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"Clean environment & economic prosperity through floriculture"

Nepalese FLORICULTURE

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पत्र संख्या.:
च.नं. :

शुभकामना

नेपालमा परापूर्वकाल देखिनै अन्य बालीको खेतीसँगै पुष्प खेती प्रत्येक परिवारको परम्परा एवं संस्कृतिको रुपमा रहेको र वर्तमानमा कृषि क्षेत्रका विविध क्षेत्रहरुको व्यवसायीकरण तथा व्यापारीकरणसँगै यो एक कृषि क्षेत्र भित्र उदाउँदो व्यवसायको रुपमा विकसित हुँदै गएको छ। साना ठूला शहरी केन्द्रहरूमा पुष्प तथा पुष्पजन्य उत्पादनको मागमा वृद्धि सँगै यो व्यवसाय विस्तार र विविधीकरण हुँदै गएको र कृषकहरू माझ आयआर्जनको प्रमुख श्रोत बनी राष्ट्रिय अर्थतन्त्रमा टेवा पुऱ्याउँदै आएको छ। यो क्षेत्रको विकास, विस्तार तथा प्रविधि आयातमा निजी व्यवसायहरूको ठूलो लगानी र योगदान रहेको छ। नेपाल सरकारले पुष्प तथा पुष्पजन्य व्यवसायको महत्वलाई मध्यनजर गरी कृषि विकास रणनीति, दीर्घकालिन कृषि योजना, राष्ट्रिय कृषि नीति, २०६१, पुष्प प्रवर्द्धन नीति, २०६९ र वाणिज्य नीति, २०६५ मा पुष्प व्यवसायलाई प्रमुख निर्यात योग्य नगदेबालीको रुपमा प्राथमिकता दिँदै आलंकारिक फूलमा गुणस्तरीय उत्पादन र मूल्य श्रृंखला सुधारमा समेत जोड दिएको छ। पुष्प तथा पुष्पजन्य व्यवसायलाई प्रवर्द्धन गर्न आर्थिक विधेयक, २०७८ मा पुष्प तथा सो सँग सम्बन्धित सामाग्रीहरुमा भन्सार छुटको व्यवस्था गरिएको छ।

नेपालको कृषि पर्यावरणीय विविधता, यहाँ पाईने स्थानीय तथा रैथाने पुष्प तथा पुष्पजन्य प्रजातिहरूका पहिचान, संरक्षण, सम्वर्द्धन र व्यवसायिक प्रयोजनकालागि उपयोगको सम्भावनाले उपलब्ध गराएको अवसरलाई उपयोग गर्न सकेमा थप रोजगारी श्रृजना हुनुका साथै पुष्प तथा पुष्प जन्य उत्पादनको निर्यात वृद्धिको ठूलो अवसर रहेको छ।

पुष्प तथा पुष्पजन्य उत्पादनको व्यवसायीकरण तथा व्यापारीकरणका पर्याप्त अवसर भए पनि उत्पादन तथा बजारीकरणको सन्दर्भमा अति नै संवेदनशिल व्यवसाय रही आएको छ र यसले भण्डारण, ढुवानी तथा बिक्री केन्द्रसम्म विशिष्ट पूर्वाधारको माग गर्दछ र यसको अभावमा व्यवसायीहरूले उपलब्ध अवसरहरूको उपयोग गर्न सकेका छैनन्। पुष्प तथा पुष्पजन्य व्यवसायको विस्तारकोलागि यसको मूल्य श्रृंखलाका प्रमुख अवरोध हटाउन, समस्या निराकरण गर्न, आवश्यक पूर्वाधारहरूको पहिचान, विकास, सञ्चालन तथा व्यवस्थापन गर्न सरकारी, निजी तथा अन्य सरोकारवालाहरूको बिचको समन्वय र सहकार्य तथा सहलगानी आवश्यक रहेको छ। यसका साथै वर्तमानको कृषिको शासकीय संरचनामा कृषि उत्पादन तथा बजारीकरण प्रवर्द्धनका अधिकांश कार्यहरू प्रदेश सरकार तथा स्थानीय तहको दायरामा आएकोले यस क्षेत्रको विकासमा यहाँहरूको भूमिका अझ महत्वपूर्ण रहेको छ।

पुष्प तथा पुष्पजन्य व्यवसायको विकासमा निजी क्षेत्रले महत्वपूर्ण भूमिका खेलेको छ र यसै सन्दर्भमा पुष्प व्यवसायीहरूको संस्था फ्लोरिकल्चर एशोसिएसन नेपालले पुष्प व्यवसायसँग सम्बन्धित विविध विषयहरू र लेख रचना सहितको "Nepalese Floriculture Book" को २५औं संस्करण प्रकाशन गर्न लागेकोमा खुशी लागेको छ। यो पुस्तिकाले पुष्प र पुष्पजन्य व्यवसाय सम्बन्धी विविध विषयहरूको अभिलेखीकरण गरेकोले यो पुस्तिका पुष्प व्यवसायीहरू, उद्यमी, विद्यार्थी, अनुसन्धानकर्ता, अध्ययनकर्ता तथा यसमा चासो राख्ने सम्पूर्ण सरोकारवालाहरूको लागि उपयोगी हुनेछ भन्ने आशा लिएको छु। यस पुस्तकको प्रकाशन गर्न लाग्नु भएकोमा कृषि तथा पशुपन्छी विकास मन्त्रालय र मेरो व्यक्तिगत तर्फबाट बधाई तथा शुभकामना व्यक्त गर्दछु। यसका अतिरिक्त पुष्प तथा पुष्पजन्य व्यवसाय सम्बन्धी विशिष्ट प्रकाशन भएकोले यस प्रकाशनमा सम्मिलित लेख रचनाहरूले नेपाल सरकारलाई नीति तथा योजना निर्माणमा मार्गदर्शन गर्दै आएका छन्। अन्तमा पुष्प व्यवसायमा तथा सम्पूर्ण पुष्प क्षेत्रमा आउने चुनौती तथा समस्याको समाधान गर्दै नविनतम संभावनालाई पहिल्याउनमा फ्लोरीकल्चर एसोसिएसन नेपालको निरन्तर संलग्नता रहने विश्वास राख्दै उत्तरोत्तर प्रगतिको शुभकामना दिन चाहन्छु।

चैत्र २, २०७८

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शुभ-कामना

फ्लोरिकल्चर एशोसिएसन नेपालले विगत बर्षमा जस्तै यस बर्ष प्रदेश सरकार, बागमती प्रदेश, भुमी व्यवस्था कृषि तथा सहकारी मन्त्रालय, पुष्प बिकास केन्द्रको सहयोगमा मिति २०७८ चैत्र १० देखि १३ गतेसम्म 23rd Flora Expo 2022 को आयोजना गर्न लागेको जानकारी पाएँ, मलाई अत्यन्त खुशी लाग्यो । संघको यस प्रयासको प्रशंसा गर्दछु । मेलाकै अवसरमा संघले पुष्प सम्बन्धी बिबिध लेख रचनाहरु सहित प्रकाशन गर्ने Nepalese Floriculture प्रकाशनको पनि पूर्ण सफलताको कामना गर्दछु ।

फूलको आन्तरिक मागको करिब ९१ प्रतिशत स्वदेशी उत्पादनले पुरा गर्न थालेको छ र यो व्यवसाय छिट्टै पूर्णरुपमा आत्मनिर्भरतातर्फ उन्नमुख देखिन्छ । नेपालमा पुष्प व्यवसायको प्रवर्द्धनमा संघले निर्वाह गरेको भूमिकाको प्रशंसा गर्दछु । कोभिडका कारण पुष्प व्यवसाय क्षेत्रले ठूलो नोक्सानी व्यहोर्नु परेकाले यस क्षेत्रका लागि राहत सहयोग राज्यकातर्फबाट उपलब्ध गराउनुपर्ने, स्वदेशी पुष्प प्रवर्द्धनका लागि आयातित फूलमा नियन्त्रण गर्नुपर्ने, पुष्प नीतिलाई संघीय संरचना अनुसार परिमार्जन गर्नुपर्ने लगायतका संघका सुझावलाई सम्बन्धित निकायमा पुरयाउने काममा महासंघले पनि निरन्तर पहल गर्दै आएको छ । संघले हरेक वर्ष आयोजना गर्ने० पुष्प मेला व्यवसायिक पुष्प खेतीको प्रवर्द्धनका लागि महत्वपूर्ण माध्यम बन्दै आएको छ । संघकै अनवरत प्रयासका कारण आन्तरिक खपतका साथै विस्तारै निर्यात समेत हुन थालेको छ । नेपालको भौगोलिक बनावट सबै प्रकारका फूल उत्पादनका लागि उपयुक्त छ । कोरोना महामारिले विगत दुई वर्षभन्दा बढी समयदेखि थला परेको उद्योग व्यवसायलाई यस्ता गतिविधिले पुरानै लयमा फर्काउन सहयोग गर्ने मेरो विश्वास छ ।

Nepalese Floriculture 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 तपाईंहरूलाई सफलता मिल्दै जाओस भन्ने शुभेच्छाका साथ यहाँहरूको उत्तरोत्तर प्रगतिको कामना गर्दछु ।

अन्त्यमा, **23rd Flora Expo 2022** को आयोजना र **Nepalese Floriculture** प्रकाशन कार्यको पूर्ण सफलताका लागि हार्दिक शुभ-कामना व्यक्त गर्दछु ।

(शेखर गोल्छा)
अध्यक्ष

मिति २०७८ चैत्र १ गते, मंगलवार ।

Regd. No. 244/049/50

फ्लोरिकल्चर एशोसिएसन नेपाल
Floriculture Association Nepal (FAN)

Ref.:

सन्देश

फ्लोरिकल्चर एशोसिएसन नेपाल (फ्यान) ले आफ्नो स्थापना काल देखि नै विभिन्न काल खण्डमा आई परेका विभिन्न समस्याहरुलाई चिर्दै सेवामुखि भावनाले समस्त पुष्प व्यवसायीहरुको हकहितलाई उचो राखि निरन्तर रुपमा पुष्प व्यवसायको समग्र बिकास बिस्तार तथा प्रबर्द्धन गर्दै आइरहेको छ।

दोस्रो संबिधान सभा २०७२ बाट देश पुनःसंरचनामा गई सके पश्चात यस संस्थाले देशको तीनै तहका सरकारसंग सहकार्य गर्ने नीति लिदै आईरहेको छ र संस्थाको संरचनामा पनि परिमार्जन गर्दै लगिरहेका छौं। बिशेष गरि स्थानिय सरकारसंग उत्पादन, प्रदेश सरकारसंग प्रबिधी बिकास र वजारिकरण साथै संघिय सरकारसंग अनुसन्धान, बिकास र नितिगत लबिङ्ग साथै प्रबर्द्धनसंग जोडिएर सहकार्य गर्ने प्रयास भईरहेको छ।

विगत वर्षहरुमा सरकारको लगानी बिना नै निजी क्षेत्रको प्रयासमा लगानी, उत्पादन, गुणस्तर, आयात प्रतिस्थापन र निर्यात प्रवर्द्धन कार्यमा नेपाली पुष्प व्यवसायले उल्लेख्य उपलब्धि हासिल गरेको छ। तथापी अझै आन्तरिक बजारको मागलाई स्वदेशी उत्पादनले पुरा गर्न सकिरहेको छैन। वार्षिक १० देखि १५ प्रतिशतको दरले पुष्प तथा पुष्पजन्य वस्तुको माग बजारमा थपिने गरेको छ। यो असन्तुलनलाई आन्तरिक उत्पादनले पुरा गरि निर्यात प्रवर्द्धनका लागि एशोसिएसनले सरकार, संघ संस्था एवं उद्यमी व्यवसायीसँग बहस पैरवी र सहकार्य गर्दै आइरहेको छ। आन्तरिक उत्पादनलाई गुणस्तर सुधार सहितको सबल र सक्षम बनाउनु आजको आवश्यकता हो। जसबाट पुँजीको उपयोग, अवसरको सृजना तथा साधन स्रोतको ग्रामीण स्तरसम्म पहुँच पुग्न सक्दछ।

बि.सं. २०६९ मा मन्त्री स्तरबाट पास भई लागु समेत भएको पुष्प प्रबर्द्धन नीति २०६९ लाई समय सापेक्ष परिमार्जन गरिनु पर्ने आबश्यकता 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।

भोलिका दिनहरुमा यस क्षेत्रमा उच्च प्रविधियुक्त ग्रिनहाउस थोपा सिंचाई तथा मिष्ट सिंचाई प्रणालीसंगै वाटर सोलुवल फर्टिगेसन सिस्टम, नियन्त्रित (रोग तथा किराको लागि) प्रणाली सहितको प्रविधि र उत्पादन सामग्री वीउ वीजनको उत्पादन तथा बितरण भित्र्याउन अत्यन्त आवश्यक छ। यसले आन्तरिक उत्पादनमा गुणस्तर सुधार हुनुका साथै स्वस्थ उत्पादनबाट अन्तराष्ट्रिय बजारमा प्रतिस्पर्धा योग्य वस्तुको विकास हुनेछ यसैको माध्यमबाट विश्व पुष्प बजारमा हामीले आफ्नो स्थान सुरक्षित पाउने छ। वर्तमान अवस्थामा दैनिक हजारौ युवाशक्ति विदेश पलायन हुनबाट रोक्न समेत महत्वपूर्ण भूमिका खेल्नेछ।

अन्तमा हामीलाई सहयोग गर्ने नेपाल सरकारका निकायहरु, 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 याहाँहरुको सदैब साथ र सहयोग रहनेछ भन्ने समेत आशा लिएको छु।

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सम्पादकीय

फ्लोरिकल्चर एशोसिएसन नेपालले प्रत्येक वर्ष पुष्प मेला तथा प्रदर्शनी आयोजना गर्ने क्रममा पुष्प सम्वन्धी लेख, रचना, अध्ययन, अनुसन्धान, सुचना तथा आधुनिक खेती प्रबिधी सम्बन्धि बिबिध बिषयहरूलाई समेटी पुस्तक प्रकाशन गर्दै पाठक सामु पस्कदै आएका छौं । यसै क्रममा यस बर्ष पनि बार्षिक स्वमा प्रकाशन हुदै आएको Nepalese Floriculture २५ औं संस्करणको रूपमा प्रकाशन गरी तपाँईहरु समक्ष ल्याई पुऱ्याएका छौं ।

हाम्रो अर्थतन्त्रमा बिगत केहि बर्ष देखि लगातार अप्रिय घटनाहरुको सामना गर्नु परिरहेको अवस्था छ । २०७२ को महाभुकम्प लगत्तै पछिको अघोषित नाकाबन्दीले हाम्रो अर्थतन्त्रमा दिर्घकालिन स्वमा पुऱ्याईरहेको असर सेलाउन नपाउदै अर्को बिनासकारी महामारी कोभिड १९ ले सम्पुर्ण बिश्वलाई नै प्रत्यक्ष असर पुऱ्यायो । संसार भरी महामारीको स्वमा फैलिएको कोरोना भाइरसका कारण लाखौ मानिसहरु मृत्युको मुखमा पुग्न बाध्य भए, करोडौ संक्रमीत भए । उद्योग, कलकारखाना, व्यापार व्यवसाय ठप्प भए । ठूलो आर्थिक मन्दिको सामना गर्न बाध्य भईरहदा पुष्प व्यवसाय झनै समस्यामा पर्न्यो । २०७६ फागुन अधिसम्म सहज स्वमा चलि रहेको पुष्प व्यवसाय २०७६ चैत्र पछि पुष्प व्यवसाय भित्रका कतिपय बिधाका व्यवसाय प्राय ठप्प नै भयो । हाम्रो जस्तो सानो अर्थतन्त्र भएको देशमा उत्पादन बजारीकरणका स्थापित संजालहरु कोभिड महामारीको कारण बिस्थापित हुन पुगे । हामीहरु बिगत दुई बर्ष देखि कोभिड-१९ महामारीसंग प्रत्यक्ष स्वमा जुधिरहेका छौ । हाल महामारीको प्रकोप बिस्तारै कम हुदै गईरहेको सन्दर्भमा नेपाली पुष्प क्षेत्रले बिस्तारै अग्रगामी मार्ग समात्ने छ भन्ने पुष्प व्यवसायीहरुको अपेक्षा अनुरुप हुन सकिरहेको अवस्था छैन । समग्र नेपालको अर्थतन्त्रमा यो बर्ष सोच्नै नसकिने अवस्थामा फस्यो । पुष्प व्यवसाय पनि यसबाट अछुतो रहन सकेन । कोभिड-१९ का कारण पुष्पको बजार अस्थिर हुदा उत्पादकहरु अन्योलमा रहे । उत्पादनका सामाग्रीहरु समयमा आयात गर्न नसक्दा पुष्पको आन्तरिक उत्पादन चक्र बिथोलिन पुग्यो । जसका कारण बजारमा आन्तरिक उत्पादनको आपुर्ति कम हुदा आयातमा बृद्धि भईरहेको सन्दर्भमा आगामी दिनहरुमा यस बिषम परिस्थितीबाट पुःन सहज परिस्थितीमा फर्कन राज्यको सरोकारवाला निकायहरुको बिषेश पहल तथा सहजीकरण हुनु पर्ने आजको आबश्यकता रहेको छ । पुष्प व्यवसायमा चुनौती र अवरोधहरु हाम्रो अगाडी पर्खालको स्वमा खडा भएका छन । पुष्प व्यवसाय भित्रका चुनौती र अवरोधहरुलाई सम्बोधन गर्न पुष्पको बर्तमान परिबेशबारे जानकारी, पुष्पको खेती प्रबिधीबारेको ज्ञान र बिचार सहितको लेख रचनाहरु यस अंकमा समेट्ने प्रयास गरेका छौ ।

प्रस्तुत अंकमा Major Insects and disease of Gerbera and their management in Nepal, Floriculture Research in Nepal, Indigenous ornamental plant and flower of Nepal: Need to be explored, Different growing media: Application in Floriculture, Vertical Gardening, History and management of indoor gardens, नेपाली गुराँसहरु आदि 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 भए पनि पुष्प सम्बन्धि 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 कमि कमजोरी प्रति औल्याई परिमार्जन सहित यसको स्तर उन्नती गर्न र समय सापेक्ष बनाउन यंहाँहरुको सहयोगको सदैब हार्दिक अपेक्षा राख्दछौं ।

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Status of light quality in greenhouses growing flower and vegetable crops

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Abstract:

Light is important for growth and development of plants. However, in protected cultivation quality of light is very critical. In this study, quality of light (Photosynthetically Active Radiation (PAR) and Ultraviolet (UV) transmission was measured in several greenhouse under flowers and vegetable scultivation in different parts of Nepal. The measurement was done with UV meter and Light meter. Result showed disparity in quality of the UV stabilized polyethylene (PE) plastic cover used in the country. The UV transmission was higher, and the PAR was lower than ordinary plastic cover (Silpoline) in some UV stabilized cover, which was unexpected. These warrants monitoring of the quality of UV stabilized PE plastic cover supplied in the country.

Introduction:

Light is important for growth and development of plants. However, in protected cultivation quality of light is very critical.The spectrum of light such as UV, PAR, blue, red, or far-red light could play an important role in the growth and development of the plant (Huche-Thelier *et al.,* 2016). Recently, light emitting diodes (LED) lamps supplemental lighting of blue, red, or green light has been found to influence flowering in Strawberry (Magar, *et al.,* 2018), Phalaenopsis (Magar *et al.,* 2020) and Cymbidium (Magar *et al.,* 2022). In Nepal, offseason cultivation of vegetables under plastic cover supported by bamboo structures began in 1996 at Lumle Agriculture Center now Lumle Regional Agriculture Research Center (Atreya *et al.,* 2019) but use of plastic cover as tunnel to cover seed beds for early germination of vegetables was used much earlier in Dhading. In flower nurseries, shade nets were used much earlier and subsequently plastic (90-120gsm) were used for both nursery and cut flower productions (Atreya *et al.,* 2019).

In recent years, more hi tech greenhouses were built either on the initiative of the crop grower or supported by the government as a subsidy scheme. This new generation of greenhouse are well ventilated, GI framed, insect proof, fogger and lighting installed and covered with UV stabilized PE plastic (Atreya et al, 2019). In floriculture crops such as carnations, vase life of the cut flowers was found better, and productivity increased by about 20-30% (Rajesh B Shrestha personal communication, April 2022). This increment in productivity has been attributed to better quality of light among other factors. UV stabilized PE plastic has also been reported to reduce pest infestations (Antignus *et al.,* 1996). The light factor is influenced by the quality of UV stabilized PE plastic cover and the cost of this plastic cover is several times more than the regular plastic cover (120gsm; Silpoline). A range of quality has been observed in the supply of greenhouse materials, but it is yet to be measured objectively (Atreya *et al.,* 2019). However, there has been no study on general quality testing of the UV stabilized PE plastic cover on UV and PAR transmission inside the greenhouse. This study was important to understand the quality of UV stabilized PE plastic cover in different greenhouses built in Nepal to assure better productivity with higher investment.

Materials and Methods:

The survey of greenhouse was done in 5 sites in Kathmandu valley, 2 sites in Kavare districtand one site in Kaski district of Nepal during 2017 and 2018. Newly built greenhouse with either top ventilation or dome shaped and covered with UV stabilized PE plastic (Silpoline also as control) were selected for this research.These greenhouses were used for cultivation of flower or vegetable crops. The UV transmission (gross; UV-A, UV-B and UV-C) was measured using UV Light meter (SP-82UV) Made in Taiwan. The measuring device was held at the about 1m from ground level. UV was measured under clear sky and readings were done both outside and inside the greenhouse. The percentage reduction in UV transmission inside the greenhouse was calculated as per the following equation.

UV transmission (outside) – UV transmission (inside)= ?/100= % of reduction in UV transmission inside the greenhouse.

Photosynthetically Active Radiation (PAR) was measured by Quantum Flux meter (Apogee Instruments Model MQ-100) Made in USA. PAR was measured under clear sky and readings were done both outside and inside the greenhouse. The percentage reduction in PAR transmission inside the greenhouse was calculated as per the following equation

PAR transmission (outside) – PAR transmission (inside) =? /100= % of reduction in PAR transmission inside the greenhouse.

Results and Discussion:

UV transmission in different greenhouses:

There was a wide variation in UV transmission in the different greenhouse ranging from 75.3µWatt cm2 to 1055.6µWatt cm2 (Table 1) this variation suggest that the quality of UV stabilized PE plastic is not consistent. In this research, in two sites (4, 7) the UV transmission was higher than regular plastic ((8)120gsm; Silpoline) whereas in other 5 sites (1, 2, 3, 5,6) it was less. The best reduction of UV transmission was found in site 2 (Kathmandu) and it was 75.3µWatt cm2. The difference in UV transmission from UV stabilized PE plastic could be due to type of plastic used or age of plastic. In this research, utmost care was taken to include only those greenhouses where the UV stabilized cover was one year or less. Differences in the UV transmission could be due to the supply of some poor quality material. The UV transmission in two greenhouses ((4)1055.6µWatt cm2 and (7)1020µWatt cm2) with UV stabilized PE plastic cover is higher than the regular plastic cover ((8)120gsm; Silpoline; 766.8µWatt cm2) which is not expected. This warrants government to do quality testing of UV stabilized PE plastic imported in Nepal so as to ensure quality cover material. The poor quality cover material could affect the productivity and production of the crops there by causing loss to the growers. UV stabilized PE plastic cover has been found to significantly reduce infestations by various types of pests and virus vectored by various types of pests (Antignus *et al.,* 1996). Similarly, the reduction of injured fruits due to pests in the UV stabilized PE plastic growing tomatoes has been found less than regular PE plastic house (Papaioannou *et al.,* 2012). Further, productivity of the various crops grown in the greenhouses with different UV stabilized PE plastic should be studied to objectively measure the yield of the crops by the growers under different conditions.

Table 1: UV transmission in different greenhouses with UV stabilized PE plastic cover.

Site	Altitude (masl)	Outside the greenhouse (µWatt cm^2)	Inside the greenhouse (µWatt cm^2)
1, Kaski	1138	1140	443.8
2, Kathmandu	1336	1811.6	75.3
3, Kathmandu	1300	1000	156.2
4, Kavare	1551	2170	1055.6
5, Kavare	1650	2470	462.2
6, Kathmandu	NA	2240	196
7, Lalitpur	1579	2100	1020
8, Silpoline, Lalitpur	1579	2420	766.8

PAR transmission in different greenhouses:

Greenhouses tested differed in PAR transmission ranging from 425.3µmolem2s1 to 1295µmolem2s1 (Table 2). This variation could be due to several factors, but one major factor could be the quality of the UV stabilized PE plastic cover. In four greenhouses, the PAR transmission was lower ((3)425.3µmolem2s1, (5)641µmolem2s1, (6)729.8µmolem2s1 and (1)738.8µmolem2s1) than the regular plastic cover ((8)120gsm; Silpoline: 1041.2µmolem2s1). This was unexpected because UV stabilized PE plastic cover was supposed to allow transmission of more PAR than the regular plastic ((8)120gsm; Silpoline). Among the 7 greenhouses tested, only greenhouse 2 was found to be superior to the regular plastic cover ((8)120gsm; Silpoline). In greenhouse 2, the UV transmission (75.3µWatt cm2) was lower, and PAR (1252.5µmolem2s1) was higher than the regular plastic cover (8) (UV:766.8µWatt cm2) and PAR: (1041.2µmolem2s1). The season having higher light intensity(Spring and Summer) has been associated with longer vase life of roses (Pompodakis *et al.,* 2005), implying higher PAR associated with better photosynthesis and higher accumulation of carbohydrates (Pompodakis *et al.,* 2005).

Table 2: PAR transmission in different greenhouses with UV stabilized PE plastic cover.

Site	Altitude (masl)	Outside (µmolem^{2}s^1)	Inside (µmolem^{2}s^1)
1, Kaski	1138	1575	738.8
2, Kathmandu	1336	1427.5	1252.5
3, Kathmandu	1300	1300	425.3
4, Kavare	1551	1791	1295
5, Kavare	1650	1402	641
6, Kathmandu		1625.8	729.8
7, Lalitpur	1579	1927	1267.6
8, Silpoline, Lalitpur	1579	2175	1041.2

UV and PAR transmission inside greenhouse in percentage:

The wide variation in UV and PAR transmission in different greenhouses was observed. It was therefore important to calculate the indoor UV and PAR transmission so as to make it

more logical irrespective of high or low outdoor or indoor transmissions. The reduction in UV transmission inside the greenhouse was lower than regular plastic ((8)120gsm; Silpoline) in four greenhouses (2, 3,5 and 6) (Fig. 1) but was more in other three greenhouses (1, 4 and 7a) (Fig. 1). Similarly, the PAR transmission was higher than the regular plastic ((8)120gsm; Silpoline) in three greenhouses (2, 4 and 7) similar transmission in three greenhouses (1, 5 and 6) and lower than the regular plastic cover (120gsm; Silpoline) in one greenhouse (3). It is apparent that the greenhouse 2 is found to be the best in reduction of UV and increment of PAR in contrast to control (8) and other tested greenhouses in various sites. This research is the first of its kind conducted in the region and needs to be replicated with crop productivity and health of the crops.

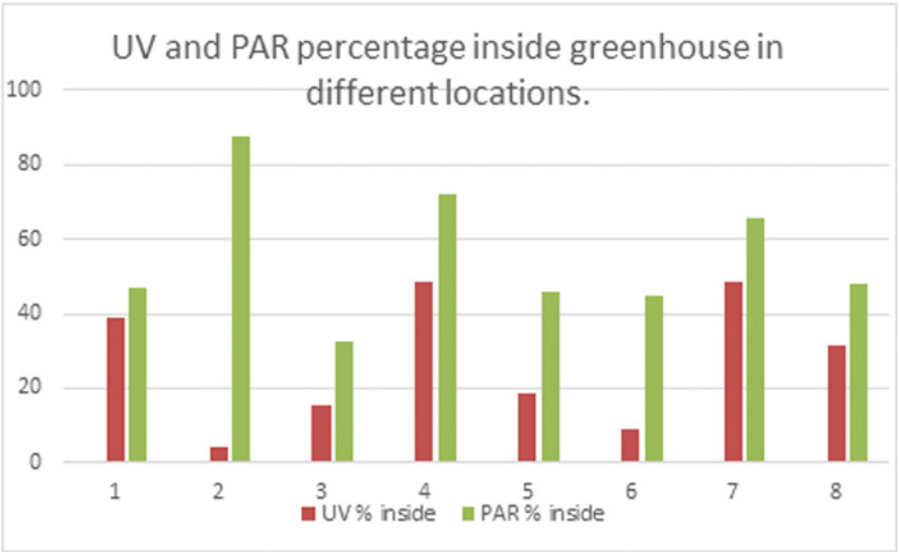

Fig. 1.UV transmission in different greenhouses fitted with UV stabilized PE plastic cover (in percentage) # 8 is covered with Silpoline and others (1-7) are UV stabilized PE plastic cover.

Conclusion:

There is variation on the quality of UV stabilized PE plastic currently being used in the country impacting the crop yield. The UV stabilized PE plastic used in site 2 has been found the best and superior to control (8) (120gsm, Silpoline), Therefore, all the stakeholders and in particular the importers need to be vigilant about the kind of materials they are importing into the market. Similarly, the crop growers also need to know the quality of the UV stabilized PE plastic so that they can get the value for their investment. Furthermore, the government needs to inspect the quality of UV stabilized PE plastic from different suppliers from time to time to ensure good quality product in the Nepalese market. This research needs to be expanded to understand the impact of UV stabilized PE plastic greenhouse on various crops and understand productivity and quality of produce.

Reference:

Antignus, Y., Mor, N., Ben Joseph, R., Lapidot, M., Cohen, S. 1996. Ultraviolet-absorbing plastic sheets protect crops from insect pests and from virus diseases vectored by insects. Environmental Entomology 25 (5) 919-924.

Atreya, P.N., Kafle, A., Subedi, B., Shrestha, S. B. 2019. Precision and protected horticulture in Nepal. Proceedings of the TenthNational Horticulture Seminar, Kirtipur, Kathmandu, Nepal. 161-174.

Huche-Thellier, L., Crespel, L., Gourrierec, J.L., Morel, P., Sakr, S., Leduc, N. 2016. Light signaling and plant responses to blue and UV radiation -Perspective for application in horticulture. Environ. Exp. Bot. 121. 22-38.

Magar, Y. G., Ohyama, K., Noguchi, A., Amaki, W., Furufuji, S. 2018. Effects of light quality during supplemental lighting on the flowering in an everbearing strawberry. Acta Hortic. Vol 1206, 279-284 https://doi.org/10.17660/ActaHortic.2018.1206.39

Magar, Y. G., Koshioka, S., Noguchi, A., Amaki, W. 2020. Effects of light quality during cultivation on the flowering and floret arrangement in Phalaenopsis amabilis. Acta Hortic. Vol.127, 135-139 https://doi.org/10.17660/ActaHortic.2020.1271.19

Magar, Y. G., Noguchi, A., Furufuji, S., Amaki, W. 2022. Effects of light quality during supplemental lighting on the growth and flowering in Cymbidium. Acta Hortic. Vol. 1337, 297-303 https://doi.org/10.17660/ActaHortic.2022.1337.40

Papaioannou, Ch., Katsoulas, N., Maletsika, P., Siomos, A., C. Kittas. 2012. Effects of a UV-absorbing greenhouse covering film on tomato yield and quality. Spanish Journal of Agricultural Research 10 (4) 959-966.

Pompodkis, N. E., Terry, L. A., Joyce, D.C., Lydakis, D. E., Papadimitriou, M. D. 2005. Effect of seasonal variation and storage temperature on leaf chlorophyll fluorescence and vase life of cut roses. Postharvest Biology and Technology 36 1-2.

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Major insects and diseases of Gerbera and their management in Nepal

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ABSTRACT

Gerbera is one of the popular cut flower in Nepal which requires specific crop management and plant protection measures for quality cut flower production to the Nepalese and international market. This study was carried out during summer and rainy season of 2018 to assess the major insects and diseases of gerbera by visiting the selected farms and using semi-structured questionnaire based survey and review of literature. Whitefly, thrips and leaf miners were reported as major insects of gerbera followed by mites, borer and aphids. Similarly, rots, powdery mildew, alternaria leaf spot and blight, flower blight and bacterial leaf spot and blight are the major diseases of gerbera according to the severity of infection. This study moreover illustrates the adopted management measures of insect pests and diseases by the growers in Nepal.

Key Words: *Cut flower, disease, gerbera, insect pest and management*

INTRODUCTION

Floriculture in Nepal is an infant sector of agriculture in Nepal that holds a great potential for export (Gauchan, et.al, 2009). Traditional floriculture in Nepal is gradually turning to a modern lucrative business since early Nineties. Entrepreneur's enthusiasm and investment in this sector has grown spontaneously with the encouragement received from the domestic as well as foreign markets (Baral, 2010). Floriculture Association of Nepal (FAN), 2016 reported the benefit cost ratio of Gerbera cut flower cultivation as 1.40 followed by Carnation (1.23) and Gladiolus (1.09). Gerberas *Gerbera jamesonii* (Asteraceae) are perennial flowering plants but are often treated as annuals. Flowers can bloom at any time of the year and are usually red, orange, yellow, or cream-colored and sit upon a thin stem (UC IPM, 2017). Gerbera (*Gerbera jamesonii*) is a one of the most important commercial cut flowers in Nepalese flower market (Pun, 2004 and FAN, 2017). Day temperature of 22-25°C and night temperature of 12-16°C are ideal for the flower production and it requires shade house (50%) or naturally ventilated polyhouse. Well drained, rich, light, neutral or slightly acidic soil with pH range of 5.5 - 7.0 is suitable for it's production (TNAU, 2015). It has been accepted as an important competitive product for export in the international market too (FAN, 2007). According to the Floriculture Association Nepal, 2016 the daily demand of Gerbera cut flower is 5000-7000 stems in Nepali market. Whereas, the area covered by Gerbera cultivation is 120 Ropanies (approximately 6 ha) although most of them are cultivated in protected conditions (Naturally ventilated plastic house, dome type plastic house, Bamboo pole plastic house). The crop management practice is the most important for the successful cultivation of Gerbera cut flower. Soil, climatic and management requirements, water and fertilizer as well as insect pest control are very specific for this cut flower.

White fly, thrips, mites, aphids, are common insects and powdery mildew, flower bud rot, fusarium, stem & root rots and wilt are common diseases of gerbera (TNAU, 2015 and Neupane, 2016). Gerbera cut flower production is challenged by numerous diseases affecting plant health and petal quality of cut flower. Powdery mildew, botrytis blight, alternaria leaf spot, root and crown rot diseases are important diseases of gerbera cut flower (Brisco and Hausbeck, 2018). Knowledge and skill regarding the identification and management of insects and diseases of flower crops are not well studied and not on-hand in Nepal. Thus, this study washeld from March-July, 2018 and accomplished to assess the major insects and diseases of gerbera cut flower and their management practices and recommended measures in Nepal.

METHODOLOGY

Assessment of the major insects and diseases of gerbera cut flower was conducted by visiting the different types of growing conditions (Top vent, Dome and Bamboo poly-house) in five major Gerbera growing districts (Kathmandu, Lalitpur, Bhaktapur, Kavrepalanchok and Chitwan) of Nepal in summer and rainy season of 2018. The commercial Gerbera cut flower producing farms were purposively selected with the consultation of FAN personnel considering at least one year of Gerbera cut-flower production experiences (Annex 1). The general list of the common insects and diseases of Gerbera cut flower was collected by questionnaire and by reviewing the literature and reported insect-pests in district technical reports. General morphological observations of insects and symptomatic diagnosis of diseases were performed in the field and the photographs of insect-pests' and their damage symptoms were taken. The scoring of insects and diseases was done according to the severity responded by the growers in the photo-sheet game. The management practices for the insect-pest and diseases observed adopted by the growers were listed and compiled in the tables.

RESULTS AND DISCUSSION

CULTIVATION STATUS

Area and Demand of Gerbera cut flower

According to the FAN, 2017 the area under gerbera cultivation and demand of gerbera cut flower both are in increasing trend (Fig. 1 and 2). It might be because of consumer's preference to this cut flower.

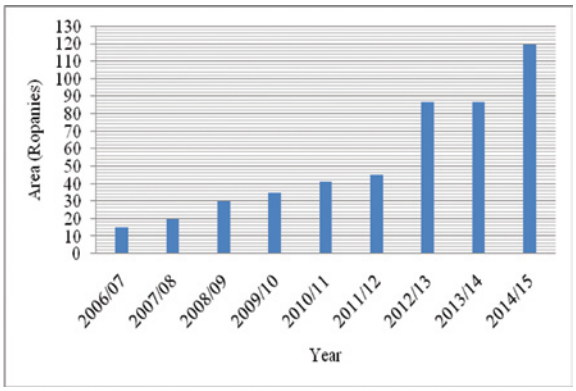

Fig 1. Area covered by Gerbera in Nepal

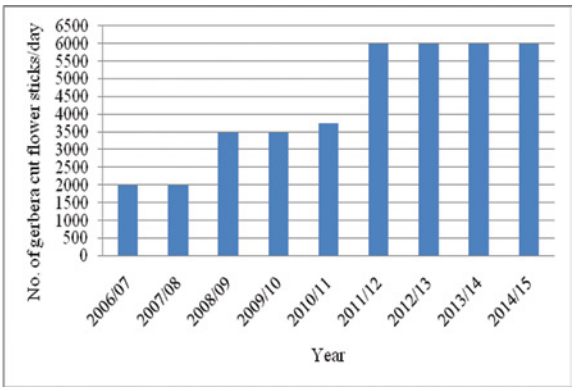

Fig 2. Demand of Gerbera cut flower sticks per day in Nepal

The graph in figure 1 provides information about areas coverage (in ropani) under gerbera cut flowers in Nepal over the period of nine years between 2006/07 and 2014/15. The figure reveals gradual increment of areas in terms of Ropani over the initial six years (2006/07 to 20118/12) whereas it jumped contrastingly from 2011/12 to 2012/13. Then, it gradually increased for next year to 2013/14. There after it again jumped up in the next year 2014/15 (Figure 1).The bar chart in figure 2 represents the demands of gerbera cut flower sticks/day over the period of nine years in Nepal. Overall, the demand of sticks/day was equally the highest in the four ultimate years (2011/12 to 2014/15) in comparison to those of remaining early years.

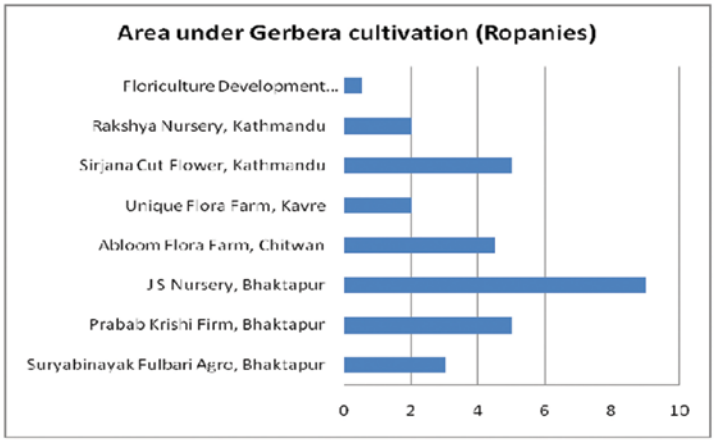

Fig 3. Area under Gerbera cultivation in surveyed farms

The growers cultivated gerbera and other cut flowers such as carnation, chrysanthemum, gladiolus, rose, limonium, marigold, gypsophilla, statics etc. in their farms. Maximum 9 Ropanies and minimum 0.5 Ropani was the area under gerbera cut flower in the respondent farms (Fig. 3). Most of the flower farms are the members of Floriculture Association Nepal (FAN). The growers had more than 15 years experience in the floriculture sector and considered as the major occupation for their livelihood and earnings.

Source of Planting Material and Varieties

The growers imported the planting materials from India, Spain and The Netherlands. K F Bioplants and Rise and Shine Biotech are two popular planting materials suppliers from India. Some growers are found to propagate their planting materials by themselves. The common varieties of gerbera cut flower grown in Nepal according to the color are presented in the table 1.

Table 1. Major varieties of gerbera cut flower according to the color

S N	Color	Varieties
1	Red	Alcaltraj, Zingaroo, Red Explosion, Ruby Red, Brunello
2	Pink	Bismark, Cerena, Rosalin, Picobela, Pink Eligence, Glamour
3	White	Paula, White Balance, Dalma, White House, Artist
4	Purple	Rubel,
5	Yellow	Amulet,
6	Orange	Candela, Dune

Source: Survey, 2018

Cultivation Practices

Well-drained soil having high organic matters is suitable for the gerbera cultivation. Gerberas

require regular deep water and do best in rich, well-drained soil. They should be fertilized adequate regularly during the bloom period. Plants can do well in full sun, but in very hot climates, gerberas need partial shade. The general plant population of gerbera cut flower is 4000-5000 plants per Ropanii.e. 500 m2(30-40 cm x 25-30 cm). The land preparation is done with the application of recommended manure and fertilizers such as farm yard manure or compost, Chemical fertilizers (DAP, MOP,) organic source of nitrogen, secondary and micronutrients (Calcium, Boron etc.). The raised beds prepared for planting seedlings. The cultivation structure for the gerbera cut flowers were bamboo poly-house and upgrading to dome without ventilation and top-vent structure. Silpaulin and UV stabilized plastic sheet both were found used in the cultivation structures. Some grower used thermal net in the plastic house. Most of the farms had drip irrigation system. Dis-budding is the major operations for quality cut flower production. Regular feeding to the plants and adoption of appropriate plant protection measures are important for the successful cut flower production.

INSECTS PESTS AND DISEASES

The major insects and diseases observed during the farm visit and mentioned by respondents were presented in the figure 4 and 5 and listed and described in the below table 2 and 3 according to the severity of the damage.

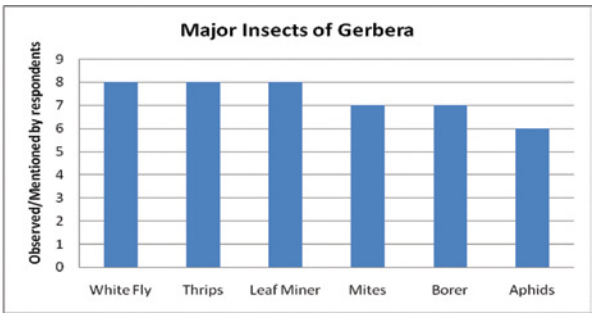

Fig 4. Major Insects of Gerbera

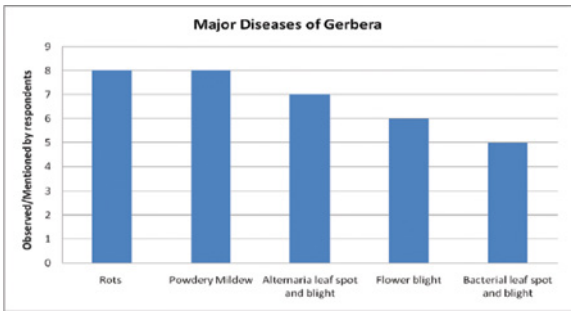

Fig 5. Major Diseases of Gerbera

Table 2. Major insect pest of Gerbera

S N	Name	Symptoms description	Time of severe attack	Management measures adopted	Recommended management Measures
1	White Fly	White fly is an important sucking pest of gerbera, especially in green house condition. This pest also transmits the viral diseases into the plants.	Summer	Pesticides applied: Use of yellow sticky trap, Spray of insecticides: Acetamiprid (EKKA), Ebamectin Benzoate (KINGSTAR), Spiromesifen (OBERON), Flonicamid (ULALA)	Flonicamid 0.5gm/lit., Spiromesifen1ml/lit.or Acetaprimid 1gm/lit. or Bathing shampoo 2ml/lit. water

S N	Name	Symptoms description	Time of severe attack	Management measures adopted	Recommended management Measures
2	Thrips	Puncture leaves and flower to suck cell sap. Thrips feeding causes stippling, color break and papery leaves, and leave speck-like black feces where they feed. Heavy infestation of this pest causes the flowers to the distorted shaped flower.	Dry summer months	Pesticides applied: Ebamectin Benzoate (KINGSTAR), Dimethoate (ROGER), Imidacloprid (ANUMIDA)	Ebamectin Benzoate 1 gm/ 3 lit., Imidacloprid 1 ml/ 3-5 lit. or Spiromesifen 10ml/16 lit. Intraprid 1ml/lit.
3	Leaf Miner	Leaf miner is a serious pest of gerbera. larvae borne inside the leaves and make irregular serpentine tunnels feeding mesophyll.	All round the year	Pesticides applied: Dimethoate (ROGER), Imidachloroprid (ANUMIDA)	Cartaphydrochloride 1.5 to 2 gm/lit., Cyromazine 10 ml/16 lit. or Intraprid 1ml/lit.
4	Aphids	Aphids infest young leaves and buds and causes injury by sucking the sap which results in distortion of tissues.	All round the year	Pesticides applied: Dimethoate (ROGER), Imidachloroprid (ANUMIDA)	Imidachloroprid, Chloropyriphus + Cypermethrin, Intraprid etc.
5	Mites	The development of leaves and flower buds were adversely affected and the flowers were malformed and unsalable.	Summer months (Chitra-Shrawan)	Pesticides applied: Cyromizine (KINGHUNTER), Proparizite (OMITE), Dimethoate (ROGER), Abamectin (COBRA KING), Spiromesifen (OBERON)	Proparizite 2ml/lit., Pyaramite 1.5 ml/lit., and/or fresh water spray.
6	Borer	The larvae stage (caterpillar or borer) of the moth feed the floral part of the plant and flowers distorted and unsalable.	All round the year	Pesticides applied: Ebamectin Benzoate (KINGSTAR), Abamectin (COBRA KING), NEEMRAJ, DADAGAURD	Ebamectin Benzoate 0.33 gm/lit., Spinosad 0.33 ml/lit., Neem based pesticide 3-5 ml/lit. (PQPMC, 2019)
Besides, above mentioned insects pests cut worms in soil, slugs are also reported to damage the gerbera cultivation.					

Table 3. Major diseases of Gerbera

S N	Name	Symptoms description	Time of severe attack	Management measures adopted	Recommended management measures
1	Rots (root/ foot, crown/ stem)	**Root Rot** *(Pythium spp.):* Plants wilt and die as roots rot. **Crown Rot** *(Phytophthora spp., Rhizoctonia spp.):* Plants wilt, leaves brown, crown rot develops. Besides, Stems at the soil level have a brown lesion. Plants wilt and die. **Stem Rot** *(Fusarium spp.):* Petiole of leaves blacken at the base as the plant collapses.	All round the year, mostly during hot and humid period	Fungicides applied: Carbendazim, Mancozeb, Copperoxychloride, Metalaxyl etc. And proper management of irrigation water and maintain good drainage.	Copperoxychloride 1.5 gm/lit. Plant healthy planting material in sterilized potting media/treated soil media. Avoid overhead watering. Apply a fungicide to protect plants.
2	Powdery Mildew	White fungal growth develops on the surface of leaves.	Rainy season (hot and humid period)	Prune and destroy diseased leaves and plant. Fungicides: Dinocap (KARATHANE), Sulphur based fungicides.	Dinocap 1.5 ml/lit. or WetableSulpher 1.5 gm/lit. or Thiophynate Methyl 2 gm/lit.
3	Leaf Spot *(fungal)*	Brown specks form on florets and the leaves. Centers become white on the leaf spots.	all round the year	Maintain low relative humidity and do not wet leaves when watering. Apply a fungicide to protect plants. Fungicides applied: Hexaconazole (HEXA PLUS).	Mancozeb 2 gm per lit.er water
4	Floral Blight *(fungal)*	Petioles have long brown spots. Leaves yellow and die. Petals have tan spots. Stems at soil level are killed. Infected tissues become covered with gray fungal growth.	Mostly during low night temperature and hot during day time.	Space plants to insure good air circulation. Maintain low humidity. Avoid watering late in the day. Remove crop debris. Apply a fungicide to protect plants.	Mancozeb 1 gm + Copperoxychloride 1 gm per lit. water.

S N	Name	Symptoms description	Time of severe attack	Management measures adopted	Recommended management measures
5	Bacterial leaf spot and blight	Small to large spots are circular at first, then become irregular and dark brown to black. Later, it will spread in whole leaf and blight symptoms appear.	Die back of branches after removal of flower stick.	Maintain low relative humidity. Avoid overhead watering.	Copperoxychloride 1 gm per lit. water.
Besides above illustrated diseases, damping off in cutting, nematodes problem in the roots and viruses were also mentioned by the respondents during farm visit. Most important factor is proper management of farm as well as greenhouse climate control if growers maintain good operations then the insects and diseases incidence and severity will automatically reduce (Moorman, 2016).					

CONCLUSION AND RECOMMENDATION

Gerbera is one of the most important cut flowers in Nepalese flower market. The demand and production of gerbera cut flower is increasing year by year. Flower growers of Kathmandu valley and vicinity districts are producing gerbera cut flower. Most of the cultivation is under protected condition i.e. plastic house. The insect, diseases and nutritional problems are also the factors that reduced the yield and quality of cut flowers. White fly, thrips, mites, aphids, borer and leaf miner are major insects; and rots, powdery mildew, alternaria leaf spot, flower blight and bacterial leaf spot were observed as the major diseases during the study period. Growers were mostly used the chemical measures for pest management. Disease management strategies vary depending on the production system involved and can include cultural, biological and chemical measures as well as the use of resistant varieties. Two specific recommendations have been made;

- Year round surveillance of insect and diseases of gerbera cut flower should be conducted to know the time of incidence of the problems.
- The appropriate management measures should be generated to recommend gerbera cut flower growers for management.

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REFERENCES

Baral, S.P. (2010). Term paper on Trade Competitiveness of Floricultural Sub-sector in Nepal. Institute of Agriculture and Animal Science, Rampur Campus, Rampur, Chitwan.

Brisco-McCann E.I., Hausbeck M.K. (2018). Diseases of Gerbera. In: McGovern R., Elmer W. (eds) Handbook of Florists' Crops Diseases. Handbook of Plant Disease Management. Springer, Cham.

FAN.(2016). Economic analysis of Gerbera, Gladiolus and Carnation Production in Nepal. Floriculture Association Nepal. Baluwatar-3, Kathmandu.

FAN.(2017). Estimated Flower Production, Demand,Yearly Export & Import Transaction Scenario

in Nepal. Assessed from http://www.fanepal.org.np/en/cms/publication/present-status.html on 28th July, 2017.

FAN. (2007). Trade competitiveness of the floriculture sub-sector in Nepal. Floriculture Association Nepal/ Agro Enterprise Centre, FNCCI, Kathmandu, Nepal.

Gauchan, D. P., Pokhrel, A. R., Pratap, M. and Lama, P. (2009). Current Status Of Cut Flower Business In Nepal. Kathmandu University Journal Of Science, Engineering And Technology. Vol. 5, no. I, January, 2009, pp 87- 98.

Moorman, G. W. (2016). Gerbera Diseases. Accessed from https://extension.psu.edu/gerbera-diseases on 13th May, 2019.

Neupane, S. (2016). Gerbera Flower Cultivation Technology in Nepali language. Floriculture Development Centre, Godawari, Lalit.pur.

Pun, U.K. (2004). Commercial cut flower production in Nepal and status of four important cut flowers. Journal of Institute of Agriculture and Animal Science, 25:17-21.

PQPMC. (2019). List of registered pesticides and pesticides consumption data. Plant Quarantine and Pesticides Management Centre. Hariharbhawan, Lalitpur, Nepal.

TNAU.(2014). Gerbera. Accessed from http://agritech.tnau.ac.in/horticulture/horti_flower%20 crops_gerbera.html on 28th July, 2018.

UC IPM.(2017). Gerbera daisy, Barberton daisy, Transvaal daisy—Gerbera jamesonii Family Asteraceae (Sunflower family). Agriculture and Natural Resources, University of California. Assessed from http://ipm.ucanr.edu/PMG/GARDEN/FLOWERS/gerbera.html on 29th June, 2018.

Annex. 1: Respondents detail

SN	Name of the organization/farm	Address	Responsible/ Respondent personnel	Cultivation structure	Area under Carnation cultivation (Ropanies)
1	Suryabinayak Fulbari Agro, Bhaktapur	Suryabinayak-1, Bhaktapur	Decent Baidya	Naturally Ventilated plastic house	3
2	Prabab Krishi Firm, Bhaktapur	Katunje - 5, Bhaktapur	Prajwal Chaguthi	Naturally Ventilated plastic house	5
3	J S Nursery, Bhaktapur	Suryabinayak-4, Bhaktapur	Jaya Bahadur Khadka and Sushil Khadka,	Naturally Ventilated plastic house	9
4	Abloom Flora Farm, Chitwan	Bharatpur-19, Chitwan	Prakash Pant	Naturally Ventilated plastic house	4.5

S N	Name of the organization/farm	Address	Responsible/ Respondent personnel	Cultivation structure	Area under Carnation cultivation (Ropanies)
5	Unique Flora Farm, Kavre	Banepa-10, Janagal, Kavre	BhojrajTimalsina	Naturally Ventilated plastic house	2
6	Sirjana Cut Flower, Kathmandu	Nagarjun-8, Ghattekhola, Kathmandu	Pandav Shrestha	Naturally Ventilated plastic house	5
7	Rakshya Nursery, Kathmandu	Shankarapur, Gagalfedi, Kathmandu	Min Bahadur Tamang	Naturally Ventilated plastic house	2
8	Floriculture Development Center, Lalitpur	Godawari, Lalitpur	Drona Raj Kafle, Tara Chandra Chaudhari, and Sirjana Poudel,	Naturally Ventilated plastic house	.5

Floriculture Research in Nepal

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Introduction

Floriculture refers to the cultivation and marketing of ornamental and flowering plants for gardening and floristry, including floral design. Floriculture crops include flowering plants, garden plants, foliage or cut flowers, grasses, and cultivated greens (Newman and Collins, 2019). It is an emerging agribusiness sector in Nepal and is rapidly growing in last three decades. This sector is mainly private sector driven and government has also started to extend the support for the improvement of floriculture sector (Pun *et al.,* 2019). Floriculture transaction was about 4 times increased from 688.5 million NPR in 2067/68 (2010 AD) to 2416.4 million NPR in 2075/76 (2019 AD). Even though it was projected that there would be 18% increment in the transaction of floriculture products in 2076/77 (2931 million NPR) as per the higher investment by entrepreneurs in the sector, result was observed into reverse. This was due to the pandemic COVID 19 resulting into lockdown situation during 2076/77 (2020 AD), transaction of floriculture products was reduced by 10.88% (from 2416.4 to 2155.3 million NPR) (Acharya *et al.,* 2021).

Research in floriculture sector in Nepal is still at a preliminary stage despite the tremendous growth of this sector (Pun *et al.,* 2019). In Nepal, different sectors such as Floriculture Association Nepal (FAN), Nepal Agriculture Research Council (NARC), Floriculture Development Centre (FDC), Godawari, and various Universities are doing the several researchin this sector but our growers and stakeholders are unable to benefit fully. This article reviews the floriculture related research in Nepal with their important findings that would benefit the growers and other stakeholders of the floriculture sector. The paper has mainlyfocused on the research done in Nepal, published in Nepalese journal and international journal as well as thesisincluding their important findings.

Research in floriculture sector
Agronomic practices

Gladiolus

Piya *et al.* (2008) tested various planting depth and corm size of gladiolus for its quality spike production and higher corm yield at Agriculture Research Station, Pakhribas. They had taken three planting depths 6cm, 8cm and 10cm and three corm sizes 2.5-3cm, 3-3.5cm and 3.5-4cm. The corm and cormel yield were not significant due to both corm size and planting depth. They found large size corm (3.5-4cm) and 8cm planting depth was better for flower quality considering all floral characters.

Similarly, Joshi *et al.* (2008) conducted an experiment to assess the effect of corm size and varieties on growth performance and cut flower characteristics of gladiolus in the farmer's field at Gunjanagar, Chitwan. They studied three varieties viz. American Beauty, Interpret and Yellow Summer Sunshine and four sizes of corms viz. 2-3cm, 3-4cm, 4-5cm and 5-6cm. They found growth performance and cut flower characteristics varied significantly among varieties and were

also affected by the size of corm. Plant height, leaf length and number of leaves per plant were found higher in American Beauty followed by Interpret. The cut flowers characteristics were found superior on Interpret cultivars having a greater number of florets/spike (16.12). Large size corm (5-6cm) showed better performance with respect to postharvest characters such as number of florets opened/spike (11.40).

Joshi (2008) studied the influence of corm size on cut flower quality, corm/cormel production and postharvest behavior in gladiolus cv. American Beauty at Kathmandu, Nepal. The experiment was conducted with five corm sizes (1-1.50, 1.5-2.25, 2.25-3.0, 3.0-3.75 and 3.75-4.50cm diameter and planted at uniform depth of 7cm. The large size corm (3.0-3.75cm) produced early sprouting (15days), tallest plants (70.08cm), highest numbers of leaves per plant (9.6), greatest length and breadth of leaves (41.9cm and 3.7cm respectively), longest spike (101.2cm), highest number of florets per spike (16.1). The biggest corm also produced maximum size and weight of daughter corms (5.0cm and 48.8g respectively). Corm size 3.75-4.50cm had maximum number of florets opened per spike (14.2), longer day for last floret opening (11.3). The benefit cost ratio was found highest (2.1) from corm size 3.00-3.75cm followed by 2.25-3.00cm and least benefit cost ratio was found from corm size 1-1.5cm.

Baral *et al.* (2012) studied the influence of nitrogen level (100, 150, 200, 250, 300kg/ha) on vegetative characteristics, cut flower characteristics and corm/cormel production of three varieties (American beauty, Interpret and Candyman) of gladiolus (*Gladiolus hybrida* L.) in Chanauli, Chitwan. They found with the increasing level of nitrogen up to 200kg/ha, increased the rate of sprouting (97.33%), number of sprout/corm (2.05), taller plant (106.7cm) with more number of leaves (9.85), longest spike (86.58cm) with more number of florets/spike (16.73) were produced. However, they found largest spike (92.62g weight) having thicker (1.14cm girth) at 300kg/ha dose of nitrogen. Size of daughter corm (5.8cm) was highest with 300kg/ha while number of the cormels per plant (89.45) was highest at 200kg/ha nitrogen. In overall vegetative and floral characteristics, they found Candyman variety superior one.

Basnet *et al.* (2017) studied the effect of four levels of nitrogen (0kg, 50kg, 100kg and 150kg) and three levels of phosphorous (0kg, 50kg and 100kg) on vegetative parameters, floral parameters and corms parameters. Plant height, leaf length, spike length, diameter, weight, and number of corms per plant was found highest at 150kg N/ha and 100kg P/ha so they recommended this dose of fertilizers for commercial cultivation of gladiolus in Nepalese condition.

Dhakal *et al.* (2021) studied seven promising genotypes of Gladiolus viz. ARSDG-01, ARSDG-02, ARSDG-03, ARSDG-04, ARSDG-05, ARSDG-06 and ARSDG-07 during the two consecutive years of 2014/15 and 2015/16 in the field of Horticulture Research Division (HRD), Khumaltar, Lalitpur to evaluate the performances of their vegetative, floral and corm characteristics. The crop geometry was maintained at 25 x 25cm, and sixteen characters were observed. Summing up all sixteen characters of evaluated genotypes, ARSDG-04 as the first, ARSDG-05 as the second and ARSDG-03 as the third have respectively emerged as superior of the rest of evaluated genotypes of Gladiolus.

Rose

Adhikari *et al.* (2014) conducted, during 2009, an experiment in a farmer's field at Gunjanagar, Chitwan to assess the impact of pruning duration and intensity on the growth and flowering

behavior of cut rose cv. Super Tata (Rosa hybrida). They had taken three pruning dates viz. July 30th, August 15th, and August 30th and three pruning intensities viz. heavy (6 buds per plant), medium (12 buds per plant), and light (18 buds per plant).The plants pruned heavily on 30th July produced highest plant height, number, length, and diameter of canes as well as earlier floral initiation. On the other hand, fresh and dry weight of leaf and leaf area index were highest from the plants pruned heavily on 15th August. Heavily pruned plants produced earlier floral initiation (45.48 days), highest flower stem length (50.33cm) and diameter (0.60cm) and large size floral buds compared to medium and light pruning. Flower stem diameter was higher on July 30th pruned rose plants while, flower stem length was found longer (47.67cm) on August 15th pruned ones. Number of flowers per plant was recorded higher (22) from earlier (30th July) and lightly pruned rose plants. The longest duration of flowering (212.8 days) was observed from earlier and heavily pruned (198.1 days) plants. They concluded sequential pruning can produce rose flowers at desired time.

Marigold

Adhikari and Pun (2011) carried out an experiment to determine the feasibility of winter planting of marigold in Chitwan. They had studied the response of two hybrid varieties of marigold (*Tagetes erecta*) viz. Karma-1 and Karma-2 on three planting date viz. 16th Dec, 31st Dec and 15th Jan. They found maximum number of flowers per plant (59.9) and flower yield (410.6 g) on 15th January planting from Karma-1.

Khanal (2014) compared vegetative and floral characteristics of marigold in three different growing conditions viz. open field, plastic house and shade house. Three varieties of marigold viz. Marvel Yellow, Marvel Orange and Marvel Garland with similar cultural practices were grown. Both vegetative growth and floral characteristics were found significantly better in plants grown under plastic house.

Poudel *et al.* (2017) studied the effects of spacing and pinching on the growth parameter of African marigold var. Inca Orange-1KS at Horticulture Research Station in Malepatan, Pokhara. The two spacing (40cm x 60cm and 40cm x 45cm) and three pinching (no pinching, single pinching, and double pinching) were examined. They concluded, with closer spacing (40cm x 45cm) grew taller (132.61cm) plants than those with a wider spacing. Pinching lowered the plant height, flower size, flower weight, and flowering time. Thus, closer spacing and pinching resulted in a higher number of flowers and was proven to be more cost-effective than wider spacing and unpinch plants. But, unpinch plants yielded early harvest compared to pinch plants.

Adhikari *et al.* (2020) studied the effect of various dose of nitrogen on growth and flower yield of marigold under container growing. They had taken five doses of nitrogen viz 180kg/ha, 135kg/ha, 90kg/ha, 45kg/ha and 0kg/ha. Phosphorus and potassium were applied at the rate of 90kg/ha and 75kg/ha. Their finding showed that 180kg/ha nitrogen gave the maximum height (49.47cm), spread (36.40cm), and number of branches (24.75per plant) in 45DAT (days after transplanting). Similarly, 180kg/ha nitrogen was found to be effective for early flowering initiation (32.50DAT), maximum number of flower (34.73per plant), flower diameter (7.03cm) and yield (22.29mt/ha) compared to other treatments.

Gerbera

Acharya *et al.* (2010a) studied three varieties of *Gerbera jamesonii* Hook. cvs. Primrose, Malibu and Sunway to identify the influence of seasons and varieties on vase life of gerbera cut flower. Experiments were carried out in controlled room having 18±2oC temperature, 68±2% relative humidity and 100 lux light. Their study revealed that vase life was longest in Sunway, followed by Primrose and Malibu. Regarding the season of production, longest vase life (18.37 days) was found in the flowers harvested in winter, followed by spring (14.8 days) and autumn (9.57 days). The interaction effect of season and variety showed that longest vase life (23.2 days) was found in Sunway harvested in winter.

Similarly, Acharya *et al.* (2010b) studied the influence of locations and varieties on vase life of gerbera (*Gerbera jamesonii*, Hook). Three varieties of gerbera, cv- Primrose, Malibu and Sunway and three different localities; Kamalbinayak, Bhaisepati and Dhulikhel were selected. They found longest vase life for Bhaisepati, followed by Dhulikhel and Kamalbinayak. Likewise, the longest vase life was found in the case of Sunway (28.2 days) followed by Primrose (27.6 days) and Malibu (26.8 days).

Based on research conducted during 2009-2010, Acharya *et al.* (2010c) concluded that it was necessary to raise the bed above 2 feet height in lowlands (Khet) to avoid water lodging condition whereas in the up lands (Bari), bed height might be 1 feet. Likewise, they also found that red and pink colors were highly preferred varieties of gerbera while the purple color had the lowest preference in Nepal.

Carnation

Pun *et al.* (2008) evaluated the effect of growing locations on vase life of carnation (*Dianthus caryophyllus* L.) cut flowers in laboratory of Nepal Agriculture Research Council (NARC). They had chosen four growing locations and four cultivars, and six different chemical preservatives were also tested to see whether they could extend the vase life of carnation cut flowers. The cultivar Nelson had the longest vase life, followed by Lisa and Eskimo, and Helix. The flower grown from Naikap had the longest vase life, followed by Jorpati and Techo, and Lokunthali. The vase solution sucrose+HQS demonstrated the highest total solution uptake, resulting in increased vase life and exceptional flower quality, including highly turgid and fresh flowers with vibrant petal color.

Dahal *et al.* (2020) studied, during 2017-2018, the response of carnation varieties (*Dianthus caryophyllus* L.) to different levels of boron (0, 60 and 120ppm) under polytunnels in Lalitpur. They examined four varieties viz. Baltico, Vinco, Cervantes and Master. They concluded, variety Baltico was found superior on vegetative, floral, yield and vase life parameters. Similarly, 60ppm boron was found optimum for better yield and vase life. Thus, they concluded variety Baltico and 60ppm boron to be used at the climatic condition of Lalitpur.

Tuberose

Dahal *et al.* (2014) carried out an experiment during 2012 to standardize stage of nitrogen application in tuberose (*Polianthes tuberosa* L.) cv. Double for improving growth, flowering, and vase life in Chitwan. Their results showed that three equal split dosages of nitrogen viz. 33%N basal + 33%N 50 days after planting + 33%N 70 days after planting were appropriate for commercial cultivation of tuberose in Nepalese condition.

Orchid

From the 26th of February 1996 to the 30th of May 1997, an experiment was carried out at Institute of Agriculture and Animal Sciences (IAAS) in Rampur, Chitwan, Nepal, to examine the growth performance of Orchid (*Rhynchostylis retusa*) in various media (Sphagnum Moss, Brick, and Coal and their combination). Treatment combinations (T1-Sphagnum moss+Brick+Coal, T2-Sphagnum moss+Brick, T3-Brick+ Coal, T4-Sphagnum moss+Coal, T5-Sphagnum moss, T6- Brick, and T7- Coal) were replicated three times with five plants per replication using a Randomized Complete Block Design (RCBD). The number of leaves increased significantly in the media containing Sphagnum moss and coal, the number of roots increased in the media containing Brick+ Coal, and the stem length increased in the media containing Sphagnum moss and coal. On average, the media Sphagnum moss and Coal demonstrated good growth performance, but the media Sphagnum moss was found superior and more suitable for commercial purposes (Pun *et al.,* 1995).

During the months of January and February 1994, a partial survey of orchids in relation to their host trees was carried out in the foothills of Nepal's Chitwan and Nawalparasi districts. In 14 different host trees, 21 different species were discovered. Sal (*Shorea robusta*) was the most preferred host, followed by simal (*Bombax ceiba*) in Chitwan and chiuri (*Aesandra butyracea*) in Nawalparasi (Pun and Thapa, 1996).

A new and unreported (in Nepal) epiphytic orchid (Pelatnantheria insectifera) was discovered growing only on Sal trees in a survey of orchids conducted between January and August 1994 in the Lothar area of Chitwan district (350-450m above mean sea level) of Nepal. This species was collected and kept at the Orchidarlum of the Department of Horticulture at IAAS, Rampur Chitwan, Nepal (Pun *et al.,* 1995).

A trial on the effect of silver nitrate (AgNO3) at 25, 50 and 100ppm and citric at 100, 200 and 400ppm with 5% glucose, glucose only and distill water as control on vase life of orchid (Vanda tessellata) was conducted under Bhubaneswar condition. Citric acid 400ppm + 5% glucose produced the best results, followed by citric acid 200ppm + 5% glucose and citric acid 100ppm +5% glucose. However, AgNO3 25ppm+5% glucose was discovered to be the most effective for bud opening (Pun *et al.,* 1996).

Bougainvillea

Marasini and Khanal (2018) conducted an experiment, during 2016, to evaluate the root performance and bud sprouting of Bougainvillea on various growing media (coco peat + sand, sand + FYM, garden soil, garden soil + FYM, and garden soil) in a partially controlled environment. They studied on various parameters related to growth of cutting and concluded best growth on sand + FYM.

Postharvest practices

Gladiolus

Pant (2002) studied the effect of different concentrations of sucrose on the vase life of gladiolus at IAAS, Rampur, and concluded that 12 percent sucrose solution was the most effective substrate in extending vase life (11.3 days) and maximizing the number of floret openings when compared to the control one (9.0 days).

Gerbera

Acharya *et al.* (2011) conducted an experiment to find the influence of different preservatives for longevity of gerbera (*Gerbera jamesonii*, Hook). Two varieties of gerbera; Malibu and Sunway were used in controlled room having 18±2°c temperature, 68±2% relative humidity and 100 lux light. Sodium hypochlorite 40ppm (19.1 days) and calcium chloride 1% (18.8 days) were found as the most effective vase solution for increasing the vase life of gerbera cut flowers. Sunway variety had longest vase life of 21.2 days in Sodium hypochlorite followed by Calcium chloride solution with vase life of 19.4 days. Likewise, in Malibu variety highest vase life was recorded in Calcium chloride solution (18.2 days) followed by Sodium hypochlorite solution (17 days).

Timalsina (2021) had assessed the effect of various combinations of carbohydrates, calcium chloride and germicides on vase life and quality of two cultivars of gerbera viz. Rosalin and Carambole. The research was done in controlled lab having 17±2˚C temperature, 55 ± 2% relative humidity (RH) and 100 lux light on an average. The studies revealed that among two varieties, Rosalin cultivars had longer vase life (14.05 days) and lower stem bending (43.8˚) on 15th day of vase life. Among the ten different vase solutions tested, 4% sucrose +1% calcium chloride (18.25 days), 4% sucrose + 0.5% calcium chloride (16.58 days) and0.5% calcium chloride (16.25 days) were found most effective vase solutions to prolong the vase life of gerbera cut flower as compared to control (7.67 days). Researcher had concluded 4% sucrose + 1% calcium chloride has the potential to be used as a commercial preservative solution to improve the keeping quality and vase life of cut gerbera.

Paudel (2018) had assessed the effect of vase solution on the vase life of four varieties of gerbera viz; Belcanto, Esmara, Mimosa and Silver Snow. The vase solution consisted of combination of carbohydrates, germicides and acidifiers. The research was done in the controlled lab having 22± 2˚C temperature, 70 ± 2% relative humidity and 84 lux light on an average. Esmara variety had the longest vase life (18.52 days), followed by Mimosa (13.12 days), Belcanto (12.10 days) and Silver Snow (11.00 days). Similarly, vase life of gerbera cut flowers was found highest in 40ppm Sodium hypochlorite (17.33 days) followed by 4% Sucrose + 250ppm Citric acid (16.25 days), 4% Sucrose + 40ppm Sodium hypochlorite + 250ppm Citric acid (14.91 days) and least in distilled water (10.75 days).

Carnation

Pun *et al.* (2008) studied the effect of different vase solution on vase life of carnation (*Dianthus caryophllus* L.) cut flower at Nepal Agriculture Research Council (NARC), Lalitpur. Two carnation varieties; Helix and Nelson were evaluated on six different vase solutions viz. Tap water, Tapwater+Hydroquoniline sulfate (200ppm), Distilled water, Distilled water+Hydroquoniline sulfate (200ppm), Sucrose (5%)+Hydroquinoline sulfate (200ppm) and Silver thiosulfate (0.2mM). Pulse solution of STS showed longest vase life (9.4 days) followed by sucrose+ HQS (8.1 days) and the cultivar Helix had longest vase life (10.1 days) at STS followed by Nelson at sucrose+HQS (9.9days). Though STS was found prominent to prolong vase life, harmful effect on flower petal was recorded so this research suggests sucrose treatment over STS pulsing for increasing the vase life of carnation cut flower.

Similarly, Pun (2008) studied the effect of growing locations and cultivars on vase life in

the four places of Kathmandu valley viz. Naikap, Techo, Lokanthali and Jorpati on four common cultivars viz. Eskimo, Helix, Nelson, and Lisa. The vase life of these cultivars grown at different locations ranged from 2.7 days to 6.9 days in control vase solution, indicating that there was a significant variance in vase life due to the growing locations and cultivars. Physical factors such as flower head diameter stem diameter and length, chlorophyll and sugar content were also found varied and correlated with vase life. Researcher also concluded that sucrose (5%) + HQS was found to be superior (11.6 days) to control (2.7 days).

Rose

Joshi (2009) studied the postharvest life of different cultivars of rose to determine the most effective preservatives at NARI, Lalitpur. Researcher had studied nine cultivars of rose viz. Angelina, Aqua, Voodoo, Formula One, Love Unlimited, Leonessa, Sleeping Beauty, Sputnik and Cool Water. Among these cultivars, sputnik (16.62 days) had the longest vase life followed by Formula One (16.52 days) and Sleeping Beauty (14.90 days) while shortest vase life was found in Angelina (10.56 days). Researcher had selected two varieties viz. Sputnik (longest vase life cultivar) and Angelina (shortest vase life cultivar) to find the effectiveness of floral preservatives. Among the seven preservatives tested, Glucose 2% was found to provide the longest vase life for both cultivars followed by Glucose 2% + Citric Acid 30ppm. Glucose 2% solution had extended vase life of cultivars Sputnik and Angelina up to 34 days and 24 days respectively.

Chaudhary and Khanal (2018) conducted an experiment to determine the optimal concentration of sucrose for improving and prolonging flower quality and durability of rose flower. The experiment included ten treatments: tap water, tap water + 2 percent sucrose, tap water + 4 percent sucrose, tap water + 6 percent sucrose, tap water + 8 percent sucrose, distilled water, distilled water + 2 percent sucrose, distilled water + 4 percent sucrose, distilled water + 6 percent sucrose, and distilled water + 8 percent sucrose. Two rose sticks were retained in each vase solution after being extracted at the flower bud stage. Their experiment showed that distilled water + 6% sucrose was most efficient solution for cultivar longevity among the various concentrations tested.

Aryal *et al.* (2019) also conducted an experiment to determine the appropriate solution for prolonging the vase life of rose. They had examined nine treatments viz. distilled water (control), 2% sucrose solution+15ppm Citric acid, 4% sucrose solution +30ppm Citric acid, 6% sucrose solution+45ppm Citric acid, 8% sucrose solution+60ppm citric acid, 10% sucrose solution+75ppm citric acid, 12% sucrose solution+90ppm citric acid, 14% sucrose solution+105ppm citric acid and 18% sucrose solution+120ppm citric acid. Their finding showed that combination of 2% sucrose and 15ppm citric acid gave the longest vase life of rose.

Marigold

Khanal (2014) compared the postharvest life of three varieties marigold grown in three different conditions viz. plastic house, shade house and open field. They found the longest vase life in the flowers grown under the plastic house (6.44days) as compared to shade house (4.30 days) and open field (4.63days). Similarly, Marvel Garland (6.90 days) had long vase life as compared to marvel yellow (4.36days) and marvel orange (4.13 days). They had also compared the postharvest life in dry and wet storage condition. In dry storage, flowers were kept over the dry plastic and in wet storage; flowers were kept over the dry and sprayed with distilled water every day in the

evening time (5 - 6pm). They found longer postharvest life in wet storage conditions (6.46 days) than in dry storage conditions (4.46 days).

Plant growth regulator

Gladiolus

Khanal *et al.*(2015) conducted an experiment to determine the effect of plant growth regulator on growth and flowering of gladiolus cv. American beauty at Agriculture and Forestry University (AFU), Rampur. Three different concentrations of NAA, three levels of GA, three levels of Kinetin were applied as foliar application at 30 and 45 days after planting. GA @ 100-150ppm was found as appropriate concentration of PGR for growth and flowering of gladiolus.

Bougainvillea

Marasini and Khanal (2018) studied the effect of NAA on the root performance and bud sprouting of Bougainvillea cutting. They found maximum rooting success and better root growth in media applied with 3000ppm NAA.

Marigold

Acharya *et al.* (2021) examined, in 2019, eight concentrations of GA3 viz. 0, 50, 100, 150, 200, 250, 300 and 350ppm on growth and flowering attributes of African marigold (*Tagetes erecta*). They found tallest plant height (72.93cm) and the largest basal diameter (1.49cm) at 300ppm concentration of GA3. The highest number of primary branches (3.11), largest plant spread (32.11cm) and maximum numbers of flowers per plant (104.13) were found at 250ppm concentration. But the duration of flowering was found longer (58 days) at 300ppm concentration of GA3. They concluded that the 250ppm level of GA3 was most suitable in terms of production perspective.

Conclusion

Although floriculture business is flourishing in very good speed, floriculture related research activities are very few in Nepal. Research is mainly focused on the few commercially important cut flowers and there are several flowers which need to be explored in our country. Moreover, these research are not in the easy access of the targeted farmers or commercial growers or entrepreneurs. And these research findings are also rarely adopted by the entrepreneurs. Adequate technical, physical as well financial support from different concerned stakeholders is prerequisite for the further expansion of floriculture related research activities and to disseminate those research findings to commercial growers and entrepreneurs.

References

Acharya, A.K., Shrestha, K.K., Tamang J.B., and Pun. U. (2021). Impact of COVID 19 on Floriculture Industry of Nepal. Proceedings of 12th National Horticulture Seminar, Nepal Horticulture Society.

Acharya, A.K., Baral, D.R., Gautam, D.M., and Pun, U.K. (2010a). Influence of seasons and varieties on vase life of gerbera (Gerbera jamesonii Hook.) cut flower. Nepal Journal of Science and Technology, 11, 41-46.

Acharya, A.K., Baral, D.R., Gautam, D.M., & Pun, U.K. (2010b). Influence of locations and varieties on vase life of gerbera, (Gerbera jamesonii, Hook). Journal of Institute of Agriculture and Animal Science, 31(1), 43-50.

Acharya, A.K., Baral, D.R., Gautam, D.M., and Pun, U.K. (2010c). Gerbera cultivation and postharvest management practices in Kathmandu valley. Nepalese Horticulture, vol.7, issue 1, Nepal Horticulture Society.

Acharya, A.K., Baral, D.R., Gautam, D.M., and Pun, U.K. (2011). Influence of different preservatives for longevity of Gerbera vase life. Proceedings of the 7th National Horticulture Seminar, 12-14 June 2011, Khumaltar, Lalitpur, Nepal.

Acharya, S., Ghimire, B., Gaihre, S., Aryal, K., and Chhetri, L.B. (2021). Effect of gibberellic acid on growth and flowering attributes of African marigold (Tagetes erecta) in inner terai of Nepal. Journal of Agriculture and Natural Resources, 4(2), 134-147. DOI: https://doi.org/10.3126/janr.v4i2.33693

Adhikari, P., Mishra, K., Marasini, S., Neupane, R.C., Shrestha, A.K., Shrestha, J., and Subedi, S. (2020). Effect of nitrogen doses on growth and yield of marigold (Tagetes erecta L.) in subtropicalclimate of Nepal. Fundamental and Applied Agriculture 5(3), 414–420.https://doi.org/10.5455/faa.108327

Adhikari, D.R., Baral, D.R., Gautam, D.M., and Pun, U.K. (2014). Influence of time and Intensity of pruning on growth and flowering behaviour of cut rose. Nepal Journal of Science and Technology, 15(1), 7-12. https://doi.org/10.3126/njst.v15i1.12004

Adhikari, D. and Pun, U. (2011). Response of Marigold (Tagetus erecta) Varieties to Winter Planting in Chitwan, Nepal. In Proceedings of the 7th National Horticulture Seminar (pp. 12-14).

Aryal, P., Adhikari, A., Pathak, R., and Pudasaini, R. (2019). Effects of different concentrations of sucrose and citric acid on vase life of rose. Journal of Agriculture and Natural Resources, 2(1), 127-134.

Baral, S.P., Baral, D.R., Gautam, D.M., and Pun, U.K. (2012). Influence of nitrogen on growth performance, cut flower characteristics and corm/cormel production of gladiolus. Nepal Journal of Science and Technology, 13(1), 25-31.

Basnet, M., Shakya, S.M., and Pant, S.S. (2017). Effect of different dose of nitrogen and phosphorous on gladiolus yield at Ilam, Nepal. Himalayan Biodiversity, 5(1), 32-37.

Chaudhary, G. and Khanal, A. (2018). Effects of different concentrations of sucrose on vase life of rose (Rosa sps. cv. Dutch Hybrid). Journal of the Institute of Agriculture and Animal Science, 35(1), 183-190.

Dahal, J., Adhikari, D. andPun, U.K. (2020). Differential response of carnation varieties (Dianthus caryophyllus L.) to different levels of boron under polytunnels. International Journal of Environment, 9(2), 133-145.https://doi.org/10.3126/ije.v9i2.32603

Dahal, S., Mishra, K., Pun, U.K., Dhakal, D.D., and Sharma, M. (2014). Evaluation of split doses of nitrogen at different growth stages of tuberose (Polianthes tuberosa L.) for improving flowering and vaselife. Nepal Journal of Science and Technology, 15(1), 23-30.https://doi.org/10.3126/njst.v15i1.12006

Dhakal, M., Poon, T.B., Adhikari, P., Pandey, S., and Bhattarai, S. (2021). Characterization of gladiolus genotypes under Khumaltar condition of Nepal. Journal of Nepal Agricultural Research Council, 7, 22-29.

Joshi Y.R. (2009). Effects of different preservatives on vase life and soluble sugar content ofselected cut rose cultivars (Unpublished master thesis). Institute of Agriculture andAnimal Science, Tribhuwan University, Rampur, Chitwan.

Joshi, G.R. (2008). Influence of corm size on cut flower characteristics, corm/cormel production and flower longevity in gladiolus cv. American Beauty (Unpublished master thesis). Institute of Agriculture and Animal Science, Tribhuwan University, Rampur, Chitwan.

Joshi, K.R., Gautam, D.M., Baral, D.R. and Pun, U.K. (2008). Effect of corm size and varieties on growth, performance and cut flower characteristics of gladiolus. Journal of Nepal Horticulture Society, 7(1).

Khanal A., Mishra,K., Pun, U., Dhital, M., and Timilsina, S. (2015). Effects of plant growth regulators on growth and flowering of gladiolus Cv. American Beauty. Nepal Journal of Science and Technology 16 (2), 17-22.

Khanal, B. (2014) Effects of Growing Conditions of Marigold in Ilam District, Nepal. American Journal of Plant Sciences, 5, 3389-3395. http://dx.doi.org/10.4236/ajps.2014.522354

Marasini, P. and Khanal, A. (2018). Assessing rooting media and hormone on rooting potential of stem cuttings of Bougainvillea. Journal of the Institute of Agriculture and Animal Science, 35(1), 197-201.

Newman, S.E. and Collins, F. (2019). The Floriculture Industry. https://doi.org/10.1016/B978-0-12-409548-9.11830-5

Pant, S.S. (2002). Effect of different doses of nitrogen and phosphorus on growth and development, cutflower characteristics and vase life of gladiolus cv. American Beauty. M. Sc. Ag (Horticulture) Thesis, 4-23.

Piya, S., Bajracharya, A.S., Subba, N., Mandal, J.L., Choudhary, B.P., and Khatiwada, P.P. (2008). Effect of corm size and planting depth on flower quality and corm yield of gladiolus (cv. Jester). Proceedings of the 3rd SAS-N Convention.

Poudel, S., Regmi, R., Pun, U., and Rijal, A. (2017). Influence of spacing and pinching on growth parameters of african marigold cv. inca orange-1ks. Proceedings of Ninth National Horticulture Workshop, (1), 345–350

Pun, A.B., Shresth, A.K., Shakya, S.M., and Pun, U.K. (2008) Effect of vase solution treatment with different chemical preservatives on vase life of carnation (Dianthus Caryophyllus L.) cut flower. Proceedings of fifth National Seminar on Horticulture/Nepal Agricultural Research Council (NARC), Khumltar, Lalitpur, Nepal.

Pun, A.B. (2008). Effect of growing locations and cultivars on vase life of carnation (Dianthus caryophyllus L.) cut flowers. M. Sc. Ag (Horticulture) Thesis, 1-43.

Pun, U., Tripathi, K.M., and Kafle, D.R. (2019). Prospects and challenges of floriculture business in federal Nepal. Nepal Horticulture Society, 132–140.

Pun, U.K., Mohanty C.R., Nayak, B., and Maharana, T. (1996). Effect of some chemicals in vaselife of orchid under ambient condition. Journal of Institute of Agriculture and Animal Science, 17-18, 87-90.

Pun, U.K., Adhikari, T.R., Gurung, C.B., and Thapa, F. (1995). Pelantnantheria insectifera – An addition into the orchid flora of Nepal. Green World, 6(1), 35-36.

Pun, U.K.and Thapa, F. (1996). A partial survey of orchids in the foothills of Chitwan and Nawalparasi districts of Nepal. Banko Janakari, 6(2), 79-81.

Pun, U.K., Shrestha, S.R., and Upreti, G. (1995). Standardization of media for the establishment of orchid Rhynchostylis retusa in Chitwan. Journal of Institute of Agriculture and Animal Science, 16, 31-34.

Poudel, S. (2018). Influence of different vase solutions on quality and vase life of different varieties of Gerbera (Gerbera jamesonii Hook.) cut flowers at Kathmandu, Nepal. M. Sc. Ag (Horticulture) Thesis. Institute of Agriculture and Animal Science, Tribhuwan University, Kirtipur.

Timalsina, S. (2021). Effect of calcium chloride and other floral preservatives in the vase life of gerbera cut flower flowers. M. Sc. Ag (Horticulture) Thesis. Institute of Agriculture and Animal Science, Tribhuwan University, Kirtipur.

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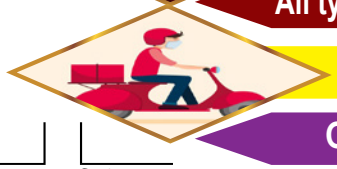

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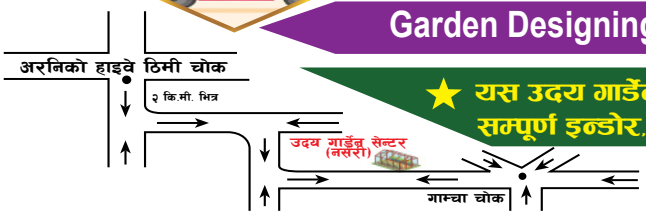

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Indigenous Ornamental Plant and Flower of Nepal: Need to be Explored

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Introduction

Nepal possesses a unique geographic position on Earth, possessing high elevational and climatic variation within the small area (147, 516 km2) which ranges from 59 m to 8848.86 m, the highest point in the world. Nepal is considered a crossroad of plant migration in the Himalayan region, with rich floral diversity due to the overlap of eastern and western Himalayan floral elements (Shrestha and Joshi, 1996). Due to variation in topography, climate and presence of unique physical features, Nepal is rich in the context of biodiversity.

Current estimates of species number indicate that there are 1,001 species of algae (Prasad 2013), 2,182 species of fungi (Kost and Adhikari 2015), 850 species of lichens (Sochting, 2015), 1,213 species of bryophytes (Pradhan 2016), 550 species of pteridophytes (FraserJenkins *et al.* 2015), Angiosperms 6653 (Kunwar *et al.,* 2010) and 41 species of gymnosperms (Shrestha *et al.,* 2018). According to Rajbhandari *et al.* (2016), there are 324 species of endemic flowering plants, belonging to 132 genera and 45 families. 30 species of bryophytes are endemic (Pradhan, 2016).

In recent time, biodiversity richness is reduced due to forest fire, habitat destruction, population growth, overharvesting, unplanned tourism, pollution, overfishing, indiscriminate product extraction, invasive alien species, infrastructure expansion, climate change. Nepal contains world's 2% of flowering plants, 3% of the pteridophytes and 6% of the bryophytes (Paudel *et al.,* 2011). Tiwari *et al.* (2019) reported that current plant checklists for Nepal record some 6076 species of flowering plants (Press *et al.,* 2000) and about 534 ferns (DPR, 2013).

Ornamental plants are grown for their aesthetic qualities, such as flowers, fruit, stem, bark, leaves, fragrance, and foliage texture.Unusual traits, such as thorns or spines, may be regarded interesting in some instances. It is a plant primarily grown for its beauty either for screening, accent, specimen, color or aesthetic reasons. Nepal is rich in Ornamental plants though there are many under explored species in country. Nepalese had been using ornamental plants for different purpose like to offer god and goddess, establishment of chautra (shading tree), beautification around the temple and gumba from time immemorial but commercial ornamental and floriculture business origin is recent years. Floriculture in Nepal is started from mid-forties of 20th century while commercial cut flower enterprise began at the later part of 1980 (Pun, 2004). Different species of ornamental plants can be used for various purpose like hedge, shrubs, palms, cacti, succulent plants, bonsai, pteridophytes ornamental trees, climbers indoors plants, bulbous plants, lawn grasses, cut flower, avenue plantation, topiary, etc. Indigenous ornamental plants can adapt to the temperature and soil conditions of the area where they grow naturally. These essential plant species also offer nectar, pollen, and seeds to native animals, butterflies, insects, birds and other creatures and main the boundary ecosystem.

Major advantages of using indigenous ornamental plant can be summarized below:

- Save external inputs like water, fertilizer and pesticide requirement
- Indigenous plants have better resistance to local weather fluctuation. This allows them to survive in severe weather
- Indigenous plants require less maintenance due to disease resistance and tolerance to harsh environmental condition
- Gardening with indigenous plant helps in conservation of natural genetic pool
- Most of the invasive species are alien species so, it helps to maintain biodiversity of locality
- Indigenous ornamental plants had been using in tradition medicine, religious ceremonies and symbol of status

Although we are rich in indigenous ornamental plants, we depend on about 90% imported ornamental plants and seeds to fulfill national demand (Acharya *et al.,* 2021). The purpose of this paper is to explore the indigenous ornamental plants which can be used for home garden, cut flower, avenue plantation, hedge, topiary and lawn purpose etc. Obviously, use of indigenous plants significantly substitute import volume and value of the ornamental plants and its product and simultaneously promote its export to different countries. Similarly, by using indigenous ornamental plant different value added products such as cosmetic items, energy drinks, food products, medicines, etc. can be manufactured to uplift the economic condition of both the farming communities and nation.

Indigenous ornamental plant and flower

Common ornamental plants

Common indigenous ornamental plants and flowers are listed in the Table 1 and glimpses of some are given in Annex 1.

Table 1. List of indigenous ornamental plants of Nepal (Malla *et al.,* 2017; Acharya, 2011).

S.N.	English name	Nepali name	Scientific name	Flowering season
1	Yellow Hibiscus, Manihot Mallow	बननलु, जंगलीभिंडी (Jungali bhindi)	*Abelmoschus manihot* (L.) Medik.	Aug-Oct
2	Zinnia	पार्वती (Parbati)	*Zinnia spp*	Jun- Oct
3	Himalayan Silver Fir	तालिसपत्र (Talis patra)	*Abies spectabilis* (D. Don) Mirb.	Jun-July
4	Maple	फिरफिरे (Firfire)	*Acer oblongum* Wall. ex DC.	-
5	Sweet Flag, Calamus Root	बोझो (Bojho)	*Acorus calamus* L.	-
6	-	मसिनोखपटे (Masino khapate)	*Actinodaphne longipes* Kosterm.	-
7	Hooker's Blushwort	थिर्जो (Thirjo)	*Aeschynanthus hookeri* C.B. Clarke	Jun-July
8	Horse Chest-nut	लेखपाङ्रा (Lekhpangra)	*Aesculus indica* (Wall. ex Cambess.) Hook.	-
9	Persian Silk Tree/Pink Silk Tree	रातोसिरिस (Rato siris)	*Albizzia julibrissin* Durazz.	April-May
10	Nepalese Alder	उत्तिस (Uttis)	*Alnus nepalensis* D. Don	Sep- Oct
11	Devil's Tree, Ditta Bark Tree	छतीवन (Chatiban)	*Alstonia scholaris* (L.) R. Br.	Jan-April
12	Amaranthus	लट्टेफुल(Latte phul)	*Amaranthus spp*	Sep- Oct

S.N.	English name	Nepali name	Scientific name	Flowering season
13	Pearl/ Pearly Everlasting		*Anaphalis sp.*	-
14	Rock Anemone		*Anemone rupicola* Cambess.	Jun-Aug
15	Grape Leaf Anemone	कपासे (Kapase), धनेरो (Dhanese)	*Anemone vitifolia* Buch.-Ham. ex DC.	July-Aug
16	Himalayan Coralberry	दमाईफल (Damai phal)	*Ardisia macrocarpa* Wall.	-
17	Jack in the Pulpit	काल (Kal)	*Arisaema costatum* (Wall.) Mart.	May-Jun
18	Scarlet Milk Weed, Bloodflower, Silkweed	खुर्सानीकोसेफूल, माछाफूल (Maccha phul)	*Asclepias curassavica* L.	April-May
19	Asparagus	कुरिलो (Kurilo)	*Asparagus racemosus* Willd.	
20	False Spiraea	ठुलाऔषधी (Thula aausadhi)	*Astilbe rivularis* Buch.-Ham. ex D.Don	July- Oct
21	Malabar Bauhinia	अमिलटाँकी (Amil tanki)	*Bauhinia malabarica* Roxb.	Jun-July
22	Orchid Tree, Mountain Ebony	कोइरालो (Koiralo)	*Bauhinia variegata* L.	Feb- May
23	Dogwood, Himalayan, Strawberry Tree, Benthum's Cornel	डमरु, डीम्मर (Damaru,Dimber)	*Benthamidia capitata* (Wall.) H.Hara	May-Jun
24	Barberry, Tree Turmeric	किरमडौं,चुत्रो (Chutro)	*Berberis aristata* DC.	April-Jun
25	Asian Barberry	चुत्रो (Chutro)	*Berberis asiatica* Roxb. ex DC.	March-May
26	Nepal Mahonia	जमानेमान्द्रो (Jamanemandro)	*Berberis napaulensis (DC.)* Laferr.	Oct- May
27	Rockfoil/ Winter Begonia	पाषानभेद (Paasanbhed)	*Bergenia ciliata* (Haw.) Sternb.	Jan- April
28	Himalayan Birch, Indian –birch	लेकपैयु (Lekh painu)	*Betula alnoides* Buch.-Ham. ex D.Don	March-May
29	-	दाम्पाते(Dampate)	*Boenninghausenia albiflora* (Hook.) Rchb. ex Meisn.	July -Sep
30	Himalayan Knot Weed, Himalayan Fleece Flower	म्याकुरी (Myakuri)	*Bistorta affinis* (D.Don) Greene	Jun-Sep
31	Silk Cotton Tree	सिमल (Simal)	*Bombax ceiba* L.	Feb-May
32	-	सेतोचुलेत्रो (Seto Chuletro)	*Brassaiopsis hainla* (Buch.-Ham.) Seem.	Dec- March
33	Java Brucea, Kosam	भक्किम्लो (Bhakkimlo)	*Brucea javanica* (L.) Merr.	Jan- July
34	Christmas Orchids	सुनाखरी (Sunakhari)	*Calanthe sp.*	Nov- Feb
35	Marsh-marigold, Cowflock	एकआँखेफूल (Eak aakhe phul)	*Caltha palustris* var. *himalensis* (D.Don) Mukh.	April-July
36	Fish Tail Palm	जगर (Jagar)	*Caryota urens* L.	Throughout the year
37	Indian Chestnut	ढालेकटुस (Dhale kathus)	*Castanopsis indica* (Roxb. ex Lindl.) A.DC.	Feb- May
38	Himalayan Ceder	देवदार (Deodar)	*Cedrus deodara* (Roxb. ex D.Don) G.Don	March- May
39	Nepal Chlorophytum, Spider Plant	बनप्याज (Banpyaja)	*Chlorophytum nepalense* (Lindl.) Baker	July- Sep
40	Nepalese Hog Plum	लप्सी (Lapsi)	*Choerospondias axillaris* (Roxb.) B.L.Burtt & A.W.Hill	March-April

S.N.	English name	Nepali name	Scientific name	Flowering season
41	Frangipani Vine	गोठालेफूल, हम्मलकाँडा (Hammal phul)	*Chonemorpha fragrans* (Moon) Alston	May-Jun
42	Nepali Cinnamon	तेजपात (Tejpat)	*Cinnamomumtamala* (Buch.-Ham.) T.Nees & Eberm.	
43	Tibetan Clematis	इमोंग नाम्पो	*Clematis tibetana* Kuntze	May-July
44	Japanese Glorybower	धागोफूल (Dhago phul)	*Clerodendrum japonicum* (Thunb.) Sweet	July-Sep
45	Masuri Berry, Tanner's Tree	मछाइनो, भोजिन्सी	*Coriaria nepalensis* Wall.	March-April
46	Rockspray Cotoneaster	खरेटो (Khareto)	*Cotoneaster microphyllus* Wall. ex Lindl.	May-Jun
47	Wild turmeric, Aromatic Turmeric	बनहलेदो (Ban haledo)	*Curcuma aromatica* Salisb.	April-May
48	Flying Spider-monkey Tree Fern		*Cyathea spinulosa* Wall. ex Hook.	
49	Himalayan Lady's Slipper	टुकीफूल, खुजुक्पा (Khajukpa)	*Cypripedium himalaicum* Rolfe	Jun-July
50	Dahlia	लाहुरे (Lahure)	*Dahlia spp*	Jun-Oct
51	Delphinium	नेपालीअतीस (Nepali atish)	*Delphinium himalayae* Munz	Aug-Sep
52	Antifertile Dichroa	भासक (Bhasak)	*Dichroa febrifuga* Lour.	Jun- Aug
53	Nepal Butter Fruit	चिउरी (Chiuri)	*Diploknema butyracea* (Roxb.) H.J.Lam	Nov-Jan
54	-	बनमुला (Banmula)	*Dipsacus atratus* Hook.f. & Thomson ex C.B.Clarke	
55	Radhish Leaf	मूलापात (Moolaapaat)	*Dipsacus inermis* Wall.	Jun-Sep
56	Himalayan Weeping Bamboo	निगाले (Nigale)	*Drepanostachyum falcatum* (Nees) Keng f.	
57	Fragrant Inula	गाईतिहारेफूल, कानपाते, तिहरेफूल (Tihare phul)	*Duhaldea cappa* (Buch.-Ham. ex D.Don) Pruski & Anderb.	Aug-Sep
58	Nepalese Paper Bush	अर्गेली (argali)	*Edgeworthia gardneri* (Wall.) Meisn.	Nov-April
59	Heliotrope Tree	चिल्ले (Chille)	*Ehretia acuminata* R.Br.	Jan- April
60	Joint Fir	सोमलता (Somalata)	*Ephedra gerardiana* Wall. ex Stapf	
61	Spindle Wood	बनचितु (Ban chitu)	*Euonymus hamiltonianus* Wall.	May- Jun
62	Royal's Spurge	–	*Euphorbia royleana* Boiss.	-
63	Perennial Buckwheat	–	*Fagopyrum dibotrys* (D.Don) H.Hara	July-Oct
64	Fig	–	*Ficus neriifolia* Sm.	Jun-July
65	Eastern Teaberry	–	*Gaultheria sp.*	-
66	Wild Gerbera	पातेझुलो (Pate jhulo)	*Gerbera nivea* (DC.) Sch.Bip.	July-Oct
67	Glory Lily	केवरी, अग्नीशिखा (Aagni sikha)	*Gloriosa superba* L.	Jun-Aug
68	Globe Amaranth	मखमली (Makhamali)	*Gomphrena globosa* L.	Aug-Dec
69	Nepal Ivy Climber	पिपलपाते (Pipalpate)	*Hedera nepalensis* K.Koch	Oct- April
70	Wax Flower	मैनफूल (Main phul)	*Hoya longifolia* Wall. ex Wight	Jun-July
71	Himalayan Tree Hydrangea	हंसराज, फिरफिरेघाँस (Firfire ghas)	*Hydrangea aspera* D. Don	July-Aug

S.N.	English name	Nepali name	Scientific name	Flowering season
72	Nepali Holy Tree	पुर्बौले (Purbaulo)	*Ilex excelsa* (Wall.) Hook. f.	May-Jun
73	Golden Balsam	तिउरी (Tiuree)	*Impatiens balsamina* L.	Jun-July
74	Brown Pine, Mount Teak, Oleander Podocarpus	गुन्ती (Gunti)	*Podocarpus neriifolius* D.Don	April-May
75	Yellow Jasmine	जाई (Jaai)	*Jasminum humile* L.	July- Aug
76	Wild Jasmine, Chinese Jasmine	जंगलीबेली (Gunti beli)	*Jasminum multiflorum* (Burm.f.) Andrews	April-Sep
77	Walnut	ओखर(Okhar)	*Juglans regia* L.	March-April
78	Privet	कनिकेफुल (Kanike phul)	*Ligustrum confusum* Decne.	Jun-July
79	Large Flower Lindenbergia	भेंडीफूल (Bhendiphool), बिनास (Binaas), धुर्सेत (Dhurset)	*Lindenbergia grandiflora* (Buch.-Ham. ex D. Don) Benth	-
80	Wild Privet	फुसुरे (Phusure), खराने (Kharane)	*Lindera pulcherrima* (Nees) Hook. f.	-
81	Luculia	बनकाइंयो (Bankaiyo)	*Luculia gratissima* (Wall.) Sweet	Year round flowering
82	Cockspur Thorn	डमरु (Damaru)	*Maclura cochinchinensis* (Lour.) Corner	April- Jun
83	Champak, Joy Perfume Tree	औलेचाँप (Aaule chap)	*Magnolia champaca* (L.) Baill. ex Pierre	Jun-July
84		भोटेचाँप, भालुकाठ (Bhotechap, Bhalu kath)	*Magnolia hodgsonii* (Hook.f. & Thomson)H.Keng	April-May
85	Kisopa Magnolia	बनचाँप (Ban chap)	*Magnolia kisopa* (Buch.-Ham. ex DC.) Figlar	July-Sep
86	Turk's Cap	खुर्सानीफुल (Khursani phul)	*Malvaviscus arboreus* Cav.	April- Sep
87	Himalayan Melastome	चुलेसी (Chulesi)	*Melastoma malabathricum* var. normale (D. Don) R.C. Srivast.	March-Jun
88	Chinese Silver Grass		*Miscanthus nepalensis* (Trin.) Hack.	July- Sep
89	Curry Leaf Tree	मिठानिम (Mitha Nim)	*Murraya koenigii* (L.) Spreng.	Feb- April
90	Himalayan Mussaenda	धोबिनी (Dhobini)	*Mussaenda macrophylla* Wall.	May-Aug
91	Box Myrtle/ Bay-berry	काफल(Kaphal)	*Myrica esculenta* Buch.-Ham. ex D. Don	
92	Sword Fern	पानी अमला (Pani Amala)	*Nephrolepis cordifolia* (L.) C. Presl.	
93	Large-leaved False Lily		*Notholirion macrophyllum* (D. Don) Boiss.	Aug-Sep
94	White Mondo Grass	बनसुपारी (Ban Supari)	*Ophiopogon intermedius* D.Don.	
95	Starry Osbeckia	रातोचुलेसी (Rato chulesi)	*Osbeckia stellata* Buch.-Ham. ex Ker Gawl.	July-Sep
96	Fragrant Olive, Tea Olive	सिरिंगे (Siringe)	*Osmanthus fragrans* Lour.	Sep-Oct
97	Bristletips	अङ्गेरी (Angeri)	*Oxyspora paniculata* (D. Don) DC.	July- Sep
98	Skunk Vine, Stink Vine	पदेबिरी (Padebiri)	*Paederia foetida* L.	May-Jun

S.N.	English name	Nepali name	Scientific name	Flowering season
99	Screw Pine	बनकेवर (Bankebar)	*Pandanus furcatus* Roxb.	
100	Acorn Peperomia		*Peperomia tetraphylla* (G.Frost.) Hook. & Arn.	
101	Chinese Knotweed	कुकुर्ठोट्ने (Kukur thotne)	*Persicaria chinensis* (L.) H. Gross	
102	Rosette Sage	तगबग (Tagbag)	*Phlomis rotata* Benth. ex Hook.F.	Jun-Aug
103	Palm, Phoenix		*Phoenix sp.*	
104	Rattlesnake Orchid	सुनाखरी(Sunakhari)	*Pholidota sp.*	July- Sep
105	Chir Pine	रानीसल्ला (Rani Salla)	*Pinus roxburghii* Sarg.	
106	Blue Pine	गोब्रेसल्ला (Gobre Salla)	*Pinus wallichiana* A.B. Jacks.	
107	Evergreen Laburnum	सिकसिके, सुगाफूल (Siksike, Sunga phul)	*Piptanthus nepalensis* (Hook.) D.Don	March-May
108	Early Blooming Pleione	लसुनपाते (Lasun pate)	*Pleione praecox* (Sm.) D.Don	Oct-Nov
109	Mountain Teak, Brown Pine	गुन्सी (Gunsi)	*Podocarpus neriifolius* D.Don	
110	Shrubby Cinquefoil	चिनियाफूल, भौरंगपाते (Bhauranga phul)	*Potentilla fruticosa* L.	Jun-Sep
111	Silver Leaf	बज्नदन्ति (Bajnadanti)	*Potentilla lineata* Trevir.	April-Sep
112	Large Primrose		*Primula macrophylla* D.Don	Jun-Aug
113	Himalayan Wild Cherry	जंगलीपैयु, जंगलीआरु (Jungali aaru)	*Prunus napaulensis* (Ser.) Steud.	April-May
114	Nepal Fire Thorn	काठगेडी (Kath Gedi)	*Pyracantha crenulata* (Roxb. ex D.Don) M.Roem.	May- April
115	Himalayan Pear	मयल (Mayal)	*Pyrus pashia* Buch.-Ham. ex D.Don	March-April
116		सेतिकाठ (Seti kath)	*Rapanea capitellata* (Wall.) Mez	Jan-Feb
117	Serpentine	सर्पगन्धा (Sarpagandha)	*Rauvolfia serpentina* (L.) Benth. ex Kurz	
118	Yellow Flax	प्याउली(Pyauli)	*Reinwardtia indica* Dumort.	March- May
119		कन्चिना (Kanchina)	*Rhaphidophora glauca* (Wall.) Schott	Aug- Sep
120	Dwarf Rhododendron	सुनपाती (Sunpaati)	*Rhododendron anthopogon* D. Don	May-Jun
121	-	बुलु, सानुचिमाल (Sanu chimal)	*Rhododendron cinnabarinum* Hook. f.	April-Jun
122		कोरलिंग (Korlinga)	*Rhododendron hodgsonii* Hook. f.	April-May
123	Pink Scaly Rhododendron	भालेसुनपाती (Bhale sunpati)	*Rhododendron lepidotum* Wall. ex G. Don	Jun-July
124	Bristly Rhododendron	झुसेसुनपाती (Jhuse sunpati)	*Rhododendron setosum* D. Don	May-July
125	Rhy		*Rhynchostylis*	
126	Himalayan Musk Rose	भैसेकाँडेगुलाफ, बारमासेगुलाफ (Baramase gulaf)	*Rosa brunonii* Lindl.	April-Jun
127	Himalayan Rose, Big Hip Rose	हिमालीजंगलीगुलाफ (Himali Jungali gulaf)	*Rosa macrophylla* Lindl.	Jun-July

S.N.	English name	Nepali name	Scientific name	Flowering season
128	Silky Rose	भौतेगुलाफ, रियुली (Bhuaute gulaf, Riyalu)	*Rosa sericea* Wall. ex Lindl.	May-Aug
129	Mountain Roscoe Lily	नक्कलीपाँचऔले (Nakkali panchaaule)	*Roscoea alpina* Royle	Jun-July
130		भुइँसरो (Bhui saro)	*Roscoea capitata* Sm.	July- Aug
131	Indian Madder	मजिठो (Majitho)	*Rubia manjith* Roxb.ex Fleming	
132	Himalayan Raspberry	ऐसेलु (Aiselu)	*Rubus ellipticus* Sm.	
133	Yellow Dock, Common Field Sorrel	हलहले (Halhale)	*Rumex nepalensis* Spreng.	April- May
134	American Alder	कनिकेफुल (Kanike phul)	*Sambucus hookeri* Rehder	May- Aug
135	Sarcococca	फितफिया (Fitfiya)	*Sarcococca pruniformis* Lindl.	Nov- Jan
136		गोगन (Gogan)	*Saurauia napaulensis* DC.	April- May
137	Needle Wood	चिलाउने (Chilaune)	*Schima wallichii* (DC.) Korth.	April- May
138	Forest Champa	बेनचम्पा, तुगासागे (Banchampa, Tugasage)	*Spermadictyon suaveolens* Roxb.	Oct-March
139	Marigold	सयपत्री (Sayapatri)	*Tagetes patula* L.	Aug-Dec
140	Leafy Meadow-rue	दाम्पते (Dampate)	*Thalictrum foliolosum* DC.	July-Aug
141	Black Pea	कालोकेराउफूल (Kalo kerau)	*Thermopsis barbata* Benth.	May-July
142	Common Mallow	बनकपास (Ban kapas)	*Thespesia lampas* (Cav.) Dalzell	Aug-Oct
143	Nepalese Broom Grass	अम्रिसो (Amriso)	*Thysanolaena latifolia* (Roxb. ex Hornem.) Honda	Throughout the year
144	Muskroot	नक्कली जटामसी (Nakkali Jatamashi), सुगन्धवाल (Sugandhawal)	*Valeriana jatamansi* jones	
145	Viola		*Viola sp.*	
146	Pink Rain Lily	हाडेलसुन (Hande Lasun)	*Zephyranthes carinata* Herb.	Jun-Sep

Avenue plants

Avenue plants are shrubs or small or large trees planted along the road within or outside the garden to reduce the effect of dust, shading purpose and beautification. In Nepal many exotic as well as indigenous species are widely used for the avenue plantation. Many Nepalese indigenous plants can be planted along the road side. Avenue plants should be planted with planning otherwise it will cause many problems: No pruning of plant leads to heterogeneity, falling branches or trees cause accidents, branches entangled with electric wire. Indigenous Nepalese avenue plants along with avenue plantation are also used in religious functions, medicinal purpose, source of vegetable etc. Indigenous avenue plants are listed in the Table 2.

Table 2. List of indigenous avenue plants (Lamichhane, 2019)

S.N.	English name	Nepali name	Scientific name	Family
1	Malabar Bauhinia	अमिलटाकी	*Bauhinia malabarica* var. *reniformis* Baker	Fabaceae
2	Mountain Ebony	कोइरालो	*Bauhinia variegata* L.	Fabaceae

S.N.	English name	Nepali name	Scientific name	Family
3	Mahonia	जमानेमान्द्रो	*Mahonia napaulensis* var. *roxburghii* DC.	Berberidaceae
4	Indian Berberry	चुत्रो	*Berberis aristata* Sims	Berberidaceae
5	Flame of Jungle	पलाँस	*Butea braamania* DC.	Fabaceae
6	Himalayan Cherry	पैयु	*Prunus cerasoides* var. *majestica* (Koehne) Ingram	Rosaceae
7	Himalayan Sweet Box	फितफिया, पिपिरे	*Sarcococca coriacea* Sweet	Buxaceae
8		बनरुखकमल	*Magnolia insignis* Wall.	Magnoliaceae
9	Hairy White-Wand	भुसुरे	*Leucosceptrum canum* Sm.	Lamiaceae
10	Golden Shower	राजवृक्ष	*Cassia fistula* L.	Fabaceae
11	Tree Rhododendron	लालीगुरास	*Rhododendron arboreum* Sm.	Ericaceae
12	Himalayan Horse chestnut	लेखपाङ्गा	*Aesculus indica* (Wall. ex Cambess.) Hook	Sapindaceae
13	Yellow Champaka	चाँप	*Magnolia champaca* var. *champaca*	Magnoliaceae
14	Mountain Teak	गुन्सी	*Podocarpus neriifolius* D.Don	Podocarpaceae
15	Himalayan Yew	लौठसल्ला	*Taxus wallichiana*Zucc.	Taxaceae
16	Scholar Tree	छतिवन,छलामैन	*Alstonia scholaris* (L.) R. Br.	Apocynaceae
17	Nepali Holy Tree	पुवाँले, निरस्याउल	*Ilex excelsa* (Wall.) Hook. f.	Aquifoliaceae
18	Camel Foot Plant Kachnar	टाँकि	*Bauhinia purpurea* L.	Fabaceae
19	Ban Champ	बनचाँप	*Magnolia kisopa* (Buch.-Ham. ex DC.) Figla	Magnoliaceae
20	Gai Lie Mu (In Chinese)	भोटेचाँप	*Magnolia acuminata* (L.) L.	Magnoliaceae
21	Sweet Olive	सिरिंगे/बकलपाते	*Osmanthus fragrans* Lour.	Oleaceae
22	Silk Tree	रातोशिरिष	*Albizia julibrissin* Durazz.	Mimosaceae
23	Indian Bay Leaf	तेजपात	*Cinnamomum tamala* (Buch.-Ham.) T.Nees & Eberm.	Lauraceae
24	Indian Chestnut	ढालेकटुस	*Castanopsis indica* (Roxb. ex Lindl.) A.DC.	Fagaceae
25	Utrasum Bead Tree	रुद्राक्ष	*Elaeocarpus sphaericus* (Gaertn.) K.Schum.	Elaeocarpaceae
26	Night Flowering Jasmine	पारिजात	*Nyctanthes arbor-tristis* L.	Oleaceae
27	Himalayan Maple	फिरफिरे	*Acer oblongum* Wall. ex DC.	Sapindaceae
28	Himalayan Cedar	देवदार	*Cedrus deodara* (Roxb. ex D.Don) G.Don	Pinaceae

Orchid

Orchid is one of the prettiest flowers in nature available in different color, shape and some have pleasant fragrance. Orchid requires proper fungal symbiont for its multiplication and vegetative reproduction is also very slow so, nowadays tissue culture is gaining popularity for its multiplication. In Nepal, orchids are found from 60-5200m above sea level (ASL) comprising 104 genera, 451 species, 16 varieties, 3 subspecies and 18 endemic species. Orchids are found in different habitat. There are 251 epiphytic species in Nepal, 63 lithophytic species (51 as epiphytic or lithophytic), 211 terrestrial species (14 as terrestrial and lithophytic), and 21 saprophytic species (10 as terrestrial or saprophytic). The Himalayan region has 115 endemic species, while Nepal has 18 endemic species (Rokaya *et al.,* 2013). Some common orchids found in Nepal are enlisted in Table 3.

Table 3. Indigenous orchids, their habitat and distribution in Nepal (Blair, 1909)

SN	Scientific name	Habitat	Distribution in Nepal
1	*Acampe rigida* (Buch.-Ham. ex Sm.) P.F.Hunt	Epiphytic	Eastern and central region
2	*Brachycorythis obcordata* (Lindl.) Summerh.	Terrestrial	Eastern and central region
3	*Bulbophyllum rolfei* (Kuntze) Seidenf.	Epiphytic/ Partial shade	Eastern and central region
4	*Calanthe puberula* Lindl.	Terrestrial	Central Nepal
5	*Coelogyne ovalis* Lindl.	Epiphytic	Central and western region
6	*Cymbidium longifolium* D.Don	Epiphytic	Eastern and central region
7	*Dendrobium fimbriatum* Hook.	Epiphytic	Eastern, central and western region
8	*Gastrochilus acutifolius* (Lindl.) Kuntze	Epiphytic	Central Nepal
9	*Goodyera foliosa* (Lindl.) Benth. ex C.B.Clarke	Terrestrial	Eastern and Central region
10	*Nervilia carinata* (Roxb.) Schltr.	Terrestrial	Central Nepal
11	*Papilionanthe teres* (Roxb.) Schltr.	Epiphytic	Eastern and Central region
12	*Trichotosia annulata* Blume	Epiphytic	Central Nepal

Conclusion

In Nepal, many indigenous ornamental species are found in different landscape of Himalayan, Mountain and plain region. Indigenous ornamental plants having aesthetic value fulfill our domestic as well as international demand. Using indigenous plants in different aesthetic purpose maintain the natural genetic pool for the conservation of biodiversity. Currently, commercial ornamental plants and flowers used are mainly exotic species which create dependency to other country. By exploring indigenous ornamental plants and flowers and developing new cultivars through using biotechnology will certainly boost our floriculture trade in international market. Simultaneously, it also promotes the income generation of marginalized as well as commercial farmer/entrepreneur of different geographical zones. Therefore, use of indigenous plants and flowers in garden design, avenue plantation, and ornamental plants and flower production should be promoted through the joint venture of public and private partnership approach.

References

Acharya, A.K. (2011). Integration of ornamental plants and flowers in home garden for livelihood strengthening. "Hamro Sampada (National Monthly)", Year 10, No.8, https://www.researchgate.net/publication/351226234)Integration)of)ornamental)plants)and)flowers)in)home)garden)for)livelihood)strengthening

Acharya, A.K., Shrestha, K.K., Tamang J.B., and Pun. U.K. (2021). Impact of COVID 19 on Floriculture Industry of Nepal. Proceedings of 12th National Horticulture Seminar, Nepal Horticulture Society.

Blair, K. (1909). The Orchids of Ohio. The Ohio Naturalist, vol. x, No.2, 24-35, https://kb.osu.edu/bitstream/handle/1811/1658/V10N02)024.pdf;jsessionid=52E04871917639EF31B22681C39F46CA?sequence=1

DPR. (2013). Plants of Nepal: Fact Sheet. Department of Plant Resources (DPR), Kathmandu.

Fraser-Jenkins, C.R., Kandel, D.R., and Pariyar, S. (2015). Ferns and Fern-allies of Nepal Volume 1. National Herbarium and Plant Laboratories, Department of Plant Resources. Ministry of Forests and Soil Conservation, Kathmandu, Nepal. 492p.

Kost, G. and Adhikari, M.K. (2015). Mycota. In: Nepal: An Introduction to the Natural History, Ecology and Human Environment of the Himalayas, Miehe, G., C.A. Pendry and R. Chaudhary (eds.), Edinburgh: Royal Botanic Garden Edinburgh. pp. 203-210.

Kunwar, R.M., Shrestha, K., and Dhungana, S.K. (2010). Floral biodiversity of Nepal: an udate. Journal of Natural History Museum. Vol. 25, 295-311.

Lamichhane, D. (2019). Avenue. Nepalese floriculture, vol 23. Floriculture Association Nepal (FAN). pg 51-53.

Malla, K., Lamichane, D., Kafle, D., Pun, U.K., and Bade, D. (2017). Indigenous ornamental flowering plants of Nepal. Floriculture Association Nepal (FAN).

Malla, K., Lamichane, D., Kafle, D., and Bade, D. (2018). Indigenous ornamental flowering plants of Nepal (supplement-I). Floriculture Association Nepal (FAN).

Paudel, P.K., Bhattarai, B.P, and Kindlmann, P. (2011). An overview of the biodiversity in Nepal. Himalayn Biodiversity in the changing world. http://dx.doi.org/10.1007/978-94-007-1802-9)1, https://www.researchgate.net/publication/227038793)An)Overview)of)the)Biodiversity)in) Nepa

Pradhan, N. (2016). Bryophytes of Nepal. In: Frontiers of Botany, Jha, P.K., M. Siwakoti and S. Rajbhandary (eds.). Central Department of Botany, Tribhuvan University, Kathmandu, pp.100-123.

Press, J.R., Shrestha, K.K., and Sutton, D.A. (2000). Annotated Checklist of the Flowering Plants of Nepal. Natural History Museum, London.

Pun, U.K. (2004). Commercial cut flower production in Nepal and status of four important cut flowers. Journal of the Institute of Agriculture and Animal Science. 25:17-21.

Rajbhandari, K.R., Rai, S.K., and Bhatt, G.D. (2016). Endemic flowering plants of Nepal: an update. Bulletin of Department of Plant Resources, 38, 106-144.

Rokaya, M.B., Raskoti, B.B., Timsina, B., and Münzbergová, Z. (2013). An annotated checklist of the orchids of Nepal. Nordic Journal of Botany, 31(5), 511–550. https://doi.org/10.1111 /j.1756-1051.2013.01230.

Shrestha, T.B. and Joshi, R.M. (1996). Rare, Endemic and Endangered Plants of Nepal. WWF Nepal Program, Kathmandu, Nepal.

Shrestha, K. K., Bhattarai, S., and Bhandari, P. (2018). Handbook of Flowering Plants of Nepal. Scientific Publishers India, Jodhpur.

Sochting, U. (2015). Lichens. In: Nepal: An Introduction to the Natural History, Ecology and Human Environment of the Himalayas, Miehe, G., C.A. Pendry and R. Chaudhary (eds.), Edinburgh: Royal Botanic Garden Edinburgh. pp.191-199.

Tiwari, A., Uprety, Y., and Rana, S.K. (2019). Plant endemism in the Nepal Himalayas and phytogeographical impliations. Plant Diversity 41: 174-182, https://www.keaipublishing. com/en/journals/plant-diversity/

Annex 1.Some glimpses of indigenous ornamental plants and flowers (Source: Malla *et al.* (2017); Malla *et al.* (2018); websites)

i. Himalayan mussaenda
ii. Mountain roscoe lily
iii. Common mallow
iv. Wild gerbera
v. Pink scaly rhododendron
vi. Silky rose

vii. Early blooming pleione
viii. Skink vine
ix. Starry osbeckia
x. Himalayan musk rose
xi. Cowflock
xii. Nepali holy tree
xiii. Kisopa magnolia

xiv. Damai phal
xv. Ban Kaiyo (Luculia)
xvi. Persian silk tree
xvii. Masuri berry
xviii. Wax flower
xix. Large leaved false lily

xx. Black pea
xxi. Wild turmeric
xxii. Himalayan fleece flower
xxiii. Devil's tree
xiv. Brown pine
xxv. Large prime rose
xxvi. Evergreen laburnum

xxvii. Dogwood
xviii. Glory lily
xxix. Leaf meadow-rue
xxx. Frangipani vine
xxxi. Bristly rhododendron
xxxii. Rockspray cotoneaster
xxxiii. Champak

xxxiv. Nepalese paper bush
xxxv. Rosette sage
xxxvi. Himalayn lady's slipper
xxxvii. Silkweed
xxxviii. Jack in the pulpit
xxxix. Grape leaf anemone
xxxx. Himalayan melastome

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Different Growing Media: Application in Floriculture

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Introduction

Growing medium, a foundation for healthy root system, is a substance through which plant extract water, nutrients and minerals (Jacobs *et al.,* 2009) and is fundamental for good nursery propagation and management (Landis *et al.,* 1990). These are all those materials, other than soil, that can be used to grow plants (Kampf, 2000; Gruda, 2011; Kaushal and Kumari, 2020). Soil-less substrates are being popular nowadays, especially in horticulture (Di Benedetto *et al.,* 2006; Verhagen, 2007)for raising seedlings, plant propagation, vegetable production and for the production of foliage, flowers and ornamental plants (Garcia-Gomez *et al.,* 2002; Di Benedetto, 2007; Chavez *et al.,* 2008).The quality and quantity including number, size of flowers and overall seedling growth is largely affected by the composition and nutritional status (Riaz *et al.,* 2008) including physical, chemical and biological characteristics of a selected growing medium (Jacobs *et al.,* 2009; Raviv, 2009) and hence growers should carefully consider both biological and operational aspects as well as positive and negative characteristics of growing media (Landis *et al.,* 1990).

Generally, a mixture of substrate is often recommended than using a substratum as a sole (Bures*et al.,* 1993; Hartz *et al.,* 1996; Spiers and Fietje, 2000). Offering satisfactory moisture holding capacity, aeration and more reservoir and uptake of nutrient and mineral, application of growing media is proved effective for significant yield in horticultural crops (Kaushal and Kumari, 2020). A good quality substrate plays a vital role for acquiring luxuriant vegetative growth as well as profuse flowering in various flower, foliage and ornamental crops. Therefore, this paper aims to familiarize different growing media for their application to increase quality and quantity of different floriculture commodities.

Growing Media

Growing media or plant substrate or simply, a substrate may be an inorganic / soil based or an organic based (Landis *et al.,* 1990; Gruda, 2011). Apart from these, additives like fertilizers, cattle manure compost (Marfà *et al.,* 1997), liming materials, wetting agents, bio-control agents (Savvas and Gruda, 2018), buffering materials, binders, hydrogels, chemical pesticides, biological products, dyes and many more adds up the quality of growth media (Schmilewski, 2008). The Figure 1 shows the types of growing media.

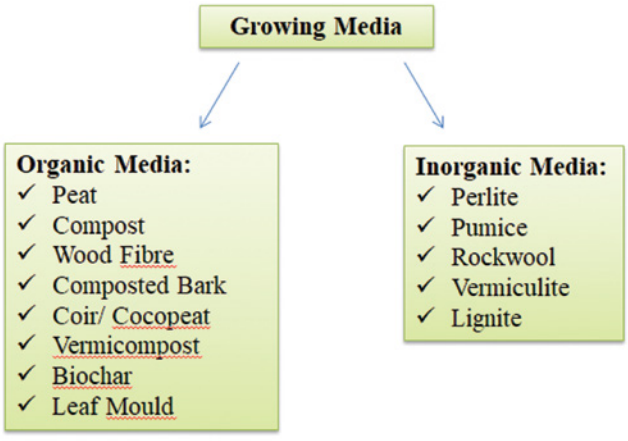

Figure 1. Types of growing media

Criteria for selecting media

Kaushal and Kumari(2020) described following criteria for selecting media:

- Serves as reservoir of plant nutrients
- Sufficiently firm enough to encourage or support the plants
- Provides aeration for exchange of gases
- Should not shrink or expand easily
- Should have good drainage, porosity, aeration, etc
- Should be easily available and economic
- Should be sterilized easily
- Free from pathogens, pests and weed seeds etc.

Advantages of soilless growing media

With the application of soilless growing media, following advantages can be explored in floriculture:

- Overcome problems related with soil borne diseases and disorders (De Hertogh and Le Nard, 1993; Hoitink *et al.,*1997; Tribulato and Noto, 2000; Grassotti *et al.,* 2003); Compost being more suitable than peat (Lumsden *et al.,* 1986; Inbar *et al.,* 1993; Hoitink and Grebus, 1994; Pinamonti *et al.,* 1997; Atiyeh *et al.,* 2001)
- Soilless systems also have generally higher water and nutrient use efficiencies (Van Os, 1999; Savvas, 2002; Gruda, 2019)
- Soil less culture being alternative against chemical sterilization (Grassotti *et al.,* 2003).
- Ready to use and may even contain some fertilizer (Hochmuth *et al.,* 1996)
- Compared with soil-based cultivation, soilless culture can be more cost-effective (Grafiadellis *et al.,* 2000)
- Ensure more production (Raviv *et al.,* 2008; Nejad and Ismaili, 2014), qualitative product and produce (Massantini *et al.,* 1988)
- Fairly good physical and chemical characteristics as a growingmedium (Ozcelik*et al.,* 1997)
- Provide adequate storage of water and nutrients, and maintaining satisfactory porosity and aeration (Lopez-Real *et al.,* 1988; Raviv, 2009; Ali *et al.,* 2011).

Disadvantages / Limitations of soilless growing media

Although, soilless growing media have various advantages, we should also be aware about their following limitations:

- Provides a very shallow depth of growing medium which becomes quickly saturated during irrigation (Bunt, 2012)
- Geo- disinfection required for soil culture through chemicals like methyl bromide, which may induce water and environmental disorders (Grassotti *et al.,* 2003)
- Compost may contain toxic substances (Castaldi *et al.,* 2004) and higher salt content (Ribeiro *et al.,* 2000; Castillo *et al.,* 2004)
- Application of high rates of compost may result an accumulation of trace metals in plants(Castaldi *et al.,* 2004), being dangerous pollutants (Castaldi *et al.,* 2004) and causing toxicity being dangerous for living creatures feeding on them (Petruzzelli, 1996)

Description of different growing media

Description (Table 1) and images (Plate 1) of different growing media are given below:

Table 1. Description of different growing media

Organic Media	Description
Peat - Processed from the remains of aquatic, marsh, bog, swamp vegetation and mires and is formed at low temperatures, oxygen and nutrient levels over years	➢ Low pH (3.7-5.2), High Nutrient content (Savvas and Gruda, 2018) ➢ Excellent air and water holding qualities (Kaushal and Kumari, 2020) ➢ Excellent physical, chemical and biological properties (Robertson, 1993; Krucker *et al.,* 2010) ➢ Considerable CO_2 emissions (Gruda, 2011) ➢ Difficult to re-wett; Low Bulk Density (Easy Transport) (Michel, 2010; Kaushal and Kumari, 2020)
Composted biodegradable waste (Composts) - Well decomposed organic matter obtained by aerobic/ anaerobic decomposition (Kaushal and Kumari, 2020)	➢ Higher organic matter and nutrients; EF (Senesi *et al.,* 1996; Farrell and Jones, 2010) ➢ Resistance to pythium and other soil borne disease (Gruda, 2019; Schmilewski, 2008) ➢ Prominent source of potassium & micronutrients (Eklind *et al.,* 1998; Prasad and Maher, 2006) ➢ Higher pH (>7), soluble salt and the higher K_2O content (Gruda *et al.,* 2006) ➢ Higher bulk density (Costly Transport) (Benito *et al.,* 2005) ➢ Longer Storage (Salinity); May be Phyto-toxic (Hartz *et al.,* 1996; Castaldi *et al.,* 2004)
Wood Fibres - Product from fresh pine chips or waste wood streams and is produced in environment with high temperature and pressure	➢ Fibrous, porous, loose and elastic; Low Bulk Density (Maher *et al.,* 2008) ➢ pH (4.5-6); Low shrinkage or shrinkage resistance; High C: N; may be toxic to various Horticulture plants (Schmilewski, 2008)
Coir / coconut peat / coco peat / Coir pith / Coir Dust - Byproduct of coir industry and composed of mesocarp tissue, or husk of the coconut fruit	➢ Better (High) balance between waterand air capacity (Schmilewski, 2008; Barrett *et al.,* 2016) ➢ Resistance to bacterial and fungal growth; 4 years (Kaushal and Kumari, 2020) ➢ Low bulk Density, High K; pH -5.2-6.8 (Evans *et al.,* 1996; Prasad, 1996) ➢ Leaching and immobilization of N, expensive than Peat (Prasad, 1996; Noguera *et al.,* 1998; Barrett *et al.,* 2016) ➢ Chlorine and Sodium Toxic (Singh *et al.,* 2015)
Vermi-compost - Worm castings and is the end-product of organic matter break down by earthworm	➢ Stable (Recalcitrant to Micro-Organism), free from pathogens, good aeration and water holding (Savidov and Nichols, 2010; Steiner and Harttung, 2014) ➢ Good source of P, K, Micronutrients (Zulfiqar *et al.,* 2019) ➢ Higher pH; May impart osmotic Stress (Neumaier *et al.,* 2015)
Biochar - Charcoal formed from organic matter by heating in an anoxic situation (pyrolysis)	➢ Free from pathogens; high structural stability and good air and water-holding capacity (Steiner and Harttung, 2014) ➢ Recalcitrant against microbial decay (Savidov and Nichols, 2010) ➢ Good sources of P, K and other micronutrients (Kuzyakov *et al.,* 2009) ➢ May impart an osmotic stress and may be phytotoxic (Zulfiqar *et al.,* 2019; Neumaier *et al.,* 2015)

Leaf Mould - Form of compost produced by the fungal breakdown of shrub and tree leaves	➢ Improves soil structure providing fantastic habitat for soil life, including earthworms and beneficial bacteria (Kaushal and Kumari, 2020) ➢ Good aeration, drainage and water holding properties ➢ Economic, being locally available
Inorganic Media	**Description**
Perlite - Glassy volcanic rock with a rhyolitic composition and 2–5% of combined water	➢ Readily available Moisture and nutrients; neutral pH (6.5 to 7.5), sterile and free of weeds and disease (Bar-Tal *et al.,* 2019) ➢ Light in weight & Poor compress ability – i.e. Porous (Kaushal and Kumari, 2020) ➢ Dusty on drying, floating during irrigation ➢ May contain potentially toxic levels of fluorine
Vermiculite - Natural micaceous mineral with hydrated magnesium and aluminium-iron silicate	➢ High water holding capacity (five times its weight) (Kaushal and Kumari, 2020) ➢ Sterile in nature, suitable Even for hydroponics ➢ Prominent source of K and Mg
Rockwool - Rock based mineral fiber insulation comprised of basalt rock (volcanic rock) and recycled slag (by-product of the steel and copper industry)	➢ Chemically and biologically inert (High Temperature Manufactured) (Bussell and Mckennie, 2004) ➢ Offers as mulching medium for trees like Avocado ➢ Disposal problem, lung cancer, cost ineffective (Drent *et al.,* 2000)
Pumice - Inert alumino-silicate mineral of volcanic origin characterized by high porosity and, therefore, by low density	➢ Free of pathogens and weed seeds (Raviv *et al.,* 2002; Boertje, 1995) ➢ High porosity, low density; N retained (13 times that of peat) (Challinor, 1996; Crippa *et al.,* 2017)
Lignite - Diagenesis of peat at an elevated temperature and pressure	➢ Durable, Pathogen free, pH (6-7), low salinity (NowosielsKi, 1995) ➢ Higher humic acids and their salts- mineral nutrients (Kalembasa andTengler, 2004)

i. Peatii

ii. Leaf mould

iii. Cocopit

iv. Biochar

v. Wood fibres

vi. Vermicompost

vii. Sphagnum pest moss

viii. Perlite

ix. Vermiculite

x. Rockwool

xi. Pumice stone

xii. Lignite

Plate 1. Images of growing media (Source: websites)

Types of Peat

Peat is highly variable due to its different origins, and hence produces a range of growing media, some of which are better suited to specific plants (Table 2).

Table 2. Types of peats and their characteristics

Parameters	Peat Moss	Reed Sedge Peat	Peat Humus	Sphagnum Moss
Processed product of:	Sphagnum or other moss	remains of grasses, reeds, sedges and other swamp plants	advanced state of decomposition of either reed-sedge peat or hypnum moss	dehydrated remains of acid-bog plants from the genus Sphagnum
Moisture Holding Capacity	High	Less	Less	High
Color	Light to dark brown	Reddish brown to black	brown to black	Light brown
pH	3.2-4.5	4-7.5	5-7.5	3.5-4

Source: (Kaushal and Kumari, 2020)

Among peat, the peat moss (Sphagnum) is the most used organic soilless substrate for the production of container plants in floriculture (Álvarez *et al.,* 2018) while Sphagnum moss has high physical and chemical stability and low degradation rate (Heiskanen, 1993, 1995) that support sustainability. The increasing prize of high quality peat moss and its decreasing availability in the near future due to environmental constraints (Robertson, 1993); as extraction methods involving clearance of the surface vegetation and site drainage has prompted a search for alternative materials (Garcia Gomez *et al.,* 2002).

Application of growing media in floriculture

Ozcelik*et al.*(1997) found that Peat and pumice (1:1) as a growth medium offers highest flowers per plant (59.31) in gerbera when compared with other substrate like perlite and rook wool.

Jeong and Hwang (2000) found that the recycled hydroponic Rockwool slabs particles and pine wood chips at the ration of 3:1 as a medium for growing Cut Roses gives better results in all the parameters.

Rose and Haase (2000) found that Douglas-fir seedlings in a coir-based medium were significantly smaller than those grown in peat moss.

Papafotiou *et al.*(2004) found that on replacing a peat at rate of 50 % and 75% by olive-mill wastes compost (on a medium with 1:1 peat and perlite) cause gradual decrease in plant height, bract number and node number of poinsettia.

Coconut fiber when used both singly or as a mixture, determine a greater dimension of the inflorescence and increase in the number of buds; length and weight increase in the stem in two cultivars of lily hybrids ('Cordelia' and 'Narbonne'), with growth medium containing perlite and coconut fibre, either singly, mixed together or mixed with clay pellets or peat was reported (Grassotti *et al.,* 2003).

Benito *et al.*(2005) found that the substrates containing spent mushroom compost (Pruning waste compost + Peat + Spent mushroom compost and Pruning waste compost + Spent mushroom compost) seems to be the most adequate growing media for perennial ryegrass (*Lolium perenne* L.) and cypress (*Cupressus sempervirens* L.) then the media with sand and ground leaves.

Similarly, Jhon *et al.* (2005) on analyzing the effect of media on floral and bulb production characters in tulip cv. 'Apeldoorn' under polyhouse conditions found that media comprising Soil + Poultry manure + Sand (2:1:1) give better result for scape length, number of bulbs per plant and vase life and Soil + Sheep manure + Sand (2:1:1) on tepal diameter.

Rani *et al.* (2005) studied the effect of growing media on various cultivars of Lilium and as a result Soil + Cocopeat as a medium gave earliest flowering, plant spread, bulb size and weight of bulblets, whereas soil also found to be at with Soil + cocopeat in case of earliest flowering and plant spread.

Similarly, Aswath and Padmanabha (2004) on studying the effect of growing medium in growth and flowering of Gerbera jamesonii concluded that Coco peat alone as a medium gives better result in case of stalk thickness, stalk length and flower diameter. Better result for growth and flowering of gerbera cv. 'Mammut' with Coir pith + Garden soil + FYM as a medium was found under naturally ventilated green house (Sekar and Sujata, 2001).

Barreto and Jagtap (2006) on studying the yield, quality and profitability of Gerbera cv. 'Sangria' found that growing media with Coco peat + Compost (1:1) gives better results in growth, flowering and yield of gerbera. In case of net return both Coco peat + Compost (1:1) and Coco peat + perlite + Rice Husk (3:1:1) are found effective.

Tsakaldimi (2006) found that 1:3 mixture of rice hulls and peat were an effective substitute for perlite for growing Aleppo pine (Pinus halepensis) seedlings. Similar result was found by Marianthi (2007) when Sphagnum peat moss and rice hulls were used in the ratio of 7: 3.

The addition of the upper layer of coco fiber on adding as a top layer over perlite raised the leaf water potentials (-0.74 vs. -0.84 MPa) and the rates of net assimilation (13.7 vs. 12.1 µmol

CO_2 m-2 s-1) and transpiration (6.01 vs. 5.19 mmol H_2O m-2 s-1) compared to the perlite alone (Paradiso and De Pascale, 2005) of gerbera.

Coconut compost induces the maximum size of flowers and found to be significantly greater than soil in Zinnia elegans cv. blue point when compared with different growing media like coconut compost, silt, soil, leaf manure, leaf manure mix (silt + leaf manure + coconut compost; 1:1:1) (Riaz *et al.,* 2008).

Likewise, Ali *et al.* (2011) studied the Response of Freesia cultivars to different growing media and found that the Mushroom compost results early emergence (25.22 days), maximum number of leaves (10.44), maximum lamina length (22.7 cm), maximum leaf area (310.54 cm^2), maximum number of florets per plant (41.71), maximum number of spikes per plant (7.67) and maximum plant height (36.18cm) whereas poultry medium results late emergence (62.23 days), less number of leaves (8.14), less lamina length (18.16cm), less leaf area (205.55 cm2) plant-1 , late flowering (153.39 days), less number of florets plant-1 (21.33), less number of spikes plant-1 (3.93), less spike persistence (8.01 days) and less plant height (28.28 cm).

Leaf manure as a sole component produced significantly the maximum vase life and diameter of flower in zinnia (Sardoei *et al.,* 2014).

High nitrogen immobilization and being toxic, biochar even at 30% in growing media may impart reduced growth in potted basil (Neumaier *et al.,* 2015).

Mathew (2002)on studying the effect of media composition on growth and flowering of Lisianthus (Eustoma grandiflorus), found that treatment- 2 Coir Peat: 2 Sand: 1 Soil gives better results for growth and flowering of Lisianthus except maximum flower length on 1 Coir Peat: 2 Sand: 1 Soil.

Ali *et al.* (2011) found early emergence, maximum number of leaves, lamina length, leaf area, florets/plant, maximum number of spikes/plant of Freesia with the growing media having leaf mould, mushroom compost, poultry manure.

Maximum vase life and diameter of flower of Zinnia was found with the leaf manure as a growing substrate (leaf manure + soil loam + silt; 1:1:1) (Sardoei *et al.,* 2014).

Conclusion

Soilless culture is one of an emerging agribusiness to overcome water shortages, pest and disease, poor yield, even in areas with poor soil, geography and problematic conditions. Besides, soil, number of organic media: peat, compost, coco-peat, composted bark, leaf mould, vermin-compost, wood fiber, biochar, etc. and inorganic media like: perlite, pumice, vermiculite, rook-wool, etc. had gained popularity in the field of floriculture. Also, soilless media has been found to impart qualitative and quantitative advantages in respect of vegetative, flowering and yield attributes. But some of the media may impart a negative effect in growth, development and overall production of floriculture crops. Also, none even a single substrate as a growing media possess exactly those properties as needed by the crops for optimum yield and growth. In the context, blending or mixing more than one media and composting of some raw materials has been found to be offering the best result. Blending of media for few important crops of Nepal like Gerbera, which is susceptible to crown rot especially during wet seasons, could be helpful.

References

Ali, T., Khattak, A.M., Amin, N.U., and Khan, M.A. (2011). Response of freesia cultivars to different growing media under Peshawar conditions. Sarhad J. Agric, 27(1), 43-49.

Álvarez, J.M., Pasian, C., Lal, R., López, R., Díaz, M.J., and Fernández, M. (2018). Morpho-physiological plant quality when biochar and vermicompost are used as growing media replacement in urban horticulture. Urban forestry & urban greening, 34, 175-180.

Aswath, C. and Padmanabha, P. (2004). Effect of cocopeat medium and electrical conductivity on production of gerbera. J. of Orna. Hort, 7(1), 15-22.

Atiyeh, R.M., Edwards, C.A., Subler, S., and Metzger, J.D. (2001). Pig manure vermicompost as a component of a horticultural bedding plant medium: effects on physicochemical properties and plant growth. Bioresource technology, 78(1), 11-20.

Barreto, M.S. and Jagtap, K.B. (2006). Assessment of substrates for economical production of gerbera (Gerbera jamesonii Bolus ex Hooker F.) flowers under protected cultivation. Journal of Ornamental Horticulture, 9(2), 136-138.

Barrett, G.E., Alexander, P.D., Robinson, J.S., and Bragg, N.C. (2016). Achieving environmentally sustainable growing media for soilless plant cultivation systems–A review. Scientia horticulturae, 212, 220-234.

Bar-Tal, A., Saha, U.K., Raviv, M., and Tuller, M. (2019). Inorganic and synthetic organic components of soilless culture and potting mixtures. In Soilless culture, 259-301.

Benito, M., Masaguer, A., De Antonio, R., and Moliner, A. (2005). Use of pruning waste compost as a component in soilless growing media. Bioresource technology, 96(5), 597-603.

Boertje, G.A. (1995). Chemical and physical characteristics of pumice as a growing medium. In International Symposium on Growing Media & Plant Nutrition in Horticulture, 401, 85-88. https://doi.org/10.17660/ActaHortic.1995.401.9

Buamscha, G.and Altland, J. (2005). Pumice and the Oregon nursery industry. Digger, 49(6), 18-27.

Bunt, B.R. (2012). Media and mixes for container-grown plants: a manual on the preparation and use of growing media for pot plants. Springer Science & Business Media.

Bures, S., Pokorny, F.A., and Ware, G.O. (1993). Estimating shrinkage of container media mixtures with linear and/or regression models. Communications in soil science and plant analysis, 24(3-4), 315-323.

Bussell, W.T. and McKennie, S. (2004). Rockwool in horticulture, and its importance and sustainable use in New Zealand. New Zealand journal of crop and horticultural science, 32(1), 29-37.

Castaldi, P., Garau, G., and Melis, P. (2004). Influence of compost from sea weeds on heavy metal dynamics in the soil-plant system. Fresenius Environmental Bulletin, 13(11), 1322-1328.

Castillo, J.E., Herrera, F., López-Bellido, R.J., López-Bellido, F.J., López-Bellido, L., and Fernández, E.J. (2004). Municipal solid waste (MSW) compost as a tomato transplant medium. Compost Science & Utilization, 12(1), 86-92.

Challinor, P.F. (1996). The use of pumice in horticulture. Proc., 5th International Congress on Soilless Culture, 101-104.

Chavez, W., Di Benedetto, A., Civeira, G., and Lavado, R. (2008). Alternative soilless media for growing Petunia× hybrida and Impatiens wallerana: Physical behavior, effect of fertilization and nitrate losses. Bioresource Technology, 99(17), 8082-8087.

Crippa, L., Zaccheo, P., and Bedussi, F. (2017). Influence of pumice on ammonium dynamics in soilless culture. In International Symposium on Growing Media, Soilless Cultivation, and Compost Utilization in Horticulture, 1266, 243-248.

De Hertogh, A.A. and Le Nard, M. (1993). Production systems for flower bulbs. In: A. De Hertogh & M. Le Nard. (Eds.), The physiology of flower bulbs, Elsevier (pp. 45), Amsterdam.

Di Benedetto, A. (2007). Alternative substrates for potted ornamental plants based on Argentinean peat and Argentinean river waste: a review. Floric. Plant Ornamental Biotechnol, 1(2), 90-101.

Di Benedetto, A., Petracchi, J.C., Marcella, G., Montaron, P., and Chavez, W. (2006) Evaluation of alternative substrates for bedding plants. Int. J. Agric. Res., 1, 545-554.

Drent, M., Bomans, P.H.H., Van Suylen, R.J., Lamers, R.J.S., Bast, A., and Wouters, E.F.M. (2000). Association of man-made mineral fibre exposure and sarcoidlike granulomas. Respiratory medicine, 94(8), 815-820.

Eklind, Y., Salomonsson, L., Wivstad, M., and Rämert, B. (1998). Use of herbage compost as horticultural substrate and source of plant nutrients. Biological agriculture & horticulture, 16(3), 269-290.

Evans, M.R., Konduru, S., and Stamps, R.H. (1996). Source variation in physical and chemical properties of coconut coir dust. HortScience, 31(6), 965-967.

Farrell, M. and Jones, D.L. (2010). Food waste composting: Its use as a peat replacement. Waste Management, 30(8-9), 1495-1501.

Garcia-Gomez, A., Bernal, M.P., and Roig, A. (2002). Growth of ornamental plants in two composts prepared from agroindustrial wastes. Bioresource technology, 83(2), 81-87.

Grafiadellis, I., Mattas, K., Maloupa, E., Tzouramani, I., and Galanopoulos, K. (2000). An economic analysis of soilless culture in gerbera production. HortScience, 35(2), 300-303.

Grassotti, A., Nesi, B., Maletta, M., and Magnani, G. (2003). Effects of growing media and planting time on lily hybrids in soilless culture. In International Symposium on Managing Greenhouse Crops in Saline Environment, 609, 395-399.

Gruda, N. (2011). Current and future perspective of growing media in Europe. In V Balkan Symposium on Vegetables and Potatoes, 960, 37-43.

Gruda, N.S. (2019). Increasing sustainability of growing media constituents and stand-alone substrates in soilless culture systems. Agronomy, 9(6), 298.

Gruda, N., Prasad, M., and Maher, M.J. (2006). Soilless Culture. In: R. Lal (ed.), Encyclopedia of Soil Sciences. Taylor & Francis, Boca Raton, Florida, USA.

Hartz, T.K., Costa, F.J., and Schrader, W.L. (1996). Suitability of composted green waste for horticultural uses. HortScience, 31(6), 961-964.

Heiskanen, J. (1993). Variation in water retention characteristics of peat growth media used in tree nurseries, Silva Fennica, 27(02), 77-97.

Heiskanen, J. (1995). Physical properties of two-component growth media based on Sphagnum peat and their implications for plant-available water and aeration. Plant and Soil, 172(1), 45-54.

Hochmuth, R.C., Davis, L.L., and Dinkins, D. (1996). Greenhouse cut flower zinnia production Florida Cooperative. Extension Service, 3(48), 98-102.

Hoitink, H.A.J., Stone, A.G., and Han, D.Y. (1997). Suppression of plant diseases by composts. HortScience, 32(2), 184-187.

Hoitink, H.A. and Grebus, M.E. (1994). Status of biological control of plant diseases with

composts. Compost Science & Utilization, 2(2), 6-12.

Inbar, Y., Chen, Y., and Hoitink, H.A.J. (1993). Properties for establishing standards for utilization of composts in container media. Science and Engineering of Composting: Design, Environmental. Microbiological and Utilization Aspects. Ohio State University, USA, 668-690.

Jacobs, D.F., Landis, T.D., and Luna, T. (2009). Growing media [Chapter 5]. In: Dumroese, R. Kasten; Luna, Tara; Landis, Thomas D., editors. Nursery manual for native plants: A guide for tribal nurseries-Volume 1: Nursery management. Agriculture Handbook 730. Washington, DC: US Department of Agriculture, Forest Service, 77-93, 730.

Jeong, B.R. and Hwang, S.J. (2000). Use of recycled hydroponic rockwool slabs for hydroponic production of cut roses. In World Congress on Soilless Culture: Agriculture in the Coming Millennium, 554, 89-94.

Jhon, A.Q., Khan, F.U., Bhat, R.A., Rouf, A., and Qadri, Z.A. (2005). Flowering and bulb production in Tulip as influenced by media amendment under polyhouse conditions. Journal of Ornamental Horticulture, 8(2), 143-145.

Kalembasa, S. and Tengler, S.Z. (2004). The role of brown coal in fertilization and environmental protection. Wyd. AP Siedlce, Monogr, 52, 174.

Kampf, A.N. (2000). The substrate Commercial production of ornamental plants. Guaba: Agriculture, 254.

Kaushal, S. and Kumari, P. (2020). Growing media in floriculture crops. Journal of Pharmacognosy and Phytochemistry, 9(2), 1056-1061.

Krucker, M., Hummel, R.L., and Cogger, C. (2010). Chrysanthemum production in composted and noncomposted organic waste substrates fertilized with nitrogen at two rates using surface and subirrigation. HortScience, 45(11), 1695-1701.

Kuzyakov, Y., Subbotina, I., Chen, H., Bogomolova, I., and Xu, X. (2009). Soil Biology & Biochemistry. Soil Biology and Biochemistry, 41, 210-219.

Landis, T.D., Jacobs, D.F., Wilkinson, K.M., and Luna, T. (1990). Growing media. The container tree nursery manual, 2, 41-85.

Lopez-Real, J.M., Witter, E., Midmer, F.N., and Hewett, B.A.O. (1988). Evaluation of composted sewage sludge/straw mixture for horticultural utilization. In Water Pollution Research and Control Brighton, 889-897.

Lumsden, R.D., Millner, P.D., and Lewis, J.A. (1986). Suppression of lettuce drop caused by Sclerotinia minor with composted sewage sludge. Plant Disease, 70(3), 197-201.

Maher, M., Prasad, M., and Raviv, M. (2008). Organic soilless media components. Soilless culture: Theory and practice, 459-504.

Marfà, O., Tort, J.M., Olivella, C., Cáceres, R., and Martínez, F.X. (1997). Cattle manure compost as substrate. II-Conditioning and formulation of growing media for cut flower cultures. In International Symposium on Composting & Use of Composted Material in Horticulture, 469, 305-312.

Marianthi, T. (2007). Kenaf (Hibiscus cannabinus L.) core and rice hulls as components of container media for growing Pinus halepensis M. seedlings. Biores. Tech., 97:1631-1639.

Massantini, F., Favilli, R., Magnani, G., and Oggiano, N. (1988). Soilless culture, biotechnology for high quality vegetables. Soilless culture, 4(2), 27-40.

Mathew, D. (2002). Effect of Media Composition on Growth and Flower Attributes of Lisianthus

(Eustoma Gradiflorum (Raf.) Shinner). Sivakumar, KC, Deepu Mathew and Shetty, S, 149-153.

Michel, J.C. (2010). The physical properties of peat: a key factor for modern growing media. Mires and Peat, 6(2), 1-6.

Nejad, A.R. and Ismaili, A. (2014). Changes in growth, essential oil yield and composition of geranium (Pelargonium graveolens L.) as affected by growing media. Journal of the Science of Food and Agriculture, 94(5), 905-910.

Neumaier, D., Lohr, D., Vobeler, R., Girmann, S., Kolbinger, S., and Meinken, E. (2015). Hydrochars as peat substitute in growing media for organically grown potted herbs. In International Symposium on Growing Media, Composting and Substrate Analysis-SusGro2015, 1168, 377-386.

Newman, J. (2007). Core facts about coir. Greenhouse Management and Production, 27(2), 57.

Noguera et al., 1998

Noguera, P., Abad, M., Noguera, V., Puchades, R., and Maquieira, A. (1998). Coconut coir waste, a new and viable ecologically-friendly peat substitute. In XXV International Horticultural Congress, Part 7: Quality of Horticultural Products 517 (pp. 279-286).

Nowosielski, O. (1995). Lignite as a base and fertilizer and raw material for production of bases and fertilizers. Węg. Brunat, 4, 87-92.

Ozcelik, A., Besroglu, A., Ozaltin, A.S., and Ozgumus, A. (1997). The use of different growing media in greenhouse gerbera cut flower production. In International Symposium Greenhouse Management for Better Yield & Quality in Mild Winter Climates, 491, 425-432.

Papafotiou, M., Phsyhalou, M., Kargas, G., Chatzipavlidis, I., and Chronopoulos, J. (2004). Olive-mill wastes compost as growing medium component for the production of poinsettia. Scientia horticulturae, 102(2), 167-175.

Paradiso, R. and De Pascale, S. (2005). Effects of coco fibre addition to perlite on growth and yield of cut Gerbera. In International Symposium on Growing Media, 779, 529-534.

Petruzzelli, G. (1996). Heavy metals in compost and their effect on soil quality. In The science of composting, 213-223. Springer, Dordrecht.

Pinamonti, F., Stringari, G., and Zorzi, G. (1997). Use of compost in soilless cultivation. Compost science & utilization, 5(2), 38-46.

Prasad, M. (1996). Physical, chemical and biological properties of coir dust. In International Symposium Growing Media and Plant Nutrition in Horticulture, 450, 21-30).

Prasad, M. and Maher, M.J. (2006). Botanic composted material and spent mushroom compost as micronutrient sources for peat diluted growing media. In International Conference ORBIT, 441-446.

Rani, N., Kumar, R., and Dhatt, K.K. (2005). Effect of nitrogen levels and growing media on growth, flowering and bulb production of Lilium cultivars. Journal of Ornamental Horticulture, 8(1), 36-40.

Raviv, M. (2009). The future of composts as ingredients of growing media. In International Symposium on Growing Media and Composting, 891, 19-32.

Raviv, M., Lieth, J.H., & Raviv, M. (2008). Significance of soilless culture in agriculture. Soilless culture theory and practice, 1-11.

Raviv, M., Wallach,R., Silber,A., and Bar-Tal,A. (2002). Substrates and their analysis. In: D. Savvas & H.C. Passam (Eds.). Hydroponic production of vegetables and ornamentals, 25–101. Embryo Publications, Athens, Greece.

Riaz, A., Arshad, M., Younis, A., Raza, A., and Hameed, M.A.N.S.O.O.R. (2008). Effects of different growing media on growth and flowering of Zinnia elegans cv. Blue point. Pak. J. Bot, 40(4), 1579-1585.

Ribeiro, H.M., Vasconcelos, E., and Dos Santos, J.Q. (2000). Fertilisation of potted geranium with a municipal solid waste compost. Bioresource Technology, 73(3), 247-249.

Robertson, R.A. (1993). Peat, horticulture and environment. Biodiversity & Conservation, 2(5), 541-547.

Rose, R. and Haase, D.L. (2000). The use of coir as a containerized growing medium for Douglas-fir seedlings. Native Plants Journal, 1(2), 107-111.

Sardoei, A.S., Fahraji, S.S., and Ghasemi, H. (2014). Effects of different growing media on growth and flowering of zinnia (Zinnia elegans). International journal of Advanced Biological and Biomedical Research, 2(6), 1894-1899.

Savidov, N.A. and Nichols, M.A. (2010). Biochar–A new hydroponic growing medium. In Proc. 28th International Horticultural Congress, Lisbon, Portugal, 1, 35.

Savvas, D. (2002). Hydroponic production of vegetables and ornamentals (p. 463). In H. Passam (Ed.). Athens: Embryo publications.

Savvas, D.and Gruda, N. (2018). Application of soilless culture technologies in the modern greenhouse industry—A review. Eur. J. Hortic. Sci, 83(5), 280-293.

Schmilewski, G. (2008). The role of peat in assuring the quality of growing media. Mires & Peat, 3.

Sekar, K. and Sujata, A. (2001) Effect of media on flowering of gerbera cv. 'Mammut' under naturally ventilated green house. Journal of Ornamental Horticulture. 10(2):78-79.

Senesi, N., Miano, T.M., and Brunetti, G. (1996). Humic-like substances in organic amendments and effects on native soil humic substances. Humic substances in terrestrial ecosystems, 531-593.

Singh, S., Dubey, R.K., and Kukal, S.S. (2015). Performance of cocopeat amended media mixtures on growth and flowering of chrysanthemum. Journal of Applied Horticulture, 17(3).

Spiers, T.M. and Fietje, G. (2000). Green waste compost as a component in soilless growing media. Compost Science & Utilization, 8(1), 19-23.

Steiner, C. and Harttung, T. (2014). Biochar as a growing media additive and peat substitute. Solid Earth, 5(2), 995-999.

Tribulato, A. and Noto, G. (2000). Forcing oriental and asiatic lilies in soilless culture. In V International Symposium on Protected Cultivation in Mild Winter Climates: Current Trends for Suistainable Technologies, 559, 639-645.

Tsakaldimi, M. (2006). Kenaf (Hibiscus cannabinus L.) core and rice hulls as components of container media for growing Pinus halepensis M. seedlings. Bioresource technology, 97(14), 1631-1639.

Van Os, E.A. (1999). Closed soilless growing systems: a sustainable solution for Dutch greenhouse horticulture. Water Science and Technology, 39(5), 105-112.

Verhagen, J.B.G.M. (2007). Stability of growing media from a physical, chemical and biological perspective. In International Symposium on Growing Media 2007, 819, 135-142.

Zulfiqar, F., Allaire, S.E., Akram, N.A., Méndez, A., Younis, A., Peerzada, A.M., Shaukat, N., and Wright, S.R. (2019). Challenges in organic component selection and biochar as an opportunity in potting substrates: a review. Journal of Plant Nutrition, 42(11-12), 1386-1401.


भरत कुमार भट्टराई
प्रोप्राईटर
फोनः ९८६९२७७४०४
अन्तराष्ट्रिय स्तरबाट मान्यता प्राप्त
भट्टराई नर्सरी
सिनामङ्गल, पञ्चकुमारी चोक, काठमाण्डौ,
फोन नं. ९८४९३४७४७४, ९८४९११९०४२
हाम्रा सेवाहरूः
मौसमी फूलहरु, आलंकारिक ईन्डोर तथा आउटडोर
बोट बिरुवाहरु, हरेक प्रकारका फूलका बिऊहरु,
ल्याण्डस्केपिङ्ग, रक गार्डेन, वाटर फाउण्टेन, कार्पेट
दुवो सम्बन्धि सबै सेवाहरु उपलब्ध छ ।


धन प्रसाद घिमिरे
मोबाइलः ९८४१२५००३३
ओम नर्सरी प्रा. लि.
जोरपाटी, नयाँबस्ती, काठमाडौं
सुधिमा नर्सरीः नख्खु, ललितपुर
यहाँ दुबो रोप्ने, छाप्ने, दक्ष इन्जिनियरद्वारा बगैंचा डिजाइनिङ, डेकोरेसन गराइन्छ । सिजनल फलफूलका
बोट-बिरूवाहरू आउटडोर/इन्डोर प्लान्ट, मसला र कम्पोष्ट मल, पिना, हड्डी मल पाइन्छ । साथै
घर वा ठूला-ठूला हाउजिङ अपार्टमेन्टहरूमा कन्ट्याक्टमा गार्डेनर पठाउने व्यवस्था छ ।

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 ।

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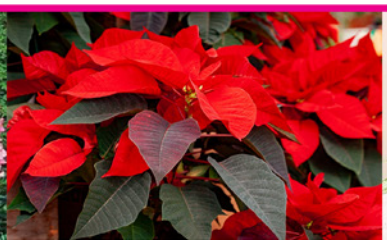

Post harvest guidelines for major cut flowers in Nepal

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Introduction

Cut ornamentals are complex plant organs in which loss of quality of stems, leaves or flower parts may result in rejection in the marketplace. In some ornamentals, loss of quality may result from one of the several causes, including wilting or abscission of leaves and/or petals, yellowing of leaves, and geotropic or phototropic bending of stems. Maintaining the freshness of cut flowers and other ornamentals requires an understanding of the factors that lead to their deterioration. The major factors that affect the post harvest life are plant species, variety, pre-harvest factors, food supply, light, temperature, moisture, water supply, air embolism, fungal and bacterial plugging, water quality, growth tropisms (like geotropism and phototropism), mechanical damage, maturity stage, grades, sizes and packaging materials, pre-cooling conditions, chilling sensitivity, ethylene production and sensitivity, storage conditions, respiration rates, physiological disorders, post harvest pathology and entomology, retail outlet display considerations, customer care information etc. Hence, post harvest handling plays a crucial role in cut flower business and determines the success of the floriculture industry. Nepal as a member of WTO, postharvest technology has become very important to maintain the quality of horticultural products so as to go along with the competitive global market. This article reviews the vital post harvest steps to be considered for major cut flowers being produced in Nepal.

Post harvest loss of cut flowers in Nepal

In Nepal about, 20 to 30 percent postharvest loss of horticultural crops has been recorded (Karki, 2002) and cut flowers also being highly perishable the loss is found upto 19 % in the wholesale market as reported by FAN (2008). The quality of cut flowers is there to suit with the international standards and it has been accepted as an important competitive product for export in the international market (AEC/FNCCI, 2007) but we are unable to enter our products at international market in a larger scale due to several problems and constraints. Maintaining the quality for long distance market is a challenging factor.

Postharvest handling of cut flowers is equally important for all the stakeholders including growers, wholesalers, retailers and consumers. It is found that the level of improved postharvest knowledge is low at all levels of stakeholders. High postharvest loss and problems associated with handlings are also major constraints in limiting cut flowers marketing in Nepal (FAN, 2007). Post harvest handling system in Nepal is still undeveloped, majority of cut flower growers (more than 85%) do not apply preservatives and keep in cold store and 100% of the wholesaler, retailer and consumer do not apply any kind of preservatives (FAN, 2007).

Table 1. Post-harvest loss of cut flowers at different level

Level	Post-harvest loss
Growers level	5%
Wholesale	15%
Florist	5%
Total	25%

(FAN, 2007)

A survey by FAN, showed that 25% of post harvest loss has been reported during cut flowers. In 2006, crop wise cut flowers losses were observed in Gerbera (16%), Dutch rose (15%), Gladiolus (14%), Carnation (12%) and in Local rose (6%).

Table 2. Crop wise post-harvest loss percentage of cut flowers

Cut flower	Post-harvest losses (%)
Gerbera	16%
Dutch rose	15%
Gladiolus	14%
Carnation	12%
Local rose	6%

(FAN, 2007)

Most of the retailers had poor knowledge about proper handling of cut flowers especially in Janakpur, Rupendehi and Kailali. Keeping products directly in the sunlight, not isolating deteriorating flowers from fresh ones are some of the examples. 41.17% retailers display cut flowers directly to the sunlight whereas 58.8% do not do such activity (FAN, 2008).

Table 3. Extent of Postharvest loss in different districts at growers level

SN	Districts	Extent of Post-harvest Loss
1	Dhanusa	<10 % to 10-20%
2	Makwanpur	10%-20%
3	Kaski	<10 % to 10-20%
4	Rupandehi	10% -20%
5	Kailali	>30%

(FAN, 2008)

Hence, post harvest handling requires specialized management and technique to counteract this challenge/loss especially in country like Nepal where logistics with regards to cold chain is very poor. Regarding the knowledge of postharvest technology among the stakeholders, FAN (2008) reported that majority of them are ignorant with the use and importance of proper postharvest handling practices even within Kathmandu valley and in its periphery. Pun (2003) also stated that all the stakeholders are confronted with the limited knowledge related to postharvest technologies in Nepal. At present, the cut flower production and marketing have been extended to many parts of the country but due to lack of proper postharvest management the country in not getting enough supply and quality products.

Table 4. Post-harvest guidelines for Carnation

Harvesting	Star-stage buds are too immature for most purposes except long-term storage. Buds at the 'paint-brush' stage, with petals straight up, will open quickly. Flowers for immediate use are normally harvested with the outer petals between vertical and horizontal. Miniature carnations should be harvested when two flowers open and the remaining buds show color. The best place of cutting stem is the area where leaves are well spaced leaving bottom 5 nodes of stalk to facilitate side shoot development. The flowers are harvested by cutting off with a sharp knife or small shears. Before grading the foliage at the bottom half of the stem should be removed (stripping). After harvest, the flower stems have to be trimmed at the base and should be immediately placed in a bucket of preservative solution of warm and deionized water (5 cm depth).
Grading and bunching	Both standard and miniature carnations are graded by stem strength, stem length, bloom diameter and freedom from defects. Stem strength is determined by holding the stem horizontally at a point one inch above the minimum length for the grade. If the deviation of the flower head is more than 30° from horizontal (with the natural curvature down), the flower is considered defective. Other defects include slabsides, bullheads, blown heads, singles, sleepy appearance, splits, discoloration and damage from insects and diseases. Standard carnations are bunched and tied at the base and at least one other place below the flower heads. The standard carnations are packed in a bunch of 20 flowers and spray carnations of 10 flowers. With standard carnations, flower heads may be alternated (five high and five low) at the top of the bunch to produce a neat and compact bunch and reduce the risk of neck breakage. According to SAF, a flower with 50 mm diameter and 55 cm stem length is graded as fancy, 44 mm diameter and 43 cm stem length as standard while below 30cm stem length is graded as short.
Ethylene sensitivity	Carnations are ethylene sensitive and exposure to ethylene causes premature petal wilting referred to as 'sleepiness.' Some newer cultivars are less sensitive to ethylene than the standard 'Sim' types, and carnations have now been genetically modified by the addition of a mutation of the ethylene binding site that makes them insensitive to ethylene (Bovy et al., 1999).
Pretreatments	Carnation flowers must be pre-treated with 1-MCP or STS. Research shows that the effectiveness of 1-MCP is lost within a week at room temperature but is retained for extended periods when carnations are held at low temperatures. Pulsing the treated flowers overnight with a preservative containing 10% sucrose + 200 ppm Physan-20 improves flower opening and quality carnation buds can be opened at room temperature and under normal room lighting. The buds should have been treated, first, with 1-MCP or STS. Alternatively, 8-hydroxyquinoline sulphate (8-HQS) or 8-hydroxyquinoline citrate (8-HQC) @ 200 ppm, silver thiosulphate @ 0.2 mM, cytokinin @ 50-100 ppm, sucrose @ 2.0% and citric acid @ 50-100 ppm are used as flower preservatives. The pH of the preservative solution should be maintained at 4-5. The flowers should be placed in the solution at least for 4 hrs. Before shipping the packed flowers must be cooled by forced air cooling at 4-7^{0}C. If forced air cooling is not available, flowers should be cooled first without placing the lid on and then place the lid before shipping.
Storage conditions	Carnations should be stored at 0 to 1 ^{o}C and 95% RH. Forced air cooling is normally followed. Bud-harvested flowers perform best in storage because they are less sensitive to ethylene than mature flowers. Flowers or buds for storage should be of the highest quality and absolutely free of pests and diseases. They should be treated with 1-MCP or STS and a fungicide for Botrytis control then packed in a box lined with polyethylene and newspaper. Open flowers can be stored 2 to 4 weeks, while bud-cut flowers can be safely stored up to 4 to 5 weeks.

Packing	A range of polythene, polypropylene and paper sleeves are available. Normally perforated sleeves are used as wrapping material. The basal ends of the stems can be placed in absorbent cotton saturated with water and enclosed in waxed paper or aluminium foils. Carnations are usually packed in standard horizontal fiberboard boxes. Place flower stems in cartons that are lined with polyethylene and a few sheets of newspaper inside the plastic. Do not seal the plastic lining tightly. Ensure that packing system allows an unimpeded flow of air through the length of carton. Normally a box size of 122cm, 50cm and 30cm or 98 cm, 30cm and 12cm length, width and height respectively is used. Standard carnations are packed with 24, 28 or 32 bunches per box according to the grade. Spray carnations are packed with 100 bunches per telescopic corrugated carton. All gaps inside the boxes should be filled with shredded paper. Sides of box should have vent holes with flap. Total vent size should be equal to 4-5% of the area of the end wall of the box.
Special considerations	Spray carnations do not always respond well to STS because the different flower maturities do not take up the STS solution equally. It is difficult to recognize water-stressed carnations, but severe reduction in vase-life is the result. So, keep them hydrated when held above 0 to 1 °C.

Table 5. Post-harvest guidelines for Chrysanthemum

Harvesting	Standards are harvested when outer row of florets start unfurling for distant market and for local market half opened flowers are harvested. Spray types are harvested when two flowers have opened and others have shown color for local market while for distant market harvest when 50% flowers show color. Pot mums are harvested when 50% flowers have shown color. Harvesting too early may result in failure of the flowers to open. However, chrysanthemums can be harvested as quite tight buds and opened satisfactorily with simple bud-opening solutions. Bud-cut standards can be harvested when the inflorescence is about 5 cm (2 in) across or greater and opened into full-sized flowers. Remove chrysanthemum bunches from the boxes, re-cut stems to remove about 2.5 cm (1 in) and place in a good re-hydration solution. Educate workers and customers to accept flowers that are from two thirds to three quarters open as these flowers will last longer than tighter harvested ones. Harvesting of flowers should be done about 10 cm above the soil and 1/3rd of the stems are stripped off leaves and places in biocides. Flowers harvested at late hours of the day have better keeping life compared to morning harvest.
Grading and bunching	Standard chrysanthemums are graded by length and packed individually. Spray-types are graded by length and bunched. Standards or disbuds of equal sizes are graded into groups of 10, 20 or 25. Each bunch of five to eight spray chrysanthemums should be sleeved with plastic to prevent flowers from becoming entangled. Standards and spider mums can be wrapped individually with thin wax paper to avoid bruising and entangling florets. Some growers place nets over spider mums in the greenhouse before the buds open. **Table 5.1. Grading of standard chrysanthemum by Society of American Florists (SAF)**

Grades	Blue	Red	Green	Yellow
Stem length (cm)	75	75	60	60
Flower diameter (mm)	15	12.5	10	-
Stem strength	Strong	Strong	Strong	-

Ethylene sensitivity	Chrysanthemums are not sensitive to ethylene.
Pretreatments	Stems should be placed in a re-hydration solution or water containing a germicide soon after harvest if they are not to be packed immediately (van Meeteren et al., 1999). Immersion in solutions of the cytokinin 6-benzyl adenine has been shown to be effective in preventing premature leaf yellowing in some spray cultivars that are prone to this problem. This treatment is not yet used commercially. Bud-harvested flowers can be opened in fresh-flower solutions containing 2 to 3% sugar (higher concentrations damage leaves) at 15 to 20 °C with 16 h per day of normal room intensity light. Silver nitrate at 25 ppm + citric acid at 75 ppm is very effective. **Pulsing**: Sucrose 4 % for 24 hrs (Vase life: 18 days) **Holding solution**: BA 10 ppm + Bavistin 0.1 % + Sucrose 2 % (Vase life: 17 days)
Storage conditions	Chrysanthemums should normally be stored at 0 to 1 °C. Bud-cut stems that are held in cold storage beyond the recommended time can develop flat-topped flowers. Fully mature blooms can be stored dry (wrapped in polyethylene) for 3 to 4 weeks at 0 °C. Storage at 0 to 1 °C should not exceed 2 weeks. However, literatures reveal that storage temperature below 1^0C leads to freezing injury. For long time storage, they should be stored at 2-5^0C, 97-98% RH and can be stored for 40 days. Flowers wither at high temperature and low RH.
Packing	Flowers are wrapped in cellophane sleeves. Wrapping material is poly sleeves with holes (50 gauge thickness). Chrysanthemums are normally packed in standard horizontal fiberboard boxes. Standards are packed individually, and a layer of wax paper often separates each row of flowers. 91×43×15 cm cardboard box is taken and placed for standard chrysanthemum and 80×50×30 cm cardboard box for spray chrysanthemum.
Special considerations	The main postharvest problems for chrysanthemums are premature foliage yellowing, wilting and the failure of the flowers to fully open. Yellow foliage is cultivar specific and is caused by poor production, excessive or improper storage and preservative solutions used at higher than recommended concentrations. The bottom portion of some mum stems can be woody: make sure these stems are cut above this woody tissue to facilitate water uptake, delay wilting and extend end-user life.

Table 6. Post-harvest guidelines for Gerbera

Harvesting	Most gerbera varieties should be harvested when the two outer rows of disk florets have begun to open. Flowers are harvested by twisting the stems off near the point of attachment to the rhizome; this is thought to encourage subsequent flower production. If flower stems are pulled from the ground, immediately cut 3-4 cm from the bottom to remove the 'woody' base of the stem, which does not draw water readily. Place soon after harvest in a solution containing 40 ppm Sodium hypochlorite or 1% Calcium chloride. To reduce the bacterial infection, pH of the solution should be 3.5-4. Mixing 25mg chlorine in 1 liter water can reduce the pH of the solution. Make sure that at least one or two rows of disk flowers (tubular flowers in the center of the head) are showing pollen.

<table>
<tr><td>Grading and bunching</td><td>Maturity, freedom from defects, and stem length, strength and straightness are important quality criteria for gerberas. Some producers bunch the flowers, but most pack them individually. Some producers place each flower into a firm plastic sleeve and may insert the stem into a plastic tube to reduce stem bending. An Ideal flower has stalk length 45-55cm and diameter 10-12 cm.
Table 6.1. Grading in gerbera given by FDC, Nepal
<table><tr><th>Grades</th><th>A</th><th>B</th><th>C</th></tr><tr><td>Stem length</td><td>50 cm</td><td>40 cm</td><td>30 cm</td></tr><tr><td>Flower diameter</td><td>9 cm</td><td>7.5 cm</td><td>7.5 cm</td></tr></table></td></tr>
<tr><td>Ethylene sensitivity</td><td>Gerberas are unaffected by exposure to ethylene.</td></tr>
<tr><td>Pretreatments</td><td>Present industry practice is to place cut gerbera stems in a 40 ppm sodium hypochlorite solution for 4-5 hours immediately after harvest to improve vase-life. A rapid pulse treatment with 100 ppm silver nitrate is sufficient to greatly alleviate postharvest problems. After the dip, rinse the flowers in good quality water. This treatment causes only minimum phytotoxicity (brown damage to the stem). The use of 6% sugar + 200 ppm 8-HQC as a preservative has shown to be of some benefit but can cause stem elongation during storage and may reduce overall flower quality. GA_3 5 ppm is also found to increase flower longevity in gerbera. Commercial bleach or Sodium Hypochlorite @ 7-10 ml/lt of water or mixture of Citric acid and Ascorbic acid (@ 5ml each/lit of water) can be mixed to increase vase-life of gerbera.</td></tr>
<tr><td>Storage conditions</td><td>Gerberas should be stored at 0 to 1°C; the widely-held opinion that gerberas are sensitive to chilling injury has not been scientifically substantiated. Generally, gerberas should not be stored longer than 1 week; even this short storage period can reduce subsequent vase-life.</td></tr>
<tr><td>Packing</td><td>Most commonly, producers pack individual flowers horizontally in shallow cardboard containers especially designed to support gerberas. Flower stems are passed through slits in the bottom of a cardboard tray so that the flower heads face up showing their colors while the stems pass under the box. Several rows of flowers can be arranged in each box. The boxes are then hung so that the stems dangle downward and can be placed in a re-hydration solution (hypochlorite is most commonly used). Alternatively, Sleeve the individual flower with 4.5” x 4.5” polythene bag and make a bundle of 10 flowers. Place it in a box of dimension with (98 x 40 x 12) cm box. Generally 200-300 flowers are packed.</td></tr>
<tr><td>Special considerations</td><td>Stem bending is primarily in response to gravity and is greatly reduced if flowers are held at the proper storage temperature. One of the major problems in postharvest handling of these flowers is their tendency to 'conk,' which is folding of the stem 10 to 15 cm (4 to 6 in) below the flower head, resulting in an unmarketable flower. This bending has been variously attributed to harvesting of the flower before the stem has hardened sufficiently, and/or microbial plugging of the stem and subsequent water stress. Be sure to enhance water uptake by keeping holding solutions and buckets clean and including hypochlorite in the water.</td></tr>
</table>

Table 7. Post-harvest guidelines for Gladiolus

<table>
<tr><td>Harvesting</td><td>Normal harvest is at the stage when the bottom two or three florets on the spike are showing color. For long-distance transportation, an even earlier harvest stage can be recommended if it is combined with sugar pulsing to ensure proper opening of the flowers at their destination. Local market flowers are cut when the first floret is open. Harvesting is carried out to leave as many leaves on the plant as possible (Minimum 2 pair of leaves). A knife is run down between the leaves with the back of the knife down. When the knife blade is as low as the cutter believes it should go, it is pulled upward and out, severing the stem, which can then be pulled out of the leaves.</td></tr>
<tr><td>Grading and bunching</td><td>Gladioli, like most spike-type flowers, are very sensitive to the force of gravity and will always tend to grow away from the ground, particularly at warm temperatures. This can result in permanent deformation of the upper part of the spike and consequent reduction of flower quality. Throughout the postharvest procedures, gladioli should be held upright to avoid this effect. Quality factors for gladiolus include stem straightness and strength, freedom from damage and disease and maturity. The flowers are bunched by color and maturity in groups of 10, 12 or 24, wrapped with news paper and loosely tied with rubber band to avoid bruising.
Table 7.1. Grading in gladiolus given by North American Gladiolus Council
<table>
<tr><th>Grade</th><th>Spike length (cm)</th><th>No. of florets/spike</th></tr>
<tr><td>Fancy</td><td>>107</td><td>16</td></tr>
<tr><td>Special</td><td>96-107</td><td>15</td></tr>
<tr><td>Standard</td><td>81-96</td><td>12</td></tr>
<tr><td>Utility</td><td><81</td><td>10</td></tr>
</table></td></tr>
<tr><td>Ethylene sensitivity</td><td>Although exposure to ethylene does not affect the life of open florets, it can reduce the flower life by causing abortion of unopened buds (Serek et al., 1995).</td></tr>
<tr><td>Pretreatments</td><td>Gladioli respond very well to pulsing with a preservative containing 20% sugar (sucrose or glucose) and 200 ppm 8-HQC for 24 hours. Normally 50 ppm silver nitrate or STS is used. Preservation is enhanced by lowering the pH up to 3.5 with citric acid. Pulse overnight at room temperature or in the cooler. The flowers can be pulsed in the dark. Treatment with 1-MCP or STS provides some protection against the effects of exposure to ethylene which causes young buds to abort.</td></tr>
<tr><td>Storage conditions</td><td>Although earlier recommendations were to store gladiolus at 5 °C to prevent chill damage to tips, research have shown that they can safely be stored for a week at 0 to 1 °C. Flowers are negatively geotropic (they bend away from the force of gravity), so they are commonly stored and shipped upright. One beneficial aspect of low temperature handling and transportation is that this negative geotropic response is inhibited, allowing gladioli to be packed in the standard horizontal flower box. For longer storage, gladioli are best stored upright at the lowest safe storage temperature.</td></tr>
<tr><td>Packing</td><td>Traditionally packed in tall 'glad hampers' clearly marked for upright stacking. Since the advent of pre-cooling, some shippers have packed gladiolus in normal flower boxes. Perforated card board boxes having 1.2 m length, 60cm width and 30cm height are convenient. This practice is fairly safe if the flowers will remain refrigerated throughout the marketing chain, and will be removed from the box on arrival. Excessive moisture on the foliage should be avoided so as to minimize the risk of Botrytis infection. However, in Nepal the practice is packing in gunny bags after wrapping the flowers with paper.</td></tr>
<tr><td>Special considerations</td><td>Some cultivars are sensitive to fluoride which can result in deterioration of the petal margin (bleaching, water soaking then necrosis), failure of florets to open and develop normally, burning of the floret sheath, and marginal leaf scorch.</td></tr>
</table>

Table 8. Post-harvest guidelines for Orchids

Harvesting	Orchid flowers are usually harvested 3 to 4 days after opening because flowers cut prematurely will fail to develop normally. Early and late in the season, individual flowers are cut from the spike as they develop, because prices are high at these times. In mid-season, the whole spike is cut. Virus diseases can be spread from plant to plant during harvest, so cutting tools should be sterilized before being used on the next plant. The harvesting of Cymbidium for cut flower market is done in the morning. After cutting the flower stem, it is immediately put in a clean bucket filled with water. Utmost care should be taken not to disturb the pollinia.
Grading and bunching	The grading is done in four standard sizes, based on the quality of the stalk length. The small-S grade is for 30 cm spikes with 4-5 flowers open. The medium-M grade is for 40 cm spikes with 6-8 flowers open. The large-L grade is for 45 cm spikes with 8-10 flowers open. The extra large-XL grade is for 50 cm and above spikes with more than 10 flower open. Freedom from defects is a primary measure of quality.
Ethylene sensitivity	Some genera like Cymbidium and Phalaenopsis, are very sensitive to ethylene; others like Dendrobium are less sensitive.
Pretreatments	Pretreatment with 1-MCP is very effective in preventing the effects of ethylene (Heyes and Johnston, 1998) and increasing the life of orchid flowers. Cut stems of Cymbidium are not treated for local market in Nepal but if treated with 0.2mM Silver thiosulphate (STS) for 30 minutes, the vase life of the cut Cymbidium would significantly increase. Silver treatment also negate the response of the flower to pollinia disturbance thereby reducing postharvest loss. Foliar spray of Al_2Cl_3 at 500 ppm, $(NH_4)_2Mo$ at 100 ppm, Boric acid (H_3BO_4) at 1000 ppm lengthened the vase life. Vase life is also extended by mixture of 8-hydroxyquinoline, ascorbic acid, aspirin and sucrose or 8-HQC alone for flowers cut at all stages. Also, the use of chrysal (silicate of Mg, Fe) along with 5% sucrose increases the vase life.
Storage conditions	Can range from 0 to 12.5 °C depending on cultivar. Many cultivars are not chill sensitive and therefore can be stored as other cut flowers at 0 to 1 °C. If feasible, leaving flowers on the plants at room temperature is a good storage procedure. Be careful not to remove or knock off the pollinia (anthers) as this causes an immediate surge in ethylene production which in turn causes premature death.
Packing	Because of their fragility and relatively high value, most orchids are packed as individual flowers or spikes, frequently in shredded paper to cushion and protect them from mechanical injury to the blooms. They are then packed 12 to 24 flowers in each carton. Box inserts hold individual water tubes stationary. Shredded wax paper is tucked around and between the flowers for additional protection. The standard size of corrugated/cardbord boxes are 76cm X 29cm X 10cm, 98cm X 48cm X 20cm, 98cm X 40cm X 30cm (30 spikes can be packed in each box).
Special considerations	Only some species and cultivars are ethylene sensitive which explains why anti-ethylene treatments like STS and 1-MCP work only some of the time. The two most common ethylene-induced symptoms are flower discoloration and premature wilting and flower fall.

Table 9. Post-harvest guidelines for Rose

Harvesting	For long-distance transport or storage, roses should usually be harvested with some of the sepals reflexed. Flowers harvested before the sepals reflex may fail to open, or may be more susceptible to bent neck. Red and pink cultivars can be harvested when first two petals of flowers start to unfold and calyx is reflexed below the horizontal line. However, the yellow types should be harvested slightly earlier and white rose types slightly later than red and pink. Avoid blooms that are already open; flowers should normally have some or all their sepals (the green protective leaves at the base of the flower) folded back, but the petals should not have started unfolding. Brown spots or patches on the outer petals may be an indication of Botrytis infection.
Grading and bunching	Objective grading is based on stem length; subjective grading is based on flower maturity, stem straightness, stem caliper and quality of flower and foliage. Defects on the outer "guard" petals are not normally a cause for down-grading, because these petals are removed by the retail florist. Leaves and thorns may be removed manually or mechanically if desired. This operation has little effect on vase-life if flowers are placed in an effective preservative. The number of stems per bunch, and bunch pattern (single layer, staggered two-layer) depends on market preferences. In Nepal roses are bunched in a group of 10 or 20, after which wrapped with plastic sleeve.
Ethylene sensitivity	Some cultivars are ethylene sensitive. Treat with 1-MCP or STS if they are being distributed through the mass markets, especially if being shipped through distribution centers and treat to prevent the effects of the ethylene prior to dry storage.
Pretreatments	During storage or transportation, the cut rose should be treated with 200 ppm Aluminium sulphate or citric acid. The cut roses upon reaching the wholesale center is re-cut and kept in water containing anti-microbial agent. Commercial re-hydration solutions are effective, or you may use clean water containing 50 ppm hypochlorite, preferably below pH 5.0. This solution has proved safe, and is inexpensive, so the buckets can be filled to the desired 20 to 30 cm (8 to 12 in) deep (Reid et al., 1996). Calcium hypochloride treatment can be done before storage. GLCA 10% has also been found to be effective in increasing the vase life of cut roses not only at normal ambient temperature but also at higher temperature of 30^{0}C. Glucose, Isothiazolinonic germicide, citric acid and Aluminium sulphate (GLCA) was also effective in opening rose buds harvested at much early stage. **Vase life**: 5% sucrose + 200 ppm 8-HQS + 50 ppm silver nitrate
Storage conditions	Roses should be stored at 2-4^{0}C and 60-70% RH. Roses intended for long-term storage should be packed in polyethylene-lined cartons and pre-cooled. They may be held for up to 2 weeks in dry storage if the temperature is maintained close to the freezing point.
Packing	Rose bunches are routinely sleeved in plastic, waxed paper, or soft corrugated card sleeves. They are placed in card board boxes 12"X20"X60" (bottom and lid with two 3" holes on each side) with the cut stems at the center and flower head at the sides. After a layer of such bunches are placed, a sheet of butter paper is placed above which another layer of rose bunches are laid in similar fashion. The 'spiral' bunch used by many off-shore producers increases the difficulty of pre-cooling the flowers, and the opportunity for condensation collecting on the outer petals. Botrytis infection is a common result of the presence of free moisture on the petals of cut roses.
Special considerations	Removal of those leaves and thorns below the water line should not reduce vase-life if stems are placed into a preservative solution. The fungus Botrytis represents a major problem for roses. Symptoms of Botrytis infection include brown blotches on petals and gray, fuzzy growth on leaves, stems or flowers. Postharvest fungicide dips can be helpful.

Conclusion and Recommendations

Improper post harvest handling is the major cause of loss in cut flower business in Nepal. It is because cut flowers are very sensitive to deterioration and need due care and handling after harvest. Both the pre and post harvest factors should be considered to minimize the wastage and there by increase the economic benefit to the farmers. In order to extend the self-life of cut flowers one must be well known with the quality criteria or standards, grading and bunching methods, ethylene sensitivity, pretreatments, packaging methods, storage conditions as well as other special considerations that largely affect the post harvest quality, so that, the end user will be satisfied with fresh products. This not only benefits the farmers and sellers but also help to gain good will of the consumers.

Important recommendations for post-harvest handling of cut flowers

- Lack of calcium and potassium results in poor vase-life while excessive salinity and nitrogen (especially ammonia) cause a poor longevity of cut flowers. The correct supply of phosphorus promotes a good hardening of the wood of the last node of the stem (that holds the bud) and longer vase-life.
- Flowers harvested in the afternoon (from 3.00 pm to 5.00 pm) present photosynthetic contents (sugars) in the leaves and stems at their highest concentration. This determines an increase in longevity of the flower. In particularly warm weather (i.e. summertime) it is advisable to harvest the flowers in the cooler hours (i.e. morning). Avoid the time of dew, high temperature, rain or moisture during harvesting.
- To avoid infections it is advisable to always use very sharp cutting tools (secateurs) and cleaning them with a disinfectant (i.e. 1% sodium hypo-chloride).
- As soon as the stems have been cut they have to be immediately placed into a water + preservative solution. It is important to remember that water must be clean and likewise the buckets. Avoid tap water and use DI water. Water quality parameters like pH, EC and hardness of water must be checked.
- After the first harvesting phase, the flowers must always be kept in cool environments (Pre-cooling). The direct light and warm temperatures causing rapid opening of the flower, and increase the bacteria in the preservative solutions. The temperatures in refrigerators and during transportation after packing must always be kept between 2 and 6°C while the humidity at around 70-80% max. For the management of temperature during transfer points, the concept of cool chain should be followed.
- Re-cutting of the stem is mainly practiced before placing in preservative solution. It promotes rehydration, speeds up flower opening, revives wilted flowers and helps in unbending of bent-neck flowers.
- Providing consumers with care and handling information not only helps the consumers to realize the maximum enjoyment from the product but also helps to build good will from the consumer.

References

AEC/FNCCI. (2007). Trade competitiveness of floriculture sub-sector in Nepal. Improving the policy environment for agriculture trade, production and marketing in Nepal. USAID support project. FAN, Kathmandu, Nepal.

Bovy, A.G., G.C. Angenent, H.J.M. Dons & A.C. van Altvorst. (1999). Heterologous expression of the Arabidopsis etr1-1 allele inhibits the senescence of carnation flowers. Molec. Breed. 5:301-308.

FAN. (2008). Study on current postharvest handling practices of cut flowers in different districts of Nepal. Floriculture Association Nepal, Kathmandu Nepal.

Heyes, J.A. & J.W. Johnston. (1998). 1-Methylcyclopropene extends Cymbidium orchid vase-life and prevents damaged pollinia from accelerating senescence. New Zealand J. Crop Hort. Sci. 26:319-324.

Karki, T.B. (2002). Postharvest technology in Nepal. In: Proceedings of SAARC workshop on postharvest technology held on 25-27 September 2002. SAARC Agricultural Technology Information Centre, Bangladesh. Pp. 53-85.

Philosoph, H.S., S. Meir, I. Rosenberger & A.H. Halevy. (1995). Control and regulation of the gravitropic response of cut flowering stems during storage and horizontal transport. Acta Hort. 405:343-350.

Pritchard, M.K., C.S. Hew & H. Wang. (1991). Low-temperature storage effects on sugar content, respiration and quality of anthurium flowers. J. Hort. Sci. 66:209-214.

Pun, U.K. (2003). Commercial cut flower production in Nepal and status of four important cut flowers. J. Inst. Anim.Sci.25:17-21.

Reid, M.S., M. Mokhtari, J.H. Lieth, W.G. van Doorn & R.Y. Evans. (1996). Modeling the postharvest life of cut roses. Acta Hort. 424:137-144.

Reid, M.S., M. Mokhtari, J.H. Lieth, W.G. van Doorn & R.Y. Evans. (1996). Modeling the postharvest life of cut roses. Acta Hort. 424:137-144.

Serek, M., R.B. Jones & M.S. Reid. (1995). Physiology of flower senescence in gladiolus. Acta Hort. 455-459:16-21.

van Meeteren, U. & H. van Gelder. (1999). Effect of time since harvest and handling conditions on rehydration ability of cut chrysanthemum flowers. Postharv. Biol. Technol. 16:169-177.

Wernett, H.C., T.J. Sheehan, G.J. Wilfret, F.J. Marousky, P.M. Lyrene & D.A. Knauft. (1996). Postharvest longevity of cut-flower Gerbera. I. Response to selection for vase-life components. J. Amer. Soc. Hort. Sci. 121:216-221.

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Cut flower production of Gerbera flower

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Gerbera is one among the most important cut flowers grown commercially throughout the world in a wide range of climatic conditions under open conditions or plastic or glass houses. It ranks fifth amongst cut flowers after rose, carnation, chrysanthemum and tulip. The wide range of color flowers and the beautiful blooms with long peduncle make them attractive in floral arrangements. The cut flowers alsohave a reasonable vase life. In landscaping, gerbera are ideal for beds, borders, pot and rock gardens. Gerbera stands in top five commercial cut flowers in Nepal in terms of the area under cultivation. However, there is lack of published data on characteristics of different varieties of gerbera cultivated and its performance in Nepal.

Figure: Gerbera Flower

Classification

Gerbera jamesonii (Transval Daisy) is a tender, stem less, perennial herb which belongs to family Compositae. Flower heads are solitary. Flower possess a wide range of colors including yellow orange, cream, white, pink brick red, scarlet, maroon and various other intermediate shades. Based upon flower heads, they are classified into single, double and semi double cultivars. The double cultivars also have bicolor flowers.

Varieties

Gerbera is very rich in its varietal wealth due to ease in hybridization and survival of seedlings. Thousands of cultivars have been developed which are highly suitable for commercial production of cut flowers under open as well as under green house conditions. Several varieties suitable for pot culture which are characterized by their busy nature, dwarf, bearing large numbers of flowers, may be, somewhat little smaller in size have also been developed. According to flower size also cultivars are grouped into large and mini types. The varieties that are being cultivated in Nepal are Mimosa, Silver Snow, Gyamar, Whitehouse, Brunelo and Dune.

Important varieties of gerbera are as follows:

Name of variety	Color	Type	Flower diameter(cm)	Length
Beauty	Red	Double	10-12cm	Long
Pinkas	Pink	Double	10-12cm	Long

Golden gate	Yellow	Semi Double	10-12cm	Medium
White Sun	White	Single	10-11cm	Long
Cheri	Red	Single	7cm	Long
Lily	Orange	Semi Double	6cm	Medium

Climate

Gerbera needs mild climate for its vegetative growth and flowering. Extreme of cold or hot temperature are not desirable. Therefore, under tropical and subtropical climate, gerbera are gown in open or in unheated plastic houses. In temperate climate, poor light conditions during winter adversely affect the flower quality and hence, artificial lighting is done. Nigh temperature plays an important role in production and quality of flowers. It has been observed that a night temperature of 12°C has been found optimum. During the entire growth and flowering period, high humidity is to be maintained.Ideal temperature for gerbera cultivation is between, 23-26°C.

Soil

For growing gerbera successfully, soil should be adequately porous and well drained. Thus light soils with good organics contents are more suitable than heavy soils. By nature gerbera loves acidic media than alkaline soil. The ideal pH of gerbera growing is 6.0-6.5 but it can be tolerate up to 7.2. Higher pH of soil needs its correction to the desirable limits.

Gerbera also responds well to artificial media if it satisfies the condition of porosity, drainage and pH. Artificial media like coco peat, peaty soil, vermiculite, perlites etc do fine for gerbera growing.

Propagation

Gerbera is propagated through seeds and clumps and micro propagation. Cutting can also be rooted and used as planting material. A faster and easier method of propagating, Gerbera is via division of clumps. The Gerbera produces numerous suckers, which can be split into many individual plants. Care should be taken that seeds should be sown immediately after harvest otherwise they lose viability quickly. Propagation through seeds is used to breed new varieties by breeders.

Figure: Gerbera seedling

Planting

In green houses or in open field conditions, two rows or four rows planting system is generally followed. Hence, accordingly bed width is kept. For large flowering gerbera 8-10 plants/m2 are planted. Close planting is followed for small flower cultivars. The spacing in row ranges from 30-40cms. While planting, care should be taken that crowns should be above soil surface. Planting time varies with place of growing, its climatic conditions and method of growing. The plants should be left in the field undisturbed for two years for flower production.

Manure and fertilization

Gerbera prefers organically rich medium for proper growth and flowering. Therefore, addition of organic matter in medium results in healthy plants and excellent flower production of better quality of flowers. It is advised before addition of fertilizers, leaf blade analysis should be done. Leaf blade analysis has been found better than Petiole as it is better index of nutrient contents. It is observed that good flowering yield was recorded when the leaves contained 2.7-3.13% N, 0.19-o.35% P and 3.06-3.64%K.

Gerbera responds well to the application of NPK which improves the number of leaves, suckers and large number of blooms of big size. Excess of N reduces of flower quality and flower production. Generally, N @ 15g/m^2 was found to be optimum for better flower production of quality blooms. N, P and K in the ratio of 3:1:1produced highest flower yield.

Irrigation

Gerbera is a moisture loving plant and hence, it needs thorough irrigation. However, a wet foot is not desirable so avoid water logging conditions. Water requirement vary with the varying environmental conditions. It has been observed that there was an increase in flower number when the water regime is higher in summer and low in winterwhen it was compared with constant supply water. Hence, watering should be adjusted according to crop requirement. Watering methods like flood irrigation, sprinkler and drip irrigation can be employed.

Weeding and Hoeing

Depending upon season and method of growing, weed types will be appear in gerbera field. Gerbera being perennial crop and remains in the field for 2-3 years and its rosette nature of growth, weeds appear only in the early stages of crop. Two to three manual weeding are required. Efforts should be done to keep the soil loose and friable by regular hoeing and free from weeds.

Flower Regulation

After planting, normally it takes 2-3 months to produce flower by the plants. If plants take longer period for flower production, plants can be sprayed with 100ppm of GA3. This will results in early flowering with longer stem.

Flowering yield

Once the gerbera plants enter into reproductive stage, continuously plants keep on producing flowers. Under green house modern varieties are very heavy yielder and produce about 250-300 flowers/m from 8-10 plants. Under open conditions different varieties show variation in yield depending on types of media, pH, climatic conditions and seasonal changes.

Storage of flowers

Optimum storage temperature for gerbera is 4°C. The flowers can be stored efficiently up to 4 weeks. The cut flowers should be kept in clean water containing preservative and bactericide without delay after harvesting. Removal of stem improves water uptake, addition of chrysal is generally used. Advise easily available and cheaper version too such as sodium hypochlorite or calcium chloride with or without sucrose.

Harvesting and packing of flowers

The harvesting of gerbera flowers should be done at optimum stage. This stage can be identified very easily by observing outer two whirls of disc florets which should be perpendicular to the stem and show pollen grains otherwise flowers will wilt and close at night. After harvesting individual flower head is provided with thin layer of plastic cup which protects it during transport and keeps fresh and do not allow any damage to occur to flower head.

All the flowers are packed in insulated boxes individually for safe transport. Good quality gerbera should have at least 40 cm stem length and should be firm and straight. Stems showing bending are not desirable in the trade. The flower should be uniform in size and should not be less than 7 cm in diameter. Flowers of gerbera are packed in flat boxes having paper shreds and holes for individual flowers.

Disease

1. **Alternaria:** It is a common disease caused by Alterneria spp. and other fungus. It can be controlled by spraying 0.2% Captan, or Benomyl 0.1%.
2. **Root rot and foot rot:** It is soil born disease caused by Pythium irregularae and Rhizoctonia solani. Soil sterilization is through formaline is good solution. Drenching of soil with Cupper oxychloride 0.4% or Dithane M-45(0.2%) gives the good control of disease.
3. **Powdery Mildew:** It is caused by fungus Oidium erysidphoides sp. and produces a white coating on the foliage. Good control can be achieved by spraying Karathane 40EC @0.5% (50ml per liter of water).

Insect and pests

1. **Leaf Miners:** Gerbera is easily attacked by leaf miners. Adults of the insects lay eggs on the leaves. The larvae bore into the leaf and makeirregular shaped tunnels which are easily identified by the presence of yellowish tan coloured marking on the leaves. On maturity, larvae fold leaves on inner surface. It can be controlled by spraying 0.1% 30EC Rogor.
2. **Mites:** It is commonly found in green house. The development of leaves and buds was adversely affected and flowers become malformed and unsalable. These can be controlled by spraying Pentac W.P or Aquaflow on a preventive basis.
3. **Thrips:** These are small insects and suck the sap from leaves and flower stalk. It can be controlled by 125ml of Dimecron85SL or 400 ml of Rogor 30ECin 100L of water.

Special Problems in gerbera flower:

1. **Bent Neck:** Stem bending in Gerbera flowers is induced by a bacterial occlusion in the lower stem end. Bending is due to net water loss in the part of the stem that bends. Insufficient development of a lignified sclerenchyma layer in the stem is another cause of bending.
2. **Stem hollowness:** Hollowness in gerbera is a serious problem that could be observed. High temperature growth and heavy nutrition is the major cause of hollowness. This could be managed by growing crops in lower temperature belts below 30 degree Celsius. This could also be managed by reducing the nutrition for the flower crops during rainy season.

References:

Gajanana, T. M., Singh, K. P., Subrahmanyam, K. V., & Mandhar, S. C. (2003). Economic analysis of gerbera cultivation under protected cultivation. Indian Journal of Horticulture, 60(1), 104-107.

Gautam, K. K., Kumar, S., & Raj, S. K. Diseases affecting gerbera cultivation and their control measures.

Maitra, S., Shankar, T., Sairam, M., & Pine, S. (2020). Evaluation of gerbera (Gerbera jamesonii L.) cultivars for growth, yield and flower quality under protected cultivation. Indian Journal of Natural Sciences, 10(60), 20271-20276.

Mandal, A. K. A., & Datta, S. K. (2002). Introduction of gerbera cultivation in Lucknow agro-climate through tissue culture of young flower head.

Prodhan, S., Sarker, N. I., Islam, M. S., & Ali, M. A. (2017). Status and prospect of gerbera cultivation in Bangladesh. International Journal of Horticulture, 1(1).

Pun & Ichimura, 2016. Stem bending and stem hollowness in Gerbera: A review. Nepalese Horticulture, 12.

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Effect of Light on Production of Chrysanthemum (Chrysanthemum Morifoilum)

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Introduction

Chrysanthemums (Chrysanthemum morifolium) are native to East Asia and North-Eastern Europe. Most species originate from East Asia and the centre of diversity is in China (Kofranek, 1992). Chrysanthemum is a native of china known as 'Autumn Queen' or ' Queen of the East' and is commercially exploited for its attractive coloured flowers (Koley & Sarkar, 2013). In Nepal research on chrysanthemum was done in 2016 B.S after the establishment of the botanical garden. There are greater than 15000 varieties were developed by Japan whereas more than 60,000 varieties were listed by the National Chrysanthemum Society of Britain (FAN, 2015)

Photoperiod and role of photoperiod in chrysanthemum

In chrysanthemum, photoperiod and variety are the major factors for quality flower production. Chrysanthemum is a photosensitive plant with a critical day length of 13 ½ h (Post 1931, Furuta, 1954). It produces flowers by exposing the plants to a short day length than the critical photoperiodic requirement. The flowering could even be controlled when the long night is interrupted by short exposure of light (night break) especially red (R) light. In the open cultivation, the flowering of chrysanthemum is confined only to a limited period from October to December, which cannot meet the growing demand of chrysanthemum flowers among the people and, thus, limits the economic return to the grower. It is, therefore, always desirable to control the short-day effect for controlling the vegetative growth or extend the flowering duration in chrysanthemum for the off-season availability of flowers.

Role of light quality on growth of chrysanthemum

Plants grown under LED lamps were characterized by lesser growth in comparison to those growing on shelves equipped with FL lamps. This probably results from the fact that LED lamps do not emit heat, as opposed to FL lamps. Depending on the light colour, the lowest height was observed in plants exposed to green, white and blue light. In contrast, the tallest plants were produced under the influence of a combination of white + blue light and red + blue light. Fan et al. (2013) showed that the height of tomato plants exposed to red + blue light (50:50) was significantly dependent on light intensity – the lower the light intensity, the higher of plants.

Role of light quality on flowering of chrysanthemum

Plant flowering also depended significantly on a light colour. The largest number of flower head buds occurred on plants grown under blue light, on average by 20 buds more in comparison to plants grown under the red-colour light. Jeong et al. (2012), supplementary lighting of chrysanthemums with blue light induces flowering to a greater extent than a short day does.

FaKuda et al. 2016 demonstrated that longer exposure to blue LED light-induced earlier flowering of petunia. In turn, QingWu, and Runkle (2015) reported that low-intensity blue light has no effect on plant flowering.

Findings of our research in Chanauli, Chitwan, Nepal

Six varieties of Chrysanthemum (Chrysanthemum morifolium) Pink Chandramallika, Arctic Queen White, Zembla Sunny, Kathleen Dark Red, Green Button and Zembla Cream were tested with two photoperiod conditions (light and No-light) to evaluate their performance in terms of growth, flowering and yield parameters in 2018/2019 at Abloom flora farm Chanauli, Chitwan, Nepal. We have managed the light for 1 month by giving light from 11:00 PM to 5:00 AM. We started research in the month of December. It was concluded that giving artificial light through LED light delays the flowering up to 25-30 days so it may be helpful for delaying flowering or off seasonal flowering of chrysanthemum

Data collection

Measurement of flower diameter

Research plot under light condition

Research plot under No light condition

Table 1. Days to first flowering as influenced by photoperiod on different varieties of Chrysanthemum (*Chrysanthemum morifolium*) at Chitwan, Nepal on 2018/19

Treatments	Days to 1st flowering (Days)
Variety	
V1 (Pink Chandramallika)	85.48 [b]
V2 (Arctic Queen White)	82.12 [c]
V3 (Zembla Sunny)	83.56 [bc]
V4 (Kathleen Dark Red)	90.03 [a]
V5 (Green Button)	75.61 [d]
V6 (Zembla Cream)	81.54 [c]
SEm(±)	0.908
$LSD_{0.05}$	2.604
P-value	<.001**
Photoperiod	
L1 (No-Light)	71.76 [b]
L2 (Light)	94.36 [a]
SEm(±)	0.524
$LSD_{0.05}$	1.503
P-value	<.001**

Treatments means followed by the common letter (s) within column are non-significantly different among each other based on DMRT at 5% level of significance. LSD = Least significant difference, SEm = Standard error of mean and CV = Coefficient of variation

Table2. Flower yield as influenced by photoperiod on different varieties of chrysanthemum (*Chrysanthemum morifolium*) Chitwan, Nepal, 2018/19

Treatments	Flower yield (t/ha)
Factor A (Variety)	
V1 (Pink chandramallika)	27.85 [c]
V2 (Arctic queen white)	25.86 [c]
V3 (Zembla sunny)	22.48 [d]
V4 (Kathleen dark red)	32.15 [b]
V5 (Green button)	20.76 [d]
V6 (Zembla cream)	48.3 [a]
SEm(±)	0.739
$LSD_{0.05}$	2.118
P-value	<.001**
Factor B (Photoperiod)	
L1 (No-Light)	29.33[a]
L2 (Light)	29.80[a]

SEm(±)	0.426
$LSD_{0.05}$	1.223
P-value	0.445^{NS}

Treatments means followed by the common letter (s) within column are non-significantly different among each other based on DMRT at 5% level of significance. LSD = Least significant difference, SEm = Standard error of mean and CV = Coefficient of variation

Conclusion

We can conclude that among the varieties under study, Zembla cream, Arctic queen and Green button can successfully be cultivated in Chitwan by changing the day length with the use of artificial light under protected condition which can fulfill the demand of flower in lean season. Giving artificial light through LED light delays the flowering up to 25-30 days so it may be helpful for delaying flowering or off seasonal flowering of chrysanthemum.

References

Desai, M. N. (n.d.). Photoperiodic influences on Master of Science (Agriculture).

Dierck, R., Dhooghe, E., Huylenbroeck, J. Van, Straeten, D. Van Der, & Keyser, E. De. (2017). Scientia Horticulturae Light quality regulates plant architecture in different genotypes of Chrysanthemum morifolium Ramat. Scientia Horticulturae, 218, 177–186. Website: https://doi.org/10.1016/j.scienta.2017.02.016

Furuta T. (1954). Photoperiod and flowering of Chrysanthemum morifolium. ProceeAmer So HortSci, 63, 457-61.

Kozai t., ohYama K., Chun C. 2006. Commercialized closed system with artifcial lighting for plant production. Acta Hort., 711:61-70.

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नोट: बगैचा सम्बन्धी सम्पूर्ण काम गरिन्छ ।

Vertical Gardening

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Introduction

Vertical Gardening is a special kind of urban gardening suitable to small spaces, particularly for decorating the walls and roofs in various styles. This is an alternative method for gardening by expanding the scope of growing plants in a vertical space. Vertical elements in the garden are eco-walls, fences and gates, planter or containers with plants, Plants like trees, shrubs and climbers, hedges, bushes, garden divisions like arches and pergolas. Vertical gardens are particularly suitable for cities, as they allow good use of available vertical surface areas. Vertical green is the result of greening vertical surfaces with plants, either rooted into the ground, in the wall material itself or in modular panels attached to the façade.

Types of Vertical Garden

On the basis of structure and growing methods of plants, there are two types of vertical garden i.e. Green façade and Living wall. Green facades have climbing plants weaving themselves in and around a framework of mesh, wires or cables where as living walls usually contain evergreen herbs or shrubs rather than climbers.

1. Green facade

Green facades are made up of climbing plants either growing directly on a host wall or in specially designed supporting structures such as fences, gate, door or wall or pergolas or hang along the walls. Plants can grow upward or downward. In green façade plants are planted into the ground i.e. either in the side of the building or any other structure in which plant shoot system can climb up easily.

There are also two types of green facades i.e. direct and indirect.

Direct green facades are attached to the wall while indirect green facades incorporate a structure that will support for plants to climb up. Green facades are generally outdoors.

Fig: Green façade of star jasmine (NBG,Nepal)

2. Living /green wall

Living walls offer a remarkable, practical small-space solution to grow vertically. Living walls are purposeful as well as beautiful also.

Living wall system requires more maintenance such as fertilizer and water than green facade systems.

Living walls are either indoors or outdoors and support a wide range of vegetation.

Living wall system (LWS) is constructed from modular panels so; it is also known as modular green wall. Modular panels comprised of polypropylene plastic containers with a growing medium, irrigation systems and vegetation (plants). Perennial plants are more suitable than seasonal plants in this wall system.

Regular maintenance, the right places, and the right plants are needed to sustain a living wall. Pruning and removing dried leaves and replacing dead plants and weeds will keep the wall healthy. Plants need to be close together in order to improve aesthetics. The right plants need to be chosen for the right places because the ones with disease can infect others surrounding it. To have a wall growing all year round, 95 percent of the plants need to be evergreen.

Fig: Panel with hanging pots Fig: Modular green wall of Begonia

Components of Modular green wall (Living wall)

Structure, suitable plants, growing media, irrigation system and plant nutrients are the essential components of living wall.

i. Structure

- Structural wall or metal/GI frame, plastic pots (4"/6") and panel are the structural components for modular green wall.

ii. Suitable Plants

- Perennial, variegated, foliage and succulent plants are the most suitable plants for living wall.

iii. Growing media

Cocopeat, Perlite, vermin compost, leaf molds are the common weightless media combinations are the good growing media for plants used in modular green wall. This media has high water holding capacity, nutrient holding capacity, good porosity and neutral pH(pH 7). Soil is not used since it increases the weight of the green walls.

iv. Irrigation and plant nutrition

Plant nutrition can be supplied by dissolving in water by drip irrigation or hose pipe and container can be put at the bottom of the structure for collecting access water. Water tank with filter and stand also needed for supplying water regularly.

Suitable plants for living wall

Plants which are suitable for indoor and outdoor green wall are given in the table:

Table 1: For Indoor Green walls or shaded areas

S.No.	Habit	Plants
1	Herbaceous perennials	***Syngonium*** *podophyllum* (Arrow head plant), *Epipremnumaureum* (Golden pothos), *Begonia* spp., *Anthurium* spp., *Chlorophytumcomosum* (Spider plant), *Pilea peperomioides* (Chinese money plant), *Tradescantiaspathacea* (Rheo discolor), *T.zebrine* (Wandering Jew) *Spathiphylum wallisii (Peace lily)*,etc.
2	Ferns	*Nephrolepisexaltata* (Boston fern), *Adiantum*sp., etc.

Table 2: For Outdoors/Exterior Green walls

S.No.	Habit	Plants
1	Herbaceous perennials	*Asparagusdensiflorus* (Foxtail asparagus fern) ,*Pilea cadierei* (Watermelon pilea/Aluminium plant), *Tradescantia pallida* (Purple heart plant), etc.
2	Succulents	*Crassula ovata*(Jade plant), *Sedum* spp., *Portuluca* spp., etc.
3	Shrubs	*Cupheahyssopifolia* (Maxican heather), ***Pelargonium zonale*** (Geranium), etc.
4	Grass like foliage forms	*Ophiophogon intermedius* (Lily turf), *Dianella tasmanica* (Tasman flax-lily), *Chlorophytumcomosum* (Spider plant),etc.
5	Ferns	*Nephrolepis cordifolia* (fishbone fern/tuberous sword fern), *Nephrolepisexaltata* (Boston fern), etc.

Caring for green walls/vertical garden

Regular maintenance and caring for green walls/vertical garden are:

iii. Watering in appropriate time
iv. Carefully selection for wind prone areas (Succulent and hardy plants)
v. Removing the dried leaves
vi. Keeping the structure neat and clean
vii. Disposing the water from drainage system
viii. Pruning and replacing the plants if necessary and
ix. Timely application of fertilizers

Advantages in Vertical Gardening

Not only does it look beautiful, but there are lots of advantages of vertical gardening. Vertical gardening is a wonderful way to grow our favorite flowers and plants.

Some of the most exciting vertical gardening benefits are:

1. Growing more plants in less space
2. Can make use of spaces where we otherwise couldn't grow anything like on walls and fences.
3. Adds beauty and privacy
4. Easier to maintain and care
5. Vertical gardens in urban areas as a tool to increase air quality near windows and entrances so it prevents from dust and air pollution
6. Develop healthy green urban environment
7. Promotes biodiversity in the urban areas (cities)
8. Green layer on building causes a shading effect, which also reduces the amount of UV light that will fall on building materials.

Practice of Vertical Gardening in National Botanical Garden, Godawari, Lalitpur, Nepal

National Botanical Garden (NBG), Godawari, Lalitpur, Nepal initiating vertical gardening since its establishment (28th Oct 1962) by using various vertical elements like eco-walls, fences and gates, planter or containers with plants, plants like trees, shrubs and climbers, hedges, bushes, garden divisions like arches and pergolas.
Vertical gardening practice in NBG are:

a. Green Facade:
Pergola, green gates and wall as well as green fences are practice of green facades in NBG.

i. Pergola: Pergola or garden walk or terrace is roofed with an open framework over which climbing plants grow easily and give shade. The framework/structure of the pergola in NBG is made up of from sal (*Shorearobusta*) wood. Its length is 30 m, breadth is 2 m and height is 2.2 m. Plant species used in this pergola is *Wisteria chinensis*.

Pergola

ii. Green gates and wall: Some gates, building wall and boundary wall in NBG are covered by climbers. Plant species used in green gates and wall are *Trachylospermumjasminoides* (Star jasmine), *Jasminum mesnyi* (Jasmine), *Rosabanksiae* (Lady Banks' rose),etc.

Green gate

Green boundary wall

iii. Green fences: In NBG, there are also green fences in GI mesh wire. *Hedera nepalensis* (Himalayan ivy), *Cissampelos pareira* (Velvet leaf), Dolichandra unguis-cati (cat's claw trumpet) and *Rosa* sp. (climbing rose) are the plants used for green fences.

Fig: Green fences of climbing rose

b. Living wall/Modular Green wall:

In NBG, living wall system (Modular green wall) is made by two ways i.e. by fixing directly the panel in building wall and ii. by fixing in prepared structural metal frame. Both structures are outdoors (exterior).

Size of a panel in a modular green wall is 150mm in width x 450 mm in height. Similarly, size of a plastic pot is 6". In a metal frame structure (21 sq ft), 24 panels (3 pots in each panel) i.e. 72 plant pots are fitted. The plants used in this green wall are: Lily turf, Geranium, Jade plant, Foxtail asparagus fern, Spider plant, Maxican heather, Sedum, Polka dot plant, Dracaena, Ivy, etc. Watering has been done regularly by using hose pipes and by drip pipe. Similarly, caring and maintenance work has been done regularly.

There are total 20 modular green wall frames. Out of 20, 10 are kept near the main entrance gate and 10 are in special garden. This modular green wall provides beautiful color to the environment and become one of the attraction center to the visitors also. This was installed in NBG in July 2021.

(i) *(ii)*

Fig: Modular green wall

(i) Panels directly attached to the wall and (ii) Panels attached to the metal frame

Conclusion

To sum up, vertical gardening is suitable in urban area having limited space to grow plants. This provides a taste of rural feeling in urban areas. Different types of plants (either seasonal or perennial but preferably perennial plants) can be selected in vertical gardening.

Green façade and living wall are the types of vertical garden. Vertical gardening increases the healthy green urban environment and provides the aesthetic value too. Selection of right places and right plants, regular maintenance and caring of plants is needed to sustain a living wall. There is also a practice of vertical gardening i.e. green façade and living wall in NBG, Nepal since its establishment.

References

https://agritech.tnau.ac.in

https://en.wikipedia.org/wiki/Green_wall

https://getbusygardening.com/vertical-gardening-benefits

https://intechopen.com

https://simplicable.com/new/green-walls-vs-green-facades

Perini,K., Ottele, M., Hass, E.M and Raiter, R. (2011). The building envelope façade greening and living wall systems. Open Journal of Ecology Vol 1, No.1 (1-8)

Lamichhane, D., Shah, S., Nepali, K.B. (2016). Plants of National Botanical Garden. National Botanical Garden, Godawari, Lalitpur, Nepal

Raina, S (2001).SuttonsSeeds Seasonal Gardening Guide. Hind Pocket Books (P) Ltd., Delhi, India

Tripp, T. (2013). Vertical Gardening Tips for Beginners. Timothy Tripp, USA

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History and Management if Indoor Gardens

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1. Introduction

The art of growing house plants or indoor plants inside a house is known as indoor gardening. In our urbanized society not everyone has a plot of ground on which to grow a garden. However, almost everyone does have a room with a window or an electric light, and almost everyone can obtain a tin can or plastic cartoon and some soil or potting medium, all that are required for growing an indoor or container garden. Indoor gardening is possible in apartments, dormitories, trailer houses, condominiums, offices, school rooms and public buildings where outdoor gardening is not feasible. The indoor landscape can form an integral part of interior design and, naturally, reflect our personal preference and style. Plants with dark or light green, gray, or variegated leaves tend to add a relaxed ambience to a room—philodendrons, variegated ficus or polyscias, podocarpus, or cereus are a few examples. Bold colors, such as red, yellow, and orange provide dramatic effects and statements—furnished by crotons, caladiums, marantas, coleus, or bright-blossomed anthuriums, hibiscus, or orchids.

Though the fashion of growing house plants became universally popular during the past three or four decades, it is not a new art. In the ancient civilization of Egypt, India and Rome it was not unusual to bring pot-grown or tub-grown plants inside a room for the purpose of decoration. In Europe, particularly in Britain, during 17th to 19th centuries it was a common practice for the well-to-do people to grow exotic house plants for interior decoration. But it is only in the 20th century the practice of growing house plants has spread to millions of homes in Europe and America.

2. History of gardening

It is generally accepted that gardening and farming began during the Neolithic period, as long as 8,000 years ago. The propagation of plant which is necessary part of gardening also began during this period. Many of our food crops and some of our popular house plants, as well, are available to use today because they were encouraged and improved by our ancestors of thousands of years ago. Although early gardens were grown for food rather than pleasure, the growing of ornamental plant followed soon after, usually in the homes of the very rich, or in public places. The ancient Egyptians built beautiful walled gardens. The Mesopotamians constructed elaborate terraced gardens. After the biblical Garden of Eden, perhaps the most famous early garden was a Mesopotamian product-the Hanging Gardens of Babylon.

Styles and techniques of gardening were brought to different areas of the world by traders, explorers, conquerors, and others who had cause to leave their native lands. Thus, the Moors introduced advanced Arabic styles and techniques to Spain. The planting of naturalistic gardens, which emulate nature instead of forcing plants into artificial forms, was widely practiced throughout Asia by the Buddhists, who regarded such gardens as sacred places. The Japanese learned the style

from the Buddhists, and refined it through the centuries to the precise and breath taking art it is today.

The history of gardening, after ancient times, becomes more interesting and complex. In Europe, early gardening styles were developed under the Roman Empire and tended to be classical in nature, closely following the other arts. The Crusaders introduced Asian techniques upon returning from their quests. The Spanish and Portuguese, early conquerors of America, brought their Moorish gardening techniques to the New World, where they merged with Inca and Aztec styles.

3. History of indoor gardens

People bringing the green plants growing indoor have a history of more than 2000 years. Ancient Greeks and Romans grew plants in pots in both courtyards and buildings. Indoor gardening made few strides in Europe through the Middle Ages, up until about the time of discovery of the Americas. Some noble and wealthy Europeans delighted in displaying exotic plants brought from the New World, often growing them indoors to protect them.

The construction of artificial climates for plants is first alluded to in 500 BC Greece, in reference to the "Gardens of Adonis" (which were probably early precursors to cold frames). In his work Phaedo (n), Plato remarks: "A grain of seed, or the branch of a tree placed in or introduced to these gardens, acquired in eight days a development which cannot be obtained in as many months in the open air."

It was in 50 AD that the first window glass was manufactured. This paved the way for the development of the greenhouse, glasshouse, and glazed windows for private residences during the next eight centuries. The enormous expense of manufacture made glass cost-prohibitive for most people, so glazed windows remained a luxury for the abodes of royalty, the homes of the landed gentry and wealthy merchants, and church buildings.

The general public, however, did not take up the cultivation of indoor plants until relatively recently. Cacti, palms, and ferns became popular at various times during the nineteenth century in North America as well as in Great Britain. It was not until after World War II, however, that indoor plants began to assume more importance throughout the wider American society. At this time, there began a trend to family homes with large windows, airy rooms, patios, and terraces. American architecture softened the lines between indoor and outdoor plants. Plant health was enhanced not only by brighter rooms, but also by the increased use of room and furnace humidifiers. The increased use of fluorescent light also made the indoors a better environment for plants.

4. Some Historical Indoor Gardens

4.1 Armoire Garden

The idea of creating a miniature landscape in a piece of furniture dates back to Victorian times, as is witnessed by archival illustrations from the mid- to late 1800s, depicting lushly planted miniature oasis. These idealized visions of Victorian gardeners can actually become reality today with the right grow lamps to provide the necessary light and electric fans to keep the air circulating in a small enclosed space.

When converting an armoire into a plant cabinet, it should be protected against humidity. Its interior walls should be painted with a light-reflecting, waterproof paint, or better if lined the walls with galvanized sheet-metal panels. Make a two-inch sheet-metal pan for the bottom of the cabinet

and interior shelves to catch any water that drips from pots. Each pan should be filled with stones to keep the pots above the water level. The pans will help keep the plants in an environment of raised humidity.

Fluorescent lamps are mounted in the top of the cabinet and underneath any interior shelves, alternating between warm and cool white light bulbs or tubes in each section. If the doors have glass panels, they can be shut to further increase the humidity. A small fan should be installed above each group of plants to move the air and hinder the growth of fungus.

4.2 Window Garden

The usual place for houseplants is the windowsill. Often it is too small for the number of plants collected by the true plantoholic and does not provide enough light for the plants to be grown.

Taking an idea from a Victorian illustration, the inventive gardener can increase the window space by building a glass-enclosed "window box" that juts out into the room. Build a wooden structural frame and fit it with ¼-inch thick glass panels on the top, one side, and the front. Fit the second side with a glazed door that allows access to the plants and can be opened to regulate heat and humidity. Line the bottom and the sides of the box with galvanized sheet-metal and fill the bottom pan with a one-inch layer of stones. Plants can be set on the base or mounted on brackets attached to the sides of the window frame. Cast iron gas-lamp brackets are an attractive option; they can often be found in antique stores.

If the window receives full sun, choose plants that are sun-tolerant, or control the intensity of the light that reaches sensitive plants. Either mount a fabric sunscreen or position pots of tender plants in the shade of larger sun-tolerant plants.

If the window doesn't get enough sun, you'll need to install additional lighting. Your options are fluorescent lamps in industrial fixtures, such as those sold for home workshops, or grow bulbs, which may be screwed into a hanging fixture.

4.3 Closet Garden

The Victorians created garden rooms in their homes but were limited in their plant choices by the amount of available natural light. Some old illustrations seem to be overly optimistic in terms of the plantings they suggest, but with the addition of artificial lights, they are easily implemented today,

even if there is no natural light available in the space.

How about transforming a walk-in closet into a garden? The first step is to replace the solid closet doors with glass French doors. If the ceiling is high, consider a raised platform to separate the garden from the rest of the room. The space below the platform is an excellent place to install a sunken water feature, and it allows you to hide the plant containers below the "garden floor."

This closet design has an Asian theme that is further explored in the choice of containers. A bamboo grid is attached to the back wall and an Asian wall hanging is displayed to expand the theme. A Victorian design is shown above.

If the ceiling is too low to allow for a raised platform, or if it is impractical for the site, set the pond and the plants in their trays onto the floor and camouflage with artificial or real stones and smaller plants. Don't forget to check the weight limit of your floor and stay within the load limit.

Make sure to line any sunken areas and/or the surface of the floor with a waterproof rubber pool liner to catch any escaped water that could cause damage to the building structure. The sunken pool can be a fiberglass pond from a garden center mounted one inch above the floor surface. Make sure it is installed perfectly level, so it does not leak into the liner below.

Set the sunken pots on stone-filled trays on the bottom liner. Be extremely careful when watering to prevent water from collecting under the plants. Remove the plants from their holes periodically and check for water accumulation. If you find water, soak it up with a large sponge.

As a finishing touch, you may want to hide the pot edges and the pool liner with pebbles. Light the garden with high intensity discharge (HID) lamps and include a fan in the design to circulate the air.

4.4 Garden Room

The most ambitious and rewarding project is to create a whole room that is dedicated to gardening. If the space has windows, they can provide for air circulation and some minimal light. You will have to install additional lighting though, as most plants are going to be too far away from the windows. Work with a combination of timer-controlled HID and incandescent grow lights to give the plants the amount of light they need. Fans help circulate the air.

The walls should be painted a light-reflecting color and may be decorated with architectural elements for an outdoor ambience. The floor should have a durable and waterproof cover to avoid damage from leaking pots and dripping hoses. A relatively inexpensive way to do this is to lay down a heavy-duty pool liner and cover it with loose-laid bricks or tiles, creating an indoor terrace. (Remember to check the weight load for your structure and do not exceed the limit, allowing for floor covering and plants.) Japanese shoji sliding panels, for example, create the feeling of an exterior window wall and separate the room from the interior space.

Group plants by size, color, texture, and form, bearing light and water requirements in mind. Place the plants in decorative pots. Custom-built wooden planters with adjustable shelving allow

The most ambitious and rewarding project: creating a whole room dedicated to gardening. The design above achieves an outdoor ambience for an indoor terrace. Above, a 19th-century example of a garden room.

you to raise plants to the level you desire. In that way shorter plants can gain height and become tall enough for you to sit under. Use smaller plants to hide large containers to give the appearance of a planted landscape.

For easier maintenance, grow smaller plants in individual pots that can be moved to the bathtub or kitchen sink for a good showering. Large plants have to be cleaned in place. Close access to water is recommended. Alternatively, you may want to use a small-gauge hose, available in custom sizes up to 75 feet, that can be attached to a faucet by a removable clip-on feature.

If you are planning to use the room at night, consider installing some low-wattage light fixtures, such as outdoor garden lights, to create a pleasant atmosphere, as plant lights seem very strong and harsh at night. A focal point—for example a sculptural form or even a splashing wall fountain—can finish the outdoor feel of the room. Small flowering plants and cut flowers complete the illusion of a country garden room.

5. Selection of Indoor Plant

One point should be taken account while choosing the plants for indoors. Even though a room may appear to be well lit to our eyes, the available light may not be enough for proper growth and development of the plant. Hence, the majority of the house plants should have the capacity to tolerate shade of varying intensity. One more quality important to any house plant is that it should remain evergreen to retain its permanent decorative character.

The plants to be selected should always be healthy. The undersides of the foliage and the axils of leaves should be checked for signs of insects or disease. Select plants that look sturdy, clean, and well-potted. Choose plants with healthy foliage. Avoid plants with yellow or chlorotic leaves, brown leaf margins, wilted foliage, spots or blotches, or spindly growth.

Before procuring a house plant one must consider many points. The first consideration is that under what conditions a plant has to grow, i.e. whether there is sufficient light or the humidity is adequate or the temperature is favourable. Secondly, due thought must be given as for what purpose the plant is needed. For example, if its for decoration of a small table, the plant should be compact and bushy in nature. Another important point is the experience of the grower in handling a house plant. A beginner must try his hand with hardy plants only.

6. Acclimatization

Research conducted in Florida in the late 1970s revealed an interesting phenomenon. Tropical plants grown in full sun have leaves (so-called sun leaves) which are structurally different from the leaves of plants grown in shade (shade leaves). Sun leaves have fewer chloroplasts, and thus less chlorophyll. Their chloroplasts are located deep inside the leaves and the leaves are thick, small, and large in number. Shade leaves have greater numbers of chloroplasts and thus more chlorophyll, are thin, large, and few. When plants are grown in strong light, they develop sun leaves which are photo synthetically inefficient. If these same plants are placed in low light, they must either change existing sun leaves into shade leaves or drop their sun leaves and grow a new set of shade leaves which are photo synthetically more efficient. To reduce the shock which occurs when a plant with sun leaves is placed in shade, gradually reduce the light levels it is exposed to. This process is called acclimatization. The gardener should acclimatize plants when placing them outdoors in summer by gradually increasing light intensities and reverse the process again before plants are brought indoors in the fall. For newly purchased plants grown in high-light conditions, acclimatize them by initially locating them in a high-light (southern exposure) area of your home and gradually moving them to their permanent, darker location over a period of 4 to 8 weeks.

7. Repotting

Actively growing indoor plants need repotting from time to time. How often a plant needs to be repotted depends upon how fast it is growing. In general, foliage plants require repotting when their roots have filled the pot and are growing out the bottom holes.

8. Containers

When repotting becomes necessary, it should be done without delay. The pot selected for repotting should be no more than 2 inches larger in diameter than the pot the plant is currently growing in; should have at least one drainage hole; and must be clean. Wash soluble salts from clay pots with water, soap, and a scrub brush, and wash all pots in a solution of 1 part liquid bleach to 9 parts water.

There are many types of containers from which to choose. A good container should be large enough to provide room for the medium and roots, have sufficient room above the medium line for proper watering, provide bottom or side drainage, and be attractive without competing with the plant it holds. Containers may be made from clay or ceramics, plastic, fiberglass, wood, aluminum, copper, brass, and other materials.

8.1 Clay and ceramic containers

Unglazed porous and glazed clay pots with drainage holes are widely used. Unglazed clay pots absorb and lose moisture through their walls. Although easily broken, unglazed clay pots provide excellent aeration for plant roots and are considered by some to be the ideal type of container for a plant.

Ceramic pots are usually glazed on the outside, and sometimes on the inside. Frequently they are designed without drainage holes, which necessitates careful watering practices to avoid soil saturation and root rot. Ceramic containers are often used as an outer shell covering a plain clay or plastic pot.

8.2 Plastic and fiberglass containers

Plastic and fiberglass containers are usually quite light and easy to handle. They have become popular in recent years because they are relatively inexpensive and often quite attractive in shape and color. Plastic pots are easy to clean and sterilize for reuse, and, because they are not porous, they need less frequent watering.

9. Potting Media

The potting soil, or medium in which a plant grows, must be of good quality. It should be porous for root aeration and drainage, but also capable of water and nutrient retention. Most commercially prepared mixes are termed artificial, which means they contain no soil. High-quality artificial mixes sometimes contain slow-release fertilizers, which take care of a plant's nutritional requirements for several months. A number of excellent commercial mixes are available for houseplant culture.

9.1 Preparing artificial mixes.

Artificial mixtures can be prepared with a minimum of difficulty. Most mixes contain a combination of organic matter, such as sphagnum peat moss or ground pine bark, and inorganic material, like washed sand, vermiculite, or perlite. Materials commonly used for indoor plants are mixtures consisting of sphagnum peat moss, vermiculite and perlite.

Peat moss

Peat is a broadly applied term referring to the partially or entirely decomposed remains of plants. Peat moss is the peat obtained from peat bogs, usually containing the remains of the genus Sphagnum. Most sphagnum peat moss is acid in reaction, with a pH ranging from 4.0 to 5.0. It usually has a very low fertility level. The chief benefit of peat moss is as a soil conditioner. Since it can hold up to 15 times its dry weight in water. It also can be combined with heavier soils to form aggregates for improved soil structure. Peat moss is often used in place of leaf mould or compost in potting mixtures, since all share certain characteristics.

Vermiculite

Vermiculite is a sterile, lightweight, mica product. When mica is heated to approximately 1800°F, its plate like structure expands. Vermiculite will hold large quantities of air, water, and nutrients needed for plant growth. Its pH is usually in the 6.5 to 7.2 range. Vermiculite is available in four particle sizes. For horticultural mixes, sizes 2 or 3 are generally used. If possible, the larger-sized particles should be used, since they give much better soil aeration.

Perlite

It is a sterile material produced by heating volcanic rock to approximately 1800°F. The result is a very lightweight, porous material that is white in color. Its principal value in medium mixtures is aeration. It does not hold water and nutrients as well as vermiculite. The pH is usually between 7.0 and 7.5. Perlite can cause fluoride burn on some foliage plants, usually on the tips of the leaves. Artificial mixtures are usually very low in trace or minor elements; therefore, it is important to use a fertilizer that contains these trace elements.

9.2 Other potting ingredients

Charcoal

Every indoor gardener should maintain a small supply of charcoal, which is often used to help provide drainage, sweeten soils, and absorb impurities. It is a good idea to add a little charcoal with the gravel used to line pots. A layer of charcoal added to the terrarium, just above the gravel layer and below the potting mixture, can extend the life of potting mixture.

Gravel

The gravel is used to line the bottom of pots and should be clean, free from salt and chemical contaminants. It should be 6 to 13 mm in size, and irregular in shape so that it offers adequate space for water drainage. Broken clay pots and bricks can also be used as a substitute for gravel.

Lime

Limestone (calcium carbonate) is a good source of calcium, a necessary element in plant nutrition. It is used in potting mixtures not for this nutrient, however, but as a neutralizer, bringing acid mixtures toward the neutral range. Lime also helps to improve soil structure and it releases some of the phosphorus and potash from insoluble compounds, making them available for the plants. Ground limestone or dolomitic limestone should be used as a source of lime in potting mixtures. Quicklime, slaked lime or hydrated lime should not be used because they can kill soil life and cause root burn.

Garden soil

Good garden loam may be used as a primary ingredient of all potting mixtures. Not only does it contain particles of different sizes to form good structure and texture, but it contains living substances (fungi and bacteria) capable of breaking down raw organic matter and thus providing a steady supply of nutrients for house plants.

The usual constituent of a potting compost are a good garden soil, preferably loam, which generally forms the greater part of the compost, leaf-mould or peat-moss, coarse sand, old mortar rubble, well-rotted manure, and cinder ash. The proportion of the constituent will vary according to the type of the plant. For plants which need rich potting compost, the amount of soil in the compost is reduced and other constituent such as leaf mould and manure are increased. Some greenhouse plants such as Anthurium, ferns, Alocasia, and Dieffenbachia need rich compost. In clayey soils, the proportion of sand in the compost will be more than in the alluvial soils.

9.3 Potting mixture recipes

Potting mixture recipe depends upon soil conditions required for different plants. It can be as simpler as a common garden loam to complex mixture containing a number of ingredients. The following is a simple all purpose mixture used by many successful gardeners.

2 parts garden loam
1 part leaf mould or compost or peat moss
1 part sharp sand or perlite
Add ½ cup (118 ml) of bone meal per peck (8.8 lit) of above mix.

Many others prefer this basic recipe:

1 part garden loam
1 part sand
1 part peat moss or leaf mold
Add bone meal as for above.

For humus-loving plants

1 part garden loam
2 parts compost or leaf mold
1 part sharp sand or perlite
Add ½ cup of bone meal per peck of above mix.

For desert-living cacti and other succulents (xerophytes):

1 part garden loam
1 part compost or leaf mold
1 part sharp sand or perlite
½ part crushed clay pot, brick or small pebbles (approximately pea size)
Add 1 cup bone meal and 1 cup ground limestone per bushel (35.2 lit) of above mix.

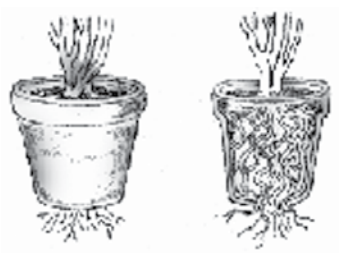
For epiphytes

1 part garden loam
2 parts leaf mold, peat moss, osmunda fiber, or shredded fir bark
1 part sharp sand or perlite
½ part crushed clay plot, brick or crushed gravel (approximately pea size)
Add 1 cup bone meal and 1 cup ground limestone per bushel (35.2 lit) of above mix.

If the garden soil is sandy, the amount of sand added to the recipe should be reduced. Heavy soils will require somewhat more sand, although it is not wise to use heavy clay in the potting mixture, since it is difficult to mix with other materials.

10. The Process of Repotting

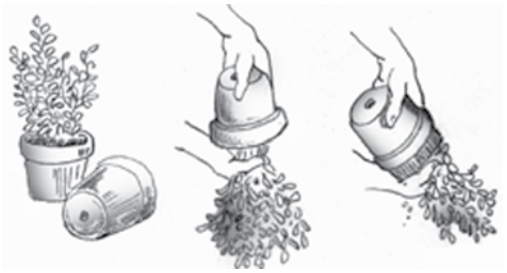
Most plants requiring repotting can be easily removed from their container if it is held upside-down while knocking the lip of the container sharply on the edge of a table. Hold your hand over the medium, straddling the plant between the fore and middle fingers.



If the plant has become root-bound it will be necessary to cut and unwind any roots that circle the plant, otherwise the roots will never develop normally. If the old medium surface has accumulated salts, the top layer should be removed.

Potting media should be moistened before repotting begins. To repot, put some medium in the bottom of the new pot, which should

be two to four inches larger in diameter than the old pot. Set the root ball in the middle of the new medium. Fill medium around the sides between the root ball and pot. Do not add medium above the original level on the root ball, unless the roots are exposed, or it has been necessary to remove some of the surface medium. Gently press or firm the medium with your fingers. After watering and settling, the medium level should be sufficiently below the level of the pot to leave one-half to an inch or more headroom - depending on the size of the container. Headroom is the space between the medium level and the top of the pot that allows for watering a plant. If not enough headroom, water may spill over the top of the rim when watering; if too much headroom, the volume of medium has not been optimized and over watering may occur.



10.1 Care and Grooming

It is important to keep plants clean and neat through regular grooming. This not only improves the appearance of plants but reduces the incidence of insects and disease problems. Remove all spent flowers, dying leaves, and dead branches. Keep leaves dust-free by washing plants with warm water and mild true soap - avoid detergent which can cause damage to leaves and buds. Cover pot to prevent soap from entering the soil. If tips of leaves become brown and dry, trim them off neatly with sharp scissors.

Humidity can be increased by placing plants on trays lined with pebbles and filled with water to within one half inch of the base of the pot. If you heat with wood, keep a pot of water on the stove. Training includes a number of minor care activities that distinguish the beginner from the more experienced indoor plant grower. For example, pinching is the removal of 1 inch or less of the stem tip and leaf growth, just above a node, to stimulate new growth below the tip and encourage lateral branching. Pinching can be a one-time or continuous activity, depending on the need and the desires of the plant owner. Frequent pinching will keep a plant compact, but well filled-out.

Pruning includes removal of plant material other than terminal shoot tips. Sometimes an entire branch or section of a plant should be removed for the sake of appearance. Disbudding is the removal of certain flower buds either to obtain larger blooms from a few choice buds or to prevent flowering of a very young plant (or recently rooted cutting) that should not bear the physical drain of flowering early.

Trellising is an attractive way to display vining plants such as Ivies and Hoya, as well as Philodendron and Syngonium.

10.2 Watering and fertilizing

Adding fertilizer to a dry root ball burns the roots, damaging or killing the plant, so water dry houseplants before fertilizing and NEVER fertilize wilted plants. It's better to water plants a couple of hours before fertilizing. Houseplants can be fertilized beginning in March, and more frequently with the onset of spring and new growth. Keep winter fertilization of most houseplants to a minimum as plant growth is at its slowest and the added nutrients stress the plant.

Most plants should not be watered until the soil feels dry. Water thoroughly, let the water soak in, then water again until water drains into the saucer. Empty the saucer within an hour. Water again when the soil is dry to the touch.

10.3 Putting indoor plants outside

Houseplants should be taken outdoors for some period during favourable weather conditions. This is generally done in spring. Houseplants that have been outside should be allowed to make a fairly slow transition to indoor conditions. Quick changes in environment can result in yellowed foliage and leaf drop. Initially the plants may be introduced indoors only for a couple of hours, gradually increasing the time. The plants may finally be shifted to indoors about a fortnight or after month. Plants should be checked for insect pests before moving the plants indoors; it is easier to get rid of pests while plants are still outside. Rinse the plants' leaves, and soak pots in water for 15 to 20 minutes to drown most soil-dwelling pests.

11. Environmental factors for growth of Indoor Plants

Most of the food crops (cereals, vegetables, fruits) do not grow well in the interior of homes. The reasons for this can be summarized (1) too little light (2) low humidity (3) limited space to grow (4) restricted rooting area. (5) low circulation of fresh air. But plants designated as house plants are able to withstand these adverse conditions to some extent. Moreover, it is often possible to choose plants adapted to special home conditions, for example, Cacti for an extremely dry atmosphere or ferns for a cool moist corner. Ever so, growth of any plant indoors is likely to be limited by many conditions. The key to success in growing indoor plants depends on various factors which are discussed below.

11.1 Light

Light is an important factor in the cultivation of house plants. The demand for light, however, varies from plant to plant. While Hedera helix, climbing house plants thrives well under a relatively dark corner, plants such as Sansevieria trifasciata requires a good amount of light. Though as a general rule, no house plants should be exposed to direct sunlight, there are few exceptions such as Sansevieria trifasciata, most of the cacti and a few trees grown as house plants such as Grevillea robusta which do not mind exposure to direct sun provided it is not very scorching. Modern houses with broad glass windows admit sufficient light inside the rooms. But there may be some corners which need decoration with live plants but the place is not sufficiently lit for this purpose. Such dim corners need supplementary artificial illumination. The best artificial source is the florescent lighting. It is difficult to stipulate the optimum light conditions for indoor plants as this depends on a number of factors including the varietal difference. The plants should not be exposed for more than 16 hours per day under two 40 watt 120 cm fluorescent tubes, placed not more than 90 cm from the plants. It is also difficult to specify at what distance the plant should be kept from the

tubes. A general recommendation is that 15-20 watts of fluorescent light is needed for each 30 square centimetres of plant area. A 60 cm long tube produces 20 watts of light, while a 120 cm tube emits 40 watts of light. A 20 watt tube will provide sufficient light for a 75 cm by 25 cm wide area.

11.2 Temperature

We may be surprised to learn that temperatures inside homes are too high for optimum growth of plants. The actual outdoor temperature may be higher than that of indoors but there is a difference between outdoor and indoor conditions. Temperatures are out-of-doors usually in conjunction with high light intensity, and the combination of high light and high temperature permits a high rate of photosynthesis. An indoor, high temperatures frequently occurs with low light intensity, and plants suffers because all of their activities except photosynthesis are speeded up. The ideal range of temperature for house plants should be around 15°C-21°C during daytime and the night temperature never falling below 20°C. Most of the hardy house plants, however, can withstand much higher temperature than this provided the humidity is good. The role of temperature is more important in the temperate regions than in the tropics. Heating system in the rooms of western houses provide the near-ideal conditions for the culture of house plants. In houses with central heating plants may dry out, so it is advisable to resort to misting of the foliage with water during daytime.

11.3 Humidity

Humidity inside homes is generally lower than outside environment. In case of air-conditioned rooms, humidity is further lower. Inside a house, it is not possible to maintain high humid conditions because it will be rather uncomfortable for the humans. As a result, plants requiring high humid conditions cannot be grown properly indoors. However, humidity can be raised to some extent in the vicinity of the plants. One of the methods is to put the potted plant in another empty container which is larger than this and to fill the surrounding empty space with peat or sphagnum moss which is kept moist by consistent watering. The other method is to stand the pot on the shallow waterproof trays containing small size gravel or pebbles. Water is poured over the pebbles until it is just covered, and this level is maintained constantly. The evaporating water will maintain humidity.

11.4 Moisture

The water requirement of house plants varies from one kind to another. Epiphytic plants need more water than a cacti or some succulents. Plants kept in a comparatively cooler atmosphere need less water than when kept in a warmer house. A plant growing in a porous clay pot will need more water compared to one growing in a plastic or glazed container. Similarly, a smaller pot will need more frequent watering. A plant needs more water during its growing period and the amount is reduced appreciably during the winter which is a resting period for most plants. Whether or not a pot need water will be indicated by the dry surface of the soil. Other method is to strike the pot with a wooden hammer gently and if the resulting sound is of a ringing tone the plant needs watering, while a dull sound indicates that the soil is moist. It is always better to water in good amounts at reasonable intervals, which may vary from 3 to 10 days depending upon the climate and species, rather than small daily doses. It is safe practice to under-water rather than over-watering. Rain water, if available, should be preferred to tap-water which contains lime.

11.5 Air circulation

Most house plants are sensitive to all sorts of atmospheric pollutants. The air in the room may become polluted due to fumes, high concentration of carbon dioxide and other gases that escape in lighting stoves and other appliances. In industrial and congested urban areas pollution that is damaging to outdoor plants can seep indoors and damage houseplants. Windows can be opened occasionally to let in fresh air, or the plants can be put outdoor in mild days.

12. Insect and disease management for Indoor Plants

No advice about the care for houseplants is complete without mention of houseplant pests and diseases. Indoor gardening can be plagued with pests and diseases just as voracious as their outdoor counterparts. The insects are insect like pests that are most troublesome on houseplants are aphids, mealybugs, scale, spider mites, thrips and whiteflies. The diseases most likely to infect houseplants are mildews, damping-off, nematodes, and viruses.

The best control of insect and disease pest of houseplants is to prevent infestation. Cut flowers and new plants should be examined to determine that they are free of pests before they are brought into the home. Using sterilized soil for potting will prevent the introduction of such soil-borne problems as root rot, damping-off, nematodes, slugs, centipedes, and earthworms.

Since our plants are in living space, often in close quarters with pets and children, it's best to avoid using toxic chemicals to get rid of the problem. If a plant is badly affected, it's often wiser to simply get rid of the plant. At the very least, the infected plants should be isolated to avoid infecting other nearby plants.

Pests and diseases tend to invade when conditions are not ideal. For example, the Red Spider Mite thrives on almost any plant when the air is warm and dry. Fungus gnats love it when plants are overwatered, and parts of the plant may rot.

Red Spider Mites are very common. The leaves will look paler or darker than normal, and they produce white webbing between the leaves and stems, and if examined closely, we can see them crawling around. Once these creatures take hold, the only way to get rid of them may be to get rid of the plant.

Aphids are most common on flowering plants. They are usually green and can be found underneath leaves, especially the newer ones, and leave behind sticky sap. Most commercial houseplant pest sprays can control them. Scale insects are small brown discs on the undersides of leaves. Mealybugs look like little pieces of white fluff. Sprays will not affect either of them, but you can take them off with a cotton swab or damp cloth. A few aphids, mealybugs, thrips, spider mites, or scales can also be washed from infected plants by spraying with a light spray of lukewarm water or by washing the plants with a soft cloth and soapy water made with two teaspoons of mild detergent in a gallon of water (10 ml in 4 litres). The washing may need to be repeated several times as eggs hatch or nymphs mature. It is also possible to handpick and kill larger insects if only a few plants are infested. A swab dipped in alcohol can be used to eradicate a minor infestation of mealybug or aphids.

Whiteflies are tiny insects that look like moths. They fly away when the plant is shaken. Like Aphids, whitefly larvae hide under leaves and suck their sap, leaving a sticky residue behind. They are very contagious and hard to control. Isolate the plant immediately and spray every three days with a houseplant pest spray containing permethrin.

Diseases are not very common among houseplants. Many conditions mistaken for diseases are caused by improper plant care, such as rotting crowns and stems from over watering. Mold, fungi, and mildew do occur, but they can usually be prevented by maintaining the right conditions. If you see fluffy mold, brown spots, or powdery deposits on the leaves, remove the affected leaves and spray the plant with fungicide.

When more than a few plants have insects or diseases or where infestations are severe, chemical control will be necessary. Only formulations prepared for houseplants should be used. These will contain chemicals such as malathion, neem oil, pyrethrins, all of which are relatively non-toxic to people and animals.

The pests and diseases that may occur are common, but usually not hard to prevent with proper care. The best way to keep these invaders at bay is to give your plants the environment they need and examine them frequently.

REFERENCES:

Bienz, D.R. 1980. The Why and How of Home Horticulture. W.H. Freeman and Company.

Halpin A. M. 1980. Rodale's Encyclopedia of Indoor Gardening. Rodale Press. Pennsylvania. USA

Purchell, M. 1997 Indoor insect and disease problem. Bachman's Floral Home and Garden [online] :Available http://www.bachmans.com/retail/tipsheets/indoor_plants/IndoorInsectandDiseaseProb.cfm[Retrieved December 10 2003]

Randhawa, G.S. 1986. Floriculture in India. Allied Publishers Private Limited. New Delhi.

Relf D. and Ball E. 2001. Indoor plant culture [online]Available: http://www. ext. vt.edu/pubs/envirohort/426-100/426-100.html [Retrieved October 25 2003]

Shank B. 2003. Four indoor garden designs [online]Available:http://www.bbg.org/gar2/topics/indoor/handbooks/landscaping/designs.html [Retrieved October 25 2003]

नेपाली गुराँसहरू

कुवेर जङ्ग मल्ल
(पूर्व बैज्ञानिक अधिकृत)

परिचय

वनस्पतिका विभिन्न प्रजातिहरु मध्ये गुराँस प्रजाति यसका आकर्षक फूलहरुको लागि प्रसिद्ध छ । त्यसैले गुराँसले वनस्पति जगतमा विशेष महत्व ओगटेको छ । यसका धेरै प्रजातिहरुका फूलहरु सुगन्धित हुँदैनन् तापनि फूलहरुले बोटलाई यसरी ढाकेका हुन्छन कि वनै आकर्षक र सुन्दरमय देखिन्छ, जसले मानिसहरुको मन नलोभ्याई छाडदैन । गुराँसका प्रजातिहरुमा फूलहरुको रंगमा पनि विविधता पाइन्छ जस्तै राता, सेता, गुलाबी, पहेंला, नीला, सुन्तला आदि । गुराँसलाई अंग्रेजीमा Rhododendron भनिन्छ । Rhododendron नाम ग्रीक भाषाको Rhodo र Dendron शब्दबाट आएको हो । ग्रीक भाषामा Rhodo को अर्थ Rose (गुलाफ) र Dendron को अर्थ Tree (रुख) हुन्छ । तसर्थ यसका फूलहरु गुलाफ जस्तै आकर्षक हुने भएकाले Rhododendron भनिएको हुनुपर्छ । विश्व भरी गुराँसका करीव १०५० प्रजातिहरु पहिचान भएका छन् । यस प्रजातिका विरुवाहरु सानोमा ५ सेन्टीमीटर देखि लिएर ठूलोमा २५ मीटरसम्म अग्ला हुन्छन् । चीनमा गुराँसका करीव ६०० प्रजाति छन र ती मध्ये ४०० प्रजाति त्यहाँका रैथाने प्रजाति मध्ये पर्दछन् । त्यस्तै गरी नेपालमा गुराँसका ३१ प्रजाति छन् र जसमध्ये दुइवटा प्रजाति नेपालका रैथाने प्रजाति मध्ये पर्दछन् । विशेषगरी गुराँस प्रजाति अनुसार पौष/माघ देखि लिएर भाद्र/आश्विनसम्म फुल्ने गर्दछन् । गुराँस प्रजाति अनुसार समुद्र सतहबाट करीब १००० मीटर देखि लिएर करीव ६००० मीटर सम्मको उचाइसम्म पाइन्छन् ।

हुनत *Rhododendron hirsutum* बैज्ञानिक नाम गरेको गुराँसको प्रजाति बारे Charles de l'Écluse (Clusius) ले १६ औं शताब्दिमा बर्णन गरेको पाइन्छ तापनि पछि इश्वी सम्बत १७५३ मा Linnaeus द्वारा लिखित Species Plantarum नाम गरेको पुस्तकमा यसको बारेमा प्रष्ट्याइएको पाइन्छ । त्यही पुस्तकमा *Rhododendron hirsutum* सहित गुराँसका अन्य ४ प्रजातिको बर्णन गरिएको पाइन्छ । सम्भवतः यही नै विश्वका गुराँस प्रजातिहरुको पहिचानको पहिलो शुरुवात हुनुपर्दछ ।

नेपालका गुराँसहरु

नेपालमा गुराँसका प्रजातिहरुको बारेमा उल्लेख गरिएको पहिलो पुस्तक बनस्पति बिज्ञ डेविड डन (David Don) द्वारा इश्वी सम्बत १८२५ मा प्रकाशित Prodomus Florae Nepalensis हो । यस पुस्तकमा गुराँसका चार प्रजातिहरु (*Rhododendron anthopogon, R. arboreum, R. campanulatum,* र *R. setosum*) को बारेमा बर्णन गरिएको पाइन्छ । तत्पश्चात विभिन्न विदेशी तथा नेपाली बनस्पतिविदहरुको अथक सर्भेक्षण, अध्ययन र अन्वेषण प्रयत्न पछि हाल नेपालमा ३१ प्रजातिका गुराँसहरु भएको तथ्य अगाडि आएको छ । यीमध्ये दुई प्रजातिहरु *Rhododendron cowanianum*, र *R. lowndesii* रैथाने छन् अर्थात नेपाल बाहेक अन्य देशमा पाइँदैनन् ।

नेपालको भौगोलिक अवस्था अनुसार गुराँसका प्रजातिहरु लगभग १००० मीटर देखि लिएर ५५०० मीटरको उचाइसम्म पाइन्छन् । ती मध्ये सबभन्दा कम उचाइमा पाइने गुराँस लाली गुराँस (*Rhododendron arboreum*) हो भने सबैभन्दा उचाइमा पाइने गुराँस *Rhododendron nivale* हो ।

गुराँसका प्रजातिहरु पूर्वी नेपालमा बढी छन् भने पश्चिम नेपालमा जम्मा ५ प्रजातिहरु मात्र पाइन्छन् । पश्चिम नेपालमा पाइने प्रजातिहरुमा *Rhododendron anthopogon, R. arboreum, R. barbatum, R. campanulatum,* र *R. lepidotum* हुन । पूर्वी नेपालको तीनजुरे, मिल्के र जलजले क्षेत्र गुराँसका लागि प्रसिद्ध छ । यहाँ गुराँसका ३१ प्रजातिहरु मध्ये २९ प्रजातिहरु पाइन्छन् । नेपालमा पाइने गुराँसका प्रजातिहरुको नाम निम्न प्रकार छ ।

नेपालमा पाइने गुराँसका प्रजातिहरु

क्र.सं.	बैज्ञानिक नाम	नेपाली नाम	स्वरुप
१	*Rhododendron anthopogon*	सुनपाती	झाडी
२	*Rhododendron arboreum*	लालीगुराँस	रुख
३	*Rhododendron barbatum*	कालो चिमाल	रुख
४	*Rhododendron camelliflorum*	चिया फूले गुराँस	झाडी
५	*Rhododendron campanulatum*	नीलो चिमाल	रुख
६	*Rhododendron campylocarpum*	पहेलो चिमाल	झाडी
७	*Rhododendron ciliatum*	जुँगे चिमाल	झाडी
९	*Rhododendron cinnabarinum*	सानो चिमाल	झाडी
८	*Rhododendron cowanianum*	---	झाडी
१०	*Rhododendron dalhousiae*	लहरे चिमाल	झाडी
११	*Rhododendron falconeri*	कोरलिङ गुराँस	रुख
१२	*Rhododendron fulgens*	चिमाल	रुख
१३	*Rhododendron glaucophyllum*	तकमा चिमाल	झाडी
१४	*Rhododendron grande*	कालो गुराँस	रुख
१५	*Rhododendron griffi thianum*	सेतो चिमाल	रुख
१६	*Rhododendron hodgsonii*	गुलाबी कोरलिङ	रुख
१७	*Rhododendron hookeri*	---	झाडी
१८	*Rhododendron lanatum*	---	झाडी
१९	*Rhododendron lepidotum*	भाले सुनपाति	झाडी
२०	*Rhododendron lindleyi*	सेतो गुराँस	झाडी
२१	*Rhododendron lowndesii*	---	झाडी
२२	*Rhododendron nivale*	हिउँ चिमाल	झाडी
२३	*Rhododendron pumilum*	पुड्के चिमाल	झाडी
२४	*Rhododendron setosum*	झुसे सुनपाति	झाडी
२५	*Rhododendron thomsonii*	---	रुख
२६	*Rhododendron trichocladum*	---	झाडी
२७	*Rhododendron triflorum*	पहेँले चिमाल	रुख
२८	*Rhododendron vaccinioides*	खिर्याउने पाते गुराँस	झाडी
२९	*Rhododendron virgatum*	हाँगिने गुराँस	झाडी
३०	*Rhododendron wallichii*	---	झाडी
३१	*Rhododendron wightii*	---	रुख

लाली गुराँस *(Rhododendron arboreum)*

नेपाली गुराँसका प्रजातिहरु मध्ये लाली गुराँस सबैभन्दा आकर्षक छ । त्यसैले यसलाई नेपालको राष्ट्रिय फूलको स्वमा छानिएको हुनुपर्छ । यसलाई नेपालको राष्ट्रिय फूलको स्वमा वि.सं. २०१९ साल पुष १ गते घोषित गरिएको हो । यसको फैलावट करीव १००० मीटर देखि २५०० मीटरको उचाइसम्म छ । उचाई अनुसार लाली गुराँसका फूलको रंगमा परिबर्तन देखिन्छ । त्यसैले यसका विभिन्न उप-प्रजातिहरु पनि छन् ।

लाली गुराँस (नेपालको राष्ट्रिय फूल)

लाली गुराँसको फूल

नेपाली गुराँसका प्राकृतिक स्वरुप

नेपाली गुराँसहरु प्रजाति अनुसार साना झाडी, झाडी, मझौला रूख र ठूला रूख हुन्छन् । केही प्रजातिहरु अन्य रूखमा हुर्कने *(epiphytic)* किसिमका पनि हुन्छन् । सबै प्रजातिहरु मध्ये सबभन्दा अग्लो रूख लाली गुराँस हो । यो ५ मीटर देखि १५ मीटरसम्म अग्लो हुन्छ । त्यस्तैगरी सबभन्दा सानो चाँहि *Rhododendron lowndesii* हो । यो ५ देखि १० सेन्टीमीटर मात्र अग्लो हुन्छ ।

नेपाली गुराँसका गुण तथा अवगुणहरु

नेपालमा पाइने गुराँसका विभिन्न प्रजातिहरुका विभिन्न विशेषताहरु छन् र ती विभिन्न किसिमले उपयोग गरीन्छन् ।

लाली गुराँस दाउराको लागि प्रयोग गरिन्छ भने यसको काठ खुकुरी तथा खुर्पाको बाँड बनाउन समेत प्रयोग गरिन्छ । त्यस बाहेक गुराँसका काठबाट तयार गरिएको कोइला फलाम तथा सुनचाँदीका कामका लागि उत्तम मानिन्छ र त्यसका लागि पनि प्रयोग गरिन्छ । त्यस्तैगरी यसको फूलको मह पनि खाने गरिन्छ । तर धेरै खाएमा रिगटा लाग्ने र वान्ता हुने गरेको पनि अनुभव गरिएको छ । त्यस्तैगरी माछाका परिकार खाँदा काँडा घाँटीमा अड्कियो भने यसको फूल खाँदा काँडा गल्छ भन्ने पनि आम चलन छ । हाल यसको फूलबाट गुराँसे जुस पनि बनाउने गरिएको पाइन्छ ।

त्यस्तै गरी सुनपाति *(Rhododendron anthopogon)* को नामले चिनिने गुराँसको एक प्रजातिको पातबाट सुगन्धित तेल उत्पादन गरिन्छ । यो एन्थोपोगन तेल (anthopogon oil) को नामले बजारमा बिक्री हुन्छ । यसको राम्रो माग छ । त्यसबाहेक सुनपातिको पात धुप बनाउन पनि प्रयोग गरिन्छ ।

सुनपातिको विरुवा

त्यसैगरी गुराँसका केही प्रजातिहरु विषालु पनि छन् । नीलो चिमाल नाम गरेको गुराँस *(Rhododendron campanulatum)* का भरखर पलाएका मुनाहरु बन्य जन्तु तथा घरपालुवा जन्तुहरुका लागि विषालु हुन्छन् ।

नीलो चिमाल (*Rhododendron campanulatum*)

पुष्प व्यवसायमा गुराँसको महत्व र प्रवर्धन

गुराँसका आकर्षक फूलहरुले सबैको मन लोभ्याउँछ नै । गुराँसका विरुवाहरु आफ्नो बगैचामा लगाएर फुलाउन पुष्प प्रेमीहरुको आकाँक्षा हुन्छ नै । अति आकर्षक, लामो अवधिसम्म टिक्ने र बोट नै ढाक्ने गरी लटरम्म फुल्ने फूलहरुको आकर्षणले गर्दा गुराँस धेरैले मन पराउने फूलहरु मध्ये पर्दछ । त्यसैकारण पश्चिमा मुलुकहरुमा गुराँसका विरुवा उत्पादन गरी बगैचामा लगाउने प्रक्रिया शुरु भएको पनि शताब्दि भैसकेको इतिहास छ । त्यसका साथै अध्ययन अनुसन्धानको आधारमा विभिन्न बर्णशंकर प्रजातिका गुराँसहरुको विकास गरेको पनि पाइन्छ । गुराँस खासगरी गमला र बगैचामा नै लगाउने गरीन्छ ।

नेपालमा पनि गुराँसका विरुवाहरुको राम्रो माग छ । तैपनि विरुवा उत्पादन गर्ने, हुर्काउने जस्ता कार्यमा कठिनाई महशुस गरिएको छ । तसर्थ नर्सरीहरुमा प्रायजसो गुराँसका विरुवाहरु उपलब्ध छैनन् । हुनत बीउ, हाँगाको कलमी (cutting), गुटी (air layering) र जैविक प्रविधि *(Tissue culture)* बाट गुराँसका विरुवाहरु उत्पादन गर्न सकिन्छ, तैपनि हुर्काउन र फुलाउन उचित प्रविधिको ज्ञान तथा शीपको आवश्यकता पर्दछ । यसको लागि धैर्यताको खाँचो पर्छ । यी सब कारणहरुले गर्दा नेपालमा गुराँसको उत्पादन तथा प्रवर्धन हुन नसकेको होला ।

गुराँस अति आकर्षक र माग भएको विरुवा भएकोले यसको प्रवर्धन गर्न आवश्यक देखिन्छ । यसको उत्पादन गर्ने प्रविधि, हुर्काउने र फुलाउने वातावरणीय अनुकुलताको लागि शीप विकास गर्न सकेमा नेपालका गुराँसहरुको उचित उपयोग हुनका साथै आय आर्जनको श्रोत पनि श्रृजना हुन सक्छ । यस कार्यमा पुष्प विकास केन्द्र, वनस्पति विभाग, नेपाल कृषी अनुसन्धान परिषद जस्ता सरकारी निकायहरुद्धारा अध्ययन अनुसन्धान गरी प्रविधि हस्तान्तरण गर्न सकेमा यसको प्रबर्धनमा उचित टेवा पुग्न जाने संभावना देखिन्छ ।

त्यस बाहेक गुराँसको उत्पादन गर्ने प्रविधि विकासका साथै बोटहरु हुर्काउने र फुलाउने वातावरणीय अनुकुलता सम्बन्धी अध्ययन अनुसन्धान गरी यसको प्रवर्धन गर्नका लागि कुनै एक सुहाउँदो स्थानमा गुराँस उद्यान स्थापना गर्न सकिएमा यसको अनुवांसिक विविधताको संरक्षण हुनका साथै व्यावसायिकतामा पनि बृद्धि गर्न सहयोग पुग्ने थियो ।

संरक्षणको आवश्यकता

नेपालको पूर्वदेखि पश्चिमसम्मका उच्च पहाडी तथा हिमाली क्षेत्रमा पाइने गुराँसका प्रजातिहरू विभिन्न कारणबाट विनाश हुदै गइरहेका छन् । स्थानीय बासिन्दाहरुको बनमा निर्भरताका कारणले गर्दा दाउरा तथा काठको लागि गुराँसका रुखहरु काट्ने, कोइला बनाउने प्रचलन र खुला चरिचरन यसका प्रमुख कारणहरु हन् । त्यस बाहेक बन फडानी र डढेलो जस्ता कारणहरुले गर्दा पनि गुराँस पाइने क्षेत्रहरु संकुचित हुँदै गइरहेको अनुभव गरीएको छ । त्यसैले गुराँसका प्रजातिहरूको संरक्षण गर्नु आवश्यक देखिएको छ ।

यसको लागि मुख्यत गुराँसका प्रजातिहरूको स्वः-स्थानीय संरक्षण गर्न आवश्यक देखिन्छ । तत्पश्चात गुराँसका प्रजातिहरूको नर्सरी प्रविधिको विकास गर्ने र आवश्यक स्थानको छनौट गरी बृक्षारोपण गर्ने कार्य गर्न उचित हुन्छ । गुराँसका केन्द्र मानिने क्षेत्रहरुको पहिचान गरी तिनीहरुको संरक्षण गर्न आवश्यक देखिन्छ । त्यसका साथै गुराँस संरक्षण क्षेत्रको व्यवस्था गर्न सकेमा नेपाली गुराँसका प्रजातिहरुको संरक्षण हुनका साथै पर्या-पर्यटनको विकास समेत हुन जाने कुरामा दुइमत हुने छैन ।

सन्दर्भ सामाग्रीहरु

कमल मादेन : कहाँबाट कसरी आइपग्यो नेपालमा गुराँस रु १४ बैशाख २०७८, हिमाल खबर पत्रिका ।

वन तथा भू-संरक्षण विभाग (२०७५): गुराँस संरक्षण कार्ययोजना (२०७५-२०८०). वन तथा भू-संरक्षण विभाग, वन तथा वातावरण मन्त्रालय,काठमाडौं, नेपाल ।

Department of Plant Resources (2012) : Catalogue of Nepalese Flowering Plants-III.

Rene De Milleville (2002): The Rhododendrons of Nepal. Himal Books

Tirtha Bahadur Shrestha (1984) : Rhododendrons. In Nepal-Nature's paradise (T.C. Majpuria), Tec Press, Bangkok.

उर्वरा माटोलाई भावी सन्ततिका लागि बचाऔं ! किसान थोपा सिंचाई लगाई उत्पादन बढाऔं !!

किसान एग्रिकल्चर प्रा. लि.

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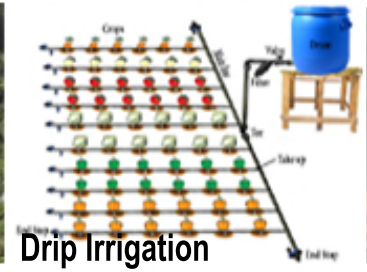
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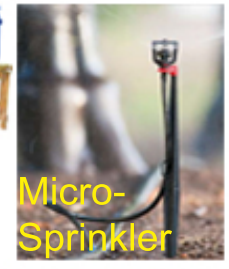
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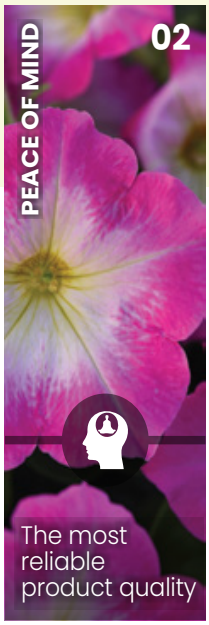

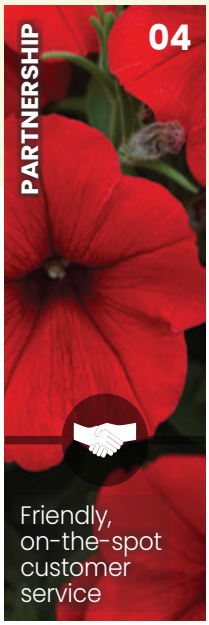

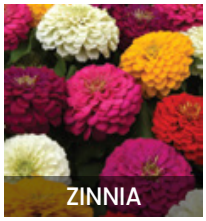

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