ISSN-2565-4837

Nepalese FLORICULTURE

"Clean environment & economic prosperity through floriculture"

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Floriculture Association Nepal (FAN)
Jwagal, Lalitpur

Published by:
Floriculture Association Nepal (FAN)
Jwagal-11, Lalitpur Nepal
Tel/Fax: 977-1-5261089
Email: fan_nepal@yahoo.com, fanepal2049@gmail.com
Web: www.fanepal.org.np; www.nepalfloraexpo.com.np

1500 Copies
2021 AD.

Volumn: 24
ISSN-2565-4837

Price: NRs. 150/-

Design and Layout By:
Sabin Maharjan

Printed By:
S 2 Printers & Stationery
Nayabazar-16, Town Planning, Kathmandu
Tel.: +977-1-4358921, Cell: 9841722948
E-mail: s2printers@yahoo.com.au

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शुभकामना

व्यावसायिक पुष्पखेतीको माध्यमबाट नेपाललाई पुष्प क्षेत्रमा आत्मनिर्भर उन्मुख बनाउन मन, वचन र कर्मले अहोरात्र खटिनुभएका समग्र पुष्प व्यवसायीको प्रतिनिधित्व गर्ने संस्था फ्लोरिकल्चर एशोसिएसन, नेपालले विगतका वर्षहरूमा जस्तै यो वर्ष पनि पुष्प सम्बन्धी विभिन्न लेख रचनाहरू समावेश गरी Nepalese Floriculture (Volume-24) प्रकाशन गर्न लागेकोमा अत्यन्तै खुशी लागेको छ।

आर्थिक, धार्मिक, सामाजिक र सांस्कृतिक रूपमा अत्यन्तै ठूलो महत्व राख्ने पुष्प र आलंकारिक बोट विरुवाको उत्पादन र बजार दिन प्रतिदिन फैलिंदै गइरहेको छ। नेपालको भौगोलिक विविधताका कारण विभिन्न प्रकारका पुष्प उत्पादन गर्ने यथेष्ट सम्भावना भएता पनि मौसमी रूपमा बढ्ने माग अनुसार पुष्प उत्पादन गर्न नसकिएकोले वाह्य मुलुकबाट आयात गर्नुपर्ने बाध्यता रहँदै आएको देखिन्छ। पुष्प क्षेत्रको व्यवसायीकरण गरी यसलाई गुणस्तरीय, प्रतिस्पर्धी, दिगो बनाउन सकिएमा आयात प्रतिस्थापन तथा निर्यात प्रवर्द्धनमा टेवा पुर्याउन सकिन्छ।

फ्लोरिकल्चर एशोसिएसन नेपालले आफ्नो स्थापना कालदेखि नै आफ्नै प्रयास एवम् कृषि तथा पशुपन्छी विकास मन्त्रालयसँगको सहकार्यमा विभिन्न प्रवर्द्धनात्मक कार्यक्रमहरू गर्दै आएको र यस प्रकारका कार्यक्रमहरूबाट पुष्प क्षेत्रको विकास तथा विस्तारमा महत्वपूर्ण उपलब्धि हासिल गर्न सफल रहेको विषय जानकारी पाउँदा खुसी लागेको छ। यस संस्थाले किसान, पुष्प व्यवसायी, विद्यार्थी र अन्य सरोकारवाला निकायहरूसँग समन्वय गर्नुको साथै देशको समग्र पुष्प क्षेत्रको विकासका लागि सरकारी स्तरबाट सञ्चालन गर्नुपर्ने कार्यक्रम तथा नीतिगत व्यवस्था सम्बन्धमा आवश्यक पृष्ठपोषण तथा सुझाव प्रदान गर्दै आएकोमा मन्त्रालयको तर्फबाट धन्यवाद व्यक्त गर्न चाहन्छु।

नेपाल सरकारको आत्मनिर्भरताको लक्ष्य पूरा गरी व्यापार घाटा न्यूनीकरण गर्ने बाटोमा पुष्प व्यवसायले पनि महत्वपूर्ण भुमिका खेल्ने हुँदा सम्पूर्ण कृषक तथा पुष्प व्यवसायीहरूबाट सहकार्य र सहयोगको अपेक्षा गर्दछु। अन्त्यमा, यस एशोसियसनले प्रकाशन गर्न लागेको Nepalese Floriculture (Volume-24) बाट पुष्प व्यवसायी, अनुसन्धानकर्ता, अध्येता तथा पुष्प क्षेत्रमा चासो राख्ने सबै सरोकारवालाहरू लाभान्वित हुने अपेक्षा गर्दै भावी दिनहरूमा यस संस्थाको प्रगतिको हार्दिक शुभकामना व्यक्त गर्दछु।

चैत्र, २०७७

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नेपाल सरकार
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फोन नं. ४२११६३५
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पत्र संख्या :
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नेपाल

शुभकामना

नेपालको सन्दर्भमा भौगोलिक परिवेश, जलवायु उपलब्ध स्रोत साधन र संभावनाको उपयोगको आधारमा पुष्प तथा पुष्पजन्य व्यवसायले राष्ट्रिय अर्थतन्त्रमा टेवा पुर्याई गरिबी न्यूनीकरणमा सकारात्मक योगदान पुर्याएको छ। नेपालमा पाईने विभिन्न मौलिक तथा रैथाने फूल, बोट बिरुवाको पहिचान गरी संरक्षण तथा सम्बद्धन तथा अन्य आयातित प्रजातिका र आर्थिक महत्वका पुष्प उत्पादन र यो संग सम्बन्धित व्यवसायबाट रोजगारीका अवसर सृजना गर्नुका साथै निर्यातको ठूलो संभावना पनि रहेको छ । यसै विषयलाई मध्यनजर गर्दै नेपाल सरकारले कृषि विकास रणनीति, दीर्घकालिन कृषि योजना, राष्ट्रिय कृषि नीति, २०६१ र वाणिज्य नीति, २०६५ मा पुष्प व्यवसायलाई प्रमुख निर्यात योग्य वस्तु र नाफामुलक बालीको रुपमा प्राथमिकता दिएको छ। त्यसैगरि पुष्प व्यवसायलाई एक गाँउ एक उत्पादन कार्यक्रममा समावेस गरि आलंकारिक फूलको गुणस्तरिय उत्पादन तथा मूल्य अभिवृद्धि श्रृङ्खला सुधारमा समेत जोड दिएको छ । पुष्पबाली अति नै जोखिमपूर्ण, चाडै बिग्रिएर जाने, विशेष अवस्थामा मात्र प्रयोग हुने वस्तु भएको हुदा यसको उत्पादनस्थल देखि स्थानीय र अन्तराष्ट्रिय बजारसम्म बजारिकरणका लागि विभिन्न प्रविधिहरुको अध्ययन अनुसन्धान, विकास र उपयोग आवश्यक रहेको छ। यि कार्यहरुलाई व्यवस्थित बनाउनको लागि सरकारी, निजि तथा अन्य सरोकारवाला निकायहरुको बिच समन्वय र सहकार्यलाई विशेषत प्राथमिकता दिईएको छ ।

यसै सन्दर्भमा नेपालमा पुष्प व्यवसायको निरन्तर विकासका लागि कार्यरत पुष्प व्यवासयिहरुको संस्था फ्लेरिकल्चर एशोसिएसन नेपालले बार्षिक रुपमा प्रकाशन गर्दै आईरहेको पुष्प व्यवसायसँग सम्बन्धित विविध लेख रचना सहितको Nepalese Floriculture Book को २४ औं संस्करण प्रकाशन गर्न लागेकोमा अत्यन्तै खुशी लागेको छ र प्रकाशित पुस्तकबाट पुष्प व्यवायमा सहभागि हुने किसान, उधमी, विद्यार्थी, अनुसन्धानकर्ता, अध्येता तथा यस क्षेत्रमा चासो राख्ने सबै सरोकारवालाहरु लाभान्दित हुने अपेक्षा राखेको छु। पुस्तकको प्रकाशन गर्न लागनुभएकोमा कृषि तथा पशुपन्छी विकास मन्त्रालय तथा मेरो व्यक्तिगत तर्फबाट बधाई तथा शुभकामना व्यक्त गर्दछु। यस प्रकाशनबाट पुष्प व्यवसाय प्रवर्द्धनमा भएका सकारात्मक पहलहरु, यस क्षेत्रमा भएका अनुसन्धान र विकास भएका प्रविधिहरु र तथ्याङ्क अद्यावधिक भई यस क्षेत्रको व्यवसायिकरण तथा आधुनिकिरण गरि पुष्पको आयात प्रतिस्थापन र निर्यात अभिवृद्धि गर्ने कार्यमा थप पृष्ठपोषण र उर्जा मिल्ने कुरामा म विस्वस्थ छु। साथै यस प्रकाशनमा सम्मिलित लेख रचनाहरुले नेपाल सरकारलाई नीति तथा योजना निर्माणमा मार्गदर्शन गर्ने अपेक्षा राख्दै पुष्प क्षेत्रको विकास, विस्तार, प्रवर्द्धन तथा पुष्प व्यवसायको क्षेत्रमा आईपरेका विभिन्न चुनौति तथा समस्याहरुलाई चिर्दै संभावनालाई पहिल्याउने क्षेत्रमा संस्थाको निरन्तर संलग्नता रहने विस्वास राख्दै फ्लेरिकल्चर एशोसिएसन नेपालको उत्तरोत्तर प्रगतिको शुभकामना दिन चाहन्छु।

चैत्र १९, २०७७

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शुभ-कामना

फ्लोरिकल्चर एशोसिएसन नेपालले वार्षिक रूपमा प्रकाशन गर्दै आएको Nepalese Floriculture Book यस वर्ष पनि विविध लेख रचनाहरू सहित अद्यावधिक गरी यसको २४ औं संस्करण प्रकाशन हुन लागेको जानकारी पाउँदा मलाई अत्यन्त खुशी लागेको छ । संघको यस प्रयासको प्रशंसा गर्दछु ।

नेपालमा पुष्प व्यवसायको प्रवर्द्धनमा संघले निर्वाह गरेको भूमिका निकै नै प्रशंसनीय छ । कुनै समयमा पुष्प व्यवसाय र खेतीलाई पनि व्यवसायिक रूपमा लैजान सकिन्छ र भन्ने सोंच व्याप्त रहेको बेला उक्त सोंचलाई यथार्थतामा रूपान्तरण गर्न संघले हासिल गरेको उपलब्धी सांच्चिकै मुल्यवान र उत्साहबर्धक छ । संघले हरेक वर्ष आयोजना गर्ने Flora Expo व्यवसायिक पुष्प खेतीको प्रवर्द्धनका लागि महत्वपूर्ण साधन बन्दै आएको छ । संघकै अनवरत प्रयासका कारण मुलुकभर ७ सय भन्दा बढी व्यवसायिक पुष्प खेती संचालनमा रहेका र नेपालबाट विस्तारै निर्यात समेत हुन थालेको छ । यो व्यवसायमा अहिले ६.५० अर्व भन्दा बढी लगानी रहेको, करिव आधालाख मानिसहरूले रोजगारी पाएको, आ.व. २०७६/७७ मा मात्र करिव सवा २ अर्वको कारोवार भएको देखिन्छ । अहिले मुलुकको खपतको अधिकांश मागलाई आन्तरिक उत्पादनले नै धान्न थालेको र केही मात्रामा मात्र आयात भैआएको कुरा मैले पाएको छु । नेपालको भौगोलिक बनावट सवै प्रकारका फूल उत्पादनका लागि अनुकुल भएकाले व्यवसायिक फूल उत्पादनलाई बढावा दिने नीति सरकारको हुनुपर्नेमा हाम्रो जोड छ । संघले प्रकाशन गर्ने Nepalese Floriculture Book यस व्यवसायमा आवद्ध उद्यमी व्यवसायीका लागि महत्वपूर्ण दस्तावेज हुने मेरो विश्वास छ ।

अन्त्यमा, Nepalese Floriculture Book प्रकाशन कार्यको पूर्ण सफलताका लागि हार्दिक शुभ-कामना व्यक्त गर्दछु । सबै पुष्प व्यवसायीहरूको व्यवसाय प्रवर्द्धनका लागि हार्दिक शुभ-कामना व्यक्त गर्दछु ।

(शेखर गोल्छा)
अध्यक्ष

मिति २०७७ चैत्र ०४ गते, बुधबार ।

Regd. No. 244/049/50

फ्लोरिकल्चर एशोसिएसन नेपाल
Floriculture Association Nepal (FAN)

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सन्देश

फ्लोरिकल्चर एशोसिएसन नेपाल (फ्यान) ले विभिन्न काल खण्डमा आई परेका विभिन्न समस्यालाई चिर्दै पुष्प व्यवसायको समग्र बिकास बिस्तार तथा प्रबर्द्धन गर्दै सेवामुखि भावनाले समस्त पुष्प व्यवसायीहरूको हक हितको क्षेत्रमा आफ्नो स्थापना काल देखि निरन्तर कार्य गर्दै आइरहेको छ। २०५१ साल देखि निरन्तर पुष्प मेला प्रर्दशनी आयोजना मार्फत पुष्प उद्यमको प्रवर्धन कार्यक्रम सहित संस्थाको मुख्य अन्य कृयाकलापहरू कोभिड-१९को कारण बि.सं.२०७६ र २०७७ सालमा आयोजना गर्न असमर्थ रह्यौ। विश्वमा सिर्जित बिषम परिस्थितीको कारण नेपालको पुष्प उद्योगले ठूलो क्षति बेहोर्न परेको छ यस संगै यस व्यवसायमा आश्रीत हजारौँ कामदारहरूले रोजगारी गुमाउनु पुगेको छ।

पुष्प प्रवर्द्धन निती २०६९ मा उल्लेख गरेको उद्धेस्य अनुसार सरकार निजी क्षेत्र साझेदारीमा फ्यानले देशको तीनै तहका सरकारसंग सहकार्य गर्ने, बिशेष गरि साझेदारी कार्यक्रमलाई उपलब्धिमुलक बनाउदैँ बद्लिदो परिस्थिती अनुसार निती परिमार्जनका साथै पुर्नलेखन गरि तिनै तहका सरकार मार्फत कार्यान्वयनमा जोड दिई प्रतिस्पर्धी पुष्प उद्योगको विकास गर्ने फ्यानको स्पष्ट निती रहेको छ। स्थानिय सरकारसंग उत्पादन, प्रदेश सरकारसंग प्रबिधी बिकास र बजारिकरण साथै संघिय सरकारसंग अनुसन्धान र बिकाससंग जोडिएर सहकार्य गर्ने निती लिएको छ।

विगत वर्षहरूमा सरकारको लगानी बिना नै निजी क्षेत्रको प्रयासमा लगानी, उत्पादन, गुणस्तर, आयत प्रतिस्थापन र निर्यात प्रवर्द्धन कार्यमा नेपाली पुष्प व्यवसायले उल्लेख्य उपलब्धि हासिल गरेको छ तथापी अझै पनि आन्तरिक बजारको मागलाई स्वदेशी उत्पादनले पुरा गर्न सकिरहेको छैन। वार्षिक १० देखि १५ प्रतिशतको दरले थप पुष्प तथा पुष्पजन्य वस्तुको माग बजारमा थपिने गरेको छ। यो असन्तुलनलाई आन्तरिक उत्पादनले पुरा गरि निर्यात प्रवर्द्धनका लागि फ्यानले तीनै तहका सरकार, संघ संस्था एवं उद्यमी व्यवसायीसँग बहस पैरवी र सहकार्य गर्दै आइरहेको छ। आन्तरिक उत्पादनलाई गुणस्तर सुधार सहितको सबल र सक्षम बनाउनु आजको आवश्यकता र हाम्रो लक्ष्य हो। जसबाट पुँजीको उपयोग, अवसरको सृजना तथा साधान स्रोतको ग्रामीणस्तरसम्म पहुँच पुग्न सक्दछ। पुष्प उद्योगको लागि पुर्वाधारको विकास, नीतिगत व्यवस्थापन, जनशक्तिको उचित विकास र प्रविधिको हस्तान्तरणका क्षेत्रमा सरकारको लगानी हुनु आवश्यक छ। पुष्प व्यवसायको विकासको लागि पछिल्लो समय सरकार निजि साझेदारी कार्यक्रमका पुर्वाधार विकासमा लगानी बढिरहेको छ। यसले पुष्प उद्योगलाई आधुनिकिकरण र यान्त्रिकरणको विकासमा उल्लेख्य योगदान पुर्याउने छ साथै कृषिका अन्य क्षेत्रले पनि पछ्याउदै कृषिको आधुनिकरण संगै उत्पादन र उत्पादकत्व वृद्धि हुदै गएको स्पष्ट संकेत गरेको छ।

परम्परागत उत्पादन र बजारीकरण प्रणालीबाट आधुनिक र स्मार्ट उत्पादन र बजारीकरणमा अपग्रेड हुनै पर्ने वाध्यात्मक परिस्थिती सिर्जना भएको छ। उपभोक्ताहरूको खरिद गर्ने र उपयोग गर्ने वानी व्यवहारमा आएको परिवर्तनलाई सम्बोधन गर्न (Flora e-commerce) को अवधारणा सहित अनलाईन बजार निर्माणको क्रममा रहेको सहर्ष जानकारी गराउँद छौँ। यस कार्यले नेपाली पुष्प उद्योगको विकासको लागी कोसेढुंगा साबित हुने अपेक्षा राखेका छौँ।

अन्तमा पुष्प उद्योगको विकास विस्तार र प्रवर्धनमा सहयोग पुर्याउने संघिय, प्रदेश एवं स्थानिय सरकार, उद्यमी व्यवसायीहरू, विज्ञहरू लगायत पदाधिकारी र कर्मचारी साथीहरूलाई आ-आफ्नो क्षेत्रबाट पुष्प व्यवसाय र एशोसिएसनलाई उपलब्ध गराउनु भएको सल्लाह, सुझाब र सहयोगको लागि हार्दिक आभार प्रकट गर्न चाहन्छु। आगमी दिनहरूमा याहाँहरूको सदैब साथ र सहयोग रहनेछ भन्ने समेत आशा लिएको छु।

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सम्पादकीय

फ्लोरिकल्चर एशोसिएसन नेपाल (फ्यान) ले प्रत्येक वर्ष पुष्प सम्वन्धी लेख, रचना, अध्ययन, अनुसन्धान, सुचना तथा आधुनिक खेती प्रबिधी जस्ता बिबिध बिषयहरूलाई समेटेर पुस्तक प्रकाशन गरी पाठक सामु पस्कदै आएका थियौं । तर नियमित रूपमा प्रकाशन गर्दै आएको पुस्तक गतबर्ष कोभिड-१९ महामारीका कारण प्रकाशन गर्न असमर्थ भयौं । यस बर्ष बार्षिक रूपमा प्रकाशन हुदै आएको Nepalese Floriculture पुस्तकलाई निरन्तरता दिदै तपाँईहरु समक्ष २४ औं संस्करणको रूपमा प्रकाशन गरी ल्याई पुऱ्याएका छौं ।

बिश्वव्याापी महामारीको रूपमा फैलिएको कोभिड-१९ का कारणबाट हाम्रो मुलुकको अर्थतन्त्रमा आएको बिषम परिस्थितीबाट नेपालको पुष्प व्यवसाय पनि अत्यन्त कष्टकर परिस्थितीबाट गुज्रियो । बन्दबन्दिको प्रथम तीन महिनासम्म पुष्पका सबै बिधाहरूमा अत्यन्त नकरात्मक स्थिती देखिएतापनि २०७७ असार पछि आलंकारिक बोट बिरुवाहरूको उपयोगमा अलिकति सकरात्मक पक्षहरु देखिए । देशको पर्यटन व्यवसाय पुर्णरूपमा बन्द रहेको र कुनै पनि सभा, समरोह, पार्टि आदि कार्यक्रमहरु संचालन गर्नमा सरकारले पुर्णरूपमा प्रतिबन्द गरेकोले कट फ्लावरको प्रयोग लगभग १ देखि ५ प्रतिशत भित्र संकुचन हुन पुग्यो । बि.सं. २०७६ चैत्र देखि २०७७ चैत्र मसान्तको स्थितीलाई हेर्दा कट फ्लावरको उपभोक्ताहरु मध्ये केहि घरायसी प्रयोगकर्ताहरु मात्र सक्रिय रहेको तर होटल तथा पर्यटन व्यवसायी उपभोक्ताहरु निस्कृय नै रहेको छन् । अझै पनि आगामी बर्ष पुष्पको बजार सुखद हुने स्थिती देखिएको छैन ।

पुष्प व्यवसायलाई देश भित्र आत्मनिर्भर बनाउन FAN को पहलमा नेपाल सरकारको समेत लगानीमा उत्पादन क्षेत्र बिस्तार गरी व्यवसायीहरूले ठूलो लगानी गरिसकेका थिए । बैंक एवं वित्तिय संस्थाको यस भित्र ठूलै लगानी भित्रीएको थियो । तर हालको परिस्थितीले गर्दा पुष्पको बजार आगामी दिनमा असहज तर्फ बढ्ने चिन्ता सबैमाझ फैलिएको छ । फेरी पुष्पको आयात प्रतिस्थापनका लागि थप पुँजी, श्रम र श्रोतको व्यवस्थापन कसरी गर्ने भन्ने बिशेष प्रश्न पुष्प व्यवसायमा उब्जिएको छ । दैवी प्रकोप, महामारी सबैको कल्पना बाहिरको बिषय हो । कोभिड-१९ को खोप एवं रोगथाम पछि आउने संभावनालाई मध्यनजर गरी बिद्यमान पुष्प उद्योगलाई यथास्थितीबाट माथि उठाउन नेपाल सरकार, निजी क्षेत्र, संघ संस्थाहरु सबै क्षेत्रबाट सकृय रूपमा हातेमालो गर्नु जरूरी छ ।

प्रस्तुत अंकमा Landscape design: A way to move against over concretization; Plant Growth Regulators (Plant Hormones): Application in Floriculture; Postharvest Management of Cut Flowers: Using Chemicals and Preservatives; Flower Opening Stages of Rose and Marigold; Greenhouse cultivation: Cultivation pattern in isolation; Gardening with Native Wild Plants; काठमाडौं उपत्यकाको हरियाली सौन्दर्यीकरण, पुष्प व्यवसायमा कोभिड-१९ ले पुऱ्याएको असर र वर्तमान अबस्था जस्ता बिबिध शिर्षकमा लेखिएका उपयोगी लेखहरु समेटिएको छ । पुष्प क्षेत्रमा लाग्नु भएका उधमी व्यावसायीहरु, अध्ययन अनुसन्धानमा लाग्नु भएका महानुभावहरु, सरकारी तथा गैर सरकारी संघ संस्थाहरु लगायत सम्पूर्ण पुष्प प्रेमी महानुभावहरूले थोरै भएपनि पुष्प सम्बन्धि सामग्रीहरु प्राप्त गर्नु हुनेछ र यसबाट लाभान्वित हुनु हुनेछ भन्ने आशा लिएका छौं ।

अन्त्यमा यस प्रकाशनमा लेख रचना पठाई सहयोग गर्नुहुने लेखकहरु, विज्ञापन दाताहरु प्रति हार्दिक धन्यवाद ज्ञापन गर्दछौं । आगामी दिनहरूमा पनि यहाँहरूको अमुल्य सुझाब, सहयोग र सद्भावको अपेक्षा लिएका छौं । प्रकाशनका क्रममा भएका कमि कमजोरी औल्याई परिमार्जन सहित यसको स्तर उन्नती गर्न र समय सापेक्ष बनाउन यंहाँहरूको सहयोगको सदैब हार्दिक अपेक्षा राख्दछौं ।

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नव वर्ष २०७८

को सुखद् उपलक्ष्यमा सम्पुर्ण सदस्यज्युहरू,
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फ्लोरिकल्चर एशोसिएसन नेपाल
परिवार

Landscape design: A way to move against over concretization

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Introduction

A landscape is the visible features of an area of land, its landforms, and how they integrate with natural or man-made features. It may be defined as any area, either big or small, on which it is possible or desirable to mould a view or a design". A landscape includes the physical elements of geophysical defined landforms such as (ice-capped) mountains, hills, water bodies such as rivers, lakes, ponds and the sea, living elements of land cover including indigenous vegetation, human elements including different forms of land use, buildings, and structures, and transitory elements such as lighting and weather conditions. Combining both their physical origins and the cultural overlay of human presence, often created over millennia, landscapes reflect a living synthesis of people and place that is vital to local and national identity (Khan et al., 1997).

The art of designing is known as "Landscape Architecture," although the older term "Landscape gardening" is also popular. Landscape design is an independent profession and a design and art tradition, practiced by landscape designers, combining nature and culture. In contemporary practice, landscape design bridges the space between landscape architecture and garden design (Wyer, 2012). Landscape gardening is the decoration of a tract of land with plants and other garden materials to produce a picturesque and naturalistic effect in a limited space.

Landscape gardening is a very fascinating and interesting subject. It is a money spinner business and people who are involved in designing and preparing landscape gardens are earning handsome money. A beautiful landscape is a vital part of your home and community. A well-planned landscape can save your money by reducing energy consumption. Since the landscape gardening is the making pictures on the ground with plant and other material, landscape designer should be proficient in art, ornamental gardening, ecology and physiology (Vroom, 2006). Thus, landscape gardening is both an art and science of the establishment of a ground in such a way that it gives an effect of a natural landscape.

As the result of rapid urbanization and modernization in Nepal, most of the urban areas are moving towards concretization. The tragedies are easily visualized with the airplane views or aero views. Therefore, the paper aims to share different terminologies of landscape designing, combination of different parameters and components of landscape, its multipurpose uses, and focus the mixing role of horticulturist and architect/engineer to appreciate the relationship between plants' type and form, colors and structures. Their wider application would have significant way forward to move against over concretization.

Landscape Architecture

Design projects may involve two different professional roles: landscape design and landscape architecture. Landscape design typically involves artistic composition and artisanship, horticultural finesse and expertise, and emphasis on detailed site involvement from conceptual stages through to

final construction while landscape architecture focuses more on urban planning, city and regional parks, civic and corporate landscapes, large scale interdisciplinary projects, and delegation to contractors after completing designs (Thompson, 2008).

In landscape architecture, there are three areas of activity: landscape planning, landscape design and landscape management (Thompson, 2008). Landscape planning is concerned with the long-term development and preservation of natural and cultural landscapes by implementation of strategic goal-oriented concepts and allocation of types of land use. Landscape design deals with form and meaning and is concerned with the organization of a physical, functional and aesthetic arrangement of a variety of structural elements to achieve desired social, cultural and ecological outcomes. Landscape management is concerned with the conservation and enhancement of the long-term beneficial use of landscape resources as well as its heterogeneity, character, and beauty (Vroom, 2006).

Landscape Design

Landscape design is an independent profession and a design and art tradition, practiced by landscape designers, combining nature and culture. In contemporary practice, landscape design bridges the space between landscape architecture and garden design (Wyer, 2012). Landscape design focuses on both the integrated master landscape planning of a property and the specific garden design of landscape elements and plants within it.

The landscape design phase consists of research, gathering ideas, and setting a plan. Design factors include objective qualities such as: climate and micro-climates; topography and orientation, site drainage and groundwater recharge; municipal and resource building codes; soils and irrigation; human and vehicular access and circulation; recreational amenities (i.e. sports and water); furnishings and lighting; native plant habitat botany when present; property safety and security; construction detailing; and other measurable considerations (Wadley and Colfer, 2004).

Design factors also include subjective qualities such as client's needs and preferences; desirable plants and elements to retain on site, modify, or replace, and that may be available for borrowed scenery from beyond; artistic composition from perspectives of both looking upon and observing from within; spatial development and definition using lines, sense of scale, and balance and symmetry; plant palettes; and artistic focal points for enjoyment (Nijhous, 2013).

The fundamental concept of landscape design is problem solving with horticultural science, artful composition and spatial organization to create attractive and functional outdoor "rooms" for different uses. The elements (visual qualities)-line, form, texture and color (basic color schemes are monochromatic, analogous and complementary), and principles (guidelines)- rhythm, balance, proportion/scale, unity, focal point, mass effect and level of design are used to create spaces, connect them and make them visually pleasing to the eye (Nijhous, 2013).

Due to the frequent lack of non-visual, supplementary data such as soil assessments and pH tests, online landscaping necessarily must focus on incorporating only plants, which are tolerant across many diverse soil conditions.The practical, aesthetic, horticultural, and environmental sustainability are also components of landscape design, which is often divided into hardscape design and softscape design. Hardscapes are permanent structures that require installation and construction, such as patios and fences. Softscapes are the natural living components, such as plants and trees.

Components of Landscape

A judicious blend of plant and non-plant components in a garden makes it beautiful and useful (Bhattarai and Baral, 2008). The common plant components of a garden are discussed here:

I. Soft-scape components of landscape (Patel, 2018)

Lawn: A lawn can be defined as the green carpet for a landscape and a basic feature for any type of garden. In a home garden, lawn improves the appearance of the house, enhances its beauty, increases conveniences and usefulness thus adding monetary value to the real estate. The lawn provides a perfect setting for a flower bed, a border, a shrubbery or a specimen tree or a shrub.

Shrubbery: Growing of shrubs in a group is called shrubbery. It is of two types (i) Pure shrubbery (ii) Mixed shrubbery. Pure shrubbery refers to planting of entire selected area with a single species whereas a mixed shrubbery has many different species of shrubs.

Flower beds and borders: Annuals and herbaceous perennials are grown in flower beds to provide mass effect of different colors. Borders are continuous beds of more length than width containing plants of one kind only.

Rockery: A rockery or a rock garden is the arrangement of rocks with plants growing in the crevices. Its bold ruggedness is a pleasant contrast to the softness of the flowers. The stones help the plants in retaining their moisture and keeping their roots cool. In plains, on the sunny side some of the cacti and succulents and plants like *Lantana, Setcreasea, Verbena,* etc., can be grown successfully. Ferns and some indoor plants also look natural on the rockery slopes in shade.

Carpet beds: The art of growing ground cover plants closely and trimming them to a design or alphabetical letters is called a carpet bed. Colorful foliage as edge plants is found to be more suitable for this purpose.Plants for carpet beds should be perennial in naturehaving quick recuperative qualityandshould withstand frequent pruning, summer sun and heavy rain, and drought condition e.g. *Alternenthera*

Topiary: It is the art of developing the plant or training the plant into different forms or shapes like animals, birds, arches, etc. The plant should be amenable for repeated pruning and also flexible with more vegetative growth. e.g. For hills - *Cupressusmacrocarpa, Pinuspatul;* for plains - *Casuarina sp., Caesalphiniacoriari, Bougainvillea sp., Clerodendronsp.*

Trophy: It is the arrangement of colorful potted plants in different tiers around a central object, which may be a tree trunk, lamp post or a pillar.

Hedges: With the help of plants, live hedges can be formed and used as a fence or a green wall *Acalypha, Casuarina, Dividivi (Caesalpiniacoriaria),* etc., are plants suitable for hedging. Hedges help to screen a particular site or building or hiding of unwanted places. They help to partition the garden into several parts.

Edges: These are perennial herbs often used as a short border for lawn or ground cover or dividing beds from roads, walks or paths. These herbs often stand frequent trimming e.g. *Eupatorium, Alternanthera, Duranta,* Dwarf marigold, etc.

II. Hardscape components of landscape (Patel, 2018)

Arches: Arches are supports provided for climbers. It should be at least two meter height and one meter wide. The breadth depends upon the path over which it is constructed but should not be less than 1 meter. Arches may be made of wood, metal, stones or concrete structures.

Pergolas: A pergola is formed by connecting a series of arches over a considerable length. Usually flowering creepers are trained over the arches. A pergola is a useful resting place during the summer months in tropical regions. The path below remains cool due to the creepers growing above. Below the pergola, concrete or wooden benches may be constructed for sitting.

Trellises: A garden trellis makes the most of limited space with a vertical display of lush greenery and colorful blooms.Uses of a garden trellis creates a privacy screen in a garden and screens an unattractive area of the landscape. It also provides shelter from wind and shade for sitting area. Climbers such as climbing roses, clematis, English ivy, passion flower, etc., are suitable for trellises.

Islands: Various types of islands are made in garden lakes and ponds. Islands are decorated with trees, flowers, several other features and connected with bridges. Islands are very important feature in Japanese garden. It is no doubt a special representation of nature and a retreat for quiet meditation.

Garden walls: Garden walls serve many purposes in different situations. They provide privacy and security, screen out wind and noise. They can also be constructed to observe the ugly sights in the garden.

Garden fences: They have a specific function as well as beauty. Fencing provides privacy, separates different areas of gardens and ensures safety. They have almost infinite possibilities and variations in design, material and usefulness. Fences may be solid or open. Materials like wood, bamboo, wire, wire-netting and chain link fences may be used for fencing. Painted fences are an additional attraction in the garden.

Foot paths: Foot paths facilitate movement within the garden area. Foot paths may be winding, circular or straight. Spinal or herringbone designs can also be adopted. Winding foot path conceals the components beyond and creates curiosity. Straight foot paths make one walk fast. A vista at the end of a straight footpath adds beauty to the scenery.

Roads: The different locations of landscape over an area require proper roads. In a small garden, foot path will serve the purpose. Roads are constructed in larger gardens like dam

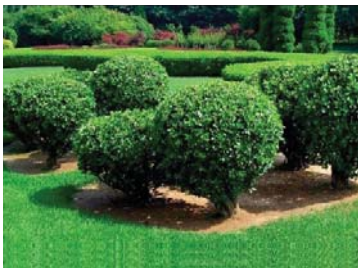
site gardens, public gardens and botanical gardens. Such roads should be straight in formal gardens and with curvatures in informal gardens.

Arbors: Garden arbors are an attractive and very functional addition to landscape that will allow exploring the vertical dimension of garden. Arbors come in a variety of shapes from rounded or gently curved tops, to linear, flat tops to suit any garden style and space. An arbor, or pergola, can also cover a larger area such as a patio or balcony.

Bridges: Bridges are essential constructed features in a garden to link ponds and rivers. The design and color of the bridge should merge with the landscape design; always a rustic design is preferred. Bridges should be structurally sound to withstand traffic. The culverts along the main road and foot paths also should be rustic. Bridges made of single or double trees fallen across a stream or a single long stone, arched bamboo bridges will serve better in informal gardens.

Garden adornments: There are several garden adornments and accessories such as birdbath, sun clock, fountains, garden seats, ornamental posts, pillars, etc., which make the garden more enjoyable.

Flower beds



Shrubbery

Lawns

Rockery

Arches and Trellises

Islands

Pergolas

Bridges

Topiary

Landscape design

Home garden

Landscaping as it is done for larger estates or public parks can also be implemented in a tasteful and artistic way for a home ground. There are some basic guidelines for a home landscape. But personal preferences play a considerable role in developing a home garden. The home including its surroundings should be an outward expression of the inner personality and individuality of the house owner (Dash, 2005). Some following points should be considered in designing a home garden (Wadley and Colfer, 2004):

- To keep down maintenance cost and time, an untrimmed hedge should be preferred over trimmed one; open lawns and shrubs need less attention than annual flower beds. If the beds and borders in a lawn are edged with stone or brick, hand-clipping of grass will not be required.
- The water outlets in the garden should be fixed at appropriate places so that the hoses are not dragged to long distances.
- To create privacy, trees, hedges, shrubs, fences, or creepers trained on wire-mesh structure supported by angle iron or GI pipe pillars can be grown. Trees are used when height is needed, otherwise hedges and other types of screens should be preferred. The first thing is to select the materials for the basic framework such as background, screens, trees needed for shade, the doorway and the corner of the house.
- To this, the features needed for effects and beauty as for example, plants for foundation planting, flower beds, specimen shrubs or trees are added.
- After everything is finalized on paper, these are put into practice on the ground with the help of split-bamboo stakes and rubber hose.
- The trees are represented by bamboo stakes, while the beds and borders can be plotted by bending a rubber hose in the desired pattern. Paths, hedge, or screen area can also be marked with stakes. Before implementing the plan, some compounds may need a little dressing-up like cleaning, leveling, and tidying-up.

Roof garden

A spacious and well-planned roof garden can be a place of joy and recreation. In bigger cities many of the large hotels and public buildings are developing this type of gardening. Depending upon the sun and the shade, the climate, the size of the roof, etc., the following plants are recommended for growing in the roof garden (Shrestha, 2001).

Flowering annuals: Antirrhinum, stocks, dwarf sweet pea, pansy, dahlia, chrysanthemum, marigold, sweet alyssum, phlox, pinks (Dianthus) and verbena.

Herbaceous perennials: *Pelargoniums, Michaelmas daisy, Canna, Mirabilis jalaba, Portulaca, Solidagocadanensis*

Trees: One or two drawf trees such as *Plumeria sp., Callistemon lanceolatus* and *Gliricidamaculata* can be grown as specimen plants. Some large to medium trees such as *Araucaria cookii, Mimusopselengi, Brassaiaactinophylla*, etc., can also be grown tillthey are young.

Vertical gardening

In cities people living in flats have very little space for the conventional type of gardening, but can easily afford to put up a vertical garden. A vertical garden can be shifted from place to place and even used as an ornamental partition in the drawing room (Gadgil and Vartak, 1976).

Since the aeration and the drainage of the medium are perfect, shallow-rooted plants needing very little anchorage will grow well. The vertical garden should be planted with either sun-loving dwarf or trailing flowering annuals such as Alyssum, Pansy & Nasturtium etc. or shade loving foliage plants such as *Fittonia, Peperomia, Oxalis, Zebrinapendula* etc., or flowering begonias. The vertical garden is provided with legs on the sides to enable it to stand on its own (Jamir and Pandey, 2003).

Children's park, school and recreational garden

The concern for the plants, love for plants and knowledge about plants have to be imparted to the younger generations along with other educational activities. A good relationship and interaction with plants will pave way for a better environment, healthy family, peaceful societies, stable government, etc (Khan et al., 1997).

Presenting attractive plants to the children will create interest and love among children. Gardening kits for children is another important aspect to be considered. Small handy gardening tools given to the children will automatically tempt them to use and involve them in gardening activities. Several studies have shown that plants have a positive effect on the body, mind and soul. Gardens and gardening activities have been utilized for improving not only the physical health but also the mental health. Mentally handicapped people can be rehabilitated easily by bringing them to the gardens and allowing them to participate in the garden activities (Khumbongmayum et al., 2005).

Landscape gardening for children's parks and school

Industrial area

The primary aim in a factory garden will be to plant trees to arrest the drifting dust and smoke and to cut down noise. Another important aim is to provide ample shade and coolness so that the workers get a respite under the coolness of trees from the hostile hot interior of the factory. Moreover, the trees bring down the temperature in the factory premises to a considerable extent. The places where garden can be laid in the factory area are canteen, rest-shed, hospital, administrative building, etc (Mgumia and Oba, 2003).

The basic component of industrial area landscaping includes hardscape material as usual having both decorative and functional use, and plant materials that have more significant different uses and importance. The plants should be aesthetic as well as pollution reductants. Some of the plants that can tolerate sulfur dioxide are *Casuarina, Albizzia, Acacia nilotica, Delonixregia, Moringaoleifera, Eucalyptus, Morusalba*. The plants that can sustain Fluoride are: *Ailanthus excels, Cassia fistula, Eucalyptus, Ficus sp., Thujacompacta, Artocarpus, Pithecelobiumdulce* (Oviedo et al., 2005).

Public places

The government and private offices, courts, auditorium, cinema halls etc. fall under this group. In large cities with paucity of space for gardening, growing plants in pots is the only possibility. But where space is available, a lawn may be laid with a few flower beds and shrub borders. The entrance and exit roads may be lined with flowering trees. The kind and the size of the trees will depend upon the size of the building. Dwarf trees in front of a sky-scraper will be a total misfit. Majestic-looking, non-spreading large trees will be the right choice for such buildings (Marriot, 1978).

Road landscaping

It is that branch of landscape planning which aims at aligning roads in a visually aesthetic manner. Whereas landscape planning is that branch of planning which aims at designing human settlements of all sizes keeping in mind the natural resources such as vegetation, water, air, minerals etc. It aims at making development ecologically sensitive which in turn makes it sustainable. There is a wide variety in the scale at which landscape planning can be carried out. When it is done at the regional scale, the emphasis is on land utilization and locating human settlements with respect to natural resources. Landscape planning can be carried out till site planning level e.g. designing the landscape of group housing. As we move from macro to micro, the landscape becomes more contrived i.e. manmade.

Road landscaping forms an integral part of landscape planning from urban design viewpoint. It aims at making cities and towns more comfortable places to live in, aesthetically and visually more pleasant-looking (Planning Tank, 2017). Landscape planning takes into account the existing landscape of an area, topography, vegetation, natural drainage patterns, wind directions, temperature, humidity etc. it aims at investing in nature for the benefit of humans. It also studies how strong natural settings are e.g. many more types of settlements can come up in plains as opposed to hilly areas as the former type of terrain offers greater flexibility in development. Mountainous terrain has less dense developments due to physical barriers. Landform dictates the built form to a large extent.


Avenue trees/Pathways

Characteristics and features of Road Landscaping

It is important to landscape roads as they are the channels of movement and it is desirable to make the experience on them comfortable and pleasant. A road should be landscaped suitably with respect to the hierarchy of the road. The height, spread and bulk of the trees should be in proportion with the width of the road and height of abutting buildings (Planning Tank, 2017). Highways and regional roads are more exposed to winds than urban roads which have buildings around them. Roads also have recreational and tourism importance. Suburban roads have a greater potential for landscaping due to the greater availability of land. Additionally it serves following purposes:

- Roadside plantation acts as noise buffers. For this purpose, sunken roads can be created as when the noise source disappears, psychological impact of noise also decreases. Mounds with trees can be planted as foliage absorbs noise. For this purpose, trees with thick and dense foliage (evergreens) should be chosen. Dust and other particulate matter settles on leaves which decreases pollution in the air. The leaves through their pores absorb smoke and other gases, which further helps in purifying the air.
- Trees have a cooling effect in hot climates.
- Plantation on the median help in decreasing glare from the oncoming direction which decreases chances of accidents.
- When different kinds of trees are planted on different roads, they help in giving the roads an identity which helps people find their bearings.
- Roadside plantation provides shade for pedestrians.

Consideration while performing road landscaping

The landscape elements should be such that they complement the existing landscape and built structure. Landscaping should not be jarring. It should give the road users pleasant views. On highways, row plantation and trees in clusters can be used. Breaks in between the clumps provide road users with views of the surrounding landscapes (Planning Tank, 2017). Without changing the width of the carriage way, the right of way can be changed by modifying the footpaths and medians. Landscaping should be harmonious with the existing landscape, but at the same time should provide adequate variety and contrast. Fencing should not be monotonous. The carriageway can be modulated. Intersections are important visual nodes. Selective cutting of trees should take

place in such a manner that views are created. Topography can be flat, gently sloping, steep or undulating. Very undulating road alignment can be jarring. It is desirable to have water bodies along roads. Harmony should not lead to monotony due to repetition of landscape elements. Road landscaping should be in context with the surroundings. Surrounding landscape can give cue about the environment.

Conclusion

A landscape is the visible features of an area of land, its landforms, and how they integrate with natural or man-made features. Landscape gardening is an art and science of decorating the piece of land with hardscape and softscape materials under the guidance of design principles using design elements to make a cohesive design in a collaboration/partnership of horticulturist and architect/engineer that is more amenable and functional. Thus it creates more naturalistic and picturesque effect and makes the land more beautiful, convenient, pleasurable and private.

The importance landscape gardening in modern times, urbanization and over concretization has gone further in modern days as they are not only known for amenity but also with the new dimension that is horticultural therapy. It is a money spinner business and people who are involved in designing and preparing landscape gardens are earning handsome money.The "art" is always changing as the plants grow environmental conditions change and people use the space. For this reason, both customer and landscape designersuse a design process that systematically considers all aspects of the land, environment, growing plants needs of the user to ensure a visually pleasing, functional and ecologically healthy design. It certainly move against the over concretization of urban areas.

References

Bhattarai, K.R. andBaral, S. 2008. Potential role of sacred grove of Lumbini in biodiversityconservation in Nepal. BankoJanakari, 1.

Dash, S.S. 2005. Kabi sacred grove of North Sikkim. Current Science 89: 427-428

Gadgil, M. and Vartak, V.D. 1976. The sacred groves of Western Ghats in India. EconomicBotany, 30:152–160

Jamir, S.A. and Pandey, H.N. 2003. Vascular plant diversity in the sacred groves of Jaintia Hills in northeast India. Biodiversity and Conservation 12:1497-1510.

Khan, M.L., Menon, S. and Bawa, K.S. 1997. Effectiveness of the protected area network in biodiversity conservation: a case study of Meghalaya state. Biodiversity and Conservation, 6:853–868.

Khumbongmayum, A.D., Khan, M.L. and Tripathi,R.S. 2005. Sacred groves of Manipur, northeast India: biodiversity value, status and strategies for their conservation. Biodiversity and Conservation, 14:1541–1582

Marriot, B.M. 1978. A preliminary report on the feeding behavior of Rhesus monkey (Macacamulatta) in Kathmandu, Nepal. Nature Annual, Nepal Nature Conservation Society, Kathmandu, II:68–72.

Mgumia, F.H. and Oba, G. 2003. Potential role of sacred groves in biodiversity conservation in Tanzania. Environmetal Conservation, 30:259- 265

Nijhous, S. 2013. Principles of Landscape Architecture. Flowerscapes, 54-55

Oviedo, G., Jeanreunad, S., andOtegui, M. 2005. Protecting Sacred Natural Sites of Indigenous and Traditional Peoples: an IUCN Perspective. Gland, Switzerland.

Patel, M. 2018. Landscape Gardening. Commercial Horticulture, 513-520

Planning Tank. 2017. Planning Tank: happy, healthy and sustainable human settlements. (https://planningtank.com/urbanisation/road-landscaping)

Shrestha, S. 2001. An ecological study of trees of Shleshmantak forest, Pashupati Development Area, Kathmandu. MSc. Dissertation, Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu, Nepal.

Thompson. 2008. Ecology, Community and Delight. Sources ofvalues in landscape architecture. London & New York.

Vroom, M. 2006. Lexicon of garden and landscape architecture. Berlin

Wadley, R. L. and Colfer, C.J.P. 2004. Sacred forests, hunting, and conservation in west Kalimantan, Indonesia. Human Ecology 32:313-338.

Wyer, J. 2012. When is a garden designer a landscape designer? Indeed, when is a garden a landscape – or vice-versa?https://www.bowleswyer.co.uk/when-is-a-garden-designer-a-landscape-designer-indeed-when-is-a-garden-a-landscape-or-vice-versa/

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मौसमी फुल, कार्पेट ग्रास र गार्डेन डिजाईनका
लागि हामीलाई सम्झनुहोस् ।

Plant Growth Regulators (Plant Hormones): Application in Floriculture

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Introduction

Ornamental plants include a wide range of species such as annuals, biennials and perennials, cut foliage, cut flowers, bedding plants, indoor and outdoor plants, potted plants, bulbous plants (Sajjad et al., 2017). The trade of ornamental plants in the world is over 100 billion USD and is growing 15% per annum (Alhajhoj, 2017). As demand of ornamental plants is getting higher, so to meet this demand the growers involved in ornamental industry adopt various strategies such as application of organic and inorganic fertilizer, manipulation of plant environment including temperature, light, and the use of plant growth regulators (PGRs) (Alhajhoj, 2017). PGRs has been used in floriculture since 1940 with the aim of controlling vegetative, reproductive and postharvest developmental process (Basra, 2000).The global plant growth regulators market size was valued at USD 4.67 billion in 2016. It is projected to exhibit a Compound Annual Growth Rate (CAGR) of 8.6% from 2014 to 2020 (Grand View Research, 2017).The ornamental plants (flowering and potted) produced in 2014 in the world has a value of 32 billion euro and the contribution of Europe alone is 34.3% followed by China (15.9%) (AIPH, 2015). According to The International Association of Horticultural Producers (AIPH, 2015), the area under flower production in different countries of the world was 702,383 ha, among this total area in Europe was 48,705 ha, 1,067 ha in North America, 523,829 ha in Asia, 4,026 ha in middle East, 7,604 ha in Africa, 21,067 ha in North America and 97,152 ha in South America.

Plant growth regulators (PGRs) are organic molecules, which are produced synthetically, and which is used in the alteration of growth and development of plant and plant parts (Sajjad et al., 2017). In plants, developmental processes are regulated by the action and balance of the different groups of growth regulators either acting as promoters or inhibitors in these processes (Mostafa and Alhamd, 2011). American Society for Horticultural Science classified plant growth regulators into six classes: auxins, gibberellins, cytokinins, ethylene generators, growth inhibitors and growth retardants (Pal, 2019). PGRs are applied for a specific purpose to elicit specific plant responses. Plant growth regulators (PGRs) such as auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, jasmonates, salicylates etc are commonly used in ornamental industry for nursery production, several flowering crops, and ornamental foliage plant (Sanap et al., 2000).

In ornamental plant culture, the majority of plant growth regulators are chemical growth retardants to control the size of plants, improve compactness and enhance flowering (Marosz and Matysiak, 2005). These compounds have also the ability to resist the negative effects of water stress (Navarro et al., 2007) and low temperature in winter (Fletcher et al., 2000). Generally, application of gibberellins increases stem extension, ethylene aborts flower buds and auxin promotes the rooting of cuttings (Runkle, 2009).

In ornamental plants, application of PGRs alters the various characteristics which include the increase or reduction in height of plant (Currey and Lopez, 2010), increase in number of flowers

(Carey et al.,2013), increase compactness in plants (Meijón et al.,2009), increase in number of lateral shoots (Wróblewska and Debicz, 2013), early flowering (Cardoso et al., 2010), delay in flowering (Taha, 2012), delayed senescence (Duan et al., 2006), control of sex ratio in flowers (Sajjad et al., 2017), increase flower life (Khandaker et al.,2013), resistance against pathogen (Pozo et al., 2004), induce systemic acquired resistance against diseases (Darras et al., 2011), breaking dormancy (Gashi et al., 2012), improve seed germination (Khan et al.,2004), reduce the vernalization requirement (Wang and Walter, 2006), and increase vase life (Iqbal et al.,2012). Among these functions of the PGRs in the ornamental plants, reducing shoot elongation and promoting lateral branching and flowering is of much greater relevance (Rademacher, 2015). The paper aims to highlight the use of plant growth regulators in growth and development as well as manipulation of plants for the specific purpose to meet the national and international consumers' demand.

Use of PGR

Growth of Plant

- Growth retardant is commonly used to prevent excessive elongation of stem (Sachs et al.,1975) and reduce internode length in plants (Kuehny et al.,2001).
- In floriculture, growth retardants are commonly used to control the height of plants (Pasian, 1999) but there may be increase in number of lateral shoots or the growth of vegetative shoots developing beneath the flower may suppress which results in a larger number of inflorescence (Whealy et al.,1988).
- It has been reported that several PGRs can be used to produce the shorter ornamental plants, such as ancymidol, paclobutrazol, ethephon and uniconazole (Bailey and Miller, 1989).
- Application of plant growth retardant (paclobutrazol) is used in some potted plants like Easter lilies to produce compact plants (Currey and Lopez, 2010; Gaston, 2001).
- Plant growth regulators, triazoles also reduce stem elongation as it inhibits the synthesis of ent-kaurene (precursor for the synthesis of GA) (Basra, 2000).
- In ornamental crops, a compound of the trizole group, paclobutrazol (PAC) is used extensively (Marosz and Matysiak, 2005).
- Besides this, Daminozide is also very popular in inhibition of shoot growth (Marosz and Matysiak, 2005), this also inhibits the biosynthesis of GA.
- Likewise, chlormequat chloride is also a chemical growth retardant used in controlling the shape of ornamental plants by blocking the biosynthesis of GA at a different step (Basra, 2000).
- Trees, which are planted for ornamental purpose in parks, historic downtowns, and residential areas, are difficult to do pruning and trimming. In this condition, if the paclobutrazol is applied through soil injection or soil drenching or flurprimidol through stem injection then the tree canopy could be maintained (Chaney, 2005).
- In the production of herbaceous ornamentals, application of GA_3 produces longer stems or peduncles (Rademacher, 2015).
- Application of gibberellic acid (GA_3) enhanced the vegetative growth of *Zantideschia aethiopica* plants (Attia, 2004).
- In *Sterliziareginae*, spraying of GA_3 at 100-200ppm improved the vegetative growth parameters (Youssef, 2004).

- Similarly, in *Acanthus mollis*, application of GA_3 enhanced vegetative growth measurements (Mostafa and Alhamd, 2011).
- GA_3 increases mobilization of starch in cotyledons by increasing amylase activity, which enhanced germination and seedling growth changing the activities of enzymes in carbohydrate metabolism (Kaur et al.,2000).
- Pal (2019) reported that, stem diameter, early seed ripening, fresh weight of flower and seed yield was maximum with the application of kinetin @ 200 ppm as compared to other levels in marigold.
- Application of ethrel and B-nine retarded plant height, number of nodes and intermodal length in ornamental plants (Pal, 2019).

Lateral Branching

- Some of the PGRs which enhances lateral branching are ethylene (Florel), benzyladenine (BA), dikegulac sodium and methyl easters, called plant pinchers as they inhibit the growth of the terminal shoots or enhance the growth of lateral buds, which increases the number of lateral branches (Latimer and Whipker, 2013). These PGRs replaces the mechanical pinching of many crops like Vinca vine, Verbena, Lantana, and English ivy.
- Application of Florel (ethylene releasing compound) is commonly used on zonal and ivy geraniums and poinsettias to increase lateral branching (Latimer and Whipker, 2013).

Rooting

- Auxin tiggers the adventitious root formation in stem cutting of several ornamental plant species (de Klerk et al., 1999).
- High level of auxin is needed in the basal region of the cuttings to resume proliferation and to initiate root development (Ahkami et al., 2013).
- After the induction of adventitious root formation, the auxin levels in the base of stem cutting of ornamental plant (e.g. Carnation) declines and remain in steady state and which remains constant if auxin is applied exogenously in later stages of primordial outgrowth (Cano et al., 2014; de Klerk et al., 1999).
- Cytokinins also have an important role in adventitious rooting (Konieczny et al., 2009).
- Application of cytokinin in the stem cuttings suppressed the adventitious root formation (De Klerk et al., 2001).

Flowering

- Flower production is influenced by the application of plant growth regulators and it can advance or delay flowering depending on the species and timing of application (Yuceer et al., 2003).
- Generally, application of GA_3 in certain species of ornamental plants increases flowering (Rademacher, 2015).
- Paclobutrazol promotes initiation of flower bud and induction of precocious flowering in diverse species (Yuceer et al., 2003).
- As paclobutrazol inhibits the GA biosynthesis, this reduces vegetative growth and the availability of assimilates to the apex increases which leads to flower initiation (Katz et al., 2003).

- Dorajeerao and Mokashi (2011) reported that the foliar spray of cycocel at 3000ppm produced maximum number of flowers per plant as compared to other concentrations.
- Similarly, there is increase in flower and seed yield when SA (Salicylic acid) sprays at 100 ppm. A higher number of flowers per plant were recorded with the application of paclobutrazol at 40 ppm compared to 60 and 80 ppm (Pal, 2019). Application of GA3 at 100 ppm gave maximum flower quality in terms of average flower weight, flower diameter and seed quality (Pal, 2019).
- Application of ethrel (300 ppm) exhibited delayed flowering, minimum flowering duration and reduced spike length in tuberose (Mandal, 2017).

Senescence

- Combined application of cytokinin and gibberellic acid @ 100 ppm and 200 ppm respectively prevented the chlorosis of leaf and senescence in compositae family (Nicole et al., 2010).

Postharvest

- In ornamental plants, 1-MCP is used to prevent premature wilting, premature flower opening, leaf yellowing, and premature death during storage and transportation (Serek et al., 1994).
- When exogenous ABA is applied in vase solution, it accelerates senescence process in the flowers because of enhanced membrane leakage, reduced water uptake, reduced fresh weight and decrease the vase life of flowers in gladiolus (Kumar et al., 2014).

Dormancy

- Seed dormancy and germination is controlled by a dynamic balance between synthesis and catabolism of two antagonistic hormones: ABA and GA_3 (Rodríguez-Gacio et al., 2009).
- GA_3 is used to break the dormancy of gladiolus corms as its application induces the formation of hydrolytic enzymes, which regulates the mobilization of reserves (Groot and Karssen, 1987).
- GA_3 interacts with the inhibiting action of ABA. When the corm of gladiolus is dipped at various concentration of ethrel for 30 minutes, the sprouting was enhanced and ethrel @ 1000 ppm enhanced sprouting in high temperature stored corms (Halevy et al., 1970).

Some other typical examples of PGRs use in floriculture

Name of PGRs	Name of crops (use in ornamental plants and cutflowers)	Application dose and time	References
Auxin	Orchids- for seed germination, seedling growth	All are foliar spray	Arditti (1967)
	Chrysanthemum- increase in plant height	NAA Upto 100 ppm	Pal (2019)
	Gladiolus – increased flowering and corm production –increased sugar content in petal and leaves	IAA @100 mg/l 200 mg/l	Pal (2019)

Name of PGRs	Name of crops (use in ornamental plants and cutflowers)	Application dose and time	References
	Tuberose – highest number of leaves	NAA @75ppm	Bharathi and Kumar (2009)
GA_3	Marigold – increased plant height, increased number of primary and secondary branches, plant spread, early flower bud initiation	@200ppm	Kumar et al. (2010) Anuradha et al. (2017)
	Chrysanthemum – increases plant height Advanced flower bud initiation and blooming	@150 ppm @100ppm	Singh et al. (2018) Gupta et al. (2001)
	Orchids- negative effects like decrease in leaf numbers, sign of chlorosis		Arditti (1984)
	Gerbera – early flower bud initiation	@150 ppm	Jamal Uddin et al. (2014)
	Sterliziareginae (improved the vegetative growth parameters)	100-200ppm	Youssef (2004)
	Enhanced the vegetative growth of *Zantideschia aethiopica* plants		Attia (2004)
	Good flower quality in terms of average flower weight, flower diameter and seed quality	100ppm	Pal (2019)
Cytokinins	Terrestrial orchids – inhibition, no effect or stimulation in seed germination Tuberose- increased flower diameter	BAP and kinetin @ 200ppm	Bharathi and Kumar (2009)
	Marigold (stem diameter, early seed ripening, fresh weight of flower and seed yield increases)	200ppm	Pal (2019)
Cytokinin + gibberellic acid	Composite family (prevented the chlorosis of leaf and senescence)	100ppm & 200ppm resp.	Nicole et al. (2010)
Ethrel	Gladiolus (enhanced sprouting in high temperature stored corms)	100ppm	Halevy et al. (1970)
	Tuberose (delayed flowering, minimum flowering duration and reduced spike length)	300ppm	Mandal (2017)
	Ethrel retarded plant height, number of nodes and intermodal length in ornamental plants		Pal (2019)

Name of PGRs	Name of crops (use in ornamental plants and cutflowers)	Application dose and time	References
Ethylene	Marigold- dwarfing effect Tuberose – maximum number of florets and spike length and flowering duration (kalyani double var.) - early spike emergence, floret opening and maximum number of spikes/m^2 Orchids – no promotion in flowering and high concentrations cause defoliation	Upto 400 ppm Upto 300 ppm	Kumar et al. (2010) Pal (2019) Hew and Clifford (1993)
ABA	Enhances senescence, not used in floriculture		Kumar et al. (2014)
	ABA is applied in vase solution, it accelerates senescence process in the flowers and decrease the vase life of flowers in gladiolus		
Growth retardants	Chrysanthemum – luxurious increase in spread of plant, increased no. of branches and leaves , reverse effect on first flower bud appearance, increase in length of flower stalk and no. of flowers	CCC @ 5000 ppm	Talukdar and Paswan, 1998 Deotale et al. (1994)
Cycocel	Chrysanthemum- (produces maximum number of flowers per plant)	3000ppm	Dorajeerao and Mokashi(2011)
Salicylic acid	Increase in flower and seed yield	100ppm	Dorajeerao and Mokashi(2011)
Paclobutrazol	Increase in number of flowers	40ppm	Pal (2019)
	Easter lilies to produce compact plants		Currey and Lopez (2010)

Conclusion

Commercial growers have to adopt various strategies such as application of organic and inorganic fertilizer, manipulation of plant environment including temperature, light, humidity, and the use of plant growth regulators to meet the national as well as international demand of ornamental plants. Higher investment and advance technology is required to manipulate the environmental factors such as temperature, light and humidity to produce the demand oriented quality plants and flowers on a seasonal basis, the alteration directly goes to judicious use of PGRs including the management of organic and inorganic fertilizers in the Nepalese context. Application of PGRs alters the various characteristics which include increase or reduction in height of plant, increase in number of flowers, increase compactness in plants, increase in number of lateral shoots, early in flowering, delay in flowering, delayed senescence, control of sex ratio in flowers, increase flower

life, resistance against pathogen, induce systemic acquired resistance against diseases, breaking dormancy, improve seed germination, reduce the vernalization requirement, and increase vase life. The use of PGRs in ornamental plants also enhances the quality of plant, flowers as well as seeds. Therefore, in our context, growers should focus tothe appropriate use of different plant growth regulators for the manipulation of growth and development ofdifferent ornamental plants to meet the season specific demand of the commodities.

References

Ahkami, A. H., Melzer, M., Ghaffari, M. R., Pollmann, S., Javid, M. G., Shahinnia, F., Hajirezaei M. R., and Druege, U. 2013. Distribution of indole-3-acetic acid in Petunia hybrida shoot tip cuttings and relationship between auxin transport, carbohydrate metabolism and adventitious root formation. Planta, 238(3), 499-517.

AIPH. 2015. International Association of Horticultural Product. Available online at http://aiph.org

Alhajhoj, M. R. 2017. Effects of Foliar Application of Plant Growth Regulators on Growth and Flowering Characteristics of Chrysanthemum CV. Paintball. Pakistan Journal of Life & Social Sciences, 15(2).

Anuradha, R. W., Sateesh, R. P., Priyanka, T. K., Naveenakumar and Kulakarni, B. S. 2017. Effect of Growth Regulators and Pinching on Vegetative, Flowering and Flower Yield Parameters in African Marigold cv Culcatta Orange. Int. J. Pure App. Biosci 5, 989-994.

Arditti, J. 1967. Factors affecting the germination of orchid seeds. The Botanical Review 33, 1-97.

Arditti, J. 1984. Physiology of germinating orchid seeds. Orchid biology: reviews and perspectives 3.

Attia, A. 2004. Physiological studies on some ornamental bulbs. Ph. D. Thesis, Faculty of Agriculture, Kafr El-Sheikh, Tanta University, Egypt.

Bailey, D. and Miller, W. 1989. Whole-plant response of Easter lilies to ancymidol and uniconazole. Journal of the American Society for Horticultural Science (USA).

Basra, A. 2000. Plant growth regulators in agriculture and horticulture: their role and commercial uses: CRC Press.

Bharathi, T. and Kumar, S. 2009. Effect of growth regulators on growth and flowering parameters of tuberose cv. Suvasini. Advances in Plant Sciences 22, 127-128.

Cano, A., Pérez-Pérez, J. M., and Acosta, M. 2014. Adventitious root development in ornamental plants: insights from carnation stem cuttings Root Engineering (pp. 423-441): Springer.

Cardoso, J. C., Ono, E. O., and Rodrigues, J. D. 2010. Gibberellic acid and water regime in the flowering induction of Brassocattleya and Cattleya hybrid orchids. Horticultura Brasileira, 28(4), 395-398.

Carey, D. J., Fair, B. A., Buhler, W., McCall, I., and Whipker, B. E. 2013. Growth control and flower promotion of Salvia with benzyladenine foliar sprays. Journal of Applied Horticulture, 15(2).

Chaney, W. 2005. Growth retardants: A promising tool for managing urban trees. Purdue Extension document FNR-252-W.

Currey, C. J. and Lopez, R. G. 2010. Paclobutrazol pre-plant bulb dips effectively control height of 'Nellie White'easter lily. HortTechnology, 20(2), 357-360.

Darras, A., Joyce, D., and Terry, L. 2011. Methyl jasmonate and acibenzolar-S-methyl protect cut Freesia hybrida inflorescences against Botrytis cinerea, but do not act synergistically. The Journal of Horticultural Science and Biotechnology, 86(1), 74-78.

De Klerk, G.-J., Hanecakova, J., and Jasik, J. 2001. The role of cytokinins in rooting of stem slices cut from apple microcuttings. Plant Biosystems-An International Journal Dealing with all Aspects of Plant Biology, 135(1), 79-84.

de Klerk, G.-J., van der Krieken, W., and de Jong, J. C. 1999. Review the formation of adventitious roots: new concepts, new possibilities. In Vitro Cellular & Developmental Biology-Plant, 35(3), 189-199.

Deotale, A.B., Belorkar, PLV., Patil, S.R., Zode, V.N., and Keche, M.B. 1994. Effect of date of planting and foliar spray of GAa onflowering and yield of chrysanthemum. Journal of Soils and Crops,4(2):148-151.

Dorajeerao, A. and Mokashi, A. 2011. Yield and quality parameters of garland chrysanthemum (Chrysanthemum coronarium L.) as influenced by pinching time. Mysore Journal of Agricultural Sciences, 45(2), 326-331.

Duan, H., Li, Y., Pei, Y., Deng, W., Luo, M., Xiao, Y., Luo, K., Lu, L., Smith, W.,and Mcavoy, R. J. 2006. Auxin, Cytokinin and Ab sei sic Acid: Biosynthetic and Catabolic Genes and Their Potential Applications in Ornamental Crops. Journal of crop improvement, 18(1-2), 347-364.

Fletcher, R. A., Gilley, A., Sankhla, N., and Davis, T. D. 2000. Triazoles as plant growth regulators and stress protectants. Horticultural reviews, 24, 55-138.

Gashi, B., Abdullai, K., Mata, V., and Kongjika, E. 2012. Effect of gibberellic acid and potassium nitrate on seed germination of the resurrection plants Ramonda serbica and Ramonda nathaliae. African Journal of Biotechnology, 11(20), 4537-4542.

Grand View Research. 2017. Market Research Report: plant growth regulators (PGRs) market size, share and trends analysis report by product (Cytokinins, auxins), by region (North America, Europe, Asia Pacific, RoW), vender landscape, and segement forecasts, 2012-2020. https://www.grandviewresearch.com/industry-analysis/plant-growth-regulators-market

Groot, S. and Karssen, C. 1987. Gibberellins regulate seed germination in tomato by endosperm weakening: a study with gibberellin-deficient mutants. Planta, 171(4), 525-531.

Gupta, V., Datta, S., and Banerji, B. 2001. Influence of Gibberellic Acid (GA3) on Growth and Flowering in Chryanthemum (Chrysanthemum morifolium, Ramat) cv. Jayanti.

Halevy, A., Shilo, R., and Simchon, S. 1970. Effect of 2-chloroethanephosphonic acid (Ethrel) on health, dormancy, and flower and corm yield of gladioli. Journal of Horticultural Science, 45(4), 427-434.

Hew, C. S. and Clifford, P. E.. 1993. "Plant growth regulators and the orchid cutflowerindustry," Plant Growth Regulation 13: 231–239.

Iqbal, D., Habib, U., Abbasi, N. A., and Chaudhry, A. N. 2012. Improvement in postharvest attributes of zinnia (Zinnia elegans cv. benary's giant) cut-flowers by the application of various growth regulators. Pak. J. Bot, 44(3), 1091-1094.

Jamal Uddin, A., Mehraj, H., Taufique, T., Ona, A., and Parvin, S. 2014. Foliar application of gibberellic acid on growth and flowering of gerbera cultivars. J. Biosci. Agric. Res 2, 52-58.

Katz, E., Ziv, O., Venkatachalam, R., Shlomo, E., Halevy, A. H., and Weiss, D. 2003. Promotion of Globularia sarcophylla flowering by Uniconazol, an inhibitor of gibberellin biosynthesis. Scientia Horticulturae, 98(4), 423-431.

Kaur, S., Gupta, A. K., and Kaur, N. 2000. Effect of GA3, kinetin and indole acetic acid on carbohydrate metabolism in chickpea seedlings germinating under water stress. Plant Growth Regulation,

30(1), 61-70.

Khan, M. A., Gul, B., and Weber, D. J. 2004. Action of plant growth regulators and salinity on seed germination of Ceratoides lanata. Canadian Journal of Botany, 82(1), 37-42.

Khandaker, M. M., Faruq, G., Rahman, M. M., Sofian-Azirun, M., and Boyce, A. N. 2013. The influence of 1-triacontanol on the growth, flowering, and quality of potted bougainvillea plants (Bougainvillea glabra var."Elizabeth Angus") under natural conditions. The Scientific World Journal, 2013.

Konieczny, R., Kępczyński, J., Pilarska, M., Cembrowska, D., Menzel, D., and Šamaj, J. 2009. Cytokinin and ethylene affect auxin transport-dependent rhizogenesis in hypocotyls of common ice plant (Mesembryanthemum crystallinum L.). Journal of plant growth regulation, 28(4), 331.

Kuehny, J. S., Painter, A., and Branch, P. C. 2001. Plug source and growth retardants affect finish size of bedding plants. HortScience, 36(2), 321-323.

Kumar, M., Singh, V., Arora, A., and Singh, N. 2014. The role of abscisic acid (ABA) in ethylene insensitive Gladiolus (Gladiolus grandiflora Hort.) flower senescence. Acta Physiologiae Plantarum, 36(1), 151-159.

Kumar, R., Ram, M., and Gaur, G. 2010. Effect of GA3 and ethrel on growth and flowering of African marigold cv. Pusa Narangi Gainda.

Latimer, J. G. and Whipker, B. 2013. Selecting and using plant growth regulators on floricultural crops.

Mandal, M. 2017. Studies on the Effect of Cytokinin on Growth and Quality Production of African Marigold (Tagetes erecta L.) CV. Pusa Narangi Gainda, M.Sc. Thesis. Uttar Banga Krishi Viswavidyalaya.

Marosz, A. and Matysiak, B. 2005. Influence of growth retardants on growth and flower bud formation in rhododendron and azalea. Dendrobiology, 54, 35-40.

Meijón, M., Rodríguez, R., Cañal, M. J., and Feito, I. 2009. Improvement of compactness and floral quality in azalea by means of application of plant growth regulators. Scientia Horticulturae, 119(2), 169-176.

Mostafa, G. G. and Alhamd, M. A. 2011. Effect of gibberellic acid and indole 3-acetic acid on improving growth and accumulation of phytochemical composition in Balanites aegyptiaca plants. American Journal of Plant Physiology, 6(1), 36-43.

Navarro, A., Sanchez-Blanco, M. J., and Bañon, S. 2007. Influence of paclobutrazol on water consumption and plant performance of Arbutus unedo seedlings. Scientia Horticulturae, 111(2), 133-139.

Nicole, L., John, F., and Michelle, L. 2010. Benzyladenine and Gibberellin prevent leaf chlorosis in compositae family. Horticulture Science, 45(6), 925-993.

Pal, S. 2019. Role of plant growth regulators in floriculture: An overview. Journal of Pharmacognosy and Phytochemistry, 8(3), 789-796.

Pasian, C. 1999. Response of Dendranthema grandiflora (Ramat) to three plant growth regulators in container paint mix applications. Scientia Horticulturae, 80(3-4), 277-287.

Pozo, M. J., Van Loon, L., and Pieterse, C. M. 2004. Jasmonates-signals in plant-microbe interactions. Journal of plant growth regulation, 23(3), 211-222.

Rademacher, W. 2015. Plant growth regulators: backgrounds and uses in plant production. Journal of plant growth regulation, 34(4), 845-872.

Rodríguez-Gacio, M. d. C., Matilla-Vázquez, M. A., and Matilla, A. J. 2009. Seed dormancy and ABA

signaling: the breakthrough goes on. Plant signaling & behavior, 4(11), 1035-1048.

Sachs, R., DeBie, J., Michael, J., Frank, J., and Creager, R. 1975. Comparative Growth Retarding Activity in Relation to Endogenous Tissue Concentration of Daminozide and a Pyrrolidino Analog (Uni-629) in Phaseolus vulgaris L. and Chrysanthemum morifolium Ramat. J. Amer. Soc. Hort. Sci. 100: 593-597.

Sajjad, Y., Jaskani, M. J., Asif, M., and Qasim, M. 2017. Application of plant growth regulators in ornamental plants: a review. Pakistan Journal of Agricultural Sciences, 54(2).

Sanap, P., Patil, B., and Gondhali, B. 2000. Effect of growth regulators on quality and yield of flowers in tuberose (Polianthes tuberose L.) cv. Single. Orissa Journal of Horticulture, 28(1), 68-72.

Serek, M., Sisler, E. C., and Reid, M. S. 1994. Novel gaseous ethylene binding inhibitor prevents ethylene effects in potted flowering plants. Journal of the American Society for Horticultural Science, 119(6), 1230-1233.

Singh, J., Nigam, R., Singh, R., Kumar, A., and Kumar, A. 2018. Effect of gibberellic acid and cycocel on growth, flowering and yield of chrysanthemum (Dendranthema grandiflora ramat) cv. birbal sahni

Taha, R. A. 2012. Effect of some growth regulators on growth, flowering, bulb productivity and chemical composition of iris plants. J. Hortic. Sci. Ornam. Plants, 4(2), 215-220.

Talukdar, M.C. and Paswan, L.. 1998. Effect of GAs and CCC on growthand flowering of standard chIysanthemums. Journal of OrnamentalHorticulture, New Series, 1(11): 11-16.

Wang, J. and Walter, V. 2006. Effect of vernalization and plant growth regulators on flowering of Ornithogalum'Chesapeake Snowflake'. Agric. Sci. Tech, 7, 23-28.

Wróblewska, K. and Debicz, R. 2013. Influnce of time of benzyladenine application on rooting of cuttings and subsequent development of Portulaca umbraticola kunth. Acta Scientiarum Polonorum-Hortorum Cultus, 12(1), 89-99.

Youssef, A. S. M. 2004. Physiological studies on growth and flowering of Strelitzia reginae Ait. Plant. Ph. D. Thesis, Fac. of Agric., Moshtohor, Zag. Univ.

Yuceer, C., Kubiske, M. E., Harkess, R. L., and Land Jr, S. B. 2003. Effects of induction treatments on flowering in Populus deltoides. Tree physiology, 23(7), 489-495.

सिष्टता नर्सरी
SISTATA NURSERY

रिङ्गरोड, थसीखेल, ललितपुर, फोनः ०१–५५३२५९४
(महालक्ष्मी पार्टी प्यालेसको पछाडि)

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Postharvest Management of Cut Flowers: Using Chemicals and Preservatives

Nirmala Acharya, M.Sc. Ag. Student, IAAS
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Introduction

Cut flowers are the cuttings of ornamental plants (Da Silva, 2003). Specialist and florist are interested on production of cut flowers as they can be boxed, shipped dry and stored for long periods (Redman et al., 2002). Today, flora business worth more than US$ 100 billion at global level, which is expanding day by day and with an annual average growth rate of around 10-15 percent. Cut flowers are the 337th most traded product and the 1122nd most complex product according to the product complexity index (PCI)(OEC, 2020). Cut flower business has shown steady and continuous development in Nepal with an increment by 15% in 2016/2017. Due to urbanization and modernization, the demand of the cut flower has increased tremendously. Nepal imports cut flower from Thailand, Italy and India. Most of the cut flower comes from India during winter season. The need of import has risen due to poor postharvest care, highly complex and inefficient supply chains, and inadequate storage facility.

Flowers remain alive even after harvest and continue their metabolic activities causing depletion of carbohydrates, rise in temperature and respiration rates, rapid attack by micro-organisms, water stress and increased accumulation of ethylene. All these activities lead to deterioration of the harvested flowers, which in turn decreases the longevity of the fresh produce (Gupta and Dubey, 2018). The interaction between flowers, stems, leaves influences the water balance and postharvest quality of flowers. Thus, special care is needed in the development and postharvest handling of cut flowers.

The blockage of xylem vessels by microorganisms that accumulate in the vase solution or in the vessels themselves is the major cause of deterioration of cut flowers. When the stem is blocked, and the leaves continued transpiration there is a net loss of water from the flower and stem tissues. Generally, blockage of cut stem ends, xylem conduits by microbes, physiological plugging, disruption of water column in xylem vessels by cavitation and air emboli reduce the stem conductivity (Edrisi et al., 2012). An important factor in prolonging vase life of the cut flowering stem is the maintenance of turgidity (Mayak and Halevy, 1974). The turgidity of the leafy, flowering stem is related to the balance between the uptake of water by the stem and its loss through the leaves and flowers. This balance is influenced by the addition of chemicals (e.g. sugars, germicides) to the water in which the cut stems are placed. However, the function of the chemicals, some of which have become well known components of flower preservatives, is not clear because many have more than one physiological effect. For many years, floral preservatives have been acidified and have usually included biocides to inhibit bacterial proliferation (Nowak, 1990). Postharvest management using chemicals, preservatives and antimicrobial substances holds a key solution to address the problem of flower loss.

For the supply of quality cut flower in Nepalese market, all the stakeholders need to follow most crucial technical steps since production place to retail outlet. Customers are not satisfied

from the products (cut flowers) that are easily available in the present retail market of Nepal. In production side, there are some limitations and the supply chain also have some lacking. It is teamwork, so, every stakeholder needs to care in his step and forward the product with proper information to forward linkage.

Longer postharvest life of flowers makes sure that the customers, retailers and final consumers will be satisfied and will return to transact more flowers. For increasing the postharvest life of flowers, we should know about the factors that affect postharvest life, so that we can provide required condition to plant and hence, postharvest life will be increased. Therefore, this paper aims to provide an overview of the chemicals, preservatives and antimicrobial substances in order to maintain the quality and improve the longevity of cut flowers.

Postharvest Management of Cut Flower

Whether cut or intact, ornamentals are complex plant organs, in which loss of quality of stems leaves, or flower parts may result in rejection in the market place. In some ornamentals, loss of quality may result from one of several causes, including wilting or abscission of leaves and/or petals, yellowing of leaves, and geotropic or phototropic bending of scapes and stems (Reid, 2009). A goal for all produce and flower growers is to deliver the highest quality product to the customer. For flowers, this means an extended vase life once flowers are brought home from market. If properly cared for, flowers should last for one week after purchase (Nakahara and Fake, 2015). Postharvest technology is necessary to reduce the loss and provide consumers with high-quality flowers. Ornamental plants are widely used in the world as cut flower, cut branch, cut foliage, potted plant, bedding plant, garden tree and so on. In cut flowers, chrysanthemum, rose, carnation and lily have a high popularity in the world market (Yamane, 2015). There are a series of steps involved to prepare flowers for market after harvesting known as postharvest handling. These steps include: Harvesting, Conditioning, Pre-cooling, Pulsing, Grading, Bunching, Wrapping, Packaging, Storage, Transport and Sale. All the factors that affect postharvest life of a flower should managed properly to provide optimum condition for plant growth (Gupta and Dubey, 2018).

Physiology of cut flowers

In general, cut flowers complete their life cycle in two distinct phases: (i) bud swelling to bud opening and (ii) maturation, senescence and wilting. Flower bud development to swelling involves growth or a change in the orientation of petals or subtending tissues and may also require abscission of protective structure. When an inflorescence is cut from the plant, a number of physiological processes are affected which include the supply of water, depletion of stored substrates and production of ethylene. The most common symptom of flower senescence is wilting i.e. loss of turgor pressure of the cells due to failure of water uptake. The failure of water uptake because of stem blockage may be due to air blockage, microbial growth or physiological plugging (De et al., 2014).

Respiration and transpiration are primarily responsible for the quality of cut blooms. Rate of transpiration and the rate of water absorption are internal processes of plants. The principal plant factors on which these processes depend are relative area of absorption and the total water holding capacity of the tissues. After the flower is detached, the area of absorption is reduced, whereas the proportionate area for the transpiration is much higher. Thus, the cut flower will

wither within no time unless postharvest technology is adopted properly. Various environmental factors are also related with respiration and transpiration that shorten the vase life. If temperature is high, there will be faster rate of respiration and burning of tissue and as a consequence the life of the flower will be short. Higher the relative humidity, the less is the transpiration rate and vice versa. Strong hot breeze (wind) will cause higher rate of transpiration and shorten the life of cut flowers. Therefore, to prolong postharvest life we need to control respiration and transpiration rate (Randhawa and Mukhopadhyay, 1986).

Pulsing

Plant tissue requires sugar in order to carry on its vital functions, especially respiration, and in practical issues, supplying alcoholic drinks, sugar or lemonade is common practice, continuously, or as a pulse. Pulsing is a principle in which plant tissues are filled with carbohydrate to ensure that there is sufficient substrate for the flowers to mature and possess longevity (Da Silva, 2006). Sucrose is the main ingredient of pulsing solutions providing additional sugar, and the proper concentration ranges from 2 to 20%, depending on the crop. The solution should always contain a biocide appropriate for the crop being treated. Ethylene-sensitive flowers are pulsed with silver thiosulphate (STS). Treatments can be for short periods at warm temperatures (e.g. 10 minutes at 20°C) or for long periods at cool temperatures (e.g. 20 hours at 2°C). Alstroemeria and lilies can be pulsed in a solution containing gibberellic acid to prevent leaf yellowing, and this is often a useful pre-treatment (Reid, 2009).

Pulsing by 20% Sucrose + $AgNO_3$ (1000ppm) for 16-24 hours at 21°C or by 50 ppm $AgNO_3$, 300ppm $Al_2(SO_4)_3$, 200ppm 8-HQC, 20% sucrose can also be applied (Arora, 2013). The most popular preservatives today contain 8-hydroxyquinoline citrate (8-HQC) and sucrose (common table sugar). The 8-HQC is a bactericide and an acidifying agent. Besides suppressing bacterial development and lowering the pH, 8-HQC also prevents chemical blockage, thus aiding in the absorption of water. Sucrose taken up by the stem maintains quality and turgidity and extends vase life by supplementing the carbohydrate supply. Silver ion is capable of specifically blocking the action of exogenously applied ethylene in classical responses such as abscission, senescence and growth retardation (Beyer, 1976). Various studies reported that silver ions are capable of generating ethylene insensitivity in plants (Zhao et al., 2002). Ethylene-insensitive mutations (Hall et al., 1999) and silver ions are thought to perturb the ethylene binding sites (Rodriguez et al., 1999).

Chemicals use in postharvest management of cut flowers

Large number of biocides has been reported to prevent the proliferation of microorganisms in vase solutions; however, their other physicochemical effects may confound their antimicrobial action. The principle antimicrobial compounds that have been used to lengthen the vase life of cut flowers are: (i) chlorine and bromine compounds, such as sodium hypochlorite (NaOCl) (Himelblau and Amasino, 2000); (ii) hydroxyquinoline (HQ) compounds, such as 8-hydroxyquinoline citrate (HQC) (Knee, 2000) and 8-hydroxyquinoline sulphate (HQS) (Hussein, 1993); (iii) quaternary ammonium compounds, such as benzalkonium chloride (n-alkyl dimethylbenzyl ammonium chloride) (iv) silver compounds, such as silver nitrate (AgNO3) (Fujino et al., 1983) and, (v) a range of miscellaneous compound including aluminium sulphate ($Al_2(SO4)_3$) (Put et al., 1992); sodium

benzoate (Knee, 2000); bromopropanediol (Knee, 2000); and, thiabendazole or 2-(4-thiazolyl)-benzimidazole (TBZ) (Halevy, 1978). Each of these potential biocides has advantages and disadvantages (Faragher and Faragher, 2002), and many of them have other functions beside antimicrobial.

Yeast, filamentous fungi and bacteria are the microorganisms on stems of cut flowers and in vase solutions (van Doorn, 1997). These microorganisms vary in their response to biocidal agents. For example, mycobacteria are relatively resistant to biocides, and then Gram-negative and Gram-positive bacteria being most sensitive (Maillard, 2002). Moreover, the developmental stage of a microorganism may result in a differential response to a biocidal agent. For instance, fully mature spores of *Bacillus subtilis* are much less susceptible to biocides than non-sporulating bacteria or vegetative cells (Turner et al., 2000). The differential response of microorganisms to biocides may be prescribed to variations in morphological structure (e.g. vegetative cell versus mature spore) and chemical composition (e.g. different types of peptidoglycans in bacterial spores) of the individual microorganism (Maillard, 2002). To be effective, an antimicrobial treatment must function in all conditions, including across varying vase solution composition (Knee, 2000), and against the prevalent microorganism, such as a specific bacterial species (Turner et al., 2000). Postharvest losses of many cut flowers are estimated to be as high as 40% in the absence of floral preservatives (Hutchinson et al., 2003).

a. Sucrose: Sucrose is useful as a respiratory substrate and as an Osmolite that helps in the maintenance of a favorable water balance. Sucrose at 2-4% in the holding solution reduced stomatal aperture in rose cut flower leaves, thus reducing water loss and improving water retention and solute uptake capacity (Marousky, 1969). Sucrose at 2% slightly increase vase life of tuberose (Reid, 1996).

b. 8-Hydroxyquinoline salts: Sulphate or citrate of 8-hydroxyquinoline is well transported within flower stem (Halevy and Mayak, 1981). It inhibits microorganism's growth in the vase and stems vessels and maintains proper water balance in flowers, decreases in respiration rate. It inhibits formation of ACC and ethylene production (Yang, 1980). Hydroxyquinoline citrate (HQC) increases the vase life, as well as improves the fresh mass of cut carnation flowers compared to the control (Knee, 2000). Different authors reported that treatment with 8-HQS plus sucrose led to the prolongation of the vase life of various cut flowers (Patil et al., 2001). HQS behaves as an anti-transpirant. The action of HQS in prolonging vase life must therefore be due to other properties (Gay and Nichols, 1977).

c. Silver thiosulphate: Silver ions complexed with thiosulphate in the form of silver thiosulphate (STS), which is easily transportable in the stems of many flowers (Veen, 1983). Pulsing of flowers prior to storage with STS or in a mixture with sucrose and 8-HQ salts considerably prolongs the vase life of flowers, as it blocks infection of flower stem by preventing effect of ethylene (Dineshbabu et al., 2002; Goszczynska et al., 1984).
Since the 1970s, silver thiosulphate (STS) was found effective against ethylene and more than doubles the vase life of cut flowers (Hassan and Schmidt, 2004). Menguc and Usta (1993) reported that STS + sucrose pretreatment had a positive effect on the vase life and petiole size

of cut carnations. It was reported by Celikel and Karacaly (1995) that STS pulsing prolonged the vase life of cut carnation flowers to 15.5 days whereas it was 6.8 days in the control. Flowers continuously treated with 0.2 mM STS exhibited no morphological or respiratory responses to any concentration of exogenous ethylene, whereas both a respiratory increase and irreversible petal wilting were observed in flowers pulsed with 0.5 mM STS (Altman and Solomos, 1995). They also suggested that the interaction between silver ions and ethylene is competitive.

d. 1-methylcyclopropene (1-MCP): STS contains silver, which is a potential environmental pollutant (Sisler et al., 1996). Researchers have therefore been seeking alternative strategies, for the inhibition of ethylene biosynthesis and ethylene binding to prevent the undesirable postharvest effects of ethylene. 1-methylcyclopropene (1-MCP) with trade name EthylBloc, was found as an alternative options for extending the vase life of cut flowers. 1-MCP is a gas in its natural state (as is ethylene) comes in powder form, which is added to water to release the gas. According to Hassan and Schmidt (2004) 1-MCP is an effective blocker of ethylene perception in cut carnations. It has non-toxic character thus can replace environmentally unsafe silver ion. Even at very low concentrations, it has been found to eliminate the effects of ethylene on the abscission and wilting of many ornamental crops, such as carnation and rose even at very low concentration (Sisler et al., 1996).
It was reported that treatment with 1-MCP at 0.5 g/m^3 for 6 hr led to an increase in the vase life as well as minimizing the percentage loss of the initial weight of cut carnations (Tar and Hassan, 2003).

e. Household bleach or sodium hypochlorite (NaOCl): It is widely used in experimental vase solutions (Knee, 2000). In microorganisms, chlorine action involves the oxidation of cellular components and essential enzymes in cell membranes and protoplasm (Bloomfield and Arthur, 1989). In preservative solution, 5 to 10 mg/l free available chlorine helps to control bacteria (Xie et al., 2008).

f. Silver nitrate: Ag+ can act as an antimicrobial agent (van Doorn et al., 1990). It inhibits aquaporins in plants (Niemietz and Tyerman, 2002). In addition to this, it is an ethylene-binding inhibitor during ethylene synthesis and action (Serek et al., 2006). Ag+ on microorganisms inactivated the expression of cellular proteins and enzymes that is necessary for ATP production (Yamanaka et al., 2005) and DNA loses its replication ability. However, it is noted that $AgNO_3$ cannot be used in water containing chlorine due to immediate precipitation of AgCl (van Doorn et al., 1990). Also in DI and distilled water, $AgNO_3$ will slowly undergo photochemical oxidation leading to a black Ag_2O deposit. In contrast, HQS probably acts principally by its chelating ability with metal ions, and thereby disruption of bacterial cell enzyme function (Weinberg, 1957). Nowadays, silver nitrate is not used in commercial vase solutions because of the danger for human health and environmental risk moreover it causes blackening of flower stems (Damunupola and Joyce, 2008).

g. Copper sulphate: An artificial tap water solution containing low concentrations of $CuSO_4$ (50 µM), $CaCl_2$ (0.7 mM), and $NaHCO_3$ (1.5 mM) is appropriate as a standardized vase solution (van Meeteren et al., 1999). Copper ions are a biocide that can be used in vase solution (van Doorn, 1997). It is a non-specific inhibitor of peroxidase; Cu_2+ also inhibits other enzymes, such as phenylalanine ammonium lyase (PAL) (Kim et al., 1996). PAL is also involved in cut stem wound reactions.

h. Halamid: It is a disinfectant based on a chemical substance known as Sodium N-Chloro-para-Toluenesulfonamide, (C7H7ClNNaO2S, 3H2O). It ionizes when dissolved in water and attacks microbes through a process of oxidation; they cannot build up a resistance to it. Thus, it is a new biocide that is used in cut flower and foliage postharvest handling (Edrisi et al., 2012).In addition, the chloramine T is highly stable and remains active over an extended period of time (Edrisi et al., 2012). The Chloramine T ion in Halamid reacts with organic material like proteins or enzymes and destroys cell material or disrupts essential cell processes, quickly. The effect of Halamid on longevity of gerbera was about 20% higher than sodium hypochlorite and 200% higher than control (tap water) (Edrisi, 2009).

i. Essential oils: It is the novel antimicrobial agent. Essential oils are organic natural substances both safe and environmental friendly. It has strong antimicrobial properties. As it contains phenolic compounds like: carvacrol, thymol, and eugenol (Sharififar et al., 2007).

j. Silver nano particles: These particles are newly discovered antimicrobial agents. It causes structural changes in bacterial cell membrane, lose of DNA replication, dissipation of the proton motive force and finally cell death (Maneerung et al., 2008).

Post harvest management of some cut flowers

Carnation

Carnation flowers are sensitive to ethylene. Cut flowers produce small amounts of ethylene just after harvest, while there is a sharp increase in ethylene production a few days later. The deleterious effects of ethylene exposure include leaf yellowing, flower (or petal) drop, irregular opening and premature death (Nowak, 1990).

Hassan and Schmidt (2004) carried out an experiment to study the effect of different chemicals on postharvest quality of cut flowers of *Dianthus caryophyllus* L. cv. Asso, the cut flowers were treated with 8- hydroxyquinoline sulphate (8-HQS) at 200 and 400 ppm with or without sucrose at 50 g/l, silver thiosulphate (STS) at 0.2 and 0.4 mM with or without sucrose at 50 g/l, and 1-methylcyclopropene (1-MCP) at 0.3, 0.5 and 0.7 g/m^3 for 6 hr. The experiment found that 8-HQS treatments increased the vase life and the percentage loss of initial fresh weight compared to the control. In addition, the vase life was longer when sucrose was applied in combination with 8-HQS. The best treatment involved 400 ppm 8-HQS + 50 g/l sucrose. All the concentrations of STS prolonged the vase life and fresh mass compared to the control. The best treatment was STS at 0.4 mM with sucrose. All levels of 1-MCP prolonged the vase life and increased the fresh weight in comparison with the control. The best treatment in this respect was 1-MCP at 0.5 g/m^3 for 6 h. The chlorophyll content (chl a and chl b) in the leaves was higher than the control in the best treatment of each chemical. The results show

the importance of 8-HQS in increasing the vase life of cut carnations. These results may be due to the role of 8-HQS as an anti-microbial agent, which could thus reduce stem plugging. The results could also be explained through the maintenance of leaf turgidity, and by the fact that fresh weight and chlorophyll losses were kept to a minimum (Hassan and Schmidt, 2004).

In the experiment carried out byEdrisi et al. (2012) to determine the effect of some chemicals on postharvest longevity and microorganisms in solution of cut carnation 'Delphi' reported that flowers harvested in paint brush stage and recutted to 60 cm stem length. Vase life evaluated in 20±2 oC temperature, relative humidity 60% and 1800 lux light intensity. Copper sulfate and Halamid (Sodium N-Chloro-para-Toluenesulfonamide) were the best treatments. Highly significant negative correlation of relative water content and the bacterial population in solution indicate that the main effect of bacteria in reducing the water uptake.

Tuberose

Tuberose (*Polianthes tuberosa* L.) is a very popular cut flower with white flowers, which are sweet scented. It usually flowers during summer and early autumn, when planted in spring. Keeping quality of the spikes is only 3 days per floret (Rameshwar, 1974), and vaselife of the flowers is only few days. Vaselife of tuberose flowers can be extending by chemical treatments after harvest. Several preservatives/chemicals i.e. silver nitrate, aluminium sulphate, cobalt sulphate, 8-hydroxyquinoline sulphate, boric acid, citric acid, ascorbic acid, sucrose etc. have been used in different formulations and combinations to enhance the vase life of tuberose (Saini et al., 1994).When flowers are kept at room temperature in houses for decoration, flowers dry up due to water loss. If flowers are kept in vase containing water, the main cause of deterioration is stem end rot. Hence, if stem rot at cut end of the stalk is controlled, it may result in enhanced vaselife of the flowers. Calcium salts especially calcium chloride has been reported in literature to delay ripening and senescence in fruits by lowering the respiration rate (Singh et al., 1993). In the experiment carried out by Anjum et al. (2001) cut spikes of tuberose were kept in $CaCl_2.2H_2O$, AgNO3, ascorbic acid and Tri-Miltox Forte (a fungicide) solutions with various concentrations to see their effects on keeping quality and vaselife of the flowers. A control (tap water) and a standard preservative were also included in the experiment. $AgNO_3$, $CaCl_2.2H_2O$ and Tri-Miltox Forte delayed flower opening as compared to ascorbic acid and standard preservative, but stood at par with control. $CaCl_2.2H_2O$ at concentrations of 750 to 1250 ppm and Tri-Miltox Forte at 1500 ppm resulted in minimum flower wilting after six days. Hutchinson et al. (2003) carried out an experiment and reported that STS, BA and sucrose can improve tuberose vase life and floret opening through improvement of water balance.

Gerbera

Gerbera (*Gerbera jamesonii*) has flower of variable shapes and colors. The cut flowers are sensitive to microbial contamination at the base of the stem or in the vase solution (Balestra et al., 2005).Vase life and stem bending are the main factors for evaluation of postharvest quality of cut gerbera flowers. Recently, many new gerbera cultivars with different vase life and especially stem bending have been produced. In the experiment carried out by Javad et al.(2011) to assess the postharvest quality in 21 different important cultivars found that screening and selection of cultivars have the highest vase life and the lowest stem bending as an applied and proper strategy using a basic pulse treatment (HQS 600 ppm, citric acid 300 ppm and sucrose 4%. In the experiment carried out by Solgi et al. (2009) found

that using various concentrations of essential oils and Silver nano particles (SNPs) in preservative solutions showed promising prospects for the utilization of natural essential oils or plant extracts in extending gerbera vase life. In the experiment carried out by Oraee et al. (2011) to evaluate the effect of preservative solutions on vase life, number of bacteria in the end of stem and in vase solution of cut gerbera 'Double Dutch' and 'Red Explotion'. Cut flowers were pulse-treated with nano-silver (2, 4, 6, 8 or 10 mg/l) and thymol (12.5, 25, 50, 75 or 100 mg/l) + 5 % sucrose. Flowers were harvested from a commercial greenhouse and transported to laboratory with 22±1°C temperature and 60±5% relative humidity. In addition, found that these materials had positive effects on vase life of flowers. 6 mg/l nano-silver treatments in 'Red Explotion' cultivar had highest longevity (14 days). All treatments were effective on decreasing of bacteria in stem end and solution. In 4 and 6 mg/l SNP treatments were not any bacteria in vase solutions of 'Red Explotion' cultivar.

Among 7 different vase solutions (distilled water, sodium hypochlorite 40 ppm, 8-HQS 200 ppm, Flora Life 10 gm/l, GA_3 5mg/l, sucrose 2%+8-HQS 100 ppm and $Cacl_2$ 1%) in controlled room having 18±20c temperature, 68±2% relative humidity and 100 lux light; sodium hypochlorite 40 ppm (19.1 days) and calcium chloride ($Cacl_2$) 1% (18.8 days) were found to be the most effective to prolong the vase life of the gerbera cut flowers (Acharya et al., 2011).

Chrysanthemum

Cut chrysanthemum flowers have a longer vase life than most other cut flowers. The loss of quality is mainly due to their leaves wilting (Halevy and Mayak, 1981) because of impededwater transport (van Doorn, 1997). This loss of turgidity accompanied by chlorophyll degradation results in leaves senescing earlier than the inflorescences. Water uptake and 'rehydration' of chrysanthemum stems has been facilitated by postharvest manipulations such as immersion into detergent solutions and cold water. Alternatively, the addition of antibacterial agents in the holding solutions has been recommended (van Doorn, 1997).

Chemicals, wrapping material and storage conditions, significantly influence vase life and flower quality. Minimum weight loss of spikes, maximum total water absorbed, flower diameter and vase life were obtained in 4% sucrose as compared to Tap water (Srivastava et al., 2015). Methanol applied continuously and BA as a pulse increased quantum yield of photosynthesis in the leaves. In addition, BA, and methanol to a lesser extent, prevented the formation of anthocyanins in the petals, allowing the flowers to retain their natural white color and to prolong vase life even longer. All substances, methanol in particular, caused a decrease in the Chl a:Chl b ratio, indicating a better adaptation of the photosynthetic apparatus to low light regimes, and potential capacity of these substances to facilitate acclimatization of cut flowers to interior environments (Petridou et al., 2001). Silver nitrate (0.003 %) or 8-hydroxyquinoline sulphate (0.02 %) either had no effect or increased leaf water conductance. Thus, these two substances increase the vase life of cut flowers by affecting the physiology and pathology of the stem rather than the stomatal physiology of the leaf (Gay and Nichols, 1977).

Rose

The prevalent method for maintaining the vase life of cut flowers is the use of moderately low temperatures. An alternative is the use of a sucrose solution (Mayak and Halevy, 1974). Such a solution can affect vase life, ethylene production, and regulation of sugar accumulation in floral organs (Ichimura and Hiraya, 1999).

Applying STS at 0.04 mM + 50 g/l sucrose extend vaselife of cut rose flowers to 12.33 days compared to 5.33 days in control (Hassan et al., 2004). In the experiment carried out by Liao et al. (2000)a pulse treatment of sucrose at 0, 20, 40, 60, 80, 100, and 120 gL-1 in combination with 8-hydroxyquinoline sulfate (HQS) at 200 mg L-1 for 10h was evaluated daily for its effect on the vase life and flower quality of cut rose flowers. The pulse treatment of sucrose at above 80 g L-1 produced a vase life of 6 to 7 days, while at below 80 g/L vase life was maintained for 4 days on average. The pulse treatment of silver thiosulfate (STS) at 0.2 mM for 2 h or followed by sucrose at 120 g/l supplemented with HQS for 10 h extended the vase life of cut rose flowers to about 9 and 10 days, individually. On the other hand, a pulse treatment with sucrose or distilled water in combination with HQS maintained vase life for 7 and 3 days, respectively. Flower quality of specimens treated with STS followed by sucrose in combination with HQS was better than that of those treated with STS alone. Although visual quality could be maintained for up to 13 days in STS followed by sucrose in combination with HQS, flower quality decreased notably after 10 days. The ethylene production was greatest in untreated rose flowers (about 3 h after harvest) and decreased after chemical solutions treatment. The inhibition of ethylene production was greater in sucrose in combination with HQS than with STS followed by sucrose along with HQS, although the effectiveness of the latter for maintaining rose vase life was better than the former.

Gladiolus

Cut spikes of gladiolus have a short vase life of around 7–8 days (Singh et al., 2008). Hence, prolonging vase life with improved quality for an extended period would be highly beneficial. In the experiment carried out by Singh et al. (2008) it was found that 50 mg/l GA3 + 50 g/l sucrose in vase solution improved the fresh weight, dry weight ofspikes, the concentration of petal sugars, the antioxidative activities of Superoxide Dismutase activity (SOD) and GR enzymes and decreased Lipoxygenase activity (LOX) and lipid peroxidation. The decreased LOX activity and lipid peroxidation was linked to a high membrane stability of the petal cells which delayed the petal senescence and enhanced vase life of gladioli. SA was foliar sprayed at 0, 0.5, 1 or 2 mM concentrations on harvested flowers before or after simulated transport to local market in order to evaluate its effect on postharvest qualities and physiochemical parameters. In the experiment carried out by Rahmani et al. (2015) salicylic acid significantly increased flower vase life, as well as membrane stability, anthocyanin and flavonoid concentrations, and activities of catalase and superoxide dismutase enzymes in the flower petals. The relative fresh weight was not significantly affected by SA foliar treatment applied pre- or post-transport. Significant reduction was observed in lipid peroxidation of the SA-treated flowers, compared with the control group. The results suggest that foliar application of SA, especially at low concentration (0.5 mM), improves gladiolus vase life through modulating its antioxidative system and reducing lipid peroxidation.

Conclusion

In order to improve vase life and maintain quality of cut flowers; carbohydrates, anti-ethylene substances and germicides should be applied in vase life at the balance concentration. As the trend of production and transaction of Nepalese cut flower is increasing by 15%, our entrepreneurs should adopt the use of different chemicals to capture national as well as international demand. Without postharvest treatment in the produced cut flowers, our products might not compete with international products.

References

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

Altman, S.A. and Solomos, T. 1995. Differential respiratory and morphological responses of carnations pulsed or continuously treated with silver thiosulfate. Postharvest Biology and Technology, 5(4), 331-343.

Anjum, M.A., Naveed, F., Shakeel, F., and Amin, S. 2001. Effect of some chemicals on keeping quality and vase-life of tuberose (Polianthes tuberosa L.) cut flowers. LIFE, 12(1).

Arora, J.S. 2013. Introductory Ornamental Horticulture (7th edition). Kalyani Publishers.

Balestra, G.M., Agostini, R., Bellincontro, A., Mencarelli, F., and Varvaro, L. 2005. Bacterial populations related to gerbera (Gerbera jamesonii L.) stem break. Phytopathologia Mediterranea, 44(3), 291-299.

Beyer, E.M. 1976. Silver ion: a potent anti-ethylene agent in cucumber and tomato. HortScience, vol. 11, no. 3, p. 175-196.

Bloomfield, S.F. and Arthur, M. 1989. Effect of chlorine-releasing agents on Bacillus subtilis vegetative cells and spores. Letters in applied microbiology, 8(3), 101-104.

Celikel, F. and Karaçalý, Y. 1995. Effect of preharvest factors on flower quality and longevity of cut carnations (Dianthus caryophyllus L.). Paper presented at the VI International Symposium on Postharvest Physiology of Ornamental Plants 405.

Da Silva, J.T. 2003. The cut flower: postharvest considerations. J. Biol. Sci, 3(4), 406-442.

Da Silva, J.A.T. 2006. Ornamental cut flowers: physiology in practice. Floriculture, Ornamental and Plant Biotechnology: Advances and Tropical Issues, Da Silva, IAT (Ed), 1, 124-140.

Damunupola, J.W. and Joyce, D.C. 2008. When is a vase solution biocide not, or not only, antimicrobial? Journal of the Japanese Society for Horticultural Science, 77(3), 211-228.

De, L., Vij, S., and Medhi, R. 2014. Postharvest physiology and technology in Orchids. J Horticulture, 1(102), 2.

Dineshbabu, M., Jawaharlal, M., and Vijayakumar, M. 2002. Influence of holding solutions on the postharvest life of Dendrobium hybrid sonia-17. South Indian Horticulture, 50(4/6), 451-457.

Edrisi, B. 2009. Postharvest physiology of cut flowers. Payam-e Digar Publication, Arak. Iran.

Edrisi, B., Sadrpoor, A., and Saffari, V. 2012. Effects of chemicals on vase life of cut carnation (Dianthus caryophyllus L.'Delphi') and microorganisms population in solution.

Faragher, J. and Faragher, J. 2002. Postharvest Handling of Australian Flowers: From Australian Native Plants and Related Species: a Practical Workbook: a Report for the Rural Industries Research and Development Corporation: RIRDC.

Fujino, D.W., Reid, M.S., and Kohl, H.C. 1983. The water relations of maidenhair fronds treated with silver nitrate. Scientia Horticulturae, 19(3-4), 349-355.

Gay, A. and Nichols, R. 1977. The effects of some chemical treatments on leaf water conductance of cut, flowering stems of Chrysanthemum morifolium. Scientia Horticulturae, 6(2), 167-177.

Goszczynska, D.M., Rudnicki, R., and Reid, M. 1984. The role of plant hormones in the postharvest life of cut flowers. Paper presented at the II Symposium on Growth Regulators in Floriculture 167.

Gupta, J. and Dubey, R. 2018. Factors affecting post-harvest life of flower crops. Int J Curr Microbiol App Sci, 7(1), 548-557.

Halevy, A. 1978. Postharvest handling methods for bird-of-paradise flowers (Strelitzia reginae Ait.). J. Am. Soc. Hort. Sci., 103, 165-169.

Halevy, A.H. and Mayak, S. 1981. Senescence and postharvest physiology of cut flowers-part 11. Horticulture

Review, 3, 59-143.

Hall, A.E., Chen, Q.G., Findell, J.L., Schaller, G.E., and Bleeker, A.B. 1999. The relationship between ethylene binding and dominant insensitivity conferred by mutant forms of the ETR1 ethylene receptor. Plant Physiology, vol. 121, no. 1, p. 291-299.

Hassan, F. and Schmidt, G. 2004. Postharvest characteristics of cut carnations as the result of chemical treatments. Acta Agronomica Hungarica, 52(2), 125-132.

Hassan, F., Schmidt, G., Hafez, Y., Pogány, M., and Ankush, J. 2004. 1-MCP and STS as ethylene inhibitors for prolonging the vase life of carnation and rose cut flowers. International Journal of Horticultural Science, 10(4), 101-107.

Himelblau, E. and Amasino, R.M. 2000. Delivering copper within plant cells. Current opinion in plant biology, 3(3), 205-210.

Hussein, H. 1993. Varietal responses of cut flowers to different antimicrobial agents of bacterial contamination and keeping quality. Paper presented at the International Symposium on Postharvest Treatment of Horticultural Crops 368.

Hutchinson, M., Chebet, D., and Emongor, V. 2003. Effect of accel, sucrose and silver thiosulphate on the water relations and postharvest physiology of cut tuberose flowers. African Crop Science Journal, 11(4), 279-287.

Ichimura, K. and Hiraya, T. 1999. Effect of silver thiosulfate complex (STS) in combination with sucrose on the vase life of cut sweet pea flowers. Journal of the Japanese Society for Horticultural Science, 68(1), 23-27.

Javad, N.D.M., Ahmad, K., Mostafa, A., and Roya, K. 2011. Postharvest evaluation of vase life, stem bending and screening of cultivars of cut gerbera (Gerbera jamesonii Bolus ex. Hook f.) flowers. African Journal of Biotechnology, 10(4), 560-566.

Kim, S.H., Kronstad, J.W., and Ellis, B.E. 1996. Purification and characterization of phenylalanine ammonia-lyase from Ustilago maydis. Phytochemistry 43: 351–357.

Knee, M. 2000. Selection of biocides for use in floral preservatives. Postharvest Biology and Technology, 18(3), 227-234.

Liao, L.J., Lin, Y.H., Huang, K.L., Chen, W.S., and Cheng, Y.M. 2000. Postharvest life of cut rose flowers as affected by silver thiosulfate and sucrose. Botanical Bulletin of Academia Sinica, 41.

Maillard, J.Y. 2002. Bacterial target sites for biocide action. Journal of applied microbiology, 92, 16S-27S.

Maneerung, T., Tokura, S., and Rujiravanit, R. 2008. Impregnation of silver nanoparticles into bacterial cellulose for antimicrobial wound dressing. Carbohydrate polymers, 72(1), 43-51.

Marousky, F. 1969. Vascular blockage, water absorption, stomatal opening, and respiration of cut'Better Times' roses treated with 8-hydroxyquinoline citrate and sucrose. J. Amer. Soc. Hort. Sci., 94, 223-226.

Mayak, S. and Halevy, A. 1974. The action of kinetin in improving the water balance and delaying senescence processes of cut rose flowers. Physiologia plantarum, 32(4), 330-336.

Mengüc, A. and Usta, E. 1993. Research on the effects of silverthiosulphate+ sucrose pretreatment on the cold storage period and post storage vase life of cut flowers of carnation cv. Astor harvested at different maturities. Paper presented at the International Symposium on Postharvest Treatment of Horticultural Crops 368.

Nakahara, M. and Fake, C. 2015. Practical postharvest handling of cut flowers. University of California Cooperative Extension, https://ucanr.edu/sites/placernevadasmallfarms/ files/220303.pdf

Niemietz, C.M.and Tyerman, S.D. 2002. New potent inhibitors of aquaporins: silver and gold compounds inhibit aquaporins of plant and human origin. FEBS letters, 531(3), 443-447.

Nowak, J. 1990. Postharvest handling and storage of cut flowers, florist greens, and potted plants.

OEC. 2020. Cut flowers. The Observatory of Economic Complexity. https://oec.world/en/profile/hs92/0603/

Oraee, T., Asgharzadeh, A., Kiani, M., and Oraee, A. 2011. The role of preservative compounds on number of bacteria on the end of stems and vase solutions of cut gerbera.

Patil, S., Reddy, B., Kulkarni, B., Kalasareddi, P., and Shivaprasad, M. 2001. Effect of metal salts, citric acid and 8-HQS and their combinations on postharvest physiology of golden rod (Solidago canedensis L.). Haryana Journal of Horticultural Sciences, 30(1/2), 60-61.

Petridou, M., Voyiatzi, C., and Voyiatzis, D. 2001. Methanol, ethanol and other compounds retard leaf senescence and improve the vase life and quality of cut chrysanthemum flowers. Postharvest Biology and Technology, 23(1), 79-83.

Put, H.M., Clerkx, A.C., and Boekestein, A. 1992. Aluminium sulphate restricts migration of Bacillus subtilis in xylem of cut roses: a scanning electron microscope study. Scientia Horticulturae, 51(3-4), 261-274.

Rahmani, I., Ahmadi, N., Ghanati, F., and Sadeghi, M. 2015. Effects of salicylic acid applied pre-or post-transport on postharvest characteristics and antioxidant enzyme activity of gladiolus cut flower spikes. New Zealand journal of crop and horticultural science, 43(4), 294-305.

Rameshwar, A. 1974. Aluminium Sulfate, A New Preservative for Cut Flowers. Indian Journal of Horticulture, 31(1), 95-96.

Randhawa, G.S., and Mukhopadhyay, A. 1986. Floriculture in India: Allied Publishers.

Redman, P.B., Dole, J.M., Maness, N.O., and Anderson, J.A. 2002. Postharvest handling of nine specialty cut flower species. Scientia Horticulturae, 92(3-4), 293-303.

Reid, M. 1996. Postharvest handling recommendations for cut tuberose. Perishable Hand. Newsletter, 88, 21-22.

Reid, M.S. 2009. Handling of cut flowers for export. University of California, Davis, CA, 95616, USA. https://ucanr.edu/sites/Postharvest_Technology_Center_/files/231308.pdf

Rodriguez, F.I., Esch, J.J., Hall, A.E., Binder, B.M., Schaller, G.E., and Bleecker, A.B. 1999. A copper cofactor for the ethylene receptor ETR1 from Arabidopsis. Science, vol. 283, no. 5404, p. 996-998.

Saini, R., Yamdagni, R., and Sharma, S. 1994. Effect of some chemicals on the vase-life of tuberose (Polianthes tuberosa L.) cv. Single. South Indian Horticulture, 42, 377-378.

Serek, M., Woltering, E., Sisler, E., Frello, S., and Sriskandarajah, S. 2006. Controlling ethylene responses in flowers at the receptor level. Biotechnology advances, 24(4), 368-381.

Sharififar, F., Moshafi, M., Mansouri, S., Khodashenas, M., and Khoshnoodi, M. 2007. In vitro evaluation of antibacterial and antioxidant activities of the essential oil and methanol extract of endemic Zataria multiflora Boiss. Food control, 18(7), 800-805.

Singh, A., Kumar, J., and Kumar, P. 2008. Effects of plant growth regulators and sucrose on postharvest physiology, membrane stability and vase life of cut spikes of gladiolus. Plant Growth Regulation, 55(3), 221.

Singh, B., Tandon, D., and Kalra, S. 1993. Changes in postharvest quality of mangoes affected by preharvest application of calcium salts. Scientia Horticulturae, 54(3), 211-219.

Sisler, E.C., Dupille, E., and Serek, M. 1996. Effect of 1-methylcyclopropene and methylenecyclopropane on ethylene binding and ethylene action on cut carnations Plant Hormone Signal Perception and Transduction (pp. 127-134): Springer.

Sisler, E. and Serek, M. 2001. New developments in ethylene control-compounds interacting with the ethylene receptor. Acta horticulturae.

Solgi, M., Kafi, M., Taghavi, T.S., and Naderi, R. 2009. Essential oils and silver nanoparticles (SNP) as novel

agents to extend vase-life of gerbera (Gerbera jamesonii cv.'Dune') flowers. Postharvest Biology and Technology, 53(3), 155-158.

Srivastava, R., Sharma, G., and Chand, S. 2015. Postharvest life of cut chrysanthemum cultivars in relation to chemicals, wrapping material and storage conditions. J. Hort, 2, 1-4.

Tar, T., and Hassan, F. 2003. Evaluating vase life and tissue structure of some compositae (Asteraceae) species. International Journal of Horticultural Science, 9(2), 87-89.

Turner, N., Harris, J., Russell, A., and Lloyd, D. 2000. Microbial differentiation and changes in susceptibility to antimicrobial agents. Journal of applied microbiology, 89(5), 751-759.

Van Doorn, W., De Witte, Y., and Perik, R. 1990. Effect of antimicrobial compounds on the number of bacteria in stems of cut rose flowers. Journal of Applied Bacteriology, 68(2), 117-122.

van Doorn, W.G. 1997. Water relations of cut flowers. Hort. Rev, 18(1), 85.

Veen, H. 1983. Silver thiosulphate: an experimental tool in plant science. Scientia Horticulturae, 20(3), 211-224.

Van Meeteren, U., Van Gelder, H., and Van Ieperen, W. 1999. Reconsideration of the use of deionized water as vase water in postharvest experiments on cut flowers. Postharvest Biology and Technology, 17(3), 175-187.

Weinberg, E.D. 1957. The mutual effects of antimicrobial compounds and metallic cations. Microbiol. Mol. Biol. Rev. 21: 46–68.

Xie, L., Joyce, D.C., Irving, D.E., and Eyre, J.X. 2008. Chlorine demand in cut flower vase solutions. Postharvest Biology and Technology, 47(2), 267-270.

Yamane, K. 2015. Markets of Ornamental Plants and Postharvest Physiology in Cut Flowers. Reviews in Agricultural Science, 3, 36-39.

Yamanaka, M., Hara, K., and Kudo, J. 2005. Bactericidal actions of a silver ion solution on Escherichia coli, studied by energy-filtering transmission electron microscopy and proteomic analysis. Appl. Environ. Microbiol., 71(11), 7589-7593.

Yang, S. 1980. Regulation of ethylene biosynthesis [in plant tissues]. HortScience.

Zhao, X.C., Qu, X., Mathews, D.E., and Schaller, G.E. 2002. Effect of ethylene-pathway mutations upon expression of the ethylene receptor ETR1 from Arabidopsis. Plant Physiology, vol. 130, no. 4, p. 1983-1991.

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Green space and Landscape management by local government

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Introduction:

The provision of green space and landscaping of the village or towns is an integral part of a modern-day living space. In Kathmandu valley, not much has been done in this sector by the governments in past thirty years. Two big park projects, UN Park along the river Bagmati corridor and Martyr Memorial Park, Gokarna is yet to be completed although few small parks were built. The big parks such as Balaju Park, Sukedhara Park or Tribuvan Park (now named Martyr Memorial Park, Coronation Park are all built before 1990 (Pun and Maharjan, 2013).

Recently, the Nepalese government has given due importance to open spaces and has begundeveloping parks. The campaign began with the slogan "Each village or town with many parks". In recent years, many local governments havebegun park projects and greening of towns however the maintenance of the parks has become a problem due to lack of adequately trained human resource and management plan. Although, provision of funds is created for establishment of parks yet not much importance is given for sustainable maintenance of the park or green space. This has largely resulted in development of many parks but with no proper maintenance plan the beauty of the newly built park is compromised. The time and again greening of Tinkune triangle in Kathmandu is an example of developing project with no plan for maintenance. The current status of this space is in dire state and is perhaps waiting for another major national activity to get a facelift.

The success of greening urban space or park need to be given priority so that the inhabitants can fully utilize the facility. This is only possible when there is provision for efficient planning, development and maintenance of space and is led by the local government. Since, 2017 local election, 753 local governments were elected across the country and each of these governments has an agriculture unit. The agriculture unit of a rural municipality is supposed to be headed by an agriculture officer while the metropolitan agriculture unit is to be headed by an agriculturist of a joint secretary level. The public green spaces and parks should come under the jurisdiction of this unit in addition to its other responsibilities.

Earlier, the parks or green spaces within the town or city was under the jurisdiction of the local government but didn't have an agriculture unit. Hence, none of the 15 parks and green spaces within the Kathmandu valley was under a trained horticulturist (Pun, 2013). Thus, the operation of the many parks was not very efficient. However, after induction of federal system, agriculture unit is under each palika and is most likely to have a trained human resource. It will be therefore important for the palika leadership to activate the agriculture unit for park and greenery management within the palika jurisdiction in addition to its other agriculture extension activities.

Approach:

For the effective management of the green space or park by local government, the following approach may be undertaken.

1. **Engage trained human resource:**
   The first and the foremost is the trained human resource. Federal system has brought agriculture section under the palika leadership and with that, there is provision of at least one agriculture graduate at any rural municipality. The presence of a senior agriculturist and higher number of agriculture graduate officers increases with town municipality, sub-metropolitan and so on. The availability of these human resources creates opportunities not only at rural municipality but also at metropolitan for green space and park management. The core focus of agriculture unit could be food security and agriculture commercialization particularly in the rural areas. However, provision of green space and parks in small village or town will bring positivity and create opportunities for people to meet and build fellowship. Besides, such provision will also improve the environment of the locality.

2. **Establish plant resource center:**
   Many palikas in particular sub-metros and metros have few to many parks within its jurisdiction. These parks should be used as plant resource centers. An inventory of the list of plant species in the park or green spaces needs to be documented. This documentation should include name of the plants, its morphological description, flowering time, fruit ripening time and fruit harvesting time etc. It should also include information on its propagation methods and other benefits. Key information can be displayed in the park for the benefit of public consumption.The technical team in the palika or at the park should keep these plant species healthy and collect seeds from the plant species. These seeds can be used for propagating new plants, exchanging seeds with other parks or palikas or can be sold to generate income. Research can also be conducted at the plant resource center on various aspects such as plant physiology, plant propagation, plant protection, nutrition management, canopy management etc.

3. **Establish plant nursery:**
   Landscaping in a park or green space requires many ornamental plants and flower plants. The need of annual flower is more significant because it is needed with the change of the season and to add colour in the landscape. Thus, a significant amount of financial resource is required to meet the demand for purchase of the seeds or seedlings. It is therefore very pragmatic to have a plant nursery that produces both annual seedlings and plant seedlings in the park premises.Annual seeds can be purchased while plant seeds can be collected from the plant resource center or parks. The availability of trained human resource should ease this activity and save funds that would have otherwise spent on purchase of flowers seedlings. Besides, the nursery can produce plants and seedlings that can be used in the landscape and the extras can be sold to generate additional funds.

4. **Prepare and approve landscape management plan:**
   The leadership needs to approve a landscape plan for the whole palika in general and a park (s) in particular. The planting and management of the landscape will be based on the master plan and it would be a multi-year plan. The availability of trained human resource, plant resource center (source of seeds and cuttings or divisions) and plant nursery (availability of flower seedlings and ornamental plants of desired size and quantity) will make the landscaping process efficient and cost effective. Thus, making the park or palika much more beautiful and environmentally friendly.

Example:

An example of how to improve parks and greenery of Kathmandu Metropolitan (KM)

1. Activate agriculture section of KM. This section will cater to urban greenery, roof top gardening and extension of vegetables or flowers farming to peri urban farmers.
2. Develop human resource such as gardener, landscaper and nursery worker. This section in collaboration with FAN (Floriculture Association of Nepal), Floriculture Development Center (FDC) and Nepal Horticulture Society (NHS) could train in service staff or new hire to improve their skill and competency.
3. Deploy trained human resource in different parks under the jurisdiction of the metropolitan.
4. Build infrastructure such as net house, plastic house and production area within the park premises.
5. Provide budget for inputs such as manures, fertilizers, soils, peat, sand, rooting hormones, plastic bags, secateurs, hedge shears, garden tools etc.
6. Provision of centralized nursery and production center that will cater to plants required in beautification of the metropolitan or public parks within the jurisdiction. This is necessary to cater to rapid greening of the city apart from purchase made through the private suppliers. City will need several hundred thousand plants of various types and sizes.
7. Staff at the park and the central nursery and production center should be regularly trained in different aspects of plant production and greenery management. Staff needs regular training, and this is essential to keep the staff more efficient and vibrant.

Reference:

Pun, UK and Maharjan PK: 2013. Public parks of Kathmandu valley: Some historical facts and current status of some parks. Nepalese Floriculture Vol 17

Pun, UK. 2013. Public parks and urban landscape plan in Nepal. Nepalese Floriculture Vol 17

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विशेषताहरु

- शुष्म जीवाणूको संख्या वृद्धि गरी माटोको उर्वराशक्ति बढाउने ।
- माटोको जैविक, रासानिक, भौतिक गुण वृद्धि गरी बोट बिरुवाको रोग प्रतिरोधात्मक शक्ति वृद्धि गर्ने ।
- सबै आवश्यक पोषक तत्वहरु प्रदान गर्ने हुनाले छुट्टा छुट्टै अरु मल हाल्नु नपर्ने ।
- उच्च तापक्रममा पकाएको हुनाले पूर्णरुपमा स्वास्थ तथा हानिकारक जीवाणु रहित ।
- सबै बोटबिरुवा, फलफुल तथा तरकारीको लागि उपयुक्त ।
- अरु मल जस्तो वर्षेनी मात्रा बढाउन नपर्ने ।

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Flower Opening Stages of Rose and Marigold

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Introduction

Flower opening is a reproductive trait of flowering plants (Van Doorn and Van Meeteren, 2003).Opening of flower is generally due to cell expansion. More scientifically, osmotic solute levels increase by the conversion of polysaccharides to monosaccharides, and/or the uptake of sugars from the apoplast favor flower opening.Flower opening is an interesting biological process from a physiological point of view as, in many species; it is accompanied by a high rate of cell expansion, rather impressive movements, and complex regulation by external and internal factors. The process of flower opening is related with environmental cues such as humidity, light and temperature, and that of endogenous rhythms as well as hormonal regulation, carbohydrate requirements and water relations.

The reproductive structures of the flowering plants differ vastly. Thus, the mechanism of flower opening also varies considerably. No comprehensive review has been published previously on floral opening in Nepalese context, as far as is known. Therefore, it is interesting to review regarding opening of flower with reference to rose and marigold flower. These reviews focus on the physiological mechanism and illustrate the visual changes in selected cut flowers during opening. The knowledge on stages of flower opening is important for the quality flower production, optimum time of harvesting and post harvest handling of cut flowers.

Review and Discussion

Development of tissues adjacent to the flower growth of the pedicel and separation or abscission of covering parts, bracts or sepals favor for the flower opening. Similarly, petal movements also related to the opening of flower. In most species, the storage carbohydrates mobilization and/or the import of sucrose accompanies flower opening. Young petal cells of many species contain higher amounts of starch which, shortly before opening, is rapidly changed to glucose and fructose (Ho and Nichols, 1977; Hammond, 1982). Rose flower's young petals contain high starch concentrations (Ho and Nichols, 1977). The ease in opening of rose cultivar Delilah when harvested in tight bud stage has been associated with higher carbohydrate in the petals in contrast to cultivar Sonia which fails to open and is associated with lower carbohydrate in the petals (Ichimura et al. 2005).

In Marigold, the flowers are open permanently, where opening is terminated by petal withering or abscission. Thus, the flower opening in marigold flower is a process of senescence. Yamame et al., 1991 reported that flower opening may be due to a combination of sugar uptake and degradation of various polysaccharides. In gladiolus florets, where starch was a source of soluble carbohydrate, the increase in sugar content was 7–8 times higher than the decrease in starch content, which is indication of sugar uptake.

Besides, cell wall expansion also has role on the growth and opening of the flower. Similarly, water relation playsan important role in flower opening. Cell elongation is usually very sensitive to

drop in water potential. Infact, flower opening in cut rose flowers is often inhibited as a result of a blockage in the basal stem part, which results in a low water potential in the flower (Van Doorn, 1997). Likewise, flower opening phenomenon is regulated by endogenous hormones. Gibberellins application promotes opening in several flowers. The role of ethylene is as yet unclear. Ethylene promotes or inhibits flower opening depending on the floral species (Raab and Koning, 1987). Floral opening in several species is apparently independent of specific external factors as it occurs at any time of the day. Floral opening in some other species, show a relationship with the time of day. This dependence on the time of the day may be regulated by external cues such as temperature, humidity, and light and/or by the internal factors.

Below figures 1 and 2, illustrate the stages of flower opening in rose and marigold flower respectively as reported by Adhikari, 2009 and Adhikari and Pun, 2011 respectively. The proper stage of harvesting of rose for cut flower purpose is stage 1 and 2 (bud stage and petal exposed stage) for distance market. Whereas, stage 3 and 4 (petal exposed stages) of cut rose flower for nearby market. Stage 5(75% Petal unfold stage) the best stage of marigold flower for garland purpose.

1. Bud Stage

2. Petal exposed

3. Petal unfold

4. 50% Petal unfold

5. 75% Petal unfold

6. 100% Petal unfold

(Source: Adhikari, 2009)

Fig. 1: Stages of flower opening in rose

1. Bud Stage

2. Petal exposed

3. Petal unfold

4. 50% Petal unfold

5. 75% Petal unfold

6. 100% Petal unfold

(Source: Adhikari, and Pun, 2011)

Fig. 2: Stages of flower opening in marigold

Conclusion

In most species, flower opening is due to elongation growth; the elongation growth of petals, leading to opening, does not seem different from that in other plant parts, as it requires a source of energy and cell wall loosening and expansion. The timing of opening is regulated by factors such as temperature, the quality and quantity of light, and the duration of both light and darkness. Besides, other internal factors are also associated in the regulation of the flower opening stages. The know-how on stages of flower opening has practical implication on harvesting and post-harvest operations.

References

Adhikari, D. 2009. Influence of Time and Intensity of Pruning on Growth, Flowering and Post-Harvest Performance of Cut Rose cv. Super Tata (Rosa hybrida). M Sc Ag (Horticulture) Thesis, Tribhuwan University, Institute of Agriculture and Animal Science, Rampur, Chitwan.

Adhikari, D., U. Pun. 2011. Response of Marigold (Tagetuserecta) Varieties to Winter Planting in Chitwan, Nepal. Proceedings of the 7th National Horticulture Seminar. 12- 14 June 2011, Khumaltar, Lalitpur, Nepal. pp. 216-220.

Hammond, J. B. W. 1982. Changes in amylase activity during rose bud opening. Scientia Horticulturae 16, 283–289.

Ho, L. C. and R. Nichols. 1977. Translocation of 14C sucrose in relation to changes in carbohydrate content in rose corollas cut at different stages of development. Annals of Botany 41, 227–242.

Ichimura, K., Kishimoto, M., Norikoshi, R and Kawabata, Y. 2005. Soluble carbohydrates and variation in vase life of cut rose cultivars Delilah and Sonia. Journal of Horticulture Science and Biotechnology 80 (3) 280-286.

Raab M.M. and Koning R.E.1987. Interacting roles of gibberellin and ethylene in corolla expansion of Ipomoea nil (Convolvulaceae). American Journal of Botany 74, 921–927.

Van Doorn W.G. 1997. Water relations of cut flowers. Horticultural Reviews 18, 1–85.

Van Doorn, W. G. and U. Van Meeteren. 2003. Flower opening and closure: a review Journal of Experimental Botany. 54. (389). pp. 1801-1812.

Yamane, K., Kawabata S., Sakiyama R.1991. Changes in water relations, carbohydrate contents and acid invertase activity associated with perianth elongation during anthesis of cut gladiolus flowers. Journal of the Japanese Society for Horticultural Science 60, 421–428.

Greenhouse cultivation: Cultivation pattern in isolation

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Greenhouse is the most practical method of achieving the objectives of protected horticulture, where the natural environment is modified by using sound engineering principles to achieve optimum plant growth and yields. A greenhouse is a framed or an inflated structure covered with a transparent or translucent material in which crops could be grown under the conditions of at least partially controlled environment and which is large enough to permit growers to work within it to carry out cultural operations. Glasshouses and rigid plastic houses are longer-life structures, and therefore are mostly located in cold regions where these structures can be used throughout the year. Thus, for year-round use in cooler regions, use of greenhouses is becoming predominant, but in moderate and warm climate regions, they are still provisional and are only used in winter.

In Nepal, we have heard a lot about protected cultivation in context of horticulture sector. Mostly it is heard during the support package of the different horticulture organizations regarding the horticulture crop production. During construction of the greenhouses government is also providing grants at different levels so as to promote the construction. The growers, whom the government is convincing to construct the greenhouse, are mostly aware about the cause, its use and benefits of utilization of greenhouses which will surely benefit them with higher accomplishment of production of horticulture produce? Have we thought about the maximum utilization of all the parameters of greenhouses? Could the growers produce the crop at ultimate level of production? Will it empowers the grower regarding the production as well as economy? These are simple questions, if answered could be helpful for the granting organizations as well as growers and the growers may benefit from it.

The first point to be considered is, we have to put in our mind the owner of the greenhouses. From when is s/he growing the crops in the field? We have heard in the news about the growers who are building the greenhouses are totally ignorant about the usage of the houses. They complain that building greenhouses had damaged their cultivable land into dumped area. Most lacking fact about the greenhouse growers are lack of information regarding the greenhouse cultivation practice of crops. They are growing the crops in the greenhouses similar to the open cultivation without a mere difference in cultivation practices. They are following the same type of whole cropping pattern along with methods which they used to do earlier or they have learned from their earlier generations. The growers are just utilizing the equipment's in the greenhouses which they have learned from the developers which is just a technique of how to operate the tools.

The next point to be considered is, growers are not provided the information on how could greenhouse impact on the physiology of crops which will help the growth patterns of crop with regards to the climatic balance. Without this information the growers will only be capable of utilizing the tools in the good way rather than effective way for which the greenhouses are constructed.

The government and non-government agencies are constructing different types of greenhouses in different states of Nepal with the hope of increasing productivity per unit area of the land. Unanimously, they are hoping to get better results regarding production ability increment in different regions of our country, which will help in ample production of crops. It should be understood that there are different types of greenhouses for variety of climatic regions and topography. The whooping result of crop productivity could not be attained certainly by construction of similar type of greenhouses for different purposes. Most of the greenhouses are of similar type which might not be beneficial for different crops as well as in different regions. We have seen in the news that the newly constructed greenhouses are blown up by the wind which cause huge losses to the growers as well as government. Why are we not planning different greenhouse construction types, materials and design along with regions for efficient crop production?

Greenhouse construction might be an expensive technology. Do all greenhouses should be constructed in a way so that the cost reaches a whooping figure and out of reach for a normal grower? The way we are developing greenhouses also should have some plans according to the growers. The materials that could be used in the greenhouse are of different categories which could cause variation in the cost. The greenhouses constructed in the plain land as well as in sloppy land might show some figurative difference which will resolve some parameters. The tropical, subtropical and temperate regions might have some differences which will figure out some parameters which will affect in price of the greenhouses. One best example is, do we need higher temperatures inside the greenhouses in most of the time period with in tarai region of Nepal? Attachment of chilling equipment's in the greenhouses of subtropical and temperate regions of Nepal is necessary or not. Have we planned the models as well as construction materials before building greenhouses? Most of the growers are building the greenhouse in their fields not only by their need but alsobecause of the granting organization and their design.

The greenhouses cultivation of Nepal does not have a long history in context of commercialization. These are in an increment phase in the recent decade. The major thing we have to follow in context of greenhouses construction is to develop a guideline. The guidelines should include the proper construction techniques as well as regions on which the construction could be done spatially. Firstly, the idea should be collected from the growers which crops they want to grow inside the greenhouses. The crops guidelines should match the construction parameters of the greenhouses including moderation of climatic parameters like temperature, light, relative humidity etc. Growers who want to grow crops inside the greenhouses should have knowledge regarding the cultivation techniques of the specific crop which will be grown inside greenhouses. Governmental agencies could test different models in different crops cultivation techniques in different areas of our country. The growers who are cultivating crops in closed houses could form a group which could be supported by the government for consultation as well as technical dissemination. Secondly, there should be research and extensions practices regularly conducted between universities and government agencies which will help to impart the exact valuation of greenhouse cultivation. Most of the data we are now utilizing here are adopted from the neighboring countries. Our climate and topography are quite different in context of cropping pattern which might results in different production system. Our universities have colleges in almost all part of our country which will also benefits from the trials of different practices of crop production in greenhouses. Thirdly, different new techniques could be introduced in the greenhouse cultivation sector which will help in good quality crop production. Nowadays, grading specialty

horticulture crops could be seen in the marketing. To produce good quality produce we need better techniques in the greenhouses. Different types of manipulation of climatic parameters could help in minimizing the diseases and insect pest which could only be performed in greenhouses cultivation. Lighting techniques could be introduced in the greenhouses which will help in improvement of photosynthesis as well as day lengths. Carbon dioxide assimilation could be increased by addition of carbon dioxide in closed houses.

In context of floriculture sector, most of the flowers are graded in different quality. The main objective of grower is to produce standard grade flower which is only possible in closed houses. The greenhouses such as glass house, plastic house, screen house, plastic cum net houses are preferably constructed by the floriculture growers. Do most of the efficient growers have capacity to construct big greenhouses for flower cultivation? The growers who are involved in floriculture business are merely involved by constructing greenhouses. Quality growers should get opportunity to grow crops inside greenhouses with the facilities like temperature management, light management, carbon dioxide management and internal securities of greenhouse production. Flower production could be increased in vigorous way with cultivation inside different closed houses.

The major focus in greenhouses could be done by targeting the crops which the grower wants to grow. The design should be developed according to the planning of consultants and Agri engineers. There should be guidelines for the construction of greenhouses regarding different sectors and crops which will make easier for both the Construction Company as well as growers. New techniques should be imparted in the greenhouse cultivation which will help in production of crops in low cost of operations. Last but not the least, we should not construct greenhouse just to showoff that we are advanced growers but instead to help in increasing production and productivity of the crop.

References:

Atreya, P. N., Kafle, A., Shrestha, B., & Rayamajhi, R. J. (2020). Precision and Protected Horticulture in Nepal: Sustainability and Future Needs.

Atreya, P. N., Kafle, A., Suvedi, B. D., & Shrestha, S. B. (2019). Precision and protected horticulture in Nepal. Retrieved on July, 1, 2019.

Baudoin, W.O. and von Zabeltitz, C.H.R. (2002). Greenhouse Constructions for Small Scale Farmers in Tropical Regions. Acta Hortic. 578, 171-179 DOI: 10.17660/ Acta Hortic.2002.578.20

Connellan, G.J. (2002). SELECTION OF GREENHOUSE DESIGN AND TECHNOLOGY OPTIONS FOR HIGH TEMPERATURE REGIONS. Acta Hortic. 578, 113-117.

N. Katsoulas, C. Kittas, G. Dimokas, Ch. Lykas,Effect of Irrigation Frequency on Rose Flower Production and Quality,Biosystems Engineering,Volume 93, Issue 2,2006,Pages 237-244,ISSN 1537-5110.

Ponce, P., Molina, A., Cepeda, P., Lugo, E., &MacCleery, B. (2014). Greenhouse design and control. CRC Press.

Von Zabeltitz, C. (2011). Greenhouse structures. In Integrated Greenhouse Systems for Mild Climates (pp. 59-135). Springer, Berlin, Heidelberg.

प्रो. उत्तम तिमल्सिना
फोनः ९८५१०७२४४१

तिमल्सिना नर्सरी

लोकन्थली, भक्तपुर



हाम्रा सेवाहरूः

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

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Gardening with Native Wild Plants

Dipak Lamichhane
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Introduction

Native plants are adapted to the local climate and soil conditions where they naturally occur. These important plant species provide nectar, pollen, and seeds that serve as food for native butterflies, insects, birds and other animals. Unlike natives, common horticultural plants do not provide energetic rewards for their visitors and often require insect pest control to survive. Gardening with wild plants is certainly challenging, but once successful; our garden will become a sanctuary for many other wild creatures like birds, lizards, frogs, butterflies, moths and other insects. If we live in the heart of the city, we will be pleasantly surprised to watch the bees and the butterflies visiting our garden.

Advantages of Native Wild Plants in Garden:

- Native plants do not require fertilizers and require fewer pesticides than lawns.
- Native plants require less water than lawns and help prevent erosion. The deep root systems of many native Midwestern plants increase the soil's capacity to store water. Native plants can significantly reduce water runoff and, consequently, flooding.
- Native plants help to reduce air pollution. Native plantscapes do not require mowing. Excessive carbon from the burning of fossil fuels contributes to global warming. Native plants sequester, or remove, carbon from the air.
- Native plants provide shelter and food for wildlife.
- Native plants promote biodiversity and stewardship of our natural heritage.
- Native plants are beautiful and increase scenic values!
- Safeguards for maintaining local adaptation and genetic diversity

Steps for Gardening

1. Collecting seeds, buds, cuttings and saplings :

This is a major exercise which involves a lot of plant hunting. In Nepal, seeds of wild flowers are not readily available in nurseries and we will have to collect them ourselves. Throughout this collecting process, we should always follow the government rules and regulations.

During collections, seeds come in all sizes and shapes. As the monsoon becomes off most annuals will have seeds ready for harvesting.

On the other hand, the seeds of perennials ripen just before the rains. We have to store the seeds in cool and dry places till we plant them. It is always safer to sundry collected seeds for a week to avoid fungus and insect infections. As for bulbs and tubers, they should be collected during the first week of monsoon. This is also appropriate time to collect and transplant young saplings of wild plants. If we want to collect the saplings of recognized species, we have to dig out the young sapling soil and have to keep in the poly bags.

Monsoon is also the right time to raise the cuttings of perennial plants. Same rule of thumbs can be used for collecting and planting other garden plants. Some perennials are difficult to grow from cuttings, while other has to be raised from seeds. Much of this technique has to be learned by trial and error and one has to be as innovative as possible. For water lilies, lotus and other aquatic plants it is advisable to transplant the rootstock straight in the garden plants.

2. Planning the Garden

Since different plants flower in different seasons, the garden could be planned accordingly. The most important factor that governs the well-being of flowering plants is the amount of sunshine, and much depends on the location of the garden. Preferably, flowering plants should get at least four to six hours of sunshine. Garden facing east and southeast will get the maximum sunshine.

While planting, taller plants should be planted at the back and smaller ones at the front of the bed. Allow plenty of beds for moderate sized plants. Larger shrubs will require even wider beds. Full grown size of the selected plant species have anticipated and plant them so that they don't crowed out each other. Leave space in between plants for air circulation. Many plants do not grow tall and will not require constant pruning.

Natural rocks and pebbles could be effectively used to create a rockery. Rocks and pebbles help in holding back the soil and are used to make different levels. Planting could be done to give a cascading effect. Instead of digging the rocks out, design a rock garden around them. Similarly, rock pool or pond could be added to the garden for aquatic plants and dwelling creatures.

3. Plant Selection

Finally, selection of plants depends on factors like the plants maximum size and its adaptability.Be aware of its need for sun and water, and be sure to put it in an area of your garden where it will get it needs.

Plant shrubs and perennial climbers first, as they take longer to reach maturity than the annuals do. They will require time to grow while we plant the less permanent annuals in our landscape.Needless to say, select the plants carefully.Many shrubs may be too big for today's small garden, balconies and window-sills.Begin to train shrubs when they are young,know how your shrub grows and how its branches should be spaced.

Plants of the garden will attract birds to feed and nest, butterflies and moths to breed and feed, and several other creatures to seek shelter.Emigrant butterflies will come to lay eggs surely attract sunbirds and other nectar seekers.

4. Natural Pruning

A wild flower garden should always be informal in style. Shrubs are not to be shaped into balls and boxes. Most shrubs trimmed this way lose their natural beauty. Of course, pruning is necessary for some plants, but on a moderate scale. We can cut back long branches to maintain the size of the shrub and remove branches to keep the shrub open and airy.

5. Mulching and Watering

Organic mulch in beds helps retain moisture and prevents other unwanted plants from germinating. Dry hay, wood shavings or shredded bark is a good choice, because it is easy to walk on and doesn't wash away in the rain. If we prefer to use rock mulch, the best choice is river rock, at iameter. Smaller sized rock can easily work itself into the soil or be washed aside during heavy rain. In the absence of rain, watering is essential. Perennial shrubs need far less water than annuals. For a large garden, a good sprinkler system or a drip system of flexible black tubing may be ideal.

6. Manuring

Wild plants do not require heavy manuring, but it is essential to maintain the soil quality by adding adequate organic manure at least once a year. Well rotted farmyard manure or kitchen compost should be mixed thoroughly in a proportion of 50% to a 15cm depth into the top soil. Around the same time, bedding for the annuals should be prepared. Excessive manuring will cause more leafy growth and fewer flowers.

These are just broad guidelines to start wild native plant garden. This type of garden is certainly a happy place to be in, as it provides a place of relaxation and recreation for the gardener as well as the naturalist. With very little care, the wild native plant garden can soon become wilderness at our doorstep.

Example of Gardening with Native Wild Plants
Biodiversity Education Garden of National Botanical Garden, Godavari, Lalitpur

National Botanical Garden is situated in Godawari (1515m), the foothill of Mt. Phulchoki (2765 m), the highest peak of Kathmandu valley.It lies in the south east of the Kathmanduvalley about 12 km far from the Lagankhel bus park, Lalitpur.The garden covers an area of 82 hectar of varying topography and exposure. It is surrounded by natural forest of *Alnus-Schima-Castonopsis*. It was established in 1962 A.D. inaugurated by late king Mahendra.NBG is under the Department of Plant Resources (DPR), Ministry of Forests and Environment. Ever since its establishment much of its activities are centered in enriching with indigenous plants as to integrate its collection with scientific research, conservation, education and demonstration. The garden is also a member of Botanical Garden Conservation International (BGCI), an international network since 2015. The Plant landscape of this garden was designed by two British scientists G.A.C. Herklotts and Tony Schilling. About 450 thousand visitors visit this botanical garden every year.

This botanical garden conserves about 1000 species of living plants. There are different thematic and plant landscape garden like physic garden, biodiversity education garden, rock garden, fern garden, species garden, terrace garden, orchid garden, seasonal flowers garden, japanese style garden, rare and endangered plants garden, lily garden, water garden, tropical garden, sand garden, rose garden, VVIP plantation garden, ethno-botanical garden and arboretum.

Biodiversity Education Garden (BEG)

Biodiversity Education Gardenis nearby the main entrance gate of garden. It has been established on the auspicious occasion of British-Nepal 200 years (Bicentenary) diplomatic relationship in 2016 with the collaboration between British Embassy, Kathmandu, Royal Botanic Garden, Edinburgh, UK and Government of Nepal. This garden covers an area of 1.3 ha. Plants of three different altitudinal regions (tropical, subtropical and temperate) of Nepal are planted here. It is also anexample of wild native plant garden. List of wild native plants of BEG are given in the table:

Table : List of wild native plants

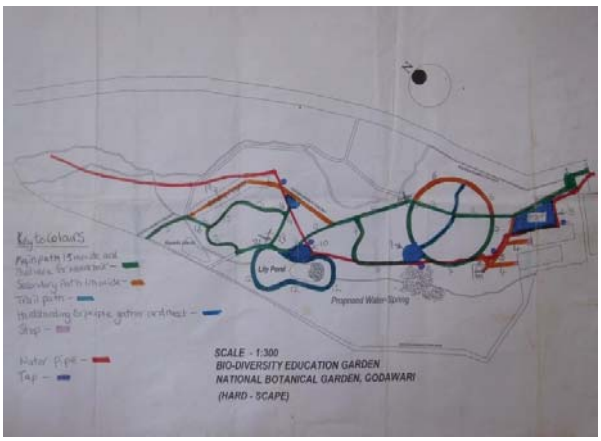
S. N.	Scientific name	Family	Common Name	नेपाली नाम	Distribution in Nepal
1	*Abies spectabilis* (D. Don) Mirb.	Pinaceae	Himalayan Silver Fir	तालिस पत्र	WC Nepal, 2400-4400m
2	*Acer oblongum*Wall. ex DC.	Sapindaceae	Maple	फिरफिरे	WCE Nepal, 700-2400m
3	*Acorus calamus* L.	Acoraceae	Sweet flag, Calamus root	बोझो	WCE, 150-2500m
4	*Actinodaphnelongipes* Kosterm.	Lauraceae		मसिनो खपटे	CE Nepal, 1600-2600m
5	*Aesculus indica* (Colebr. ex Cambess.) Hook.	Sapindaceae	Horse chest-nut	लेख पाङ्ग्रा	WC Nepal, 1900-2700m
6	*Alnus nepalensis* D. Don	Betulaceae	Alder	उत्तिस	WCE Nepal, 500-2600m
7	*Ardisia macrocarpa* Wall.	Primulaceae	Himalayan coralberry	दमाई फल	
8	*Asparagus racemosus* Willd.	Asparagaceae	Asparagus	कुरीलो,सतावरी	WCE, 150-2100m
9	*Astilbe rivularisBuch.*-Ham. ex D. Don	Saxifragaceae	False spiraea	ठूलाऔषधी,बुढो ओखती	WCE Nepal, 1400-3600m
10	*Barleria cristata* L.	Acanthaceae		भेडीकुरो	WCE Nepal, 200-2000m
11	*Bauhinia variegata* L.	Leguminosae	Orchid tree, Mountain Ebony	कोइरालो, सेतो कोइरालो	WCE Nepal,100-1900m
12	*Berberis asiatica Roxb.*ex DC.	Berberidaceae	Common berberry	चुत्रो	WC, 1000-2700m
13	*Berberisnapaulensis* (DC.) Laferr.	Berberidaceae	Nepal mahonia	जमानेमान्द्रो	WCE, 1500-3000m
14	*Bergenia ciliata* (Haw.) Sternb.	Saxifragaceae	Rockfoil	पाषानभेद	C Nepal, 900-2500m

S. N.	Scientific name	Family	Common Name	नेपाली नाम	Distribution in Nepal
15	*Betula alnoidesBuch.*-Ham. ex D. Don	Betulaceae	Himalayan birch, Indian birch	सौर	WCE Nepal, 1200-2600m
16	*Bombax ceiba* L.	Malvaceae	Silk cotton tree	सिमल	CE Nepal, 200-1000m
17	*Brassaiopsishainla* (Buch.-Ham. ex D. Don) Seem	Araliaceae		सेतो चुलेत्रो	WCE Nepal, 1000-1800m
18	*Bruceajavanica* (L.) Merr.	Simaroubaceae		भक्कीमलो	WCE Nepal, 900-2400m
19	*Carexcruciata* Wahlenb.	Cyperaceae		लामो हात कटुवा	WCE, 900-3400m
20	*Caryotaurens* L.	Arecaceae	Fish tail palm	जगर	WCE Nepal, 1200-1400m
21	*Castanopsis indica* (Roxb. ex Lindl.) A.DC.	Fagaceae	Indian Chest-nut	ढाले कटुस	WCE Nepal, 1000-2900m
22	*Cedrus deodara* (Roxb. ex D. Don) G. Don	Pinaceae	Himalayan Ceder	देवदार	WC Nepal, 1100-3000m
23	*Chlorophytum nepalense* (Lindl.) Baker	Asparagaceae	Nepal chlorophytum, Spider plant	वनप्याज, क्याउरिनो	WCE,1200-3200m
24	*Choerospondiasaxillaris* (Roxb.) B.L. Brutt& A.W. Hill	Anacardiaceae	Nepalese hog plum	लप्सि	CE Nepal, 1200-1500m
25	*Cinnamomum tamala* (Buch.-Ham.) Nees & Eberm.	Lauraceae	Nepali Cinnamon	तेजपात	WCE Nepal, 450-2300m
26	*Dendrobium densiflorum*Lindl.	Orchidaceae	The densely flowered Dendrobium	सुनगाभा	CE, 300-2900m
27	*Dichroafebrifuga* Lour.	Hydrangeaceae	Antifertiledichroa	भासक	CE Nepal, 900-2400m
28	*Diploknemabutyracea* (Roxb.) Lam	Sapotaceae	Nepal butter fruit	चिउरी	CE Nepal, 200-1500m
29	Dipsacusatratus Hook. f. & Thoms. ex C. B. Clarke	Dipsacaceae		वनमूला	C Nepal, 3000-3800m
30	*Drepanostachyumfalcatum* (Nees.) Keng f.	Poaceae	Himalayan weeping bamboo	निगालो	CE, 1000-2200m
31	*Ehretia acuminata* R. Br.	Boraginaceae	Heliotrope tree	चिल्ले	WCE Nepal, 500-1800m
32	*Elaeocarpus serratus* L.	Elaeocarpaceae	Utrasun bead tree	रुद्राक्ष	E Nepal, 800m

S. N.	Scientific name	Family	Common Name	नेपाली नाम	Distribution in Nepal
33	*Ephedra gerardiana* Wall. ex Stapf	Ephedraceae	Joint fir	सोमलता	WCE, 2000-5200m
34	*Euonymus hamiltonianus* Wall.	Celastraceae	Spindle wood	निल डाँठे	CE Nepal,700-2600m
35	*Hedera nepalensis* K. Koch	Araliaceae	Nepal ivy climber	पिपलपाते	WCE Nepal, 2000-3200m
36	*Hedychium gardnerianum* Shepperd ex Ker Gawl.	Zingiberaceae		सुन क्यामरा	CE, 1900-2000m
37	*Hedychium flavescens* Carey ex Roscoe	Zingiberaceae	Yellow ginger lily	सुन क्यामरा	E, 1200-2000m
38	*Hedychium thyrsiforme* Buch.-Ham ex Sm.	Zingiberaceae	Pincushion ginger	चण्डी क्यामरा	C, 1200-1400m
39	*Hypericum cordifolium*	Hypericaceae	St.John's wort	चैते फूल,अरेली,अरेटो	C, 900-1900m
40	*Ilex excelsa* (Wall.) Hook.f.	Aquifoliaceae	Nepal holy tree	पुँवाले	WCE Nepal, 600-2100m
41	*Jasminum humile* L.	Oleaceae	Yellow jasmine	जाई	WCE Nepal, 900-3400m
42	*Juglans regia* L.	Juglandaceae	Walnut	ओखर	WCE, 1200-2700m
43	*Ligulariafischeri* (Ledeb.) Turcz.	Compositae	Leopard plant		WCE Nepal, 2200-4600m
44	*Ligustrum confusum* Decne.	Oleaceae	Privet	कनिके फूल	WCE Nepal, 800-2900m
45	*Lindera pulcherrima* (Nees) Hook.f.	Lauraceae	Wild privet	फुसुरे, खराने	WCE, 700-3600m
46	*Luculia gratissima* (Wall.) Sweet	Rubiaceae	Luculia	वनकाँइयो	WCE Nepal, 1000-2100m
47	*Macluracochinchinensis* (Lour.) Corner	Moraceae	Cockspur thorn	डमरु	WCE Nepal, 300-1600m
48	*Magnolia champaca* (L.) Baill. ex Pierre	Magnoliaceae		सुनचाँप	CE, 600-1900m
49	*Murrayakoenigii* (L.) Spreng.	Rutaceae	Curry leaf tree	मिठा निम, करिपत्ता	WCE Nepal, 100-1800m
50	*Myrica esculenta* Buch.-Ham. ex D. Don	Myricaceae	Box myrtle/ Bay-berry	काफल	WCE, 1200-2300m
51	*Nephrolepis cordifolia* (L.) C. Presl.	Nephrolepidaceae		पानीअमला	

S. N.	Scientific name	Family	Common Name	नेपाली नाम	Distribution in Nepal
52	*Nyctanthes arbor-tristis* L.	Oleaceae	Night jasmine	पारिजात	WCE Nepal, 200-1200m
53	*Ophiopogon intermedius* D. Don	Asparagaceae		बन सुपारी, वन कसुर	WCE, 1200-3900m
54	*Osmanthus fragrans* Lour.	Oleaceae	Fragrant olive	सिरिङ्गे	WC Nepal, 2400-3300m
55	*Pandanus furcatus* Roxb.	Pandanaceae	Screw pine	वनकेवरा	CE, 600-1600m
56	*Pinus roxburghii* Sarg.	Pinaceae	Chir pine	रानी सल्ला, खोटे सल्ला	WCE Nepal, 500-2700m
57	*Pinus wallichiana* A. B. Jacks.	Pinaceae	Blue pine	गोब्रे सल्ला	WCE Nepal, 1800-4300m
58	*Podocarpus neriifolius* D. Don	Podocarpaceae	Mountain teak, Brown pine	गुन्सी	CE Nepal, 800-1500m
59	*Potentilla lineata*Trev.	Rosaceae	Silver leaf	बज्रदन्ती	WCE Nepal, 1600-4800m
60	*Prunus cerasoides* Buch.-Ham. ex D. Don	Rosaceae	Himalayan cherry	पैयुं	WCE Nepal, 1300-2400m
61	*Pyracantha crenulata* (D. Don) M. Roem.	Rosaceae	Nepal fire thorn	घंगारु, काठ गेडी	WCE Nepal, 800-2800m
62	*Pyrus pashia* Buch.-Ham. ex D. Don	Rosaceae	Wild pear	मयल	WCE Nepal, 700-3100m
63	*Rapaneacapitellata* (Wall.) Mez	Primulaceae		सेति काठ	CE Nepal, 900-1800m
64	*Rauvolfia serpentina* (L.) Benth. ex Kruz	Apocynaceae	Serpentine	सर्पगन्धा, चाँदमस्वा	CE Nepal, 100-900m
65	*Reinwardtia indica* Dumort.	Linaceae	Winter flax	प्याउली	WCE Nepal, 300-2300m
66	*Rhaphidophora glauca* (Wall.) Schott	Araceae		कन्चिर्नो	WCE, 1000-2000m
67	*Rhododendron arborerum* Sm.	Ericaceae	Tree rose, Rhododendron	लालिगुराँस	WCE Nepal, 1500-3300m
68	Roscoea capitata Sm.	Zingiberaceae		भुँई सरो	CE Nepal, 1200-2600m
69	*Rubia manjith* Roxb.ex Fleming	Rubiaceae	Indian madder	मजिठो	CE Nepal, 1200-2100m
70	*Rubus ellipticus* Sm.	Rosaceae	Himalayan raspberry	ऐसेलु	WCE Nepal, 300-2600m

S. N.	Scientific name	Family	Common Name	नेपाली नाम	Distribution in Nepal
71	*Rumex nepalensis* Spreng.	Polygonaceae	Yellow dock, Common field sorrel	हलहले	WCE Nepal, 1200-4200m
72	*Saccharum spontaneum*L.	Poaceae		काँस	WCE Nepal, 150-1900m
73	*Sambucus hookeri* Rehder	Adoxaceae	American Alder	कनिके फूल	CE Nepal, 1400-2400m
74	*Sarcococcapruniformis* Lindl..	Buxaceae	Sarcococca	फितफिया	WCE Nepal, 600-3500m
75	*Saurauianapaulensis* DC.	Actinidiaceae		गोगन	WCE Nepal, 750-2100m
76	*Schimawallichii* (DC.) Korth.	Theaceae	Needle wood	चिलाउने	CE Nepal, 900-2100m
77	*Taxus mairei* (Lamee&H.Lev.) S.Y. Hu exT.S.Liu	Taxaceae	Chinese Yew	लौठ सल्ला, बर्मे सल्ला	C Nepal, 1500-2200m
78	*Thysanolaena latifolia* (Roxb. ex Hornem.) Honda.	Poaceae	Nepalese broom grass	अम्रिसो	WCE, 150-2000m
79	*Trachycarpusmartianus* (Wall. ex Mart.) H. Wendl.	Arecaceae	Windmill palm, Khasia hills fan palm		C Nepal, 1500-1600m
80	*Valerianajatamansii* Jones.	Caprifoliaceae	Indian valerian	सुगन्धवाल	WCE Nepal, 1500-3300m
81	*Zanthoxylum armatum* DC.	Rutaceae	Prickly ash	टिमुर	WCE Nepal, 1100-2500m
82	*Ziziphus incurva* Roxb.	Rhamnaceae	Bead plum, Common jujube	हाडे वयर	CE Nepal, 900-900m



Design of BEG

Part of BEG with snow fall in 2019 Feb 28

References

GoN.(2001). Flowering Plants of Nepal (Phanerogams). Department of Plant Resources, Kathmandu, Nepal.

Hughes,K. and Lamichhane, D.(2017). Botanic Garden Profile: The National Botanical Garden of Nepal. In : SIBBLDIA No.15 pp 9-30. Royal Botanic Garden, Edinburgh

Kehimkar, I. (2000). Common Indian Wild Flowers. Bombay Natural History Society.

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

Malla, K.J., Lamichhane, D., Kafle, D.R., Pun, U. and Bade, D. (2017). Indigenous Ornamental Flowering Plants of Nepal . Floriculture Association of Nepal.

Malla, K.J., Lamichhane, D., Kafle, D.R. and Bade, D. (2018). Indigenous Ornamental Flowering Plants of Nepal (Supplement-I). Floriculture Association of Nepal.

Press, J.R., Shrestha, K.K. and Sutton, D.A. 2002. Annotated Checklist of the Flowering Plants of Nepal. The Natural History Museum, London, UK

Rajbhandari, K.R. and Rai, S.K. (2017). A Handbook of the Flowering Plants of Nepal,Volume 1. Department of Plant Resources, Kathmandu, Nepal.

Rajbhandari, K.R. and Rai, S.K. (2019). A handbook of the Flowering Plants of Nepal, Volume 2. Department of Plant Resources, Kathmandu, Nepal.

Shrestha, K.K., Bhattarai, S. and Bhandari, P. (2018). Handbook of Flowering Plants of Nepal (Vol 1. Gymnosperms and Angiosperms: Cycadaceae-Betulaceae). Scientific Publishers, Jodhpur, India.

https://www.fs.fed.us/wildflowers

http://www.theplantlist.org

Avenue plantation: introduction, history, challenges and importance in Nepal

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Planting of line of trees along the road sides, highways or in a straight pathway is known as avenue plantation. Generally, avenue plantation means a row of trees planted along roads, pathways and canal sides. It is generally practiced for the aesthetic value, control of soil erosion, for economic use of its timber and to provide shade to the stray animals &travelers. The avenue trees are most important for maintaining ecological balance in urban area as it helps to reduce the pollution caused by vehicle movement and also reduce concentration of CO2 in atmosphere. In most of the cases, the trees planted in an avenue will be all of the same species along the full length of the avenue. Trees preferred for avenues were selected for their height, speed of growth and canopy behavior of the tree.

History of Avenue plantations:

The avenue plantation technique is one of the oldest ideas in the history of landscaping. The earliest feature of landscaping avenue plantation date back nearly 500 years from the present day. In Nepal while extending the road along Tundikhel a few years back, the Kathmandu metropolitan office removed Ginkgo biloba tree (fossil tree). The specimen which was apparently imported from japan more than one hundred years ago, was the oldest tree planted along the roadside.

Jaysthiti Malla, a reformed minded Nepali king (1382-1395 AD) issued a proclamation which levied fines of Rs, 5, a serious amount of money in the 14th century, and sent to prison those who cut trees along the Sadaks and roadsides. Nepal first civil code act of 1970 BS had almost identical punishment of fines and prison sentence for those who felled trees located next to roads. In his human justice religious book, King Jaysthiti Malla ordered his officials to encourage commoners to plant trees alongside roads and water wells a practice which was continued throughout the Malla period and rana period.

Avenue trees:

In many parts of the world, safety concerns are taken into the account by planting trees which don't grow to monstrous proportions. The rana rulers Chandra and Juddhashamsher favored important specimens like monkey puzzles and eucalyptus. Later on local types including birch (*Batulaalnoides*), mimosa or silk tree (*Albizzia indica*), willow (*Salix babylonica*) and *Jacaranda* as well as fast growing, imported populous trees were planted along roadside in Kathmandu valley.

Avenue tree must have an upright growth habit, enough space above the ground. Below ground, space is often limited and because of paving and traffic. Therefore, choose species which are able to tolerate full or partial pay particular attention to the preparation of a good planting site. In streets and avenues, the preference is often for fruitless or thorn free cultivars. The girth from 20-25 to 60-70 is best for avenue trees. These trees are pruned annually and have a densely branched root system for optimum regrowth at new planting locations.

Figure: Avenue plantation (Source: Wikipedia)

Some important tree species and their useful characteristics for avenue plantation in Nepalese context are as follows:

1. One Kind of Flowering Trees on Both Sides:

In this scheme only one kind of flowering tree is planted on both the sides of roads. So, when trees come in bloom there is riot of colour and roads look elegant for particular period. Different trees in different colours are available for this purpose.

However, for the rest of blooming time roads will look dull. Trees that can be selected are: *Cassia fistula, Delonix regia, Cassia nodosa, Cassia jauanica, Lagerstroemia speciosa, Greuillearobusta, Thespesia populnea, Bauhinia variegata* etc.

2. Two Kinds of Flowering Trees Blooming at One Time on both Sides of Road:

In this scheme, two kinds of trees blooming at the same time are planted alternatively on both sides of the roads. The overall effect of two colours is very much pleasing and there is variation in flower colour, shape of trees, leaf size etc. which avoids mono-tonus effect.

Different trees selected are:

- *Grevillea robusta* (yellow)—*Jacaranda acutifolia* (blue)—*Grevillea robusta*.
- *Cassia fistula* (yellow)—*Delonix regia* (red)—*Cassia fistula*.
- *Cassia fistula* (yellow)—*Cassia nodosa* (pink)—*Cassia fistula*.

3. Two Kinds of Flowering Trees Blooming at Different Time on both Sides of the Roads:

According to this scheme two different flowering trees blooming at different time are planted alternately on both sides of the roads. Since the flowering time is different, so one tree will be blooming in one part of the year and the other in another part of the year, hence, road sides will be colorful for longer period. There will not be mono-tonus effect.

Different trees which can be selected are:

- *Bauhinia triandra* (purple colour in November)—*Spathodeacompanulata* (red colour in end of April)—*Bauhinia triandra*.
- *Cassia fistula* (yellow in May-June)—*Jacaranda acutifolia* (blue in March-April) — *Cassia fistula*.
- *Grevillea robusta* (Yellow in April)—*Bauhinia variegata*—Mauve in March— *Grevillea robusta*.

Figure: Cassia fistula (source: Aura Greens)

4. Shady Trees Only on both Sides of Roads:

Shade during summer is required. Therefore, only shady trees are planted on both sides of road which provide coolness during hot part of the day. Suitable trees are: *Ficus infectoria, Mimusposelengi, Alstoniascholaris, Cedrella toona, Swietenia mahagoni, Swietenia macrophylla, Pterospermumacerifolium, Azadirachta indica, Ficus religiosa, Polyalthia longifolia,* etc.

Avenue trees can also be categorized on the basis of topographical condition as mentioned below:

1. **Tropical trees: (below 1000)**
   Some of the important common avenue trees for this tropical zone are *Cassia fistula, Albizzia procera, Alstoniascholaris, Bombax ceiba, Bridelia retusa, Callicarpa arborea, Cassia fistula, Casearia graveolens, Dillenia indica, Ficus spp., T. catappa, F. platyphylla, M. indica and P. longifolia.*

2. **Subtropical trees:**
   Some of the important subtropical avenue trees are as follows:
   Semicarpus anacardium, Cassia fistula, Cretaeavaunilocularis, Trewianudiflora, Premnainterrupta, Ulmuslancifolia, Ulmuschumlia, Glochidium velutinum, Callicarpa arborea, Toona ciliata, Ficus spp., Mahosamasimilicifolia, Trevesia palmate, Xylosmalongifolium, Boehmeria rugulosa, Schefferavenulosa, Michelia spp., Casearia graveilens, Rhus wallichii, Actinodaphne reticulata, Sapimuminsegne, Alnsnepalensis.

3. **Temperate trees:**
   Some of the important trees for avenue plantation in temperate region are as follows:
   Betula utilis, Buxus rugulosa, Benthamidia capitata, Corylus ferox, Deutzia staminea, Euonymus

tingens, Abies spectalbilis, Acanthopanax cissifolius, Acer campbellii, Acer pectinatum, Betula alnoides, Coriaria terminalis, Fraxinus macrantha, Dodecadenia grandiflora, Euryacerasifolia, Hydrangea heteromala, Ilex dipyrena, Ligrestum spp., Litseaelongata, Juglans regia.

Challenges of Avenue plantation:

Despite the importance of avenue plantation, ensuring the survival of roadside trees is often challenging and designers need to consider critical issues in their road landscapes including site soil condition, space availability and maintenance requirement.

More and more urban cities are undertaking avenue tree planting projects as a conscious effort to transform the urban concrete jungle into greencity where people love to live. Roadside tree plantation has more importance but the urban environment is not ideal for creating healthy and mature trees which shows in the prevalence of root system in pavements and roads. This damage to infrastructure is caused by the lack of space offered to tree roots to expand due to emerging urban cities. Some other challenges include preserving the greenery of the tree, protecting it from wild animals, children and others. And roadside tree planting ideally takes place in loose soil which is in short supply and other infrastructure requires highly compacted soil.

Importance of Avenue plantation:

Avenue trees improve the living ability of towns and cities in a number of ways including reducing storm water runoff, increasing air quality, storing carbon, providing shade, and reducing urban heat-island effects. They can also enhance bio diversity by providing food, habitat and landscape connectivity for urban fauna (Burden2006; Rhodes et al., 2011).

Planting avenue trees along roadside is an important practice of landscaping and decoration. Avenue trees give relief to humans, birds and animals in sun and rains. This practice to cut and destroy such trees today in the name of development and not planting replacement is very unfortunate. Some of the importances of avenue plantation are as follows:

- It is well known practice that is key for environmental conservations. One aspect is the ability of trees to sequestercarbon dioxide gas that is known to play a critical role in global warming.
- Roadside trees give shade to the pedestrians and also provide shade to vehicles which can be parked under the trees conveniently.
- Roadside trees with their rich foliage can acts as umbrella during rains which is helpful for the pedestrian and vehicles.
- Trees on the roadside help in restricting the wind force and act like filter.
- Avenue plantation is better option for controlling soil erosion. When planting trees along the roadside it will absorb and clean water that runs over the road.
- It supplies oxygen to the environment.
- Roadside trees also reduce greenhouse effect and noise pollutions.
- Avenue trees also can be the shelter of birds. The flowers attract bees and butterflies on it and will be real scene to watch.
- Greenery around the city boundaries can help to provide recreational opportunities, physical activities, reduces stress and stimulates social cohesion.
- And its most important advantage is the aesthetic value of its unique beauty. It plays an important role in enhancing the beauty of the road as well as attracting tourists.

References:

Agrawal, A., Pati, A. K., &Karkun, D. (1997). Seasonal variation in infestation characteristics of bagworm (Lepidoptera: Psychidae) in avenue plantation of Acacia and Peltophorum in the Chhattishgarh region. Current Science, 211-214.

Iqbal, M. Z., Shafiq, M., Athar, M., & Kabir, M. (2017). Seedlings growth performance of Azadirachta indica A. Juss. seeds collected from avenue plantation. International Journal of Life Sciences and Technology, 10(10), 86.

Joshi, D. P. (1952). Roadside Avenue Plantation Technique-As Practised in Southern Doab Division, Etawah. Indian Forester, 78(3), 153-157.

Mohanty, A. (2011). State of environment in Kathmandu Valley, Nepal: a special review. Journal of the Institute of Engineering, 8(1-2), 126-137.

Pangging, G., &Pongen, M. AVENUE PLANTATION IN EASTERN HIMALAYA: A CASE STUDY OF AVENUE TREES IN NERIST CAMPUS, ARUNACHAL PRADESH.

PALMS: An Ornamental Crop

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Introduction

Palms are the important ornamental plants widely grown in lawn or garden, along avenues and as indoor plant. Due to their compact crown with evergreen leaves and attractive structure, they have huge ornamental value. They are suited warm humid tropical conditions.Ornamental palms belong to Arecaceae family. There are about 212 genera and 3000 species of palms. They are varying in form, size and growing habit. They are very slow growing and widely cultivated as ground planting or in large pots (Arora, 1990).

Classification

Palms are classified into two groups on the basis of their leaflets.

1. Feather leaved palms: Those palms whose individual pinnae are free are called feather leaved palms. E.g., Date palm, Coconut palm
   - *i.* *Caryotaurens* (Fish-tail palm)
   - *ii.* *Roystonia regia* (The Royal Palm)
   - *iii.* *Dypsislutescens* (Areca palm)
   - *iv.* *Cytostachysrenda* (Ornamental Sealing-wax Palm)
   - *v.* *Phoenix dactylifera* (Date palm)
   - *vi.* *Phoenix roebelenii* (Pygmy Date Palm)
   - *vii.* *Hyophorbelangenicaulis* (The Bottle Palm)
   - *viii.* *Chrysalidocarpuslutescens* H. Wendl. (Golden Cane Palm, Parlour Palm)
2. Fan leaved palms: Those palms whose pinnae are partially to completely united are called fan leaved palms.
   - *i.* *Licuala grandis H. Wendl.* (The Table Palm)
   - *ii.* *Livistona chinensis R.Br.* (Chinese fan palm)
   - *iii.* *Rhapisexcelsa* (Large lady palm) (Arora, J.S., 1990; P.K. Valsalakumari, 2008)

Fig: The Bottle Palm (Source: Boonie L. Grant, Certified Urban Agriculturist)

Fig: Fish-tail Palm (Source: Plantvine)

Fig: Areca Palm (Source: Google photos)

Fig: Chinese Fan Palm (Source: Google)

Climate:

Palms are mainly tropical plants known for their sculpturistic nature. Temperature requirements are different depending upon species. Most of the species prefer warm temperature like coconut palm, while few palms can thrive cold temperature like parlor palm. Temperature above 18°C is favorable temperature for the cultivation of palm tree.Most of the palms can easily adapt to low light condition or prefer the shade. While some species do best with bright light and last longer with some direct light.

Soil:

In case of growing palm in container, soil in pots must be loose, well drained and porous with good combination of peat moss, leaf mold and shredded bark. Soil with pH neutral to slightly acidic is preferable for growing palm tree. Palms grow best in slightly sandy soil with good drainage ability.

Propagation:

Palms can be propagated by two ways: - sexually by seeds and asexually by division depending upon species. Though, asexual means of propagation are not effective, division of offshoots is quite done for propagation. Usually, the best way to propagate is through seed.

1. **By seed**

   Palms are planted from seed, usually many seeds to a single pot or cluster. Mature seeds are orange in color while immature seed are green in color. Thus, only mature seed should be used for plantation because they have better germination rate than immature seeds.All palms require high soil temperature over 26°C and relative high humidity for germination.Seeds will germinate within six to seven weeks at favorable condition.

2. From offshoots

Offshoots plants are true to type to parent plant. They develop from the axillary bud on the trunk of mother plant. Some varieties of palm such as sago palms, date palms and ponytail palms produce their offshoots called pups. These pups can be used for propagating the plant. Larger offshoots are more likely to grow than smaller ones. The plant grown from offshoots bear fruit 2-3 year earlier than seedling. Care should be taken while cutting the offshoots. Most of the palms are preferred in offshoots production rather than other methods of plantlets production (M.L. Elliott et. al, 2014).

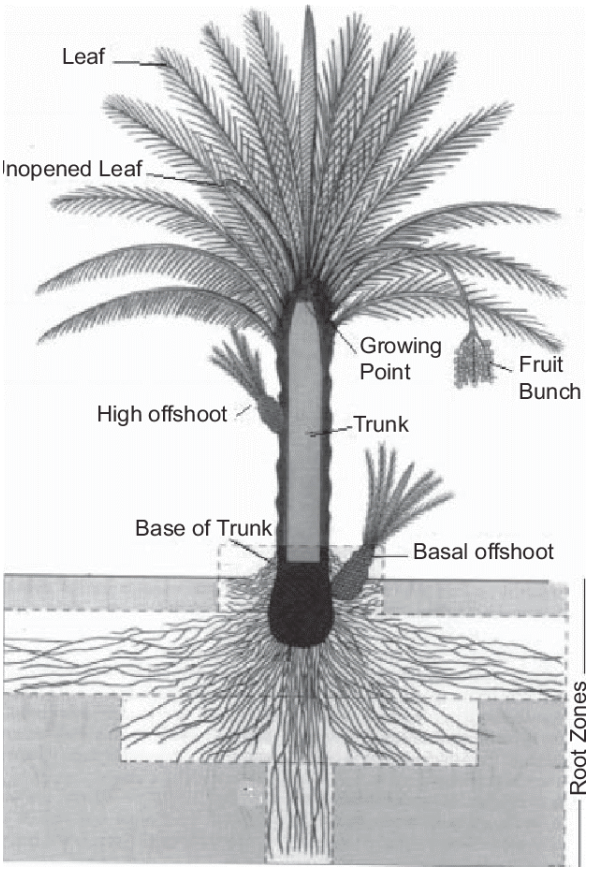

Fig: Drammatic representation of Date Palm tree
(Source: USDA, archival diagram, Chao and Krueger, 2007)

Planting

The palm tree can be planted in any time except cold winter. However, the best time for planting them in garden is during spring season or early summer. They can be planted in container with good soil mixture at any seasons by placing them in indirect bright light.

Staking

Newly planted palm tree requires staking, especially in areas suffering from high winds. Large palms should be staked at the time of transplanting.

Metal T- stakes or 2*4 wooden stakes are used at equal spacing around the tree at the distance of 4-5 feet from the base of tree.

Watering:

Most of the palms are sensitive to water logging condition. So, they cannot tolerate being water logged or sitting in saturated potting mix. Hence, good drainage is essential.

Fertilizer:

Palms require light liquid fertilizer during their growing season. Fertilizers with ratio of 3:1:3 NPK is found to be effective for palm cultivation. Fertilizer should be applied once or twice during their growing season. Organic fertilizers such as blood meal, bone meal, fish emulsion, worm casting and manure can be applied.Potassium deficiency is common in palms that results in yellowing or brownish fronds. So, required dose of potassium and other micro nutrients such as manganese should be applied (Valsalakumari et. al., 2008).

Pruning:

Since, many species of palms draw nutrients from their old fronds as they get yellow or brown. All those old fronds should be pruned well in order to maintain the whole shape of plants. Palms grow from a central tip so they cannot be top trim. If the growing tip is removed, the whole plant will die. Over pruning should be avoided in case of palm that result in weaking of overall plant (Randhawa, 1978).

Repotting:

Palms grown in pots does not require frequent repotting since they prefer to be in pot bound and thrive in under sized pots. However, repotting can be done by replacing the pot with fresh soil and manure. The growth of palm tree grown indoor can be slow down by keeping them slightly pot-bound.Top dressing can be done with oil cake or with fertilizer once or twice a year (Thekkayam, 2009)..

Disease, pest of Palms

Diseases:

- **Leaf spots**

  Palms are commonly affected by many fungi including *Septoria sp., Alternaria sp*. and *Cercospora sp*. causing leaf spots. These spots are circular to elongated, brown in color and may have oily appearance.

  Symptoms

  - Initially yellow spots on the lower leavers appear which gradually turn brown to black.
  - These spots coalesce into large necrotic areas and finally cause the death of the entire leaf.

  Control

  - Regular clean up should be done.
  - Infected plant debris should be destroyed.
  - Avoid overwatering palm tree.
  - Plant foliage should remain dry. Avoid splashing water onto them.
  - In severe condition, application of appropriate dose of fungicides with a.i. azoxystrobin, chlorothalonil, mancozeb, or thiophanate methyl should be applied.

- **False smut**

  The causal agent of this disease is *Graphiola sp.* This disease is most common in areas of high humidity in which only palms are affected.

  Symptoms

  - The infected leaves have tiny, black, wart like structures arising through both leaf surfaces.
  - Tiny filaments appear from the black spots.

  Control

  - Low relative humidity with good air circulation.
  - Infected palm frond should be completely removed
  - Avoid wetting palm fronds during watering.
  - Fungicides containing coppers should be applied according to the direction on the label.

- **Bud rot**

  This disease is caused by several fungi as well as bacteria. This disease is prevalent where maximum rainfall occurs.

  Symptoms
  - Black lesions appear on buds and young fronds.
  - Wilting of young leaves occur.
  - A firm rot which gradually becomes slimy on buds due to other invaders.
  - All the fronds fall slowly. At last, only trunk remains.

  Control
  - Infected plant should be completely removed.
  - Avoid overhead irrigation as possible.
  - Infected plant parts should be destroyed immediately to reduce the spread of this disease.
  - Several fungicides containing copper should be applied on the diseased parts.

- **Ganoderma Root Rot**

  This is a fungal disease caused by fungus, *Ganoderma zonatum*. Many species of palms are prone to this disease.

  Symptoms
  - Initially withering and drooping of older fronds occurs.
  - New growth of palms is pale green or yellow in colors and becomes stunted.
  - Roots of infected plants may severely damage.
  - The head of infected palms may fall off or the whole plant can collapse.

  Control
  - Avoid injuring tree during plating or carrying intercultural practices.
  - Fungus can survive on plant tissue so whole plants along with roots should be removed.
  - There is no specific chemical control of these diseases (Eliot et. al., 2004).

Insect-pest:

- **Spider mites**

  Spider mites are very small insect that are barely visible through naked eyes. They are sap sucking insects. Adult mites are globular in shapes with eight legs.

  Damages
  - Since they suck their fluid from plant cells causing chlorosis.
  - Damaged leaves may curl and drop from the plant.
  - Initially, their infestation only occurs on the underside of the leaves.
  - At severe condition, mites produce webbing on the top of leaves and other parts of plant (Eliot et. al., 2004).

  Control
  - Timely irrigation should be done.
  - Insecticidal soap, neem oil, horticultural oil should be applied to control them.
  - Predatory mites such as *Phytoseiulus persimilis* and *Typhlodromus occidentalis* can be effective to control them.

- **Palm scale insects**

  This is very problematic insect of pam tree. Scale insects are small and mature female insects.

  Symptoms

  - They are also sap sucking insects that damages the plant tissue.
  - These insects spoil the plants appearance.
  - Heavy infestation causes the death of whole plant.

  Control

  - Diseased free plant should be selected.
  - Palm plant should be kept clean.
  - Application of horticultural oil can be effective to control these insects.
  - Soil application of insecticides such as Dinotefuran or disulfoton also helps for controlling these insects (Howard, F. W. et. al., 2001).

Reference

Arora, J.S. (1990). Introductory Ornamental Horticulture. Kalyani Publishers

Elliott, M. L., Broschat, T. K., Uchida, J. Y., & Simone, G. W. (2004). Compendium of ornamental palm diseases and disorders. American Phytopathological Society (APS Press).

Valsalakumari, P.K. Rajeevan, P.K. Sudhadevi, C.K. Geetha. (2008). Flowering Trees. New India Publishing Agency.

Randhawa, M.S. 1978. Ornamental Horticulture in India. Today and Tomorrow Printers and Publishers, New Delhi, p. 1-39.

Spennemann, D. H. (2018). Geographical distribution of four key ornamental and production palm species Phoenix canariensis, P. dactylifera, Washingtoniafilifera and W. robusta. Institute for Land, Water and Society, Charles Sturt University, Albury, NSW.

Thekkayam, S.D. (2009). Ornamental plants. New India Publishing Agency.

Howard, F. W., Moore, D., Giblin-Davis, R.M., and Abad, R.G. 2001. Insects on Palms. CABI Publishing, Walingford, U.K.

M.L. Elliott, T. K. Broschat, Donald Hodal. (2014). Ornamental Palms: Biology and Horticulture, 42:1-20

Elhadi M. Yahia. Drammatic Representation of Date Palm Structure. 2007. https://www.researchgate.net/

Carroll, Jackie. Growing Areca Palm: Care for Areca Palm Indoor. https://www.gardeningknowhow.com/

Gardensloverclub.com https://www.gardenlovesclub.com

https://www.palmcentre.co.uk/info/Cycads-PalmCare.html

https://www.thespruce.com/grow-palms

https://hgic.clemson.edu/palm-diseases/

https://www.plantvine.com/product/caryota-mitis-fishtail-palm/

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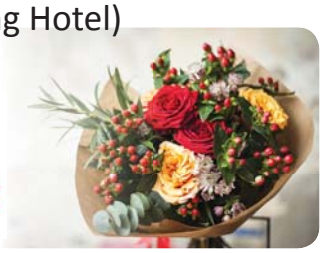

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Tuberous Sword Fern – A Multifaceted Pteridophyte

Salina Maharjan & Dikshya Maharjan

Most commonly found growing in the moist wooded areas; tuberous sword fern is quickly becoming popular at home gardens and decoration shops. Named after its elongated blade like fronds, this fern has become great choice for landscape due to graceful appearance, ease of planting and caring. Tuberous Sword Fern can spread aggressively throughout by wind-blown spores and by accidental movement of stolon, tubers, and rhizomes. The plantlets can be used as planting materials in commercial scale. The plant is fertile throughout the year producing numerous spores. Young fronds/fiddleheads appear early spring from underground rhizomes.

Botany

Tuberous Sword Fern is an epiphytic and epilithic plant which comes under Dryopteridaceae family. Chiefly known as 'Tuberous Sword fern' in English and 'Paniamala' or 'Panisaro' in Nepali, it is scientifically entitled as *Nephrolepiscordifolia* (L.) C. Presl.It is a terrestrial fern with short rhizome and small tubers. It has bright green fronds with length ranging 16-32 inches (40-80 cm) and width at their widest point about 4 inches (10cm).It produces small scaly tubers on its roots and is considered a vigorous grower and colony former.

Indiscriminate coverage

Tuberous Sword Fern is found to sustain in diverse regions of the world and is often listed as an invasive species in most of the countries. It is native to Australia and it occurs in rainforest or open forest in eastern Queensland and north eastern New South Wales. It is widely naturalized in Africa, temperate Asia, Southeastern United States, New Zealand and Macaronesia. In India, six species ofTuberous Sword Fernare found and Sikkim has two species (Envis Centre Sikkim) (Pradhan and Singh., 2018).However, it mainly enjoys sub-tropical and tropical climatic eco-zones.This plant flourish in well-drained soil mix with pH of 5-5.5. More profoundly, soil mix also must be well-aerated, good water holding capacity and slow drying.

Floriculture Industry and Tuberous Sword Fern

Floriculture industry has placed Tuberous Sword Fern in top priority foliage whether as an ornamental foliage or filler foliage and line foliage in a bouquet or a ground cover or an understory plant. Floriculturist are right in their own words, Tuberous Sword Fern is a Multifaceted Foliage. Sword Fern has become the most favorite plant, with its long evergreen fronds. Talking about interior decoration and interior landscape, this fern occupiesmoist and shady spots or sunny spotswhere other flowers and foliage fail to survive. This fern never fails to serve as a background supporter beautifying rest of the flowers in a landscape. There is no more beautiful, hardworking, or resilient fern than the sword fern.


Paniamala by Tunza eco Generation

A Bouquet without Sword Fern is like a garden without greenery. Sword Fern is beautiful, lush green, economical and traditional filler for a light touch in bouquets. It is a renowned background in bouquets. Many floral shops utilize them for making bouquets; it is mostly used during matrimonial ceremonies with roses and other flowers to decorate foyers, halls and vehicles. It gives vertical accent to design. This fern has always proved itself as best filler foliage enhancing the beauty of mass and form flowers and foliage in bouquet.

Sword Fern lines roadsides, hillsides, riversides. Besides beautification along roadsides, this fern is getting popular as a ground cover aiming control of land erosions in hills.Great soil binding capacity of the roots compels the bio-engineers choose this fern in erosion control of steep hills.

Medicinal Impacts

Keeping Floriculturists aside, Tuberous Sword Fern has inhabited hearts of Medical personals too. Medicinal properties of this fern have equally made it popular among plant lovers. The rhizome is used during cough, rheumatism, chest congestion, and nose blockage, loss of appetites and as antibacterial. The leaflets are used as anti-tussive, styptic, antifungal and in wounds (Dhiman, .1998). The decoction of the fresh frond is given as a drink for treating jaundice. The entire fern resembles medicinal property and is used to cure renal, liver and skin disorder while the juice of root tubers is taken to treat fever, indigestion, headache, cough, cold and hematuria. The nutrient analysis of different parts of the fern showed that the large amount of carbohydrate and calcium are found in tubers. (Gauchan et al., 2008)

Room for Improvement

In countryside, locals consume the tubers to quench their thirst.Despite wide scope of Tuberous Sword Fern, this fern finds itself lost in the dark sides of dense forests, corners of residences. It is one of the neglected foliage. Some scientists have demanded further researches in the bio-pesticide properties of sword fern. It can play a crucial role to protect ecosystem, farmers' health and consumers.

Being a wild species and lack of domestication, it is under less priority. Lack of research works is choking development of Cultivation Packages and thus cultivation practices is not known yet

in Nepal. Some research papers have suggested requirement of high facilities like proper media, irrigation and micronutrient application for luxurious growth of the fern. Economically sound practices are still yet to be developed.Proper investments for foliage are lagging in floriculture industry. Introducing foliage plants like sword fern as commercially cultivated foliage can assist in good quality production rather than natural harvest. Plants with multiple purposes should be a priority in researches as well as cultivation.

References

Bhandari, S. (2020). PaniAmala (Himalayan ground gooseberry). Tunza Eco Generation.

Chhetri, R. B. (2006). Trend in Ethnodomestication of some wild plants in Meghalaya, North East India. Indian J. of Traditional Knowledge, 53(3) 342- 347.

Dhiman, A.K.(1998). Ethnomedicinal uses of some pteridophytic species in India. Indian Fern journal. 15 (1-2): 61-64.

Gauchan, D. P., Manandhar, D., Shrestha, N., Suwal, S.K.(2008). Nutrient Analysis of Nephrolepis cordifolia (L.) C. Presl, Kathmandu University Journal of Science, Engineering and Technology 1(68-72).

HimaParyabaran. (2017, 2018) Livelihood improvement through Nephrolepiscordifolia in Himalayas: a case study of Kamrang village, South Sikkim PrashantiPradhan and Mithilesh Singh ((GBPNIHESD, SRC, Sikkim), 30-31(2,1)

NSTRC. (2018). Nephrolepiscordifolia (Paniamala). Nepal Science and Technology Research Center

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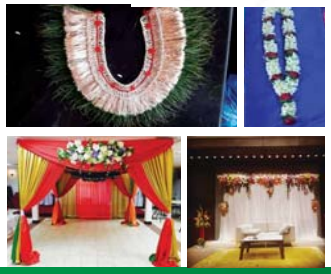

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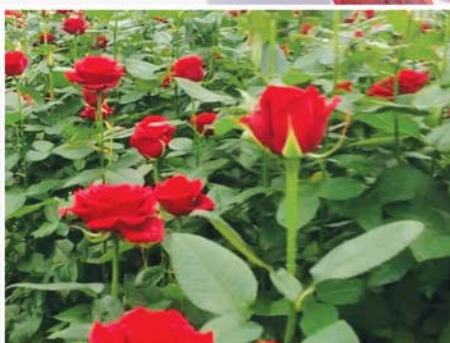

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(पूर्व बैज्ञानिक अधिकृत)

काठमाडौं उपत्यका

काठमाडौ उपत्यका २७°३२'१३" देखि २७°४९'१०" उत्तर अक्षांश र ८५°११'३१" र ८५°३१'३८" पूर्व देशान्तरको बीचमा अवस्थित छ । यो उपत्यका समुद्र सतहदेखि करीव १३५० मीटरको उचाइमा छ । काठमाडौ उपत्यकालाई चारैतिरबाट २००० देखि २८०० मटिरसम्म अग्ला चन्द्रागिरी, नागार्जुन, शिवपुरी र फुल्चोकी जस्ता अग्ला पहाडहरूले घेरेका छन् । यहाँको सरदर तापक्रम गृष्ममा २८ देखि ३० डिग्री सेन्टीग्रेड र हिउँदमा ४ देखि १० डिग्री सेन्टीग्रेडसम्म रहन्छ । काठमाडौ उपत्यका भित्र काठमाडौ, ललितपुर र भक्तपुर गरी तीनवटा जिल्लाहरु पर्दछन् । यस उपत्यका भित्र काठमाडौ महानगरपालिका, ललितपुर महानगरपालिका र भक्तपुर उप–महानगरपालिका मुख्य शहरका रूपमा प्रसिद्ध छन् भने हाल अन्य १८ वटा नगरपालिकाहरु छन् । यी मध्ये पनि काठमाडौ दक्षिण एशियाको एउटा सुन्दर शहरको रूपमा चिनिन्छ । त्यस बाहेक काठमाडौ पुरातन इतिहास बोकेको शहर हो । यहाँ विश्व सम्पदा सूचीमा रहेका वसन्तपुर दरबार, भक्तपुर दरबार, पाटन दरबार, पशुपतिनाथ, चांगुनारायण, स्वयम्भूनाथ र बौद्धनाथ गरी सात विभिन्न स्थानहरु छन् ।

हालको बढ्दो शहरीकरण तथा विभिन्न विकास आयोजनाहरूले काठमाडौंको वातावरणमा विभिन्न समस्याहरु उत्पन्न गरेका छन् । ती मध्ये काठमाण्डौ उपत्यका भित्रको सडक विस्तार, मेलम्ची खानेपानी आयोजना जस्ता आयोजनाहरूको तीव्रताले काठमाडौंको स्वरूपमा विकृति ल्याएको देखिन्छ भने वातावरण प्रदुषणले शहरबासीहरूको जीवन कष्टकर बनाउनका साथै स्वास्थ्यमा समेत विभिन्न समस्याहरु देखापरेका छन् । स्वच्छ हावा र स्वच्छ पानीको उपलब्धता शहरबासीहरूका लागि कठीन भइरहेका छन् ।

बढ्दो सवारी साधनहरूबाट उत्सर्जन हुने धुवाँ र सडक विस्तार कार्यले काठमाडौंको वातावरणमा विभिन्न किसिमका धुलोका कणहरु मिसिएर काठमाडौंमा वायु प्रदुषणको वृद्धि भइरहेको छ । यसले मानव स्वास्थ्यमा प्रतिकुल प्रभाव पार्नका साथै यहाँका विरूवाहरूको बृद्धिमा समेत प्रभाव पारेको छ । काठमाडौं विभिन्न सुविधा तथा अवसरहरूको गन्तव्य स्थलको रूपमा विकसित भएका कारणले यहां जनसंख्याको चाप बढ्दै गईरहेको र शहरीकरणको लागि निर्माण कार्यहरु पनि तीव्र रूपमा हुँदै गईरहेका कारण नगरवासीलाई उपलब्ध हुनुपर्ने हरित क्षेत्रको दिनानुदिन कमी हुँदै गईरहेको छ । त्यसै अनुपातमा यहाँको वायु, वातावरण तथा नदीहरूमा प्रदुषणको मात्रामा वृद्धि हुन गई हरित क्षेत्रमा अत्याधिक चाप परेको छ, जसको फलस्वरूप यहाँको हरियालीमा क्षयीकरण हुँदै गइरहेको स्पष्ट महशुस गर्न सकिन्छ ।

काठमाडौं उपत्यकाको हरियाली सौन्दर्यीकरणका केही सकारात्मक प्रयासहरु

शहर तथा शहरोन्मुख वस्तीहरूमा प्राकृतिक रूपमा रहेका वा लगाइएका रूख तथा अन्य वनस्पतिहरूको व्यवस्थापन खासगरी शहरमा निर्माण हुने भौतिक संरचनाहरु (जस्तै भवनहरु, उद्योगहरु, सडकहरु आदि) र त्यस स्थानमा बसोबास गर्ने समुदायको स्वास्थ्य देखि लिएर सामाजिक वातावरणमा सन्तुलन कायम गर्नका लागि हरियाली विकास, वृक्षारोपण र हरियाली संरक्षण तथा व्यवस्थापन गर्न अति आवश्यक हुन्छ । यसको उचित व्यवस्थापनले हावा र पानीको गुणस्तरमा वृद्धि गर्दछ भने तापक्रम, ध्वनिका साथै विकीरण घटाउने कार्यमा सहयोग पुऱ्याउँछ । जसले गर्दा समुदायलाई शुद्ध वातावरणको अनुभूतिका साथ बाह्य मनोरञ्जनका साथै स्वस्थ्य जीवन शैलीका लागि शक्ति प्रदान गर्दछ । त्यसैले हरियाली स्थापना तथा व्यवस्थापनले शहरी क्षेत्रमा वायु एवं ध्वनि प्रदूषण नियन्त्रण गर्ने, कार्बन सञ्चितिमा वृद्धि गर्ने, अक्सिजन उत्पादन वढाउने तथा हरित गृह प्रभाव न्यूनीकरण

गर्ने, वायुको तापक्रम नियन्त्रण गरी जलसञ्चय तथा भू(संरक्षण गर्ने, भू(दृश्य सौन्दर्यीकरण गर्ने, जैविक विविधता संरक्षण गर्नुका साथै स्थानीय पर्यापर्यटन प्रबर्द्धन गर्ने कार्यमा समेत महत्वपूर्ण भूमिका निर्वाह गर्दछ ।

गत केही वर्ष यता काठमाडौंको पर्यावरण तथा हरियालीमा केही आशा लाग्दा प्रयासहरु पनि भइरहेका देखिन्छन् । हुनत काठमाडौंका सडक किनाराहरुमा वृक्षारोपण कार्यहरु राणाकालीन शासन देखि नै शुरुवात भएको देखिन्छ । त्यस्तै गरी राणाकालमा निर्माण भएका सिंहदरबार, बबरमहल, थापाथली दरबार, सेतो दरबार, केशर महल, हरिहर भवन, बहादुर भवन, शीतल निवास जस्ता धेरै दरबारहरु निर्माण पछि ती दरबारहरुमा बनाइएका बगैचा र लगाइएका विभिन्न शोभनीय फूलका विरुवाहरु नै काठमाडौं उपत्यकामा हरियालीको शुरुवात भएको मान्न सकिन्छ । पछिल्लो समयमा काठमाडौंमा भइरहेको हरियाली प्रबर्द्धनको शुरुवात यहाँका तत्कालिन नगर प्रमुख श्री पी. एल. सिंहबाट शुरुवात भएको पाइन्छ । स्वच्छ, सफा, हराभरा काठमाडौंको नारा सहित केही कार्यको शुरुवात भए तापनि देखिने खालका कार्यहरु हुन सकेनन् । त्यस पछिका निम्न कार्यहरुलाई सकारात्मक रुपमा लिन सकिन्छ ।

काठमाडौं उपत्यका विकास प्राधिकरणले पनि काठमाडौंको सौन्दर्यीकरणमा विशेष पहल गरि रहेको छ । प्राधिकरणले काठमाडौं उपत्यकामा ८८७ खुला स्थानहरुको पहिचान गरी खुला स्थलहरु सम्बन्धी मानचित्र समेत तयार गरेको छ ।

सडकको बीच र किनाराहरुमा वृक्षारोपण :

हाल माइती घरदेखि कोटेश्वर र कोटेश्वर देखि भक्तपुरको सूर्यविनायकसम्मका सडक किनारा र बीचमा लगाइएका विभिन्न शोभनीय वृक्ष, झाडी र मौसमी फूलहरुको अवस्थालाई केही देख्न लायक कार्य भएको मान्न सकिन्छ । त्यस्तै गरी दुइवटै महानगरपालिका तथा उपमहानगरपालिकाका सडक किनारा, पेटी लगायतका विभिन्न स्थानहरुमा पनि वृक्षारोपण गरीएका छन् ।

त्यस्तै गरी सार्क (२०१४) को तयारीको समयमा काठमाण्डौको माइतीघर देखि तीनकुनेसम्मको सडक विस्तार र वृक्षारोपणले हाल केही राम्रो परिणाम पनि देखाएको छ । १/२ बर्ष अघि मात्र निर्माण सम्पन्न भएको कोटेश्वर कलंकी चक्रपथमा पनि बृक्षारोपण गरिएको छ । यस क्षेत्रमा हाल बगैचा निर्माण गतिमा अघाडि बढि रहेको छ ।

माइतीघर देखि बानेश्वर सम्मको सडक तथा हरियाली

ट्राफिक आइल्याण्डहरुको व्यवस्था :

सडकका बीचमा रहेका ट्राफिक आइल्याण्डहरुमा हरियाली तथा साना उद्यानहरुको पनि निर्माण गरी तिनीहरुको व्यवस्थापन कार्यमा विभिन्न सरकारी तथा गैरसरकारी संस्थाहरुको संलग्नता रहेको छ । काठमाण्डौ महानगरपालिकाका अनुसार काठमाण्डौका विभिन्न स्थानहरुमा हाल २६ वटा ट्राफिक आइल्याण्डहरु रहेका छन् र यी आइल्याण्डहरुले ३५०.४० वर्गफीट क्षेत्रफल ओगटेका छन् ।

पार्क र उद्यानहरु :

काठमाण्डौको सौन्दर्यीकरणका लागि शंखधर पार्क (पुरानो रत्न पार्क), बालाजू पार्क, शंख पार्क, नन्दीकेशर बगैचा (नारायणचौर) जस्ता सार्वजनिक पार्कहरुको सुधार गरिनुका साथै सशुल्क तथा निशुल्क प्रवेश र व्यवस्थापन कार्य पनि भइरहेको देखिन्छ ।

वाग्मती नदीको किनाराहरुमा हरियाली तथा उद्यान निर्माण :

त्यस्तै गरी वाग्मती नदी र यसका सहायक नदी नालाहरुलाई स्वच्छ, सफा र हराभरा बनाएर नदी किनारमा रहेका धार्मिक, सांस्कृतिक तथा पुरातात्विक महत्वका धरोहरहरुको जगेर्ना गर्ने उद्देश्यले २०५२ साल मंसीर ६ गते गठन भएको **अधिकार सम्पन्न वाग्मती सभ्यता एकीकृत विकास समिति** ले पनि हरियाली विकासका कार्यहरुमा विशेष योगदान पुऱ्याएको छ । विभिन्न इच्छुक सरकारी र गैरसरकारी संस्थाहरुबाट उक्त समितिसंग सम्झौता गरी वाग्मती नदीका किनारामा १५ वटा उद्यान/हरियाली क्षेत्रको विकास भैसकेको देखिन्छ र अरु पनि निर्माण तथा विकास क्रममा छन् । निर्माण भएका मध्ये शंखमूल (च्यासल खेल मैदान नजिक) मा **अधिकार सम्पन्न वाग्मती सभ्यता एकीकृत विकास समिति**संगको सहकार्यमा रवि शंकरको लगानीमा निर्माण भएको पार्क अहिले एउटा उदाहरणीय कार्य बनेको छ ।

शंखमूल (च्यासल खेल मैदान नजिक)को पार्क

यसैगरी, काठमाडौं महानगरपालिका, ललितपुर महानगरपालिका र भक्तपुर उपमहानगर पालिकाले पनि आ-आफ्ना कार्यक्रमद्वारा विभिन्न खाली स्थानहरु तथा तथा पार्कहरुको सुधार गरी यस उपत्यकाको हरियाली तथा सौन्दर्यीकरणमा योगदान पुऱ्याएका छन् । काठमाडौं उपत्यका विकास प्राधिकरण र काठमाडौं उपत्यका भित्रका महानगरपालिका, उपमहानगरपालिका, नगरपालिका, शहरी विकास तथा भवन निर्माण विभागहरुको पनि काठमाडौंको हरियाली विकासको लागि आवश्यक नीति निर्माणमा विशेष योगदान रहेको छ ।

उपरोक्त कार्यहरु भएता पनि काठमाण्डौ उपत्यकाको हरियाली अधुरो नै देखिन्छ । उपत्यकाका वरिपरि प्लटिङ्ग तथा क्रसर उद्योगहरुले श्रृजना गरेका नांगा भित्ताहरुले उपत्यकाको हरियालीलाई चुनौती दिइरहेका छन् ।

कमी कमजोरीहरु

- **नीतिको अभाव**

  नेपालमा हालसम्म शहरी हरियाली सम्बन्धी प्रभावकारी नीति तयार हुन सकेको छैन । त्यसकारण शहर भित्र विभिन्न प्राकृतिक स्वरुपमा रहेका तथा सडक किनार र अन्य स्थानमा लगाइएका रुख विरुवाहरु र हरियालीको उचित स्याहार सम्भार र व्यवस्थापन हुन सकेको देखिदैन । त्यसले गर्दा पनि शहरमा हरियाली र स्वच्छ वातावरणको क्षयीकरण हुन गइरहेको छ । तसर्थ शहरी वन सम्बन्धी नीतिको तर्जुमा गरी कार्यान्वयनमा ल्याउन आवश्यक देखिन्छ ।

- **जनचेतनाको कमी**

  स्वस्थ्य रहनका लागि आफू बसेको वरिपरीको वातावरण सफा राख्नु प्रत्येक नागरिकको पनि दायित्व हो । हरियालीले वायुमा अक्सिजनको मात्रामा बृद्धि गर्छ, तापक्रम घटाउन, प्रदुषण घटाउन सहयोग पुऱ्याउँछ र अन्तमा आफ्नै स्वास्थ्यको लागि फाइदा पुऱ्याउँछ भन्ने सोचाई कमैले राखेको पाइन्छ । त्यसैले पनि शहरका विभिन्न स्थानमा लगाइएका विरुवाहरु भाँच्ने, उखेल्ने, फूलहरु टिप्ने जस्ता क्रियाकलापहरु पनि देखिन्छन् । यी सबैका पछाडि जनचेतनाको कमी रहेको देखिन्छ ।

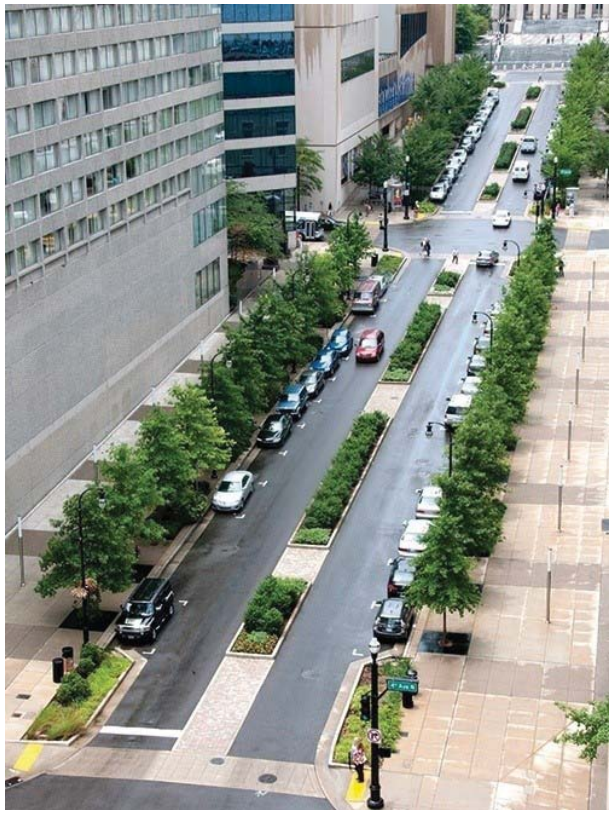
- **संरक्षण तथा व्यवस्थापनको कमी**

  सडकका किनारा तथा बीच भागमा लगाइएका विरुवाहरुलाई केही स्थानहरुमा फलामका जाली घेरामा राखिएको छ भने कतै त्यसै छोडिएको छ । धेरैजसो विरुवाहरु चाहिने भन्दा अग्ला भैसकेका छन भने कतिपय विरुवाहरु भाँचिएका, आकार बिग्रीएका स्वरुपमा रहेका छन् । यो हुनुको कारण मुख्यतः यिनीहरुको उचित स्याहार सम्भार र संरक्षण नहुनु नै हो । सडक पेटीमा लगाइएका केही विरुवाहरुलाई तारवार (फलामका जाली) हरुले छेकीएको भएतापनि तिनीहरुको आकार र साइज मिलाउने र स्याहार सम्भार गर्ने कार्य कमै भएको पाइन्छ । विरुवा लगाई सके पछि यिनीहरुको स्याहार सम्भार र संरक्षणमा कमै ध्यान दिने गरिएको छ । त्यसकारण वृक्षारोपण गरी सके पछिको व्यवस्थापन प्रमुख पक्ष हो । यसमा ध्यान पुऱ्याउन अति आवश्यक देखिन्छ ।

- **विरुवाका उपयुक्त प्रजातिहरुको छनौट**

  त्यस्तै गरी हाल शहरका सडकको बीचमा, किनारमा तथा अन्य आवश्यक स्थानहरुमा लगाइएका विरुवाका प्रजातिहरुको छनौट पनि उचित ढंगले गरिएको पाइदैन । पहिला पहिला काठमाण्डौका सडक किनारामा लगाइएका विरुवाका प्रजातिहरुमा खासगरी काँगियो, मसला, लहरे पिपल, ज्याकारेण्डा जस्ता आयातित प्रजातिहरुको बाहुल्यता थियो । त्यसबेला शहरी सौन्दर्यीकरण भन्दा पनि छिटो हुर्कने खालका प्रजातिहरुको छनौट गरिएको हुनु पर्दछ । तर पछि ती विरुवाहरुले निम्त्याएको दुर्घटनाहरुले गर्दा त्यस्ता प्रजातिका विरुवाहरु भन्दा आफ्नै वातावरणमा हुर्कि रहेका स्वदेशी प्रजातिका विरुवाहरु लगाउने बारेको सोच बन्दै आएको देखिन्छ ।

त्यस्तै गरी सडकको किनारमा लगाउने विरुवाका प्रजातिहरुमा पनि मध्यम उचाई भएका फूल फुल्ने वा सदाबहार खालका प्रजातिहरुलाई प्राथमिकता दिन उचित हुन्छ भने पार्कमा वा अन्य कुनै खाली तथा हरियाली विकास गर्नुपर्ने स्थानमा अग्ला तथा शोभनीय किसिमका प्रजातिहरुलाई प्राथमिकता दिनु पर्दछ ।



वृक्षारोपणमा एकरुपताको नमूना (चित्र : वेवसाइट)

गर्नु पर्ने कार्यहरु

तसर्थ काठमाण्डौ उपत्यकाको हरियाली सौन्दर्यतालाई कायम राख्न र हरियाली विकास तथा संरक्षण गर्न निम्न किसिमका कार्यहरु गर्न उचित देखिन्छ ।

१. **शहरी हरियाली सम्बन्धी नीति निर्माण**

शहरी विकास तथा भवन निर्माण विभागले शहरी वातावरण व्यवस्थापन निर्देशिका, २०६७ को परिच्छेद- ६ मा हरियाली, खुल्ला क्षेत्र र कृषि जमिन संरक्षण १३ मा शहरी क्षेत्रको वातावरण सफा, स्वच्छ र प्रदुषण रहित राख्न खुल्ला र हरियाली क्षेत्रको व्यवस्थापन गर्न निर्देशित गरेको छ । तर शहरी हरियालीको लागि राष्ट्रिय शहरी बन सम्बन्धी नीति निर्माण गर्न आवश्यक देखिन्छ ।

२. **नदी किनारको हरियाली विकास तथा व्यवस्थापन**

काठमाण्डौ उपत्यकाका प्रमुख नदीहरु वाग्मती, विष्णूमति, मनोहरा नदीका साथै यिनीहरुमा मिसिन आउने सहायक खोलाहरुको मुहान देखि मिलन विन्दुसम्मको क्षेत्रका दायाँ बायाँ किनारामा वृक्षारोपण गर्नका साथै वृक्षारोपण गरीएका विरुवाहरुको संरक्षण व्यवस्थापन गर्न आवश्यक छ ।

३. **काठमाडौं उपत्यका भित्र तथा वरीपरीका वनहरुको संरक्षण**

उपत्यका भित्रका सामुदायिक तथा धार्मिक वनहरुको उचित संरक्षण तथा व्यवस्थापन गर्न आवश्यक छ ।

४. **सडक किनारको हरियाली विकास तथा संरक्षण**

काठमाण्डौ उपत्यकाका नगरहरुका सडकहरुमा हरियाली विकासको लागि खाली ठाउँहरुमा वृक्षारोपण गर्नका साथै वृक्षारोपण गरीएका विरुवाहरुको संरक्षण गर्न आवश्यक छ ।

५. **पार्क तथा मनोरञ्जन स्थलहरुको निर्माण**

खाली स्थानहरुको पहिचान गरी हरियाली पार्क तथा मनोरञ्जन स्थलहरुको निर्माण तथा व्यवस्थापन गरी शहरी सौन्दर्यीकरण गर्न आवश्यक छ ।

६. सडक तथा शहरी योजनामा हरियाली विकासको प्रावधान

शहरी क्षेत्रमा सडक तथा शहरी योजना तयार गर्दा हरियाली विकासको प्रावधान राखेर योजना तयार गर्नु उचित हुन्छ । के कस्ता स्थानहरूमा कुन कुन प्रजातिका विरूवाहरु लगाउने योजना पनि त्यसमा राख्न सकियो भने उपयुक्त प्रजातिका उपयुक्त उचाई र आकारका विरूवाहरु तयार गर्न सहयोग हुन जान्छ र विरूवाहरु सहजै उपलब्ध हुन सक्छन् ।

७. हरियाली संम्बर्द्धन र संरक्षणको व्यवस्थापन

वृक्षारोपण गरिएका विरूवाहरूको स्याहार सम्भार, काँटछाँट तथा आकार मिलाउने कार्यका साथै संरक्षण गर्ने व्यवस्था र शहरका विभिन्न स्थानहरूमा कुनै कारणबाट रूखहरु सुकेमा वा ढलेमा तिनीहरूको तत्काल हटाउने व्यवस्थापन गर्न एक छुट्टै निकायको व्यवस्था हुन आवश्यक देखिन्छ ।

सन्दर्भ सामाग्रीहरु

नेपाल सरकार, वन तथा भू-संरक्षण मन्त्रालय (२०७१) : वन नीति, २०७५

नेपाल सरकार, शहरी विकास मन्त्रालय, शहरी विकास तथा भवन निर्माण विभाग (२०६७) :शहरी वातावरण व्यवस्थापन निर्देशिका २०६७

Baral S. R. and Kurmi, P. P. (2005): Assessing city beautification with plants: the Kathmandu perspective. Banko Janakari, Vol. 15, No.1, p. 49-57.

Bhattarai N. K. and K. J. Malla (1998): Current scenario of plantation and potentialities of some wild flora of Kathmandu Valley, Nepal. Plant Research 1(1): 56-76, Plant Research division, Department of Plant Resources, Kathmandu.

Gautam, S. K., Thapa, H. B., & Sharma, R. C. (2006): Urban forestry in Kathmandu valley: problems and prospects Banko Janakari, 16(2) 2006 pp.64-70

Ishtiaque, Asif, Shrestha, MilanD and Chhetri Netra (2017) : Rapid Urban Growth in the Kathmandu Valley Nepal: Monitoring Land Use Land Cover Dynamics of a Himalayan City with Landsat Imageries. Environments 2017, 4, 72; doi: 10.3390/environments4040072.

Karmacharya N. and M. K. Chhetri (2016): Dust and Plant Stress. SOUVENIR, Golden Jubilee Issue (1965-2016) of Central Department of Botany, Kirtipur, Kathmandu, p. 31-34.

पुष्प व्यवसायमा कोभिड-१९ ले पुऱ्याएको असर र वर्तमान अवस्था

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पुष्प व्यवसायको बर्तमान अवस्था

नेपालको भौगोलिक बनावट, जैबिक विबिधता तथा जलवायुको दृष्टिकोणले तराई देखि पहाडी जिल्लाहरुमा पुष्प व्यवसाय गर्न सकिने उपयुक्त र पर्याप्त ठाँउहरु रहेको छ । नेपालको पुर्व मेची देखि पश्चिम महाकालीसम्मको प्रायजसो सबै क्षेत्रमा पुष्प व्यवसाय गर्न सकिन्छ । धेरै संभावना बोकेको पुष्प व्यवसाय उच्च आयमुलक, रोजगारमूलक तथा निर्यातमुलक व्यवसाय पनि हो । नेपालमा पुष्पको व्यवसायीक रुपले वि.स. २०११ सालबाट सामान्य स्तरमा एक प्राईबेट नर्सरीको रुपमा स्थापना भई सुरुवात भएको पाईन्छ । पुष्पको व्यवसायीक बिकासलाई संस्थागत रुपमा अघि बढेको चाहि बि.सं.२०४९ मा फ्लोरिकल्चर एशोसिएसन नेपालको स्थापना भए पश्चात मात्र हो । पुष्प ब्यवसाय आ.ब.२०७६/०७७ सम्म आई पुग्दा नेपाल अधिराज्य भरमा ७३२ भन्दा बढि नर्सरी/फार्म (उत्पादन तथा बजारिकरण) हरु स्थापना भई संचालनमा रहेको छ । हाल ४४ जिल्लामा पुष्पको व्यवसायीक उत्पादन तथा बजारीकरण भईरहेको छ । यस ब्यवसायमा प्रत्यक्ष तथा अप्रत्यक्ष रुपमा ४३५०० भन्दा बढि जनशक्तिहरु रोजगार/आश्रीत रहेका छन् । पुष्प व्यवसायमा करिब ७ अर्वको लगानी भईसकेको छ । गत आ.ब. २०७५/०७६ मा २ अर्ब ४२ करोड भन्दा बढिको वार्षिक कारोबार भएको थियो । यस अघिका बर्षहरुमा पुष्पको व्यवसायीक गतीबिधी पुष्प व्यवसायको उत्पादन तथा खपतमा बार्षिक १० देखि १५% को हाराहारीमा बृद्धि भईरहेको थियो । नेपाल सरकारले सन २०२० लाई नेपाल भ्रमण बर्ष (Visit Nepal 2020) को रुपमा मनाउने उद्धेस्यले नेपाल भ्रमण बर्ष २०२० घोषणा गरी देश बिदेशमा बिभिन्न कार्यक्रमहरु अघि बढाई रहदा पर्यटकको स्वागत सत्कार तथा पर्यटन क्षेत्रमा पुष्पको खपत बढ्ने पुर्ब अनुमान गरी समग्र पुष्प व्यवसायीहरु मध्ये करिब २५ प्रतिशत व्यवसायीहरुले आफ्नो भइरहेको उत्पादन क्षमतामा २० देखि ३० प्रतिशतसम्म लगानी बृद्धि गरी उत्पादन बिस्तार गरेको थियो । अन्य व्यवसायीहरुले पनि केहि न केहि प्रतिशतले उत्पादन क्षमतामा बृद्धि गरेका थिए । पुष्पको उपभोगकर्ता मध्येको प्रमुख पर्यटन क्षेत्रमा पर्यटन व्यवसायीहरुले बिभिन्न पर्यटकिय क्षेत्रहरुमा नेपाल भ्रमण बर्ष सन २०२० को लागि नयाँ नयाँ होटल व्यवसायको निर्माणका साथै सौदर्यिकरणका कार्यहरुमा लगानी बिस्तार गरिरहेको थियो । यसले गर्दा पुष्पको खपतमा पनि बृद्धि भईरहेको थियो । नेपालमा कोराना भाइरसको संक्रमण देखिनु पुर्व आ.ब. २०७६/७७ को करिब ८ महिना (२०७६ फागुन मसान्तसम्म) पुष्प व्यवसायको उत्पादन तथा खपतमा अघिल्लो आ.ब. २०७५/७६ तुलनामा करिब १८% ले बृद्धि भईरहेको थियो ।

पुष्प व्यवसायले राम्रै गती लिईरहेको बेला विश्वव्यापी महामारीको रुपमा फैलिएको कोरोना भाइरस (कोभिड-१९)को कारण नेपाल पनि अछुतो रहन सकेन । नेपालमा पनि कोभिड-१९ रोगको संक्रमण देखियो र यो रोगको सक्रमण फैलिन थाल्यो । नेपाल सरकारले यस रोगको संक्रमण हुनबाट जोगिन बि.सं.२०७६ चैत्र ११ देखि अनिस्चित कालसम्म पुर्ण रुपमा देशै लकडाउनको घोषणा गरेको कारण समग्र आर्थिक क्षेत्रमा प्रतिकुल प्रभाव पाऱ्यो । चलायमान भईरहेको अर्थतन्त्र तथा मानब जीवन कोभिड-१९ महामारीका कारण बन्द कोठामा सिमीत हुन पुग्यो । ९० प्रतिशत भन्दा बढि स्वदेशी उत्पादनबाट आपुर्ती गर्दै आईरहेको कृषि क्षेत्रको बहुआयमिक र उदियमान बहुमुल्य पुष्प क्षेत्रले पनि अकल्पनिय क्षति ब्यहोर्नु पऱ्यो । मानब स्वास्थ्य नै प्रतिकुल रहेको बेला व्यवसायीक क्षेत्रमा असर नपर्ने कुरै भएन । बिशेषता पुष्प व्यवसायको उत्पादन तथा बजारीकरण क्षेत्रमा बढि प्रभाब पर्न गयो । पुष्प व्यवसायको बिबिध क्षेत्रहरु मध्ये कट फ्लावरको उत्पादन तथा बजारीकरणमा पुर्ण रुपले

प्रभावीत भए । नेपालमा बिषेस गरी कट फ्लावर फूलको मौसम अनुकुल अधिक उत्पादन हुने र बजारीकरणको लागि पनि राम्रो वातावरण हुने समय (फागुन, चैत्र, बैशाख, जेष्ठ, अषाढ तथा साउन) मा पुर्ण रूपमा देशै बन्दाबन्दि भई दिदा फार्म केन्द्रमा उत्पादित फूलहरु करिब ९७% सम्म नष्ट हुन पुग्यो । उक्त अवधीमा गरिएको बजार सर्बेक्षण अनुसार कट फ्वालर फूलको व्यवसायीक कारोबार करिब ३% मात्रै भएको पाईएको थियो । *(श्रोत फ्यानले गरेको सर्बेक्षण अनुसार)*

कोभिड-१९ का कारण भएको लकडाउन अबधीमा नष्ट हुन पुगेको फूललाई फाल्दै पुष्प व्यवसायीहरु

नर्सरी व्यवसाय क्षेत्र भित्र भने बिशेषगरी मौसमी फूलको व्यवसायीक उत्पादन गरी कारोबार गर्ने व्यवसायीहरु प्रभावीत भए । लकडाउनको समयमा आवत जावत बन्द हुदा फार्म तथा नर्सरीको व्यवस्थापकिय कार्य सबै ठप्प हुन पुग्यो जसका कारण मौसमी तथा बहुवर्षिय फूल बिरुवाहरु गोडमेल, सिचाईको अभावले धेरैजसो फूल बिरुवाहरु नष्ट हुन गयो ।मौसमी फूलको कारोबारमा करिब ६५% सम्म कमी आएको थियो भने आलंकारिक फूल बिरुवाहरुको व्यवसायहरुमा कम क्षति भएको पाईएको छ । तर व्यवसायीक गतीबिधी भने केहि समय ठप्प नै भएको थियो । तर पछि लकडाउन कै अवधिमा काठमाण्डौ भ्याली भित्र बसोबास गर्ने मानिसहरु कौशी खेती तर्फ आकर्षित भएको कारण नर्सरी व्यवसायीक कारोबारमा केहि गती लिएको पाईएको थियो । समग्रमा कोभिड-१९ ले पुष्प व्यवसायमा एक अर्व भन्दा बढिको व्यवसायीक क्षति भएको प्रारम्भिक सर्बेक्षणबाट देखिएको छ ।

कोभिड-१९ ले पुष्प व्यवसायमा पुऱ्याएको असर

व्यवसायीक असर

- लकडाउनले गर्दाउत्पादन भएको कट फ्लावर तथा फूल बिस्वाको बिक्री बितरण ठप्प भएको ।
- मौसम अनुसार उत्पादन भएको कट फ्लावर तथा मौसमी फूलहरु सबै नष्ट गर्नु परेको ।
- पुष्प व्यवसायमा बढि कारोबार हुने, उत्पादन पनि बढि हुने समयमानै लकडडाउन भएकोले ४ महिना अवधीमा एक अर्व भन्दा बढिको आर्थिक क्षती भएको ।
- आर्थिक गतिबिधी ठप्प हुदा प्रशासनिक खर्च, कर्मचारीको तलब तथा कामदारको ज्याला, जग्गा बाहाल, ऋणको सावाँ व्याज किस्ता भुक्तानी गर्न समस्य भएको ।

रोजगारीमा असर

- उत्पादित बस्तुको उत्पादन तथा बिक्री बितरण गर्न सबै क्षेत्र बन्द भएका कारण अर्थोपार्जन नहुदा नर्सरी तथा फार्म केन्द्रमा रहेको स्टाफ कटौती गर्नु पर्ने परेको ।
- बन्दाबन्दिको कारण घर बिदामा गएको स्टाफहरूलाई काममा फर्काउन नसकेको ।
- पुष्प व्यवसायमा आश्रित झण्डै २० देखि २५% ले रोजगारी गुमाएको ।

आपुर्ति व्यवस्थापनमा असर

- मल जलको व्यवस्थापन गर्न नसक्दाफूल बिस्वाहरुको क्षति भएको ।
- बाली संरक्षणका लागि आबश्यक पर्ने मल बिषादीको व्यवस्थापन गर्न नसकेको ।

बजार व्यवस्थापनमा असर

- नर्सरी तथा फार्म केन्द्रमा उत्पादित फूल बिस्वाहरु उपभोक्ता कहाँ पुऱ्याउन यातायात तथा बजार क्षेत्र बन्द भएको कारण फूलको बजार व्यवस्थापन गर्न कठिनाई भएको ।

सामाजिक असर

- कोभिड-१९ महामारीले बिश्वमै आतंकीत बनाईरहेका परिप्रेक्ष्यमा यसको संक्रमण भईहालेमा हालसम्म औषधी उपचार समेत नभएकोले के हुने, कसो गर्ने कसरी बच्ने भन्ने मनोबैज्ञानीक त्रासका साथ अन्यौलमा पुष्प व्यवसायीहरु रहेकोले सामाजिक तथा मनोबैज्ञानिक असर पुऱ्याएको ।
- व्यवसायीक अनिश्चितताको कारण पारिवारिक तथा मानसिक समस्या भएको ।

बिक्री ठप्प हुदा फार्म मै फुलेर खेर गएको ग्लाडिओलस फूल

पुष्प व्यवसायीक क्षेत्रमा कोभिड-१९ का कारणले सबै भन्दा बढि असर पुऱ्याएको क्षेत्र कट फ्लावर व्यवसाय रहयो । अधिकांश कट फ्लावर व्यवसायीहरू पलायन हुने अवस्थामा पुगि सकेको छ । कट फ्लावर व्यवसायीहरूले लामो समय देखि गरेको लगानी लाई कसरी सुरक्षित गर्ने र प्रभावलाई कसरी न्यून गर्न सकिन्छ भन्ने चिन्ता र चासोको विषय बनेको छ ।

उत्पादित फूल फाल्नु पर्दा निरास भएका पुष्प व्यवसायीहरु

कोभिड-१९ को कारण भएको लकडाउनको अबधीमा फ्लोरिकल्चर एशोसिएसन नेपाल (फ्यान) ले खेलेको भुमिका तथा गतिबिधीहरु

क) कोभिड-१९ महामारी नियन्त्रणका लागि नेपाल सरकारले गरेको लकडाउनको कारणमा देशै भरीका पुष्प व्यवसायीहरूलाईको निबासबाट पुष्प उत्पादन स्थल (नर्सरी/फार्म केन्द्रहरु) सम्म आवत जावत गर्न नपाएकोले फूल बिरुवाहरुमा सिचाँई तथा अन्य व्यवस्थापन कार्यहरु गर्न गराउन समस्या भई व्यापक फूल बिरुवाहरु क्षती हुन गएको बिषयमा पुष्प व्यवसायीहरुबाट व्यापक गुनासो आएको हुदा प्रभावित भएको पुष्प उत्पादकहरूलाई निजहरुको निबासबाट फार्म/नर्सरी (उत्पादन केन्द्र) सम्म आवत जावत गरी नर्सरी/फार्म व्यवस्थापन कार्य गर्न सघाउ पुऱ्याउनको लागि अत्याबस्यक सवारी पासको व्यवस्थाका लागि जिल्ला प्रशासन कार्यालय तथा कृषि बिकास मन्त्रालयमा पहल गरेको थियो ।

ख) लकडाउन अवधी भित्र पुष्प व्यवसायीहरूलाई आफ्नो व्यवसायीक स्थलसम्म आवत जावत गर्नका लागि परिचय खुल्ने गरी म यो पेशा व्यवसाय गर्ने व्यवसायी हुँ र नर्सरी/फार्म केन्द्रसम्म जान लागेको भनेर आवत जावत गर्न सहज होस भन्ने उदेश्यले फ्यान सदस्यहरूलाई पुष्प उद्यमी परिचय पत्र बितरण गरेको थियो । यस कार्यले पुष्प व्यवसायी सदस्यहरूलाई आवत जावतमा केहि सहज भएको थियो ।

ग) कोभिड-१९ महामारीका कारण भएको लकडाउनले पुष्प व्यवसाय तथा व्यवसायीहरुमा पुऱ्याएको सामाजिक, मानसिक, व्यवसायीक तथा आर्थिक असरका बिषयमा सरोकारवाला निकायहरु सम्बद्ध व्यक्तिहरूलाई सुसुचित गराउन बिभिन्न समयमा ४ पटक प्रेस बिज्ञप्ती जारी गरेको थियो ।

घ) कोभिड-१९ महामारीका कारण भएको लकडाउनले पुष्प व्यवसायमा भएको व्यवसायीक, आर्थिक तथा स्वारोजगारीमा भएको क्षतीको बिबरण संकलन गरेको थियो ।

ङ) कोभिड-१९ का कारण पुष्प व्यवसायमा भएको क्षति जानकारी सहित पुष्प व्यवसायलाई पुनःउत्थान गर्नका लागि अल्पकालिन तथा दिर्घकालिन राहत योजना सहित आबश्यक सहयोगका साथै नितीगत व्यवस्थाको लागि कृषि तथा पशुपंछी बिकास मन्त्रालयका माननिय मन्त्रीज्यू समक्ष ज्ञापन पत्र पेश गरेको थियो ।

च) पुष्प ब्यवसायको पुनरूत्थानको लागी बैक तथा वित्तिय संस्थाबाट लिएको कर्जाको २५ प्रतिशतसम्म सहुलियत दरमा पुनःकर्जाको नितिगत व्यवस्था हुनु पर्ने बिषयमा पहल गरेको थियो ।

छ) कोभिड-१९ का कारण थिलथिलो भएको पुष्प व्यवसायलाई पुनरूत्थान गर्न राहतका प्याकेज सहित कर्जा प्रबाहमा आ.ब.२०७७/०७८ को मौद्रीक नीतिमा स्पष्ट व्यवस्थाका लागि नेपाल राष्ट्र बैंक संग पहल गरेको थियो ।

ज) फ्यान कट्फ्लावर उत्पादक उपसमितिको सहयोग तथा संयोजकत्वमा बिभिन्न स्थानमा सुरक्षामा खटिएको सुरक्षाकर्मीहरु, बिभिन्न अस्पतालहरुमा बिरामीहरुको उपाचारमा संलग्न चिकित्सकहरु तथा बिरामीहरुको मनोबल उच्च बनाउने हेतुले उहाँहरूलाई कट फ्लावर (कार्नेसन, जरबेरा, लिमोनियम, गुलाव आदि) फूल (पुष्प गुच्छा) हरु निशुल्क प्रदान गरि मनोवल उच्च बनाउने कार्यमा सहयोग गरेको थियो । साथै लकडाउन कै समयमा कट फ्लावरको बजार ठप्प भएकोले कट फ्लावरको बजारिकरणका लागि रिटेल उपसमिति तथा थोक बजारको संयोजकत्वमा काठमाण्डौ भ्याली भित्रका रिटेल पसलहरूलाई कट फ्लावरको बजारिकरण गर्न प्रोत्साहन स्वरूप निशुल्क कट फ्लावर उपलब्ध गराएको थियो ।

सुरक्षामा खटिएको सुरक्षाकर्मीहरु, बिभिन्न अस्पतालहरुमा बिरामीहरुको उपाचारमा संलग्न चिकित्सकहरु तथा बिरामीहरुलाई फूल बितरण गरिदै

पुष्पको खपत अवस्था

पुष्पको खपत हिसाबले सबै भन्दा बढि काठमाण्डौ उपत्यकामा खपत हुने गरेको छ । पुष्पको उत्पादन तथा खपतको हिसाबले पनि सात प्रदेश मध्ये बागमती प्रदेशको हिस्सा करिब ६० प्रतिशत रहेको छ । बाँकी ४० प्रतिशत पुष्पको खपत अन्य ६ (प्रदेश १,२, गण्डकी, लुम्बिनी, कर्णाली र सुदुरपश्चिमाञ्चल) प्रदेशमा रहेको छ । नेपालको समग्र आन्तरिक माग परिपूर्तिमा अझै करिब ९ प्रतिशत भन्दा बढि बाह्य मुलुकमा नै निर्भर भईरहनु परेको छ । अघिल्लो आ.ब. मा २ अर्व ४२ करोड कारोबार गरेको पुष्प व्यवसायले आ.ब.२०७६/०७७ मा कोभिड-१९ का काराण रु२ अर्व १५ करोड मात्र व्यवसायीक कारोबार भई करिब १० प्रतिशतले खुम्चिन पुगेको छ ।

आगमी दिन खेल्नु पर्ने भुमिकाहरु

कोभिड-१९ संक्रमणबाट सामान्य अवस्थामा फर्कि सके पछि नर्सरी तथा उत्पादन फार्म केन्द्रहरूलाई पहिलेकै अवस्थामा संञ्चालनमा ल्याउन पुनः ठुलो धनराशी लगानी गर्नु पर्ने रहेको छ । यस क्षेत्रमा लागेका जनशक्तिहरु धेरै नै पलायन भएका छन । पुष्प उद्यमी व्यवसायीहरु व्यवसायीक तथा आर्थिक अनिश्चितताको कारण जटिल अवस्थाबाट गुज्रिरहेको छन । यो जोखिम कहिले अन्त्य हुने अझै अनिस्चित रहेको छ । यस्तो जोखिमबाट पुष्प व्यवसायलाई बचाउन नेपाल सरकार तथा मातहतका निकायहरूले अल्पकालीन र दिर्घकालिन राहत तथा सहयोगका प्याकेज कार्यक्रम ल्याई यस क्षेत्रको पुनःउद्वार गर्न आवश्यक रहेको छ ।

लकडाउनको अवधीमा उत्पादित फूललाई बजारसम्म पुऱ्याउन नसकेको कारण फाल्दै पुष्प व्यवसायी

एउटा आयआर्जन, रोजगार, स्वरोजगारको पाटोबाट मात्र नहेरी देशको सौन्दर्यता अभिबृद्धिमा गहनाको रूपमा पनि पुष्प ब्यवसायको महत्व पूर्ण भुमिका रहेको हुन्छ । विकासका पूर्वाधार, सार्वजनिक निजी जग्गा तथा भवनहरूमा पुष्पको प्रयोग, विभिन्न सोभायमान् स्वदेसी तथा विदेशी कार्यक्रमहरूमा नेपाली स्वदेशी ताजा पुष्पको प्रयोग गर्न सकेमा यसले एउटा छुटै महत्व राख्नुका साथै गौरवको समेत आभास हुन्छ । मानबको दैनिक जीवनको अभिन्न अंगसंग जोडिएको यो पुष्प विधालाई सरकारका विभिन्न निकायबाट पनि अपनत्व स्विकारी यसको उत्पादन, प्रबर्द्धन र उपयोगमा भरपुर सहयोगको खाँचो रहेको छ ।

विभिन्न समयमा आईपर्ने विभिन्न विपतमा यस व्यवसाय पनि ठूलो मारमा पर्ने गरेको छ । देशमा विपत्ती आईलाग्दा देशबासीहरुको जीउ ज्यानको सुरक्षामा बढि केन्द्रीत हुने हुदा यसमा लगानी गर्ने व्यवसायिको उत्पादनको उपभोग प्राथमिकता पर्दैन अर्थात न्युन प्राथमिकतामा पर्ने हुंदा त्यस उत्पादनको जोखिम पनि अत्यधिक नै रहेको हाम्रो अगाडी विधमान नै छ । पर्यटन विकासमा देशले लिएको नितीलाई पुरा गर्ने लक्ष्यका साथ पुष्प व्यवसायको विकास विस्तार भै रहेको हुन्छ । त्यसैले यस्ता विषम परिस्थितीबाट हुने जोखिम सुरक्षणका लागी सरकारको स्पष्ट निती हुनु पर्दछ र ईमान्दारीका साथ कार्यान्वयन हुनु पनि जरुरी छ जसले गर्दा यस प्रकारको ठूलो धनराशी खर्चेर लगानी गर्ने व्यवसायीहरुको मनोबल बृद्धि भई आत्मनिर्भतामा जान महत्वपूर्ण टेवा पुग्दछ ।

कोभिड-१९ माहामारी तथा यस प्रकारका अन्य विपतहरु स्प परिवर्तन गरि कुनै पनि स्पमा जुन सुकै समयमा आईपर्ने भएकाले वास्तविकताको धरातलबाट अध्ययन गरि लगानी सुरक्षण हुने निस्चितताका नितिहरु कार्यक्रमहरु तत्काल बन्नु पर्ने देखिन्छ अन्यथा कुल जीडिपीको २६ प्रतिसत ग्राहस्थ उत्पादनले ओगटेको कृषि क्षेत्र धारासाही भयो भने देश छिटै नै नाजुक अवस्थामा पुग्नेछ ।

एक उद्योगको स्पमा अगाडी बढीरहेको पुष्प व्यावसायको दिगो संस्थागत विकास, गुणस्तरीय उत्पादन, आन्तरिक बजार व्यवस्थापन, आयात प्रतिस्थापन तथा निर्यात प्रबर्द्धन आदिमा सम्बन्धित, संघ संस्थाहरुले निर्वाह गर्नु पर्ने महत्वपुर्ण भुमिकाको साथै आगामी दिनहरुमा पूष्प व्यवसायको दिगो व्यवसायिकरणका लागि बिबिधीकरण सहित गुस्तरिय फूल बिस्वाहरुको उत्पादन, संकलन, भण्डारण, बजारीकरण र निर्यात प्रबर्द्धनमा गुणात्मक फड्को मार्नु आजको आवश्यकता पनि हो । नेपाल सरकार तथा सरोकारवाला निकायहरुले नीतिगत व्यवस्था सहित अल्पकालिन तथा दिर्घकालिन रणनीतिक योजनाका साथ पुष्प व्यवसायलाई निर्यात मुलक बस्तुको प्राथकिताको सुचीमा समेटी यसको व्यापक अध्ययन अनुसन्धान, वातावरण सुहाउदो पुष्प खेती प्रबिधीको बिकास, पुष्पको बजारिकरणमा जोड दिने हो कोभिड-१९ का कारण पुष्प व्यवसायको क्षेत्रमा पुगेको व्यवसायीक असरलाई रिकभर गर्दै आगामी केही वर्षमानै अहिले भईरहेको पुष्प आयातलाई प्रतिस्थापन गरी निर्यात गर्न सकिने सम्भावना रहेको छ ।

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