

Quarterly Newsletter

# AGRI-CONNECTION

September 2023 | Volume 8, Issue 3



बडा दशैं, तिहार, र छठ पर्वको हार्दिक शुभकामना !!

Inside:

6-9 NAPA Conference 2024

11 Research Brief

22 Rooftop Farming

30 कलापास, कोर्नेल, र किशुन

13

Nepal  
News

PROSPERITY THROUGH AGRICULTURAL TRANSFORMATION

## Association of Nepalese Agricultural Professionals of Americas (NAPA)



बुढा  
दशैंको  
शुभकामना  
Happy Dashain



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Agri-Connection is an effort of connection - a means of linkage among Nepali hearts worldwide. We invite and encourage you to send us your articles, research summary, intellectual ideas, opinions, thoughts, perspectives, memoirs, and literary creations.

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# Message from the President

Dr. Pradeep Wagle, NAPA President



Dear NAPA members and beyond,

I am pleased to announce the release of the third issue of the eighth volume of our quarterly newsletter, Agri-connection (AC). This issue features the incredible work being done by our committees and members, articles, and research synopses on a variety of important agricultural topics, as well as condensed highlights of Nepal's noteworthy agricultural news. I would like to thank our members and well-wishers for their contributions to this newsletter and to the success of our organization.

Our sub-committees have been busy organizing events over the past quarter. The Webinar Committee (WC) organized the 35th webinar on “Breeding Innovations in CGIAR for Global Food Security” on July 23. As I am writing this presidential remark, the WC recently organized the 36th webinar on “Digital soil mapping: The state-of-the-art perspectives, opportunities, and challenges” on October 8. The Research and Capacity Building Committee (RCBC) provided research mini-grant awardees with a series of capacity-building programs on topics such as research ethics, data collection, and data analysis. The Reward and Recognition Committee (RRC) has collected nominations for NAPA Distinguished Contribution Award. The Collaboration and Resource Building Committee (CRBC) facilitated a meeting between the NAPA team and the Honorable Ambassador of Nepal for the USA, Sridhar Khatri, on October 4, 2023. The meeting was focused on exploring avenues for collaboration and contribution to Nepal's agricultural development. A consensus was made to work together in three thematic areas: Research, Teaching, and Policy.

The NAPA 4th Biennial International Scientific Conference will be held on May 24-26, 2024 in the Maritime Conference Center near Baltimore, Maryland, USA. The call for abstracts is open through October 31, and several abstracts have already been received. The call for student writing contest is also open through December 31. The Conference Organizing Committee and several sub-committees are working hard to make the conference a grand success. I encourage everyone to submit abstracts and plan to attend the conference in person, if possible. Please stay tuned for further updates in the coming months.

NAPA members have volunteered to share their experiences and expertise with academic and research institutions in Nepal during their Nepal visit. Please let NAPA know if you are interested in volunteering for a variety of tasks, such as giving guest lectures, leading workshop or training sessions, providing mentorship or career guidance, and collaborating on research projects. NAPA will work with you to arrange your volunteer placements based on your skills and interests.

I am sincerely grateful to the AC Editorial Board led by Dr. Sushil Thapa, for their dedication and hard work. The board has played a vital role in ensuring the quality and relevance of the AC. I request all our members to stay engaged with AC by sending their contributions to [newsletter@napaamericas.org](mailto:newsletter@napaamericas.org).

**Wishing everyone a very Happy Dashain, Tihar, and Chhath 2080 BS.**

**For past issues of Agri-Connection, please visit:**

<https://napaamericas.org/newsletter.php>

# Editorial

Festivals hold a special place in our hearts and serve as moments of joy, togetherness, and cultural celebration. However, festivals often impose significant financial burdens on many impoverished individuals and families. Efforts to celebrate festivals in a more frugal and inclusive manner could help alleviate some of these economic burdens and ensure that everyone can partake in the cultural richness of Nepal's traditions.

The essence of any festival lies not in the extravagance of the festival, but in the spirit of unity and happiness. Adopting cost-effective practices such as, embracing simplicity, using homemade decorations, putlock celebrations, prioritizing necessities, and sharing expenses may help everyone to enjoy festivals, regardless of their financial situation. Celebrating festivals with a low budget is an opportunity to rediscover the true spirit of these occasions. It encourages us to focus on what truly matters: the people we celebrate with and the values that bind us together. This practice not only promotes a more inclusive and compassionate society but also allows for a deeper connection with the cultural and spiritual aspects of the festivals.

Published during the major festival season in Nepal, this issue features a variety of articles on variegated succulents, rooftop farming, and plant disease epidemiology, and summarizes NAPA's initiatives and achievements in organizational development, networking, and philanthropy. The story of a Cornell University graduate who is promoting plant biotechnology in Nepal makes this issue even more exciting and inspirational to our readers. Many thanks to President Dr. Pradeep Wagle, Vice President Dr. Ramjee Ghimire, and General Secretary Dr. Nityananda Khanal for your feedback, support, and encouragement as always.

**Happy Vijaya Dashami, Dipawali, Mha Puja, and Chhath Parba 2080 BS!!**

## AGRI-CONNECTION Editorial Board



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Guest Editor: Mr. Padma Nath Atreya



# TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
Message from the President	2
Editorial	4
NAPA Announces 4th International Conference - 2024	6
Call for abstract	7
Call for nomination	8
Call for student writing contest	9
Meeting and Training	10
Research Brief	11
Webinar series-35	12
Nepal News	13
Photographs in Action	15
Appeal for Contribution to NAPA Endowment Fund	16
Membership Update	17
Appeal to Join/Renew NAPA Membership	18
Membership Type and Fee	19
NAPA Committees	20
KidsZone	21
<b>Article:</b> Rooftop Farming	22
<b>Article:</b> Beauty of Variegated Succulents	24
<b>Article:</b> The Epidemiology of Panama Wilt in Banana	26
<b>संघर्ष र प्रेरणाको कथा:</b> कलापास, कोर्नेल, र किशुन	30
<b>कविता:</b> दर्शौ आउ सधैभरि आउ	33

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**Publisher**

Association of Nepalese Agricultural Professionals of Americas (NAPA)

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*Please*

# SAVE THE DATE

NAPA PROUDLY ANNOUNCES

# 4<sup>TH</sup> BIENNIAL INTERNATIONAL SCIENTIFIC

*Conference*

**MAY 24-26, 2024**

Memorial Day Weekend

[www.napaamericas.org](http://www.napaamericas.org)



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CONFERENCE  
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*692 Maritime Blvd,  
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Stay  
**TUNED FOR  
MORE  
UPDATES**

**Conference Theme: Climate-Smart and Innovative Agriculture**



# NAPA 2024

## 4<sup>th</sup> BIENNIAL INTERNATIONAL SCIENTIFIC CONFERENCE (HYBRID)

MAY 24-26, 2024 | BALTIMORE, MARYLAND, USA

### Call for Abstract

The Conference Organizing Committee (COC) of the Association of Nepalese Agricultural Professionals of Americas (NAPA) is pleased to announce the call for abstracts for the 4<sup>th</sup> NAPA<sup>th</sup> Biennial International Scientific Conference with the theme “Climate-Smart & Innovative Agriculture.” Abstracts are solicited for oral, poster, and rapid-fire presentations within the disciplines of Agricultural and Allied Sciences.

#### Submission Guidelines

- Abstracts should be focused on achieving sustainable supplies of food, feed, fuel, and fiber (4F) considering the climate change and food security impacts are encouraged.
- Abstract should not exceed 300 words. Preparation of abstract should be as follows:

Title:

Author(s) and affiliation(s):

Email of corresponding author:

Discipline: Select the relevant discipline from the submission portal.

Keywords: Enter up to five keywords

Abstract: Include a brief introduction, objective, methods, results, and conclusions.

#### Submit the abstract online at:

<https://www.napaamericas.org/NAPA-conference-2024>

#### Award

- A limited number of awards for registration and/or accommodation (no airfare or travel support) may be available to students and young scholars. Further information about the request for award will be announced at a later date.

If there are any questions, please contact us at: [conference@napaamericas.org](mailto:conference@napaamericas.org)

- Prem B. Bhandari, Ph.D.  
Chair, Scientific Sub-committee
- Lila B. Karki, Ph.D.  
Chair, Conference Organizing Committee

**For Students Only:  
Best Oral, Poster, and  
Rapid-Fire Presentation Awards**

Three outstanding oral, poster, and rapid-fire presentations, each, will be awarded a cash prize of \$250, \$150, and \$100 for the first, second, and third positions, respectively, along with a certificate of appreciation. Students must indicate their interest in participating in oral, poster, and rapid-fire competitions.

**SUBMISSION DEADLINE**

**OCTOBER 31, 2023**  
11:59 PM EST



**CALL FOR  
ABSTRACT  
NOW OPEN**

Conference Theme: Climate-Smart and Innovative Agriculture





# NAPA 2024

## 4<sup>th</sup> BIENNIAL INTERNATIONAL SCIENTIFIC CONFERENCE (HYBRID)

MAY 24-26, 2024 | BALTIMORE, MARYLAND, USA

## Call for Nomination

### Recognizing Outstanding Master's & PhD Students

Are you a master's or Ph.D. student in agriculture with a passion for excellence?

☞ Here's your chance to shine! ☀

🏆 Nominate yourself or a fellow student for the prestigious awards at the Nepalese Agricultural Professionals of Americas 4<sup>th</sup> Biennial Conference!

#### 📌 Categories:

1. Outstanding Master's Student
2. Outstanding PhD Student

#### 🔍 Eligibility Criteria:

- Enrolled in a master's or Ph.D. program in agriculture or allied sciences or having completed the degree no more than one year before the conference date (May 2024)

#### 📅 Important Date:

- Nomination Deadline: 31<sup>st</sup> March 2024

#### 📝 How to Nominate:

- Please visit our conference website for further details: <https://www.napaamericas.org/NAPA-conference-2024>

#### 🏆 Prizes:

- Certificate of Excellence 📄
- Recognition at the Conference 🎵

For inquiries, please email  
[napaconference@conference.org](mailto:napaconference@conference.org)

☞ Join us in celebrating academic excellence in agriculture and allied sciences! ☞

**CONFERENCE THEME: CLIMATE-SMART AND INNOVATIVE AGRICULTURE**



# NAPA 2024

4<sup>th</sup> BIENNIAL INTERNATIONAL  
SCIENTIFIC CONFERENCE  
(HYBRID)

Call for Essays  
Student Writing Contest

**MAY 24-26, 2024 | BALTIMORE, MARYLAND, USA**

Association of Nepalese Agricultural Professionals of Americas (NAPA) Conference Organizing Committee is pleased to announce the call for 2024 College and University Students' Essay Writing Contest for its 4<sup>th</sup> Biennial International Scientific Conference (<https://www.napaamericas.org/NAPA-conference-2024>). A full-time student enrolled in a college, including community or vocational college, and/or university around the globe pursuing a degree in agricultural or allied fields\* is eligible to participate.

## **Essay Topic: “Climate-smart and innovative agriculture to achieve sustainable, and resilient agri-food systems”**

### **General guidelines:**

- The essay should be written in English language.
- The essay must be author's original work and should be attested by inserting a statement\*\* followed by author's full name.
- The essay should follow the standard academic essay structure and format that includes a concise abstract followed by an introduction with a thesis statement(s) along with logically organized body of supporting arguments using headings/sub-headings leading to a conclusion(s) and future perspectives.
- The essay can be developed based on student's own experience, online research, and scientific literature review.
- Appropriate credits must be given to the work of others through appropriate citation. The essay will be disqualified for the competition if any evidence of plagiarism is established. The committee strongly discourages plagiarism of any form and advises students to avoid engaging in such activity.
- The essay should include a complete list of references cited in the reference section. The references should be formatted using APA style (<http://www.apastyle.org/>), examples are available at the reference section of NAPAs' journal website: <https://gjaas.org/index.php/GJAAS/authorGuideline>
- The essay should not exceed 3,000 words, excluding footnotes, tables, figures, and references. The texts should be formatted double-spaced, and 12-point Times New Roman font size. Margin should be 2.5 cm (1 inch) on all sides.
- The essay should have author's name, affiliated college and/or university, degree program, mailing address, and email ID. A proof of student status is required (e.g., student ID card with an expiration date or unofficial transcript or a letter from the college or university certifying the student's full-time status on or before the closing date).
- A pdf or word copy of the essay must be uploaded online at: <https://www.bit.ly/NAPA-SWC>
- The pdf or word file should be named “NAPA\_2024\_SWC\_STUDENT FULL NAME\_COLLEGE OR UNIVERSITY NAME”. The deadline for submission is December 31, 2023
- Only one essay can be submitted per contestant.
- The results of the essay writing contest will be notified only to the winners prior to the conference.
- The first, second, and third place winners will be awarded with a certificate and cash prizes of \$250, \$150, and \$100, respectively at the conference during May 24-26, 2024 in Baltimore, Maryland, USA. Winners are encouraged (but not required) to be physically present at the award ceremony.

If you have any questions/concerns, please contact Dr. Bharat Pokharel, Chair, Student Writing Contest Sub-committee at [Bharat.Pokharel@gmail.com](mailto:Bharat.Pokharel@gmail.com)

**Conference Theme: Climate-Smart and Innovative Agriculture**



## Meeting with Ambassador Sridhar Khatri

The Association of Nepalese Agricultural Professionals of Americas (NAPA) and the Embassy of Nepal in Washington, D.C. met on October 4, 2023, to discuss ways to collaborate and contribute to Nepal's agricultural development and beyond.

The meeting was attended by Honorable Ambassador Sridhar Khatri, NAPA President Pradeep Wagle, Founding President and Advisor Lila B. Karki, Immediate Past President and Advisor Megha N. Parajulee, Advisor Gopi Upreti, NAPA's Collaboration and Resource Building Committee (CRBC) Chair Buddhi Gyawali, CRBC members Keshav Bhattarai, Bharat Pokhrel, and Suraj Upadhyaya.

Everyone introduced themselves at the beginning of the meeting. NAPA President Dr. Wagle then gave a brief presentation about NAPA and its activities. Ambassador Khatri thanked NAPA for its work and expressed his desire to collaborate with the organization.

After the presentation, there was an open discussion. The two sides agreed to work together on three key areas: Research, Teaching, and Policy. The Honorable Ambassador Khatri requested NAPA to develop three to five feasible and meaningful tasks or concept notes in each of these areas. NAPA President Dr. Wagle said that NAPA would develop some feasible tasks by the end of October. Both sides agreed to meet again in mid-November to discuss their progress.



## Training on Genomics and Bioinformatics

Continuing Education Center (CEC) at the Agriculture and Forestry University (AFU) and the Association of Nepalese Agricultural Professionals of Americas (NAPA) organized a two-day training program on Genomics and Bioinformatics in the Cloud at the Center for Biotechnology, AFU, Rampur, Chitwan, Nepal. The training was held from October 11-12, 2023.

Dr. Ananta Raj Acharya and Dr. Saroj Parajuli, life members of NAPA, were the resource persons for the training. Around 30 postgraduate students from the departments of Veterinary Microbiology, Biotechnology, Plant Breeding, and Animal Breeding participated in the training.



*This issue was released in the mid of October, therefore, it contains some information form October, 2023.– Editorial Board*



## Research Brief

# Livamol with BioWorma Reduces the Gastrointestinal Nematode EPG in Nursing Kiko Does

Durga Dhakal\*, Uma Karki, and Santoshi Chaudhary

College of Agriculture, Environment and Nutrition Sciences, Tuskegee University, AL 36088

\*Email: [ddhakal9095@tuskegee.edu](mailto:ddhakal9095@tuskegee.edu)

Gastrointestinal nematodes (GINs) are the significant constraints to pasture-based goat production in the southeast USA. Prevalence of GINs has become a critical issue due to indiscriminate use of anthelmintics leading to nematodes' resistance to anthelmintics available in the market. Livamol with BioWorma (hereafter BioWorma), a biological product containing spores of *Duddingtonia flagrans*, is known to trap GIN larvae and lower the chance of re-infection in artificially-infested animals (IAHP, 2020). However, the efficacy of this product is not known in pasture-raised nursing goats that may acquire natural challenges of GIN through contaminated pastures. To find out the effectiveness of BioWorma on minimizing GINs in nursing Kiko does raised on pastures, a study was conducted at the Browse Research and Demonstration Site, Tuskegee University, for 120 days (March - August 2023).

### Methodology

Sixteen nursing Kiko does and kids (30) were divided into two uniform groups based on their initial live weight, body condition score (BCS), FAMACHA score, and EPG. Each group of animals was assigned to separate sets of grazing plots and rotationally stocked in those plots throughout the study. Animals had free access to clean drinking water, shelters, and mineral mix in each plot. BioWorma at the rate of 1g/day/kg of animal live weight was fed to one group of animals. BioWorma was mixed with 0.227 kg of whole corn prior to feeding. Another group (control) was provided with an equivalent amount of corn without BioWorma. Additionally, both groups were supplemented with whole corn at the rate of 0.5% body weight. Animal performance data (live weight, BCS, and FAMACHA score) and fecal samples were taken on Day 1, every week during the study, and the last day of the study. Fecal samples were analyzed to determine the EPG.

### Results

Does fed to BioWorma had less eggs of GIN per gram of animal feces (EPG) (35%;  $p < 0.05$ ) compared to control group (Table 1). Results showed that BioWorma was able to reduce GIN EPG in nursing Kiko does raised in pastures.

Table 1. GIN EPG of does with or without BioWorma feeding.

Group	LSMean±SE	Mean score
Control	1790±162.9	146.9 <sup>†a**</sup>
BioWorma	1173±161.6	122.3 <sup>b</sup>



Figure 1: Kiko does and their kids in a pasture plot of Tuskegee University, Alabama, USA.



Figure 2: Kiko does eating Livamol with BioWorma, Tuskegee, Alabama, USA.

# Webinar Series 35: Breeding Innovations in CGIAR for Global Food Security

Prepared by - Rajan Shrestha and Sujata Bogati

The Association of Nepalese Agriculture Professionals of Americas -NAPA's Webinar Committee (WC) hosted the 35th Webinar, presented by Dr. Bhoja Raj Basnet. The highlights of this edition of the webinar series are summarized in the report. The talk focused on the undertaking of breeding programs and developments by the Consortium of International Agricultural Research Centers (CGIAR) in the background of global food security concerns.

stakeholders. Among many CGIAR initiatives, a key one includes transboundary breeding and genetic innovations which aggravate transdisciplinary efforts on accelerated breeding; gene banks and precision genetics; market intelligence and seed systems; and breeding resources. Some of the key CGIAR activities in solving global food challenges include a targeted breeding approach based on market segmentation (e.g., Maize in Southern Africa and rice

Association of Nepalese Agricultural Professionals of Americas (NAPA) presents

## NAPA Webinar Series: 35

### Breeding Innovations in CGIAR for Global Food Security



**Bhoja Raj Basnet, Ph.D.**  
Senior Scientist - Breeding scheme optimization,  
Excellence in Breeding Platform/Accelerated  
Breeding Initiative, CGIAR

**USA Time:**  
July 23, 2023 (Sunday)  
7:30 PM CST

**Nepal Time:**  
July 24, 2023 (Monday)  
6:15 AM

साउन ८, २०८० सोमबार  
बिहान: ६:१५ बजे

 **829 0346 5507**  **LIVE** [www.facebook.com/NepaleseAgriculturistAmericas](http://www.facebook.com/NepaleseAgriculturistAmericas)

The need for concerted efforts at a large scale is inevitable to address worldwide food security problems. On-going food security issues intertwined with multi-facet aspects such as population demographics, declining crop productivity, and climate crisis warrant the need for global collective initiatives and validate the importance of organizations like CGIAR. Such a challenge is not confined only to the present but has stretched even more to the future relating to global food production, demand, and supply. By 2050, a projected increase in global population by up to 20% and a 10% increment in food consumption per capita would have serious implications on food security with little scope for expansion of arable land and a rising climate crisis.

CGIAR, a platform for global agricultural research partnership is materialized with a Consultative Group of International Agricultural Research for a food-secure future acting through a unified system framework and strong partnership between research centers, funders, and key

in South Asia); the use of a breeding database management system on all aspects of the breeding process; and speeding up the breeding cycle through predictive breeding and rapid generation advancement approach among others.

Another important aspect of CGIAR is modernizing breeding through infrastructure development and upgrades. This aims to enhance the plant breeding capacity at the country and regional levels, improve the data quality for increased heritability and faster breeding, and increase the efficiency of breeding programs. For instance, a multi-funder initiative "Crops to End Hunger" is supporting low-income countries in the modernization of public plant breeding programs. Importantly, CGIAR's breeding innovation and programs thrive through an extensive public-private collaboration worldwide through more than 16 research centers and 9,000 scientists, researchers, technicians, and staff. As a result, a prominent global impact has been made through genetic improvement and yield gains, driven by new advancements and innovations in breeding

## Nepal News

### Highlights of agriculture-related news/events in Nepal

Compiled by: Shaurav Sharma

Agriculture and Forestry University (AFU), Chitwan, Nepal

Email: [shauravsharma5151@gmail.com](mailto:shauravsharma5151@gmail.com)



#### Nepal's government implements revised fertilizer guidelines

New site-specific recommendations for maize, wheat, and rice were jointly launched by the Nepal Agricultural Research Council (NARC) and the National Soil Science Research Center (NSSRC). These updates, led by the Nepal Seed and Fertilizer (NSAF) Project in collaboration with the Department of Agriculture (DoA) and CIMMYT, address previous one-size-fits-all recommendations from 1976. They consider soil diversity, agronomic management, and nutrient supply, taking six years to develop through advanced analytical methods and machine learning. These recommendations were validated in meetings with soil scientists and agronomists in July and October 2022.

(July 24, CIMMYT)

#### Nepal's traders hike rice prices as India orders export halt

Concerns over the return of the El Niño weather phenomenon (caused by warmer surface water in the Pacific Ocean, leading to an increased risk of heavy rainfall and droughts in certain parts of the world) have already elevated the prices of rice with heightening fears of potential crop damage. The embargo was imposed by southern neighbour to mitigate the risk of heightened inflation ahead of the upcoming Indian elections. Nepal requires 4 million tonnes of rice annually to feed its population, and the deficit is made up by imports from India.

(July 31, Asian News Network)

#### Jumla exports 21,000 metric tonnes of apple

The apple farmers in Jumla have exported over 21,000 metric tonnes of apples so far this year. Despite the growing interest of local farmers in apple farming in Jumla in recent years, apple production has decreased by 40% this year compared to the previous year. Approximately 16,000 households in Jumla depend on apple farming, and apples are cultivated across 4,250 hectares of land.

(August 5, OnlineKhabar)

#### Oranges worth NRs. 290 million produced in Tanahu last year

Orange production has been on the rise in the district consistently year after year. Farmers are increasingly drawn to orange farming due to its potential for generating substantial income. The district has the potential to expand orange cultivation across 8,570 hectares of land. To support farmers in this endeavour, the Agriculture Center has earmarked Rs 10 million in funding for the ongoing fiscal year 2023/24.

(August 5, myRepublica)

#### Edible oil export earnings decline by two-thirds in FY 2022/23

Edible oil exports, a significant revenue source, declined by one-third in FY 2022/23. Specifically, palm, soybean, and sunflower oil exports dropped from Rs 93.698 billion to Rs 29.425 billion. Sunflower oil exports were only Rs 441.83 million in 2022/23. Nepal imports raw soybeans from several countries, primarily Argentina, Brazil, Paraguay, Indonesia, and Ukraine. Crude palm oil is sourced from Malaysia and Indonesia, processed in Nepal, and exported to the southern neighbor. Additionally, Nepal imported legumes worth Rs 1.34 billion from mid-July to mid-August from various countries.

(August 9, myRepublica)

#### Nepal sends tomatoes to India, and asks for rice

Since July 20, India has maintained an embargo on non-basmati rice amid the threat of El Niño weather disruptions. Imports of basmati and non-basmati rice dropped sharply to 812,028 tonnes in 2022-23 as India strangled exports. While India has started importing tomatoes from Nepal amid a record-high spike in prices, Nepal has written to the Indian government to send rice and sugar.

(August 11, The Kathmandu Post)



## Nepal...

### Panama disease in banana: primary study begins

The Panama infection (TR-4) was detected while carrying out a sample test on bananas by the Nepal Agriculture Research Council (NARC). A seven-member task force headed by the scientist of the National Plant Pathology Research Centre, Dr. Ram Bahadur Khadka has reached Tikapur to initiate the study. The task force has started discussions with the chiefs of Sudurpaschim and Lumbini province offices working in the area of agriculture as well as local farmers. *Fusarium oxysporum f. sp. cubense* (Tropical Race 4- TR4) was confirmed after PCR and sequencing of the deadly Panama wilt pathogen.



(August 30, NepalNews.com)

### Government enforces Yarsagumba harvesting guidelines

The Ministry of Forests and Environment is introducing the "Yarsagumba Management Guideline" for the Himalayan region, limiting collection to 30 days (with a possible 15-day extension) during the Baisakh and Asar months. The guidelines ban plastic below 40 microns and specify authorized tools while prohibiting littering, fires, and digging in the area.

(September 8, myRepublica)

### Monsoon rainfall is below normal in Terai districts

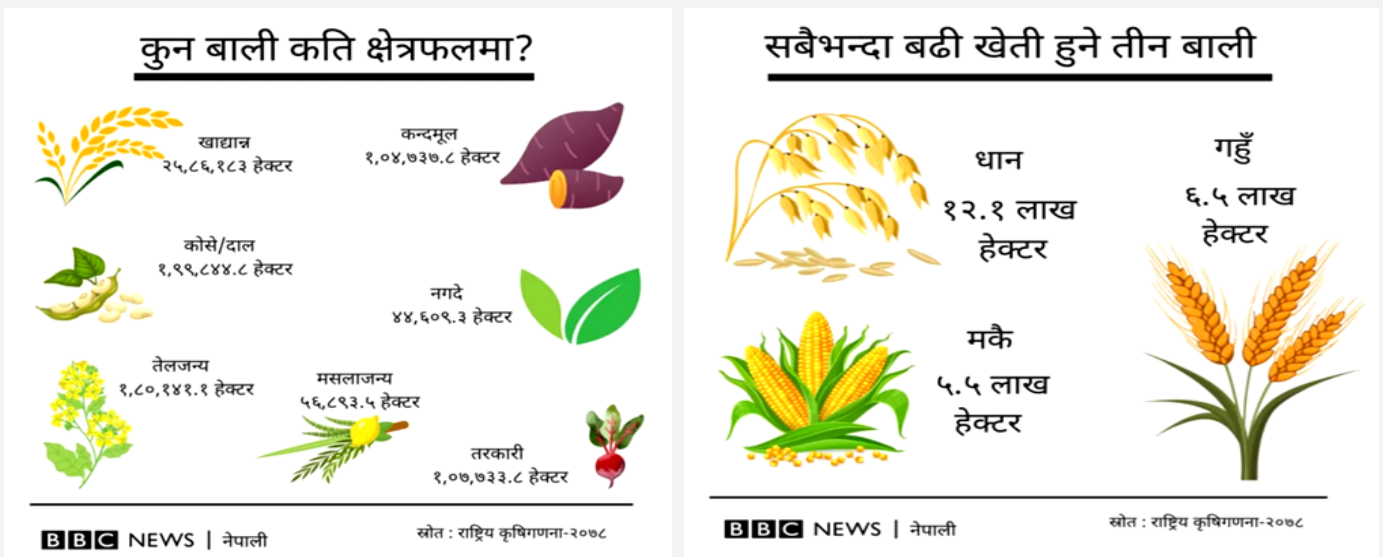
Numerous Terai districts are facing an unusual mid-monsoon drought, causing concern among farmers due to severe dry spells. Only 60% of the land has been cultivated, raising worries about a potential food crisis. The lack of adequate rainfall not only hampers cultivation but also affects timely crop production. Nepal typically receives 1,472 mm of monsoon rainfall over four months from June to September, but this year's below-average precipitation was predicted by the authorities.

(September 12, The Kathmandu Post)

### Cultivating health and sustainability through millets in Nepal

In March 2021, the UN General Assembly, with the support of 72 countries, including Nepal and India, declared 2023 as the International Year of Millets. Millets, often overlooked, have been a staple food in Nepal for centuries, especially for small-scale farmers facing agricultural challenges. In the face of climate change, millets provide a sustainable solution for enhancing nutrition, food security, and biodiversity protection. Finger millet, for instance, is used in various local dishes and is rich in nutrients, making it a valuable choice for pregnant women, diabetics, and those with high blood pressure. Millets are not just grains; they are seeds of sustainability, nutrition, and health.

(September 14, The Annapurna Express)





## Photographs in Action



Photograph 1: Tomato farm belongs to Yuvaraj KC at Rupakot Majhuwagadhi-1, Diktel.

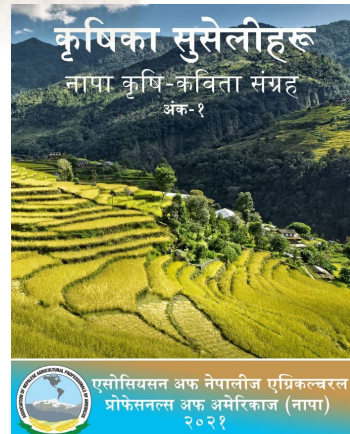
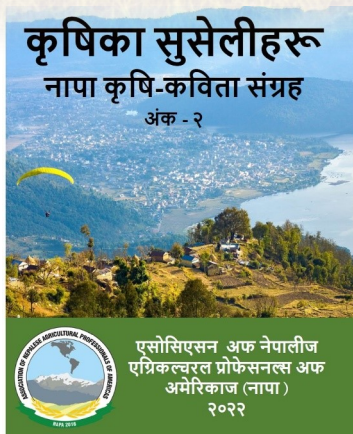
Source: Sanjay K. Pandit



Photograph 2: Finger millet ready to harvest at Rupakot Majhuwagadhi-1, Diktel.

Source: Sanjay K. Pandit

## NAPA Publishes Agri-Poem Compendiums





# Appeal for Contribution to NAPA Endowment Fund



**ENDOWMENT FUND  
ADVISORY BOARD**  
~ESTD. 2020~

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Dr. Basu D. Bhandari

Dear Sir/Madam:

The Endowment Fund Advisory Board (EFAB) of the Association of Nepalese Agricultural Professionals of Americas (NAPA) sincerely requests you to consider a donation to its **Endowment Fund**. Your donations to the endowment fund would help NAPA achieve its overarching goal, “*Global Food Security through Agricultural Transformation.*” NAPA is a non-profit, non-governmental, non-religious, and non-political professional organization dedicated to serving humanity through scientific research, teaching, outreach, and charitable initiatives in agricultural and allied disciplines. Since its inception in 2016, NAPA has implemented outstanding programs such as international scientific conferences, scholarships, research mini-grants, webinars, seminars and workshops, peer-reviewed Global Journal of Agriculture and Allied Sciences (GJAAS), a seminal book on food security, Research and Policy Briefs, and Agri-Connection – an online quarterly newsletter.

To facilitate and expand its endowment fund, originally initiated in 2017, envisioning the economic and programmatic sustainability of this emerging organization, the NAPA Executive Committee established an EFAB in January 2021. The EFAB envisages utilizing the endowment revenue to sponsor NAPA's flagship programs, prioritizing donor-specified activities while allowing the principal to grow through its productive investment strategies.

**The Endowment Fund Advisory Board  
has already received a pledge commitment of  
over \$110,000.**

You can contribute to this noble cause by establishing the fund in your name or your beloved ones'. As a contributor, you can also express your activity of interest to NAPA, consistent with NAPA's mission and vision. It is an incredible opportunity for you to contribute to this cause through an upfront donation or any amount on a monthly or annual basis for any number of years, based on your interest and willingness. **Donations to NAPA endowment funds are tax-deductible.** Our Endowment Fund Donation Recognitions/Tiers are:

Platinum Sponsor ≥\$10,000	Diamond Sponsor ≥\$7,000
Gold Sponsor ≥\$5,000	Silver Sponsor ≥\$3,000
Bronze Sponsor ≥\$1,000	Green Sponsor ≥\$500
Valued Sponsor or Supporter <\$500 (allocated to common/pool fund)	

The endowment fund's beauty is that a sponsor may customize the donation as a single or multiple installment(s) over the years. The tiered recognition level may scale up anytime your support reaches the designated tier, as mentioned above. The EFAB assures you that every donation to this fund will be maintained, managed, and utilized transparently.

Please support NAPA with your kind donations!



# Membership Update (September 30, 2023)

Member Category	Members
Founding life member	5
Life member	128
Associate life member	74
Student member	99
Associate student member	10
Regular member	14

## Member's Diary

### TWO YEARS JOURNEY IN THE USA: WAY TO GO....

Santoshi Chaudary, Phd Student  
Penn State University

I successfully completed my master's degree in animal and poultry sciences from Tuskegee University, Alabama, in the summer of 2023, having commenced my academic journey in the fall of 2021.

Under the esteemed guidance of Dr. Uma Karki, I undertook a thesis project - "Performance and immune response against gastrointestinal parasite of lactating ewes in woodlands with varying supplements." During my two-year graduate assistant tenure, I enthusiastically contributed to eight additional projects within Dr. Karki's lab, amplifying my knowledge and expertise. It was a period of relentless dedication and hard work that ultimately paid dividends. Consequently, I was thrilled to receive a Ph.D. offer from Penn State University's Department of Veterinary and Biomedical Sciences, a testament to my commitment to academic excellence. Currently, I am deeply engrossed in a compelling project focused on immunology, where I am unraveling the intricate host immune responses against Schistosoma infection. This opportunity at Penn State exemplifies the culmination of my academic journey thus far and sets the stage for further impactful contributions to the field of veterinary sciences



## Appeal to Join/Renew NAPA Membership

We would like to request potential members to join NAPA - a **common professional platform for all of us**. Meanwhile, we request all members who are not currently in good standing to renew their memberships. Members' contributions thus far to bring NAPA to the current level is greatly appreciated. We request our dedicated members and well-wishers to promote NAPA to the next level by recruiting eligible friends/colleagues/students in your network. New NAPA members must write the recruiter's name in the "referred by" row in the membership form. **The highest recruiter(s) will be recognized at our Biennial Scientific Conference.**

### A few reasons to join/renew NAPA membership:

NAPA is a member-driven voluntary organization. Members can benefit from the association to advance their career growth, develop organizational practices and leadership skills at all stages. Some of the membership benefits include:

- Peer-to-peer networking and research collaboration opportunities
- Professional development and advancement
- Serving on various committees
- Opportunity to publish scientific works in NAPA's various outlets (Journal, Book, Research/Policy Brief, and Agri-Connection)
- Opportunity to sponsor scholarships and research mini-grants in preferred agricultural institutions and disciplines in Nepal through NAPA
- Eligibility for organizational awards, scholarships, and endowment funds
- Opportunity to share scientific works, experiences, and expertise via association's Talk Sessions (Webinars) and Online Teaching/Learning Programs
- Joining global expert repository to contribute to Nepalese Agriculture and beyond
- Keeping up-to-date on association's programs and activities
- Volunteering and charitable opportunities
- Discounted rates for registration and hotel reservation during scientific conferences organized by the association

Please check for more details on Joining NAPA at <http://napaamericas.org/join-napa.php> and membership type and fees at <http://napaamericas.org/membership.php>. We look forward to welcoming you for a great cause. Please let us know if you have any questions and willingness to volunteer in various committees.



Thank you.

On behalf of NAPA Executive Committee,  
Dr. Ramjee Ghimire  
Vice President  
Chair, Membership Drive Committee  
Email: ramghi@gmail.com

BECOME A  
MEMBER  
JOIN TODAY!

Renew now

**Please join or renew your membership. Become a life member if possible!**

## Membership Type and Fee

NAPA Membership Drive Committee seeks to create a database of students, faculty, researcher, and other professionals of agriculture and allied fields in public, private and nonprofit institutions, industries, and enterprises working in Americas, Nepal and beyond; establish contact with potential NAPA members and promote awareness about NAPA's vision, mission, goals, objectives, and activities; conduct membership drive; inform members in advance their membership; and regularly update the membership directory on the NAPA website. NAPA membership pool has nine categories including honorary members, senior members, and members for the eligible spouse.

Table 1. Membership fees and eligibility.

Membership Type	Fee	Eligibility
Regular Member	USD 50 (for two years)	Individuals who hold at least an undergraduate or bachelor or equivalent degree in agriculture or allied areas
Student Member	USD 25 (for two years)	Current students of agricultural and allied areas of studies who are in good standing student status.
Life Member	USD 200 (one time)	Individuals having met regular/general member's category and pay defined dues at a time.
Life Member (eligible spouse)	USD 100 (one time)	Eligible spouse of Life members
Family (Joint) Member	USD 15 (for two years) or USD 50 (one time for Life Membership)	Spouse of a member of any of the five categories (regular/general, student, life, honorary, and associate), who is not eligible for other categories of membership. Family members will not have voting right.
Associate Membership (Outside Nepal)	USD 25 (for two years) or USD 100 (one time for Life Membership)	Interested individuals who do not qualify for membership types above. Associate members shall not have a voting right and shall not be eligible for the candidate of the Executive Committee. An Associate member may become Associate Life member with the payment of defined dues at a time.
Associate Life Membership from Nepal	NPR 5,000 (one time)	Interested individuals who do not qualify for membership types above. One-time membership fee of NRs. 5,000.00 (five thousand rupees) to become Associate Life Member.
Associate Student Membership from Nepal	NPR 1,000 (one time)	Undergraduate and graduate students in good standing in Nepal. One-time membership fee of NRs. 1,000.00 (one thousand rupees) to become Associate Student Member as long as they are a student in Nepal.

**NAPA is for and by members. Please join NAPA and request your friends and family to join too. We would like to request eligible and interested people to join the NAPA family and work together with other fellow members. You can access this link to join NAPA: <https://napaamericas.org/join-napa.php>.**



## NAPA Committees

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Dr. Aditya R. Khanal

Outreach and Investment

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## KidsZone

# Dashain and Tihar in Nepal

Sushan Thapa

Grade 5, Missouri



Dashain and Tihar are two special festivals celebrated in Nepal. Dashain usually happens in September or October and lasts for 15 days. During Dashain, families come together to celebrate and have fun. It's a bit like Christmas in some ways!

One of the exciting things about Dashain is receiving "tika" and "jamara" from our elders. They put tika (a mixture of yogurt, rice, and red color) on forehead and offer jamara (corn and barley seedlings) as a symbol of good luck. It's a special time to show respect to elder family members.

People also play a lot of fun games and enjoy delicious foods. Kite flying is a famous game during Dashain. People love to fly colorful kites in the sky.

Tihar is also known as Deepawali. It is another wonderful festival in Nepal. It comes a few weeks after Dashain and lasts for five days. During Tihar, they celebrate and honor animals, which is very unique!

On the first day, they worship crows and offer them food. The second day is for dogs, and they make them feel extra special. The third and fourth days are for cows and oxen. People show them gratitude for all the help they give us. They also pray for goddess of wealth,

Laxmi. They decorate homes with beautiful lights and candles to welcome her.

The fifth day is the most exciting because it is all about celebrating the bond between brothers and sisters. Sisters put tika and give blessings to their brothers. Brothers give money and gifts in return. It is a day filled with love and happiness.

So, Dashain and Tihar are not just about festivities. They are also about love, respect, and spreading happiness in Nepal. Kids love these festivals because they bring families closer and create lots of fun memories!

I think these festivals are more enjoyable in Nepal than in the USA.



## Please Encourage Your Kids to Participate

Dear NAPA members and AC readers,

Please inform and encourage your kids to contribute for KidsZone. Creations such as arts, drawings, and any forms of writings (short essay, poem, story, memories, etc.) related to agriculture and allied sciences are accepted.

**KidsZone** also includes features on kids, animals, plants, life at school, and issues of particular interest to kids.

### Please include the following:

Name:  
School (optional):  
Grade:  
State/District:  
(And a photograph)

# KIDS TODAY, SCIENTISTS TOMORROW!



# Rooftop Farming

*Tribikram Dahal\* and Utsav Pageni*

*Agriculture and Forestry University (AFU), Chitwan, Nepal*

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## Introduction

In a developing country like Nepal, unplanned urbanization has led to a dearth of agricultural land. Cities have become crammed and the fertile lands have been concretized. Strategic planning can be employed to effectively address this issue, which may involve peri-urban farming, traditional soil-based farming, indoor farming, and rooftop farming. Amidst the urbanization, rooftop spaces will certainly be available for raising plants for household consumption. Rooftop farming (RF) is an undermined technique that could be practiced using soil-filled containers or a soil-free hydroponics system. It presents a viable solution to the increasing food demand and simultaneously enhances the quality of urban environment.

## Current status of rooftop farming

Rooftop farming has garnered global attention, especially in urban areas, as a viable solution to address environmental, social, and economic challenges. The interest has intensified following the 2012 Rio+20 Conference, which underscored the importance of sustainable development goals (Griggs et al., 2013). It has become a thriving initiative in numerous cities around the world such as New York, Chicago, and Montreal. In a study by Buehler and Junge (2016), it was found that 39% of the farms were aiming to enhance the quality of urban life, while 26% were aiming for commercial operations.

In the capital city of Nepal, Kathmandu, 34% of the households are practicing some form of kitchen gardening and rooftop farming covering an area of around 5.7 sq. Km (Shakya and Shrestha, 2017). Rooftop gardening has extensively been practiced only with assistance from NGOs, municipalities, and the Ministry of Agriculture and Livestock Development (MoALD) (Rawal and Thapa, 2022). There are very few private initiatives for such farming practices at present. However, with more of the public becoming aware of its perks, this practice is likely to flourish soon.

## Types of rooftop farmings

Quesnel et al. (2011) have categorized the rooftop farming into three primary types.

1. *Agricultural Green Roofs (AGRs)*: It incorporates edible crops into a soil-based growing medium placed above a waterproofing membrane. These systems typically involve extra components like a

root barrier, drainage layer, and irrigation system.

2. *Rooftop container gardens*: These involve the cultivation of vegetables, herbs, and wildflowers in containers or elevated beds filled with soil-based growing mediums. These gardens can vary from basic pots to more intricate setups and potentially occupy a significant area on the rooftop.
3. *Rooftop hydroponics system*: It is an approach to plant cultivation that utilizes water-based nutrient solutions instead of soil. These systems demand continuous energy input and are frequently situated within greenhouses, which extend their growing seasons and contribute to increased crop yields.

## How to start a rooftop farming?

The general process to set up a rooftop farm is outlined below.

1. *Select suitable pots*: Pots are vital for rooftop farming, serving as containers for soil needed for plant growth. Clay, plastic, cement, and other types are available and widely considered suitable for year-round rooftop farming.
2. *Preparation of potting mixture*: Once pots are ready, the next step is to prepare a planting mix for vegetables and fruit seeds or saplings. Dense soils are avoided and the mixture is prepared using composted manure or kitchen waste, in addition to the cocopeat, soil, and sand.
3. *Filling pebbles and stones*: After mixing the potting soil, pebbles are added to create drainage at the base of the pot. The pot is filled with the mixture, leaving a two-inch gap from the top to prevent spillage.
4. *Choose the right vegetables and fruits*: Seasonal and year-round vegetables and fruits are to be grown which may include tomatoes, garlic, coriander, and more. Deep-rooted plants need to be avoided and the soil should be lightly watered following the seeding.
5. *Placement of containers in the right place*: Pots should be placed strategically to expose sun-loving plants to sunlight and offer shade to shade-loving plants. The climbing plants such as beans, bottle gourds, and sponge gourds should be provided with support structure on time. They may also be placed near trellises, sturdy plants, walls, or railings.



## Rooftop Farming ...

6. *Taking care of plants:* Vegetables and fruits need to be watered at regular intervals by adjusting the frequency based on plant type and season of growth. Watering during the evening hours is preferred as it prevents the rapid evaporation. Drip irrigation could be used if possible, to increase the efficiency. In addition, disease and pest inspection needs to be carried out, which could be managed using organic pesticides, insect traps, and protective nets.

### Advantages of rooftop farming

1. Year-round access to a variety of fresh fruits and vegetables.
2. Reduction in the expenses of grocery shopping. Also reduces the import of vegetables and fruits.
3. Access to quality and organic food.
4. Therapeutic break that leads to physical and mental well-being.
5. Reduction in the demand for air conditioning as green roofs insulate heat in buildings.
6. Reduction in air pollution and maintenance of a healthy environment.

### Limitations of rooftop farming

1. Deficit of reliable plant varieties with no quality assurance from the supplying nurseries.
2. Intense sunlight on the rooftop results in greater loss of moisture and nutrients by evaporation.
3. Hailstones and strong winds pose a threat during monsoon.
4. Large buildings in the city could block the sunlight necessary for plants leading to poor performance.

### Conclusion

Rooftop farming has proven to be a sustainable solution to rapid urbanization and shrinking agricultural land. Cities like Kathmandu have adopted this type of urban farming, and the trend continues to grow. Despite its many benefits, including year-round access to fresh produce and increased energy efficiency, RF faces challenges such as the availability of high-quality crop varieties and weather constraints. Government agencies and relevant authorities should introduce appropriate policies and subsidies to promote this form of agriculture, which seems to be of great importance for urban areas.

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# Beauty of Variegated Succulents

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## What are succulents?

Succulents are plants with thick and fleshy leaves, stem and roots. They have the ability to store water in their leaves, stems, and roots, enabling them to survive in water-deficient conditions for extended periods (Hall, 2023). The term “succulent” is derived from the Latin word “sucus” which means “juice or sap” Water accounts for over 70% of the total weight of succulents (Lyra Gardens, 2020). . These plants can thrive in dry environments and are unable to tolerate higher humidity levels. Most succulents are used as indoor plants because they require low maintenance thereby saving time (Heath, 2022). The most common succulents include cacti, aloe vera, jade plants, portulaca, sedum, and rubber trees.

## Different color of succulents

Succulents can naturally exhibit a variety of colors or develop them due to factors such as light exposure, temperature, moisture. However, in nature, most succulents are green. Green color of their leaves results from the presence of chlorophyll pigment, which absorbs sunlight and provide energy for photosynthesis (Plants in a Box, 2019). In addition to chlorophyll, succulents contain pther pigments like carotenoids or anthocyanin and the color of the plant depends on the concentration of these pigments. Green-leafed succulent can effectively absorb light and resist sunburn, while succulents with other colors are more susceptible to sunburn.

## Why do people choose variegated succulents?

The word “variegated” is derived from the Latin word “variegatus” which means ‘made of various sorts of colors. Variegation refers to the presence of distinct markings of different varieties of colors on plant parts (Plants in a Box, 2019). These marking can be found in different forms like stripes, patches, rings, spots, mottled colors (similar to blended watercolors), spatters, shadings, streaks and colored margins which can be regular or irregular in shape (Carol, 2022). Variegation is mostly commonly observed on the margins or in the center of leaves, but it can also appear in flowers, stems and even in fruits. The colors can be white, yellow, different shades of green, pink and purple. These variations are seen randomly and infrequently (Kellogg Garden, 2020). Variegation is classified into two types based on the degree of variegation: complete and incomplete variegation.

## Causes of variegation

The green pigment chlorophyll is distributed unevenly throughout the plant cells, giving the appearance of variegation. Variegation can result from various causes, with mutation being a primary factor and considered a natural accident. When this mutation affects only some of the plant’s cells, the variegation becomes irregular and unstable, meaning it could revert to its all-green state. However, when the mutation affects all the plant's cells, the variegation is regular and stable. Variegation can also occur when there is an abundance of plant cells that have undergone mutations and are unable to produce chlorophyll (Christina, 2022). The pattern variation caused due to mutation of plant DNA are transmissible to progenies such as Rattlesnake pattern in Calanthea (*Calathea Lanciofolia*) (Pistils Nursery, 2018). The morphology of the succulent's leaves also contributes to the coloration of variegated succulents. When light interacts with air pockets or hairs found in leaves, it produces distinct colors. Outside factors such as watering, sunlight, temperature, chemicals , viruses, radiation and climatic changes can also induce variegation (Succulent Growing Tips, 2021).



Figure 1. Various types of succulents.



## Beauty of Variegated ...

### Benefit of Choosing Variegated Succulent

People are picky by nature and are fond of uniqueness. Variegated succulent with different colors and patterns in their parts are unique, beautiful and attractive. The presence of variegated colors elevates gardens and indoor spaces to a whole new level. Green plants become even more impressive and distinctive when some color is imparted upon them, enhancing the overall appearance. The vividness of patterns and colors can uplift people's spirits and change their moods with a touch of transcendence. Variegated succulents are capable of reducing anxiety and increasing energy and motivation.

### How to care variegated succulents?

The care of a variegated succulent differs somewhat from that of a normal succulent. Variegated succulents have a disadvantage when it comes to converting sunlight into energy due to the absence of chlorophyll (Sprouting Indoors, 2020). Excessive shade or insufficient light can limit the amount of chlorophyll in variegated succulents, slowing down their growth. Therefore, these plants should be kept out of the direct sunlight to prevent sunburn and provide them with Indirect light. Unlike their green counterparts, variegated succulents suffer more from extreme temperatures and do not respond well to frost and heat. Hence, it is recommended to maintain the temperature between 18 and 25 °C (Succulents Box, 2019). Darker colors can absorb heat, allowing plants to thrive in colder climates, which is why some succulents change color in response to cold weather. Like other succulents, variegated ones require well drained soil containing 50–70% mineral grit in the form of coarse sand, pumice, or perlite. The soil should be totally dry before watering (Planet Desert, 2022). Throughout the summer, watering should be done once a week and in winter once every three to four weeks. Pot should have adequate drainage holes. It is important to use minimal nitrogen in fertilizer to maintain the color of variegation.

### Can reverted plant variegation come back?

Plants that have completely lost their variegation have an extremely low chance, roughly 1%, of regaining variegation. If a plant still has some variegated leaves, it may produce more in the future. The loss of variegation in plants can be attributed to factors like low light, seasonal changes, or extreme weather conditions (myplantin, 2023; Beaulieu, 2021).

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# The Epidemiology of Panama Wilt in Banana

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## Introduction

Banana (*Musa* spp.) is a staple food in many countries around the world. The majority of commercially grown bananas are sterile triploid varieties ( $2n = 3x = 33$ ), resulting from hybridization within the same species or between different species. This hybridization typically involves two wild diploid species, *M. acuminata* (with the genome designation AA) and *M. balbisiana* (BB) (Harrison and Schwarzscher, 2007). Diploid banana plants produce seeded fruits, while the triploid banana plant yield seedless fruits through parthenocarpy (Siamak and Zheng, 2018).

Banana holds significant agricultural value and ranks as a prominent fruit in Nepal, both in terms of their potential cultivation area, production levels, and local consumption. Presently, it is cultivated across 68 out of Nepal's 76 districts, covering a total land area of approximately 21,634 hectares (MoALD, 2021a). Of these 68 districts, 15 districts have banana acreage over 500 hectares, constituting about 74 % of the total area under banana cultivation in Nepal (MoALD, 2021b). Varieties such as Jhapali malbhog, Sthaniya malbhog, Australian hybrid, Chini Champa (Poovan), Harichal (robusta), Giant governor, Grand naine, Basrai dwarf (Dwarf cavendish) are grown in these areas. Due to the open border with India and loose plant quarantine measures at the border, farmers have been importing various other types of varieties and experimenting with them. Besides these, our indigenous local varieties like Dhusre, Mungre, Marche, Dhose, and Hazari are grown at a small scale in a subsistence farming system (MoALD, 2021c). Despite these efforts, the production of the country is not enough to meet self-sufficient (Republica, 2022). Therefore, this industry, which holds high prospects, needs to flourish rapidly. But, Fusarium Wilt aka Panama Wilt has created a major hurdle in the growth of this sector (Paudel, 2020).

## Etiology

*Fusarium oxysporum* pathogenic isolates induce fusarium wilt in various crops and are differentiated into formae speciales based on host specificity. The causative agent of the Panama wilt of banana is *Fusarium oxysporum* f. sp. *Cubense* (Foc). It is one of the most devastating plant pathogens in the history of agriculture (Fourie et al., 2009). Foc is classified into races 1, 2, 3, and 4, depending on their ability to cause disease in a set of different banana cultivars. Race 1 generally af-

fects AAA and AAB cultivars. Race 2 affects ABB cooking bananas. Race 3 affects *Heliconia* spp, a relative of Tropical American banana (Buddenhagen, 2009). Race 4 is further subdivided into Tropical Race 4 (TR4) and Sub-Tropical Race 4 (SR4). SR4 infects all types of cultivars but only under stress conditions and is therefore found only in sub-tropical regions like South Africa, the Canary Islands, etc. It hasn't stood as an economically serious race yet due to its stringent environmental requirements. Race TR4 infects all kinds of cultivars including Race 1 resistant Cavendish cultivars (AAA) both in tropical and sub-tropical conditions (Bastidas et al., 2014). Among the identified races of Foc, Race 1 and Race TR4 are of paramount international importance and attention (Zhang et al., 2018). Additionally, Foc is characterized into Vegetative Compatibility Groups (VCGs) based on nit-mutant heterokaryotic complementation (Mostert et al., 2017).

## History

Panama wilt is a soil-borne disease and stands as the most destructive and lethal disease of bananas (Ploetz, 2000). Foc is believed to have originated in Southeast Asia, though its initial discovery dates back to 1876 when it was first identified in Australia (Ploetz and Pegg, 1997). One of the disease's popular names, "Panama Wilt," originates from the nation "Panama" which experienced enormous devastation of its export banana crops in the 1890s (Ploetz, 2005). Thousands of hectares of Gros Michel banana in Central America were destroyed by Race 1 in the twentieth century, evolving into one of the deadliest plant plagues in history (Maryani et al., 2019). The trade's transition to the Cavendish banana was significantly influenced by rising losses and the scarcity of pathogen-free soil (Stover, 1962). Cavendish possesses resistance to Race 1 which caused Gros Michel epidemics. Fusarium wilt became less of a concern for the trades after Cavendish replaced Gros Michel. The black leaf streak disease caused by *Mycosphaerella fijiensis* became the primary concern, and Fusarium wilt was no longer seen as a significant threat to the industry (Ploetz, 2015).

The identification of resistant Cavendish bananas marked the end of the disease outbreak, and these bananas proved so successful that they quickly spread globally, ultimately dominating the international banana trade. What sets Cavendish bananas apart is their robust resistance to Foc-Race1 strains. However, the dangers

## The Epidemiology ...

of global monocultures become evident when additional pathogenic Foc-Race 4 emerged, capable of causing Panama wilt even in Cavendish crops. During the 1990s, newly established Cavendish banana plantations started to experience widespread infections and losses in various regions due to the presence of Foc-Race TR4 (Ploetz, 2006). Since then, TR4 has been confirmed in several countries and regions, with its effects and spread intensifying rapidly (Ploetz, 2015). In 2019, two neighbouring states of India, Bihar and Uttar Pradesh, had already reported TR4 (Damodaran et al., 2019; Thangavelu et al., 2019). Due to the porous border with India, this was already a matter of serious concern. Unfortunately, it was recently detected in Nepal for the first time and was highlighted by most of the national media.

### Symptoms

Foc infects the roots of susceptible banana cultivars and slowly reaches the vascular bundle. Upon infection, the xylem lumen responds by producing tyloses, gums, and gels. Eventually, the vessels get occluded impeding the flow of water and minerals through the xylem (Beckman, 1990). The oldest leaves of diseased plants wilt, die, and often split at the base of the leaf lamina, but non-yellowing wilt signs are also evident. Affected leaves bend down at the base and hang down around the pseudostem, like a skirt. This condition gradually spreads to younger leaves and the entire plant ultimately collapses. The distinctive internal symptom of the disease is the reddish-brown coloration of xylem vessels in infected plants (Walduck and Daly, 2006).

### Epidemiology

Because Foc is a soilborne illness, it spreads through contaminated farm equipment, tools, clothing, and footwear. Surface waters are also contaminated with Foc, and their usage for irrigation has accelerated the spread of pathogens along river basins. Moreover, due to the pathogen's lengthy lifespan, replanting bananas in the field is risky for an extremely long duration. Pathogen survival in the form of chlamydo spores has been observed to last up to 40 years (Buddenhagen, 2009). The onset of the disease outbreak typically originates from one or a few initially affected plants. The primary mode of transmission is through the interconnection of roots, especially in areas where root systems overlap. Additionally, passive dissemination of the disease-causing agents leads to the formation of new infection centers. Factors such as intensive farming practices, vehicular traffic, lapses in basic farm hygiene protocols by workers, and the use of contaminated water sources for irrigation all contribute to the emergence of fresh outbreak zones. It's worth noting that the spread of the disease tends to be slower on smaller farms, as these are often

interspersed with banana-free land patches. Moreover, smaller farms may rely on rainwater rather than irrigation, which limits the disease's dissemination through flowing water (Pegg et al., 2019).

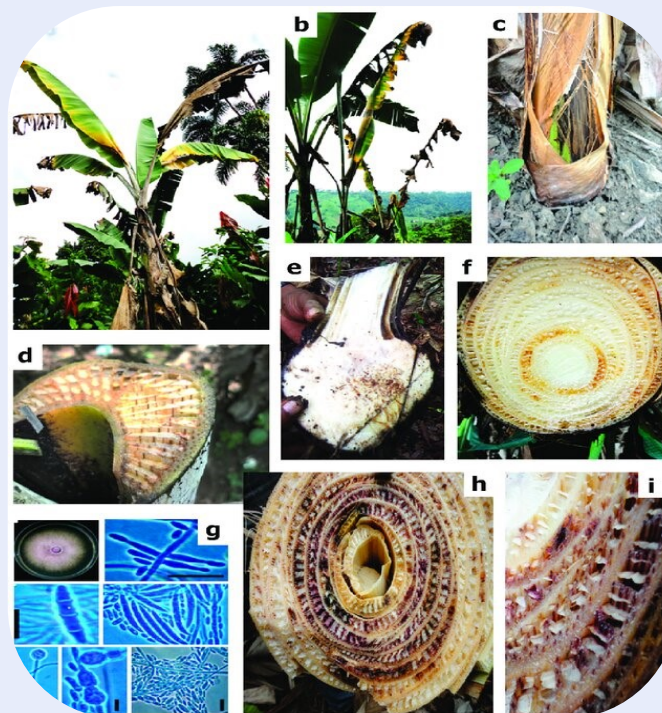


Figure 1. Illustration of the symptoms in banana plants regarding Fusarium wilt: (a) Leaves turning yellow and wilting; (b) Young leaves curling; (c) Pseudo-stem exhibiting cracks; (d) Fungal infiltration of the plant's veins; (e) Infection of the rhizome; (f) The initial phase of vascular infection; (g) Characteristics Microconidia, macroconidia, and Chlamydo spores of *Fusarium oxysporum* f. sp. *Cubense*; (h, i) Advanced stages of vascular infection marked by distinctive reddish-brown discoloration. (Adapted from Magdama et al., 2020)

### Management

Dealing with Fusarium wilt in bananas presents limited alternatives. By the early 2000s, numerous microbes had been studied, but most of this research relied on in vitro assessments or short-term greenhouse investigations. The success rates of biocontrol methods for Fusarium wilt of bananas were found to be similar to those reported for other types of Fusarium wilt but showed poor field efficacy. Unlike some other fungal diseases affecting bananas, such as Sigatoka leaf diseases, which can be managed with fungicides, Fusarium wilt cannot be effectively treated without resorting to complete soil sterilization. However, this approach is prohibitively expensive and also disrupts the soil microbiome. An alternative method attempted was soil fumigation, which had been used successfully to treat vari-



## The Epidemiology ...

ous Fusarium wilt infections in other crops. Nevertheless, fumigated areas eventually experience re-infestation by the disease, making continued production challenging. The most successful strategy for addressing the disease is to prevent its spread into uninfected regions and take swift containment measures upon detection. When an infestation occurs in a plantation, the only viable method to control the pathogen is to implement specific phytosanitary measures, including the complete removal of all plants and taking the farm out of production, with the primary goal of halting the dissemination of spores to new areas.

Today, Cavendish varieties are still a viable solution in Race 1 infested orchards, but things are different with Race TR4. Progress in resistance breeding for this crop faces several significant hurdles, including its polyploid nature, lengthy generation times from planting to seed production, notably low fertility in commercially accepted varieties, the large physical size of the plant necessitating extensive space for hybrid assessment, the presence of genetic abnormalities in many parental lines, and the necessity for the final products to be parthenocarpic (Pegg et al., 2019). As a result, an ultimate solution, i.e., a resistant and commercial variety against Race TR4 is still unavailable. Until the breeders come up with resistant varieties, the only effective method at present against Race TR4 is restricting mobility in infested areas through strict quarantine regulations. Any human activities in the infested field need to be rigorously monitored to contain the disease.

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## Heartfelt Condolence



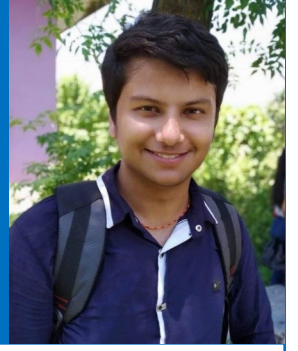
*We are deeply saddened by the unexpected demise of 10 agricultural students from Nepal who were working in Israel under the Israeli government's "learn and earn" program, killed by Hamas militants on October 7, 2023. Picture: en.nepalkhabar.com*

# कलापास, कोर्नेल, र किशुन

प्रस्तुति: अमृत शर्मा

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विगतका केहि वर्षहरूमा नेपालमा युवा उद्यमीको संख्या बढ्दो क्रममा छ। व्यवसायिक वातावरण नभएपनि देशमै केहि गरौं भन्ने सकारात्मक उर्जाले भरिपूर्ण युवाहरू विदेशीअवसर छाडेर नेपालमै संघर्ष गर्न प्रेरित छन्। नेपालमा नयाँ प्रविधि प्रयोग हुने उद्यम संख्यात्मक रूपमा कम भएपनि हुँदै नभएका भने होइनन्।



**किशुन घलान** कलापास बायोटेक कम्पनीका प्रमुख कार्यकारी अधिकृत (CEO) हुनुहुन्छ। सन् २०१६ मा नेपालबाट बायोटेक्नोलोजी (biotechnology) बिषयमा स्नातक तह पूरा गर्नुभएका

उहाँले, हालै अमेरिकाको कोर्नेल विश्वविद्यालयबाट भिटीकल्चर एण्ड इनोलोजी (viticulture and enology) मा स्नातकोत्तर गर्नुभएको छ। सरल शैलीमा वार्तालाप गर्न रुचाउने किशुन आफुलाई, देशमै केहि असल कार्य गर्न प्रयासरत एक युवा उद्यमीको रूपमा चिनाउनुहुन्छ। बायोटेक्नोलोजीको प्रयोग विविध तवरले संसारभर हुने गरेको छ, जसमध्ये टिस्यु कल्चर (tissue culture) को प्रविधि विशेष गरि बिरुवा उत्पादनका लागि गरिन्छ। वनस्पतिहरूको जुनकुनै भागबाट लिएको कोष, उचित खाना एवं खनिज तत्वको सहारामा पूर्ण वोट बन्न सक्ने गुणलाई टोटीपोटेन्सी (totipotency) भनिन्छ। उक्त प्राकृतिक गुणको प्रयोग गरि थोरै तन्तु (tissue) बाट धेरै संख्यामा बिरुवा उत्पादन गर्न सम्भव हुन्छ। यस विधिद्वारा उत्पादित बिरुवामा भाईरस एवं अन्य रोगको प्रकोप कम हुने गर्दछ भने बिरुवा उत्पादन पनि छिटोछरितो हुन्छ। यसै विधिको प्रयोगबाट कलापासमा विभिन्न बिरुवाहरूको उत्पादन कार्य भईरहेको छ।

काभ्रे जिल्लामा अवस्थित कलापास बायोटेकको सुरुवात सन् २०१७ मा भयो भने २०१८ मा ल्याब भवन लगायत अन्य आवश्यक संरचनाहरू बने। सन् २०१९ मा बजारमाग अनुसार उत्पादनको काम हुँदै गर्दा कोभिड-१९ को प्रकोपले व्यवसायमा ठूलो असर पर्न गयो। त्यसबखत संस्थामा आबद्ध कर्मचारीहरूको संख्या घटाएर केवल साना अनुसन्धान गर्दै कम्पनी धान्ने कार्यमा ध्यान दिएको उहाँले बताउनुभयो। कोभिड लगत्तै उच्च अध्ययनका लागि अमेरिका प्रस्थान गरेपछि उहाँ हालै नेपाल फर्किनुभएको हो। अब भने कम्पनीको पुनःसंरचना गरेर अगाडी बढ्ने सोच रहेको उहाँले जानकारी गराउनुभयो। सानै उमेरमा कलापास जस्तो प्रविधियुक्त कम्पनी सञ्चालन गरिरहनुभएका किशुनलाई यस कम्पनीको सफलताको मोड भने आउनै बाँकि रहेको जस्तो लाग्छ।

केही नौलो एवम् प्रयोजनमुखि प्रयास गरौं भन्ने आदर्शले निर्देशित किशुन, सानैदेखि सिकाईमा लगाइने बाधा एवं सिमाको बिरोधी हुनुहुन्थ्यो। स्कुलमा रहँदा कम्प्युटरको प्रारम्भिक ज्ञान एवम् जीवविज्ञानप्रतिको मोहले उहाँलाई बायोटेक्नोलोजी अध्ययनतर्फ डोर्यायो। “कुनै नविन कार्यको लागि सही समय कुरेर बस्नु हुँदैन। काम सुरु गरिहाल्नुपर्छ। हामीले टिस्यु कल्चरमा प्राप्त गरेको सफलता पनि लामो परिश्रमको परिणाम हो”, किशुन भन्नुहुन्छ।

टिस्यु कल्चरको सिकाईकै क्रममा किशुन भारत तथा अमेरिकाका विभिन्न विश्वविद्यालय एवम् कम्पनीहरूमा पुग्नुभएको छ। सन् २०१९ मा अमेरिकी दुतावासको छनोटमा उहाँ ओक्लोहमा विश्वविद्यालय एवं अन्य ठाउँको भ्रमणमा निस्कनुभयो। आफुले त्यहाँ असल प्राध्यापक एवं सफल व्यवसायीहरूसँग अन्तरक्रिया

## कलापास, कोर्नेल ...

गर्न पाएको र सो ज्ञानले पछिसम्म ठूलो प्रभाव परेको बताउनुभयो। “टिस्यु कल्चरको कुरा गर्दा, हामी अन्य विकसित मुलुकको तुलनामा, त्यति पछाडी छौं। भारतबाट कल्चर मिडिया (culture media) ल्याउनुपर्ने बाध्यता भएपनि एक्स-प्लान्ट (ex-plant) को व्यवस्थापन नेपालमै हुने गरेको छ। हाम्रोमा बिरुवा उत्पादनको लागत् कम भएकोले भारतबाट आउने बिरुवासँग प्रतिस्पर्धा गर्न सक्षम छौं।”

अन्तर्राष्ट्रिय शिक्षाबाट दिक्षित किशुनले कुराकानीकै क्रममा जोड्नुभयो, “कुनै विषय-विशेष छनोट गरि चार वर्ष अध्ययन गर्नु, ठूलो समयको लगानी हो। सहि रूपमा उक्त समयको उपयोग गरेमा धेरै अगाडी बढ्न सकिन्छ। सिक्ने ईच्छाशक्ति एवं धैर्यता भने हुनुपर्छ। खाली सैद्धान्तिक ज्ञानले मात्र काम चल्दैन। प्रयोगात्मक सिप अपरिहार्य छ।”

अध्यात्ममा पनि रुचि राख्ने किशुनले कलापासको नामकरण बौद्ध दर्शनमा आधारित रहेको बताउनुभयो, “अणुभन्दा पनि सुक्ष्म, परमाणुको तहमा हुने, चेतनाको मानकका रूपमा सो शब्द छनोट गरिएको हो।”

कम्पनी संचालन सरल र सहज भने नहुने बताउँदै उहाँले भन्नुभयो, “सुरुवाती दिनहरूमा आलुको टिस्यु कल्चर असफल भएपनि त्यसलगत्तै पाउलोनिया (paulownia) मा भने सफलता मिलेकाले मनोबल कायम गर्न सहज भयो।” अहिले कलापासमा केरा, स्ट्रबेरी, सुनगाभा लगायत् २० भन्दा बढी बिरुवाहरूको सफलतापूर्वक उत्पादन गरिएको छ। कलापासमा हाल ठूलो लगानी रहेको भएपनि प्रविधि बढोत्तरी पर्याप्त नरहेको किशुनले खुलाउनुभयो। कुल लगानीको ७५ प्रतिशत रकम भवन लगायतका भौतिक संरचनामा खर्च भएकाले अबको समयमा प्रविधिको विस्तारतर्फ जोड दिने उहाँको योजना छ।

कलापासको सुरुवाती दिनहरूको स्मरण गर्दै किशुनले बताउनुभयो, “कुनैपनि उद्यम गर्दा लगानीको जोहो गर्नु चुनौतीपूर्ण हुन्छ। त्यसका लागि कि आफुसँग यथेष्ट धन एवं ज्ञान हुनुपर्छ, नत्र अलिक जानेबुझेका

मानिसहरूलाई आफ्नो टिममा सामेल गरेर अगाडी बढ्नुपर्छ। लगानीकर्ताहरूको बिश्वास बढाउँदै राम्रो टिम खडा गर्न सके काम गर्न सहज हुन्छ।



फोटो १. कलापासलमा टिस्यु कल्चर गरिँदै।

बायोटेक्नोलोजी अध्ययनरत् नयाँ विद्यार्थीहरूलाई अनुसन्धानात्मक कार्यमा पर्ने कठिनाई एवम् कार्यस्थलको अभाव बुझेकाले कलापास खोल्ने सोच विकास भएको किशुन बताउनुहुन्छ। यसका अलावा आम किसानलाई ठूलो परिमाणमा, सस्तो एवम् गुणस्तरीय बिरुवा उपलब्ध गराउन कलापास प्रयासरत् छ। स्थानीय स्रोतसाधनको प्रयोग गरेर अनुसन्धानात्मक खोज एवम् अन्वेषण गर्ने गरि दशकौंको कार्ययोजना बनाएको किशुन बताउनुहुन्छ।

विशेष गरि नयाँ नर्सरी वा फार्मलाई लक्षित गरि कलापासले गुणस्तरीय बिरुवा उत्पादन गर्छ। स्थापनाको केहि बर्षमै यहाँबाट करिब १-२ लाख हाराहारी बिरुवा उत्पादन एवम् बिक्रि-वितरण भैसकेका छन्। अबका दिनमा भने कलापास मार्फत साना उद्यमीलाई नर्सरी खोल्न सहयोग गर्दै अन्य युवा व्यवसायीसँग हातेमालो गर्ने किशुनको विचार छ। उहाँले उचित लगानीकर्ता भेटेमा, कोर्नेलमा सिकेको ज्ञानले, नेपालमा स्याउ, आरु, सुन्तला, अनार लगायतको ब्रान्डेड वाईन बनाएर विदेश निर्यात गर्न सकिने बिश्वास व्यक्त गर्नुभयो।

नेपालमा बायोटेक्नोलोजी-लक्षित उचित नीति नबन्नु, बजार मागको व्यवस्थापन नहुनु, सरकारबाट युवा



## कलापास, कोर्नेल ...

उद्यमीलाई प्रोत्साहन नगर्नु, सरकारी संयन्त्र फितलो एवम् कर्मकाण्डी हुनु, र संकटको बेला सरकार मौन रहनु, प्रमुख चुनौती रहेको उहाँ बताउनुहुन्छ।

नेपालमा त्यस्तो के छ जुन अन्य देशमा पाईदैन भन्ने प्रश्नको जवाफमा किशुनले छरितो उत्तर दिनुभयो, “जलवायु!” - “नेपालमा रहेको जलवायु विविधताको उचित प्रयोग गर्ने हो भने हामी कृषि उत्पादनमा एक नमुना मुलुकको रूपमा स्थापित हुनेछौं। हाम्रोमा मौसमपनि तुलानात्मक रूपमा सन्तुलित छ, जसले गर्दा अन्य देशमा जस्तो अनपेक्षित समस्या भोग्नु पर्दैन। यसकारण, नेपाल, बस्नको लागि समेत, विश्वमा नै उत्कृष्ट मुलुक मध्ये पर्दछ”, उहाँको बुझाई छ।

अहिले नेपाली युवाहरूमा विदेश पलायन हुने मानसिकताबारे किशुन भन्नुहुन्छ, “केहि विशेष-ज्ञान वा सिप विकास गर्नु छ र त्यो नेपालमा सम्भव छैन भने विदेश गएर सिक्नुपर्छ। तर देशमा अवसर भएन भनेर सबै अब्बल युवा उता नै बस्ने हो भने, नेपाल कसरी बन्ला? अनि फेरी आफ्नै देशमा आत्मसम्मान सहित जीवनयापन गरे जस्तो बाहिरी देशमा हुँदैन।” नेपालमा काम गर्दा आफ्नो छुटै पहिचान बनाउन सकिने र त्यसको ठूलो महत्व रहेको किशुन मान्नुहुन्छ।

नेपालको दाँजोमा विदेशी विश्वविद्यालयहरूमा ज्ञानको सम्मान गर्ने प्रचलन भने राम्रो रहेको उहाँले बताउनुभयो। “आफ्नो विज्ञता भएको विषयमा मात्र बोल्नुपर्छ। कर्नेलमा, परिचयको क्रममा मैले, आफु नेपालको तमाङ्ग समुदायमा हुर्केको र यहाँ प्राचिन पद्धतिद्वारा वाईन बनाउने प्रचलन रहेको बताएँ। त्यहाँ उपस्थित मानिसहरू यो बिषयबारे जान्न निकै उत्सुक थिए”, किशुनले भन्नुभयो। अमेरिकामा रहँदा आफुले टिस्यु कल्चरबारे हाँसिल गरेको ज्ञान एवं सिप अन्य समकक्षीमाझ बाँड्दा रमाइलो अनुभव भएको उहाँ बताउनुहुन्छ। अमेरिका बसाईले उहाँलाई कोरा ज्ञानको सिमितता र अनुभवजन्य सिपको विशिष्टताबारे थप चेतनशील बनायो। यसका साथसाथै त्यहाँ आफुले भेटेका

असल प्रध्यापकहरू समेत उद्योगमा लागेको देख्दा उहाँलाई खुशी लाग्यो।

“देश विकासको लागि युवाहरूले जिम्मेवारी वहन गर्नुपर्छ। विकासको पहलकदमी युवाले नलिएसम्म परिवर्तन सम्भव देखिँदैन”, किशुन बताउनुहुन्छ। अबको समयमा आवश्यक परेको खण्डमा राजनीतिमा पनि लाग्नुपर्ने उहाँको विचार छ। अमेरिकाबाट स्नातकोत्तर पश्चात् नेपाल आउनुभएका उहाँ अहिले केही सृजनशील एवम् युवा-लक्षित योजनाको खाका कोर्दै हुनुहुन्छ। सिसाकलम नामक नयाँ उद्यमद्वारा किशुन नेपाली नवयुवकहरूको सिकाई शैलीमा परिवर्तन ल्याउन चाहनुहुन्छ। सानो उमेरमा नै बच्चामा अन्तर्निहित प्रतिभाको पहिचान गरि, उनीहरूलाई उचित मार्गदर्शन प्रदान गर्न सकिएमा, देशको मानवस्रोत व्यवस्थापनमा सहयोग पुग्ने उहाँको बुझाई छ। यसका अलावा युवा सशक्तीकरण लक्षित अन्य कार्यक्रमहरूको गुरुयोजना समेत बनाएको उहाँले बताउनुभयो।



फोटो २. कलापासमा टिस्यु कल्चर सिकदै विद्यार्थीहरू।

किशुनजस्ता प्रगतिशील युवाहरूको संख्यामा बढोत्तरी भए, नेपाली आकाशको सुदुर क्षितिज स्वर्णमय बन्ने निश्चितप्रायः छ। यस विषयमा नेपाल सरकार एवं सम्पूर्ण सरोकारवाला निकायको उचित ध्यान पुग्न जरुरी छ।

(कलापास बायोटेकको बारेमा अन्य जानकारीका लागि तल दिएकोको लिंक प्रयोग गर्न सक्नुहुनेछ):

<https://kalapasbiotech.com/>

# कविता

- नित्यानन्द खनाल



## दशैं आउ सधैभरि आउ

दशैं आउ गाउँ शहरमा उमङ्ग लिएर आउ  
बर्षा पछिको हराभरा रसिलो रङ्ग लिएर आउ  
सभ्य र शिष्ट आचरणको ढङ्ग लिएर आउ  
परोपकार परम धर्मको प्रशङ्ग लिएर आउ।

वन्धुत्वको विशुद्ध भावना बकुन शुभकामना  
मायाममता छचल्किउन् बनी समृद्धिका प्रेरणा  
जगतै बोलोस श्रेष्ठ छ भनी हाम्रो धर्म संस्कृति  
नहुन कतै मठमन्दिरहरुमा बलि बध विकृति।

दशैं आउ,

युधिष्ठिरको जस्तै इमान लिएर आउ  
चरित्रवानहरुलाई सम्मान लिएर आउ  
पराक्रमिहरुलाई कीर्ति लिएर आउ  
कुरिती रहित निर्मल संस्कृती लिएर आउ।

गाउँ शहर सकल समाजमा भातृत्व लिएर आउ  
सवको भलो सार्थक गर्ने नेतृत्व लिएर आउ  
लटरम्म अनाज फल्ने फाँट लिएर आउ  
सत्यताको शंखघोषको आँट लिएर आउ।

मनमोहक उद्यान सरि पाखा लिएर आउ  
यो नेपाली शिर उचाली भाका लिएर आउ  
मानव सब समानताको प्रस्तावना लिएर आउ  
बाचाँ र बचाउँ भन्ने भावना लिएर आउ  
सत्यमेव जयते, शुभकामना लिएर आउ।



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