial properties of nanoparticles (eg. nano-silver) and nanomaterials (eg. graphene oxide (GO)) can be used to extend the vase life of many cut flowers, improve packaging for shelf life, prevent microbial growth in water, and inhibits the ethylene production (Wani *et al.*, 2023). Nano-pesticides and nano-fertilizers, enhance the efficacy and specificity of pesticides, improve nutrient use efficiency and plant absorption, and minimize the risk of pollution to the ecosystem (Kapoor *et al.*, 2024). Nano-sensors and Nano-biosensors are designed to detect changes in temperature, humidity, nutrient levels, and other factors that affect plant growth and provide farmers with early warning signs of potential problems (Wani *et al.*, 2023). Hence, nanotechnology can be one of the most important methods to minimize the maximum use of chemicals and increase the input use efficiency along with its potential to improve production by monitoring soil and plant health along with the prediction of pests or diseases (Atal *et al.*, 2021).

Block Chain Technology

Blockchain is the ledger in which agents alternately record details about the creation, sale, and consumption of goods and services (Xiong *et al.*, 2020). Blockchain technology has promising applications in floriculture and is used to enhance the supply chain, traceability, and transparency (Wani *et al.*, 2023). Customers can use it to verify the freshness, quality, and place of origin of flowers and to feel more confident about the goods they buy (Wani *et al.*, 2023). Producers can use it to improve payment systems without the interference of intermediaries (Wani *et al.*, 2023). In addition, blockchain technology can help to minimize the risk of fraud, and mislabeling in the flower industry with transparency as it has been proposed for auctioning and trading of products (Sendros *et al.*, 2022). Blockchain technology's decentralized nature and management can be used for agricultural insurance, smart farming, traceability, land registration, food supply chain, farm security and safety, and e-commerce of agricultural productsas the world becomes more digitalized in the near future (Xiong *et al.*, 2020; Sajja *et al.*, 2023). Since floriculture is amongst the agri-industry with the minimal integration of digital technologies, the use of ICT tools as blockchain will be an easy way to bring digitization and solve the problems in transparency, traceability, and efficiency in the supply chain (Sendros *et al.*, 2022). In brief, these technologies are still in their infancy and difficult to use because of their complexity, but they seem very heartening and full of potential, demonstrating good versatility for applications in multiple areas (Antonucci *et al.*, 2019).

Precision farming

Precision farming is the concept of farm management with continuous monitoring and adjusting to intra-field variation (Mandal *et al.*, 2021). It uses mechatronics to manage fields with reduced environmental risks as compared to conventional methods (Nayak *et al.*, 2024). Precision farming is a modern and scientific approach to sustainable agriculture that uses new technologies such as Global Positioning Systems (GPS), satellites or aerial images, Geographical Information Systems (GIS), Remote sensing, and Internet of Things (IoT) (Mandal *et al.*, 2021; Nayak *et al.*, 2024). GPS is a navigational tool, based on satellites applied for crop scouting, soil sampling, field mapping, farm planning, and yield mapping (Mandal *et al.*, 2021). It enables precise

equipment installation within inches, monitored input application, and specific fertilizer and pesticide applications considering soil characteristics (Nayak *et al.*, 2024). GIS suggests creating and displaying digital maps using a computer to monitor the cropping system, disease, and pest infection area monitoring, and judging several attributes affecting ornamental crop production (Mandal *et al.*, 2021). Remote sensing information from satellites or airplanes can offer important insights about weed infestation, growth, and agricultural conditions which are beneficial for site-specific cropping management (Nayak *et al.*, 2024). IoT has the potential to enhance the supply chain and flower production's effectiveness and quality control. With the use of IoT sensors and gadgets, cultivators and distributors can improve farming conditions, and guarantee fresh and highest-quality flowers for customers (Wani *et al.*, 2023). Large amounts of environmental and plant growth data can be analyzed by Artificial Intelligence (AI) algorithms to find trends and forecast the best growing circumstances of several kinds of flowers (Wani *et al.*, 2023). The integrated use of AI, IoT, and machine learning can help the floriculture industry and supply chain management. AI and machine learning can assist growers and distributors in making data-driven decisions for increased productivity, quality, and sustainability and IoT sensors and devices can help them minimize waste and optimize growing conditions (Wani *et al.*, 2023). Thus, precision agriculture also known as smart farming is the farming technique for sustainable management by collecting real-time data on temperature, humidity, soil moisture, and nutrients so that growers can optimize inputs, minimize waste, and improve yield and quality of produce (Rabiya, 2024).

Post-Harvest Technology

Post-harvest technology is essential to maintain the quality and freshness of produce from harvest to use by end consumers. The main aim of post-harvest preservation is to elongate the vase life of cut flowers and improve their quality in the market (Wani *et al.*, 2023). There are several techniques to extend the shelf life of flowers and flower preservation, including the use of ethylene action inhibitors, growth regulators, floral preserving treatments, temperature regulation, and flower dehydration (Costa *et al.*, 2021). Initially, a major concern for improved longevity of flowers is the proper stage of harvesting the plant according to the distance to deliver. The use of sucrose in a pulsing solution or as a component of a vase solution delays the senescence of cut flowers either by increasing water balance and energy or with a decrease in ethylene production (Costa *et al.*, 2021). Techniques such as reverse osmosis and UV sterilization help to improve the quality of water used in flower care as water quality is highly essential for post-harvest vase life (Wani *et al.*, 2023). Storage in lower temperatures is highly applicable to reduce carbon dioxide concentration and ethylene production in flowers but, chilling sensitive flowers as bird-of-paradise, heliconia, and orchids, cannot be stored below 10- 13°C because of the severe tissue discoloration. The use of plant hormones as; rose sprayed with 1-mM GA3 suppressed the development of postharvest diseases by inhibiting the senescence-related changes, Benzyl adenine (BA) improved the vase life of *Anthurium andraeanum, Heliconia psittacorum, Heliconia chartacea*, and *Alpinia purpurata* by 1.5-2.5 folds. Also, the use of ethylene inhibitors such as Rhizobitoxin analogs as Aminoethoxyvinylglycine (AVG) or Aminooxyacetic acid (AOA) can improve the vase life of orchids (Costa *et al.*, 2021). Thus, the elements that greatly affect the regulation of cut flower senescence are handling conditions, environment, plant hormone activity, carbohydrate content, and water relations. The quality and durability of cut flowers are being enhanced by innovations in post-harvest technology, which additionally aids in lowering waste and improves the sustainability of the floral industry.

Conclusion

Floriculture is an attractive sector of agriculture, thus the emerging technologies mentioned are highly beneficial to uplift the production and productivity of ornamental plants in Nepal. New and emerging agricultural tools and techniques made the sector more attractive to the growers and can play significant role in improving the quality of the produce. However, barriers like high initial costs, technical skill requirements, and technological know- have made it difficult to adopt these technologies. As the floriculture sector develops, scientists, practitioners, policymakers, and consumers must collaborate and develop new ideas for a more resilient, sustainable, and bright future. Thus, with further support and guidance, innovative techniques can uplift the Nepalese floriculture industry with sustainable and profitable production.

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प्रो.
Mob.: 9840439925
9826729115

Mob.: 9849852741

मेलिशा नर्सरी

सुन्दरबस्ती, भंगाल, काठमाडौं

यहाँ विभिन्न किसिमका सिजन अनुसारको बोटबिरुवा, फलफूल, फूलहरु, गमला, मल पाउनुका साथै इन्डोर, आउट डोर गार्डेन डिजाइन गर्न हामीलाई सम्झनोस् ।

Green City Initiative and Heritage Trees

Umed Kumar Pun
King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand
Email: umedpun@gmail.com

Abstract

FAO Green City Initiative began in 2020 to support cities across the world to improve its green urban regeneration, increasing well-being of urban and peri-urban population and promoting sustainable urban development. The role of trees in the urban greenery development is significant as old town and cities of Nepal have old and large trees across the country. However, due to lack of policy, such trees are indiscriminately cut down in some cities. If such, trend is not stopped by new policy ensuring conservation of such trees there could be further losses of such trees. Commissioning of large, historical, religious, culturally and horticulturally important trees in a city as Heritage trees could help in safeguarding and better conservation. Heritage trees of a city will have identity number, will be taken care of by the city and no part of the tree can be pruned without the approval of the Heritage trees committee of the city council.The heritage trees will be the pride ofCityand help young people and public in general to understand, appreciate, love and care these beautiful trees that lived before us and will live after us.

Introduction:

Food and Agriculture Organization's (FAO) Green City Initiative (GCI) began in 2020 and assist cities to identify, develop and implement strategies tailored to their context contributing to green urban regeneration, increasing health and well-being of urban and peri-urban population, supporting mitigation and adaptation to climate shocks and minimization of the carbon footprint, strengthening urban-rural linkages, and promoting sustainable urban development (FAO, 2020). This is achieved by integrating urban and peri-urban forestry, agriculture and bioeconomy into the fabric of urban life.Trees form significant segment in the green cover of a city and are important component for the greenery of the city. Earlier study in Kathmandu valley public office gardens has revealed that the highest number of plant species were trees (Nirajan and Pun, 2022). However, old trees are not only the symbol, legacy but also an important part of the ecosystem that stabilizes the environment of the city. In every city and towns of Nepal, we see huge trees in the middle of the city. These tree species are mostly Ficus religiosa (Peepul) or *Ficus benghalensis* (Bar) because both of these tree species is very important both to the Hindu and Buddhist community (Amatya et al, 2024). These trees are very large with huge tree canopy, wide circumference of the trunk and represent a landmark of the part of the city where it majestically stands. They are easily more than 100 years old and many are more than few hundred years old (Amatya *et al.*, 2024) testifying their successful adaptability to the local conditions despite of the changes in the climate over the centuries.

Since time immemorial, in Nepal these trees were used for planting in *Chautaro*, a resting place builtby using flat stones beside the walking trails for people moving from one place to another (Elias and Burbunk, 2014). The construction of *Chautaro* in the earlier times used to be a philanthropic activity and ideally, during the opening of the *Chautaro*, a sapling each of Peepul and Bar used to be planted (often symbolically marrying them). *Chautaro* provided the much-needed resting place for the travellers along the trails and interestingly provision was made in the *Chautaro* to

rest their doko, a traditional bagpack made from *Bambusa species* to carry stuff. The development of road infrastructure in rural region resulted in less use of the walking trails eventually resulting with no maintenance of the *Chautaro*in many places but the trees still exist. However, in city like Pokhara early planners of the road infrastructure saved large trees wherever possible and designed the road accordingly. Those trees have grown into healthy and large trees numbering about 48 *Chautaro* in Pokhara metropolitan city (Gautam, 2024) and many have become iconic land mark of the location. Unfortunately, in 2024, in Pokhara metropolitan city, ward 19 of Nepal, extreme chopping/pruning resulting in retention of few branches and trunk was observed in large and iconic Peepul or Bar trees (Anonymous, 2024a). There were reports in social media where local government directed citizens to cut down their trees or else face monetary penalty and action. The reason given was to deter monkeys from visiting the human settlements and robbing off food crops (Anonymous, 2024a). Subsequent study resulted in the evidence of chopping in 56 trees out of 1435 trees in the city (Gautam, 2024). Pokhara Metropolitan government (ward no 19) approved for such heinous action to these trees without understanding the historical significance as well as environmental benefit. There was lots of criticism in the social media and the mayor intervened and overruled the notification given by the ward chair (Anonymous, 2024b). Cutting down trees definitely impacts environment negatively but whether or not it deters monkey visit is unknown and yet to be proven. Thus, taking action, such as cutting trees without hard fact with regards to monkey infestation is matter of grave concern.

Furthermore, recent controversy in 2025 about severe pruning (only trunk and few branches left) of old and large Chautora trees primarily Peepul and Bar trees in Pokhara Metropolitan for religious ceremony is a matter of grave concern (Anonymous, 2025). In contrast, some major cities such as Kathmandu Metropolitan (Parks and Greenery Management Project) and Lalitpur Metropolitan (Garden and Greenery section) have planted thousands of trees along the road, open spaces and parks. The importance of planting trees is important for the quality of life to the city dwellers. It is a proven fact that trees help in lowering the temperature, absorbs pollutants and facilitate infiltration of water that improves ground water recharging. Lalitpur Metropolitan city in 2024 went even further and declared large, historically, religiously and important trees as Champion trees (Amatya, *et al.*, 2024). The inconsistent policies of the local government with regards to conservation and planting of trees warrants urgent attention and intervention by the federal government. Nepal is vulnerable to climate change and the federal government policy is conserving trees and planting trees whereas inconsistent action by the local government creates confusion. It is therefore important to have uniform policy for plantation and conservation of trees in the urban regions of Nepal and have a designated tree officer in the government as is been practiced in India (Anonymous, 1994a). The policy should be no felling of large and historical trees unless it is dead and is hazardous to property and member of the public. In India, for trees, any construction work happening 1m from the tree needs clearance from the designated treeofficer. This has largely deterred indiscriminate tree felling and hopefully improved greenery of the city. In about 2 decades, the average minimum temperature is in an increasing trend in Bharatpur Metropolitan city. This is a cause of concern in all the cities of the country more so in the terai. Besides, lately the rapid installation of Air Conditioner in Nepal will add to spike in the summer temperature of cities in the terai and also major cities across the nation especially in the Kathmandu valley.

It is therefore very important to identify, conserve and celebrate these old trees of the city and increase greenery in the city. It is now important that thesetrees are discovered, their stories told and let the people within the city and beyond enjoy these majestic heritages. To do this, we need to estimate their trunk size, age, cultural/religious/historical significance, uncover their underlying stories, do some facelift and highlight them as the heritage trees.The heritage trees will be the pride ofCityand help young people and public in general to understand, appreciate, love and care these beautiful trees that lived before us and will live after us.

Heritage trees

Heritage trees are trees that have been formally recognized by the City Council for their unique size (trunk diameter more than 4.5'), age (more than 100 years), historical, religious, and horticultural significance (Anonymous, 1994b). Heritage trees are designated with small plaque so they can be identified by the public and listed in the Heritage Tree database.In the US, the first state-sponsored heritage tree program began in 1995 in Oregon state with the Giant Sitka Spurce (*Picea sitchensis*) tree.

(Cinnamomum camphora), Ekanta Kuna, Ward #13, Lalitpur Metropolitan City

Why to designate Heritage tree?

Declaration of an old, large and historical tree as Heritage tree by a city will give the tree identity, protection and purpose. Conservation and protection of these trees will send a strong message that the city cares not only for the people but also its old trees.

Role of Town/City government:

a. Formation of Heritage Trees of Town/City Committee with the Mayor as Chair and Advisor (Floriculture and Landscaping) as member secretary and three other expert members (Forestry, Botanist and Horticulturist).
b. Approval of the Town/City council to adopt the selected trees as Heritage trees.
c. Town/City government will take care of the tree and annual general health check-up will be conducted by a forester or a horticulturist assigned by Town/City.
d. Town/Citygovernment responsible for the protection and wellbeing of the heritage trees.

How to designate Heritage tree?

a. Identification of old and large trees.
b. Identification of trees with historical, cultural or horticultural significance.
c. Measurement of the Diameter at Breast (DBH) of the trunk at 1.3m height.
d. Estimation of the age of the tree based on DBH.
e. If the DBH is more than 4.5' and estimation of the age of the tree is more than 100 years, that tree will be selected. However, if the trees are historically important or falls under endangered species as per CITES, they could be also considered.
f. All selected trees to be designated as HERITAGE TREE should be approved by the city council.
g. In future, new trees can be nominated by the member of the public to the heritage committee of City to designate as Heritage tree. The committee will investigate and if meeting the criteria (4.5' trunk diameter and more than 100 years) recommendation can be given for the city council to approve.
h. Approved new tree as Heritage tree shall be added into the list of Heritage trees.

Privileges of a Heritage tree:

a. Annual general health check-up will be conducted by a forester, or a horticulturist assigned by City.
b. All Heritage trees will be given identification number by the City.
c. No pruning or training of the tree can be done without the approval of the Heritage trees committee of the City.
d. In a situation where the tree is dying or is a threat to the safety, the Heritage Trees committee will approve for decommissioning of the tree and allow removal.
e. Heritage trees committee will meet twice a year or when required in special cases to evaluate the health conditions of the Heritage trees and for inclusion of new trees as heritage trees.

Heritage trees in Nepal:

Lalitpur Metropolitan City is in the process to declare about 10 trees as Heritage trees for the first time in Nepal.

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Rose flower: Postharvest Physiology and Physiological disorder

Dr. Debraj Adhikari, Senior Plant Protection Officer
Plant Quarantine and Pesticide Management Centre, Hariharbhawan, Lalitpur, Nepal

Introduction

Rose, a member of the Rosaceae family and the genus *Rosa*, derives its name from the ancient Greek word *rhedon*, signifying its remarkable fragrance (Yadav *et al.*, 1989). Often referred to as the "queen of flowers," roses are among the most cherished garden shrubs. Their leaves, typically 5–15 cm long, are pinnate with 5–9 leaflets, featuring serrated margins and sometimes small prickles on the stem's underside. The fruit of the rose, known as a rose hip, is an aggregate, berry-like structure. Roses flourish in sunny locations, free from shade and competition with tree roots. A garden without roses is considered incomplete (Arora, 2007). In the Kathmandu Valley, cut rose production, except for high-tech units, takes place from summer to autumn, whereas in the Madhesh and Terai regions, it occurs from winter to spring (Joshi, 2009). Beyond garden cultivation, roses serve as exquisite cut flowers for table arrangements and bouquets (Adhikari, 2009). When displayed in vases, rose cut flowers enhance interior aesthetics. Generally, varieties with more petals slow blooming, and extended vase lives are preferred as cut flowers. Additionally, loose rose flowers are widely used for garlands, religious offerings, and perfume production.

Postharvest Physiology

Cut flowers consist of multiple morphological components compared to leafy vegetables, roots, or fruits, making their postharvest behavior a complex interaction among sepals, petals, ovary, stem, and leaves (Bautista, 1990). Each of these floral structures, including the sepals, petals, androecium, gynoecium, stem, and leaves, undergoes senescence at varying rates, adding to the intricacy of their postharvest management. The delicate and perishable nature of rose cut flowers necessitates careful handling techniques to maintain their quality. Flowers require careful, patient, and expert handling, as even minor damage can significantly impact their aesthetic appeal and vase life. Once detached from the plant, cut flowers continue their metabolic processes by utilizing stored carbohydrates, proteins, and fats to sustain their freshness for a limited period (Patil & Singh, 2008). Given that cut flowers are a luxury item, ensuring their postharvest quality and

extending their vase life is crucial to maintaining their market value.

The longevity of cut flowers after harvest is a critical factor in commercial rose production. For economic viability, it is essential to ensure both high-quality flowers and an adequate vase life. Since transporting cut flowers to distant markets demands an extended shelf life, effective postharvest management plays a vital role in preserving their freshness and overall appeal (Pun, 2003). Significant losses of fresh-cut flowers can be minimized by carefully addressing the factors that contribute to postharvest deterioration. Implementing proper handling, storage, and transportation practices can substantially enhance the quality and longevity of cut flowers, ultimately benefiting both growers and consumers.

Postharvest physiology of cut rose

The longevity of cut flowers in a vase is one of the most crucial factors influencing consumer preference. Studies indicate that selecting long-lasting cultivars over short-lived ones can more than double the vase life of cut flowers. This highlights the significant role that cultivar selection plays in determining flower longevity. However, the lifespan of cut flowers is not solely dependent on the cultivar; other factors such as pre-harvest conditions including cultivation practices, environmental factors, and overall plant management also contribute to postharvest durability. Additionally, the conditions in which flowers are stored and handled after harvest play a crucial role in extending their freshness and visual appeal. Proper care at both pre-harvest and postharvest stages, including optimal watering, nutrient management, temperature regulation, and handling techniques, can significantly enhance the vase life of cut flowers, making them more desirable to consumers.

Key biological processes affecting postharvest physiology

Transpiration (Water loss)

The deterioration of cut flowers in vase solutions is primarily caused by ongoing transpiration from the leaves and a decline in water absorption, leading to a net loss of moisture from the flower, stem, and leaf tissues. In roses, water deficit stress often results in bent neck disorder, ultimately shortening their vase life. Excessive water loss is a major factor that negatively affects both the storage quality and longevity of cut flowers. When flowers continue to lose water after being detached from the plant, they experience an imbalance, which accelerates wilting. To minimize water loss, it is essential to cool cut flowers immediately after harvesting. Since cut flowers contain a significant amount of water, a reduction of just 10-15% of their fresh weight can cause visible wilting symptoms. Proper hydration management and cooling techniques are crucial in maintaining the freshness and visual appeal of cut flowers for an extended period.

Respiration

Respiration is a vital metabolic process that supplies energy to all living cells, including those in cut flowers. After harvest, cut flowers rely on stored energy reserves, primarily starch and sugars, to sustain respiration and support essential cellular activities. The rate at which respiration occurs is directly influenced by temperature, with higher temperatures accelerating the process in an exponential manner. This increase in respiration leads to faster depletion of stored reserves, ultimately reducing the lifespan of cut flowers. Since respiration plays a critical role in determining postharvest longevity, managing temperature is essential to prolonging vase life. By maintaining

cool storage conditions, the rate of respiration can be slowed down, helping to conserve energy reserves and extend the freshness of cut flowers. Proper postharvest handling techniques, such as refrigeration and the use of floral preservatives, can effectively regulate respiration and enhance the overall quality and longevity of cut flowers.

Hormonal imbalance

After harvest, the hormonal balance in cut flowers often undergoes significant changes. Stress conditions can trigger increased ethylene production, which accelerates senescence or petal drop in ethylene-sensitive varieties. The effects of ethylene are observed only when plant tissues possess ethylene receptors, making them responsive to this hormone. Another key hormone involved in flower senescence is abscisic acid (ABA), which plays a crucial role in response to water stress. ABA levels tend to rise in leaves and petals due to water deficiency and can also result from the breakdown of carotenoids in leaves. Higher concentrations of ABA may contribute to the early aging of flowers in certain species. Additionally, once flowers are cut, they no longer receive cytokinins from the plant's roots. The absence of cytokinins, which play a vital role in delaying leaf senescence, leads to premature leaf yellowing. These hormonal imbalances significantly impact the postharvest life of cut flowers, emphasizing the need for proper storage, hydration, and hormone regulation strategies to extend their freshness and aesthetic appeal.

Senescence

Senescence can be broadly defined as the series of physiological and biochemical processes that occur after a plant, organ, tissue, or cell reaches full maturity, eventually leading to its deterioration and death. In cut flowers, senescence is a crucial factor influencing their postharvest longevity and overall quality. The aging process in flowers, particularly roses, is marked by visible symptoms such as browning and necrosis at the petal edges, weakening of petal attachment, and ultimately, petal drop. As senescence progresses, both the fresh and dry weight of the flower gradually decline due to moisture loss and the breakdown of cellular components. This deterioration significantly affects the aesthetic appeal and market value of cut flowers. Understanding the mechanisms of senescence can help in developing effective postharvest management strategies, such as the use of floral preservatives, temperature control, and hormone treatments, to delay the aging process and extend the vase life of cut flowers.

Physiological disorders of rose cut flower

Discoloration of foliage (Yellowing and darkening)

Green leaves, bracts, and the green calyx of flower shoots typically remain fresh longer than the non-chlorophyll-containing petals. Flowers with green petals tend to have a longer vase life compared to those with the usual colored petals. There are two primary types of foliage discoloration: yellowing and darkening. Yellowing occurs when chlorophyll, proteins, and nucleic acids in the leaves break down, and it worsens when cut flowers are kept in the dark or exposed to high temperatures. On the other hand, leaf darkening, which involves browning and blackening, results from the oxidation of natural phenolic compounds, primarily leucoanthocyanins. These compounds react with other cellular elements to create dark, condensed byproducts. Water stress exacerbates this darkening process. The blackening of leaves leads to a depletion of leaf carbohydrates, causing additional issues for the flower's longevity. Interestingly, while continuous

sucrose and pulsing treatments did not help prevent leaf blackening and sometimes even worsened it, reducing glucose and fructose concentrations helped alleviate the problem in both leaves and flowers. This highlights the importance of managing sugar levels and environmental conditions to minimize foliage discoloration and improve postharvest quality.

Abscission of petals

Abscission, the process in which flower parts detach from the plant, is often the final stage of flower senescence. This natural process can be accelerated by various external factors such as mechanical stress (e.g., shaking or wounding), exposure to high temperatures, and certain gases. These factors can trigger a rapid shedding of petals, with petals responding much more quickly than leaves. For example, in roses, high temperatures can hasten petal shedding, leading to early abscission. Ethylene, a plant hormone, is a key promoter of this process, encouraging the shedding of flower buds and petals in many plant species. Additionally, in many flowers, the act of pollination, and especially fertilization, can also trigger the abscission of flower parts, particularly the petals. This is part of the plant's natural lifecycle, signaling the end of the flower's reproductive phase. Understanding these triggers can help improve postharvest handling techniques, such as controlling environmental conditions, to reduce premature petal loss and prolong the vase life of cut flowers.

Geotropic bending (Neck bending)

Bending of the flower stem and inflorescence in response to gravity is a significant issue for certain cut flowers, particularly during transportation when they are held horizontally. This problem is especially common in cut roses, where the vase life is often relatively short. The flowers tend to wilt, and the floral stem may bend just below the flower head, a condition known as "bent-neck." This phenomenon is generally attributed to vascular occlusion, a blockage in the water-conducting vessels, which restricts the flow of water to the flower, leading to wilting. Additionally, this issue can also arise from harvesting flowers at an immature stage. Roses that are cut at an earlier, less mature stage are more prone to bending than those harvested at later, more developed stages. The immature flowers are less able to maintain structural integrity during transport, and their susceptibility to bending increases. Understanding the factors that contribute to this condition, such as the timing of harvest and the conditions during transport, can help develop strategies to minimize stem bending and extend the vase life of cut roses. Proper handling and hydration techniques are crucial to ensuring flowers remain upright and fresh for longer periods.

Discoloration of foliage

Petals rot, abscission of petals

Neck bending

Conclusion

The postharvest physiology and physiological disorders of rose flowers significantly influence their longevity, aesthetic appeal, and economic value in the cut flower industry. Factors such as transpiration, respiration, hormonal imbalances, and senescence impact postharvest life, necessitating effective management strategies. Water loss due to transpiration leads to early wilting and bent neck disorder, requiring immediate cooling and hydration treatments. Respiration depletes stored carbohydrates, making temperature control crucial for longevity. Hormonal imbalances, including ethylene biosynthesis and abscisic acid accumulation, accelerate deterioration, which can be mitigated through ethylene inhibitors and controlled environments. Physiological disorders like foliage discoloration, petal abscission, and geotropic bending reduce market value, often resulting from stress conditions and poor storage. Addressing these challenges through proper cultivation, postharvest handling, and storage techniques, alongside advancements in postharvest technology, can enhance flower freshness, reduce losses, and sustain economic viability in the cut rose industry.

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Successful Business Starts with Nursery Management

Ineke van Meggelen – Laagland MSc
PUM Expert Horticulture

The author of this article is a horticulturist from the Netherlands, former lecturer at universities and now volunteers Expert of PUM Netherlands. In July 2024 I had the pleasure to execute a training programme in the beautiful scenery of Ilam requested by FAN. FAN is an NGO that works for the benefit of its members with an aim to organize and promote floriculture business in Nepal. It focusses on enhancing product quality and market promotion of its members utilizing various tools and techniques. My assignment was in line with enhancing product quality and aiming at self sufficient market for camellia and double azalea. The visited nurseries in Ilam are relatively small and have awide assortment of pot plants. Apart from delivering to the market many of the growers sell (part of their) produce insmall plastic houses at the nearby roadside. From my almost 40 years experience I have shared best practices with the growers, with focus on double azalea and camellia. To my opinion these best practices should be available for all FAN growers as they apply to many crops. For that reason, I decided to list many of the advises I gave, without the illusion of being complete.

Before starting a cultivation

First thing to consider before starting cultivation is to question: What is your market? Is there a demand for the product that you want to produce? What is the size of the demand? What is the quality standard? How is your marketing, direct sales, middle man, whole sale market? Only after determining your market, you can decide to grow a specific crop. After all, if there are too many plants of a variety the price may go down because of oversupply. As an example: in Ilam many nurseries have a small greenhouse with succulent plants. There had been a big demand some years ago, but now the demand is very low. Having these plants still in a greenhouse, even still investing in propagating them, seems more like a nice hobby then good entrepreneurship.

Lay out of the nursery

After deciding which crop to grow the nursery lay out has to be clear. Is it indoor (plastic house, shading house) or in the field? What cultivation system will you use, for instance on the floor (with or without cover), on tables or other elevated systems? What is your water source (well, spring, rain, tap) and what is the quality of the water? Always make a drawing of your nursery so you can make a planning of your cultivations. Make visible what the situation is during the year, for instance with a beam planning that combines the 52 weeks of a year with the available space. (see figure 1 for an example)

Month	1	2	3	4	5	6	7	8	9	10	11	12
bed1												
bed2												
bed3												
bed4												

As an example a beam planning for 12 months. The young plants start in January (1) on one bed. In March (3) we need to re-pot them and they will need double the space. As of June (6) all your beds are filled with the further spaced plants. As of October (10) you start delivering and have space for new plants. This beam planning can be further developed to see each week (so 52 columns instead of 12) and with more beds and different batches of plants.

Figure 1, Example of a beam planning per month

Cultivation planning

Especially pot plants require good planning. As they start as small plants or cuttings and they require little space. Later on they have grown in size, possibly have been re-potted, and require more space. To make sure that the space is available it is essential to have a good planning. Again a beam planning is helpful here.

Propagation

Propagation is often done by cuttings. This is an excellent way as the genetics are the same as the stock plants (also called mother plants). However, as stock plants age they tend to get minor problems like less vitality, affected by virus or some genetic changes. It is important to know how long you can keep the stock plants. For double azalea this is advised to be two harvests of cuttings, say one year. When the stock plants are older, they already have flower induction leading to flower buds in just rooted cuttings. This leads to less vegetative growth of the young plants, meaning less plant size and low quality.

In case problems like virus infection (figure 2) are observed in stock plants, they need to be refrained from production of cuttings. Stock plants that do no longer serve for production of cuttings, can be cultivated till flowering and be sold.

Figure 2, Virus infected azalea

In case of seed propagated crops the quality of the seeds has to be up to standard. Be aware that F1-hybrids will produce uniform plants in shape and flowers, but harvested seeds from the same plants will not have the same characteristics when used for next cultivations!

During propagation the climate has to be monitored well. Mostly a cover like plastic or shading net has to be provided to keep humidity high and/or avoid too much light on the young plants. Remember that the cutting cannot take up water as it does not have roots yet. To promote root formation rooting powder can be used containing IBA. Major problem in this phase can be damping-off which is caused by fungi due to high humidity and high temperature.

Substrate and fertilizer

The substrate used is also of major importance for the plants. It provides anchorage to the plant and storage of water and nutrients. Often chopped leaves from the forest are used in Ilam, sometimes mixed with cow manure, coarse sand or forest soil. Options for improved substrates are (addition of) coco peat, coco coir, bark, rice hulls as well as inert material like pumice and perlite. One very important issue to keep in mind is the structure of the substrate. There needs to be enough water holding capacity, draining capacity as well as air (pores). Other aspect to observe is the possible presence of seeds of weeds and soilborne diseases. The most reliable are substrates (especially for coco-substrates) bought from suppliers with a good (certified) quality control system.

In any case, analysis of substrates will lead to the best information on the composition and total amount of macro- and micro nutrients and the pH. Each plant has its own optimum in these aspects. For double azalea a pH of around 4.5 to 5 is required for good growth as well as a low number of nutrients (indicated as EC).

Irrigation

Potted plants need to have sufficient supply of water as they are not able to get water from the substrate or soil. The water provided needs to be of good quality, meaning clean. Depending on the source of water there might be nutrients in the water, biological pollution like algae, fungi, bacteria or weed seeds. Bore hole water may contain iron, which may disturb the irrigation system. That iron is not available for uptake by the plant due to oxidation. Calcium- or magnesium carbonate may be present in water (hardness of the water). Depending on the amount this leads to high pH. Problem with the higher pH is that applied nutrients are not available for uptake by the plant. So again: have an analysis done on your water source for the content of nutrients, pH and hardness of the water. This is not limited for irrigation, but also counts when applying crop protection chemicals as some are prone to low half-life time when the hardness or the pH of the water is not correct.

Irrigation is often done by hose, whereas a drip irrigation system may reduce the loss of water caused by overirrigation. By not wetting the upper plant parts during irrigation they are less prone to fungal infestation. In case of high humidity combined with high temperature drip irrigation helps to lower the additional humidity caused by evaporation of water from the soil/substrate. It is important that plant parts are dry soon after sun set to prevent fungal and bacterial infections.

Crop protection

As the cultivation progresses, problems with pests and diseases may show. In line with international standards Integrated Pest Management (IPM) is the way to follow. The first step is to prevent problems, for instance by maintaining good hygiene measures. As an example, dead or diseased plant material needs to be removed from the cultivation area. Also we need to have strong plants, properly supplied with water, fertilizer and other conditions for growth. The next steps involve monitoring. By checking your crop regularly (scouting), you know what is happening. Monitoring involves the scouting and registration of occurrence of pests and diseases. Based on the numbers, e.g. white fly caught on yellow sticky traps, you can decide to take measures. If the threshold is not met yet, you can leave it as it is, otherwise you use crop protection products of natural orchemical origin for the specific pest or disease. Avoid broad spectrum chemicals as they will also have a killing action on natural enemies and are more harmful for humans and the environment. Avoid calendar spraying and alternate pesticides with different active ingredients (a.i.).

To check pests and diseases the next free apps are available on your mobile:

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- Plantwise Plus Factsheet Library (including downloadable country pack Nepal)

Make sure within your nursery you have a storage for crop protection products that is locked in a room that can be locked as well. Needles to say that you keep the chemical away from children and read the safety instructions on the label before applying the chemical. Apart from direct intoxication, there are long term health effects which should not be neglected.

Labour

Most labour is provided by the owner and his family. When the business gets bigger more workers are required. Needles to say that they need to have proper training on the job. Once well trained the workers can be of enormous added value in monitoring problems in the cultivation. They should feel free to notify the farmer that they have seen abnormalities like a spider mite infestation in a corner of the greenhouse. As the farmer you can then take action and have a small treatment in that area before it spreads throughout the greenhouse. If you involve the workers in this way, they will feel responsible for what happens in the nursery. They will be proud to be part of the team that delivers good quality produce.

Postharvest

When having produced good quality pot plants, you want them to reach the final consumer in good condition. To do so, be aware that the potted plants are packed appropriately and have enough moisture in their substrate to survive some days. Take care of proper storage and transport conditions in terms of temperature and humidity. Most pot plants can be stored at around room temperature (e.g. 20 °C) when light is available. High temperatures lead to wilting of the plants and loss of vigour. Try to keep the time between collection in the nursery and arrival at the consumer as limited as possible. Ideally the conditions throughout this chain are uniform and adequate for the specific product. Avoid transport of flowering plants, especially cut flowers, together with fruits and vegetables. The latter is likely to produce ethylene which is a plant hormone promoting aging. It may lead to early drop of flowers.

Conclusion

At present growing pot plants requires more than green fingers. The farmer needs to be an entrepreneur who is able to manage the cultivation as well as procurement, sales, marketing, human resources etcetcra. In this article many aspects are touched briefly and require further explanation and study to be able to apply in your nursery. Feel free to contact Floriculture Association Nepal (FAN) for more information.

About PUM

PUM is a Dutch non-profit organisation (NGO) that has an expert pool of professionals providing advice on voluntary basis. Horticulture is one of the sectors in which PUM has activities. Over the last 13 years FAN has requested several projects as well as Trade promotion visits to the Netherlands have taken place. All information that experts have given is available both hardcopy and soft copy at the FAN office. Colleagues that have taken part in trainings or visits are able to provide training based on this information to interested farmers (groups). Take the opportunity to professionalize yourself and request a training or information at FAN. They will be more than happy to help.

Potted Plants: Improving Growth & Quality

Rinus de Vreede,
Senior expert PUM the Netherlands

Introduction

During my visits in 2024, I noticed several key aspects. With simple solutions, significant improvements can be achieved. Unfortunately, costs always come before benefits, which is often a challenge. Some of the important factors for improving growth and quality of potted plants are briefly discussed below under five headings.

- Propagation of seeds and young plants
- Growing medium
- Nutrition
- Watering
- Focus on less

Propagation of Seeds and Young Plants

Let's start with the basics: sowing and cutting. Young plants and seeds need a protected space to grow safely. I like to call this the "baby room." Here, they are shielded from drafts and benefit from higher humidity. When sowing, it is essential to keep the soil moist. Covering the soil with plastic helps retain moisture and promotes germination.

Growing Medium

Below the surface, a plant's roots play a crucial role they form the foundation of the plant. For healthy root growth, the balance between solid particles, water, and air must be correct. The soil anchors the roots, ensuring plants remain upright and do not topple over.

The growing medium must retain water, but excess water should drain well to prevent root rot. Oxygen in the soil is essential for root respiration and energy supply. Moisture in the soil contains dissolved nutrients that the plant can absorb.

Different plant species have varying requirements for soil composition, but a general recommendation is:

- 60% garden soil
- 10% compost
- 10-20% cocopeat (coconut fiber)
- 10-20% sand, perlite, or rice husks

Nutrition

Plants need nutrients to grow. The first fertilization can be mixed into the soil before potting. An ideal choice is a balanced fertilizer such as 10-10-10 or 20-20-20. These numbers indicate the ratio of nitrogen (N), phosphorus (P), and potassium (K).

After preparing the soil, the EC (electrical conductivity) should be between 1.0 and 1.5 mS/cm for a good start. For seedling soil, a lower EC of 0.5 to 1.0 mS/cm is more suitable. These fertilizers cost money, and a cheaper alternative is chicken manure. However, it is not ideal, as its composition can vary. Still, something is better than nothing, and it is inexpensive. As plants grow for several months, the nutrients in the soil become depleted, requiring additional fertilization. It is best to apply a small amount of fertilizer weekly through irrigation. Soluble fertilizers can be used for this purpose. Since soil analysis is usually not performed, it is best to use a balanced fertilizer again. The recommended dosage is 1 gram per liter of water. Supplemental fertilization results in healthier plants with better color and greater resistance to diseases and pests.

Watering

Watering depends on several factors, including weather conditions, soil composition, and the plant's own needs. Naturally, more water is required on sunny days than on cloudy days. The best practice is to water several times a week to maintain consistent soil moisture levels. Some plants, such as poinsettia (Euphorbia pulcherrima), are particularly sensitive to fluctuations in soil moisture. A useful method for monitoring water needs is to regularly weigh a marked plant. This allows you to track changes in the pot's water content and better estimate when watering is necessary.

Focus on Less

As a grower, it is often beneficial to cultivate fewer different plant varieties. This makes the work more efficient and allows you to specialize more effectively. You become familiar with the specific needs of your crops, which helps improve quality and achieve better results.Additionally, it reduces costs since fewer types of seeds, fertilizers, and crop protection products are needed. This not only simplifies purchasing but also makes crop management easier. Watering, fertilizing, and pest control can be better coordinated, saving time on maintenance and care.

Final Tips

- **Always use your eyes** – While plants grow even when you're not watching, they require constant attention. This includes not only watering but also monitoring for diseases and pests, which can damage your valuable plants if left unchecked.
- **Visit other growers in groups** – Growers in the same region often face similar challenges, so why not find solutions together? Organize farm visits: sometimes they learn from you, and other times you learn from them. Collaboration raises the standard and keeps you sharp. This is how Dutch horticulture became so successful.

प्रो. उत्तम तिमल्सिना
फोनः ९८५१०७२४४१, ९८४१६३०५७८

तिमल्सिना नर्सरी

सानागाउँ, ललितपुर



हाम्रा सेवाहरूः
यहाँ विभिन्न जातका फूल, फलका विरूवाहरू पाउनुको साथै घर अनुसार बगैंचा डिजाइन, आइल्याण्ड निमार्ण र झरना पनि बनाइन्छ ।

प्रो. रेवती प्रसाद घिमिरे
मो.: ९८४१४१५६६४

घिमिरे नर्सरी

धापाखेल, ललितपुर



हाम्रो सेवाहरुः सिजनल फुलहरु, इन्डोर आउटडोर प्लान्ट, फलफुलका विरुवाहरु, गमला पाउनुको साथै जर्मन दुवो छाप्ने तथा गार्डेन डिजाईन पनि गरिन्छ ।

The Versatile Marigold: A Symbol of Tradition and Utility in Nepali Culture

Dilip Bade, Jai Kishan Nursery

Marigold flowers, known as "Sayapatri" in Nepali, are a key part of Nepal's cultural, religious, and social life. These bright flowers, with their rich yellow and orange colors, are beautiful and have significant symbolic and practical value. In this article, we will explore the many uses of marigold flowers in Nepal, from religious rituals to their applications in agriculture and medicine.

1. Religious and Spiritual Significance

1.1 Festivals and Ceremonies

Marigold flowers are very important during Nepali festivals and ceremonies. One of the biggest festivals is Tihar, also known as Deepawali, which is a five-day festival of lights. During Tihar, marigold garlands, or "mala," are used to decorate homes, temples, and even animals. The bright colors of marigolds are believed to attract the goddess Laxmi, who is the goddess of wealth and prosperity. On the third day of Tihar, known as Laxmi Puja, homes are adorned with marigold garlands, and oil lamps are lit to welcome the goddess. Marigolds are also used to create beautiful rangoli designs at the entrance of homes, symbolizing joy and festivity. The use of marigolds during Tihar reflects the deep-rooted cultural belief that these flowers bring good fortune and happiness. Another major festival is Dashain, the largest Hindu festival in Nepal. During Dashain, marigold flowers are used in various rituals. They are offered to deities and used to decorate the sacred space where the family's ancestral deities are worshipped. Family members also wear marigolds as garlands during the festival's main events.

During Chhath, a festival dedicated to the Sun God, marigolds are used to decorate the offerings and worship areas. The golden hue of marigolds is symbolic of the sun's rays, making them a fitting choice for this festival. The flowers are arranged in elaborate patterns and used to honor the deities, highlighting their importance in Nepali religious practices.

1.2 Weddings and Puja (Worship) Rituals

In Nepali weddings, marigold flowers play an important role. They are used to make garlands for the bride and groom, symbolizing the purity and sanctity of their union. Marigold petals are often scattered over the couple as a blessing for a happy and prosperous married life. The vibrant colors of the flowers add to the festive atmosphere, making the wedding ceremony even more special.

Marigold flowers are also used in daily worship rituals, known as puja, in many Nepali households. These flowers are offered to deities as a symbol of devotion and respect. The use of marigolds in pujas is common in homes, temples, and during large-scale religious gatherings. The flowers are arranged around idols and altars, creating a serene and spiritual environment. During special religious ceremonies, such as the initiation rituals for children or during the worship of family deities, marigolds are essential. They are used to adorn the sacred space and are often placed in the hands of the person performing the rituals as a mark of respect and devotion.

2. Cultural and Social Uses

2.1 Decorations and Aesthetics

Marigolds are widely used in Nepali culture for decoration. Their bright and cheerful colors make them a popular choice for decorating homes and public spaces during festivals and special occasions. Marigold garlands are often seen hanging at the entrances of homes and businesses, believed to bring good luck and ward off evil spirits. In rural areas, marigolds are used to decorate village squares and community centers during celebrations. The flowers are woven into intricate patterns and used to adorn gates, doorways, and arches. This practice not only beautifies the surroundings but also fosters a sense of community and shared joy. During national holidays and public events, marigolds are used to create large floral displays and decorations. These displays often include images of national symbols, such as the flag or important historical figures, crafted entirely from marigold flowers. This showcases the flower's versatility and its deep connection to Nepali identity.

2.2 Folk Traditions and Symbolism

In Nepali folk traditions, marigolds hold symbolic meanings. They are often associated with the sun due to their bright yellow and orange colors. This association makes them symbols of brightness, positivity, and life. In many rural areas, marigold flowers are used in traditional dances and cultural performances, adding a splash of color and enhancing the visual appeal. Marigolds are also used in folk medicine and traditional healing practices. Healers and shamans use marigold petals in their rituals to ward off evil spirits and bring good health. The flowers are believed to have protective properties and are used to make amulets and charms. In various parts of Nepal, marigold flowers are woven into the fabric of local myths and legends. Stories passed down through generations often feature marigolds as symbols of love, bravery, and divine blessings. These tales highlight the cultural importance of marigolds and their enduring presence in Nepali folklore.

3. Medicinal and Therapeutic Uses

Marigold flowers are not just for decoration; they have been used in traditional medicine for centuries. Known for their anti-inflammatory, antiseptic, and antifungal properties, marigolds are used to treat various health issues.

3.1 Herbal Remedies

In traditional Nepali medicine, marigold flowers are used to make herbal teas and infusions that help treat digestive issues, respiratory problems, and skin conditions. The petals are often used in poultices to treat wounds and infections due to their antiseptic properties. For instance, a poultice made from marigold petals can be applied to cuts and bruises to prevent infection and promote healing.

Marigold tea is commonly used to soothe stomach aches and improve digestion. The tea is made by steeping dried marigold petals in hot water, releasing the flower's medicinal properties. This remedy is popular in rural areas where access to modern medicine may be limited. In addition to treating physical ailments, marigolds are used in traditional healing practices to calm the mind and reduce stress. The flowers are often included in herbal baths and aromatherapy sessions, believed to have a relaxing effect on the body and mind.

3.2 Modern Applications

With the growing interest in natural and organic products, marigold extracts are now used in modern skincare and health products. They are incorporated into creams, lotions, and ointments designed to soothe skin irritations, reduce inflammation, and promote healing. Marigold-based skincare products are particularly popular for their gentle and natural properties, making them suitable for sensitive skin. Marigold oil, extracted from the flowers, is used in aromatherapy and massage therapies. The oil is believed to have calming effects and is used to alleviate anxiety and promote relaxation. It is also used in the treatment of minor skin infections and irritations, showcasing the flower's versatility in modern medicine. In the field of natural medicine, marigold extracts are being studied for their potential benefits in treating various diseases. Research has shown that marigold extracts have antioxidant properties, which may help protect against chronic diseases such as cancer and heart disease. This has led to the inclusion of marigold extracts in dietary supplements and health foods.

4. Agricultural Benefits

4.1 Companion Planting

Marigolds are widely used in Nepali agriculture as companion plants. They are planted alongside crops to repel pests and improve soil health. The strong scent of marigold flowers deters harmful insects, reducing the need for chemical pesticides. This practice is particularly beneficial in organic farming, where maintaining ecological balance is crucial. Farmers plant marigolds next to vegetables like tomatoes, peppers, and beans to protect them from pests such as aphids and nematodes. The marigolds act as a natural pest deterrent, allowing farmers to reduce their reliance on chemical pesticides and promote healthier crops. In addition to repelling pests, marigolds attract beneficial insects such as ladybugs and bees. Ladybugs help control aphid populations, while bees are essential for pollination. By planting marigolds, farmers create a more balanced and sustainable farming environment.

4.2 Soil Improvement

Marigolds are known to improve soil health by secreting substances that suppress harmful nematodes and other soil-borne pests. This makes them valuable in crop rotation and sustainable farming practices. Farmers in Nepal have long recognized these benefits and incorporate marigolds into their farming systems to enhance crop yield and soil fertility. The roots of marigold plants release chemicals into the soil that inhibit the growth of harmful nematodes, which can damage crop roots and reduce yields. By planting marigolds in rotation with other crops, farmers can naturally reduce nematode populations and improve soil health. Marigolds also help improve soil structure and fertility. As they grow, their roots break up compacted soil and improve its aeration and drainage. When marigold plants decompose, they add organic matter to the soil, enriching it with nutrients and promoting the growth of healthy crops.

5. Economic Impact

5.1 Local Markets

The cultivation and sale of marigold flowers have significant economic implications in Nepal. During festival seasons, the demand for marigolds skyrockets, providing income opportunities for local farmers and flower vendors. Markets across the country are filled with vibrant displays of marigold garlands, attracting buyers from all walks of life.

In addition to festivals, marigolds are sold year-round in local markets for use in daily worship and special occasions. Flower vendors in towns and cities earn a livelihood by selling fresh marigold garlands, bouquets, and loose petals. The flower trade supports the local economy and provides employment opportunities for many individuals.

5.2 Export Potential

Nepal's floriculture industry has been expanding, with marigolds being a key export product. The flowers are exported to neighboring countries and used for similar cultural and religious purposes. This trade contributes to the national economy and provides livelihoods for many individuals involved in the cultivation, processing, and export of marigolds.

5.3 Value-Added Products

5.3.1 Incense (Dhoop) from Waste Marigold Flowers

An innovative and sustainable way to use marigold flowers economically is the production of incense, or dhoop, from waste marigold flowers. After the flowers have served their decorative or ceremonial purpose, they can be collected and processed into incense sticks. This practice not only reduces waste but also creates a valuable product that is in high demand. The process involves drying the marigold petals and mixing them with other natural ingredients such as wood powder, essential oils, and natural resins. The mixture is then shaped into sticks or cones and left to dry. This environmentally friendly approach provides additional income for farmers and small-scale manufacturers, creating jobs and supporting the local economy. The production of marigold incense has gained popularity as more people seek eco-friendly and natural alternatives to synthetic products. Incense made from marigold flowers is not only aromatic but also carries the added benefit of repelling insects, making it a practical choice for households and religious ceremonies.

5.3.2 Extraction of Pigment from Marigold Flowers

Marigold flowers are also a rich source of natural pigments, particularly carotenoids, which can be extracted and used in various industries. The extraction of pigment from marigold flowers has significant economic potential, offering a natural alternative to synthetic dyes. The pigment extraction process involves drying the marigold petals and then using solvents to extract the carotenoids. The resulting pigment can be used in the food industry as a natural colorant for products such as cheese, butter, and beverages. It is also used in the cosmetic industry to add color to products like lip balms, eyeshadows and creams. The use of natural pigments is becoming increasingly popular due to growing consumer awareness of the potential health risks associated with synthetic dyes. Marigold-based pigments are not only safer but also biodegradable and environmentally friendly. In addition to the food and cosmetic industries, marigold pigments are used in the textile industry to dye fabrics. Natural dyes from marigold flowers produce vibrant and long-lasting colors, offering an eco-friendly alternative to chemical dyes. This practice supports sustainable fashion and promotes the use of renewable resources. The extraction of pigment from marigold flowers presents a significant economic opportunity for Nepali farmers and entrepreneurs. By developing value-added products such as natural dyes and pigments, they can diversify their income sources and enhance the profitability of marigold cultivation. This also aligns with global trends towards sustainability and natural products, positioning Nepal as a key player in the market for natural pigments.

6. Environmental and Ecological Contributions

Marigold flowers play a role in promoting biodiversity and ecological balance. Their presence in gardens and fields supports pollinators like bees and butterflies, which are essential for maintaining healthy ecosystems. The use of marigolds in pest management also reduces the reliance on chemical pesticides, leading to more sustainable and environmentally friendly farming practices. By planting marigolds, farmers and gardeners create habitats for beneficial insects. Bees and butterflies, attracted by the bright colors and nectar of marigold flowers, play a crucial role in pollinating crops and wild plants. This contributes to the overall health and diversity of the ecosystem. The practice of using marigolds in companion planting and natural pest control helps reduce the environmental impact of agriculture. By minimizing the use of chemical pesticides, farmers protect soil health, water quality, and biodiversity. This sustainable approach aligns with traditional Nepali farming practices that prioritize harmony with nature.

7. Creative and Artistic Expressions

7.1 Art and Craft

Marigolds inspire creativity and are often used in Nepali arts and crafts. Artists use marigold petals to create intricate rangoli designs, especially during festivals. These designs, made on floors or courtyards, are a form of decorative art that brings a festive spirit to homes and public spaces.
Craftsmen and women also use marigold petals to make traditional paper and dye fabrics. The bright colors of the petals are extracted and used to create natural dyes for textiles, adding a unique and eco-friendly touch to traditional clothing and crafts.

7.2 Photography and Visual Arts

The striking colors of marigold flowers make them popular subjects in photography and visual arts. Photographers capture the beauty of marigold-laden temples, market scenes, and festivals, showcasing the flower's cultural significance and aesthetic appeal. These images often feature in exhibitions, publications, and online platforms, promoting Nepal's rich cultural heritage.
In the visual arts, marigold flowers are depicted in paintings, murals, and sculptures. Artists use the vibrant hues of marigolds to create visually stunning works that celebrate Nepali culture and traditions. These artworks are displayed in galleries, cultural centers, and public spaces, enhancing the cultural landscape.

8. Educational and Awareness Programs

8.1 School Projects and Competitions

Marigold flowers are commonly used in educational settings for various projects and competitions. Schools organize events where students create garlands, floral arrangements, and art pieces using marigolds. These activities not only promote creativity but also educate students about the cultural and ecological importance of marigolds.

In addition to art projects, marigold flowers are used in science experiments and environmental education programs. Students learn about the life cycle of plants, pollination, and sustainable farming practices through hands-on activities involving marigolds. This fosters a deeper understanding of the natural world and encourages environmental stewardship.

8.2 Community Awareness

Various NGOs and community organizations in Nepal conduct awareness programs about the benefits of marigold cultivation. These programs educate farmers about sustainable farming practices, pest management, and the economic potential of marigold farming. By promoting the cultivation of marigolds, these initiatives aim to enhance rural livelihoods and support environmental conservation. Community workshops and training sessions provide farmers with the knowledge and skills needed to grow marigolds effectively. These programs also highlight the economic opportunities available through marigold cultivation, encouraging more farmers to participate in the floriculture industry.

9. Historical Context

9.1 Introduction to Nepal

The history of marigold cultivation in Nepal dates back centuries. It is believed that marigold flowers were introduced to Nepal from Central America through trade routes. Over time, they became an integral part of Nepali culture and agriculture. Historical records and oral traditions suggest that marigolds were first brought to Nepal by traders and travelers. The flowers quickly gained popularity due to their vibrant colors and versatility, becoming a staple in Nepali gardens and temples.

9.2 Evolution of Uses

Initially, marigold flowers were used primarily for their aesthetic value and in religious rituals. However, as their medicinal properties became known, their use expanded into traditional medicine. With advances in agricultural science, marigolds were recognized for their benefits in pest management and soil improvement. Over the centuries, marigold flowers have become deeply embedded in Nepali culture and traditions. Their uses have evolved and expanded, reflecting the changing needs and knowledge of society. Today, marigolds are celebrated for their beauty, cultural significance, and practical applications.

10. Marigold Varieties in Nepal

10.1 Common Varieties

Several varieties of marigolds are cultivated in Nepal, each with unique characteristics. The most common types are the African marigold (Tageteserecta) and the French marigold (*Tagetespatula*). The African marigold is known for its large, full blooms, while the French marigold has smaller, more delicate flowers.African marigolds are popular for their large, pom-pom-like flowers, which come in shades of yellow and orange. These marigolds are often used in garlands and large floral displays due to their size and vibrant color. French marigolds, on the other hand, are smaller and more compact. They come in a range of colors, including yellow, orange, and red, often with contrasting stripes or patterns. French marigolds are commonly used in garden borders, flower beds, and potted arrangements.

10.2 Hybrid Varieties

In recent years, hybrid varieties of marigolds have been developed to enhance their ornamental and agricultural value. These hybrids often have more vibrant colors, longer blooming periods and greater resistance to pests and diseases. Hybrid marigolds are increasingly popular among gardeners and farmers for their improved performance and versatility. Hybrid marigolds are bred

to combine the best traits of different marigold species. This results in flowers with more intense colors, larger blooms, and increased resilience to environmental stressors. These hybrids are well-suited to the diverse climatic conditions of Nepal, making them a valuable addition to gardens and farms.

11. Challenges in Marigold Cultivation

11.1 Pest and Disease Management

Despite their natural pest-repelling properties, marigolds can still be susceptible to certain pests and diseases. Farmers must be vigilant and use integrated pest management strategies to protect their crops. Common pests that affect marigolds include aphids, spider mites, and whiteflies. These pests can damage the flowers and leaves, reducing the quality and yield of marigold crops. Farmers use a combination of cultural practices, biological controls, and organic pesticides to manage pest populations and protect their plants. Diseases such as powdery mildew and root rot can also affect marigold plants. These diseases are often caused by poor growing conditions, such as high humidity and waterlogged soil. Farmers need to maintain proper plant spacing, irrigation, and soil drainage to prevent the spread of diseases and ensure healthy marigold crops.

11.2 Climate and Environmental Factors

Climate change poses a challenge to marigold cultivation in Nepal. Changes in temperature and rainfall patterns can affect the growth and blooming of marigold flowers. Farmers need to adapt their practices to cope with these changes and ensure the sustainability of marigold cultivation.
Extreme weather events, such as heavy rains and droughts, can impact marigold crops by causing water stress or flooding. Farmers use techniques such as mulching, drip irrigation, and raised beds to manage water levels and protect their plants from adverse weather conditions. In addition to climate change, environmental factors such as soil quality and availability of water resources influence marigold cultivation. Farmers need to implement sustainable practices, such as crop rotation and organic fertilization, to maintain soil fertility and conserve water resources.

12. Future Prospects

12.1 Research and Development

Ongoing research and development efforts aim to improve marigold cultivation techniques and expand their uses. Scientists are exploring new ways to enhance the medicinal properties of marigolds and develop more resilient hybrid varieties. Research institutions and agricultural universities in Nepal are conducting studies on the genetic diversity and breeding of marigolds. These studies aim to develop new varieties with improved traits, such as disease resistance, drought tolerance, and enhanced medicinal properties. In addition to breeding new varieties, researchers are investigating the potential health benefits of marigold extracts. Studies on the antioxidant, anti-inflammatory, and anticancer properties of marigolds are being conducted to explore their use in pharmaceuticals and nutraceuticals.

12.2 Sustainable Practices

Promoting sustainable marigold cultivation practices is essential for the future. This includes using organic farming methods, conserving water resources, and protecting biodiversity. By adopting sustainable practices, farmers can ensure the long-term viability of marigold cultivation in Nepal. Farmers are encouraged to use organic fertilizers and pesticides to reduce

the environmental impact of marigold cultivation. Techniques such as composting, vermiculture, and the use of biofertilizers help improve soil health and reduce the reliance on chemical inputs. Water conservation is also a key aspect of sustainable marigold cultivation. Farmers implement efficient irrigation systems, such as drip irrigation and rainwater harvesting, to reduce water usage and ensure a consistent water supply for their crops. Protecting biodiversity is another important consideration in sustainable marigold cultivation. Farmers are encouraged to maintain diverse cropping systems, including intercropping and crop rotation, to support a healthy ecosystem and enhance the resilience of their farming systems.

Conclusion

Marigold flowers, or Sayapatri, are deeply intertwined with Nepali culture, traditions, and daily life. Their vibrant colors and versatile uses make them a cherished part of festivals, religious ceremonies, and social events. Beyond their cultural significance, marigolds offer numerous practical benefits in medicine, agriculture, and the economy. As Nepal continues to embrace sustainable practices and research, the future of marigold cultivation looks promising, ensuring that these bright flowers will continue to brighten lives for generations to come.

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PhoolPrasad: A Journey of Faith, Sustainability, and Social Change

Sushama Sharma, Founder CEO
info@phoolprasad.com

In the heart of Kathmandu, where the air is thick with the scent of marigolds and the hum of devotion, lies a story of transformation a story that began with a simple yet profound realization. Flowers, offered to gods and goddesses as symbols of faith and devotion, were being discarded as waste. In a city that generates 479 tons of solid waste daily, much of it unsegregated and left to pile up at landfills, this sacred waste was adding to an already mounting crisis. But what if these offerings could be transformed into something meaningful? What if, instead of contributing to the city's waste problem, they could be repurposed into something that carried the essence of faith while fostering sustainability?

This is the story of PhoolPrasad, a women-led enterprise that has turned this vision into reality. Founded in 2018 by Sushama Sharma and Samundra Raj Aryal, PhoolPrasad is more than just an incense company. It is a movement that combines faith, sustainability, and social empowerment, creating a circular economy where waste is not the end but the beginning of a new product cycle.

Market Scenario -As per World Bank:

- Over 3,000 temples in Kathmandu Valley and 30,000 across Nepal highlight the deep-rooted tradition of incense use
- More than $5 million worth of incense sticks/ ropes are imported on an annual basis*
- Key countries: India, Vietnam, Bhutan, and China.
- Kathmandu's recognition as a city of temples and heritage sites underscores the cultural demand for incense
- Approximately $1m of incense sticks/ ropes are exported on an annual basis
- Key countries: China and USA

The Birth of an Idea

Sushama Sharma, a first-generation entrepreneur with decades of experience in the corporate world, had always been driven by a deep sense of social responsibility. After retiring from her successful career in banking and IT, she sought to channel her passion for business into something that aligned with her values. It was during this time that she met Samundra Raj Aryal, a young graduate student researching floral waste recycling. Their shared vision led to the birth of PhoolPrasad.

For Sushama, this was more than just a business venture. Growing up in Kathmandu, she had been deeply influenced by religious traditions and had a profound respect for temple offerings. Seeing these sacred flowers discarded as waste pained her. At the same time, she was acutely aware of the larger problem Kathmandu's inefficient waste management system, where only a fraction of recyclable waste was actually repurposed, mainly by informal sectors and NGOs. PhoolPrasad, she realized, could be a powerful force in addressing these interconnected issues of waste, sustainability, and social empowerment.

Core objective:

- Green & sustainable project
- Heritage site clean up
- From temples to Temple
- Economic empowerment of women
- Blessings directly from temples
- Charcoal free
- Eco friendly and organic product
- Soothing & lasting fragrance

Creating Value from Waste

PhoolPrasad's model is built on the principle of the circular economy where waste is not the end of the line but rather the beginning of a new product cycle. Every day, temple flowers that would otherwise end up in landfills are carefully collected. These flowers are then sorted and dried before being combined with natural Himalayan herbs like juniper, sandalwood, and rose. The result? Exquisite incense sticks that not only carry the blessings of temple offerings but also promote a healthier, eco-friendly alternative to traditional incense. Unlike many commercial incense products that contain charcoal and synthetic chemicals, PhoolPrasad's incense is 100% natural. Compared to regular incense sticks, PhoolPrasad's incense emits 45.8% lower PM2.5 and 62.4% lower PM10 factors, making it a healthier choice for consumers and the environment. This distinction is particularly important in Nepal, where the demand for high-quality, handmade incense is growing. Nepal, despite being a major importer of incense (mainly from India, Vietnam, Bhutan, and China), with over $5 million worth of incense sticks and ropes imported annually, has a strong local tradition of using "dhup," a hand-rolled rope incense made from natural ingredients. The Nepalese incense market is significant, with high demand for natural incense made from ingredients like sandalwood, cedarwood, and juniper. PhoolPrasad's products cater to this market by offering an ethical, homegrown alternative that aligns with both cultural and environmental values. Since its inception, PhoolPrasad has recycled over 500 tons of floral debris from temples and heritage sites, preventing it from ending up in landfills and reducing greenhouse gas emissions. By upcycling temple flowers, PhoolPrasad has contributed to a reduction in methane emissions from decomposing organic waste in landfills, aligning with global sustainability goals.

Women at the Heart of the Mission

From the very beginning, PhoolPrasad has been more than just an incense-making company. It is a platform for women's empowerment. Over 80% of its workforce comprises women, many from marginalized communities. By providing them with training and stable employment, PhoolPrasad is not just offering a livelihood it is fostering independence and financial security for women who might otherwise struggle to find sustainable employment opportunities.

To date, PhoolPrasad has trained over 250 women from marginalized backgrounds, equipping them with the skills needed to produce high-quality incense. This training goes beyond just employment; it empowers these women to become self-reliant and confident contributors to their households and communities.

Sushama's commitment to gender equality is deeply personal. Having started working at the age of 16 due to financial necessity, she understands the importance of economic independence.

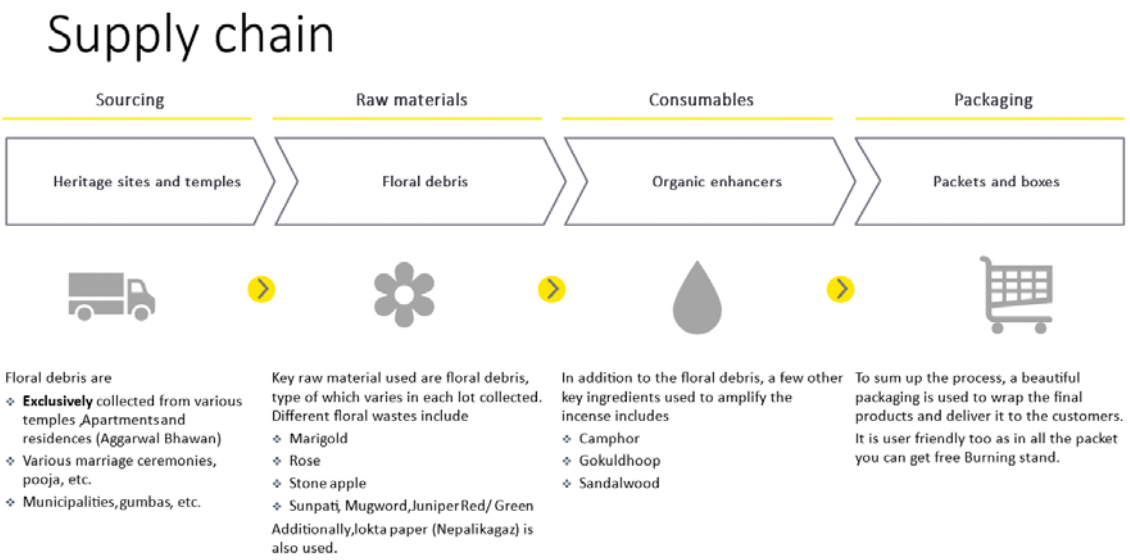
Through PhoolPrasad, she hopes to create a model where women are not just employees but stakeholders in the business, taking pride in their craft and contributing to a larger purpose.

The Cultural and Market Landscape

The incense industry in Nepal is deeply intertwined with religious and spiritual practices. Burning incense is an essential ritual in temples, homes, and meditation spaces. With over 3,000 temples in the Kathmandu Valley and 30,000 across Nepal, the tradition of using incense is deeply rooted in the culture. The demand for high-quality, natural incense is growing, driven by an increasing awareness of health and environmental concerns. Many commercially available incense sticks contain artificial fragrances and charcoal, which release harmful pollutants when burned. PhoolPrasad's commitment to using only natural ingredients positions it as a premium, conscious choice for consumers who value both tradition and sustainability. Moreover, the government's stance on environmental conservation has further aligned with PhoolPrasad's mission. In 2022, Nepal's Ministry of Forests and Environment banned the production, sale, import, and distribution of plastic flowers, signalling a move towards more sustainable alternatives in religious and decorative practices. This policy shift presents an opportunity for businesses like PhoolPrasad to lead the way in eco-friendly solutions.

The Role of Innovation in Sustainability

PhoolPrasad's success is not just about recycling floral waste it is about redefining sustainability through innovation. The company continuously experiments with new production techniques to improve the quality and efficiency of incense-making. Research and development play a crucial role in its operations, as the team works to create new blends of incense with unique fragrances, sourced sustainably from Himalayan flora. Beyond incense, PhoolPrasad is exploring additional ways to upcycle waste. The company is piloting a project to create organic dyes from flower pigments, a potential alternative to chemical-based dyes used in textiles. Such initiatives highlight the brand's commitment to expanding its impact beyond incense, exploring multiple avenues from discarded temple flowers.



Expanding Beyond Nepal: A Global Vision

While PhoolPrasad has established a strong presence in the local market, it has its eyes set on global expansion. The rising demand for ethically sourced, handmade incense in international markets presents an opportunity to take Nepalese craftsmanship to the world stage. Eco-conscious consumers in regions like Europe and North America are actively seeking sustainable, fair-trade products, making PhoolPrasad a perfect fit for this growing niche. Exporting Nepalese incense, however, comes with its challenges, from logistical constraints to regulatory approvals. Nevertheless, the brand is already in discussions with global distributors and sustainable lifestyle brands, laying the groundwork for future international ventures.

Values That Drive PhoolPrasad

At PhoolPrasad, values shape the company culture and guide every decision. These core values define the brand and its vision for the future:

Sustainability: PhoolPrasad is dedicated to promoting sustainability by upcycling discarded temple flowers to create incense. This approach reduces the demand for new raw materials and promotes a more resource-efficient production cycle, contributing to a greener future.

Ownership: The Company fosters a culture of accountability. Every employee takes ownership of their work, ensuring that quality, ethics, and sustainability remain at the core of all operations.

Honesty: Integrity is central to PhoolPrasad's business model. Transparency, ethical sourcing, and fair trade practices define how the company operates, ensuring trust with customers and partners alike.

Innovation-Focused: PhoolPrasad thrives on innovation. Its unique process of transforming floral waste into incense is a testament to how creativity can solve pressing environmental problems. The company is committed to continually improving its production techniques and exploring new product lines that align with its sustainability mission.

A Vision for the Future

Despite its successes, PhoolPrasad is still in the early stages of its journey. Scaling up remains a challenge, but the company is determined to expand its reach, both domestically and internationally. With growing interest from global markets in ethical, handmade products, there

is significant potential for Nepalese incense to carve a niche in the global incense industry. As PhoolPrasad grows, it envisions a more structured supply chain, expanded production capabilities, and increased employment opportunities for women. The business aims to develop collaborations with international eco-conscious brands, further amplifying its impact. PhoolPrasad's vision is clear: to be more than just an incense company. It aims to be a movement one that transforms waste into value, empowers communities, and preserves cultural heritage while championing sustainability. As Sushama Sharma puts it, "Business should not just be about profit. It should be about creating impact. If we can keep our traditions alive while making our world cleaner and fairer, then we have truly succeeded."

Join the Movement

Every PhoolPrasad incense stick tells a story of devotion, sustainability, and empowerment. When you choose PhoolPrasad, you are not just buying incense; you are supporting a mission to reduce waste, uplift communities, and celebrate Nepal's rich cultural heritage. PhoolPrasad's journey is a testament to the power of innovation, sustainability, and social responsibility. It is a story of how faith and devotion can be transformed into a force for good, creating a cleaner, fairer, and more sustainable world.

PhoolPrasad is not just a brand. It is a revolution one incense stick at a time.

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- ❖ Gift Items

Garbage to Garden: An Exemplary Work of Dhankuta Municipality, Nepal

Nirajan Bhandari[1*], Ganesh Lamsal[2], Umed Kumar Pun[3], Upendra Khanal[4], Sashin Dahal[1]
[1]College of Natural Resource Management, Agriculture and Forestry University, Pakhribas, Dhankuta, Nepal
[2]College of Natural Resource Management, Agriculture and Forestry University, Marin, Sindhuli, Nepal
[3]King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand
[4]Dhankuta Municipality, Koshi Province, Nepal
*Corresponding author Email:nbhandari@afu.edu.np

Abstract

Solid waste management is one of the crucial problems of many developing countries and landfilling for solid waste disposal is globally preferred including Nepal. Dhankuta Municipality in Nepal is doing pioneering work in solid waste management and has proved that solid waste can be managed systematically and that garbage disposal sites can be turned into attractive destinations. The municipality launched the campaign "Flowers Instead of Garbage" in 2017 which set a benchmark for effective waste management, significantly enhanced the municipality's visual appeal, and promoted environmental sustainability and tourism. The primary data were collected from the Dhankuta municipality's environment section. The officials of this section provided primary information regarding the process of establishing landfill site into beautiful garden. In Dhunkuta municipality, waste segregation is done at the households where most of the biodegradable waste is composted, recyclable waste is collected to the landfill site in which 60% is sold to the industries in the region and 40% is being used for landfill. A beautiful garden is established in the landfill site with open space in the middle carpeted with Bermuda grass and systematic planting of ornamental plants comprising about 30 species. The municipality also actively engages the local people in the sanitation and beautification of the garden. This innovative idea of building a garden in the landfill site attracts many visitors from within the municipality and elsewhere in the country, giving a strong message that landfills can also be made attractive. The transformation of a landfill into a green landscape serves as evidence of sustainable urban development, illustrating that with strategic planning, dedication, and community engagement, waste can be converted into valuable wealth.

Keywords: Garden, Landfill site, Ornamental plants, Solid waste

Introduction

Solid waste management is one of the crucial problems of many developing countries including Nepal. Waste management especially in large cities, has been one of the burning issues in Nepal for a long time. Many developed countries have developed and practiced different approaches to solid waste management. Among different strategies, municipal solid waste management involves recycling, waste-to-energy conversion, incineration, composting, or landfilling (Nanda & Berruti, 2021). Landfilling for solid waste disposal is globally preferred and adopted in many parts of the world. Dumping of solid waste into landfill sites has been practiced by some municipalities of Nepal. However, scientific and systematic approaches are required for the sustainable management

of municipal solid waste (MSW) landfills to avoid adverse effects on human health and the environment (HHE) (Laner *et al.*, 2012). In this context, Dhankuta Municipality is doing exemplary work in solid waste management. Dhankuta Municipality has proved that solid waste can be managed systematically and the garbage disposal sites can be turned into attractive destinations. Dhankuta Municipality has developed greenery and garden in the landfill site and converted waste (Fohor) to money (Mohor). The municipality has generated income by selling trash and also attracting visitors from different parts of Nepal. The landfill site is planted with ornamental plants and flowers and the place looks more like a garden than a landfill.

Dhankuta municipality is one of the beautiful municipalities located in the eastern hills of Koshi Province, Nepal. The municipality holds a significant position in Koshi province in terms of education, tourism, agriculture, and natural resources. The municipality covers the major area of Dhankuta district including district headquarters. The municipality has approximately thirty-six thousand populations in which majority of people are residing in the two main cities Dhankuta and Hile (National Census, 2021). Dhankuta was declared the cleanest municipality in 2017 in an annual contest sponsored by the Government of Nepal's Solid Waste Management Technical Support Center (SWMTC). This achievement is directly linked with the appreciative works of the municipality in solid waste management, greening, and city beautification. The innovative approach of municipality to waste management combined with its emphasis on environmental sustainability drives towards one of the cleanest and most beautiful cities in the country (Khatiwada, 2025). The municipality launched the campaign "Flowers Instead of Garbage" in 2017 which set a benchmark for effective waste management, significantly enhanced the municipality's visual appeal, and promoted environmental sustainability and tourism.

Dhankuta municipality has been recognized as a pioneer in waste management and urban beautification, serving as a model for other local governments across Nepal. The municipality has established a garden on the landfill site, showing an innovative strategy for sustainable solid waste management. The landfill site is located in ward number 6 of Salleri forest near Dhankuta bazaar. The total land area allocated for the landfill site is 1.52 hectares. The landfill site looks like a public garden rather than a garbage disposal center. In this context, this study was conducted to understand how garbage can be converted into garden for economic and environmental sustainability.

Materials and Methods

The primary data were collected by semi-structured interviews and observation of landfill site (Figure 1). The interview was conducted with the head of the Environment branch of Dhankuta municipality. The interview was focused on gathering information about the history and process of the establishment of landfill site, the present situation, and the garden establishment. The information related to existing situation of the landfill site, its effectiveness and utilization, and existing plant species in the garden were collected through visual observation. The secondary information was also collected from municipality reports and documents, newspapers, YouTube documentaries, and social media (Facebook).

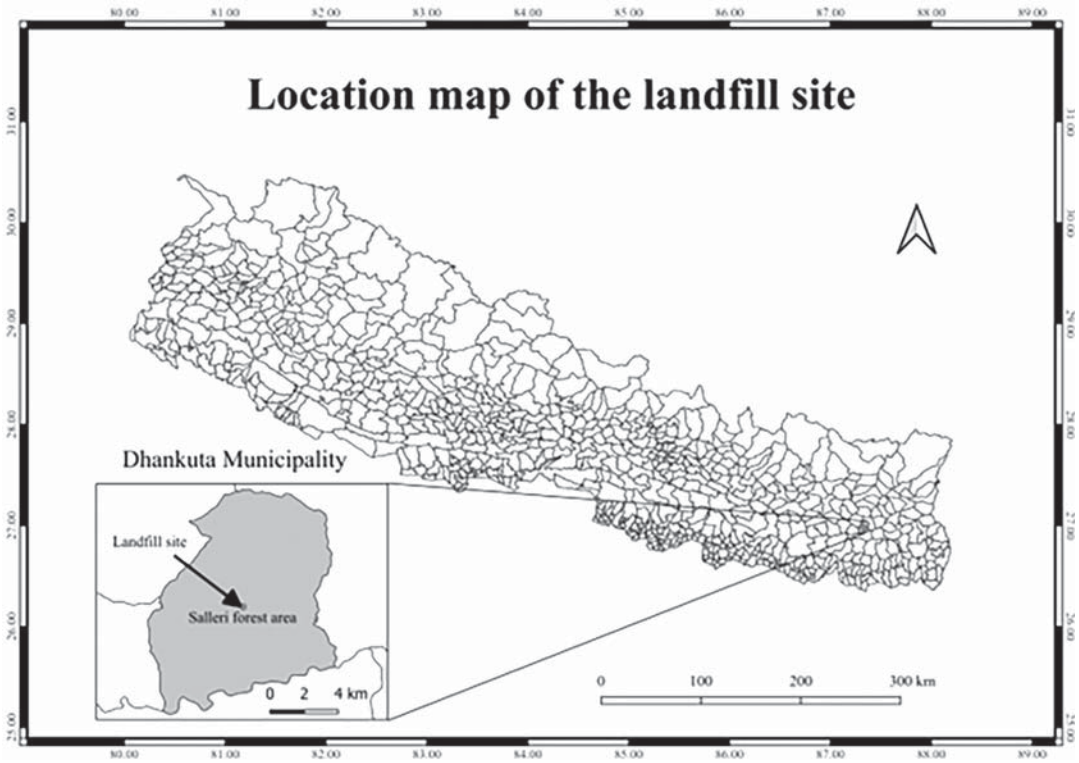

Figure 1. Location map of the landfill site in Dhankuta Muncipality, Nepal

Results and Discussion

Waste segregation

Approximately 13.5 tons of garbage is being collected daily in the Dhankuta municipality (Adhikari, 2025). Garbage segregation begins at household level in which most degradable waste is utilized in a home for making compost manure and vermicompost (U. Khanal, Personal Communication, 10 Feb, 2025). The municipality has been organizing training for local people to be aware of waste management and waste segregation. People are trained to make compost from degradable waste and its application in kitchen gardens and roof gardens. The degradable waste constitutes about 60% of household waste, which is recycled in the household level and only 10% of such waste reaches the landfill site (World Bank Group, 2017). Additionally, among 40% of nondegradable waste reached into the landfill site, about 60% of the items like iron, metals, plastic, glasses, electrical appliances, cardboard boxes, and paper are separated for recycling purposes and rest are being used for landfill purpose (U. Khanal, Personal Communication, 10 Feb, 2025).

Waste to wealth

The municipality has auctioned solid waste management to the private sector for an annual royalty of NRs.1,00,000 (U. Khanal, Personal Communication, 10 Feb, 2025). Although this amount may seem nominal, the enterprise provides regular employment to about 15 people and is also producing raw materials for industries. The collected reusable wastes are then sold to the industries of Dharan, Itahari, Biratnagar, and Jogbani (India). The private sector's annual

transactions are around 4 million, and selling recyclable solid waste generating a profit of about 1 million annually (U. Khanal, Personal Communication, 10 Feb, 2025).

Waste to wonder

The municipality has established one beautiful garden from the garbage collected over the period of four years in the landfill of approximately 40 feet depth. The well-managed landfill site has more than 30 different species of ornamental plants and flowers (Table 1). This garden serves as a model and center of attraction for the visitors. Colorful birds, bees, and butterflies can also be seen in the beautiful flower garden. Many people come to the landfill site to spend time with their family and friends. People of diverse sectors (government representatives, academicians, politicians, policymakers, social workers, conservation workers, researchers, students, etc.) come for different purposes.

Table 1. Available plant species in the garden

S.N.	Common name	*Scientific name*	Family
1.	Christmas tree	*Araucaria cookie*	Araucariaceae
2.	Weeping fig	*Ficus benjamina*	Moraceae
3.	Guava	*Psidium guajava*	Myrtaceae
4.	Mandarin orange	*Citrus reticulata*	Rutaceae
5.	Yellow bells	*Tecoma stans*	Bignoniaceae
6.	Thuja	*Thuja spp.*	Pinaceae
7.	Bar/ Banyan tree	*Ficus benghalensis*	Moraceae
8.	Bottle brush	*Callistemon lanceolatus*	Myrtaceae
9.	Oleander	*Nerium oleander*	Apocynaceae
10.	Duranta	*Duranta plumieri*	Verbenaceae
11.	Croton	*Codiaeum variegatum*	Euphorbiaceae
12.	Poinsettia	*Euphorbia pulcherrima*	Euphorbiaceae
13.	Ornamental rubber	*Ficus elastica var. decora*	Moraceae
14.	Rose	*Rosa indica*	Rosaceae
15.	Mussaenda	*Mussaenda grandiflora*	Rubiaceae
16.	Salvia	*Salvia spp.*	Lamiaceae
17.	Dracena	*Dracaena marginata*	Liliaceae
18.	Hibiscus	*Hibiscus rosa sinensis*	Malvaceae
19.	Sadabahar/ Periwinkle	*Vinca rosea*	Apocynaceae
20.	Cockscomb	*Celosia argentea*	Amaranthaceae
21.	Cuphea	*Cuphea hyssopifolia*	Lytharaceae
22.	Syngonium	*Syngonium podophyllum*	Araceae
23.	Coleus	*Coleus scutellarioides*	Lamiaceae
24.	Amaryllis	*Amaryllis belladonna*	Amaryllidaceae

S.N.	Common name	*Scientific name*	Family
25.	Alternenthera	*Alternanthera bettzickiana*	Amaranthaceae
26.	Spider plant	*Chlorophytum comosum*	Asparagaceae
27.	Bermuda grass	*Cynodon dactylon*	Poaceae
28.	Marigold	*Tagetes erecta*	Asteraceae
29.	Avocado	*Persea americana*	Lauraceae
30.	Bougainvillea	*Bougainvillea spp.*	Nyctagniaceae

Image: Initial phase of garden establishment in landfill site (Source: Upendra Khanals Facebook)]

Gardening

The garden established in the landfill site is aesthetically appealing and managed with beautiful ornamental plants and fruit trees. The garden looks like a free style and is more relaxed, natural, and harmonious. The garden has well well-managed lawn with Bermuda grass. Different plant species are planted as specimen plants. Weeping fig is planted as a focal point, Golden dew as a hedge, and Alternanthera as an edging plant. Rose dominates other flowering plants. Seasonal herbaceous annuals are also planted in different seasons to improve the aesthetics of the garden.

Image: Visitors are enjoying in dry picnic (Source: Kathmandu Post)

Image: Garden established from the waste collected over four years (Source: Upendra Khanal Facebook)

Images: Visitors from different organizations and sectors (Source: Upendra Khanal Facebook)

Public engagement and environmental sustainability

The landfill site is one kilometer far from the main city (Dhankuta bazar) while the residential area is just 150 meters away. As per the environmental branch of the Municipality, there is no disturbance from the local people residing near the landfill site. The municipality has made the provision of regular health checkup facilities for sanitation workers and local people. The municipality has formed a committee for waste management and regularly organized campaigns and trainings for waste management with the active participation of local people. Local people are actively involved in sanitation and beautification campaigns and they also take care of the plants of the roadside and garden. The landfill site has been planted with a variety of plant species which not only enhances the beauty of the location but also promotes agrobiodiversity.

Image: The webpage of municipality highlighting the waste management as a priority sector (Source: https://dhankutamun.gov.np/)

Conclusion

Dhankuta Municipality has set a remarkable example in sustainable waste management by converting its landfill site into a flourishing garden. Through organized waste segregation, recycling efforts, and active public involvement, the municipality has effectively transformed waste into an attractive destination for visitors while fostering environmental sustainability. This initiative has not only enhanced waste management practices but has also played a significant role in urban beautification, biodiversity conservation, and local economic growth. Dhankuta has introduced a pioneering waste management model by auctioning waste to the private sector for industrial uses and repurposing organic wastes for compost, which other local government bodies could follow. The transformation of a landfill into a green landscape serves as evidence of sustainable urban development, illustrating that with strategic planning, dedication, and community engagement, waste can be converted into valuable wealth.

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Jacaranda Propagation by Grafting: A Preliminary Investigation at Floriculture Development Center, Godawari

Rabindra Kaji Thapa (Senior Hort. Dev. Officer, FDC)
Poonam Pokharel (Hort. Dev. Officer, FDC)

1. Introduction

Jacaranda, scientifically known as *Jacaranda mimosifolia*, is a medium-to-large deciduous tree native to South America, and has been introduced to other parts of world as an ornamental species (Pasiecznik, 2014). It is well known for its clusters of striking bell-shaped, lilac-colored flowers that are produced in early summer, which are characteristics of many urban cities (Miyajima *et al.*, 2013). This species is a very attractive ornamental tree that is planted on large scale in public parks, avenues and streets in tropical and sub-tropical regions. Jacaranda is believed to be introduced as decorative plant to Nepal in late 19th or early 20th century during the Rana regimes (Pyakurel, 2018). Locally, it is also called "Birendraphul," in honor of the late King Birendra. Nil-mohar, Nilo-sirish is other local names for Jacaranda. This tree does best at elevations up to 1,600 meters above sea level, making it well-suited to Nepal's Terai and mid-hill regions (Jackson, 1994). In commercial scale, horticultural crops are generally propagated asexually to ensure true-to-type traits. Furthermore asexually propagated plants are short in stature which facilitates easy cultural operations like pruning, weeding, harvesting, spraying etc.; and moreover they are uniform in appearance (Meher *et al.*, 2021). Jacaranda can be propagated vegetatively via stem suckers (Jackson, 1994), and softwood cuttings (Miyajima *et al.*, 2004). However, seed propagation is the common propagation technique for Jacaranda, leading to variability in traits (Miyajima *et al.*, 2004). To address the gap in vegetative propagation technique, a preliminary investigation on effectiveness of various grafting techniques was carried out at Floriculture Development Center (FDC), Godawari. Our work focused on optimizing propagation strategies to establish a pot cultivation technique for Jacaranda and to support urban landscaping efforts.

2. MATERIALS AND METHODS

Description of the study area

The experiment was conducted at Floriculture Development Center, Godawari, Lalitpur. As the country's only governmental farm dedicated to floriculture development, this farm serves as a hub for innovation and promotion of ornamental horticulture. The experimental site is located at 27.59047°N latitude and 85.37955°E longitude, with an elevation of 1550m above sea level. This site experiences a warm temperate climate, characterized with an annual temperature range of 1.14°c - 28.31°c and an average annual rainfall of 2239.5 mm.

The grafting experiment was initiated in late February 2024, coinciding with the dormant stage of Jacaranda. Data were collected till May 2024 to monitor the graft success.

Experimental treatments and procedures

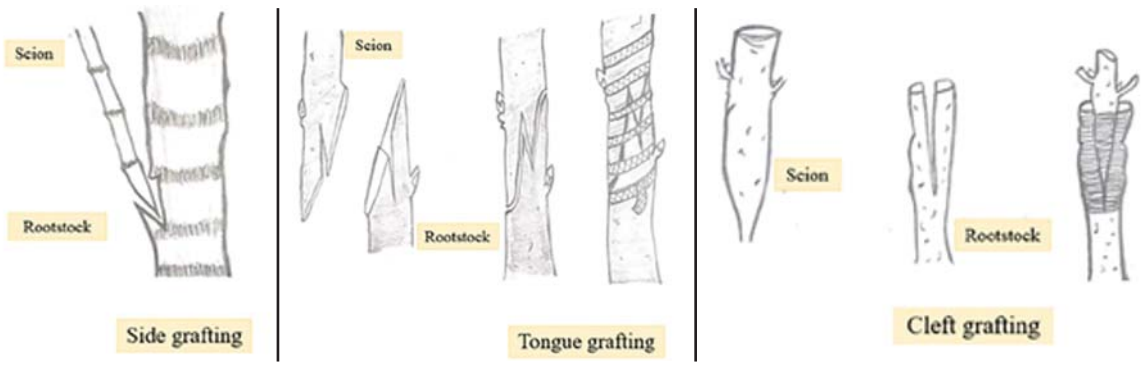
Experimental design

In this experiment, the effects of three grafting techniques (cleft, tongue, and side grafting) and parafilm application (wrapped vs. unwrapped scions and graft unions) on graft success were evaluated. A factorial design was employed; with each grafting technique combined with two parafilm treatments (wrapped or unwrapped). Each treatment combination consisted of 30 grafts, totaling 60 grafts per grafting techniques and 180 grafts in total.

Grafting protocol

The grafting protocol followed for the experiment is described briefly below;

Rootstock preparation: One-year-old Jacaranda seedlings, raised from seeds collected in ring-road area of Lalitpur Districts were used for the experiment. Seedlings were grown in perforated black polyethylene bags (6 × 8 inches) filled with a growing medium composed of soil, sand, and decomposed farmyard manure (2:1:1 ratio).



Scion preparation: Healthy scions (about 7 mm diameter) with 4–6 dormant buds were harvested from previous year's growth on a single donor tree adjacent to the Floriculture Development Center (FDC), Godawari.

Grafting techniques: Healthy rootstocks were selected and grafted at 10-15 cm height using side, tongue and cleft grafting methods. Both scions and rootstocks were in dormant state during grafting. All grafts were secured with polyethylene tape to ensure cambium alignment between scion and rootstock. The three grafting techniques implemented for this experiment were depicted in fig.1.

Fig.1. Schematic representation of different types of grafting (adapted from Rasool et al, 2020)

Parafilm application: Half of the grafts (i.e. 30 grafts) in each grafting technique had scions wrapped with parafilm from the graft union to the tip to prevent desiccation and ensure air tight conditions. The remaining other half were left unwrapped as a control.

Post-grafting management: Immediately after grafting operation, grafted plants were transferred to a low-tunnel plastic cover to maintain optimal humidity and temperature. Grafted plants were kept inside low-tunnel plastic cover for next 30 days before shifting them to open field condition.

Data collection and analysis

The grafts were monitored at fortnightly interval for 90 days post grafting to collect the data. A

graft was considered successful if the scion produced new shoots. The number of successful grafts in each treatment was recorded and expressed as a percentage of the total grafts per treatment. The data were analyzed using the Chi-square test of independence, with post-hoc pairwise comparisons adjusted via Bonferroni correction to determine the statistical significance.

3. Results And Discussion

Summary of grafting experiment result

The success of Jacaranda grafts was evaluated based on scion shoot emergence and survival 90 days post-grafting (Table 1).

Table.1. Success rates with respect to grafting techniques and parafilm use

Grafting Methods	Success count (Out of 30 grafts per treatment)	
	With Parafilm	Without Parafilm
Side	20 (66.7%)	12 (40.0%)
Tongue	19 (63.3%)	8(26.7%)
Cleft	20 (66.7%)	9 (30.0%)

Fig.2. Representative Pictures of successful grafts (From left to right: Side, cleft and tongue)

Effect of parafilm on graft success

Parafilm wrapping significantly increased the graft success rate across all grafting techniques (Table 2). The success rate for parafilm-wrapped grafts exceeds 63%, compared to below 40% for unwrapped grafts in all grafting techniques. Side and cleft grafting techniques with parafilm showed the highest success rate (66.7%), followed by tongue grafting (63.3%). The higher success rate of parafilm-wrapped grafts could be associated with the air tight condition created by parafilm on the graft union and scion, thereby retaining the natural moisture and preventing desiccation, as described by Hartmann *et al.* (2007). Comparable results were reported in walnut (Beineke, 1978) and cherry (Exadaktylou *et al.*, 2007). The use of parafilm or other moisture-retaining wraps has been shown to support callus development and graft stability, ultimately contributing to a higher number of roots (Tzeela *et al.*, 2022). The odd ratio comparisons of the parafilm used treatment with reference to the no-parafilm treatment showed 3 to 4.75 X higher success rate.

Table.2. Grafting success rates and statistical analysis

Grafting methods	Parafilm Wrapped	Success Rate	Odds Ratio	p-value
Side	Yes	66.7%	3.00	0.025*
	No	40.0%	Ref	
Tongue	Yes	63.3%	4.75	0.002**
	No	26.7%	Ref	
Cleft	Yes	66.7%	4.67	0.006**
	No	30.0%	Ref	

Notes: Ref. indicates the no-parafilm group used as reference to calculate the odd ratio comparisons.

Significance: * $p < 0.05$ and ** $p < 0.01$ Post-hoc tests showed no significant differences among grafting methods when parafilm was used (all $p > 0.05$).

Effect of grafting methods on graft success

Although parafilm-wrapped grafting treatments showed a significantly higher success rate compared to unwrapped ones, the differences among the different grafting methods were insignificant. The post-hoc analysis showed no difference among the grafting methods when parafilm was used. All methods showed a graft success rate above 63% when parafilm was used; whereas, side grafting marginally outperformed cleft and tongue grafting methods without parafilm (40% vs. ≤ 30%). However, Lynch and Mustard (1973) reported superior union in cleft-grafted Jacaranda plants compared to side grafting. Our result is also in contradiction to the result reported by Beshir *et al.* (2019) in mango, where a significantly high success rate was reported with cleft grafting. Discrepancies may be due to specific experimental conditions or species-specific responses.

4. Conclusions And Recommendations

This study opens the possibilities for commercial-scale production of grafted Jacaranda saplings. Parafilm wrapping was identified as a critical factor for increasing the grafting success rate. Among all tested grafting techniques, parafilm-wrapped grafts achieved success rates above 63%, significantly outperforming unwrapped grafts (≤40%). Additionally, the statistical analysis verified that the success rate of parafilm-wrapped grafts was over three times compared to unwrapped ones. Parafilm wrapping likely preserved moisture, thereby preventing scion desiccation. Furthermore, wrapping parafilm may have enhanced cambial alignment between scion and rootstock, promoting callus formation. Notably, there were no significant differences observed among various grafting techniques when the graft union and scions were wrapped with parafilm, suggesting economic factors such as labor efficiency, local expertise, cost, etc. should be considered to select the appropriate grafting method.

As a preliminary investigation, this study was limited by its single-time grafting, limited sample sizes and assuming environmental factors were non-interactive. It is advised for more thorough studies with bigger sample sizes and extended observations to evaluate the long-term effects of grafting while taking genetic and environmental variability into account.

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Rhododendron (Lali Gurans): Nepal's National Treasure

Nabin Nepal and Januka Dahal
Gauradaha Agriculture Campus

Nepal is a small landlocked country and a land of diverse geography of width around 90-100 km North-South, situated in the heart of the Himalayas. Nepal is very famous for its natural beauty, climatic variation, cultural diversity, rich biodiversity and many more. The Himalayas of Nepal makes it even more beautiful and famous. And in those mountains, there lies a national flower of the country, Rhododendron. Among the more than 1000 species found worldwide, Nepal alone is home for over 30 species, including the vibrant *Rhododendron arboreum*, known locally as "Lali Gurans"and they are found in different habitats and altitudes, from the subtropical lowlands to the alpine highlands. The rhododendron is known for its striking flowers, which come in a range of colors, such as red, pink, white, yellow, and purple. Rhododendrons are not only famous for exquisite blossoming but also hold cultural, ecological and economic significance for Nepal.

Propagation of Rhododendron in Nepal

In Nepal, traditional propagation of rhododendrons has primarily relied on seed germination. However, this method presents challenges, including extended germination periods exceeding one year and variable success rates. To address these issues, vegetative propagation techniques, such as stem cuttings and tissue culture, have been explored. Research conducted at the National Botanical Garden in Godawari demonstrated that stem cuttings, particularly those taken during late winter, exhibit improved rooting capacities. Additionally, tissue culture methods, like shoot tip culture, have been effective in mass-producing disease-free plants with desirable traits, thereby enhancing propagation efficiency.

Development of Hybrid and Dwarf Varieties

The creation of hybrid and dwarf rhododendron varieties holds significant promise for Nepal's horticultural sector. Hybridization efforts focus on combining desirable traits from different species to produce plants with enhanced flower colors, increased resilience to diseases, and adaptability to varying climatic conditions. For instance, crossing *Rhododendron arboreum* with other species has resulted in hybrids that bloom earlier and exhibit a range of colors, thereby extending the ornamental appeal. Moreover, the development of dwarf varieties addresses the needs of urban gardeners and those with limited space, as these compact plants offer the aesthetic appeal of traditional rhododendrons without requiring extensive room for growth.

Economic Benefits for Nurseries

The propagation of rhododendrons offers lucrative prospects for nurseries in Nepal. The increasing demand for ornamental plants, both domestically and internationally, has positioned rhododendrons as a valuable commodity. Nurseries can capitalize on this demand by cultivating and supplying a diverse range of rhododendron species and hybrids. The development of unique

hybrids and dwarf varieties caters to urban gardeners and landscapers seeking compact plants suitable for limited spaces, thereby expanding market reach and profitability.

Cultural Importance

Rhododendron is seen as symbol of pride, beauty, and perseverance by Nepalese. Rhododendrons are deeply rooted with Nepalese traditions, art, folklore, etc. The flower is commonly seen featured in Nepalese poetry and songs, symbolizing love, beauty and resilience. The flower also plays an important role in religious and festival celebrations. It is also a sacred flower in Buddhism, where it is offered to the Buddha and other deities as a sign of reverence and devotion. During the spring hill communities celebrate its bloom as a sign of renewal and prosperity.

Ecological Importance

The rhododendron is a genus of flowering plants that belongs to the family, Ericaceae. As an important part of Nepal's Himalayan ecosystem, it contributes significantly to biodiversity and its conservation. The flower of rhododendron provides nectar for pollinators such as bees and butterflies, while serving as habitat and food for various bird species and wild life. The rhododendron plays a vital role in maintaining the soil stability and water quality in the mountainous regions. Their deep-rooted root system plays a crucial role in preventing soil erosion on those steep mountain slopes as its roots anchor the soil, and its leaves helps to slowdown the water runoff, reducing the risk of soil erosion. Moreover, rhododendron forests also contribute to carbon sequestration, supporting Nepal's efforts in combating climate change.

Economic Importance

Beyond their aesthetic and ecological roles, rhododendron offers significant economic benefits to local communities and the whole nation. The rhododendron has many uses and benefits, both practical and aesthetic. The rhododendron is a popular ornamental plant, as it enhances the beauty and charm of any garden or landscape. It is source of honey, as its nectar attracts bees and other pollinators. The rhododendron is also a source of medicine, as some of its species have healing properties and can treat various ailments such as coughs, colds, fever, and inflammation. The flower of it is also used to make alcohol which is sold at good price. Some believe that the juice of petals is used against food swallowing problems. In rural areas, dried rhododendron flowers and leaves are used in herbal teas and traditional medicine, believed to have antioxidant and anti-inflammatory properties. Rhododendron-based products, including juices and syrups, are gaining popularity in domestic and international markets. Additionally, rhododendron tourism, particularly in trekking regions such as Ghorepani-Poon Hill, Langtang and Tinjure attracts thousands of visitors each year, boosting the local economy.

Medicinal and Nutritional Importance

Rhododendron arboreum, Nepal's national flower is renowned for its medicinal and nutritional benefits. Traditionally, various parts of the plant have been utilized to address numerous health conditions. The flowers, rich in bioactive compounds such as quercetin, rutin, and coumaric acid, exhibit significant antioxidant properties, aiding in the neutralization of free radicals and potentially reducing oxidative stress. These compounds also contribute to the plant's anti-inflammatory effects, making it useful in alleviating conditions like dysentery, diarrhea, and bacterial infections.

Additionally, the petals are a source of essential minerals, including manganese, iron, zinc, and copper, which are vital for various physiological processes. Culinary applications in Nepal involve transforming the petals into products like juices, jams, and chutneys, providing both nutritional value and health benefits. However, it's crucial to ensure proper identification and preparation, as certain rhododendron species contain toxic compounds.

Commercial Potential of Rhododendron-Based Products in Nepal

Rhododendrons, beyond their ecological and ornamental significance, hold immense commercial potential in Nepal's growing herbal and natural products industry. *Rhododendron arboreum*, the national flower, is particularly valuable due to its rich antioxidant, antibacterial, and anti-inflammatory properties. The petals are traditionally used in making herbal teas, jams, juices, and chutneys, offering both nutritional benefits and medicinal properties. Additionally, rhododendron extracts are gaining popularity in the cosmetic industry for their potential skin-rejuvenating and anti-aging effects, paving the way for products like organic skincare items, essential oils, and natural dyes. The rising global demand for herbal and functional foods presents an opportunity for Nepal to develop rhododendron-based beverages, including wines and syrups, targeting both local and international markets. With the right approach, Nepal can transform rhododendrons into a high-value natural resource, boosting eco-friendly entrepreneurship and rural livelihoods while promoting conservation.

Ways Forward

Despite their importance, Rhododendrons in Nepal is facing multiple threats, including climate change, deforestation, unsustainable harvesting and forest fire. Rising temperatures and shifting climatic patterns are altering blooming seasons and shrinking their natural habitat. To ensure their long-term survival, Nepal must strengthen conservation efforts through protected

area management, sustainable harvesting practices, and community-led reforestation initiatives. Ensuring the sustainability of rhododendrons in Nepal requires a multifaceted approach that integrates conservation efforts, sustainable eco-tourism, community engagement, and climate change mitigation.

Conservation Initiatives

The Tinjure-Milke-Jaljale (TMJ) region, often referred to as Nepal's "Rhododendron Capital," is home to 28 of the country's 32 rhododendron species. To protect this biodiversity hotspot, strategic land purchases have been made to connect fragmented habitats, safeguarding endangered species such as the Red Panda and Himalayan Musk Deer. These efforts also aim to prevent haphazard road construction, which poses a significant threat to these delicate ecosystems.

Sustainable Eco-Tourism

Promoting eco-tourism in rhododendron-rich areas like the Tinjure Hills offers a sustainable pathway to conservation. The region's vibrant rhododendron forests attract tourists, especially during the blooming season from March to April. Developing eco-friendly tourism infrastructure not only provides economic benefits to local communities but also fosters environmental stewardship. However, challenges such as inadequate infrastructure and environmental degradation need to be addressed through strategic planning and policy development.

Community Engagement and Sustainable Practices

Local communities play a pivotal role in the conservation of rhododendron forests. In some areas, reliance on rhododendron wood for fuel and unregulated infrastructure development has led to forest depletion. Engaging communities in sustainable practices, providing alternative energy sources, and implementing conservation education programs are essential steps to mitigate these impacts. The Ministry of Forests and Environment has initiated a five-year action plan focusing on rhododendron conservation, which includes habitat identification and the promotion of alternative energy to reduce dependence on forest resources.

Climate Change Mitigation

Rhododendrons are sensitive indicators of climate change, with shifts in blooming periods observed due to rising temperatures. Protecting these species necessitates broader climate change mitigation efforts, including reforestation, sustainable land management, and reducing greenhouse gas emissions. Monitoring phonological changes in rhododendrons can also provide valuable data for assessing ecosystem health in the face of climate variability.

Research and Monitoring

Ongoing research in Nepal focuses on various aspects of rhododendron ecology and conservation. Studies have examined the population structure of species like Rhododendron campanulatum along elevational gradients, providing insights into their response to climatic variability. Additionally, ensemble modeling of *Rhododendron arboreum* distribution has been conducted to assess current patterns and project future changes, aiding in conservation planning.

Conclusion

The rhododendron is a remarkable flower that represents the ecological and cultural values of Nepal. It is a botanical wonder that has a high diversity and abundance in the Himalayan

region, and plays a vital role in maintaining the soil and water quality, and the biodiversity of the ecosystem. It is also a cultural symbol that has a long and rich history, and a deep and diverse symbolism. It is associated with various meanings and stories, such as caution, beauty, passion, royalty, joy, purity, happiness, pride, perseverance, reverence, devotion, love, loyalty, hard work, and success.The rhododendron is a flower that deserves admiration and respect, as it reflects the spirit and identity of Nepal and its people.

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Micro propagation of Peace lily (*Spathiphyllum wallisii*), a practical experience at FDC, Godawari, Lalitpur

Sabina Devkota (Hort. Dev. Officer, FDC)
Siddhartha Gautam (Biotechnologist, FDC)

Introduction

Micropropagation involves *invitro* multiplication ofplants via culture of various plant parts including cells, tissues or organs. It includes distinct stages of shoot initiation, multiplication; rooting and acclimatization. Micropropagation techniques are applicable to various plant species, while offering several advantages over traditional propagation methods. These advantages include the production of disease-free plants, shorter production time, lower labor costs, genetic uniformity and a higher multiplication rate (Uchendu *et al.*, 2011). *Spathiphyllum wallisii*, commonly known aspeace lily, white sails or spathe flower is a popular ornamental plant, known for its lush, dark green foliage and distinctive white spathes. Adding to its aesthetic appeal, it is also renowned for its ability to purify indoor air (Wolverton *et al.*, 1989). It belongs to the family Araceae (Arum) and native to central and South America. It is a bright indoor plant flourishes in semi-shaded areas (low to moderate light conditions) but cannot be grown in direct sunlight (Bandyopadhyay *et al.*, n.d.).

Botanical characterstics:

- **Foliage:** Glossy, broad and lanced-shaped leaves that are approximately 10 inches long growing in rosette pattern. (https://plants.ces.ncsu.edu/plants/spathiphyllum/)
- **Flowers:** Produces small, chalk-white flowers packed on a spadix, borne in front of an attractive white spathe. These flowers occur in the spring and are followed by mostly inconspicuous, berry-like fruits (hort.ifas.ufl.edu).
- **Growth Habit:** This species typically reaches a height of 12 to 15 inches, forming an upright, bushy clump (hort.ifas.ufl.edu).

Peace lily can be commercially reproduced using the tissue culture method (Sarmah, 2017). In tissue culture, soma-clonal variety refers to phenotypic and genetic variations. It offers plant breeders a valuable resource with a successful selection technique (Haspolat, 2019). The material of this study includes in vitro propagation of the peace lily produced in the Plant Tissue Culture Laboratory at Floriculture Development Centre (FDC), Godawari Lalitpur, Nepal. Micropropagation offers significant benefits for both commercial plant production and tissue culture research (Currais *et al.*, 2013). Nonetheless, undifferentiated cells, isolated protoplasts, calli, tissues, and morphological features all exhibit genetic variability (Krishna *et al.*, 2016). Gene mutation (alterations in gene structure during tissue culture) or changes in epigenetic markers can result in somaclonal variance (Sarmah, 2017).The sugarcane plant grown from cell culture was the first to exhibit somaclonal variety in 1969. The source of the transplant is thought to be the crucial factor influencing somaclonal

variation. The somaclonal variance may fluctuate between different types of explants due to the fact that they may have varying capacities for regeneration (Madhavan *et al.*, 2025).

Key steps of Micro-propagation

Explant selection and sterilization

We carried out micro propagation of peace lily at Tissue Culture Laboratory, Floriculture Development Centre, Godawari, Lalitpur, Nepal from 2024-2025. Mother plants were adult *Spathiphyllum wallisii* plants. Following appropriate pruning shoot and spadix flower explants were thoroughly cleaned for 20 minutes under running tap water to get rid of all the dust and soil particles. Additionally, explants were washed with liquid soap with few drops of tween 20 for 30 minutes. After washing, explants were rinsed for 30 minutes under running tap water to remove the traces of soap and detergent from the explants.After being cut to a 2 cm length, the explants were placed beneath the laminar flow cabin and sterilization was performed using 1.5% sodium hypochlorite and 70% ethanol. Theshoot and spadix flower explants were exposed to 1.5% sodium hypochlorite for 10-15 minutes and rinsed with autoclaved distilled water for three times.Following that, the explants were treated with 70% ethanol for 2-3 minutes and rinsed with autoclaved distilled water for three times.

Culture media

Lloyd and Mccownwoody plant medium (1980) (WPM), Murashige and Skoog (1962) (MS) and modified MS mineral salts, vitamins, 3% (w/v) sucrose, and 0.8% (w/v) bacteriological grade agar (Himedia) comprised the basal media utilized in the initial set of tests. Ammonium nitrate and potassium nitrate concentrations in the modified MS basal medium were lowered by up to 50% while the other mineral constituents remained unchanged from the original basal full-strength MS. To encourage the sprouting of shoots from explants, a variety of BA concentrations (0,0.5, 1.0,1.5, and 2.0 mg/l) were added to the basal culture media, either by itself or in conjunction with (0.05, 0.2, 0.5 mg/l) naphthaleneacetic acid (NAA) in MS basal media, Woody plant media and modified MS media (Table-1). In the second series of tests, Kinetin (Kn), was added to WPM, MS and Modified MS basal media at varying concentrations (0, 0.5, 1.0, 1.5, and 2.0 mg/l) either by itself or in conjunction with (0.05, 0.2, 0.5 mg/l) naphthaleneacetic acid (NAA)along with vitamins, 3% sucrose, and 0.8% agar in order to multiply shoots. In each experiment, 1.0M NaOH was used to bring the medium pH down to 5.6-5.8 before it was autoclaved for 15 minutes at 1.1 kg/cm2 pressure (121°C). Each experiment involved filling 400 ml glass bottles with 50 ml of medium and capping them with polypropylene. The culture jars were incubated in growth room illuminated with white fluorescent light (16 h photo periods) of 2000 lux intensity at 24°C.

Table 1: Preparation of MS Stock solution and MS Media

S. N.	Name of Chemical	Amount of chemical required for different stock solutions	Amount requiredfor preparation of 1L media	S. N.	Name of Chemical	Amount of chemical required for different stock solutions	Amount required for preparation of 1L media
Micronutrients (Stock A)			100 ml	Micronutrients (Stock B)			100 ml
	Chemicals	1X g/L			Chemicals	1X g/L	
1	Ammonium nitrate (NH4NO3)	1.65		1	Boric acid (H3BO3)		
2	Potassium nitrate (KNO3)	1.90		2	Manganese sulfate (MnSO4.7H2O)	1.90	
3	Calcium chloride (CaCl2.2H2O)	0.44		3	Zinc sulfate (ZnSO4.7H2O)	0.44	
4	Magnesium sulphate (MgSO4.7H2O)	0.37		4	Cobalt Chloride (CoCl2.6H2O))	0.37	
5	Potassium dihydrogen Phosphate (KH2PO4)	0.17		5	Copper sulfate (CuSO4.5H2O)	0.17	

S. N.	Name of Chemical	Amount of chemical required for different stock solutions	Amount required for preparation of 1L media	S. N.	Name of Chemical	Amount of chemical required for different stock solutions	Amount required for preparation of 1L media
Micronutrients (Stock C)			100 ml	Micronutrients (Stock D)			100 ml
	Chemicals	1X g/L			Chemicals	1X g/L	
1	Sodium ethylenediaminetetracetic acid (Na2EDTA)	0.03730		1	Nicotinic Acid	0.0005	
2	Ferrous sulfate or Iron (II sulfate (FeSO4)	0.02780		2	Thiamine HCl	0.0001	
				3	Glycine	0.0020	
				4	Pyrodoxine HCl	0.0005	
				5	Potassium Iodide (KI) Stock	0.83	

S.N	Other chemicals required to prepare 1L MS media	
1.	Inositol/myo-inositol	0.1 g
2.	Growth hormones	As per the protocol
3.	Sucrose	30 g or as per the protocol

4.	pH adjustment	5.4-5.8 or as per the protocol
5.	Agar	8 g or as per the protocol
	Sterilization of media	In autoclave at 121oC, 15Lb pressure, 15 min
	Storage of media	In rack, preferably dark media storage rack, for a minimum of three days of media preparation to observe any contamination.

Notes: Ammonium nitrate supplement can be supplied by using other compounds having similar molecular weights such as Urea.

Result

Multiplication and rooting:

For in *vitro* culture of leaf and shoot explants, succesful multiplication was observed in shoot explants. Additionally, among different basal media used for in *vitro* shooting full strength ms fortified with 30g/l sucrose was favourable for shoot culture.The induction rate of shoot with WPM and modified MS media were 20% and 40% respectively, which was relatively far lower to 85% of induction rate as obseved in MS basal media. This result was corroborated by Dewir *et al.*, 2006 who found that a full-strength MS medium containing 30 g/L of sucrose was optimal for shoot tip culture of *Spathiphyllum cannifolium*.

In order to assesss extent of shoot multiplication and rooting, variety of BA concentrations (0, 0.5, 1.0, 1.5, and 2.0 mg/l) were added, either by itself or in conjunction with (0.05, 0.1, 0.2 mg/l) naphthaleneacetic acid (NAA) in MS basal media.

The most effective shoot multiplication and rooting was obtained in 1 mg/l BAP in conjuction with 0.1 NAA with mean of 6.5 shoots/explant and 6 roots/shoot. It was also observed that the same medium was effective for both shoot multiplication and rooting of plants over a six to eight week period.

Plantlet acclimatization

The roots of the young plantlets were first acclimated to a regulated ex vitro environment (primary hardening) after being carefully removed from the culture medium and cleaned with sterile DW. Initially, the plantlets were put in six-centimeter-diameter perforated plastic cups that held five distinct sterilized potting mixtures: coco peat: sand: perlite (2:1: 1), coco peat: soil: perlite (2: 1: 1), coco peat: perlite: vermicompost (2: 1: ½), coco peat: peatmoss (3: 1), and peat moss: perlite: vermi compost (2: 1: ½).The potting mixtures were mixed with quarter strength MS media for nourishment of young plantlets.Following that, plantlets were incubated at 20–28°C and 70–90% relative humidity (RH) in a closed growth chamber. Cool fluorescent tubes (16-h photoperiod); were used to give the light. When necessary, a hand sprayer was used to water the plants. After two weeks, the plantlets were moved to a different polythene growing chamber that was kept at 20–28°C and 70–100% relative humidity.The secondary hardening technique involved selecting 20 plants at random and potting them in a mixture of soil, coarse sand, and cattle manure (1: 1: 1, v/v) without disturbing the root system. The primary hardened plants from each treatment were moved to a greenhouse and placed in 15-cm earthen pots. Potted plants were kept in a shade house with an agro shade net that provided 50% shade, a 10-hour photoperiod, 70% relative humidity, and 28 ± 2°C. Individual plants received 200–300 milliliters of water per pot per day along with fertilizer (foliar treatment of 19: 19: 19, N: P: K). The process of primary hardening and acclimatization is running

throughout the year. Best potting mixture for success of hardening and growth.

Figure 1 Mother culture of Peace lily

Figure 2 Sub culturing Peace lily

Figure 3 Growing Peace lily

Figure 4 Preparation for acclimatization

Figure 5 Preparation for acclimatization

Figure 6 Preparation for acclimatization

Figure 7 Series of plants

Figure 8 Primary Hardening

Summary and conclusion

Micro propagation of peace lily was morphologically observed in the present study. The MS media was found effective for proper root and shoot growth. Low plant growth regulator concentrationswas used in the present study. During acclimatization, care should be given forproper combination of different media like cocopeat, perlite and vermicompost. More humidity and adverse environmental factors can cause contamination. The ornamental and high value plant Peace lily (*Spathiphyllum wallisii*) was successfully propagated through micro propagation at tissue culture laboratory, FDC, Godawari, Lalitpur. This milestone will be highly effective to meet the domestic demand and replace foreign import.

Some Glimpses of Practical Work

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कुवेर जंग मल्ल
बनस्पती बिज्ञ

पुष्प व्यवसायमा शोभनीय फूलहरुको विशेष महत्व रहन्छ । विरुवाहरुको आकर्षक फूल र वनावटले यिनीहरुको शोभनीयतामा आयाम थप्दछ । त्यसैले गमला र बगैचामा लगाइ शोभा बढाउनका साथै अन्य सजावटमा पनि यस्ता विभिन्न किसिमका फूलहरु प्रयोग गर्ने गरीन्छ । आयातित फूलहरु बाहेक आलंकारिक महत्वका जंगली फूलहरुको पनि पुष्प व्यवसायमा आफ्नै महत्व र स्थान छ । नेपाल वानस्पतिक विविधताको हिसाबले एक धनी देशको रुपमा चिनिएको छ । सानो क्षेत्रफल भएको यो देश भित्र धेरै वनस्पति प्रजातिहरु पाइन्छन् । प्राकृतिक रुपमा पाइने विभिन्न वनस्पति प्रजातिहरु मध्ये सुन्दर र आकर्षक रुख, झाडी तथा साना विरुवाहरुले यहाँको वानस्पतिक विविधतालाई झन उच्च स्थानमा राखेको छ । यहाँ विभिन्न रंग र आकारका साथै आकर्षक फूल फुल्ने बिरुवाहरु तराइ देखि हिमालसम्म प्राकृतिक रुपमा फैलिएर रहेका छन् । प्राकृतिक रुपमा पाइने यस्ता स्वदेशी आलंकारिक महत्वका विरुवा तथा फूलहरु बगैचा तथा घरको शोभा बढाउन उपयोगी सिद्ध हुन सक्छन भने पुष्प गुच्छा र भित्री सजावटका लागि पनि उपयुक्त हुन सक्छन् । तसर्थ, यस्ता शोभनीय तथा आलंकारिक विरुवाहरुको पहिचान गर्नु आवश्यक हुन्छ । नेपालका स्वदेशी तथा रैथाने शोभनीय तथा आलंकारिक विरुवाहरुको पहिचान गरी तिनीहरुको विकास गर्न सकेमा पुष्प व्यवसायमा नेपाली विरुवाहरु पनि आउन सक्ने संभावना रहन्छ । यसै क्रममा फ्लोरीकल्चर एशोसिएसन नेपालले वि. सं. २०७४ र २०७५ मा गरी फूल फुल्ने शोभनीय नेपाली विरुवाहरु सम्बन्धी दुइवटा विवरण पुस्तिकाहरु प्रकाशित गरेको छ । यी पुस्तिकाहरुमा १२५ प्रजातिका फूल फुल्ने शोभनीय नेपाली विरुवाहरुको विवरण तयार गरिएको छ । यी पुस्तिकाहरु फूल फुल्ने शोभनीय नेपाली विरुवाहरुलाई सूचीबद्ध गर्ने प्रयासको रुपमा प्रकाशित भएका छन । त्यस्ता शोभनीय विरुवाहरुको सूचीमा पर्ने विरुवा मध्ये प्रिमुला पनि एक हो ।

पुष्प व्यवसायमा प्रिमुलाको महत्व

आकर्षक तथा आलंकारिक महत्वका फूलहरु मध्ये प्रिमुला पनि पर्दछ । प्रिमुलालाई अंग्रेजीमा प्रिमरोज (primrose) भन्ने गरीन्छ । प्रिमरोज शब्द ल्याटिन भाषाको प्रिमा रोजा (prima rosa) शब्दबाट आएको हो । प्रिमा भनेको पहिलो र रोजा भनेको गुलाफ भन्ने अर्थ लाग्दछ । त्यसैले बसन्त ऋतुको शुरुवातमा फुल्ने भएकोले यस्तो नाम राखिएको हुनुपर्छ । प्रिमुलाहरु विभिन्न रंग र आकारमा फुल्छन तसर्थ गमलामा लगाउन तथा उद्यानलाई मनोरम बनाउन लगाइने प्रमुख फूलहरु मध्ये पर्दछ । प्रिमुलेसी (Primulaceae) नामको बानस्पतिक परिवारको प्रिमुला (Primula) प्रजातिका विरुवाहरुलाई प्रिमरोज भन्ने गरीन्छ । विश्व भरी प्रिमुलाका ४०० भन्दा बढी प्रजातिहरु छन भन्ने अनुमान गरिएको छ । Primula malacoides प्रजातिको प्रिमुला नेपालमा धेरै पहिले नै भित्री सकेको थियो र हाल केही बगैचाहरुमा यसको उपस्थिति पनि देखिन्छ । त्यसबाहेक प्रिमुलाका उन्नत प्रजातिहरु पनि तयार भैसकेका छन् । यी पनि नेपालमा गमलाहरुमा सजाएर राख्ने गरीएको पाइन्छ ।

नेपाली प्रिमुलाहरु

नेपालमा पनि एचष्गबि का लगभग ६५ प्रजातिहरु पाइन्छन् र नेपालका प्रिमुलाहरु आकर्षक र सुन्दर पनि छन् । नेपालमा मात्र पाइने रैथाने प्रजातिका प्रिमुलाहरु पाँचवटा छन् । नेपालमा करीव १५०० देखि ५३०० मीटरको उचाइमा यी प्रिमुलाहरु पाइन्छन् । यहाँ यी सबै प्रिमुलाहरुको बर्णन त सम्भव छैन तै पनि केही प्रजातिहरु छन्, जसको घरेलुकरण र विकास गर्न अध्ययन र अनुसन्धान गर्न सकेको खण्डमा पक्कै पनि हाम्रा स्वदेशी विरुवाहरुको विकास हुनकासाथै हाम्रा बगैचाहरु स्वदेशी प्रिमुलाहरुले सजाउन सकिन्थ्यो होला । यस्ता केही नेपाली प्रिमुलाहरुबारे केही जानकारी दिने प्रयास गरीएको छ ।

१. *Primula aureata H. R. Fletcher*

यो खासगरी नेपालको गोसाईंकुण्ड, लांगटांगतिर पाइने प्रिमुला हो । ३६०० देखि ४३०० मीटरसम्मको उचाईमा पाइने यो प्रिमुला ढुंगा वा चट्टानमा हुर्केको पाइन्छ । यसका पातहरु ४ देखि १० से. मी. लामा र १ देखि ३ से.मी.सम्म चौडा हुन्छन् । यसका पातहरु सेता पाउडरले ढाकिएका हुन्छन् । बसन्त ऋतुमा फुल्ने यसका सेता रंगका फूलहरुको बीचको भाग पहेंला हुन्छन् । यो प्रजातिको विरुवा बगैचा, ल्याण्डस्केपिङ्ग र गमलामा प्रयोग गर्न उपयुक्त हुन्छ ।

२. *Primula denticulata Smith*

Drumstick Primrose नामले चिनिने यो प्रिमुलालाई नेपालीमा डोइली फूल भनिन्छ । यो अफगानिस्तान, पाकिस्तान, चीन, नेपाल, भुटान र म्यानमारमा १५०० देखि ४५०० मिटरसम्मको उचाइमा पाइन्छ । यो बढीमा ४५ से. मी. सम्म अग्लो हुने विरुवा हो । यसका पातहरु करीव ३० से. मी. सम्म लामा र ५ सेमी सम्म चौडा हुन्छन । यसका पातहरु भुईंमा गोलाकार गुच्छामा हुन्छन् र पातहरुको बीचबाट करीव १५ से मी सम्म अग्ला डाँठहरुको टुप्पामा नीलो रंगका फूलहरु गोलाकार झुप्पामा फुल्छन् । स्थानको उचाइ हेरी यो प्रिमुला चैत्र महिना देखि असारसम्म फुल्छ । यो प्रजातिको विरुवा बगैचा र गमलामा प्रयोग गर्न उपयुक्त हुन्छ । यसको उत्पादन बीउबाट गर्न सकिन्छ ।

३. *Primula macrophylla D. Don*

Large leaf primrose को नामले चिनिने यो कडा खालको बहुबर्षीय प्रिमुला हो । यो अफगानिस्तान, पाकिस्तान, भारत, चीन, नेपाल, भुटान, सिक्किम र नेपालको ३३०० देखि ४८०० मीटर सम्मको उचाइमा पाइन्छ । यो १२ देखि २५ से. मी. सम्म अग्लो हुने प्रिमुला हो । यसका १६ देखि ३० से.मी. सम्म लामा पातहरु फेदतिर साँगुरियका हुन्छन् । पातहरुको झुप्पाको बीचबाट निस्किएको अग्लो डाँठको टुप्पामा बैजनी रंगका फूलहरु फुल्दछन् । यो खुला र ओसिलो ठाउँमा हुर्कने विरुवा हो । यसका फूलहरु असार देखि भाद्र महिनासम्म फुल्दछन् । एक पल्ट लगाएपछि सालौंसम्म यो आफै पलाउँछ । यसको प्रसारण बीउबाट पनि गर्न सकिन्छ ।

४. *Primula sikkimensis Hook. f.*

Sikkimese primula को नामले चिनिने यो प्रिमुलालाई नेपालीमा मेदोसरो भनिन्छ । यो अफगानिस्तान, पाकिस्तान, चीन, नेपाल, भुटान र म्यानमारमा ३३०० देखि ४४०० मीटरसम्मको उचाइमा पाइन्छ । यो ९० से. मी. सम्म अग्लो हुने विरुवा हो । पहेंलो फूल फुल्ने यो प्रिमुला बहुबर्षीय विरुवा हो । यो ओसिलो रही रहने स्थानमा राम्ररी हुर्कन्छ । यसका पातहरु अण्डाकारका हन्छन् र फेदतिर साँगुरिएका हुन्छन् । यो पनि एक पटक लगाए पछि हिउँदमा सुके पनि अर्को बर्ष आफै पलाएर आउँछ । यसको प्रसारण बीउबाट पनि गर्न सकिन्छ ।

५. *Primula wollastoni Balf. F.*

यो प्रिमुलालाई अंग्रेजीमा Wollaston's primrose को नामले चिनिन्छ । सन १९२१ मा A.F.Wollaston ले पहिलो पटक यो प्रिमुला संकलन गरेकाले उनको नामबाट यसको नामाकरण गरीएको छ । यो नेपाल र तिब्बतीय क्षेत्रको ३६०० देखि ४८०० मीटरसम्मको उचाइमा पाइन्छ । यो ९० से. मी. सम्म अग्लो हुने विरुवा हो । नीलो फूल फुल्ने यो प्रिमुला बहुबर्षीय विरुवा हो । यो ओसिलो रही रहने स्थानमा राम्ररी हुर्कन्छ । यसका पातहरु अण्डाकारका हन्छन् र १.५ देखि ५ से.मी. सम्म लामा र १ देखि २.५ से.मी. सम्म चौडा हुन्छन् । यसको प्रसारण बीउबाट पनि गर्न सकिन्छ ।

यस्ता प्रजातिका प्रिमुलाहरुको घरेलुकरण र विकास सम्बन्धी अध्ययन, अनुसन्धान तथा विकास गरी यिनीहरुको प्रबर्द्धन गर्न सकेमा हाम्रा आफ्नै देशका विरुवाहरु गमला र बगैचा सजावटका लागि प्रयोग गर्न सकिन्थ्यो होला । यसले विदेशबाट फूलको आयात घटनका साथै आफ्नै उत्पादनमा निर्भर रही यिनीहरुको संरक्षण र उपयोग गर्न पनि सकिन्थ्यो । तसर्थ स्वदेशी शोभनीय विरुवाहरुको प्रबर्द्धनकोलागी यिनीहरुको पहिचान, अध्ययन, अनुसन्धान र विकासका कार्यहरुलाई अगाडि बढाउन आबश्यक देखिन्छ ।

सन्दर्भ सामग्रीहरु

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पर्यावरण चक्रमा पुष्प व्यवसायको योगदान

लेखनाथ पोखरेल
उप-सम्पादक, हिमालय टाईम्स दैनिक

श्रृङ्गार, सुन्दरता र पवित्रताको प्रतिक फूल सबै धर्म र समुदायको प्रिय बस्तु मानिन्छ । विभिन्न धार्मिक, सांस्कृतिक कार्यका साथै जन्म देखि मृत्यु पर्यान्त सम्म नभइ नहुने फूलले पछिल्लो समय व्यवसायीकरणसँगै देशको अर्थतन्त्रमा समेत महत्वपूर्ण योगदान पुऱ्याउन थालेको छ । खास गरी निजी क्षेत्रको पहल र प्रयासमा पुष्प व्यवसाय आत्मनिर्भरोन्मुख तर्फ अग्रसर हुँदैछ । तथापी अझै पनि अपेक्षा अनुसार नेपालमा पुष्प व्यवसायले गति भने लिन सकेको छैन । नीतिगत, पूँजीगत, प्रविधिगत र बजारीकरण लगायतका समस्याका कारण पुष्प व्यवसायले अपेक्षा अनुसार गति लिन नसकेको हो ।

खाद्यन्न उत्पादन सरकारको प्राथमिकतामा रहेपनि पुष्प खेती खासै प्राथमिकतामा परेको देखिँदैन । तर सरकारले पुष्प व्यवसाय पनि प्राथमिकतामा रहेको बताउने भने गरेको छ र सोही अनुसार पुष्प प्रवर्द्धन नीति २०६९ निर्माण गरी कार्यान्वयनमा ल्याएको पनि छ । पुष्प नीति कार्यान्वयनमा आएपनि पूर्णरुपमा कार्यान्वयनमा आउन नसक्दा पुष्प क्षेत्रले गति लिन नसकेको हो । लगानी वातावरण बन्न नसक्नु, बजार समस्या र सरकारी उपेक्षाका कारण पुष्प व्यवसाय फस्टाउन नसकेको सम्वद्ध व्यवसायीहरुले बताउने गरेका छन् । अन्य व्यवसायमा चासो र चिन्ता गर्ने राज्यले पुष्प व्यवसायलाई उपेक्षा गरेको व्यवसायीहरुले गुनासो गर्ने गरेका छन् ।

मुलुक संघीयतामा गइसकेपछि सबै कार्यक्रम स्थानीय तहमा गए पनि पुष्प क्षेत्र भने स्थानीयस्तरबाट सुधार भएर आउन सकेन । फूल उत्पादन गाउँ केन्द्रित र खपत शहर केन्द्रित हुनु पर्नेमा उत्पादन र खपत दुबै शहर केन्द्रित रहँदै आएको छ । तर शहरी क्षेत्रमा यसको खेती विस्तारका लागि जग्गा अभाव रहेका कारण उत्पादन बढाउन सकिने अवस्था छैन । सरकारले पुष्प नीति कार्यान्वयनसँगै २०७१ देखि २०७४ सम्म कृषि मन्त्रालयसँग समन्वय गरेर लगानी गरेका कारण केही हदसम्म पुष्प क्षेत्र अहिलेको अवस्थासम्म आउन संभव भएको हो तर संघीयतासँगै धेरैजसो प्रदेश र स्थानीय तहहरुले पुष्प क्षेत्रलाई खासै प्राथमिकतामा नदिएकाले ग्रामीण क्षेत्रमा विस्तार हुन सकेको छैन । त्यसो त स्थानीय तहहरुले पुष्प व्यवसायको महत्व नबुझेका कारण पनि यस्तो भएको हुन सक्छ ।

पुष्प व्यवसायको बहुआयामिक भूमिका हुन्छ । श्रृङ्गार र सुन्दरताका लागि मात्रै नभई पुष्प व्यवसाय पर्यावरणीय महत्व अझै बढी छ । पर्यावरणीय चक्रमा महत्वपूर्ण मानिएको मौरी संरक्षणका साथै मह उत्पादन प्रवर्द्धनमा पनि पुष्प व्यवसायको भूमिका महत्वपूर्ण रहने गरेको छ । मौरीको योगदान मह भन्दा पनि पर्यावरणमा बढी हुन्छ । मह भनेको त एउटा सानो पाटो मात्रै हो । तर जलवायु परिवर्तन, कृषिमा विषादी र रसायिनक पदार्थको बद्दो प्रयोग लगायतका कारण मौरी संकटमा पर्दैछ । यदि विश्वबाटै मौरी लोप भएमा मावन जातिको पनि अन्त्य हुने बैज्ञानिकहरुले चेतावनी दिइसकेका छन् । त्यसकारण पुष्प व्यवसायले आर्थिक रुपमा योगदान त छँदैछ । मौरी लगायत मानवीय जोखिम न्यूनीकरणका लागि अझै पुष्प व्यवसायबाट ठूलो योगदान पुग्न सक्ने कुरालाई नजर अन्दाज गर्दा नयाँ पिढी माथि अन्याय गरेको ठहरिनेछ ।

धेरै मुलुकले फूललाई कृषि पर्यटनसँग पनि जोडेर ठूलो आर्थिक लाभ लिइरहेका छन् । फूलको अर्थशास्त्रलाई कृषिको नयाँ आयाम मानेर आन्तरिक र बाह्य पर्यटक आकर्षित गर्न थालिएको छ । प्राकृतिक बनफूलहरु, प्रजनन गरिएका विभिन्न प्रजातिका फूल र कृषिजन्य फलफूलका रुख बिरुवामा लाग्ने फूलहरूले वसन्तमात्र नभइ सबै सिजनलाई रमणीय बनाउने गरेको छ । कतिपय फूलका सुगन्धका हावाहरुले पर्यटकलाई आकर्षित गरिरहेको हुन्छ । गाउँ वस्तीलाई स्वच्छता प्रदान गरिरहेको हुन्छ ।

त्यसैले फूललाई नर्सरीमा मात्रै सीमित नगरी पर्यटकीय पदमार्ग र वन जंगलहरुमा लगाउन र भएकै वनफूलका जातहरु संरक्षण र सम्वर्द्धन गर्न आवश्यक छ । भौगोलिक विविधतायुक्त नेपालमा पनि गुराँस, पारिजात, बुकी, जाई, जुई चमेली, सुनाखरी, गुराँस, चाँप, चिमालो, प्याउली जस्ता बनफूल पाइने क्षेत्रहरू धेरै छन् । पूर्वी पहाडी भागका केही स्थान र रारा, खप्तड, डडेलधुरा जस्ता स्थानलाई पर्यटनका महत्वपूर्ण स्थानका रूपमा सुधार र विकास गर्न सकिन्छ भने तोरी, फापर, आँप, आरु, स्याउ, सुन्तला जस्ता अन्न र फलफूलका बोट बगान समेत विकास गरी कृषि पर्यटनको विकास गर्न सकिन्छ ।

त्यसका लागि तालिम, नेपाली माटो र हावापानीमा उत्पादन हुनसक्ने फूलका विभिन्न प्रजाति विविधता पहिचान गरी विद्यालय तथा विश्व विद्यालयमा फूल सम्बन्धी अध्ययन गर्ने पाठ्यक्रम विकास, स्थानीय सरकारहरूले व्यक्तिगत र व्यावसायिकरूपमा फूल उत्पादन गर्न चाहनेलाई परामर्श, सहयोग र तालिम, फूलखेतीमा लागेकालाई प्रोत्साहन, आर्थिक प्राविधिक सहयोग, यातायात तथा बजार व्यवस्थापनमा जोड दिनुपर्छ । त्यस्तै पुष्प तथा पुष्पजन्य वस्तु निर्यात प्रवर्द्धनका लागि उपयुक्त पूर्वाधारमा पनि ध्यान दिनुपर्छ । निर्यात अनुकुल पूर्वाधारको व्यवस्था हुन नसकेकै कारण फूल निर्यात अपेक्षा अनुसार बढ्न सकेको छैन भने महँगो कार्गो भाडादरका कारण फूल लगायतका नेपाली उत्पादनले मूल्यकै कारण अन्तर्राष्ट्रिय बजारमा प्रतिस्पर्धा गर्न नसकिरहेको अवस्था छ ।

झण्डै एक दशक अघि सरकारले जारी गरे व्यावसायिक पुष्पखेती सर्वेक्षण २०७२ अनुसार तत्कालिन समयमा मुलुकका ३६ जिल्लामा दुइ हजार नौ सय ४१ रोपनी क्षेत्रफलमा व्यावसायिक पुष्पखेती भएको तथ्याङ्कले देखाएको थियो । पाँच सय ६१ व्यवसायीले पुष्पखेती व्यवसाय सञ्चालन गरेको र सबैभन्दा धेरै बागमती प्रदेशम तीन सय ८१ व्यवसायी आवद्ध रहेको उल्लेख छ । सबैभन्दा धेरै काठमाडौंमा दुइ सय ८३ फार्म, ललितपुरमा ४०, मोरङमा

२३, कास्कीमा २२ र भक्तपुरमा २० फार्ममा पुष्पखेती भएको र पुष्प व्यवसायमा करिब पाँच अर्बको लगानी रहेको थियो । ७२ हजार तीन सय ८५ व्यक्तिले रोजगारी पाएको पुष्प व्यवसायमा काठ र बाँसबाट नौ सय ९६ टनेल, एक सय ८२ ग्रीन हाउस, जिआई पाइप फ्रेमबाट ४३ ग्रीन हाउस, एसएस पाइप फ्रेमबाट ३१ ग्रीन हाउस, २६ वटा टनेल मार्फत थप पुष्पखेती गरिएको थियो । त्यस्तै भाडामा लिएर पुष्पखेती गर्ने ६१ प्रतिशत, आफ्नो जग्गा आफैं चलन गरी खेती गर्ने ३८ र अन्य उपभोग अन्तर्गत पुष्पखेती गर्ने एक प्रतिशत थिए भने २६ प्रतिशतले ऋण लिएको मध्ये ३६ ले सहकारी, २७ ले कृषि विकास बैंक, २६ ले अन्य वित्तीय संस्था र १२ प्रतिशतले अन्य स्रोतबाट ऋण लिएर व्यवसाय गरेको उल्लेख छ । राष्ट्रिय तथ्यांक कार्यालयले उक्त सर्वेक्षण हिमाल र पहाडमा आठ आना तथा तराइमा १० धुर जमिनलाई आधार मानी गरेको थियो ।

तर फ्लोरिकल्चर एसोसिएसन नेपाल (फयान) को तथ्याङ्क अनुसार पछिल्लो समयमा पुष्प व्यवसाय सातै प्रदेशका मुख्य शहरहरुमा फैलिँदै गएको छ । पुष्प व्यवसायको माग र आपूर्तिमा बार्षिक बृद्धिदर १० देखि १५ प्रतिशत हाराहारी रहेको छ । बिगत केही बर्ष कोरोना कारण पुष्प व्यवसायमा नकारात्मक असर पुऱ्याए पनि आर्थिक वर्ष २०७९/८० देखि पुष्प व्यवसायले पुनः गति लिएको र हाल पुरानै लयमा फर्किसकेको छ । पछिल्लो समय अर्घाखाची, खोटाङ, उदयपुर र बर्दिया जिल्लामा पनि पुष्प व्यवसाय सुरु हुँदै पुष्प व्यवसाय हुने जिल्ला संख्या ५२ पुगेको छ भने लगभग २६० हेक्टरमा पुष्प व्यवसाय भइरहेको र ११७४ भन्दा बढी पुष्प व्यवसायीहरु संलग्न रहेका छन् । पुष्प व्यवसायमा अनुमानित लगानी ८ अर्ब ८३ करोड भन्दा बढी पुगेको छ भने पुष्प ब्यवसायमा प्रत्यक्ष तथा अप्रत्यक्ष गरी ५१,५०० सय भन्दा बढी जनशक्ति रोजगार रहेका छन् । आर्थिक वर्ष २०७५/७६ मा पुष्पको बार्षिक कारोबार दुइ अर्ब ४२ करोड रहेकोमा आर्थिक वर्ष २०७७/७८ मा कोरोनाको कारण कारोबारमा कमी आइ जम्मा एक अर्ब ६३ करोडमा खुम्चिएको थियो तर आर्थिक वर्ष २०७९/८० मा बढेर तीन अर्व सात करोड भन्दा बढीको कारोबार भएको थियो भने आ.ब.२०८०/८१ मा ३ अर्व ६८ करोड भन्दा बढिको बार्षिक कारोबार भएको फ्यानको तथ्याङ्क रहेको छ ।

भन्सार विभागको तथ्यांक अनुसार आर्थिक बर्ष २०८०/८१ मा पुष्प तथा पुष्पजन्य बस्तुको बार्षिक निर्यात एक करोड दुइ लाख १२ हजार रहेको छ । मुख्य गरी नेपालबाट जापान, हङकङ, अमेरिका, अस्ट्रेलिया, यूके, दक्षिण कोरिया, श्रीलंका, कतार, जर्मनी, भारतमा पुष्प तथा पुष्पजन्य वस्तु निर्यात भएको हो । त्यस्तै सोही आर्थिक वर्षमा पुष्प तथा पुष्पजन्य बस्तुको आयात कारोबार २७ करोड ७९ लाख पाँच हजार रहेको छ । पुष्प तथा पुष्पजन्य बस्तु आयात हुने देशहरुमा भारत, नेदरल्याण्ड, चीन, जापान जर्मनी, केन्या, थाइल्याण्ड, भितनाम, अमेरिका, इजिप्ट, इथोपिया, बेल्जियम, चिली, डेनमार्क, युके, श्रीलंका, ताइवन, इण्डोनेसिया, मेक्सीको लगायतका देशहरु रहेका छन् ।

नेपाली शोभनीय सुनाखरी: हरजोर

(*Cymbidium aloifolium (L.) Sw.)*

दिपक लामिछाने
वरिष्ठ वैज्ञानिक अधिकृत, वनस्पति विभाग

परिचय

हरजोर *(Cymbidium aloifolium)* एक प्रकारको एकदलीय वर्गको सुनाखरी परिवार (Orchidaceae) अन्तरगत पर्ने वहुवर्षीय वनस्पति हो, जुन मुख्य रुपमा नेपाल, भारत, भुटान, वङ्गलादेश, श्रीलङ्का, चीन, म्यानमार, मलेशिया, थाईल्याण्ड तथा अन्य उष्ण देखि उपोष्ण प्रदेशीय क्षेत्रहरुमा पाईन्छ । वनस्पति विभाग अन्तरगतको राष्ट्रिय हर्वेरियम तथा वनस्पति प्रयोगशाला, गोदावरीमा सुर्खेत, दाङ्ग, कास्की, गोरखा, म्याग्दी, चितवन, महोत्तरी, मोरङ्ग, संखुवासभा र ईलाम जिल्लाबाट सङ्कलन गरिएका हर्वेरियम नमुनाहरुको संरक्षण गरी राखिएको छ । यो वनस्पति नेपालको वन जङ्गलमा करीव १५० मिटर देखि १६०० मिटरको उचाई सम्म प्राकृतिक रुपमा पाईन्छ । *Cymbidium aloifolium* लाई पहिलो पटक आधुनिक वर्गीकरण प्रणालीका पिता (Father of Modern Taxonomy) कार्ल लिनेयस (Carl Linnaeus) ले सन् १७५३ मा आफ्नो प्रसिद्ध कृति *Species Plantarum* मा वर्णन गरेका थिए ।

हरजोरका पातहरू बाक्लो, लाम्चो र घीउकुमारी *(Aloe vera)* को जस्तै देखिन्छन्, जस्ले गर्दा यसको वैज्ञानिक नाममा "aloifolium" आएको हो भने अंग्रेजी नाम Aloe–leafed cymbidium हो । यो वनस्पति रुखको हाँगामा वा कापामा टाँसिएर (Epiphyte) झुण्डिएको वा ढुङ्गामा टाँसिएर (Lithophyte) हुर्किएको हुन्छ । यो सुनाखरी प्रकाशयुक्त तर प्रत्यक्ष घाम नपर्ने स्थानमा राम्रोसँग हुर्किन्छ । प्रायः चैत्र देखि भदौ महिनासम्म फूल्ने यो सुनाखरीका फूलहरु लामो पुष्प मञ्जरी (Inflorescence) मा समुहवद्व भएर रहेका हुन्छन् । फूलहरू आकर्षक र बहु-रङ्गी (हल्का पहेँलो, खैरो, रातो धर्साहरू भएका) हुन्छन् । ओष्ठ दल (labellum) सेतो वा बैजनी धर्सा सहितको हुन्छ । फल कैप्सुल (Capsular) जस्तो हुन्छ भने फल भित्र धुलो जस्ता ससाना हजारौं बीउहरू (Dust–like seeds) रहेका हुन्छन्।

यो वनस्पति "दुर्लभ वन्यजन्तु तथा वनस्पतिको अन्तर्राष्ट्रिय व्यापार महासन्धि "Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) को अनुसूची २ मा सुचिकृत छ । यसको संरक्षण गर्न अति आवश्यक छ किनभने प्राकृतिमा धेरै विरुवाहरु एकैपटक उत्पादन हुन नसक्ने, वन विनास, डढेलो, गाँउ घरतिर घाँसपातको रुपमा विरुवा नै उखेलेर प्रयोग गर्ने र आलाङ्कारिक विरुवा (Ornamental plant) का लागि पनि सङ्कलन गर्ने भएकोले प्राकृतिक रुपमा यसको उपलब्धता घट्दै गएको छ ।



हरजोर *(Cymbidium aloifolium)*

प्रजनन विधी *(Propagation techniques)*

Cymbidium aloifolium को प्रजनन मुख्यतयाः निम्नानुसार गर्न सकिन्छ ।

१. वीउवाट (By seeds)

यो वनस्पतिको वीउ धेरै सानो हुन्छ र प्राकृतिक विधीवाट अङ्कुरण हुन माटोमा पाईने विशेष ढुसी माईसोराईजल (Mycorrhizal roots) को जरुरत पर्छ वा माईसोराईजलको उपस्थितिमा मात्रै वीउहरु उम्रन सक्छन्। त्यसैले यो विधीवाट विरुवा उत्पादन कार्य एकदमै ढिलो र थोरै मात्रामा हुने गर्दछ ।

२. राईजोम वा स्युडोवल्व विभाजन गरेर (By division of rhizome or pseudo bulb)

परिपक्व विरुवामा रहेको राईजोम वा स्युडोवल्व काटेर वेग्लै रोप्दा नयाँ विरुवा उत्पादन गर्न सकिन्छ । राईजोम एक रुपान्तरित काण्ड हो जस्ले नयाँ जरा वा अङ्कुर उत्पादन गरेर विरुवाको फैलावट र प्रजनन् कार्यमा मद्दत गर्दछ । सामान्यतया यो माटो भित्र तेर्सो परेर रहेको हुन्छ भने स्युडो वल्व पनि एक प्रकारको काण्ड नै हो जुन मोटो हुन्छ र विरुवाका लागि आवश्यक पर्ने पानी र पोषक तत्व भण्डारण गर्दछ । यो वल्व जस्तो देखिए पनि वास्तविक वल्व नभई नक्कली वल्व हो । विशेष गरेर सुनाखरी प्रजातिमा स्युडोवल्व पाईने गर्दछ । यो विधी छिटो तथा प्रभावकारी रुपमा हुने भएकोले व्यवसायिक नर्सरीहरुमा यो विधी प्रयोग गर्न उपयुक्त देखिन्छ ।

३. तन्तु प्रजनन्विधीबाट (By tissue culturemethod)

यो विधीबाट तन्तु प्रजनन् प्रयोगशाला (Tissue culture laboratory) माछोटो समयमा धेरै र स्वस्थकर विरुवाहरु उत्पादन गर्न सकिन्छ । वनस्पति विभागको टिष्युकल्चर प्रयोगशालामा टिष्युकल्चर प्रविधी प्रयोग गरी हरजोर *(Cymbidium aloifolium)* का विरुवाहरु उत्पादन गरिएको छ, जस्को उत्पादन विधी संक्षेपमा यस प्रकार रहेको छः

- प्राकृतिक वासस्थानबाट राम्रोसँग परिपक्व नभएको हरजोरको फल (Capsule) सङ्कलन गरी प्रयोगशालामा ल्याईन्छ । प्रयोगशालामा वगिरहेको धाराको पानीमा करीव आधा घण्टासम्म राखी Sodium hypochloride र Ethanol को माध्यमबाट ढुसी र व्याक्टेरिया मुक्त गरिन्छ ।
- Petri disc मा फललाई राखेर ब्लेडको मद्दतबाट लाम्चो हुने गरी दुई भागमा काटिन्छ । यो काम प्रयोगशालामा भएको वा यो सेफ्टी क्याविनेट भित्र गरिन्छ ।
- विरुवाका लागि आवश्यक पर्ने खानेकुरा (Culture media: MS (Murashige & Skoog) culture medium+10% coconut milk) तयार गरिन्छ जस्को pH ५.५ देखि ५.८ बनाईन्छ ।
- तयार भएको Culture media लाई विरुवा उत्पादन गर्ने शिशी (Culture jar) भित्र राखिन्छ।
- Forceps को मद्दतबाट फल भित्र रहेका वीउ लाई Culture media मा छरिन्छ र Culture jar को बिर्को हावा नछिर्ने गरी बन्द गरिन्छ ।
- यसरी तयार गरिएका Culture लाई प्रयोगशालामा भएको ईन्क्युवेशन कक्ष (Incubation room) मा राखिन्छ जहाँ १६ घण्टा प्रकाश, ८ घण्टा अध्यारो र २५±२^{0}से तापक्रम र आवश्यक सापेक्षित आद्रता हुने गरी व्यवस्था मिलाईएको हुन्छ।
- केही हप्ता पछि वीउको प्रारम्भिक वृद्वि अवस्था वा अङ्कुर अवस्था (Protocorm) को विकास र Protocorm लाई Msculture medium मा काण्डको विकास गर्ने हर्मोन साईटोकाईनिन (Benzyl Amino Purine i.e.BAP) र जराको विकास गर्ने हर्मोन अक्सिन (Naphthalene Acetic Acid i.e., NAA) को विभिन्न मात्रा राखेर विरुवाको निरन्तर वृद्विका लागि सवकल्चर (Subculture) गरिन्छ यसो गर्दा पहिला सुक्ष्म काण्ड र पछि जराहरु विकास हुन्छन्।
- ८ देखि १० हप्तामा ससाना विरुवाहरु शिशी भित्र हुर्कन थाल्छन् ।
- यसरी काण्ड र जरा विकास भएका विरुवालाई Culture jar बाट वाहिर निकाली सफा पानीले जरामा भएको Culture media लाई पखाली केही मिनेट ढुसी नियन्त्रण गर्न प्रयोग गरिने रसायन (Fungicides) को झोलमा डुवाएर निकालिन्छ र पुनः सफा पानीले सफा गरे पछि झ्याउ (Sphagnum moss) ले जरालाई वेरेर अर्किड मिक्स माटो प्रयोग गरिएको गमला वा प्लाष्टिक/काठको ट्रेमा रोपी अनुकुलित वातावरण भएको ग्रीनहाउस वा

नर्सरीमा राखिन्छ ।

- जव विरुवा परिपक्व रुपमा विकसित हुन्छन् तव अर्किड मिक्स माटो राखी तयार गरिएको गमला वा अर्किड वक्स अथवा झ्याउको मद्दतबाट रुखका कापाहरुमा पनि रोप्न सकिन्छ।
- उचित हेरचाह र स्याहार सम्भार पश्चात यसरी गमला वा फिल्डमा रोपिएका विरुवा ३ देखि ४ वर्षमा फूल्न शुरु गर्दछन् ।

हरजोरको फल *(Capsule)*

फललाई पानीमा सफा गरिदैं

फल भित्र रहेको बीउ

ईन्क्युवेशन कक्ष

अङ्कुर अवस्था*(Protocorm)*

शिशी भित्र विरुवाहरु

ग्रीनहाउस भित्र पोलि व्यागमा सारिएका विरुवाहरु

गमलामा फूल्दै गरेको एक वयस्क हरजोर

परस्थानीय संरक्षणका लागि रुखको कापामा विरुवा रोप्दै

तस्वीरहरुः वनस्पति विभागमा टिष्युकल्चर प्रविधीबाट हरजोरका *(Cymbidium aloifolium)* विरुवाहरु उत्पादन

हेरचाह *(Caring)*

यो सुनाखरी रुखको हाँगामा वा ढुङ्गामा उम्रने भएकाले साधारण माटोमा राम्रोसँग हुर्कन सक्दैन् । माटोमा राम्रोसँग हावा र पानी छिर्न सक्ने (Well drained) र हल्का सुख्खा हुनु पर्दछ। यसका लागि Orchid mix माटो प्रयोग गर्नु पर्दछ । Orchid mix माटोमा काठको वोक्रा (Bark), कोईला (Charcoal), झ्याउ (Sphagnum moss), ससाना ईट्टाका टुक्रा (Small pieces of brick) र परलाईट (Perlite) मिसाईएको हुन्छ ।

हरजोरका विरुवा स्वस्थ राख्न महिनामा एक पटक सन्तुलित अर्किड मल (Balanced orchid fertilizer: 20-20-20) को प्रयोग गर्नु पर्दछ । फूल फुल्ने समय वसन्त देखि ग्रीष्म ऋतु सम्म उच्च फस्फोरसयुक्त मल (High phosphorus fertilizer: 10-30-20) प्रयोग गर्दा राम्रोसँग फूल्दछ । मल हाल्दा १ लिटर पानीमा १ ग्राम मल घोलेर पातलो पारेर महिनामा १ पटक प्रयोग गर्दा राम्रो हुन्छ।

यो सुनाखरीलाई जव जराहरु असाध्यै वाक्ला हुन्छन् तव हरेक २ देखि ३ वर्षमा गमला वा सुनाखरी वाकस (Orchid box) फेरेर नयाँ माटोमा रोप्नु पर्छ । पुराना जराहरु काटेर हटाउनु पर्दछ । पुरानो माटो कुहिन सक्छ त्यसैले सफा काठको बोक्रा थप्ने वा नयाँ अर्किड मिक्समा रोप्नुपर्छ ।

विरुवा स्वस्थ राख्न सुख्खा र पहेंला भएका पातहरु हटाउनुपर्छ । फूल ओईलाए पछि फूलको डाँठ काट्नु पर्दछ, जस्ले गर्दा नयाँ फूल फुल्ने प्रकृयालाई सहज वनाँउदछ । जराहरु असाध्यै वाक्लिएर गमलावाट वाहिर निस्कन थालेमा पनि केही भाग काटेर हल्का वनाउन सकिन्छ ।

विरुवालाई धेरै पानी हाल्नु हुदैन् । माटो आधा सुक्ने वित्तिकै हल्का पानी दिनु पर्दछ । विरुवालाई जाडो मौसममा चिसोवाट वचाउनु पर्दछ । यसरी हेरचाह गर्दायो सुनाखरी राम्रोसँग बढ्छ र सुन्दर फूल फुलाँउन सकिन्छ ।

उपयोग तथा व्यापार *(Uses and trade)*

यो सुनाखरीलाई गमलामा वा सुनाखरी वाकसमा रोप्न, बगैंचा, सडक किनारामा रहेका वोटविरुवामा समेत रोप्न र पुष्प विन्यास (Floral arrangements) मा पनि प्रयोग गर्न सकिन्छ ।

नेपाल र दक्षिण पूर्वी एसियाका केही भागहरूमा परम्परागत औषधिमा यसको प्रयोग गरिन्छ । हड्डि भाँचिएमा यसको लेप वनाई लगाएमा चाँडो निको हुन्छ भन्ने विश्वास रहेको छ भने विभिन्न रोगहरूको उपचारमा समेत यसका पात, जरार फूलको प्रयोग पनि गरिन्छ ।

साईटीसको अनुसूची २ मा सूचीकृत भएकोले यो सुनाखरीको व्यापार गर्न नेपाल सरकारको अनुमतिबाट मात्र गर्न पाइन्छ । यसको व्यावसायिक व्यापार प्रायः कृत्रिम रूपमा विशेष गरी टिष्युकल्चर प्रविधीबाट उमारिएका बिरुवाहरूको मात्र गरिन्छ । जंगलबाट गैरकानुनी रूपमा सङ्कलन गरेर व्यापार गरेमा कानुन वमोजिम कारवाही हुन्छ । नेपालमा सङ्कटापन्न वन्यजन्तु तथा वनस्पतिको अन्तर्राष्ट्रिय व्यापार नियन्त्रण ऐन, २०७३ र नियमावली २०७६ अन्तर्गत यो प्रजाति संरक्षित छ, जसले यसको अवैध व्यापारलाई नियन्त्रण गर्न मद्दत गर्छ ।

अन्त्यमा,

हरजोर (Cymbidium aloifolium) नेपालमा प्राकृतिक रुपमा पाईने एक सदावहार सुनाखरी हो । यसको फूल मञ्जरी लामो, फूलहरु वहुरङ्गी, आकर्षक र लामो समयसम्म फुल्ने हुँदा धेरै मानिसहरुले यसलाई गमला वा वगैंचामा रोपेर आलाङ्कारिक फूल (Ornamental flower) को रुपमा पनि प्रयोग गरिरहेका छन् । तसर्थ, पुष्प व्यसायमा समेत प्रचुर सम्भावना रहेको यो सुनाखरीलाई नेपाल सरकारबाट अनुमति लिएर कृत्रिम प्रविधीबाट विरुवा उत्पादन गरी व्यवसायीकरण गर्न सकिन्छ ।

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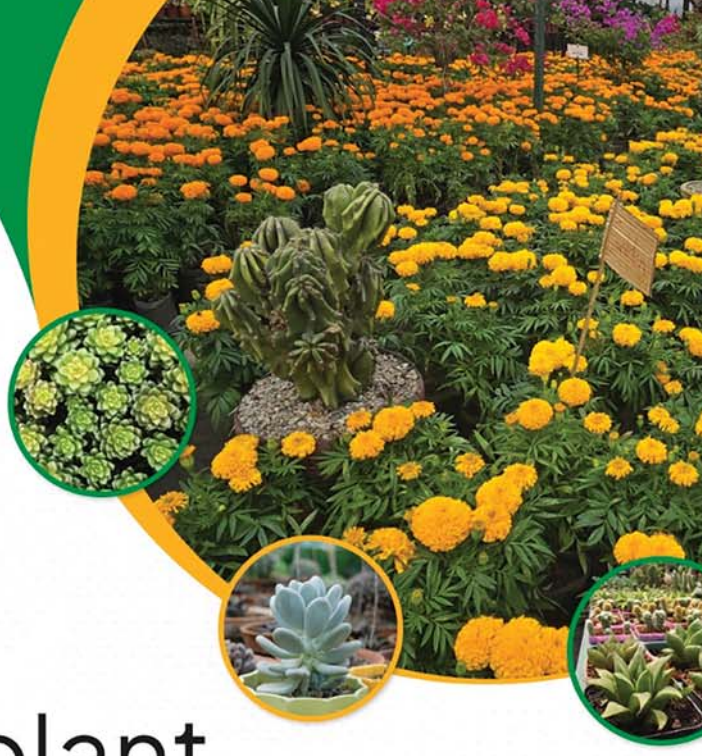

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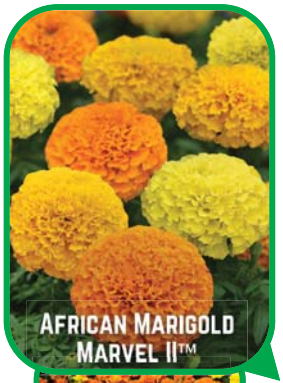

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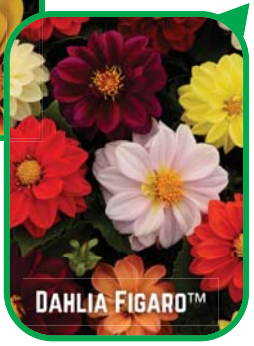

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