



# **NAPA CONFERENCE 2022 PROCEEDINGS**

## **THIRD BIENNIAL CONFERENCE**

*ADVANCING AGRICULTURE IN A CHANGING WORLD*

**MAY 27-29, 2022**  
Atlanta, Georgia, USA  
Online Everywhere

## FOREWORD



Greetings all,

Welcome to the Third Biennial International Scientific Conference of Association of Nepalese Agricultural Professionals of America (NAPA) with a fitting theme “Advancing Agriculture in a Changing World” to be held in Atlanta, Georgia, USA from May 27-29, 2022. Due to the continuous threat of COVID – 19, the conference is conducted in a hybrid mode (in person and virtual).

On behalf of the Conference Organizing Committee (COC), along with various subcommittees (Scientific Program, Student Essay, Agri Poem (Literary), Fundraising, Information Technology, and others), we would like to greet all the participants (presenters, panelists, moderators, judges, invited speakers, technical coordinators, volunteers, and all attendees) to this historic Third NAPA Biennial International Scientific Conference.

The enthusiasm of this conference is clearly reflected in the number of registered participants and presentations. We will have 150 total participants, including 60 in-person and 90 via zoom platform. We are delighted to have 131 scientific presentations (professional oral and professional posters). The submissions are from ten countries: USA, Nepal, Canada, Australia, Japan, Myanmar, China, Morocco, Thailand, and Niger. Moreover, this conference has brought together over 358 scientific scholars to this platform as authors and co-authors from the above 10 countries. The abstracts cover a wide range of disciplines in agricultural and allied sciences: agronomy, animal science, horticulture, social sciences, economics, agro-forestry, and more. There are several forums, including literary, book authors’ platform, NAPA strategic visioning, entrepreneurial roundtable, women in agricultural and allied professional roundtable, and cultural events. A students’ essay writing contest is another appealing opportunity for talented students. In addition, the literary Agri-Poem event has attracted numerous artistic poets to showcase their creativity while targeting attractive cash prizes.

It is evident that NAPA has been successful in building a strong scientific foundation amongst the Nepalese scientific community established by the first NAPA conference in 2018. It has helped to increase the member participation and broaden the scope, content, and value of this

conference. The second NAPA conference in 2020 (virtual) enhanced the international network and expanded NAPA's global outreach.

This hybrid conference has greatly energized the NAPA family in accelerating strategic efforts in achieving NAPA's mission and vision. On behalf of COC and many committees and subcommittees, we are thrilled to welcome participants from across many agricultural and allied disciplines and from around the world. Equally, we are delighted to witness the invaluable scientific contributions that address the conference theme "*Advancing Agriculture in a Changing World*". This conference is uniquely structured to provide opportunity and access to many emerging and young scholars by allowing numerous technical sessions, student competitive oral and poster presentations, student essay writing contest, agri-poem competition, panel discussions, round table sessions, and socio-cultural and professional networking. We salute all the hardworking individuals for their unwavering commitment in this enduring journey of hosting the conference. The extraordinary support and dedication of the Executive Committee led by President Dr. Megha N. Parajulee, COC – Conference Co-chairs, committed members, well-wishers, and presenters made this conference possible in this challenging situation. We specifically acknowledge the relentless hard work and commitment by the committee and subcommittee chairs and members, moderators, judges, and technical coordinators (IT personnel) to ensure that this conference will be rewarding, enjoyable, impactful, and exceed expectations for all attendees. Finally, the conference organizing team, together with the executive committee, wishes all of you an exciting hybrid conference and we trust that this conference will bring great value to your professional endeavor. Together, we can make a difference. Stay safe and healthy.

Nanda P Joshi, PhD  
Chair, Conference Organizing Committee

Megha N. Parajulee, PhD  
President, NAPA

## Message from the Scientific Committee

Achieving food security for all people everywhere is an agreed-upon international goal, most recently codified in the United Nations Sustainable Development Goals for 2030. Climate change and soil degradation have been major challenges for securing food, feed, fuel, and fiber (4F) for ever-increasing populations. Advances in agricultural innovations, best management practices, and environmentally friendly, sustainable agricultural production systems are needed to improve food security in the context of increasing climate variability, dynamic land uses, and volatile agrarian markets. In this context, the third NAPA biennial conference is organized on May 27-29, 2022, with the theme of "**Advancing Agriculture in Changing World**". This conference proceedings publication contains abstracts that were accepted for oral and poster presentations at the Third NAPA Biennial Conference. The Scientific sub-committee received one hundred thirty-one abstracts before the deadline. The submissions were from ten countries: USA, Nepal, Canada, Australia, Japan, Myanmar, China, Morocco, Thailand, and Niger. The abstracts cover a wide range of disciplines in agricultural and allied sciences: agronomy, animal science, horticulture, social sciences, economics, agro-forestry, and more.

Broadly, the abstracts are divided into five sections: i) Professional Oral, ii) Professional Poster, iii) Student Oral, iv) Student Poster, and v) research mini-grant presentations. We tried our best to minimize errors. We would greatly appreciate readers' feedback on any mistakes observed and suggestions for future publications. The NAPA Executive Committee will welcome your input and give due consideration to those suggestions in the upcoming publications.

The publication of these Proceedings would not have been possible without the support of numerous friends and colleagues who communicated with the authors and various committees and worked day and night to compile, revise, and edit the submissions. We sincerely thank Dr. Megha N. Parajulee, NAPA President, Dr. Nanda Prasad Joshi, Conference Organizing Committee Chair, and the entire Conference Organizing Committee for providing us this opportunity and for constant encouragement during the entire process. Second, we would like to thank members of the conference organizing committee and colleagues from other various sub-committees for their support during the process of proceedings preparation. Last but not least, we owe the authors a big hand for scientific contributions.

We look forward to meeting and interacting with you all at the conference and discussing how we move forward to make NAPA best serve our members and society at large as per her mission and vision.

Rajan Ghimire, Ph.D.  
Chair, Scientific Sub-committee

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## Keynote and Guest Speakers




Association of Nepalese Agricultural Professionals of Americas (NAPA)  
3<sup>rd</sup> Biennial International Scientific Conference 2022

### Keynote Speaker

## Sustainable Agricultural Intensification under Changing Climate

**P.V. Vara Prasad, PhD**  
Director, Sustainable Intensification Innovation Lab  
University Distinguished Professor; and R.O. Kruse Endowed Professor  
Kansas State University  
Past President, Crop Science Society of America



Dr. Prasad's research focuses on understanding responses of food grains crop to changing environments (temperature, water and climate change factors) and developing best management strategies for efficient use of inputs. He has research, education, outreach and capacity building programs in many countries in Africa (e.g., Senegal, Ghana, Mali, Burkina Faso, Niger, Ethiopia) and Asia (e.g., India, Bangladesh, Cambodia, Philippines) focusing on soil, water, nutrient and crop management practices, abiotic stress tolerance, and sustainable agricultural intensification for improving productivity, profitability and resilience of agri-food systems.

<https://napaamericas.org/conference-2022.php>



Association of Nepalese Agricultural Professionals of Americas (NAPA)  
3<sup>rd</sup> Biennial International Scientific Conference 2022

### Guest Speaker

## "Navigating your career in industry: An agricultural R&D perspective"

**Jason Rauscher**  
R&D Academic Relations Manager, Corteva Agriscience



Jason is currently responsible for managing the Corteva Symposia Series, which supports a network of graduate student organized symposia at over 30 universities and research centers around the world each year. His responsibilities also include management of the New Frontiers in Applied Science conference series, and support for the Corteva R&D Internship Program for undergraduate and graduate students.



<https://napaamericas.org/conference-2022.php>

## Professional Activities

### Panel Discussion on Nepal's Agricultural Development: Policies and Strategies



**NAPA**  
**3<sup>rd</sup> Biennial International Scientific Conference 2022**

**Panel Discussion on**  
**“Nepal’s Agricultural Development Policies and Strategies”**

 <p><b>Dr. Bimala Rai Paudyal</b> Member of Parliament and former NPC Member, Nepal</p>	 <p><b>Dr. Bishnu R. Upreti</b> CEO Policy Research Institute, Nepal</p>	 <p><b>Dr. Dil Bahadur Gurung</b> Member National Planning Commission, Nepal</p>	 <p><b>Prof. Gopi Upreti</b> Advisor NAPA</p>
 <p><b>Dr. Govinda P. Sharma</b> Secretary MoALD, Nepal</p>	 <p><b>Ms. Purna K. Subedi</b> Member of Parliament, Chair of Ag., Coop. &amp; Nat. Res. Comm., Nepal</p>	 <p><b>Dr. Ramjee Ghimire</b> General Secretary NAPA Coordinator</p>	 <p><b>Dr. Prakash Malla</b> Advisor NAPA Moderator</p>

## Sports (Golf) Tournament

Association of Nepalese Agricultural Professionals of Americas (NAPA)



### NAPA 3<sup>rd</sup> Biennial International Scientific Conference 2022

**NAPA Golf Tournament**

**Date:** May 27, 2022, Friday  
**Time:** 1:00 – 4:00 PM  
**Venue:** College Park Golf Course, Atlanta, GA  
**Address:** 3711 Fairway Dr. College Park, GA 30337

**Dress Code:**  
Casual or Khaki Pant (Short)  
NAPA Golf T-shirt (available to purchase at the venue)  
Sports/Golf Shoes  
Cap



## Senior's Forum

**NAPA 3<sup>rd</sup> Biennial International Scientific Conference 2022**

**Seniors' Forum**

Moderator



**Dr. Nanda P. Joshi**

Associate Professor (Emeritus),  
Michigan State University, USA  
Former Professor, IAAS,  
Tribhuvan University, Nepal

Panelists

 <p><b>Dr. Heramba Bahadur Rajbhandary</b></p> <p>Former Secretary, Ministry of Agriculture, Nepal Dairy Entrepreneur/Chairman, Nepal Dairy</p>	 <p><b>Dr. Ananta B. Shrestha</b></p> <p>Senior Horticulturist</p>	 <p><b>Dr. Kailash Nath Pyakuryal</b></p> <p>Founder Vice Chancellor, Agriculture &amp; Forestry Univ., Nepal Former Member National Planning Commission</p>	 <p><b>Mr. Satrugan Lal Pradhan</b></p> <p>Former Deputy Director General, Department of Livestock Services, Nepal</p>
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**Association of Nepalese Agricultural Professionals of Americas (NAPA)**

## Navigating Career in Academia

### NAPA 3<sup>rd</sup> Biennial International Scientific Conference 2022

## Navigating Career in Academia



**Moderator**



**Mr. Madhav Parajuli**  
PhD Candidate  
Tennessee State University, TN

**Panelists**



**Dr. Uma Karki**  
Research-Extension Professor  
and State Extension Livestock Specialist,  
Tuskegee University, AL



**Dr. Bharat Pokharel**  
Associate Professor,  
Graduate Coordinator,  
Department of Agricultural  
and Environmental Sciences,  
Tennessee State University, TN



**Dr. Shital Poudyal**  
Assistant Professor,  
Ornamental Horticulture  
Specialist,  
Utah State University, UT

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

## Financial Literacy Session

### NAPA 3<sup>rd</sup> Biennial International Scientific Conference 2022

## Discussion on Financial Planning, Savings, Risk, and Insurance



**Moderator**



**Dr. Aditya Khanal**  
Associate Professor  
Agribusiness and Applied  
Economics,  
Tennessee State University



**Dr. Ramesh Khanal**  
Financial Professional  
World Financial Group



**Mrs. Ambika Adhikari Tiwari**  
Senior Research Associate  
Mississippi State University



**Mr. Rudra Gurung**  
Financial Professional  
World Financial Group



**Mr. Dol P. Dhakal**  
Senior Research Associate  
Texas A&M University



**Mr. Balkrishna Regmi**  
Financial Professional  
World Financial Group

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

## Program Outline

### Day 1: Friday, May 27, Gulf Tournament

### Day 2: Saturday, May 28

#### Summary of the scientific program

8:30 – 10:00	10:15 – 11:45	1– 2:20	2:30- 4:30	4:30 – 6:30
<b>Session 111:</b> Student Oral (CSS) 144, 161, 229, 172, 178, 179, 181, 153, 154	<b>Session 112:</b> Student Oral (AS, AVS, SS) 193, 119, 199, 124, 126, 201, 217, 165	<b>Session 113:</b> Professional Oral (AS, SS) 230, 104, 113, 115, 228, 198, 224	Plenary Session	<b>Poster Session</b> (43 posters total, 27 student posters)
<b>Session 121:</b> Seniors' Round Table	<b>Session 122:</b> Professional Oral (CSS) 155, 157, 173, 192, 196, 145, 111, 168, 176	<b>Session 123:</b> Professional Oral (CSS, SS) 112, 170, 189, 202, 221, 214, 216		

### Day 3, May 29

8:30 – 10:00	10:15 – 11:45	1:00 – 2:20	2:30 – 5:00	6:00 – 10:00
<b>Session 211:</b> RMG 143, 175, 159, 169, 182, 209, 120, 121, 131	<b>Session 212:</b> RMG 133, 149, 156, 174, 180, 227	<b>Session 213:</b> Financial Literacy	AGM and Closing	Dinner and Cultural Night
<b>Session 221:</b> Agri-Poem (8:00-10:00)	<b>Session 222:</b> Professional Oral (AVS) 132, 135, 140, 129, 158, 147, 184, 195			
<b>Session 231:</b> Nepal Agriculture Policy Forum	<b>Session 232:</b> Industry and Academic Job Forum	<b>Session 233:</b> Joint Family Member Event		

Session 111= Day 1 of the scientific session, room 1, session number 1

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	Crop and Soil Sciences
	Social Sciences
	Animal, Veterinary and Aquaculture Sciences
	Allied Sciences

## Day 2 (Saturday, May 28, 2022) program

Chair: Rajan Ghimire, New Mexico State University, USA

### Session 111

Moderator: Aditya Khanal

Time	ID	First Author	Title of the presentation
8:30	144	Asmita Devkota	Glucosamine/ $\beta$ -Alanine Carbon Mediated Gene Delivery in <i>Escherichia coli</i> Cells
8:40	161	Krishna Neupane	Comparative Efficacy of Integrated Fungicide, Insecticide, and Blocking Agent to Manage <i>Phytophthora</i> Root Rot and <i>Ambrosia</i> Beetles in Flood Stressed Flowering Dogwoods
8:50	229	Thomas Kloepfer	The Social Acceptability of Hemp amongst Farmers: A Case Study of a Mountainous Community in Western Nepal
9:00	172	Prakash Ghimire	Spikelet Sterility in Spring Rice Cultivars under Different Planting Methods at Western Terai of Nepal
9:10	178	Rudra Baral	Yield Gap of Rainfed Alfalfa in the United States
9:20	179	Sadikshya Poudel	Interactive Effect of Heat and Drought Stress During Pod Filling on Soybean Physiology, Yield, and Quality
9:30	181	Sayara Pudasaini	Status of Pests and Diseases of Apple and Farmers' Control Intervention in Jumla District of Nepal
9:40	153	Bishnu Pandey	Effect of Plant Growth Regulators on Physiological and Agronomic Characteristics of Grass Seed Crops in Western Canada
9:50	154	Chiranjivi Sharma	Effect of Variety and Dates of Grafting on Graft Take Success on Persian Walnut ( <i>Juglans regia</i> L.) under open field conditions in Jumla district, Nepal

### Session 112

Moderator: Aditya Khanal

Time	ID	First Author	Title of the presentation
10:15	193	Uddhav Bhattarai	Towards Automated Blossom Thinning in Apple Trees
10:25	119	Suraj KC	Comparing Change in Land Surface Temperature in Relation with Elevation in Eastern and Western Nepal
10:35	199	Badri Aryal	Continuity and Change in Farming and Non-farming Occupations between Fathers and Sons
10:45	124	Chet Narayan Gyawali	Study of <i>Ehrlichia canis</i> in Febrile Dogs of Kathmandu Valley of Nepal



10:55	126	Deepak Subedi	Risk Factors Associated with Avian Influenza Subtype H9 Outbreaks in Poultry Farms in Central Lowland of Nepal
11:05	201	Bikash Gurung	Profitability, Marketing and Resource Use Efficiency of Ginger Production: Evidence from Rukum West, Nepal
11:15	217	Roshan Pun	A Review on Land Consolidation for Farming in Nepal
11:25	165	Madhav Parajuli	Cover crop usage for the sustainable management of soilborne diseases in woody ornamental nursery production system

### Session 113

**Moderator: Bharat Pokharel**

Time	ID	First Author	Title of the presentation
1:00	230	Dilip R. Panthee	Interactions on a Diverse Aspects of Agriculture Development in Nepal: Potential Implication for the Agriculture Transformation
1:10	104	Bharat Pokharel	Modeling Stand Level Forest Characteristics across Multifunctional Landscape
1:20	113	Nilhari Neupane	Renewable Energy for Food, Water and Energy (FEW) Security and Climate Change Adaptation in Nepal: a Nexus Perspective
1:30	115	Raju Adhikari	Agricultural 'Plastics' for Increased Crop Productivity
1:40	228	Lila Karki	Agricultural Problems Hierarchy and Rational Decision-Making: A Case of Minority Urban Farmers in Maryland
1:50	198	Aditya Khanal	Agritourism among Small Farms in Tennessee and Best Management Practices: What, Who, and Where?
2:00	104		
2:10	224	Shobha Poudel	Prime Minister Agriculture Modernization Programme in the Context of Rice Commercialization: Effectiveness and Challenges

### Session 122

**Moderator: Dr. Srinivasa Mentreddy**

Time	ID	First Author	Title of the presentation
8:30	155	Dev Paudel	Using the Oxford Nanopore Technology to Sequence the Genome of Tetraploid Blackberry
8:40	157	Gopi Upreti	Achieving Water, Energy and Food Security in Nepal through Nexus Approach to Development
8:50	173	Pramod Pokhrel	Evaluating Greenhouse Gas Fluxes in Grain Sorghum Production System in the Southern Great Plains

9:00	192	Tilak Bhandari	Nepal Rubber Plantation Industry, its Potential and Challenges
9:10	196	Megha Parajulee	Effect of Cover Crops on Population Abundance and Diversity of Ground Beetles in Texas High Plains Cotton
9:20	145	Basu Dev Kaphle	Vedic Agriculture: Lensing through the Present Context of Agriculture Development in Nepal
9:30	111	Rajan Ghimire	How Much Disturbance Too Much? Soil Health Response to Tillage Management in Semi-Arid Drylands
9:40	168	Nityananda Khanal	Prospects of Cropping Systems Diversification with Perennial Forage Seed Crops in Western Canada
9:50	176	Pramod Dhakal	In Search of Wisdom: Contemplating upon Culture, Agriculture and Scholarship in the Himalayas

### Session 123

**Moderator: Dol P. Dhakal/Madhav Parajuli**

Time	ID	First Author	Title of the presentation
10:15	112	Shital Poudyal	Can irrigation return flow from nurseries be reused to irrigate ornamental plants?
10:25	170	Pradeep Wagle	Comparing Vegetation Phenology and Eddy Fluxes during Non-Growing Seasons in Native Tallgrass Prairie Systems in the U.S. Southern Great Plains
10:35	189	Sundar Tiwari	Flowering Strips in Radish Fields Promote Biological Control and Improve Ecosystem
10:45	202	Devendra Gauchan	Cereal Demand and Production Projections for 2050: Opportunities for Achieving Food Self-sufficiency in Nepal
10:55	221	Sandip Subedi	Profitability and Determinants of Protected Vegetable Farming in Nepal
11:05	214	Ramjee Ghimire	How Are Egyptian Undergraduate Agricultural Students Prepare for a Career?
11:15	216	Romy Das Karna	No Wealth, Poor Health: Socio-economic Impact of COVID-19 on Marginal Communities of Nepal

## Session 211

**Moderator: Pramod Pokhrel**

Time	ID	First Author	Title of the presentation
8:30	143	Anugya Bhattarai	Investigating the Effect of Botanicals, Biocontrol Agents and their Consortia on Seedling Health of Okra with Special Reference to <i>Rhizoctonia solani</i> in Two Different Potting Media
8:40	175	Pritam Thapa	Effect of Phosphorus and Row Spacing on Performance of Mungbean ( <i>Vigna radiata</i> ) under Rainfed Conditions
8:50	159	Jebina Shrestha	Effect of Rooting Hormone and Media on Vegetative Propagation of Bougainvillea glabra cv. Single Pink Through Hardwood Cuttings
9:00	169	Prabha Adhikari	Variance Component Analysis Among Amaranth Genotypes in Mid-hill of Nepal
9:10	182	Shishir Dahal	Growth and Yield Parameters of Native Landraces of Rice ( <i>Oryza sativa</i> L) Inoculated with <i>Trichoderma viride</i> and <i>Pseudomonas fluorescens</i> in Dang Valley in Nepal
9:20	209	Mahima Gotame	Women Participation in Cardamom Production: A Study of Ilam district
9:30	120	Alok Dhakal	How Knowledgeable are People in Rural Nepal about Rabies?
9:40	121	Alok Dhakal	Investigating Attitudes of People in Rural Nepal Towards Rabies
9:50	131	Pramila Subedi	Prevalence of Hemoprotozoans and Associated Risk-factors in Sheltered Dogs of Kathmandu Valley

## Session 212

**Moderator: Pramod Pokhrel**

Time	ID	First Author	Title of the presentation
10:15	133	Sampada Devkota	Prevalence of Fish Tapeworm, <i>Diphyllbothrium latum</i> , in Commercial Fish Farms of Chitwan, Nepal
10:25	149	Bidya Ojha	Effects of <i>Rhizobium</i> spp. on Nodulation and Yield of Rice Beans ( <i>Vigna umbellata</i> ) Landraces in Chitwan, Nepal
10:35	156	Gaurav Thakur	Integrated Nutrient Management in Sesame in Lamahi, Dang
10:45	174	Prashant Bhattarai	In-vitro Evaluation of Chemical Fungicides and Botanicals against <i>Pestalotia longisetula</i> Fruit Rot of Strawberry
10:55	180	Sagar Bhandari	Assessment of Agricultural Mechanization in Rice Cultivation and Its Challenges in western Nepal

11:05	227	Susma Thapa	Community Engagement in Livestock Development: A Study of National Agriculture Development Company (NADC), Ranikot, Salyan, Nepal
11:15 to 11:45	Discussion and Q&A session for all RMG students (Session 211-212)		

## Session 222

**Moderator: Sushil Paudyal**

Time	ID	First Author	Title of the presentation
10:15	132	Ram Chandra Bhujel	Commercial Aquaculture in Nepal: An Emerging Opportunity
10:25	135	Santosh Dhakal	Sustainable Development of Livestock Sector in Post-COVID Nepal to Safeguard Animal and Human Health
10:35	140	Uma Karki	Comparative Performance of Meat Goats and Hair Sheep Raised in Pasture-based Systems
10:45	129	Nabaraj Chapagain	Effect of Garlic ( <i>Allium Sativum</i> L.) on the Growth Performance, Immunity, and Serum Cholesterol Level of Broiler (Cobb 500) Chicken
10:55	158	Hame Abdou Kadi	Evaluating Local Botanicals for Control of Red Flour Beetle, <i>Tribolium castaneum</i> (Herbst) (Coleoptera: Tenebrionidae) in Sorghum Grain in Niger
11:05	147	Bharat Shrestha	Grazing Management as a Tool to Improve Soil Health and Mitigate Effects of Climate Change
11:15	184	Sita Thapa	Soybean Cyst Nematode ( <i>Heterodera glycines</i> ) Management through an Integrated Approach: Rotation of the Resistant Varieties, Compost, and Cover crops
11:25	195	Dol P. Dhakal	Host-Plant Association of Plant Bugs and Predatory Arthropods in the Texas High Plains: Pest Management Implications

## Poster Session (4:30 to 6:30 pm)

### Student Poster (Screen 1)

4:30 - Abstract Number: 101 Title: Examining land cover change in Franklin County, Kentucky using supervised classification between 2009 and 2018

Presenter: Anjana Duwal

4: 34 - Abstract Number: 107 Title: Spatio-temporal monitoring of urban expansion and its impact in agriculture land availability using Remote Sensing: A case study of Bharatpur, Nepal

Presenter: Kabita Paudel

4: 38 - Abstract Number: 116 Title: Assessment of status of climate change and determinants of people's awareness to climate-smart agriculture: A case of Sarlahi District Nepal

Presenter: Sandhya Adhikari

4: 46 - Abstract Number: 123 Title: Effect of Supplement Type on the Nutrient Status of Lactating Kiko does Stocked in Woodlands Presenter: Bhuwan Shrestha

4: 54 - Abstract Number: 134 Title: Analysis of sensory attributes of Litchi fortified Dahi Presenter: Sanjay Kumar Pandit

4: 58 - Abstract Number: 136 Title: Cost of Feeding and Performance of Small Ruminants during the Lean Period of Forage Production

Presenter: Santoshi Chaudhary

5: 14 - Abstract Number: 151 Title: Characterization of d-tritopyrum germplasm for salt stress tolerance

Presenter: Bipin Neupane

5: 18 - Abstract Number: 162 Title: Efficacy of Biological Treatments against Root-Knot Nematode (*Meloidogyne* Spp.) in Okra (*Abelmoschus Esculentus* L.) At Nawalparasi East, Nepal. Presenter:

Kritika Adhikari

5: 22 - Abstract Number: 177 Title: Effects of cover crops and Bt (*Cry 51 Aa2*) on thrips population dynamics in cotton seedling

Presenter: Raju Sapkota

5: 30 - Abstract number: 190 title: performance evaluation of multinational maize hybrids in lamahi dang, Nepal

Presenter: Suraj Shrestha

5: 34 - Abstract Number: 191 Title: Management of crown and root rot in acid lime (*Citrus aurantifolia*) under screen house conditions in Kirtipur, Kathmandu

Presenter: Susmita Sigdel

5: 38 - Abstract Number: 138 Title: Effect of altitude and shade on production and physical attributes of Coffee in Coffee potent districts of Nepal: Gulmi, Syangja, and Palpa districts

Presenter: Manoj Paudel

5: 42 - Abstract Number: 208 Survey Study of Button Mushroom *Agaricus bisporus* bas on Production and Profitability in the Farmer's Level of Chapagaun Village Development Committee (VDC), Lalitpur Nepal

5: 54 - Abstract Number: 219 Title: Assessment of the status of rooftop garden, diversity, and determinants of adoption of urban green roofs in Nepal.

Presenter: Sandesh Thapa

6: 06 - Abstract Number: 223 Title: Non-compliance and Moral Hazard in Agricultural Conservation Programs

Presenter: Santosh Pathak

6: 10 - Abstract Number: 225 Title: An economic analysis of potato production and marketing in Achham district of Nepal

Presenter: Shreesha Pandeya

**Professional Poster (Screen 2)**

4:30 - Abstract Number: 102 Title: An Assessment of Land Use and Land Cover Changes in the Pokhara Metropolitan City, Nepal

Presenter: Anju Chaudhary

4:46 - Abstract Number: 127 Title: What is missing in Nepalese agriculture education?

Presenter: Krishna Kaphle

4:50 - Abstract Number: 139 Title: Breeding cows based on estrus detection using activity monitoring systems in grazing and non grazing environment

Presenter: Sushil Paudyal

(10 minutes break)

5: 00 - Abstract Number: 150 Title: A wheat practical haplotype graph to facilitate FHB resistance mapping

Presenter: Bikash Poudel

5: 04 - Abstract Number: 152 Title: Influence of Organic Soil Media and Date of Sowing on Germination, Growth and Seedling Vigor of Buckwheat in Chitwan Nepal

Presenter: Birendrakumar Bhattachan

5: 12 - Abstract Number: 166 Title: Influence of different tillage methods and weed management practices on weed dynamics and productivity of winter maize in Chitwan Nepal Presenter: Mahesh Kunwar

5: 20 - Abstract Number: 185 Title: Strengthening National Seed System in Nepal for Agriculture-led Transformation

Presenter: Sita Ram Ghimire

5: 28 - Abstract Number: 212 Title: Learners' perceptions of online learning COVID-19 pandemic

Presenter: Ramjee Ghimire

5: 32- Abstract Number: 213 Title: Participants' evaluation of an online international food safety short course

Presenter: Ramjee Ghimire

# ABSTRACTS

### **NAPA101: Examining Land Cover Change in Franklin County, Kentucky using Supervised Classification Between 2009 and 2018**

Anjana Duwal, Buddhi Raj Gyawali, and John David Sedlacek  
Kentucky State University, Frankfort, Kentucky, USA  
Correspondence Email: [anjana.duwal@kysu.edu](mailto:anjana.duwal@kysu.edu)

Land cover change is influenced heavily by human activities. Geographic information system (GIS)/remote sensing techniques are commonly used to estimate land cover and estimate land cover changes over time in specific areas. This research was conducted to examine the land cover change in Franklin County, Kentucky, USA, between 2009 and 2018. Landsat images from two different dates in 2009 and 2018 were classified using the maximum likelihood supervised land cover classification using ArcMap. The land cover was classified into four classes: forest, crop/pasture, developed land, and water at the Census Block Group level. It was hypothesized that the developed area increased between 2009 and 2018. A statistical analysis (t-test) was conducted to assess the statistical significance of the mean difference in all land cover classes. It was found that the land cover area did not differ significantly within the census block groups of Franklin County, Kentucky, between 2009 and 2018. However, forests decreased by 7.7 %, and crop/pasture, developed land, and water area increased by 5.8%, 2.6 %, and 38.8 %, respectively, from 2009 to 2018. Further study can be conducted to assess the land cover change in recent years and the implication of loss of agricultural lands on urbanization, food production, and ecosystems in Franklin County, Kentucky.

**Keywords:** GIS, remote sensing, land cover, supervised classification, urbanization

### **NAPA102: An Assessment of Land Use and Land Cover Changes in the Pokhara Metropolitan City, Nepal**

Anju Chaudhary, Buddhi Raj Gyawali, and Kirk W. Pomper  
Kentucky State University, Frankfort, Kentucky, USA  
Correspondence Email: [anju.chaudhary1@kysu.edu](mailto:anju.chaudhary1@kysu.edu)

Pokhara is the second largest city in Nepal, situated in the western part of the country. It is one of the most popular tourist destinations in Nepal and has an increasing population. The high population density in an urban setting increases the health and safety risks for the residents and visitors of this city. The objective of this research was to assess the land cover change between 2010 and 2020 in Pokhara Metropolitan City (PMC). Landsat images of 2010 and 2020 were downloaded from the United States Geological Survey Earth Explorer, and a vector file of administrative boundaries of the study area was acquired from Nepal Administrative Boundary Common Operational Database. Images were classified into five classes using the maximum likelihood supervised classification in ArcGIS Pro 2.9. Images were filtered through a spatial model builder after classification. Classification accuracy was assessed using high-resolution Google Earth images as ground truth. Land Use and Land Cover (LULC) data of 33 wards of PMC were extracted from the Regional Database System of The International Centre for Integrated Mountain Development (ICIMOD). A pairwise t-test (alpha level = 0.05) was conducted to compare the land cover between 2010 and 2020 at the ward level using R-Studio. There was a significant increase in the urban/built-up land, along with a moderate increase in forest cover, while the crop/pasture land decreased slightly over the study period. There was no significant difference in the area covered by the water body. This increase in the urban/built-up area can be attributed to the unsystematic city and open space planning over the study period.

**Keywords:** Pokhara, land use and land cover, land cover change, image classification



## **NAPA103: Evaluation of Climate-Smart Agriculture Scaling Framework for the Smallholders Farming System in Nepal**

Arun Khatri-Chhetri<sup>1</sup> and Pashupati Chaudhary<sup>2</sup>

<sup>1</sup>Save the Children US, Washington DC, USA; <sup>2</sup>Asian Disaster Preparedness Center, Bangkok, Thailand  
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Despite evidence of climate change adaptation and mitigation and benefits of climate-smart agriculture (CSA) technologies, practices, and services, the uptake of CSA is not adequate to achieve its full potential in Nepal. There are many plausible reasons for this, including lack of credits and extension services for the farmers, high risk of investment, weak local institutions, and unclear benefits to the farmers and food system actors. Policies, programs, and projects for CSA in Nepal are often limited in scale, short-lived, and without lasting impacts. Farmers need to make a substantial level of investment in different forms to adopt CSA technologies in their agricultural production systems. The scaling up of CSA options should offer sustainable changes in knowledge and skills, institutional innovations, and investment mechanisms at the local levels. This paper presents a framework for scaling up CSA in smallholder farming systems in Nepal. We evaluated the climate-smart village framework/approach promoted by the national and Gandaki and Lumbini provincial governments of Nepal. The framework considers climate change adaptation and resilience-building at three different levels – farm, community, and landscape. At the farm level, this framework promoted sustaining and improving crop and livestock productivity through CSA technologies, practices, and services. At the community level, group-based approaches that support collective action and decision-making were promoted for climate risk adaptation to develop social resilience. This framework focused on landscape-level natural resource management and the promotion of market-based solutions to build economic and environmental resilience. We found that the interventions at each of these three different levels contribute to the overall capacity of the agriculture sector to cope with climatic and economic shocks. We found up to 50% improvements in yields and farm income, promotion of inclusion of women, youth, and smallholders, local institutions' capacity building to prepare for climate risk management, increased engagement of the private sector to supply climate-smart technologies, and large scale convergence with government's agriculture development programs.

**Keywords:** adaptation, agriculture, climate-smart agriculture, scaling, resilience

## **NAPA104: Modeling Stand Level Forest Characteristics Across Multifunctional Landscape**

Bharat Pokharel

Department of Agricultural and Environmental Sciences, Tennessee State University  
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Modeling the spatial distribution of goods and services from the forest is the prerequisite for multi-value forest management, which aims to support the continuous supply of forest products to society and maintain forest productivity that supports major ecosystem services. Traditional field-based timber cruising and forest inventory are costly and time consuming. Therefore, there is a need to explore opportunities to utilize remote sensing data for modeling forest attributes in both temporal and spatial scales that are relevant for large-scale forest management planning. It is hypothesized that variables derived from remote sensing data could be important predictors in estimating stand level attributes from pixel to landscape level. In this work, Landsat satellite imageries and their derivatives, national land cover dataset, and digital elevation models were paired with Forest Inventory and Analysis (FIA) data, and a non-parametric approach, Random Forests, was used to develop models for estimating important stand level forest characteristics, including aboveground biomass, carbon stock, and tree density. The models explained over 40% of variability for aboveground biomass and tree density with an RMSE of 17 tons per acre and ~100 trees per acre, respectively. It is important to model forest attributes to project the role of forests in the regional and global carbon cycle and to formulate climate change mitigation strategies through appropriate forest management systems at local, regional, national, and global levels.

**Keywords:** stand characteristics, forest modeling, random forest, remote sensing

## **NAPA105: Toxins, Contaminants, and Adulteration in Food: Current Policies and Practices, and Future Strategies for Nepal**

Bhim Chaulagain<sup>1</sup>, Yakindra P. Timilsena<sup>2</sup>, and Bed P. Khatiwada<sup>2</sup>

<sup>1</sup>BASF, Research Triangle Park, NC, USA; <sup>2</sup>Nourish Nation Foundation, Melbourne, Australia

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Access to safe and quality food is a universal human right. It is also assured in Nepal through its Constitution and food-related regulations and standards developed and implemented since the 1960s. With population growth and an increase in food production, distribution, and trading during the last three decades, Nepal has experienced various issues related to food fraud, intentional adulteration, chemical contaminants, and toxins in the food systems. This has increased socio-economic burdens by putting extra pressure on the existing food regulatory system. The Government of Nepal has developed Food Safety Policy to promote food safety and quality in the country. Various acts, regulations, and standards related to food safety and quality are in place; however, implementation of laws is often constrained due to limited financial resources allocated to technical and human resources development and laboratory facilities for chemical and microbiological analysis. Inadequate financial and human resources have also hampered the proactive role that the three-tier government system needs to play in the implementation of food standards and related guidelines. Consumers could be the major drivers for the provision of safe and quality food. However, the majority of the consumers in Nepal are guided by the price rather than the product quality, nutritional value, and safety aspects. This presentation discusses current policies and practices of food safety and quality in Nepal. It provides insights on major drivers for food safety regulations in Nepal, along with the initiatives that local governments can take in formulating and strengthening laws, rules, and regulations in their jurisdictions. It concludes that a system for proactive government responsibility in developing and implementing comprehensive food safety and quality management is more important than leaving it to the mercy of an open market economy.

**Keywords:** food-adulteration, food safety and quality, regulations and standards, and food system

## **NAPA106: Agri-food Business Between North America and Nepal**

Purna Kandel

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Agri-food business is growing between North America, mainly Canada and the US, and Nepal each year. Major agri-food exports from Canada and US to Nepal are soybean, soybean meal, canola, lentils, peas, and beans. Animal genetic materials and some plant-based processed products are also exported. These products are exported on a mass scale for commercial processing and distribution in every segment of Nepalese consumers. Even during the pandemic with supply chain constraints, export to Nepal is growing. Around 500 million dollars in agri-food products were exported from Canada and the US to Nepal in 2021. Canada and the US import basically typical Nepalese food products like high-altitude Marsi rice, beans, and spices. These imports basically cater to the Nepalese diaspora. With distinct food habits and the uniqueness of food preparation back home in Nepal, these products have growing appeal. Around 40 million dollars of food and related products were imported from Nepal to the US and Canada. Several small and big sizes importers are importing these products regularly from Nepal to Canada and the US. However, a growing business is constrained by periodic policy changes by the government of Nepal and logistic issues. Even though several trade missions and visits have alleviated some problems, the banking difficulty and purchasing power of Nepal have a significant impact. Quality issues of Nepalese products are major concerns in Canada and the US. Nepal must improve the quality of products and packaging for international exports.

**Keywords:** international trade, commodities, Nepal, Canada, the US

## **NAPA107: Spatio-Temporal Monitoring of Urban Expansion and its Impact on Agriculture Land Availability using Remote Sensing: A Case Study of Bharatpur, Nepal**

Kabita Paudel<sup>1</sup>, Suraj KC<sup>1</sup>, Whitney Maynard<sup>1</sup>, Jeremy Sandifer<sup>1</sup>, Demetrio Zourarakis<sup>2</sup>, and Buddhi Gyawali<sup>1</sup>

<sup>1</sup>Kentucky State University, Frankfort, Kentucky, USA; <sup>2</sup>University of Kentucky, Lexington, Kentucky, USA

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Bharatpur, one of the major cities in Nepal, has been rapidly growing in recent years. The inward migration from the surrounding districts is the major driving force of urbanization. Urbanization has replaced fertile land with built-up structures, resulting in a decrease in available land for agricultural production. Currently, remote sensing is widely used in urban studies and planning because of the timely availability of data providing a synoptic view of urban land cover. This study aims at assessing and mapping the spatial and temporal patterns of urbanization in Bharatpur Metropolitan City from 2000 to 2022 using satellite imagery and assessing the impact of such urbanization on agricultural land availability. The analysis was conducted at the ward level and coupled with Landsat and Sentinel data to derive a Normalized Difference Built-up Index (NDBI). NDBI comparison in different years within the study period was carried out to assess the expansion of urban areas over time. Also, land use land cover changes in the study area for the 2000-2010 and 2010-2022 periods were analyzed using the supervised classification method in ArcGIS Pro. A land-use land cover change matrix was created after changes were detected. The results help visualize overall urban sprawl and identify the areas where agricultural land has been converted into built-up structures. The preliminary study shows a rapidly increasing trend of urbanization, especially on the outskirts of this major city in Nepal. This study helps study urbanization in Bharatpur, Nepal, and assists the policymakers in improving urban planning activities.

**Keywords:** urbanization, image processing, agricultural land, land use, land cover

## **NAPA108: Kishan Chautari: An Approach to Sustainable Agriculture**

Kedar Koirala and Nawaraj Basnet

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National Farmer Group Federation (NFGF) aims to contribute to socio-economic and biological sustainability by promoting organic agriculture production and certification of the product with assurance of quality and prices for the producers. The Federation has invested resources to identify and demonstrate good practices of resilient, sustainable farming partnerships with its members, especially smallholder farmer groups, for the last eight years. These practices are now organized as a system referred to as Participatory Guarantee System (PGS) that monitors quality and provides means to verify the product for organic certification. Through the multi-stakeholder process called Kishan Chautari, NFGF promotes resilient, sustainable production following the standard of PGS and collective marks and implements capacity building activities for producer groups to meet the standard. The NFGF activities have resulted in a progressive decrease in the use of inorganic substances by substituting them with locally prepared organic options, enhanced profit to the household while decreasing the cost of production, and improved coordination and collaboration, and linkage with government agencies, thereby strengthening the legitimate basis of organic certification. This transformative approach has helped enhance livelihood options, increase income and socio-economic status through a variety of crops /agriculture commodities, and boost self-esteem in individual producers and their groups. PGS has created recognition and boosted the confidence of smallholders to interact with market actors as well as relevant government institutions seeking support and services.

**Keywords:** small holder, sustainable, resilient agriculture, participatory guarantee system, Kishan Chautari, collective marks

### **NAPA109: Study on Household Food System: Common Daily Food Patterns and the Cost in Nay Pyi Taw, Myanmar**

May Thet Htar, Theingi Myint, Chue Htet Hnin, Htet Marlar Aye, Yin Nyein Aye, Moh Moh, and Thi Thi Soe  
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The ratio of food cost to total expenditure and income is a useful indicator of food security at the household level. In this study, 220 respondents from the Nay Pyi Taw region were interviewed about their monthly food consumption, costs, and income of their households. On average, the share of food costs was 71 percent of the total expenditure and 63 percent of the income. Among the respondents, 80.45 percent were satisfied with their current consumption pattern. However, 65 percent of the respondents felt that their food cost is high. The ratio of household expenditure to income higher than one was found in 14 percent of the households, while the ratio of food cost to income higher than one was found in 9 percent of the households. A large share of rice, edible oil, chicken, fish, beef, and pork costs in the total food cost was observed. Rice-based snack was commonly consumed for breakfast, and white rice, meat, fish, and vegetable were commonly consumed for both lunch and dinner. The common food pattern was found toward a healthy food system as the combination of diverse nutritious items. The chicken was the highly consumed meat type, while pulses and eggs were also commonly consumed for protein. Therefore, the improving nutrition-sensitive food system should be further promoted through interventions in the production systems, value chains, and distribution networks. In addition, healthy consumption patterns via affordable approaches should be disseminated by public health education programs for the vulnerable consumer group. Further research and extension should be conducted to identify per capita consumption and calorie intakes of these important food items in these regions to further measure the food security in the Nay Pyi Taw region and wider Myanmar.

**Keywords:** food system, household expenditure, consumption pattern, food cost

### **NAPA110: Forests and Forestry Reserves as Security Threat in Federal Capital Territory, Abuja, Nigeria**

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Forests are important plant communities that consist of trees and other woody vegetation that perform life-supporting functions on the earth. For example, the tree species can serve as diversity conservation and protection of fragile ecosystems; development of parks and event centers for relaxation and social engagements; provision of vegetables and fruits/seeds for foods and medicines; purification of air; and wind break. This paper attempts to examine forests and forest reserves as security threats in the Federal Capital Territory, Abuja, Nigeria. The study is both empirical and theoretical in nature as both primary and secondary sources of data were collected, processed, and analyzed for the research. In addition, different daily Nigerian newspapers were reviewed. Pictures were taken to support the findings. The results identified the reasons why forests and forest reserves can be security threats. The security threats they posed were examined, including basic hideouts, drinking, smoking, camping sites for insurgents, homeless on highways, armed robbers, thieves, and other criminals. The study proposed a way out of the present insecure situation by launching an attack to dislodge the insurgent, protect forests and forest reserves, and reforestation of degraded sections. These forests and forest reserves need to be properly harnessed, and recreational parks and tourist centers should be developed to increase the much-needed revenue.

**Keywords:** forest, forest reserve, security threat

## **NAPA111: How Much Disturbance is Too Much? Soil Health Response to Tillage Management in Semi-Arid Drylands**

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No-tillage (NT) practice is increasingly adopted to improve soil health and sustainability. However, soil organic carbon (SOC) and nutrient stratification under long-term NT often limit soil productivity. Targeted strategic disturbance of continuous NT is occasionally practiced to overcome challenges of long-term NT, yet limited information is available on their impacts on SOC and N components. We evaluated the response of SOC and nitrogen (N) fractions to different tillage practices after the imposition of one strategic minimum tillage operation (i.e., stubble mulch tillage: SMT) in a continuous NT system in semi-arid drylands. Tillage treatments were conventional tillage (CT), NT, SMT, and strip-tillage (ST). The CT, NT, and ST plots were established in 2013, and SMT plots were established in 2019 with one pass of stubble mulch tillage in NT plots. Soil samples were collected from 0-15 and 15-30 cm depths of each plot before SMT and 2-days, 7 months, 14 months, 19 months, and 26 months after SMT implementation. The CT management resulted in 12-27% and 11-16% lower SOC than under NT, SMT, and ST in 0-15 and 15-30 cm depth, respectively. Similarly, CT and ST had 22-53%, 44-79%, and 43% greater soil inorganic N than NT and SMT after 2-days, 7 months, and 19 months, respectively, in 0-15 cm depth. The 3d-carbon dioxide-carbon (CO<sub>2</sub>-C) was 32-65%, 48-65%, 62-102%, and 122-195% greater under CT and ST than under NT and SMT after 2-days, 7 months, 19 months, and 26 months, respectively, in 0-15 cm depth. For most samplings, there was no difference between NT and SMT on SOC and N fractions. Further research may reveal how often SMT can be utilized in a long-term NT system without negative impacts on soil properties. This study showed no effect of one stubble mulch tillage after six years of continuous NT on SOC and N storage in semi-arid drylands.

**Keywords:** carbon sequestration, no-tillage, soil nitrogen, soil structure

## **NAPA112: Can Irrigation Return Flow from Nurseries be Reused to Irrigate Ornamental Plants?**

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Irrigation return flow generated from nurseries is commonly laden with pesticides; if left unchecked, it may impair the surrounding ecosystem. Therefore, nursery growers have started to capture irrigation return flow within the production site in a pond or any inland depression to conserve the ecosystem and comply with state and federal regulations. While reusing irrigation return flow to edible crops may have human health concerns, reusing it for non-edible irrigation plants such as ornamental shrubs might be feasible. A growers' survey shows that they are concerned about potential phytotoxicity arising from pesticides present in recycled water. This study examined the possibility of reusing collected irrigation return flow to six taxa of ornamental shrubs. A three-year field study found that irrigation return flow containing ten common pesticides did not produce any phytotoxicity in six different ornamental shrubs. In addition, there was no evidence of a reduction in growth, biomass, and physiological functions by recycled water. This study demonstrates the possibility of reusing irrigation return flow collected in a nursery production site.

**Keywords:** ornamental shrubs, phytotoxicity, recycled water

### **NAPA113: Renewable Energy for Food, Water, and Energy (FEW) Security and Climate Change Adaptation in Nepal: A Nexus Perspective**

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Nepal has a huge potential for renewable energy such as hydropower. However, according to World Bank, Nepal spends 1/3<sup>rd</sup> of its gross domestic product (GDP) on importing petroleum products, and this fraction is consistently rising. Imported petroleum products, which are unsustainable and expensive, are used to meet most of the country's energy demand. Using hydropower to generate electricity is more sustainable, reduces energy import, and easily integrates with much-needed irrigation canals. Therefore, developing hydropower systems can increase the food productivity and energy security of the country. We, in this article, used secondary data and information from FAOSTAT, AQUASTAT, and the World Bank data portal to identify the roles of hydropower in achieving energy, water, and food security in the country. In addition, we also studied the prospects of exporting surplus electricity to South Asian countries like India and Bangladesh. We also identified the potential and challenges of developing hydropower for the multi-lateral energy trade. The nexus approach for integrated planning, policy coherence, and institutional harmonization is one of the strategies this article focuses on. These approaches will reduce electricity transaction costs, plan efficient hydroelectric projects, and reduce trade-offs at different scales. These approaches will also help adapt to several challenges of food, water, and energy insecurities brought by climate change and socio-economic development. We found that improving hydroelectricity in Nepal promotes a secured supply of food, water, and energy, saves money invested in importing fossil fuels, reduces emissions, and finally promotes the nation's economic development.

**Keywords:** food-water-energy (FEW), renewable energy, hydropower, climate change.

### **NAPA114: Cannabis Testing Labs: Quality Control and Standardization**

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Cannabis testing laboratories play a pivotal role in the multidimensional cannabis industry. Both cannabis production companies and consumers rely on the analytical results produced by the laboratories. Given the immense importance of accurate results, it is the responsibility of testing laboratories to produce precise, accurate, and consistent results for every sample they analyze. Quality control (QC) checks that a laboratory runs in each batch largely determine the accuracy of the results. Quality control checks are performed to satisfy the regulatory boards and have confidence in the results produced. From calibration to the sample runs, every batch should consist of quality control checks. It should be ensured that QC checks such as method blank, technical blank, laboratory control sample, and continuing calibration verifications are passed before running and generating the sample data. Blind testing, such as timely proficiency testing, helps maintain the instruments' accuracy and analysis. When the whole cannabis industry is proceeding towards standardization, testing laboratories should embrace that as well. However, a ubiquitous protocol for the ultimate standardization of cannabis testing laboratories is not available. Therefore, the debate has started on what standardization should look like, a plateau or a peak? When several countries are preparing to legalize cannabis and be part of the international market, a worldwide accepted standardization of guidelines and requirements on testing is much awaited. This study will present how quality control in testing laboratories impacts the whole cannabis industry and how a testing laboratory can maintain a good quality control system. Future scenarios for testing laboratories will also be discussed.

**Keywords:** phytochemistry, cannabis testing, testing laboratories

## **NAPA115: Agricultural ‘Plastics’ for Increased Crop Productivity**

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The world needs to double its food production by 2050 to feed a growing population expected to reach 10 billion by 2050. Preformed low density polyethylene (LDPE) plastics are widely used as a mulch film and guarantee 40 % increased crop productivity by reducing soil evaporation, promoting early germination, increasing yields, and reducing nitrogen leaching. Despite this, future legislation aims to phase out the above mulch films due to their non-degradable nature and associated long-term environmental toxicity. Biodegradable, bio-based, and compostable plastics have now been developed and trialed as an alternative technology, but due to their limited mechanical strength and increased cost, biodegradable plastic such as mulch film is still a challenge and is in different stages of the development and field trials. More recently, sprayable polymeric coatings have been developed as the next-generation mulch films due to their versatility and ease of application. This paper discusses the development and use of a preformed and sprayable biodegradable mulch film. I will also discuss CSIRO-developed biodegradable sprayable mulch film (SBM) technology, its unique properties, field trial results with an emphasis on soil water evaporation and weed control, and its commercialization potential.

**Keywords:** biodegradable mulch, sprayable, weed, water-saving

## **NAPA116: Assessment of Status of Climate Change and Determinants of People’s Awareness of Climate-Smart Agriculture: A Case of Sarlahi District, Nepal**

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The research paper aims to analyze the status of climate change and the determinants of people’s awareness regarding climate change in the Sarlahi District of Nepal. A total of 102 respondents were selected randomly from the study area and interviewed using a semi-structured questionnaire from May 12 to May 23, 2021. Along with the determinants, this survey emphasized finding climate-smart alternatives in the agriculture sector that could benefit the local population and help mitigate climate change. The chi-square test was conducted to measure the relationship between the operational variables. The results showed that there were no significant relationships of knowledge about climate change with gender, occupation, land ownership, and decisive role. However, education, family size, and age had significant effects on the knowledge about climate change. The binary logit model reported that age, years of schooling, training related to climate change, and involvement with cooperatives had significant effects on people’s awareness of climate change. Thus, the rate of adoption of climate-smart agriculture could be improved by incorporating climate change within our education system and also by offering training programs to the people in the study area.

**Keywords:** climate-smart agriculture, binary-logit model, ROC curve, training, and seminars

## **NAPA117: Microclimate and Understory Vegetation Responses to Trees in Hardwood Silvopastures vs. Open Pasture**

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Deciduous hardwood tree species such as black walnut (*Juglans nigra*) and honeylocust (*Gleditsia triacanthos*) have huge potential for integration into silvopasture and other temperate agroforestry systems. However, the modification in microclimatic conditions and vegetation composition in silvopasture created by integrating these tree species has not been studied. This study aims to quantify differences in microclimatic conditions and botanical composition between these hardwood silvopasture types and open pastures. The study site in Blacksburg, VA, contains open pastures (OP), black walnut (BSP), and honeylocust (HSP) silvopasture. In the summers of 2020 and 2021, one micro station was installed within each treatment to record ambient temperature (AT), relative humidity (RH), photosynthetically active radiation (PAR), and soil moisture (SM). The botanical composition of the pastures was determined by visual evaluation using a DAFOR scale. In 2020, the average daily AT was 1.2 °C hotter ( $p < 0.05$ ) in OP compared to BSP. In 2021, RH was higher ( $p < 0.01$ ) in OP compared to silvopasture treatments. The average daily PAR in OP was approximately 3x higher than BSP and 2x higher than HSP across both summers. SM was higher in OP ( $p < 0.001$ ) compared to silvopasture treatments across both summers. The percent of ground cover in BSP was lower ( $p < 0.05$ ) compared to HSP and OP treatments across both summers. BSP contained less ( $p < 0.01$ ) tall fescue (*Schedonorus arundinaceus*) than OP and HSP, while there was no difference in percent cover of tall fescue between HSP and OP treatments across both summers. In 2021, measures of orchardgrass (*Dactylis glomerata* L.) ground cover were greater ( $p < 0.05$ ) in BSP than in HSP and OP. The percent of Kentucky bluegrass (*Poa pratensis* L.) cover in BSP was greater ( $p < 0.05$ ) than HSP and OP across both summers. Differential variation in microclimatic conditions among treatments, thus, alters the understory forage composition among treatments.

**Keywords:** tall fescue, honeylocust, black walnut, agroforestry, PAR

## **NAPA118: Using Systems Thinking to Understand Dryland Food Systems in Northern Tanzania**

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Agro-pastoralism is the major food system in drylands and has evolved to respond to drought but is now having to adapt to reduced access to grazing land and degraded soil, which has led to food insecurity. However, scientific literature and stakeholders disagree fervently about the root cause of the problem, which has necessitated the use of systemic rather than linear approaches in identifying drivers of food security. Using a case study from Northern Tanzania, I compared two causal loop diagrams as a system tool to outline the causes of food insecurity. Through thematic analysis of literature and in-depth interviews with experts, the difference in the literature and stakeholders' perceived food systems were analyzed. A comparison of different system archetypes, a recurring pattern of behavior of how variables are causally interrelated, is demonstrated via causal loop diagrams (CLD). Literature and stakeholders agree that attempts to address food insecurity are characterized by the government's drifting goals that led to the 'success to successful' archetype. However, the food system CLD created from literature demonstrates two archetypes - 'shifting the burden' and 'escalation.' Food security is approached by addressing the symptoms without thinking about the root causes, which has led to unintended consequences that end up making the food insecurity situation worse. Literature suggests that food insecurity issues may be addressed through institutional factors such as tenure, ownership, and policy attention in agro-pastoralism. The food system CLD was created from stakeholders' perceived food insecurity to be more local and defined by three different archetypes: 'escalation' related to human-wildlife conflicts, 'tragedy of commons' related to gully erosion and loss of land productivity, and limits to growth when it comes to developing adaptive capacity for drought. The knowledge of both literature and stakeholders must be brought together through a systemic understanding of the food system if food security is to be attained in Northern Tanzania. However, potentially neither reflect the perspective of the agro-pastoralists, which needs integration for action and change.

**Keywords:** food systems, archetypes, drylands, Tanzania



## **NAPA119: Comparing Change in Land Surface Temperature in Relation with Elevation in Eastern and Western Nepal**

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Land Surface Temperature (LST) is a vital component of the Earth's climate system. LST is affected by many factors like solar radiation, land surface properties, air temperature, vegetation cover, and land use of an area. LST rapidly changes with space and time. LST can be one of the determining factors for assessing climate change. In a country like Nepal, where there is a vast change in temperature with respect to elevation, studying the variability in LST can provide invaluable data in climate studies. This study illustrates the spatial and temporal variations of LST in relation to changes in elevation in Nepal. Four places from each Himalayan, Hilly, and Terai ecological region of Eastern Nepal were selected, and the relationship between elevation and LST was assessed. For this study, the hottest and the coldest months, June and January of 2020, respectively, were assessed for the relationship between LST and elevation in hot and cold seasons. A similar study was also carried out in Western Nepal and then compared between Eastern and Western regions. LST was retrieved from LANDSAT 8- Operational Line Imager and Thermal Infrared Sensor (OLI & TIRS). The LANDSAT Data was obtained from the USGS Earth Explorer. ArcGIS Pro and R software were used for the analyses. Preliminary studies showed a negative linear correlation between LST and elevation in both Eastern and Western regions. This study shows that the elevation factor should also be considered in studies related to the spatial distribution of LST.

**Keywords:** climate, temperature, thermal band, LANDSAT

## **NAPA120: How Knowledgeable are People in Rural Nepal about Rabies?**

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Eliminating dogs' transmitted rabies by 2030 is a collective global pledge. Rabies is a vaccine-preventable, zoonotic, and fatal viral disease tormenting human beings and animals for four thousand years. An average annual fatality of 59,000 people has been reported from more than 150 countries, including Nepal. Understanding the knowledge, attitudes, and practices of people toward rabies is paramount to preventing this disease. A cross-sectional study was conducted in three districts, namely, Siraha, Parsa, and Parasi in Nepal, from October to December 2021 to assess public awareness of rabies. Information was obtained using a structured questionnaire among purposively selected 308 household heads. Most of the respondents were unfamiliar with the term 'rabies' and mistook it for an illness induced by poison transmitted through the bite of a 'mad dog'. They knew major carriers or sources of rabies, but the majority of them (85.4%) did not know the causative agent. They had some idea of how rabies is transmitted from animals to humans, but they lacked a clear understanding of the fate of the animals and humans once affected cases are rabies symptomatic. Only 35.1% of respondents knew that rabies pathogens attack and multiply in the brain. Rabies vaccination in pets is critical for rabies eradication, yet only 26.3% of respondents were aware of the schedule. Respondents appeared to be aware of taking vaccines. Nearly 90% of participants thought post-exposure prophylaxis (PEP) to be effective immediately after a suspected animal bite. However, they were unsure which disease preventative vaccines they were taking. Education to invoke awareness among rural people about rabies, its transmission, and prevention, including freely available anti-rabies vaccines, should be the priority for municipalities, public health, and veterinary health authorities in the study districts and throughout the country.

**Keywords:** awareness, Nepal, rabies, rural communities, zoonosis

## **NAPA121: Investigating Attitudes of People in Rural Nepal Towards Rabies**

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A cross-sectional study was conducted in Siraha, Parsa, and Parasi districts of Nepal from October to December 2021 among 308 purposively selected household heads to assess their attitudes towards rabies and whether and how their attitudes vary by their demographics. Gauged on a scale of 1 to 5 (1=strongly disagree, 3=neither agree nor to disagree, 5=strongly agree), most respondents tend to agree with “#1: Rabies can be prevented by educating people about the disease” (M=4.4, SD=.6), “#2: It is necessary to control stray dogs in the community” (M=4.2, SD=1), “#3: Euthanasia of dog is good if it is suspected to be rabid” (M=4.03, SD=1.2), “#4: You are willing to submit your dog for vaccination [against rabies]” (M=4, SD=.8), while they were neutral to “#5: Rabies is a problem in your community” (M=3.0, SD=1), and they disagreed to the idea that “#6: Ayurveda can be the solution for rabies” (M=2.3, SD=1.3) and “#7: Traditional healers can be solutions for rabies” (M=2.1, SD=1.3). Respondents held similar views irrespective of their gender for the former four statements but differed in their views for the latter two statements, and in both, female respondents rated high. Geography-wise, there was a difference in their attitudes towards statements #1, #3, #6, and #7 only among the three districts chosen for this survey. Those owning pets rated significantly lower for #6 and #7 than those not owning pets. No difference in attitudes by marital status was reported, but by race/caste for statements #1, #5, and #7. The findings have several policy implications that governments and stakeholders in Nepal should follow to minimize the incidences of rabies in Nepal.

**Keywords:** attitudes, prevention, rabies, rural Nepal, treatment regime

## **NAPA122: Addition of Legume into Grass Pastures Improved the Health Indicators in Katahdin-St. Croix Ewes**

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Sheep raised in pastures dominated with perennial grasses in the Southeast USA commonly show poor health and performance. Improvement in pasture quality may promote their health and performance. The objective of the study was to evaluate the impact of legume addition to grass pastures on the health condition of Katahdin-St. Croix ewes. Southern peas (*Vigna unguiculata* (L.) Walp.) and browntop millet (*Urochloa ramosa* L. Nguyen) in 50:50 mix were planted in 2.5 ha (5 plots), and the remaining 2.5 ha (5 plots) was sown to sole browntop millet. Forage biomass was collected and analyzed for dry matter and quality: crude protein (CP), acid detergent fiber, neutral detergent fiber, and total digestible nutrients (TDN). Eighteen ewes (17-18 months old) were divided into two groups: group 1 was rotationally stocked in legume-grass plots and group 2 in sole-grass plots throughout the study period (87 days). Live weight, FAMACHA score, and body condition score (BCS) were collected on day 1, fortnightly, and at the end of the study. Blood and fecal samples were collected on days 1, 47, and 87 and analyzed for nutrient and physiological components. Forage dry matter data were analyzed using the Mixed Procedure, and forage quality, animal performance, blood parameter, and fecal nutrient data were analyzed using the GLM procedure in SAS 9.4. Legume-grass pastures had greater CP (42%) and TDN (6%) than the sole-grass pastures ( $p<0.05$ ). BCS and FAMACHA scores were better in group 1 than in group 2 ewes ( $p<0.05$ ). Group 1 ewes showed a higher level of blood glucose (47<sup>th</sup> day), blood urea nitrogen (BUN) (87<sup>th</sup> day), and BUN to creatinine ratio (87<sup>th</sup> day) than did group 2 ewes ( $p<0.05$ ). Results showed that legume inclusion in grass pastures improves forage quality that eventually enhances the performance and health conditions of hair sheep.

**Keywords:** blood parameter, blood urea nitrogen, crude protein, forage quality, glucose

### **NAPA123: Effect of Supplement Type on the Nutrient Status of Lactating Kiko Does Stocked in Woodlands**

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Nutrients in feces provide knowledge on digestion and absorption of nutrients in the body. However, not much is known about the retention and excretion of nutrients in lactating goats stocked in woodlands with different supplements. The study tested the hypothesis that supplement type would not alter the concentration of nutrients excreted in the feces of lactating Kiko does stocked in woodlands. The objective of the study was to evaluate the effect of supplement type on fecal nutrients in lactating Kiko does stocked in woodlands. Seventeen lactating Kiko does with their kids (33) were divided into two groups. Each group was assigned to separate sets of woodland plots and rotated among those plots throughout the study period (July-October 2021). Group 1 was allowed for supplemental grazing in adjacent silvopasture plots for 3-4 hours daily, and group 2 was supplemented with ad libitum hay and corn (0.5% of metabolic weight). Fecal samples were collected on days 1, 33, 60, and 88 of the study and analyzed for nitrogen (N) and phosphorous (P). Crude protein (CP), digestible organic matter (DOM), and the major limiting nutrient (energy or protein) in the feedstuffs that animals consumed were predicted from nutrients present in their feces. Data were analyzed using the GLM procedure in SAS 9.4. Group 1 does had higher dietary CP on days 33 and 88 ( $p < 0.0001$ ) and lower dietary DOM on day 88 ( $p < 0.0001$ ) vs. group 2 does. Group 1 does had greater fecal P on Day 33 ( $p < 0.0001$ ) and greater fecal N on Days 60 and 88 ( $p < 0.0001$ ). Energy was predicted to be the deficient nutrient for both groups throughout the study period, except for protein as deficient in group 2 does towards the end of the study. Results show the significant effect of supplement type on nutrients in the feedstuffs consumed, lost nutrients in feces, and the limiting nutrients for the desirable performance of lactating Kiko does.

**Keywords:** digestible organic matter, fecal crude protein, fecal nitrogen, fecal phosphorous

### **NAPA124: Study of *Ehrlichia canis* in Febrile Dogs of Kathmandu Valley of Nepal**

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Canine ehrlichiosis is a tick-borne disease caused by *Ehrlichia canis*, transmitted by *Rhipicephalus sanguineus* and characterized by thrombocytopenia, variable leucopenia, anaemia, fever, anorexia, lymphadenopathy, hemorrhages in the mucous membrane, peripheral oedema, emaciation, and hypotensive shock leading to death. The aim of this study was to study the prevalence of *Ehrlichia canis* in febrile dogs of Kathmandu valley. Among febrile dogs presented to eight different hospitals and clinics in Kathmandu valley, 270 samples were randomly selected and tested by SensPERT *E. canis* antibody test kit, and a questionnaire survey was carried out. Positive samples were tested for morula detection by blood smear microscopy, and hematological and biochemistry parameters were measured. The overall seroprevalence was 11.85% (32/270) by rapid antibody test and 4.07% (11/270) by blood smear microscopy. In the rapid test, variation in the prevalence of *E. canis* was statistically significant ( $p < 0.05$ ) with housing, anorexia, hemorrhage in the mucous membrane, and edema, and statistically insignificant ( $p > 0.05$ ) with sex, location, and age groups. The similarity was observed in the blood smear test, except that housing was found statistically non-significant. When hematological and biochemical parameters were compared, variation in monocyte, hemoglobin, packed cell volume, platelets, albumin, and glucose with reference values were found statistically significant, while WBC, neutrophil, lymphocyte, eosinophil, basophil, erythrocyte sedimentation rate, blood urea nitrogen, serum creatinine, total/direct bilirubin, SGPT, SGOT, ALP, and total protein were not statistically significant in cases positive by rapid test. A significant association was observed with Eosinophil in cases positive by smear microscopy as well. This study indicates that febrile dogs have a history of hemorrhage in the mucous membrane, edema, anorexia and thrombocytopenia, monocytopenia, low packed cell volume, low hemoglobin, and decreased albumin and glucose levels may be infected with *Ehrlichia*.

**Keywords:** blood smear, *Ehrlichia canis*, ehrlichiosis, febrile dog

## **NAPA125: Seroprevalence and Associated Risk-factors of *Leptospira hardjo* in Dairy Cattle of Western Dairy Pocket Area in Chitwan District of Nepal**

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Leptospirosis is a serious spirochete-borne zoonotic disease of increasing worldwide prevalence and distribution. More than 300 distinct Leptospiral serovars are recognized, and these are arranged in 25 serogroups. Leptospire belonging to *Leptospira* serovar Hardjo is the most common cause of leptospirosis in cattle. The objective of this study was to determine the seroprevalence and associated risk factors of *Leptospira hardjo* in dairy cattle of the western dairy pocket area in the Chitwan district of Nepal. For that, a two-stage sampling survey design was used. In 2072, five village development committees (VDCs) of western Chitwan were selected from 10 VDCs according to probability proportion to size design. A total of 382 serum samples were collected. Samples were tested with PrioCHECK *L. hardjo* antibody detection ELISA kit. Data entry and analysis were done in Microsoft Excel, Open Epi, and SPSS. Out of 382 serum samples collected and tested, 19 (4.97%) were found to be positive. Statistical analysis of the risk factors showed significant differences ( $p < 0.05$ ) in the case of animals with a history of abortion, mastitis, nervous signs, presence of rodents, and dry ground surfaces, whereas no significant differences ( $p > 0.05$ ) were observed for location, age, breed, parity, body condition score, housing system, mating system, history of hemoglobinuria, and the history of reproductive problems in cattle. None of the sampled farms had reportedly used a leptospiral vaccine, and hence the presence of circulating antibodies in the cattle suggested a natural exposure to *Leptospira hardjo*.

**Keywords:** dairy cattle, ELISA, *Leptospira hardjo*, risk factors, seroprevalence

## **NAPA126: Risk Factors Associated with Avian Influenza Subtype H9 Outbreaks in Poultry Farms in Central Lowland of Nepal**

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Low pathogenic avian influenza (LPAI) of subtype H9 outbreaks have frequently been occurring in major commercial hubs of Nepal, including Chitwan, a Central lowland, causing substantial economic losses to farmers. However, the risk factors associated with these outbreaks have been poorly understood. The objective of this study was to evaluate the potential risk factors associated with the Avian Influenza (AI) subtype H9 in the central lowlands of Nepal: Chitwan, Nawalpur, and Makawanpur districts. A case-control study was conducted from October 2019 to March 2020, where a total of 102 farms (51 case farms and 51 control farms) were selected for the study. Case farms were AI subtype H9 confirmed farms by Polymerase Chain Reaction (PCR). Control farms included AI negative farms, which were confirmed from antigen tests conducted at the National Avian Disease Investigation Laboratory, Chitwan. Each farm was visited to collect information using a semi-structured questionnaire. A total of 25 variables representing farm characteristics and biosecurity measures were considered as potential risk factors. The final multiple regression model showed that the distance less than 0.5 kilometers from the main road (Odds ratio (OR))=4.04, 95% CI=1.20-13.56,  $p=0.023$ ), a distance of less than 1 kilometer from the nearest infected farm (OR=76.42, 95% CI=7.17-814.06,  $p=0.0003$ ), and wild birds coming around the farm (OR=6.12, 95% CI=1.99-18.79,  $p=0.0015$ ) as risk factors for avian influenza type H9. Using an apron or separate cloth inside the shed (OR=0.109, 95% CI=0.020-0.577,  $p=0.0092$ ) reduced the risk of farms being positive for AI subtype H9. Based on the findings, we suggest farmers give due consideration to site selection while establishing the farms and implementing appropriate biosecurity measures such as using separate cloth inside the shed and preventing the entry of wild birds inside the farm to reduce the introduction of avian influenza type H9 in poultry farms.

**Keywords:** avian influenza, biosecurity, poultry farms, risk factors

### **NAPA127: What is missing in Nepalese agriculture education?**

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Nepal is transforming to achieve sustainable development goals. It has set the goal of doubling the tigers to make a disease-free nation, which is not a small task. As a signatory of regional and international agreements, Nepal has an obligation to its citizens and international communities to achieve these goals. In addition, equity based collective prosperity and development on the strong footings of culture and tradition is now becoming even more important. Postmillennial generations that are becoming more active in education and professional fields are becoming dominant in decision making. Technology savvy youths have access to information; just the mode of knowledge and skill transfer needs a slight twerking. Specifically, coordination for linking research, extension, and education at three tiers of governance is needed to achieve sustainable development goals. One Health, collective transformation through the exchange of knowledge and skills, local strength-based enterprises, and changes toward conscious consumption provide a foundation for social transformation. This study discusses sustainable development goals, opportunities and lacking agricultural education in Nepal, and necessary steps to transform the agricultural sector through one health approach. When youths start leading politics, corruption earned wealth display being frowned upon, conscious electorates start getting elected, and brain gain starts rising, the seemingly ambitious goals are achievable.

**Keywords:** Sustainable, Generation gap, Education

### **NAPA128: RPS17 is a Host Determinant Enhancing Avian Hepatitis E virus (HEV) Replication**

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Hepatitis E virus (HEV), the causative agent of hepatitis E, is an important zoonotic pathogen. Avian HEV is an important pathogen within the poultry industry and, although it does not infect humans, is used to model human disease. Lack of an efficient cell culture system complicates the study of avian HEV. Quasispecies of human HEV can possess natural insertions of ribosomal protein (RP) S17 that bestows a growth advantage and expands their host tropism *in vitro*. RPS17 is part of the 40S ribosomal subunit and is involved in eIF-2 binding. The objective of the study was to construct an avian HEV with the RPS17 insertion to further characterize its replication and pathogenesis. Avian HEV with the RPS17 insertion in the hypervariable region of the non-structural protein was constructed. Capped RNA transcripts of RPS17 and wild-type clones were replication-competent after transfection of LMH chicken liver cells. Chickens inoculated intrahepatically with RNA transcripts of wild type, and avian HEV RPS17 developed an active infection as evidenced by fecal virus shedding and viremia. To characterize the pathogenicity, RNA transcripts of both avian HEV-wild type and avian HEV RPS17 clones were intrahepatically inoculated into the livers of chickens. Cloacal swabs and body weights were collected every 3 days. Blood was collected every 7 days. Several birds from all groups were necropsied every 7 days, bile was collected, and the liver-body weight ratio was determined. Birds were examined for gross and microscopic liver lesions. RNA was extracted from cloacal swabs, serum, and liver samples and quantified by RT-qPCR. Results showed that RPS17 insertion into avian HEV was not only replication competent but enhanced its replication ability in chicken liver cells as well as in SPF chickens when compared to wild type virus, as observed by increased capsid protein detected by flow cytometry, indirect immunofluorescence assay, and genomes quantified via qRT-PCR.

**Keywords:** avian, Hepatitis E virus, RPS17

## **NAPA129: Effect of Garlic (*Allium Sativum* L.) on the Growth Performance, Immunity, and Serum Cholesterol Level of Broiler (Cobb 500) Chicken**

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Garlic (*Allium sativum*) has been used as a spice and native medicine. A study was carried out to determine the comparative effect of feeding different levels of garlic paste supplemented diet on growth performance, feed intake, feed efficiency, Hamagglutination-inhibition (HI) titre (Log<sub>2</sub>) against Newcastle disease (ND) vaccine, level of total serum cholesterol, and serum proteins in Cobb 500 broilers. Chicken were fed isoproteinous, and isocaloric control diet (CD) and CD supplemented with four different levels of garlic paste (% of the diet), namely T1 (CD), T2 (CD + 0.5% garlic of diet), T3 (CD + 1.0% garlic of diet), T4 (CD + 1.5% garlic of diet) and T5 (CD + 2.0% garlic of diet). Live weight and feed consumption were recorded weekly up to the sixth week of age, and daily weight gain and feed efficiency ratio were calculated. Blood samples were collected from wing veins on 14, 35, and 42 days and the Newcastle Disease Virus (NDV) was measured by hemagglutination inhibition test (HI) on 14 and 35 days of the study. Serum was collected at 42 days only from where total serum cholesterol, total protein, albumin, and globulin were determined. Data were analyzed using MSTAT version 1.3 (1975). Results showed the highest ( $P < 0.01$ ) cumulative weekly live weight and daily gain (g/bird) for broilers supplemented with 2.0% garlic paste, followed by the group supplemented with 1.5% garlic paste and the lowest in the control group. Overall feed consumption was ( $P < 0.01$ ) the highest for broilers supplemented with 2.0% garlic paste. Supplementation of garlic also reduced ND antibody titer on Day 14. Total serum cholesterol was reduced by 2.58% (3.25 mg/dl), 9.15% (11.5 mg/dl), 17.43% (21.91 mg/dl), and 23.73% (29.83 mg/dl) in T2, T3, T4, and T5 respectively compared to T1. The broiler diet can be supplemented with up to 2.0% garlic paste for better growth, feed efficiency, and immunity against ND and low cholesterol level.

**Keywords:** Antibody, Broiler, Feed conversion ratio, Newcastle disease

## **NAPA130: Indigenous Farm Animal Genetic Resources and Their Welfare Status in Nepal**

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Farm Animal Genetic Resources (FAnGR) comprise all animal species, breeds, and strains of economic, scientific, ecological, and cultural significance to humanity in terms of food and agricultural output for the current and future generations. Nepal is rich in FAnGR with twenty-six breeds within seven species that can adapt to wide ranges of climatic conditions from tropical to tundra. They are tolerant to diseases and suitable for traditional farming systems. Sustainable animal production systems and future food security require access to various animal genetic resources. For the last three decades, Nepal Government has been conducting programs to identify, characterize, and sustainably conserve Indigenous FAnGR with the joint effort of research and extension. Various promotional activities to develop FAnGR, such as *in situ* and *ex situ* conservation measures, have been conducted in various regions of Nepal. The indigenous FAnGR always have to face injustice as they are judged by their production under the traditional (input-constrained) production systems and without evaluating their productivity under optimal production conditions. The traditional production system compromises subsistence production while the optimum management system provides complete animal welfare by facilitating optimal feeding, health care, comfortable housing, and other good management practices, which ultimately lead to optimal productivity of animals according to their genetic potential. Nevertheless, animal welfare for indigenous FAnGR has been inadequately discussed and implemented. The recently endorsed Animal Breeding Policy of Nepal has included, to some extent, the FAnGR conservation, utilization, and promotion. This paper focuses on Indigenous Farm Animal Genetic Resources of Nepal, their importance, and their actions to conserve, promote, and utilize them. It also discusses the status of welfare among FAnGR and explores the genetic potential of FAnGR in the optimum management system and the way forward.

**Keywords:** animal welfare, conservation, Nepal, optimum management system

### **NAPA131: Prevalence of Hemoprotzoans and Associated Risk-factors in Sheltered Dogs of Kathmandu Valley**

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Protozoans infection is a major cause of health issues in canine species. Hemoprotzoans also have zoonotic importance and can impart negative consequences to public health. Limited information is available about the status of hemoprotzoan infection in dogs of Nepal. This study determined the prevalence of hemoprotzoans in shelter dogs of Kathmandu valley. Kathmandu has a subtropical-temperate climate with heavy rainfall and favors the growth of vectors transmitting hemoprotzoans. A total of 154 dogs from four different rescue shelters, Kathmandu Animal Treatment Center (KAT), Sneha's care, Shree animal rescue center, and Animal Nepal, were included in this study. Around 5 ml of blood was collected from the cephalic or saphenous veins of the dogs for the preparation of thin smears, which were stained with geimsa stain. The stained slides were examined at 40-100X magnifications under an oil immersion microscope. The overall prevalence of hemoprotzoans was found to be 4%, and only *Babesia spp* was found to be prevalent in our study. Though the age and sex of the dogs had no significant association ( $p>0.05$ ), the presence or absence of ticks and the color of the visible mucous membrane were significantly associated ( $p<0.05$ ) with the prevalence of hemoprotzoans. Though the overall prevalence was lower than in earlier studies, it still suggests the need for improving the treatment and care of dogs in the shelter houses to protect and prevent any possible human transmission of protozoans.

**Keywords:** *Babesia spp*, blood parasites, dogs, giemsa stain, hemoprotzoans

### **NAPA132: Commercial Aquaculture in Nepal: An Emerging Opportunity**

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Due to limited job opportunities, many Nepali youths go abroad for work and a good income. Traditional agriculture contributes to the food security of rural communities, but it neither attracts youths nor produces enough food to fulfill ever-increasing demand. Food deficits and trade imbalances are occurring in the country. Commercialization of agriculture has been tried with limited success. The potential of the aquaculture sector has not been realized, although it supplies more than 90,000 mt of fish/year from wild catch and culture. Fish is the third source of animal protein after buffalo and poultry and accounts for around 20% of the total animal protein intake in Nepal. Expansion of commercial rainbow trout (*Oncorhynchus mykiss*) farming in hilly areas of Nepal utilizing cold water has attracted many private investors. As Nepal has over two-thirds of its total area covered by hills, it has a huge potential for trout farming, which has attracted some private investment. Many trout farms are combined with restaurant and lodging businesses creating additional jobs for the people. Farming of warm-water fish species in Terai is also booming, where farmers utilize low-fertile land to dig ponds, realizing its low risk and high revenue potential. The traditional culture of raising carp in ponds still accounts for more than 90% of the aquaculture. High-density culture of Pangasius (*Pangasianodon* sp.) and Nile tilapia (*Oreochromis niloticus*) has been promoted to enhance pond productivity as they can be stocked at 5-10 times more per unit area, and their productivity and revenue-generating potential could be more than 10 folds higher than that of traditional carps. More recently, an advanced form of their culture, i.e., the biofloc system, is taking momentum. Young entrepreneurs are attracted due to the potential of high-volume production and high income using small areas in backyards. Demand for fish in Nepal is rapidly increasing with the increase in awareness about health benefits and potential profit from its farming. However, almost all the fingerlings are imported. The main objective of this paper is to describe the practical models of commercial aquaculture and highlight their potential in Nepal.

**Keywords:** commercial aquaculture, trout, pangasius, tilapia

### **NAPA133: Prevalence of Fish Tapeworm, *Diphyllobothrium latum*, in Commercial Fish Farms of Chitwan, Nepal**

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*Diphyllobothrium latum*, commonly known as ‘fish- tapeworm’, holds zoonotic importance as it causes Diphyllobothriasis in humans. Fish is a highly consumed meat source by humans and also acts as a second intermediate host for *D. latum*. There are plenty of reports indicating consumption of *D. latum* infested poorly cooked fish as a cause for acquiring Diphyllobothriasis in human. Despite being a subject of public health concern, no scientific data regarding the prevalence of *D. latum* in the fish population of commercial fish farms of Nepal are available to date. This study aimed to bridge this knowledge gap. This study was performed in all six municipalities of Chitwan, Nepal. Out of 46 registered fish farms in Chitwan district, 42 were sampled randomly for the study. The fish sampled from each farm were brought to the laboratory, maintained a cold chain system, and dissected for feces collection. For qualitative parasitological examination of feces, sedimentation and centrifugal flotation methods were used. Out of the 42 farms sampled, 16 (38.10%) fish farms were found positive for the presence of any kind of gastrointestinal parasites and 9 (21.4%) farms were found positive for *D. latum*. Besides *D. latum*, fish farms were also found positive for *Contracaecum sp.* (19%), *Coccidia* (11.9%), and *Eustrongyloides* (2.4%). This research concludes that there is a significant prevalence of *D. latum* in the Chitwan district's commercial fish farms, showing possible zoonotic risk for the human population. Management practices of fish farmers must include ways to prevent *D. latum* infestation in the fish population. Moreover, the general public should be made aware of the prevalence of *D. latum* in fish and its possible risk to human health, along with preventive measures for safe fish meat consumption.

**Keywords:** *Diphyllobothrium latum*, fish tapeworm, public health, Zoonosis

### **NAPA134: Analysis of Sensory Attributes of Lychee-Fortified Yogurt (Dahi)**

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Recently, traditional foods have increasingly been modified as functional foods by fortification using nutritious ingredients. Fortified foods provide important nutrients that can help protect human health while enhancing flavor and aroma. The demand for functional food has recently increased because of these added health and sensory advantages of fortification. The objective was to analyze the physical and sensory parameters of a yogurt product fortified with Lychee (*Litchi chinesis*) juice. Three different proportions of lychee juice were added to a conventional yogurt product, and the most suitable level was identified using sensory analysis (Hedonic rating) of the fortified product. A sensory evaluation panel comprising expert members from different departments within the college evaluated the sensory attributes of the product. Lychee juice was added at the rate of 10%, 15%, and 20% of milk weight, and sugar was added at a constant rate of 5% of milk weight. Analysis of the Hedonic rating identified that the product containing 15% lychee juice was the most preferred product on a sensory basis. The visual evaluation indicated that the conventional yogurt and fortified yogurt demonstrated no difference in color (cream white color). The body and consistency of the fortified product were observed to be smooth and glossy, while the cut surface was firm and free from cracks and gas bubbles. Flavour was identified to be a delicate, pleasant, and sweetish acid taste with the increased aroma of lychee juice. In conclusion, by fortification of lychee juice, the functional value of yogurt was significantly increased. The sensory evaluation by expert members preferred the fortified yogurt containing 15% lychee juice.

**Keywords:** fortification, functional food, litchi juice, yogurt



## **NAPA135: Sustainable Development of Livestock Sector in Post-COVID Nepal to Safeguard Animal and Human Health**

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The livestock sector is an integral part of Nepalese agricultural practices and contributes to around 11.5% of the national gross domestic product (GDP). It is instrumental in mitigating the problem of food insecurity and malnutrition in Nepal and achieving sustainable development goals (SDGs) of ending poverty. The objectives of this study were to review the trend of livestock production and its contribution to achieve SDGs in Nepal; assess the impact of COVID-19; review the major zoonotic diseases, and provide recommendations for sustainable livestock development in Nepal in the post-COVID era. Data indicates that the livestock sector, particularly poultry and goat farming, is continuously growing in Nepal. There has been a substantial increase in the production of milk, meat, and eggs over the past decade. However, Nepal still has around a 50 million (USD) annual trade deficit on major livestock products. The ongoing COVID-19 pandemic disrupted the livestock supply chain in Nepal and affected all aspects of livestock production, processing, transport, sales, and consumption. The high incidence of infectious diseases is a major challenge in livestock production in Nepal. In addition, Nepal is one of the hotspots for zoonotic disease transmission, and several diseases, including influenza, rabies, brucellosis, and tuberculosis, are adversely affecting animal and human health. To achieve sustainable development of the livestock sector in post-COVID Nepal and to safeguard both animal and human health, there is a need for (i) implementation of efficient breeding, nutrition, and animal health policies to increase productivity; (ii) infrastructure development to produce value-added products and for storage of surplus; (iii) increasing the provision of livestock insurances and subsidies; (iv) establishment of biosafety laboratories and institutionalization of multidisciplinary One-Health approach for sustainable management of the infectious disease; and (iv) investment in drug and vaccine development research and education.

**Keywords:** COVID-19, Infectious diseases, Livestock production, Nepal, Sustainable development goals (SDGs)

## **NAPA136: Cost of Feeding and Performance of Small Ruminants During the Lean Period of Forage Production**

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The cost of supplementary feeding of small ruminants can be high during the lean season of forage production and can be challenging for sustaining the operation. However, the feeding costs have not been documented well, especially for small-ruminant operations in the Southeast USA. The objective of this study was to evaluate the cost of supplementary feeding and the performance of small ruminants during the lean period of forage production. The study was conducted from October 2021 to January 2022. Seventeen Kiko does with their kids (21, 5-6 months old) and 18 Katahdin-St. Croix ewes were stocked in the grazing-research facility at Tuskegee University. These animals were provided with ad libitum hay and whole corn (25 lbs./day). The quantity of hay and corn provided to these animals during the study period and their purchase price were recorded, and the cost of supplementary feedstuff was calculated. Live weight, FAMACHA score, and body condition score (BCS) were collected from animals on day 1, fortnightly during the study, and at the end. The average cost of supplements per animal was \$0.43/day, which included 77% cost for hay and 23% for corn. The FAMACHA score ranged from 1.9 to 2.3 in does and kids and from 1.0 to 1.2 in ewes. The BCS range was between 2.1 and 2.3 in does, 1.9 and 2.3 in kids, and 2.8 and 3.1 in ewes. Results show that raising small ruminants on supplements during the period of low forage production can be costly, and the adoption of strategies to minimize the need for supplements would be necessary to make this enterprise economically viable.

**Keywords:** body condition score, Katahdin-St. Croix ewes, kids, kiko does, supplementary feeding

### **NAPA137: Role of Adrenomedullin During Peri-Implantation Period of Porcine Pregnancy**

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Adrenomedullin (ADM) is an evolutionarily conserved multi-functional peptide hormone that regulates implantation, embryo spacing, and placentation in humans and rodents. However, the potential roles of ADM in implantation and placentation of domestic animals, particularly pigs, as a litter-bearing species, are unknown. This study investigated patterns of expression of ADM mRNA and protein and ADM receptor components, i.e., calcitonin receptor-like receptor (CALCRL), receptor activity modifying proteins (RAMP2 and RAMP3) and atypical chemokine receptor 3 (ACKR3; a decoy receptor) in uteri from cyclic and pregnant gilts (Days 10-16) as well as conceptuses when 30-40% of embryonic death loss occurs. Gilts (n=42) exhibiting at least two normal estrous cycles were inseminated artificially twice and then assigned randomly to be ovariectomized on days 10, 11, 12, 13, 14, 15, or 16 of pregnancy (n=6 gilts/day). Each uterine horn was flushed with 20 ml sterile PBS (pH 7.2), and the presence of morphologically normal conceptuses confirmed pregnancy. Immunohistochemical analyses revealed localization of AM only in the uterine LE of pregnant gilts between Days 12 and 16, whereas CALCRL and RAMP2 were expressed in the uterine LE, glandular epithelia (GE), and stroma between Days 12 and 16 of pregnancy in gilts. In conceptuses, expression of AM, CALCRL, and RAMP2 proteins increased in trophoblast cells between Days 12 and 16 of pregnancy. Further in situ hybridization showed that mRNA expression of ADM, CALCRL, RAMP2, and RAMP3 genes increased in the porcine conceptus trophoblast between Days 12 and 16 of pregnancy, whereas ACKR3 mRNA increased between Days 13 and 14 of pregnancy but decreased thereafter in the conceptus trophoblast. These results indicate that ADM may play functional roles in uterine receptivity and the survival, growth, and development of the porcine conceptus during the peri-implantation period of pregnancy.

**Keywords:** conceptus, implantation, uterine receptivity

### **NAPA138: Effect of Altitude and Shade on Production and Physical Attributes of Coffee in Coffee Potent Districts of Nepal: Gulmi, Syangja, and Palpa**

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Coffee (*Coffea arabica*), a benign stimulant, is the world's most popular beverage and is the second most traded commodity in the world after raw oil. Coffee is grown in around 70 countries between 23<sup>o</sup>N latitude to 25<sup>o</sup>S latitude. Coffee is grown in the mid-hills of Nepal from an altitude of 700masl to 1500masl under different shade management practices. Nepalese coffee farmers traditionally grow coffee with no application of inorganic fertilizers and pesticides, and hence Nepalese coffee is popular as organic coffee or specialty coffee in the world. A study was conducted in three potent coffee growing districts of Nepal, Gulmi, Palpa, and Syangja, from February 2020 to August 2020. Ripe coffee cherries were harvested from every 200m altitude from 700masl to 1500masl under shade management and without shade management practices. Different physical attributes such as 1000 cherry weight, wet parchment weight, dry parchment weight, green beans weight, defected beans, and green bean diameter was calculated. The highest production was obtained from an altitude of 900-1100masl with the production of 7.04 kg per plant. The highest 1000 cherry and green bean weights were obtained from 900-1100masl with the weight of 1297.17g and 450.33 g, respectively. Shade management practice was found to be a major factor for the defective beans. Under no shade management number of defective beans was 98, whereas it was 64 under shade. The interaction effect of altitude and shade management practice had a significant effect on production (P=0.035), 1000 cherry weight (P<0.001), dry parchment weight (P=0.049), and green bean weight (P<0.05). Coffee produced at an altitude of 900-1100masl produced high yield and had better quality, whereas that produced at extreme low (700-900masl) and high (1300-1500masl) altitudes produced low yield and poor quality.

**Keywords:** cherry weight, coffee quality, shade management

### **NAPA139: Breeding Cows based on Estrus Detection using Activity Monitoring Systems in Grazing and Non-Grazing Environment**

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Sensor technologies are increasingly being used in the dairy industry. However, their effectiveness in detecting estrus in grazing and nongrazing rearing condition has not yet been explored. The objective was to characterize activity before artificial insemination (AI) in cows that did or did not conceive in grazing and non-grazing conditions. Holstein cows (n = 310) from a herd milking 2,800 cows were affixed with a pedometer on one leg to monitor steps (ST; n/d), lying time (LT; min/d), and lying bouts (LB; n/d) for seven mo. Milk yield (MY; kg/d) and reproductive data were obtained from on-farm software. Reproduction was managed through heat detection by use of tail head painting, and AI technicians were unaware of activity data. Generalized linear models and logistic regression were used to evaluate activity on the day before AI (d-1) and subsequent pregnancy. Models included days in milk (DIM), parity, temperature humidity index, technician, and sire as covariables. Overall, 67% of the cows were pregnant at the end of the study. There were 551 and 221 AI during the non-grazing and the grazing period (27.6% vs. 30.8% conception). A significant effect on ST was determined for the interaction between grazing and AI outcome (P = 0.02), as conception was associated with greater or lower ST, depending on access to grazing. Subsequent analyses by grazing category indicated no differences in ST for cows that conceived or remained open. LT at d-1 was greater in cows that conceived (537±16 vs. 498±9 min/d; P<0.05). Similarly, LB at d-1 was greater in cows that conceived (9.26±0.33 vs. 8.5±0.21 n/d; P=0.05). Daily MY was not associated with AI outcomes. During the non-grazing season, the odds (95% CI) of pregnancy in cows in the high ST category were 2 (1.2–3.33) times the odds of cows in the low ST category. The level of variation in activity behavior before AI was partially different for cows that conceived or failed to conceive in grazing and non-grazing conditions.

**Keywords:** activity, dairy, reproduction

### **NAPA140: Comparative Performance of Meat Goats and Hair Sheep Raised in Pasture-based Systems**

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Meat goats and hair sheep are commonly raised under similar grazing and management conditions in the southeast USA. The difference between these breeds in terms of their performance is not reported well in this region. The objective of this study was to evaluate the performance of meat goats and hair sheep raised under similar grazing and management conditions. Studies were conducted in 2020 and 2021 involving Kiko does (17) and Katahdin-St. Croix ewes (18). Animals were rotationally stocked in grazing plots without any feed supplement during the lush-forage production seasons and supplemented during the lean period of forage growth. Performance data (live weight, body condition score (BCS – 1-5: 1- very thin, 5 - obese), and FAMACHA (a 5-color chart used to monitor anemic condition in small ruminants caused by barber pole worm; score - 1-5: 1-2- not anemic, 5 - extremely anemic) were collected at the beginning, fortnightly during, and at the end of each study. Blood profile (37 parameters), fecal nutrients (N, P), and the infestation of gastrointestinal parasites were also evaluated in one of the studies. Data from each study were analyzed separately in SAS 9.4, with the alpha value set at 0.05. Kiko does show poorer BCS and FAMACHA scores compared to ewes. Species difference occurred in about 75% of the blood parameters and in both fecal nutrients. Gastrointestinal parasite infestation was greater in does versus ewes. Results show that hair sheep (Katahdin-St. Croix ewes) are more resilient and perform better than meat goats (Kiko ewes) under the pasture-based production system in the southeast USA.

**Keywords:** blood profile, FAMACHA, Katahdin-St. Croix ewes, Kiko does, species difference

## **NAPA141: Effect of Different Chemical Priming Methods on Germination and Seedling Parameters of Blackgram Seeds**

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Black gram seeds exhibit low emergence and poor seedlings establishment, especially under dry soil conditions. Seed priming is a cost-effective technology to enhance seed germination and seedling growth in various field crops. This study aimed to determine the effect of different seed priming methods on germination and seedling parameters of black gram. The experiment was laid out in a completely randomized design and replicated three times. Treatments included control (no priming), hydro-priming, osmo-priming (polyethylene glycol [PEG]-10% and 20%), halo-priming (1% NaCl and 1% KNO<sub>3</sub>), and hormonal priming (Salicylic acid 125 ppm). Seeds were soaked for 12 hours and dried in ambient conditions for all treatments. Seeds were grown at 24°C in a germinator for eight days, and various germinability variables were recorded. The measured and derived variables included germination percentage (GP), germination energy (GE), germination index (GI), mean germination time (MGT), coefficient of the velocity of germination (CVG), length of radicle and plumule, seedling, dry weight, and seedling vigor index (SVI). PEG-treated (10% solution) seeds exhibited the highest GP (96.8%) along with the highest MGT, followed by hydropriming (94.4%). Halo-priming with 1 % NaCl solution showed the highest values of GE and GI, while salicylic acid at 125 ppm resulted in the highest CVG and SVI (1846.7). The seeds primed with salicylic acid had higher root length (10.251 cm), shoot length (10.671 cm), and dry weight (4.580 g). The non-primed seeds had the lowest GP and SVI. Based on the germinability and seedling quality parameters, the performance of primed seeds was superior to non-primed ones.

**Keywords:** blackgram, control, germination, PEG, priming, seedling growth

## **NAPA142: Evaluation of Different Nutrient Management Practices in Maize in Mid-hill of Nepal**

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Lack of site and variety specific fertilizer management recommendations may be one of the major reasons behind low productivity of maize in Nepal. A field experiment was conducted on Lamjung Campus Agronomy farm to compare the effects of different fertilizer management practices on the growth and yield of hybrid and local maize varieties. The factorial randomized complete block design experiment had two factors comprising eight treatments replicated thrice. The treatments consisted of two varieties - hybrid and local, and four different fertilizer management practices - control, farmer's practice, recommended dose, leaf color chart (LCC)-based fertilizer application. Plant height, leaf area index (LAI), kernels per cob, test weight (TW), and grain yield were measured. The variety and different fertilizer management practices significantly affected measured variables. The local variety had higher plant height at maturity (200.3 cm) and LAI (0.191) but less grain yield (3.4 t ha<sup>-1</sup>, while the hybrid variety produced a higher number of kernels per cob (349.6), test weight (318.7 g), and grain yield (5.7 t ha<sup>-1</sup>). Among the fertilizer management practices, LCC-based nitrogen application had taller plants (204.1 cm), while recommended dose resulted in higher LAI (0.216), a number of kernels per cob (372.8), test weight (301.7 g), and grain yield were obtained in a plot with a recommended dose of fertilization (5.6t ha<sup>-1</sup>). The control plot produced the lowest grain yield (2.6 t ha<sup>-1</sup>). The results revealed that maize yield is improved when a hybrid variety is used under recommended dose of fertilization and LCC-based fertilizer management practices.

**Keywords:** leaf color chart, maize, nitrogen, variety

### **NAPA143: Investigating the Effect of Botanicals, Biocontrol Agents, and their Consortia on Seedling Health of Okra with Special Reference to *Rhizoctonia solani* in Two Different Potting Media**

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The effect of botanicals, biocontrol, and their consortia against the damping-off in okra (*Abelmoschus esculentus* L.) caused by *Rhizoctonia solani* were investigated. The treatments comprised of different combinations of five botanicals (wood apple/Bel, Neem, Turmeric, Ginger, and Onion extracts), two biocontrol agents (Pseudomonas and Trichoderma), and two potting media [Vermicompost with soil and farmyard manure (FYM) with soil] in a completely randomized design with 42 treatments and 4 replications. The data of okra seedlings were recorded for the first 16 days of sowing. The greatest number of days for the onset of post-emergence damping-off was observed with Pseudomonas + Onion seed treatment in FYM substrate (15 days) followed by Pseudomonas treated seed in FYM substrate (14 days). Dickson Quality Index (DQI) was greatest for Pseudomonas + Neem seed treatment (0.00151) in FYM substrate, followed by Pseudomonas + Onion or Turmeric seed treatment in FYM substrate (0.00129), with a greater value of DQI indicating better seedling health. Germination index was greatest for FYM substrate amendment with Pseudomonas (0.53), followed by Pseudomonas + Onion seed treatment in FYM substrate (0.51). The germination index was greater for FYM substrate (0.34) as compared to Vermicompost substrate (0.24). The least percentage (34.38%) of pre-emergence damping-off was observed in FYM substrate treatment with Pseudomonas and Pseudomonas + Onion seed treatment in FYM substrate. Almost all the combinations of wood apple treatment showed inhibitory effects on seed germination and seedling growth. No significant interaction was recorded between the substrate and biocontrol treatments across the observed and analyzed parameters. Pseudomonas + Onion seed treatment in FYM substrate and amendment with Pseudomonas and Trichoderma were the most effective treatments for okra seedlings against *R. solani* led damping-off.

**Keywords:** Biological control, Damping-off, Okra, *Rhizoctonia solani*, Seedling health

### **NAPA144: Glucosamine/ $\beta$ -Alanine Carbon Mediated Gene Delivery in *Escherichia coli* Cells**

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Bacterial transformation is an important procedure in molecular research. The commonly used method of bacterial transformation involves an introduction of a foreign gene into a bacterial cell by a process such as heat shock and electroporation. However, these methods are resource and time-consuming. On this prospect, we aimed to develop a new method of plasmid delivery inside the *E. coli* cells. Recently, carbon dots have been widely used in drug delivery and gene therapy. They are popular for their properties like facile synthesis, easy functionalization, biocompatibility, and non-toxicity. We synthesized carbon dots using precursor chemicals such as Glucosamine and  $\beta$ -Alanine. We evaluated the minimum incubation time and the maximum plasmid delivered using these carbon dots. The *E. coli* was used as a model organism. The bacteria were cultured in a selection media, and the transformed colonies were counted using the ImageJ software. Later on, statistical analysis was done using R-software. We calculated the minimum incubation time and maximum plasmid size that could be delivered using these carbon dots. The best incubation time was obtained between 30 to 60 minutes, and the maximum plasmid size that these carbon dots could deliver was 10 Kb. This study showed that carbon dots could deliver genes inside the *E. coli* cells. Further studies are needed to evaluate their potential gene delivery in other bacterial strains.

**Keywords:** carbon dots, transformation, gene delivery

## NAPA145: Vedic Agriculture: Lensing through the Present Context of Agriculture Development in Nepal

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The Veda means knowledge, which basically includes wisdom and laws of nature. Vedic agriculture means applying ancient Vedic wisdom in the field of agriculture. It has been well accepted that Veda has been well documented in written form during Mahabharat Period (i.e., Pre 3000 BC). The Vedic farming system considers a farm as a living, dynamic, and spiritual entity with its own natural rhythms to be managed with its natural tunes for sustainable agricultural development. Nepal is rich in religious, cultural, ethnic, and biological diversity. Building harmony between the elements and system is the major characteristic of Vedic Farming. It considers ecological balance and the intricate relationship between farming, livestock, and forestry components as an integral part of the agroecosystems. These components are still well integrated into the farming systems in Nepal. However, food production and consumption patterns are changing with demand, commercialization, and the labor market. The changing phenomenon has brought both challenges and opportunities; a recent trend in organic agriculture is encouraging farmers to transform towards a more sustainable and healthy approach gradually. Organic agriculture is a production system that sustains soil health, ecosystems, fairness, and potential for future generations as it relies on ecological processes, biodiversity, and natural cycles. Organic agriculture and a regenerative approach can contribute to building trust and revival of Vedic Agriculture, respecting nature and ecological balance, which is relevant even in modern agricultural farming systems. Vedic Organic farming has been described in Vedic texts like Rig/Atharva Veda, Krishi Parashar, Brihat Samhita, Kashapiya Krishi Paddatti, and so on. This study documented the ancient heritage of the farming system leading to theory building, validation, and gradual replication of appropriate Vedic agriculture crucial for sustainable modern agriculture.

**Keywords:** biodiversity, farming system, organic, sustainable, Vedic farming

## NAPA146: Improving Soil Health and Soil Security for Food and Nutrition Security in Nepal

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Soil health and soil security are intrinsically interconnected with food and nutrition security. Hence, their improvement is necessary for the normal functioning of terrestrial ecosystems, including but not limited to increasing biodiversity and crop productivity and improving people's livelihoods. We reviewed the soil fertility status across various agroecological regions of Nepal, soil-related constraints to crop production, factors affecting soil fertility decline, better soil management practices, soil-related policies and strategies, and the contribution of soil to food and nutrition security in the country. Soils across hills and mountains are light-textured, shallow, and susceptible to erosion, while low-lying areas, including Terai, have heavy textured soils with greater depth and are prone to flooding. The majority of the soils are acidic, low in organic carbon and total nitrogen, and deficient in zinc, boron, and molybdenum. Soil fertility is declining mainly due to nutrient mining, depletion of soil organic matter, soil erosion in hills and mountains, and inappropriate use of chemical fertilizers in Terai. Long-term cropping systems experiments conducted across research centers and farmers' fields have indicated that integrated nutrient management with organic inputs and inorganic fertilizers is necessary for maintaining soil nutrient balance and enhancing productivity, profitability, and sustainability of cropping systems. The contribution of soil to food and nutrition security is discussed in relation to the importance of improved soil management practices, including the use of organic inputs (manure, compost, residues), inorganic fertilizers, legumes in crop rotation, green manures, cover crops, and mulching, *in-situ* manuring, strip-cropping, hedgerow/alley-cropping, and practicing conservation tillage within the framework of integrated plant nutrient management. Improving soil information systems and site-specific nutrient management using digital technologies such as digital soil maps, mobile soil testing labs, and Nutrient Expert-based site-specific nutrient recommendations are also discussed.

**Keywords:** food security, nutrient management, soil management practices

## NAPA147: Grazing Management as a Tool to Improve Soil Health and Mitigate Effects of Climate Change

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After Alan Savory propounded “Holistic Management” as a system thinking approach to resources management in the 1960s, livestock grazing by managing herbivores’ behavior to avoid predators was adopted widely to control land degradation. This grazing practice is commonly called the adaptive multi-paddock (AMP) grazing system. In this system, a pasture is divided into smaller paddocks, and a large herd of livestock is grazed intensively in a single paddock for a short duration and then moved into the next paddock allowing the grazed paddock to recover until the next round of grazing. Livestock stocking density in each paddock is determined based on available resources such as forage and water. The University of Alberta launched a five-year project to evaluate the effects of AMP grazing by cattle in different agro-ecoregion of Alberta. We measured 2017-2019 growing in-situ season fluxes of greenhouse gases (GHGs), namely carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O), from soils to test the effects of AMP grazing compared to paired conventionally grazing. Furthermore, an incubation study was carried out to test the potential effects of change in soil temperature and water content on GHG emissions from soils. Soil C content was measured down to 1 m extracting 5 cm diameter cores. The experiment showed that in-situ GHG emissions vary by year and geolocation, but they were not significantly different from each other by the grazing types. However, the incubation experiment showed that the AMP grazing might lower the GHG emissions compared to conventionally grazed soils. Particularly, the CH<sub>4</sub> uptake was 1.5 times greater in soils from AMP-grazed than non-AMP-grazed grasslands (P < 0.001). In addition, there was more C sequestration potential in the organic (Ah) layer of the soils of AMP grazed soils depending upon rest to grazing ratios. Constraints, opportunities, and relevance of the AMP system to Nepal’s transhumance grazing systems are discussed.

**Keywords:** AMP grazing, carbon sequestration, grazing, greenhouse gas

## NAPA148: Quantification of Nitrate Leaching across Four Different Rotational Production in Sandy Soils of Northern Florida

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Nitrate-Nitrogen (NO<sub>3</sub>-N) leaching from agricultural fields is considered one of the major contributors to groundwater contamination and degradation of natural springs in Florida. Computer models have the potential to simulate the water and nutrient flow in the soil and are increasingly used in the decision-making process to help manage non-point agricultural pollutants like NO<sub>3</sub>-N. These models can test the effectiveness of various best management practices (BMPs) without having to deal with long-term field trials on different soil, climate, and management conditions. Thus, the objective of this study was to evaluate computer simulation models, namely DSSAT (Decision Support System for Agrotechnology Transfer) and HYDRUS-1D (one dimensional), for their efficacy on simulating NO<sub>3</sub>-N leaching in a four-year crop rotation study involving bahiagrass (*Paspalum notatum*), maize (*Zea mays*), peanut (*Arachis hypogaea*), and carrot (*Daucus carota*). The field experiment started in 2019 at Suwannee Valley Agricultural Extension Center in Live Oak, FL, on a 40-acre center pivot irrigated field using 40 drain gauge lysimeters to measure NO<sub>3</sub>-N. This is an ongoing study, and the final work will involve simulating four years of measured data from maize-peanut rotation and rotation involving Bahia grass with both DSSAT and HYDRUS-1D. We calibrated and validated the model using the data from four production systems. Following calibration, models were used to simulate the long-term effects of crop rotation on yield, N uptake and N leaching on sandy soils. A simulation of N leaching from standard peanut-maize crop rotation using DSSAT indicated a good correlation between measured and simulated values with a d-statistics of 0.81 and RMSE of 22 kg ha<sup>-1</sup>. Thus, simulation-based estimation of nitrate leaching can be a viable means to determine the effects of rotational production on groundwater quality in a consistent and economically practical way.

**Keywords:** DSSAT, HYDRUS, SWAT, modeling, nitrate leaching

## **NAPA149: Effects of *Rhizobium* spp. on Nodulation and Yield of Rice Beans (*Vigna umbellata*) Landraces in Chitwan, Nepal**

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Rice bean (*Vigna umbellata*) is a multipurpose crop grown in the hilly areas of Nepal. A field experiment was carried out during the summer of 2021 at Rampur, Chitwan, Nepal, to assess the performance of *Rhizobium* strains on three Rice bean landraces. The experiment was laid out on a split-plot design where three landraces, namely CO1563-3 (V1), CO1564-1 (V2), and NPGR0008-3-3 (V3), were planted as the main plot. Three different *Rhizobium* species, *R. leguminosarum* (R1), *R. japonicum* (R2), *R. fascioli* (R3), and an uninoculated control (R4), were applied as subplot factors. Results showed the highest nodule biomass (3.09 gm/m<sup>2</sup>) in the control plot, followed by NPGR0008-3-3 (1.31 gm/m<sup>2</sup>) and CO1564-1 (1.09 gm/m<sup>2</sup>) at the mid flowering stage. However, the number of nodules per plant and root length was not significant. The dry matter production was significantly ( $p < 0.05$ ) affected by the interaction effects of both landraces and strains during the mid flowering stage (90DAS) and was highest in V<sub>2</sub>R<sub>2</sub> (453.33 gm/m<sup>2</sup>), followed by V<sub>2</sub>R<sub>4</sub> (416 gm/m<sup>2</sup>) and V<sub>1</sub>R<sub>4</sub> (410.66 gm/m<sup>2</sup>). Correspondingly, the yield components, namely pod yield (2229.05 kg/ha), number of seeds per pod (8.03 kg/ha), and seed yield (1654.7 kg/ha), were highest in V<sub>3</sub>R<sub>3</sub> followed by V<sub>2</sub>R<sub>4</sub> and V<sub>3</sub>R<sub>2</sub>. These components were significantly ( $p < 0.05$ ) affected by the interaction of landraces and *Rhizobium* species. A yield increase of 68.54% and 71.07% was obtained with V<sub>3</sub>R<sub>3</sub> compared to control (V<sub>3</sub>R<sub>4</sub>) and the least yielding V<sub>1</sub>R<sub>1</sub>. Hence, the *R. fascioli* on NPGR0008-3-3 performed best among other combinations.

**Keywords:** rice beans, nodule biomass, *Rhizobium*

## **NAPA150: A Wheat Practical Haplotype Graph to Facilitate FHB Resistance Mapping**

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Next-generation sequencing (NGS) technologies enable high-throughput, low-cost genotyping in wheat. However, these methods generate large numbers of missing sites. Several imputation methods have been developed to predict these missing data with accuracies dependent on reference selection, sequencing coverage, minor allele frequencies, etc. A graph-based computational framework called Practical Haplotype Graph (PHG) was recently introduced to efficiently store sequence-based genotyping data and infer high-density genotypes by imputing low-coverage skim genotype sequences. The PHG serves as a database to store large-scale genomic variation in pangenome haplotype and enables the imputation of high-density genotypes from low-density genotyping platforms. This study used the whole exome capture sequencing dataset to develop a wheat PHG database. The objectives of this study were to estimate the accuracies of imputing whole-exome capture genotypes from simulated skim-sequencing, genotyping-by-sequencing, and Illumina array data. We show that with wheat PHG built to store WGS information for 95 diverse wheat genotypes, the PHG SNP-calling accuracy was minimally affected by sequencing coverage, and imputation accuracies for low-coverage sequencing data ranged between 83% (0.01x) and 87% (1x). Beagle5.2, on the other hand, could accurately impute low-coverage skim sequencing data with 81% accuracy (1x). Surprisingly, the imputation with GBS was higher with an average accuracy of 96% and could prove to be very useful for achieving genomic selection goals at a lower sequencing cost. It is yet to be determined how the genotypes imputed using PHG would help identify SNPs with a broader range of FHB resistance traits in genetic mapping experiments.

**Keywords:** practical haplotype graph, whole-genome sequencing, skim-sequencing, Fusarium head blight



## **NAPA151: Characterization of d-Tritipyrum Germplasm for Salt Stress Tolerance**

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Strengthening the inherent ability of new cereal cultivars to tolerate environmental stress is the most effective, economical, and environmentally friendly way to safeguard crop yields in agriculture. To this end, there is an ongoing need to acquire new, valuable genes for breeding. *Thinopyrum distichum* Thunb. Löve is a highly salt-tolerant, tetraploid wild relative of wheat previously used to derive diverse, hexaploid d-tritipyrum ( $2n = 42$ , AABBJJ) lines that vary widely for agronomic traits, including salt tolerance. This study attempted to identify a subset of d-tritipyrum with good agrotypic and salt tolerance for future attempts to improve the hybrids in their own right and to also develop common wheat substitution lines with individual D-genome chromosomes replaced by homoeologues from *Thinopyrum distichum*. Thirty-six d-tritipyrum lines and secondary d-tritipyrum X common wheat hybrids were tested in a growth chamber for salt tolerance from June to September 2021. The materials were also evaluated for days to flowering, plant height, fertility, and agrotypic and tested with *Thinopyrum distichum*-specific markers that were previously associated with salt tolerance. Marked differences in salt tolerance were evident. Eleven lines will be evaluated further in a follow-up salt tolerance trial. One entry with a wheat-like phenotype and intermediate salt tolerance appears to be a common wheat substitution line with 2D and 3D replaced by their 2J and 3J counterparts, which were previously shown to affect salt tolerance. We will attempt to confirm these preliminary results and produce substitution lines for additional chromosomes that are critical to salt tolerance. Such material will be useful in future studies of the expression and utility of critical *Thinopyrum* genes in common wheat, and also could serve as a platform for chromosome engineering to introgress smaller chromosome regions into wheat.

**Keywords:** Salt tolerance, d-Tritipyrum, *Thinopyrum distichum*, *Triticum aestivum*, Wide hybridization.

## **NAPA152: Influence of Organic Soil Media and Date of Sowing on Germination, Growth, and Seedling Vigor of Buckwheat in Chitwan Nepal**

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An experiment was conducted in Chitwan, Nepal, from October 2021 to December 2021 to determine the suitable combination of organic soil media and date of sowing on seed germination, seedling vigor, and growth of farmer's buckwheat seed. A completely randomized design was used for the study with six different organic soil media as the main plot factor and the three dates of sowing as subplots. Soil media treatment included 1. soil under Moringia tree, 2. soil: farmyard manure (FYM): rice husk (RH) (2:1:1), 3. soil: FYM (1:1), 4. sand:FYM:RH (2:1:1), 5. sand:soil:FYM:RH (1:1:1:1) and 6. sand:soil:RH (1:2:1) and the date of sowing were 1. October 30, 2021, 2. November 19, 2021, and 3. December 9, 2021. Each treatment combination was replicated four times. Results showed that germination, seedling length, and seedling vigor of buckwheat seed were affected by both organic soil media and the date of sowing. Germination was in the range of 87% to 98%. Seedling length ranged from 15 cm to 24 cm, and seedling vigor index ranged from 1309 to 2080 on 18-day-old seedlings. Organic soil media with the combination of sand, soil, and rice husk (1:2:1) and sowing date of November 19, 2021 were found to be the most suitable combination for seedling Vigor of buckwheat in Chitwan Nepal.

**Keywords:** Buckwheat, soil media, date of sowing

## **NAPA153: Effect of Plant Growth Regulators on Physiological and Agronomic Characteristics of Grass Seed Crops in Western Canada**

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In grass seed crops, plant growth regulators (PGRs) reduce plant height and lodging severity, thereby promoting reproductive success. A study was conducted to determine the effect of PGRs applied with and without spring topdress nitrogen (N) on various physiological and agronomic characteristics of forage seed crops at Beaverlodge Research Farm in northwestern Alberta, Canada in 2021. A field experiment laid out in split-plot design comprised PGR treatment as main plots and spring N topdressing through urea at 40 kg ha<sup>-1</sup> as subplots on three-year-old stands of creeping red fescue (*Festuca rubra* L. ssp. *rubra*), timothy (*Phleum pratense* L.), and meadow bromegrass (*Bromus riparius* Rehmann). Three types of PGRs - trinexapac ethyl, chlormequat chloride, and ethephon - were applied at 0.200 kg, 1.116 kg, and 0.600 kg a.i. ha<sup>-1</sup>, respectively, at the early-heading stage (BBCH Scale 40-49) of crop development. The PGRs did not affect photosynthetic quantum yield (PQY), normalized difference vegetation index (NDVI), spike length, internode diameter, lodging, and seed yield of all forage grasses but significantly affected the biomass of timothy and meadow bromegrass. Trinexapac ethyl reduced plant height, internode length, and biomass in timothy and meadow bromegrass compared to other PGRs. While spring-applied N did not affect plant height, spike length, biomass, and seed yield of creeping red fescue and meadow bromegrass, N addition increased timothy seed yield. This study revealed that the use of PGRs did not have consistent positive effects on the seed yield of grasses unless there was a likelihood of severe lodging. However, unusually high temperatures and intense drought in the spring and summer of 2021 might have masked the effect of PGRs and nitrogen addition on seed yields. Further studies under diverse lodging-prone environments are needed to determine if the use of PGRs is beneficial for enhancing grass seed crops.

**Keywords:** Plant growth regulators, N topdressing, PQY, NDVI, seed yield

## **NAPA154: Effect of Variety and Dates of Grafting on Graftage Success on Persian Walnut (*Juglans regia* L.) under open field conditions in Jumla district, Nepal**

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Long juvenile period, hard-shelled nature of the fruit of seed propagated plants, difficulty in grafting, and poor success rate have been the major concerns in walnut production. Our study will aid in the standardization of suitable techniques for the multiplication of high-yielding varieties to enhance competitiveness of walnut in the international market. A field experiment was conducted to identify the appropriate variety and date of grafting to optimize the graftage success in walnut under open field conditions in Jumla district, Nepal, in 2021. Two varieties, namely 'Hartley' and 'Payne,' were subjected to in situ tongue grafting on four different dates of grafting, such as March 14, March 21, March 28, and April 4, making up eight treatments, and the experiment was laid out in 2x4 factorial RCBD design. Each treatment was assigned with 20 grafts for observation with four replications per treatment. Various parameters including circumference of graft union, scion diameter, scion length, number of leaves per shoot, days to budburst, and percentage of grafting success, and saleable plants were measured during the experiment. Our experiment revealed a highly significant effect of variety and date of grafting on scion length, number of leaves, days to budburst, graft success, and saleable plants. The highest scion length (66.03 cm) was recorded on 'Payne,' while a maximum number of leaves (39.75) was observed on April 4, and the least (32.25) on March 14. Significantly earlier budburst was found in 'Payne' (55.87 days), whereas 'Hartley' took (61.59) days to bud burst. 'Hartley' variety exhibited a maximum graftage success rate of 81.56% and saleable plants of 75%, while least graftage success rate of 70.31% and saleable plants of 64.38% were found in 'Payne' variety. Similarly, the highest grafting success of 83.13% and saleable plants of 77.50% were recorded on April 4, while the least graftage success rate of 71.25% and saleable plants of 65.63% was recorded on March 21. In a nutshell, 'Hartley' variety exhibited higher grafting success rate with April 4 as the optimum time of grafting in Jumla condition. Grafting in the first week of April using 'Hartley' variety is suggested to walnut growers of similar agro-climatic conditions to optimize the graftage success.

**Keywords:** walnut, scion, in-situ tongue grafting, callus, graftage

## **NAPA155: Using the Oxford Nanopore Technology to Sequence the Genome of Tetraploid Blackberry**

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Blackberries are rich in anthocyanins, antioxidants, and flavonoids and are considered a “superfood” with multiple health benefits. Consumption of blackberries in the United States and the world has been increasing. Commercial production of blackberries is expanding in many regions, including the southeast United States. There is an increasing demand for more efficient breeding and the introduction of new blackberry cultivars with better adaptation to subtropical regions, increased sweetness, enhanced shipping quality, and extended shelf life. As demonstrated in other rosaceous crops, genomics tools can increase the efficiency of plant breeding. So far, only the genomes of two old diploid blackberry cultivars have been sequenced. The lack of tetraploid genome sequences, a limited number of transcriptome studies, and the lack of large high-throughput marker collections have limited the development of genomics and molecular tools for application to blackberry breeding. The objective of this project was to assemble a genome for a tetraploid blackberry line that resulted from a cross between two commercial varieties, Prime-Ark® Traveler and Prime-Ark® Freedom. Prime-Ark® Freedom is the world’s first commercial thornless primocane-fruited blackberry, while Prime-Ark® Traveler is also a thornless primocane-fruited blackberry and has shipping-quality fruit. The genomic DNA of this new breeding line was sequenced using the Oxford Nanopore Technology (ONT). Approximately 160Gb sequence data with a read N50 of 15,409 were obtained, covering the genome 160X. The longest reads with approximately 40X genome coverage were used for error correction. A total of 1.3 million error-corrected reads (~40Gb) with N50 of 29,022 bp were subjected to de novo assembly using canu/1.8. Canu assembled the genome into 5,616 contigs with a total length of 1,078,629,771 bp and an N50 of 453kb. This draft genome will serve as a valuable resource to accelerate this crop's genetic analysis and breeding and related species.

**Keywords:** blackberry, genome, nanopore, tetraploid, reference

## **NAPA156: Integrated Nutrient Management in Sesame in Lamahi, Dang**

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Sesame (*Sesamum indicum L.*) is a nutrient-exhaustive crop, although less soil fertility with the suboptimal application of fertilizers causes nutrient depletion and lower yield. The use of sole inorganic fertilizers in large amounts without soil physicochemical analysis can undermine soil fertility, crop productivity and profitability. Therefore, the application of organic fertilizers combined with or without chemical fertilizers is a sustainable way to enhance crop productivity and soil fertility. A field experiment was carried out to study integrated nutrient management in sesame at Lamahi, Dang district, Nepal, starting in September 2021. The experiment was laid out in RCBD with the application of both organic and inorganic fertilizers including urea, single super phosphate (SSP), Muriate of Potash (MOP), and farmyard manure (FYM) and sulfur in ten different treatments. The results revealed that the highest plant height, number of branches, capsule length, no of capsules per plant, and seed number per capsule were found in 40 kg/ha N application, S + 40 kg N from FYM, followed by 30 kg/ha S + 30 kg N from FYM. These plant parameters were found lowest in unfertilized control, i.e., no fertilizer application. Application of FYM and sulfur + 40 kg/ha and 40 kg/ha N, respectively, resulted in significantly higher grain yield (1238.9 kg/ ha), while lowest grain yield (1094.4 kg/ha) was recorded in the controlled plots. The benefit-cost ratio was found to be highest (2.6) in 40 kg N through urea, whereas the lowest (2.4) was found in unfertilized control.

**Keywords:** integrated, farm yard manure, sulfur, yield, and yield components

## NAPA157: Achieving Water, Energy, and Food Security in Nepal Through Nexus Approach to Development

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Nepal's agriculture sector contributes 29% to the national GDP and provides employment for about 60% of the economically active population. The agricultural development planning in the country follows the sectoral silos approach, failing to understand the intricate nexus among water, energy, and food (W-E-F) production and the protection of the environment. This paper identifies problems and causes of low agricultural productivity and demonstrates that abundant water resources are available for irrigation of existing rainfed lands to increase agricultural productivity and meet the multi-sectoral energy requirements of the country. It presents three case studies on the application of the nexus framework to improve W-E-F productivity. The first two pertain to multi-purpose development projects under the construction phase in Nepal, while the third pertains to greenhouse gas emissions reduction through conservation agriculture-based sustainable intensification at field level across the Eastern Indo-Gangetic Plains, including two Terai districts of Nepal. The paper provides a perspective on the importance of the W-E-F nexus as an integrated planning framework to address the integral issues and achieve the SDGs for developing countries. It argues that the developing countries whose economies are primarily dependent on natural resources cannot afford to ignore the W-E-F nexus framework to meet the growing needs of water, energy, and food and the sustainability of the natural resource base for the current and future generations. It further discusses the necessity of the nexus perspective for the sustainable development of Nepal, where water resources are central for the generation of energy and the development of irrigation infrastructures to increase food production. This enhances a circular relation among the nexus elements in which water becomes the key and central element driving the circularity of the nexus. This is critically important for Nepal because water is the only abundant resource available. It must be utilized by integrating hydro-energy development, irrigation infrastructures, flood control, and human and industrial consumption.

**Keywords:** water-energy-food nexus, multipurpose development, climate-smart technology.

## NAPA158: Evaluating Local Botanicals for Control of Red Flour Beetle, *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae) in Sorghum Grain in Niger

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In Niger, *Sorghum bicolor* (L.) Moench, is the second major subsistence crop after pearl millet, *Pennisetum glaucum* (L.) R. Br. Insect pests damage sorghum during production and storage, thus reducing the quantity and quality of grain. Worldwide, beetles and moths are among the most destructive pests, which damage 5-35% of stored grain, and can destroy over 40% of the grains in tropical countries. To control storage insect pests, farmers rely on insecticides that are costly and toxic to the environment. Alternative strategies are needed to manage storage pests effectively. In Niger, farmers identified eight plants with chemical properties as substitutes for insecticides. The botanical products are used without scientifically based formulations. Trapping studies revealed infestation of six insect species on sorghum grains in different storage facilities. *Tribolium castaneum* (Herbst) was the dominant species. Adults are 4-mm reddish-brown beetles. Excreta, exuviae, and dead bodies of the insects contaminate stored grain. The principal objective was to assess powders of local botanical plants to prevent damage by *T. castaneum* in stored grain. *Azadirachta indica* and *Parkia biglobosa* botanical powders at 0.1 g per 5 g of sorghum grain (2% by volume) killed >2.5 *T. castaneum* adults. At 0.2 g, *Hibiscus sabdariffa* and *Adansonia digitata* killed 1.4-2.6 and 2.0-2.5 adults, respectively. Damage scores were low (1.3-2.6) for sorghum treated with >0.01 g of botanical powder, compared to the check (3.9). Damage by *T. castaneum* scored 3.3 in sorghum treated with 0.05 g of *A. digitata*. Botanical products can be cost-effective and safe for managing post-harvest insect pests, thus guaranteeing quantity and quality grain and improving food security for small-scale farmers.

**Keywords:** Sorghum, *Tribolium castaneum*, local botanicals, and alternative strategies

## **NAPA159: Effect of Rooting Hormone and Media on Vegetative Propagation of *Bougainvillea glabra* cv. Single Pink Through Hardwood Cuttings**

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An experiment was carried out to study the effect of various rooting hormones and growth media on hardwood cuttings of *Bougainvillea glabra* cv. Single Pink at Gauradaha Agriculture Campus, Jhapa, during April - July 2021. The experiment was conducted in two-factor Randomized Complete Block Design (RCBD) with eighteen treatments and three replications. The result showed that the effect of rooting hormones was not significant, but media was found significant for most of the parameters studied. Sand + cocopeat mixture was superior to other media [sand + farmyard manure (FYM), and soil + FYM] for cutting propagation success. The sand + cocopeat medium resulted in earliest sprouting (7.9 days), the lowest number of days to sprouting (11.5 days), and the highest sprouting percentage (81.5%). Similarly, the number of leaves per cutting (14.5), length of sprouts per cutting (19.7 cm), diameter of sprouts (0.32 cm), shoot fresh weight (6.2 g) and shoot dry weight (1.4 g) were also recorded maximum in sand and cocopeat mixture. Number of roots per cutting (29.9), length of root (11.0 cm), root fresh weight (1.15 g), root dry weight (0.13 g), rooting percentage (100%), and transplanting success percentage (97.2 %) were also observed maximum in the sand + cocopeat mixture. Therefore, the present study revealed that the use of the correct media (sand + cocopeat) is more crucial than rooting hormones for successful vegetative propagation.

**Keywords:** Cocopeat, Hardwood cuttings, Media, Rooting, Sprouting

## **NAPA160: Potential of Crop Simulation Models to Increase Food and Nutrition Security under a Changing Climate in Nepal**

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With current trends of increasing population, decreasing arable land, and low yearly increment rate of cereal productivity, Nepal has an annual deficit of >1.3 million tons of edible rice, wheat, and maize. This indicates the urgent need for demand-led agricultural interventions to improve cereal crops productivity for food security. However, no review work has been conducted on the potential applications of crop simulation models and their relevance in Nepal. This study aims to review and synthesize the relevant studies on the development and application of crop simulation models for major cereal crops: rice, wheat, and maize. We reviewed over 93 published papers and reports from South Asia and Nepal available in Scopus, SpringerLink, and ScienceDirect using the Google search engine. Analysis revealed that potential yield gaps of 10-12, 5-8, and 11-15 t ha<sup>-1</sup> exist in rice, wheat, and maize crops, respectively. To achieve self-sufficiency in cereal grains by 2030, the average national productivity of rice, wheat, and maize need to be increased to 5.7, 3.9, and 4.9 t ha<sup>-1</sup>, respectively. Based on the reviews, climate change has both positive and negative consequences on cereal production across all agro-ecological zones. Crop simulation models have been applied for enhancing crop productivity and exploring adaptation strategies for climate change resilience. Models are capable of generating various recommendations related to biophysical factors: crop, water, tillage, nutrient, pest management, crop yield, and weather forecasting. Furthermore, models have shown the potential to determine the effects of climate change on crop productivity across a range of environments in Nepal. Crop simulation models could be useful decision support tools for policy planning and implementation, increasing efficiency in research, prioritizing research and extension interventions for increasing crop yields, and for achieving food and nutritional security and the Sustainable Development Goals 1, 2, and 13.

**Keywords:** model application; food security; climate change; yield gap; decision support

## **NAPA161: Comparative Efficacy of Integrated Fungicide, Insecticide, and Blocking Agent to Manage *Phytophthora* Root Rot and *Ambrosia* Beetles in Flood Stressed Flowering Dogwoods**

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Phytophthora root rot is a devastating soil-borne disease of woody ornamental crops. Ambrosia beetles are another notorious pest attracted to trees weakened from biotic and abiotic stresses. The severity of root rot disease and ambrosia beetle infestation increases when plants are exposed to flooding conditions. In this study, an integrated approach was used for managing both the root rot disease and Ambrosia insect via application of mefenoxam (fungicide), permethrin (insecticide), and charcoal + kaolin (crop protectant) either alone or in combinations and compared with inoculated and non-inoculated controls. Mefenoxam (drench) and permethrin (spray) were applied 21 days and two days before flooding, respectively, while charcoal + kaolin was sprayed two days after flooding. Inoculation of the trees with *Phytophthora cinnamomi* was done three days before flooding. Flooding was ensured for 21 days, and ambrosia beetle attacks were recorded every other day. Plant growth data were recorded at the beginning and end of the study. In the end, roots and beetle attacks were assessed for disease severity and the presence of larvae, adults, and eggs, respectively. Root samples were placed in the PARPH-V8 medium to determine the pathogen recovery. All treatments significantly suppressed disease severity compared to the inoculated control, except inoculated trees treated with either charcoal + kaolin alone or permethrin combined. All treatments except inoculated trees were treated with charcoal + kaolin alone, and both controls had significantly fewer beetle attacks than the inoculated control. The combination of mefenoxam and permethrin showed promising results for integrated management of ambrosia beetles and Phytophthora root rot.

**Keywords:** Oomycete, soil-borne pathogen, fungicides, insecticides, woody ornamentals

## **NAPA162: Efficacy of Biological Treatments Against Root-Knot Nematode (*Meloidogyne* spp.) in Okra at Nawalparasi East, Nepal**

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Root-knot nematode (*Meloidogyne* spp.) is an important soil-borne pathogen affecting several vegetable crops, including Okra. An experiment was conducted to assess the management strategy against root-knot nematode in okra variety Arka Anamika in field condition of Nawalparasi, Nepal, between February to June 2021. The experiment was carried out in a randomized complete block design using seven treatments, each replicated three times. The treatments consisted of application of A-Arya 009, Abamectin, neem cake, *Pseudomonas fluorescens*, *Trichoderma viride*, *T. viride* + Spent Mushroom Substrate (SMS), and control. All the treatments showed a significant reduction in the percentage of disease ( $p < 0.001$ ) compared to the control treatment. Abamectin was the most effective in reducing root infection (69.57%), followed by neem cake (56.52%), *P. fluorescens* (47.83%), *T. viride* + SMS (34.78%), and *T. viride* (34.78%). The A-Arya 009 had the least effect on disease severity reduction (17.39%) compared to the control. The highest yield (45.45%) was recorded in neem cake treated plants, followed by Abamectin (38.22%), *T. viride* + SMS (32.28%), *P. fluorescens* (32.02), *T. viride* (31.67%), and the least yield improvement was recorded in A-Arya 009 (15.77%). A significant negative correlation ( $p < 0.001$ ) was found between gall index and total yield implying heavy losses with the progression of root infection. The study concluded that neem cake and Abamectin are effective biological treatments for managing root-knot nematodes and improving the yield of Okra.

**Keywords:** *Trichoderma*, *Pseudomonas*, and Abamectin

### **NAPA163: Scope of Connecting Food and Culture to Disseminate Message Related to Agrobiodiversity Conservation: A Case of Bala Chaturdashi in Panchase Area**

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For generations, farmers and peasant groups have been practicing Agrobiodiversity conservation along with cultural preservation. Ancestors have been celebrating different festivals and rituals for natural resource management. But due to modernization and technological advancement, people have neglected the importance of socio-cultural values crucial for biodiversity conservation and have imposed modern techniques without due consideration of their potential impacts economically and sustainably. Based on ethnobiological field observations conducted in the Panchase Area of Central Nepal, we tried to explore how culture has played a crucial role in conserving and managing agrobiodiversity by creating emotions in people by linking it with a deity or with their beloved ancestors. Through key informant survey, informational discussions, field observation, and verifying the information with learned scholars and ancient sacred texts, this paper articulated the interconnectedness between culture and agrobiodiversity management through the case study of Bala Chaturdashi, the annual Nepali festival observed in holy places of Nepal where people offer variety of seeds, fruits and wild fruits for their departed ancestors. In the current situation of declining traditional crops and seeds, this festival is encouraging people to conserve and manage seed diversity. This festival also indicates the co-existence and our role as humans to provide ecological services to other living organisms. Spiritual and cultural practices should be considered key elements for biodiversity management, and practices which disseminate the message of in situ conservation can be an efficient, cost-effective, and sustainable method for seed conservation and food diversity management and should be considered in modern development works.

**Keywords:** Cultural value, Emotion management, Biocultural diversity, Traditional knowledge

### **NAPA164: Conservation Agriculture Technologies for Cropping Systems Sustainability and Food and Nutrition Security in Nepal**

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Recent global experiences on sustainable intensification of smallholder cropping systems show that improving food security and income with reduced production inputs and increased systems sustainability would be possible through the adoption of conservation agriculture (CA) technologies. CA aims to improve productivity, reduce production costs, increase farmers' income through reduced use of labor, energy and other farm inputs, and improve the sustainability of cropping systems mainly through resource-conserving technologies (RCTs). The review complimented the authors' own results from several on-station and on-farm experiments, mainly in the context of Nepal. The result demonstrated that the CA and RCTs practices, such as dry direct-seeded rice, unpuddled transplanted rice, and zero-tillage maize, wheat, and legumes with the retention of crop residues, can increase grain yields and profits and save labor and water use compared to conventional tillage practices. No or minimum tillage along with residue retention can also suppress weeds, increase the opportunity for crop diversification, improve soil Physico-chemical and micro-biological properties, enhance nutrient- and energy-use efficiencies, and reduce greenhouse gas emissions. CA and RCTs also have the potential for reducing soil erosion in sloping hilly areas and undulating land with narrow terraces. Despite several advantages, these technologies have not been fully mainstreamed in the national agricultural research and extension system of Nepal. Knowledge gaps among extension workers, farmers, and other citizens, unavailability of farm machinery, trade-offs in using crop residues for improving soil fertility and animal feed, land fragmentation, poor rural infrastructures, and inadequate policy support are the major adoption barriers of CA-based technologies in Nepal.

**Keywords:** Terai; hills; multi-criteria assessment; direct-seeded rice; zero tillage; SWOT analysis

## **NAPA165: Cover crop Usage for Sustainable Management of Soilborne Diseases in a Woody Ornamental Nursery Production System**

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The woody ornamental nursery industry has been greatly impacted by soilborne diseases leading to significant economic losses. Cover crop usage, which has been extensively explored in small fruit, vegetable, and row crop systems, could be a potential tool in suppressing soilborne diseases in woody ornamental nursery production. A field experiment was conducted to explore the role of a cover crop on soilborne disease suppressiveness in woody ornamental nursery production systems. Soils from red maple (*Acer rubrum* L.) plantations grown with and without cover crop species crimson clover (*Trifolium incarnatum* L.) were sampled following the senescence of the cover crop. Greenhouse bioassays were conducted in a completely randomized design using red maple cuttings inoculated with *Rhizoctonia solani*, *Phytophthora vexans* or *Phytophthora nicotianae* and non-inoculated field soils and replicated ten times (N=80). Plant height, total plant and root fresh weights were measured, and plant roots were assessed for disease severity using a scale of 0 to 100% roots damaged. Also, soil samples from cover crop fields were analyzed for soil health parameters. Results showed that cover crop usage significantly reduced root rot disease severity in maple plants. Plants grown in cover cropped soil had higher total plant and root fresh weights. Soil organic matter, soil nitrogen, and bacterial pseudomonad populations were higher in cover cropped soil than in non-cover cropped. There were no significant differences in plant height within the treatments. Our results suggest that cover crops can reduce root rot disease by improving plant growth and soil properties. Thus, cover crop usage can improve woody ornamental production efficiency by reducing pressure from soilborne diseases.

**Keywords:** Woody ornamentals, root rot disease, cover crop, soil and plant health

## **NAPA166: Influence of Different Tillage Methods and Weed Management Practices on Weed Dynamics and Productivity of Winter Maize in Chitwan, Nepal**

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An experiment was conducted to study the effect of tillage and weed management practices on weed dynamics and grain yield of winter maize at the research station of the National Maize Research Program (NMRP), Rampur, Chitwan, Nepal, during the winter of 2016/17. The experiment was laid out in split-plot design using two tillage methods (zero tillage and conventional tillage) as the main plot factor and seven weed management practices (farmers' practices - two hand-weedings; cowpea co-culture; stover mulch; dry mulch as paddy straw and *Cassia tora*; pre-emergence tank mix application of atrazine @ 0.75 kg ha<sup>-1</sup> and pendimethalin @ 2ml L<sup>-1</sup> of water followed by 2,4-D; one hand weeding followed by 2,4-D with control treatments weed free and weedy check) as subplot factor with three replications. The result showed that among tillage methods, conventional tillage produced comparatively higher grain yield (4712.6 kg ha<sup>-1</sup>) than the grain yield produced by zero tillage (4681.7 kg ha<sup>-1</sup>). Among the weed management practices, dry mulch treatment produced the highest grain yield of 5698.4 kg ha<sup>-1</sup>, while weedy check produced the lowest grain yield of 2588.6 kg ha<sup>-1</sup>. Similarly, the weed management practice of dry mulch recorded the highest weed control efficiency of 74.7% and the lowest weed index of 13.3%. Mulching materials such as maize stover, paddy straw, and a byproduct of *Cassia tora* significantly suppressed the weed infestation and thereby increased the grain yield.

**Keywords:** weed, maize, mulch, tillage



## NAPA167: Study on the Antifungal Activity of Essential Oil of *Ocimum Sanctum* in Chitwan Nepal

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*Ocimum sanctum* Linn. (Rama Tulsi) is a plant with a lot of medicinal importance. Its essential oil can be used to produce medicine for various human diseases, antifungal medications, and mosquito repellents. This experiment was done to evaluate the phytochemical composition and antifungal activity of essential oil of *O. sanctum* against *Fusarium oxysporum* f.sp. *lycopersici* and *Bipolaris maydis*. Phyto-chemical analysis of essential oil was done by GC-MS analysis. A factorial combination of five different growth stages and four concentrations of essential oil (100, 200, and 300 ppm and control) with four replications was carried out for antifungal analysis. Eugenol, caryophyllene, methyl-eugenol, and  $\alpha$ -selinene were the major compounds detected in essential oil. Different concentrations of essential oil at different growth stages significantly affected the fungal growth under laboratory conditions. The 200 and 300 ppm concentrations of essential oil effectively controlled the growth of *Fusarium oxysporum* f.sp. *lycopersici* and *Bipolaris maydis*, regardless of growth stages. On lowering the concentration, essential oil of the 5<sup>th</sup> growth stage (flowering stage) had the highest antifungal activity, whereas the 1<sup>st</sup> growth stage (vegetative stage) had the lowest antifungal activity. Eugenol content was detected to increase along with the maturation days, indicating that it was responsible for the antifungal property of the essential oil.

**Keywords:** hydro-distillation, phyto-chemicals, essential oil, *Ocimum sanctum*

## NAPA168: Prospects of Cropping Systems Diversification with Perennial Forage Seed Crops in Western Canada

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Increasing functional diversity and integration of perennial crops in cropping sequences can enhance ecosystem services of cropping systems. Appropriate cropping sequence allows effective termination of preceding perennial crops, enhances the establishment of succeeding crops, and generates rotational benefits in productivity, profitability, and environmental health. A cropping sequence study attempted to examine the agroecological performance of cropping sequences integrating perennial forage seed crops in cropping systems. A replicated field experiment in split-plot design comprised eight cropping sequences as the main plot and three levels of N as sub-plot factors. Cropping systems yields expressed as canola equivalent yield (CEY), gross margins, and various soil property parameters such as aggregates, permanganate oxidizable C, microbial biomass C, and enzymatic activities of  $\beta$ -glucosidase, N-acetylglucosaminidase, acid phosphomonoesterase, and arylsulfatase were compared. Perennial legumes grown as biennial seed crops in the sequences replaced the N fertilizer requirement for succeeding wheat and canola crops by up to 90 and 45 kg N ha<sup>-1</sup>. Crop rotations between annual and perennial crops showed promising effects on agronomic and soil health parameters. However, short intervals between perennial seed crops in the cropping sequences posed difficulty in the termination of previous crops leading to the impaired establishment, volunteer competition, and poor performance of following crops. Among the test crops, wheat followed by canola may be suitable transition crops in the cropping sequence following perennial legume seed crops, while peas followed by canola may be suitable transition crops after perennial grass seed crops enhancing the agro-ecological performance of cropping systems. Further studies are needed to assess nutrient use efficiencies and the environmental health of different cropping sequences.

**Keywords:** annual, canola equivalent yield, cropping sequence, perennial, seed

## **NAPA169: Variance Component Analysis Among Amaranth Genotypes in Mid-hill of Nepal**

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Amaranthus is pseudo-cereal grown since ancient civilization. This experiment aimed to evaluate genetic parameters as the basis for further breeding activities of this crop. Fifteen accessions brought from NARC were experimented in alpha lattice design with three replications at Sundarbazar, Lamjung, Nepal, during 2021. We observed significant differences for 13 quantitative traits except for two traits, i.e., stem girth and days to true leaf emergence under study. Accession NGRCO 6977 had the highest grain yield followed by CO 2435 whereas CO 6124 had the lowest grain yield. The phenotypic coefficient of variation (PCV) values were slightly higher than the genotypic coefficient of variation (GCV), revealing a lower influence of environment in character expression. High PCV and GCV were found for the number of panicles, panicle length, number of inflorescence, inflorescence length, number of branches, number of leaves, grain yield, days to 1<sup>st</sup> inflorescence, and petiole length, which means selection based on these characters can be used for genetic improvement. High heritability was found for the number of panicles, length of panicle, inflorescence length, number of inflorescences, number of leaves, days to 1<sup>st</sup> inflorescence, grain yield, number of branches, and leaf length; this signifies these traits could be successfully transferred to next generations if properly used in hybridization program. Grain yield exhibited a positive and significant correlation with plant height, leaf length, leaf width, petiole length, number of inflorescence, inflorescence length, number of panicles, panicle length, thousand seed weight. The number of leaves had a highly significant positive correlation with the number of branches. The highest direct effect and a high correlation coefficient were shown by the number of panicles followed by panicle length, 1000 grain weight, days to 1<sup>st</sup> inflorescence, number of leaves, respectively, which suggest these traits can be used for grain yield selection and improvement programs.

**Keywords:** amaranthus, correlation, GCV, heritability, PCV

## **NAPA170: Comparing Vegetation Phenology and Eddy Fluxes during Non-Growing Seasons in Native Tallgrass Prairie Systems in the U.S. Southern Great Plains**

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Carbon dioxide (CO<sub>2</sub>) fluxes and evapotranspiration (ET) during the non-growing season can contribute significantly to annual carbon and water budgets. Comparative studies of dynamics of CO<sub>2</sub> fluxes and ET during the non-growing season in differently managed native tallgrass prairie systems from different landscape positions under the same climatic regime are scarce. Thus, the objective of this study was to compare dynamics of satellite-derived vegetation phenology (enhanced vegetation index, EVI and normalized difference vegetation index, NDVI), eddy covariance measured CO<sub>2</sub> fluxes, and ET in six native tallgrass prairie systems during non-growing seasons (November through March). For the December-February period, vegetation phenology (EVI and NDVI) and eddy fluxes were similar across all pastures, but some differences were observed during March due to the influence of weather conditions and management practices such as burning. Results illustrated interactive effects of burning and rainfall on vegetation phenology as revealed by the positive impacts of the combination of prescribed burn and non-drought conditions, and negative impacts of prescribed burn during drought conditions. This study provides better understanding of dynamics of vegetation phenology, CO<sub>2</sub> fluxes, and ET in native tallgrass prairie systems in the U.S. Southern Great Plains. This information is also crucial to improve our understanding of regional carbon and hydrologic cycles.

**Keywords:** burning, CO<sub>2</sub> fluxes, drought, evapotranspiration, grazing

### **NAPA171: Prospects of Advanced Viticulture in Nepal**

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Grape (*Vitis vinifera*) is widely cultivated worldwide and it typically prefers the Mediterranean climate. However, the development of adaptive cultivars, dynamic vine management practices, and the use of plant growth regulators has extended the cultivation of grapes to warm regions such as tropics and subtropics. Grape cultivation in Nepal started decades ago, but grape still occupies a mere cultivation area and negligible production volume, limited to few farms, research stations, and home gardens. Nepalese viticulture is suffering from a narrow range of germplasms, lack of knowledge in grapevine phenology, suboptimal chilling, abundance of diseases, inadequate vineyard management, and limited research. Based on research done during the late 1900s, monsoon-associated diseases, especially anthracnose, coinciding with the harvesting period, have been considered to be the bottlenecks of viticulture in Nepal. This study analyzes the advancements in viticulture, aiming to establish successful grape cultivation in Nepal. The study is primarily based on desk review, expert advice, case studies and experiences of select vine growers in Nepal. The study shows that more than 90% of the fresh or processed grapes consumed in Nepal is imported and the trend has been accelerating in recent years due to the growth in population and improvement in the purchasing capacity of individuals. Selection of early-season cultivars, forcing budburst by application of bud breaker aiming to prepone harvesting time before monsoon, and vertical shoot positioned trellis aiming to reduce the humidity within canopy are important vine management strategies for the successful viticulture in Nepal. A well-funded research program in viticulture is needed to establish a successful grape production in Nepal.

**Keywords:** grape, viticulture, Nepal, climate, vineyard

### **NAPA172: Spikelet Sterility in Spring Rice Cultivars Under Different Planting Methods at Western Terai of Nepal**

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Rice contributes significantly to the livelihood of a majority of people and the national economy in Nepal. An on-station trial was conducted at agronomy farm of Paklihawa Campus, Rupandehi from February to July, 2021 to evaluate the performance of spring rice cultivars against planting method. The trial was set up in split plot design consisting of two crop establishment methods, i.e., Direct Seeded Rice (DSR) and Transplanting Rice (TPR) as main factor and seven cultivars as sub-factor, each replicated three times. The seven cultivars were five released varieties (Hardinath-1, Hardinath-3, Hardinath Hybrid-1, Hardinath Hybrid-3 and Chaite-5) and two promising varieties (IR-15L-1008 and PR-126). 100% spikelet sterility was observed at maturity stage (115~125 DAS) in all the cultivars and planting methods due to high temperature induced heat stress. Plant height (94.89 cm), leaf area index (5.02) and panicle weight (1.39 g) at 120 DAS were higher in TPR. Spikelet fertility was observed at 145~155 DAS, when yield attributing characters like panicle length (22 cm), grains per panicle (130), thousand grain weight (19.8 g), above ground biomass yield (8.2 tons/ha) and spikelet fertility (75.6%) were found better in TPR. IR-1008 had better plant height (94.54 cm), panicle weight (1.39 cm) and grains per panicle (130.13), however it is not suitable for spring season due to long duration (140 DAS). Chaite-5 (84.47 %) and PR-126 (84.62 %) had significantly ( $p < 0.005$ ) higher spikelet fertility at 150 DAS, so these could be promising cultivars for spring season. Result was inconclusive regarding the suitable cultivars for spring season due to spikelet sterility. Therefore, future research should focus on selection of elite heat tolerant cultivars and adjustment of sowing date that could escape the critical period of high temperature during reproductive phase of spring rice at Western Terai of Nepal.

**Keywords:** direct seeded rice, flowering stage, high temperature stress, transplanting rice

## **NAPA173: Evaluating Greenhouse Gas Fluxes in Grain Sorghum Production System in the Southern Great Plains**

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While the majority of studies focus only on carbon dioxide, only limited studies are conducted at the field scale level to estimate other greenhouse gases (GHG) emissions from the agricultural production systems. The spatial and temporal variations in a production system affect the dynamics of GHG production. We conducted a study in the no-till sorghum production field in the Texas High Plains to measure carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), and methane (CH<sub>4</sub>) continuously in the grain sorghum production region. Specific objectives of the study were to study diurnal variation in GHG fluxes and model variation in fluxes using soil microclimatic factors. A LICOR Eddy covariance system and Aerodyne Tunable Infrared Laser Directed Absorption Spectroscopy (TILDAS) were installed at the center of a 37-ha grain sorghum production plot. High frequency (10Hz) GHG concentration data were collected for the entire crop growing season. Data showed a similar diurnal flux pattern of N<sub>2</sub>O and soil heat flux (SHF). The highest N<sub>2</sub>O flux was observed during three visible collared leaves (V3) growth stage and substantially decreased from the four visible collared leaves (V4) stage to maturity. Carbon dioxide flux was positive (from the ground) in the early growth stage but showed a negative flux from the V4 plant growth stage to maturity, indicating carbon sequestration in the plant. The methane flux varied greatly over the season and had irregular flux patterns. The preliminary results showed that the modeling of GHG may be possible using soil heat flux data. However, it is necessary to use more years of data to draw a conclusion.

**Keywords:** greenhouse gas emission, grain sorghum, semiarid

## **NAPA174: In-vitro Evaluation of Chemical Fungicides and Botanicals against *Pestalotia longisetula* Fruit Rot of Strawberry**

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Fungal diseases are the major production constraints of strawberry farming in Nepal and can infect all plant parts, including flowers, fruits, leaves, crowns, and roots, reducing fruit yield, and quality. Fruit rot caused by *Pestalotia longisetula* is a key fungal disease of strawberry in Nepal that exerts heavy yield loss and remains particularly severe during the rainy season. The objective of this study was to establish an effective disease control approach using fungicides and botanical extracts. Ten currently available fungicides [Captan 48WP (Captan), Carbendazim 50WP (Bavistin), Propiconazole 25% (Rezole), Mancozeb 75WP (All M-45), Carbendazim 12%+ Mancozeb 63WP (Surya Safe), Metalaxyl 8%+ Mancozeb 64WP (Redomill), Hexaconazole 10%+Carbendazim 25% (Dibya Hexaplus), Copper oxychloride 50% (Blitox), Copper Sulphate (Bordeaux mixture), and Tebuconazole 50% + Trifloxystrobin 25% (Nativo)], each with three concentrations (50PPM, 100PPM and 150PPM), and extracts of four botanicals [Garlic, Onion, Ginger, Onion+Garlic+Ginger] @ 5%, 10% and 15% were evaluated using the 'poisoned food technique' in a completely randomized design with three replications in laboratory conditions. Rezole, All M-45, Dibya Hexaplus, and Nativo showed mycelial inhibition >95% at all three concentrations, whereas Blitox showed the least mycelial growth inhibition. Spore germination inhibition was 99% in the Rezole, Nativo, All M-45, and Bordeaux mixture, whereas Blitox and Bavistin showed minimal inhibition. Among botanicals, garlic showed maximum inhibition of both mycelial growth and sporulation, whereas onion and ginger extract showed minimum inhibition. The chemicals found most effective might be due to their site of action against pathogens and bio-physiological responses of those pathogens. In contrast, botanicals were found effective because of their active components, affecting the metabolism and inhibiting the growth and sporulation of the pathogen.

**Keywords:** botanicals, fungicides, growth inhibition, *Pestalotia longisetula*

## **NAPA175: Effect of Phosphorus and Row Spacing on Performance of Mungbean (*Vigna radiata*) Under Rainfed Conditions**

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Phosphorus is known for its role in root growth and nodulation while plant density determines the resource access, thus, affecting the biomass of food legumes. A factorial experiment was conducted in randomized complete block design in Sundarbazar, Lamjung to study the effect of different levels of phosphorus, row spacing and their interactions on mungbean in the sub-tropical region of Nepal. Three levels of row spacing (20, 30, 40 cm) and four levels of phosphorus (0, 20, 40, 60 kg P ha<sup>-1</sup>) were used as treatments. In the experiment, row spacing failed to influence the underground growth as exhibited by root length, root weight, and root nodule formation, while the parameters increased with an increase in the level of phosphorus, particularly the number of nodules per plant in 60 kg P ha<sup>-1</sup> treatment increased by 75.7 % than the unfertilized plots. Other morphological traits including plant height, number of branches, and yield components including pod set, pod length and seed weight remained unaffected by both use of phosphorus and row spacing. In contrast, the number of seeds per pod increased with phosphorus levels. Phenological parameters such as days to flowering, pod formation and physiological maturity were not influenced by any treatment combinations. However, the biomass yield and grain yield increased significantly with the application of phosphorus, while the trend exhibited decreasing with an increase in row spacing possibly owing to lower plant population per unit area. The study, therefore, suggests dense planting of Pratikshya variety of mungbean with increased phosphorus fertilization for better yields in the sub-tropical environment.

**Keywords:** mungbean, nodulation, phosphorus, rainfed, row spacing

## **NAPA176: In Search of Wisdom: Contemplating upon Culture, Agriculture and Scholarship in the Himalayas**

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Literature suggests that ancient scholars went to the Himalayas for *Tapashya*. This tapasya meant a pursuit of full-time scholarship or spiritual practice involving ascetic lifestyle. Deliberately renouncing material possessions, scholars here lived simply, humbly and frugally. Scholars of the time believed that this practice served the interest of their own lives as well as that of the society. They established ashrams or monasteries, which served as special sanctuaries of scholarship. They earned humble living either through viksha (alm), or by growing their own food. Today, through centuries of changes, money and market have taken the center stage of societies. Scholars are entrapped in the world of material possessions. Yet, there is no shortage of scholars who seek to explore the world beyond possessions. The Himalayas could still attract many scholars from around the world if there were sanctuaries for scholars and for pure scholarship. The influence of Himalaya-dwelling tapaswis once reached from Indonesia to Mesopotamia. It is unfortunate that the Himalayas no longer have provisions to sponsor *tapaswis*. There are no institutions where scholars could congregate. *Tapaswis* have no *tapasyasthal*. Old institutions of scholarships have long been vanquished. In that light, an initiative has been envisioned where there would be a sanctuary for scholars who dream to live humbly on their own and live a life of contemplation and pure scholarship without any pressure to earn money. The 21st century know-how that we possess, we must have the capability to reinvent the new system of culture, agriculture, and scholarship in pursuit of a healthy work-life balance. We are in need to revitalize our culture and agriculture that would nourish our body through minimum hardship while allowing ample time for intellectual development, creativity, and innovation. Therefore, an appeal is extended to revive the Himalayan landscape as an attractive place for full-time scholars who are in pursuit of true liberation and peace from within and outside.

**Keywords:** spiritual practice, agriculture, peace, meditation

## **NAPA177: Effects of Cover Crops and Bt (Cry 51 AA2) Technology of Thrips Population Dynamics in Cotton Seedling**

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Cotton (*Gossypium hirsutum*) requires a long growing period for fruit and fiber maturation, which makes it vulnerable to insect pests, thus affecting the seed cotton yield. Cotton thrips (Thysanoptera: Thripidae) is one of the major insects impacting cotton yield, specifically in the Texas High Plains. Field experiments conducted in Tennessee showed that the Bt-transgenic toxin (cry51Aa2.834\_16) was a better approach to manage thrips (Thysanoptera: Thripidae) in cotton than the insecticide-based approach, but the information on the use of Bt technology in thrips management in Texas, the largest contiguous cotton producing region in the world, is lacking. Thus, we aimed to review the available literature on the effects of cover crops and Bt-technology on the cotton thrips population. Preliminary results showed that Bt does reduce both thrips injury and numbers proving non-preference against tobacco thrips (*Frankliniella fusca*). Similarly, integrating cover crops into cotton production systems significantly reduced thrips count in the strip-tillage method. To broaden our understanding, field research is underway at the Texas A&M AgriLife Research Farm in Lubbock, which will help find the effect of cover crops on thrips population dynamics in seedling cotton and determine the efficacy Bt technology (cry51Aa2) against thrips population. We expect the terminated cover crops to generate residue that affects the response variables, including thrips population in seedling cotton, population dynamics, damage, crop growth profile, yield, and fiber quality. Similarly, the use of Bt cotton affects the thrips population as compared to non-Bt cotton along with IST (insecticide seed treatment) and foliar application of insecticide during the first true leaf stage of cotton, protecting the young seedling cotton.

**Keywords:** Seedling cotton, cover crops, Bt (CRY 51 AA2) technology, thrips

## **NAPA178: Yield Gap of Rainfed Alfalfa in the United States**

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Despite massive production and high nutritive and economic value, the yield and production of rainfed Alfalfa (*Medicago sativa* L.) have not been improved in the United States (U.S.), particularly in the Midwest and Southeast region, where more than 95% of alfalfa is grown under rainfed conditions. The magnitude of the yield gap in those states is unknown. The objective of this study was to estimate the yield gap of alfalfa grown under rainfed conditions in the U.S. Based on the rainfed production area and total production, we selected 393 counties from 12 U.S. States (Midwest and East regions) and estimated alfalfa growing season, growing season rainfall, attainable yield, water-limited potential yield, water use efficiency, and yield gap. We used 10-yr (2009-2018) of recorded yield and daily weather data of selected counties and estimated attainable yield using the frontier yield function and water-limited potential yield using the boundary yield function model. Furthermore, we created a conditional inference tree (CIT) to identify major yield-limiting factors. Our frontier model predicted a mean attainable yield of 9.6 Mg ha<sup>-1</sup> and originated a mean yield gap of 29%. The boundary function model predicted a mean water-limited potential yield of 15.3 Mg ha<sup>-1</sup> and originated a mean yield gap of 54%. The potential alfalfa water use efficiency was found to be 30 kg ha<sup>-1</sup> mm<sup>-1</sup>, with mean evaporation of 163 mm (or 24% of mean growing season rainfall). The CIT analysis confirmed that the growing season rainfall is the main yield limiting factor for the rainfed states followed by minimum temperature. The findings of this study could be useful to alfalfa producers, farm managers, researchers and policymakers to minimize the current yield gap in alfalfa.

**Keywords:** Rainfed alfalfa, yield gap, frontier yield function, linear boundary function, conditional inference tree

## **NAPA179: Combined Heat and Drought Stress on Soybean Physiology, Pollen Germination, and Yield**

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The combination of heat and drought stress often occurs simultaneously in the field condition impacting the physiological, reproductive, yield, and quality of soybean. However, the combined effect of these stressors has not been well explored. In this study, ten soybean varieties were subjected to four different treatments (32°C daytime with soil moisture content, replacing 100% of evapotranspiration (ET), control), heat (38°C daytime+100% ET), drought (50% ET+32°C daytime), and heat and drought (38°C+50% ET) during early pod filling stage from May to October 2021 at Mississippi State University. Treatment impacts on pollen germination, soybean physiology, and yield components were quantified. Significant variation was observed among treatment, varieties, and treatment-varieties interaction for all the parameters studied. The average of all measured parameters was lower in the combined stress treatment relative to the control treatment. Maximum reduction in pollen germination was observed under interactive stress (25%) followed by drought (17%) compared with the control. The chlorophyll content of soybean lines decreased (24%) under combined stress conditions compared with the control. Drought stress alone or in combination with heat stress decreased stomatal conductance (95% or 98%) and transpiration (82% or 91%). The pod weight was reduced by 48%, the pod number by 35%, the number of seeds by 42%, and pod weight by 43% under combined stress compared to control. The drought resulted in more damage than heat stress. On the other hand, combined heat and drought stress negatively affected pollen germination and yield components.

**Keywords:** abiotic stress, physiology, pollen germination, yield

## **NAPA180: Assessment of Agricultural Mechanization in Rice Cultivation and Its Challenges in Western Nepal**

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Nepalese farmers have reported significant labor shortages during the transplanting and harvesting time of rice crops. The labor shortage and other associated factors result in delay or even halt in rice transplantation, causing the rice fields to remain fallow in some cases. Substitution of labor with mechanization could help rice farmers achieve a higher potential yield, addressing a reported gap of around 45 to 55 percent. This study reports the situation in western Nepal based on household surveys conducted in Pyuthan and Kanchapur districts to assess the status of mechanization in rice cultivation and its challenges. Using a primary survey through in-person interviews of randomly selected 98 rice farming households in Pyuthan district and 87 rice farming households in Kanchapur district, we examined the adoption and extent of different mechanization used in different cultivation stages and estimated the mechanization level and power use per unit area. We found that the adoption of mechanization is completely lacking in transplantation, bund preparation, fertilizer application, and weeding and harvesting stages. Among the cultivation practices, the greatest extent of mechanization prevailed for main field tillage (averaged 90.92%), followed by threshing (averaged 85.24%), seedbed tillage (averaged 52.42%), and irrigation (averaged 20.10%). We found the average power per unit area around 4.67 horsepower per hectare of rice land. Unavailability of appropriate farm machinery and land fragmentation were the two major challenges to the mechanization of the production system. Extension activities aimed at increasing awareness and disseminating the economics of mechanization, and some facilitation in the supply and price of farm machinery could support the adoption of mechanization in rice production in Nepal.

**Keywords:** rice, farmers, adoption, mechanization, power tiller

## NAPA181: Status of Pests and Diseases of Apple and Farmers' Control Intervention in Jumla District of Nepal

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Survey research was carried out to assess major pests and diseases of apple and their management strategies adopted by the apple farmers in Chandannath municipality, Tatopani, Guthichaur, and Patarasi municipality of Jumla district. These areas were purposively selected as they were the major apple-growing regions in the district and recognized as Apple Superzone. A hundred respondents were selected using a simple random sampling method. Primary data were collected using a pretested semi-structured questionnaire, household survey, and key informant interview (KII). The secondary data were collected by reviewing relevant literature. The data were analyzed by using descriptive statistics through SPSS and MS Excel. The analysis showed that the major pests in the orchard were Woolly Apple Aphid, Stem Borer, and San Jose Scale, and minor pests were Tent Caterpillar and Root Borer. The major diseases in the orchard were Papery Bark, Apple Scab, and Powdery Mildew, and minor diseases were Root Rot and Fire Blight. The study showed that the households followed the cultural, mechanical, and biological methods of managing pests and diseases. Furthermore, 57 percent of the respondents adopted pests and disease management methods in their orchards. They followed the mechanical and cultural methods for pest and disease management. None of the farmers used the chemical method since the import of chemical pesticides and fertilizers was banned in the district after the district was declared an organic district in 2007. Among very few respondents adopting the biological method, pest control efficiency was found satisfactory. Very few of the respondents knew about IPM practices. However, there was no application of IPM tactics due to a lack of knowledge and training. The study showed that lack of knowledge of insect and disease identification among apple farmers and lack of technical guidance was the limiting factor for pest and disease management.

**Keywords:** diseases, pests, management methods

## NAPA182: Growth and Yield Parameters of Native Landraces of Rice (*Oryza sativa* L) Inoculated with *Trichoderma viride* and *Pseudomonas fluorescense* in Dang Valley in Nepal

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Native rice landraces are evolved with locally adaptive eco-physiological characteristics and have high nutritive and culinary values. However, they exhibit poor response to a high level of nutrients. The use of beneficial soil micro-organisms contributing to nutrient mobilization and induction of stress tolerance can effectively enhance input use efficiency in native landraces. A field experiment was conducted to evaluate the responses of three rice landraces (Anadi, Simtharo, and Tilki) of Dang to inoculants of *Trichoderma viride* and *Pseudomonas fluorescense* on phenology, economic and biological yield, plant height, panicle length, and filled grain percentage at Campus of Life Sciences Tulsiapur, Dang in Nepal in 2021. The experiment in split-plot design comprised four main plots of micro-organism treatments – *T. viride*, *P. fluorescense*, a combination of both and non-inoculated control, and three subplots – Anadi, Simtharo, and Tilki, with three replicates. Interaction between the landraces and beneficial micro-organisms along with relationship among various agro-morphological variables were examined. Simtharo, Anadi, and Tilki were in the order of higher to lower mean grain yield. Combined application of *T. viridae* and *P. fluorescense* increased the grain yield of Simtharo compared to its Correspondence control (3.07 t ha<sup>-1</sup> vs. 2.80 t ha<sup>-1</sup>;  $P < 0.05$ ), whereas Anadi and Tilki gave significantly higher yields of 2.62 t ha<sup>-1</sup> vs. 1.88 t ha<sup>-1</sup> ( $P < 0.05$ ) and 1.12 t ha<sup>-1</sup> vs. 0.53 t ha<sup>-1</sup> ( $P < 0.05$ ) respectively with the application of *T. viridae* compared to their Correspondence controls. Based on these results, the application of *T. viride* and *P. fluorescense* hold promise in enhancing yield in native landraces of rice. Implications for agronomic adaptation and further studies are also discussed.

**Keywords:** *Trichoderma*, *Pseudomonas*, landrace, rice



### **NAPA183: In-Field Degradation of Soil-Biodegradable Plastic Mulch Films in a Mediterranean Climate**

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Soil-biodegradable plastic mulch films are a promising alternative to polyethylene mulches, but adoption has been slow because of uncertainties about in-field degradation. The international biodegradability standard EN-17033 requires 90% degradation within two years in anaerobic incubation at constant temperature (20-28 °C). However, in-laboratory biodegradability does not guarantee in-field degradation will follow the same timeframe. Field test protocols are needed to assess biodegradable mulches under a range of environmental conditions and collate site-specific information to predict degradation. Our objectives were to (1) monitor in-field degradation of soil-biodegradable plastic mulches following successive applications and incorporations, (2) quantify mulch recovery two years after the final incorporation, and (3) compare in-field degradation with the laboratory standard in terms of calendar and thermal times based on a zeroth-order kinetics model. A field experiment was established in the spring of 2015 in Mount Vernon, WA testing five biodegradable mulches laid each spring and incorporated each fall until 2018. Mulch recovery was quantified every six months until fall 2020, two years after the final incorporation. While mulches were incorporated annually, recovery of visible fragments (>2.36 mm) was constant or decreased over time, indicating mulch deterioration kept pace with new additions. In fall 2020, mulch recovery was 4-16% of total mulch mass incorporated. After the final application, a zeroth-order kinetics model was used to analyze mulch degradation. Model extrapolations indicates it would take 21 to 58 months to reach 10% recovery (90% degradation), exceeding the laboratory standard's 24-month benchmark by 2.4. However, a better agreement between in-field and laboratory degradation rates is observed when thermal time analysis is done. While other factors, including soil type, soil moisture, and mulch fragment size, are also at play, thermal time, rather than calendar time, will be more applicable for assessing site-specific, in-field mulch degradation.

**Keywords:** soil-biodegradable plastic mulch films, biodegradation standard test, cumulative degree days

### **NAPA184: Soybean Cyst Nematode (*Heterodera glycines*) Management Through an Integrated Approach: Rotation of the Resistant Varieties, Compost, and Cover Crops**

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Soybean cyst nematode (SCN) is an economically devastating pathogen of soybeans in the United States and most soybean-growing countries worldwide. The most effective SCN management practice is the use of resistant cultivars. SCN causes significant yield loss due to the continuous use of cultivars derived from a single resistance source, resulting in selection for virulent populations. A four-year-long field study (2017-2020) was conducted to evaluate the impact of six rotation systems using varieties derived from Peking/PI 548402 (PDV) and PI 88788 (8DV) on the SCN population development, virulence, and yield. SCN population levels were significantly lower in the PDV/8DV cultivar rotation in 2018 compared to the PDV/S cultivar rotation. In 2020, SCN population levels were the lowest in the 8DV/PDV/8DV/PDV rotation system and highest in PDV/PDV/PDV/PDV system. In 2017, there were no substantial soybean yield differences among the system, but for the remainder of the trial, the PDV/8DV rotations had the highest yields. Evaluation of other SCN management practices like compost/manure and cover crops is still ongoing. From 2021 we had field trials monitoring SCN development when exposed to various composts (swine manure, poultry manure, and layer ash blend) and cover crops (cereal rye, clover, oilseed radish, and white mustard) near Monroe, Michigan. In addition, laboratory assays on the effect of various composts on SCN egg hatching and juvenile mortality are going on. To support the field trial results, greenhouse trials were also established to evaluate the use of cover crops in SCN management. The expected output of these trials is to design integrated SCN management strategies and reduce soybean yield loss caused by SCN.

**Keywords:** soybean cyst nematode, rotation, compost, cover crop

## **NAPA185: Strengthening National Seed System in Nepal for Agriculture-led Transformation**

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Seed is one of the most critical inputs in crop production, determining yield and affecting food security. The ultimate gain of genetics and plant breeding efforts can be realized only when a good quality seed is available for production. This study aims to present the strengths, weaknesses, and opportunities of seed policies, programs, strategies, and implementation in Nepal and emphasizes the production and distribution of crop seeds in Nepal. Ensured supply of good quality seed is possible through a robust national seed system where public and private sectors work together. Participation of private sectors in seed production and distribution in Nepal is an encouraging trend, but a significant contribution from this sector is yet to come. Demand for hybrid seeds is increasing, especially in vegetables and cereals. Although Nepal has a well-defined system of variety development, release or registration, and notification process, sometimes seeds of unauthorized crop varieties are illegally imported through the porous borders. This often results in crop failures, as such varieties are not tested for suitability to the agroecological conditions of Nepal. Since the seed is produced and distributed through formal and informal systems, a strong coordination and seed awareness among stakeholders would minimize such financial loss to growers. More focus is needed on extension education to safeguard the seed quality, especially during harvesting, storage, and distribution using dry chain technologies. Diversified agroecology and seed policies in Nepal are relatively favorable, but these prospects go through challenges, including seed law enforcement and modern technologies. The combined effort of stakeholders to adopt modern technologies in crop breeding, seed multiplication, quality control, and seed distribution along with rigorous enforcement of seed laws in the country, could facilitate the advancement of Nepalese agriculture in a changing world.

**Keywords:** Seed policy, seed quality, plant breeding, agricultural productivity, food security

## **NAPA186: Atmospheric Pressure Plasma: Low-Temperature Plasma - An Emerging Green Technology in Agriculture**

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Plasma, also known as the ‘fourth state of matter,’ is generated by breaking up noble gases by applying high voltage with a dielectric barrier. Plasma at low temperature (LTP) is rich in reactive oxygen and nitrogen species (RONS) with several agricultural applications, including disinfection of seeds, fresh leaf and meat produce, stimulation of seed germination, and plant growth. Over the last five years, the potential use of LTP as a chemical-free biosafety agent against *Stemphyllum botryosum*, seed germination of corn, and sprouting and plant growth of turmeric (*Curcuma longa*) was evaluated. Specific objectives of this study were to; i) assess the antimicrobial activity of LTP on *S. botryosum*; ii) determine seed germination of corn and pepper and sprouting of turmeric rhizomes exposed to LTP; and iii) to determine the effects of LTP on turmeric rhizome yield. In separate experiments, the effects of LTP on the growth and reproduction of *S. botryosum*; plasma-activated water on seed germination and rate of germination of corn; and the response of turmeric varieties to LTP for 0, 60, 90, and 120 seconds were evaluated in the greenhouse and open field trials. Exposure to LTP enabled early seed germination, increased the total percentage germination and the rate of seed germination in corn, and inhibited the growth of *S. botryosum* mycelium and sporulation compared to the control. All plasma-treated rhizomes sprouted six to twenty-eight days earlier than the untreated control. The plasma-treated plants grew faster, produced taller (37 – 39 cm) plants with more shoots/plants, and yielded twice the untreated ‘control.’ Plasma-treated rhizomes produced double the rhizome yield of the ‘control’ plants. The effects varied with genotype and were consistent over the long term. The study showed that cold or low-temperature plasma could improve turmeric plant stand establishment and crop performance.

**Keywords:** low-temperature plasma, seed germination, turmeric, sprouting, rhizome yield, antimicrobial

## **NAPA187: In-Vitro Evaluation of Biological Control of Fungal Pathogens by Trichoderma Isolate and its Compatibility with Chemical Fungicides and Botanicals Commonly used By Nepalese Farmers**

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The abundant use of synthetic fungicides has led to the emergence of fungicide-resistant strains of pathogens and increased concerns regarding human health and the environment. *Trichoderma* spp. is an endophytic and versatile opportunistic plant symbiont that has been globally used as biocontrol agents in recent years. Integrated use of *Trichoderma* with compatible fungicides gives better disease management and causes less harm to the environment in the long run. An experiment was conducted to evaluate the antagonistic effect of *Trichoderma* against phytopathogens and its compatibility with chemical fungicides and botanicals in-vitro using a food poisoned technique. The experiment was conducted in a Completely Randomized Design with four replications for each treatment, and data were taken at different time intervals. *Trichoderma* isolates showed high antagonistic activity for both *Alternaria brassicola* (70.35%) and *Helminthosporium sorokinana* (66.55%). For fungicides, the maximum compatibility was found on Copper oxychloride at 100 ppm, and the highest inhibition of 100% was observed in Carbendazim + Mancozeb, Carbendazim, and Hexaconazole throughout the experiment. For botanicals, *Azadirachta indica* and *Zingiber officinale* both have an enhancing effect on the growth of *Trichoderma*. The highest compatibility was observed at 10% leaves extract of *A. indica* with a growth inhibition percentage of -5.43% (Day 5). Aqueous extracts of tested botanicals were found compatible with *Trichoderma*, except for *Acorus calamus*, *Artemisia vulgaris*, and *Allium sativum*. Therefore, in IPM practice, the combined use of compatible fungicides and botanicals with bioagents provides long-term solutions to seed and soil-borne plant pathogens and can act as the best alternative to chemical control.

**Keywords:** biological control, food poisoned technique, soil-borne disease, *Trichoderma*

## **NAPA188: Soil Fertility Evaluation of Tadikhola Watershed, Nuwakot District: Case Study of Typical Mid Hill of Nepal**

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Soil fertility management in agricultural land is challenging, particularly in hilly areas of Nepal. Soil fertility evaluation of the Tadi Khola watershed at Nuwakot district was carried out to find the soil fertility status of various agricultural land types. Thirty composite soil samples were collected from the study area using an auger in December 2020. The soil fertility parameters like pH, soil organic matter (SOM), total nitrogen (N), available phosphorus ( $P_2O_5$ ), and available potassium ( $K_2O$ ) were analyzed using standard methods in the laboratory of the Rural Development Tuki Association (RDTA) Dolakha. The results revealed no difference in soil pH between upland (6.5) and lowland (6.5) conditions.  $P_2O_5$  (24.0 kg/ha) and  $K_2O$  (198.1 kg/ha) were relatively high in the lowland. OM, available  $P_2O_5$ , and available  $K_2O$  significantly varied at  $P < 0.05$  in upland and lowland soils. There was no significant difference in pH and available N. The cultivated land had poor nutrient status while adapting an improved farming system-maintained soil fertility for better crop growth and yield. An integrated plant nutrient management system (IPNMS) was the best option for hill agriculture. On the other hand, the adoption of sloping agricultural land technologies (SALT) will also help improve and maintain soil fertility. The research finding on soil nutrients in the study area will help planners and researchers to develop effective soil fertilizer management strategies.

**Keywords:** watershed, land type, upland, lowland, soil fertility

## **NAPA189: Flowering Strips in Radish Fields Promote Biological Control and Improve Ecosystem**

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Multiple croppings are always beneficial to natural enemies and pollinators. Flowering plants in multiple cropping systems provide shelter, nectar, alternative food, and pollen (SNAP) to the pest's natural enemies. Such diversified crops in agricultural fields also enhance other ecosystem services such as restoring soil moisture, adding soil nutrients, and improved predation rate and pollination services. A study was conducted in the radish field to see the effect of flowering plants on pest management. The candidate floral plant, alyssum, *Lobularia maritima*, was deployed in a radish field to improve pest biological control. Beneficial arthropods trapped such as Syrphidae, Coccinellidae, Carabidae, Staphylinidae, Formicidae, Lycosidae, Apidae, etc. Ichneumonidae were significantly more abundant in flowering alyssum plots than in control (non-flowering) plots. Flowering alyssum in radish fields significantly increases the population of syrphids. These beneficial predators potentially increase the biological control of *Myzus persicae*. These results provide evidence of the alyssum's ability to increase the abundance of predators and support the suppression of *M. persicae* in radishes. Hence, pesticide applications can be reduced in vegetable fields. This study is useful in developing integrated pest management strategies by integrating flowering strips in radish fields. Habitat manipulation in radish fields by maintaining flower strips can improve pest biological control and improve the benefit of multiple ecosystems that restore diminished ecosystem functions in agriculture.

**Keywords:** multiple ecosystem services, SNAP, pollinators, alyssum, *Myzus persicae*

## **NAPA190: Performance of Multi Companies' Maize Hybrids in Lamahi Dang, Nepal**

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A varietal trial on multi companies' maize hybrids was conducted in the research field of Lamahi Municipality-3, Dang, Nepal, from February to June 2021. The aim of this study was to evaluate the performance of different multi companies' maize hybrids for flowering traits, yield attributes, and grain yield. Ten multi companies' along with two Nepalese maize hybrids as standard checks, were evaluated in a randomized complete block design with three replications. Analysis of variance for different characters revealed significant differences among the tested hybrids for most of the characters. The results revealed that among the tested hybrids, the shortest day to 50% anthesis and silking were recorded for TX369 and the longest in p3522. Maximum cob length (29.98 cm) was found in Bioseed 9220, but cob diameter was a non-significant difference among the tested hybrids. Star 9 (11 ton ha<sup>-1</sup>) produced the highest grain yield, whereas the lowest was recorded for Bioseed 9220 (6.74 ton ha<sup>-1</sup>). 10V10, Godavari 989, p3522, Star 9, Bioseed 9784, and Shrestha produced higher grain yield than Khumal Hybrid-2 (9.44 ton ha<sup>-1</sup>) whereas, all the tested hybrids produced higher grain yield than Rampur Hybrid-10 (7.54 ton ha<sup>-1</sup>) except Rajkumar (7.16 ton ha<sup>-1</sup>) and Bioseed 9220 (6.74 ton ha<sup>-1</sup>). The results suggested that the maize hybrids Star 9, 10V10, and Shrestha can be commercially grown for higher grain production in Dang and similar agro-climatic, regions.

**Keywords:** multi companies, maize hybrids, Dang, flowering, grain yield.

## **NAPA191: Management of Crown and Root Rot in Acid Lime (*Citrus aurantifolia*) under Screen House Conditions in Kirtipur, Kathmandu**

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Crown and root rot disease was among the major problems in acid lime (*Citrus aurantifolia*) seedlings. Samples of the diseased plants investigated at the Nepal Plant Disease and Agro Associates (NPDA) laboratory at Balaju-Chakrapath, Kathmandu, identified three fungal species, i.e., *Rhizoctonia solani*, *Fusarium solani*, and *Alternaria citri*, associated with the diseased samples. On pathogenicity testing, *R. solani* showed symptoms similar to those of the infected seedlings in the nursery. Hence, a pot experiment was conducted in a completely randomized design with four replications to manage the crown and root rot disease using seedlings grown in sterilized soil. The *R. solani* inoculum was prepared in potato dextrose agar (PDA) and used for the experiment. The treatments used in the experiment included carbendazim 50 WP @ 1000 ppm, *Trichoderma viride* @ 2 ml/l water ( $1 \times 10^9$  CFU/ml), *Pseudomonas fluorescens* @ 2 ml/l water ( $1 \times 10^9$  CFU/ml), A-arya 009 (essential oil and organic acids) @ 1 ml/l water and control (water). All treatments were applied by soil drenching 15 days before pathogen inoculation. Carbendazim at 100 and 200 ppm was also evaluated against *R. solani* by poison food technique on PDA. In the pot culture, the effect of treatments was significant on the growth of root and shoot of acid lime seedlings, disease incidence, and severity. Carbendazim had the significantly least disease incidence (43.75%) and severity (18.75%) among the treatments at 45 days after inoculation. The fungicide carbendazim at 100 ppm completely inhibited *R. solani* in PDA culture. Hence, carbendazim could be suggested to manage the citrus crown and root rot caused by *R. solani*. However, further study is required to find out the appropriate concentration of fungicide for the effective management of the disease.

**Keywords:** carbendazim, pathogenicity, reduction, *Rhizoctonia solani*

## **NAPA192: Nepal Rubber Plantation Industry, it's Potential and Challenges**

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Natural rubber (*Hevea brasiliensis*) is used in many ways: as strategic industrial raw materials for making vehicle tires, industries, defense, households, medical fields, and green industry. Rubber farming in Nepal began with planting in six hectares in Jhapa, Morang, Sunsari, and Ilam districts by Gorakhkali Rubber Industry Ltd (GRUL) in collaboration with the Jhapa-based M/S Sudha Falrus Pvt. Ltd. The GRUL also initiated rubber farming feasibility studies in collaboration with the Ministry of Forests and Soil Conservation, Ministry of Agriculture Development, and Rubber Board of India. In the initial evaluation, farmers' income from modern natural rubber farming increased up to 500%. Consequently, it has received great attention from farmers, forestry users' groups, cooperatives, local and national NGOs, and local, national, and international rubber-related industries and organizations. The Nepal government has established a Rubber PMAMP Zone in Jhapa. However, current bottlenecks are lack of appropriate regulation, lack of technical manpower, funds, and government rubber institution, unavailability of the agri-loan program for rubber farmers, and lack of proper marketing agencies and channels, etc. Nepal annually imports rubber and rubber-related products worth \$150 million. Domestic rubber plantation is limited to an estimated 555 hectares with an annual production of 400 tons of dry rubber valued at \$10,00,000. Nepal demonstrates a great potential for increasing rubber farming to 20,400 hectares and producing 37,000 tons of dry rubber with the current value of about \$100 million annually up to 25-27 years in its crop cycle, plus additional income from intercropping, beekeeping, rubber seed oil, rubber wood, and curbing global warming. If Nepal Government, NRNA, and concerned stakeholders advance to commercial rubber farming, the country can be self-reliant on rubber by creating 25,000 new jobs plus thousands of indirect jobs and multiple benefits, including huge export potential.

**Keywords:** Natural rubber, Strategic raw material, High status

## **NAPA193: Towards Automated Blossom Thinning in Apple Trees**

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Blossom thinning is one of the crucial crop-load management approaches, which controls the current season fruit yield and quality and the coming season's return bloom. Every year growers rely on laborious and labor-intensive manual hand blossom thinning to achieve systematic and controlled thinning. Although other less labor-intensive approaches such as chemical and mechanical thinning have also been practiced, the variable thinning results, lack of desired efficacy and efficiency, and restricted use of chemicals have impeded widespread adoption. This study proposes a robotic blossom thinning system to perform precision thinning using a miniature mechanical thinner that is navigated via a machine vision-assisted robotic manipulator. Flowers are densely located in clusters making individual flower segmentation highly challenging. Hence instead of segmenting and removing individual flowers, the proposed approach involves segmenting the flower clusters, counting the number of flowers per cluster, and removing a proportion of flowers. A deep learning-based pixel-level instance segmentation was used to delineate the flower clusters (Average Precision=0.86) and to control the end-effector to precisely reach the target blossom. Another deep learning-based system was developed to estimate the flower distribution and count in the canopy images (Count Accuracy = 86.6%). To control the thinning intensity, results from both cluster segmentation and counting were combined to achieve segmented flower clusters and flowers per cluster. Furthermore, a miniature electrically actuated end-effector was custom-designed using a spindle-string structure. Ongoing efforts involve developing a motion planning framework and integrating the vision system with a 6-DOF robotic arm to navigate the end-effector to the desired location and orientation and remove the expected proportion of flowers from target clusters in a commercial orchard. The proposed approach, when successful, will provide the foundation for developing robotic solutions for blossom thinning in fresh market apples.

**Keywords:** robotic blossom thinning, deep learning, agriculture robotics, agriculture automation

## **NAPA194: Survey of Vegetable Pest Management Practices in Chitwan Valley, Nepal**

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A survey was conducted to assess the pest occurrence pattern and management practices adopted by the cole crop vegetable growers of Chitwan district, Nepal, in 2017. Bhimnagar and Simalghaari were purposively selected from where 60 households were randomly sampled. Data were collected via a semi-structured questionnaire and analyzed with the help of MS-excel and SPSS software version 16. All farmers recognized insect pests as one of the major constraints of cole crop production. For cabbage, respondents said that diamondback moth (41%) was the major problem, followed by cabbage butterfly (20%), aphids (18%), cutworm (8%), white grub (5%), cabbage looper (5%), and thrips (3%). For cauliflower, 32% of respondents said that aphid was the major problem, followed by a diamond back moth (30%), cabbage butterfly (23%), white grub (7%), cutworm (4%), and cabbage looper (4%). Aphid (40%) was the major problem for broccoli production, followed by cabbage butterfly (20%), diamondback moth (17%), cutworm (14%), cabbage looper (7%), and white grubs (2%). All vegetable farmers adopted chemical pesticides as a major pest control strategy. Other pest control measures practiced included biological pesticides (45%), botanicals (48%), light traps (42%), pheromone traps (57%), and jholmal (71.7%). Most farmers adopted calendar spray rather than following pest monitoring and threshold method. The spray interval ranged from 4-6 days (8.3%) to 11-15 days (15%), while most farmers (76.7%) sprayed at 7-10 days intervals. It was found that insect pests, including diamondback moth, aphid, and cabbage butterfly hindered cole crop production to a considerable extent in the Chitwan district. All vegetable farmers used chemical pesticides in their farming system. These farmers are willing to incorporate alternative pest control strategies and reduce the overall use of chemical pesticides if they are assured of reliable alternatives. A strong outreach and grower education program is needed to incorporate integrated pest management strategies in vegetable farming in Chitwan.

**Keywords:** cole crop pest, Chitwan, cabbage butterfly, biological control

## **NAPA195: Host-Plant Association of Plant Bugs and Predatory Arthropods in the Texas High Plains: Pest Management Implications**

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Information on seasonal activity patterns, abundance, and host plant preference of agriculturally important pests and associated predatory arthropods can be helpful in predicting their occurrences and movement among crop and non-crop host plants. A field survey was conducted to evaluate the prevalence and host preference of Lygus bugs, stink bugs, and common arthropod predators across seven host plants in the Texas High Plains, including cotton (*Gossypium hirsutum*), alfalfa (*Medicago sativa*), hemp (*Cannabis sativa*), grain sorghum (*Sorghum bicolor*), Johnsongrass (*Sorghum halepense*), Russian thistle (*Salsola tragus*), and pigweed (*Amaranthus palmeri*). Arthropod survey was conducted in three counties (Hale, Lubbock, and Dawson, representing northern, central, and southern regions of the Texas High Plains in mid-October 2021). The survey revealed that the western tarnished plant bug, *Lygus hesperus*, southern green stink bug, *Nezara viridula*, brown stink bug, *Euschistus servus*, and several predatory arthropods were all quite prevalent across all the hosts surveyed. Sorghum was the most preferred host for Lygus at all three survey sites, followed by hemp. Hemp was sampled only at the Lubbock location. Lygus reproduction was predominantly on sorghum, and hemp was also an important reproductive host. Stink bugs were observed across all host plants in the southern location. Sorghum, alfalfa, and hemp were the most preferred hosts for stink bugs, while cotton appeared to be the least attractive host plant for Lygus when sorghum, hemp, cowpea, pigweed, and alfalfa were available in the host mosaic. Convergent lady beetle (*Hippodamia convergens*), green lacewing (*Chrysoperla carnea*), brown lacewing (*Hemerobius* spp.), spiders, damsel bugs (*Nabis* spp.), Chilocorus (*Chilocorus* spp., minute pirate bugs (*Orius insidiosus* and *Orius tristicolor*), big-eyed bugs (*Geocoris* spp.), assassin bugs (*Zelus renardii*), and red-cross beetle (*Collops vittatus*) were recorded as prevalent predators in late-season vegetation. These are the same set of predators we generally encounter in cotton during mid-season.

**Keywords:** stink bugs, sorghum, alfalfa, hemp, southern plain of Texas

## **NAPA196: Effect of Cover Crops on Population Abundance and Diversity of Ground Beetles in Texas High Plains Cotton**

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Beneficial arthropods provide important pest management and ecosystem services which are adversely affected by frequent farming practices such as tillage and cropping patterns. Predacious beetles (coleopterans) are an important group of natural enemies in many cropping systems. One of the best-known groups is ground beetles (Coleoptera: Carabidae), comprised of highly diverse predatory insects. A three-year study was conducted to evaluate the influence of three cover crop – tillage systems [rye cover – no-tillage, mixed cover – no-tillage, and no cover – conventional tillage] on the abundance and diversity of ground-dwelling arthropods in cotton in the southern High Plains of Texas. The mixed cover treatment included the seed mixture of rye (*Secale cereale* L.), hairy vetch (*Vicia villosa* Roth), radish (*Raphanus sativus* L.), and winter pea (*Pisum sativum* L.). Plastic pitfall traps (710 ml) were deployed in the furrows of the middle two randomly selected rows in each treatment plot and monitored fortnightly from May to October. A total of 2,026 beetles, representing six families (Silphidae, Tenebrionidae, Carabidae, Scarabaeidae, Trogidae and Histeridae) and 18 species, were recovered from pitfall traps. Six of the 18 species, *Calosoma affine* Chandroir, *Cicindela punctulata* Olivier, *Pasimachus* sp., *Scarites* sp., and *Calosoma marginale* Casey, and *Cicindela sexguttata* F., were predaceous ground beetles. *Calosoma affine* and *C. punctulata* were the most abundant predatory ground beetles, comprising 83% of the total carabid guild in the system. Species abundance and diversity of predatory beetles varied significantly with year, tillage system, and year x tillage interaction. Average predatory beetle abundances were 9.7, 16.2, and 28.2 beetles per trap per sample date in conventional tillage, rye cover, and mixed cover plots, respectively. Predatory beetle diversity was significantly greater in mixed cover (1.15) compared to that in rye cover (0.75) and conventional tillage (0.64) systems. Non-predatory beetle abundance and diversity showed much greater variability in data.

**Keywords:** ground beetles, *Calosoma affine*, *Cicindela punctulata*, cover crops, tillage

## **NAPA197: Climate Change in Value Chains of Apple, Avocado, Banana, Large Cardamom, and Timur in Nepal**

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Climate smart agriculture emphasizes managing the landscape to address the interlinked challenge of food security and climate change (CC), and so do Nepal's 15<sup>th</sup> Development Plan 2019/20-23/24, Agriculture Development Strategy 2015-2035, Climate Change Policy 2019, and Local Adaptation Plan of Action Framework 2018. This study applied the Boston Matrix to assess the CC in value chains (VC) of strategic and emerging plantation crops, namely, Apple, Avocado, Banana, Large Cardamom, and Timur, and inclusive developments. The study has seven objectives: i) Selection of VCs for the study of climate impacts; ii) Building CC scenario and micro-climate assessment, iii) Developing 'climate risk model' for VCs; iv) Estimation of potential climate impacts at different stages of VCs; v) Identifying adaptation options to mitigate climate risks; vi) Socio-economic and financial analysis for choice of an adaptation option; and vii) Developing advocacy tool to influence public and private investment on these VCs. This study is based on a reconnaissance survey conducted in 20 districts. The survey is about agri-climatic regions, altitudes, precipitation, temperature, producers, market corridors, and consumers. The CC in agri-VCs is conceived around partial market models having farmers' supply response function, consumers' demand elasticity, and equilibrium prices. It projects outputs by VCs with/without adverse effects of CC for the years 2020 and 2030. It recommends VC nodes-wise measures for CC adaptation/mitigation (CCA/M) strategies and programs. The pooled benefit-cost ratio of five VCs is about 1.92, which will decrease to 1.72 due to the adverse effects of CC. The compensating finance to offset the adverse effects of CC is NRs 230,000 per hectare. Nevertheless, investment is profitable due to increasing production, demand, and price of commodities, contribution to agri-GDP, job creation, and CCA/M missions. Finally, the adaptive measures have benefits to natural hazard mitigation, reduced GHG emission with alternative farming systems, and CO<sub>2</sub> sequestration for the stakeholders to consider.

**Keywords:** climate change adaptation/mitigation, strategic and niche plantations, partial market equilibrium, benefit/cost ratios, internal rates of return

## **NAPA198: Agritourism among Small Farms in Tennessee and Best Management Practices: What, Who, and Where?**

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Agritourism is considered one of the viable alternative enterprises for small farms. Although previous studies have examined the adoption and profit potential, none of the previous studies have specifically looked at the adoption of best management practices (BMPs) in agritourism. Note that best management practices are good practices on different aspects of the business environment, plans, visitor safety, emergency preparedness, communication, and networks. As one of the states with a vast majority of small farm operations with scope for agritourism, the research questions related to the adoption of agritourism BMPs are of significant importance in Tennessee. This study investigates questions such as, what BMPs are adopted, who adopts them, what is the rate of adoption, and where are BMP adopter farms mostly located in Tennessee. We analyzed these important questions using a sample of agritourism farms from a primary survey of small farms in Tennessee. An electronically maintained survey link was sent to 1139 sampled farmers. Our findings suggest that mostly adopted BMPs include: environmentally safe crop-related BMPs, adequate information and communication-related BMPs, and animal interaction and safety-related BMPs. Further, we discuss the attributes of BMP adopters and regional differences in BMPs adoption in Tennessee.

**Keywords:** small farms, alternative enterprises, agritourism, best management practices



## **NAPA199: Continuity and Change in Farming and Non-farming Occupations between Fathers and Sons**

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Inter-generational occupational mobility is one of the important areas of scientific investigation. However, such kind of research in Nepal is scanty. The main objective of this study was to explain what father, son, and household characteristics influence the adoption of occupation of individuals from farming to non-farming status. A well-structured questionnaire schedule was used for a total of 385 father-son pairs in Gajuri Rural Municipality of Bagmati province in Dhading district of Nepal. Information was collected from those fathers and/or sons, the senior son of a father who was married at the time of the interview and whose father was alive by using face-to-face interviews. Binary logistic regression was the main multivariate analytical tool used in analyzing the data. The findings suggested that with reference to farming fathers, the sons of non-farming fathers are at least three times more likely to shift from agriculture occupation to pursue other non-farm employments. In conclusion, the findings of the study well explained the fact that when a father is in an agriculture occupation, the son is more likely to quit agriculture, thereby creating differences in occupations than fathers. On the other hand, if a father already has an occupation other than agriculture, a son is likely to follow the father's occupation; thereby, there is a high chance of continuity of the father's occupation by the son. The findings also suggest that the promotion of attributes of socio-economic equality, including education and rural infrastructure facilities, may be instrumental in keeping up occupational mobility across the generations.

**Keywords:** father, mobility, occupations, son

## **NAPA200: Quality of Hunting Sites and Attributes Affects Willingness to Pay for Deer Hunting**

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The south-central ecotone is slowly transiting toward closed canopy forest in the absence of fire. The ecosystem and its services can be restored using active management such as prescribed fire. Active management can create various types of ecosystems ranging from savanna and grassland to forests creating deer habitat desired by deer hunters. However, active management brings an additional financial burden. Deer hunting can be an essential source of revenue for landowners in this region which can compensate for the cost of active management. We used the best worst choice model to rank deer habitat characteristics such as seer sanctuary, food plots, and forest canopy cover. We further calculated the marginal difference in willingness to pay for habitat characteristics. We found that deer hunters are willing to pay higher for the sites that provide a better opportunity for deer hunting. We found that deer hunters are willing to pay \$11.02 and \$ 9.22 for an opportunity to observe 10 and 6 deer, respectively, instead of 1 deer. Hunters are willing to pay \$3.41 for a deer habitat with a food plot and sanctuary compared to a deer habitat without them. The tradeoff value among canopy cover is small, which might allow landowners to manage land for multiple game species and livestock.

**Keywords:** willingness to pay, deer hunting, deer sanctuary, food plots, tree canopy, best worst choice

## **NAPA201: Profitability, Marketing and Resource Use Efficiency of Ginger Production: Evidence from Rukum West, Nepal**

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The study was designed to investigate the profitability, marketing, and resource use efficiency of ginger production in Rukum west. The sample size of 62 ginger-growing farmers out of 187 farmers was determined using slovin's formula. In addition, 20 traders from two major market hubs Simrutu and Jhulneta were interviewed. The pre-tested semi-structured interview schedule was administered to interview randomly selected samples. Data were analyzed using descriptive and statistical tools, including the Cobb-Douglas production function. The results showed that the average area under ginger cultivation was 0.14 ha. A major portion (46.56%) of the cost was found to be incurred by the seed alone. The benefit-cost ratio (2.02) indicates that the ginger production enterprise was profitable. The productivity of ginger in the study area was 11.39 Mt/ha, while per kg cost of production was NRs 35.67 (USD 0.30). Most of the gross income (78.85%) was contributed by fresh ginger. Similarly, gross margin, market margin, and producer's share were NRs 21.16, NRs 33.33, and 62.97%, respectively, for 1 kg of ginger. The indexing technique identified high-cost with low-quality seed and price instability as the major problems associated with the production and marketing of ginger, respectively. Cobb-Douglas production function estimated the value of return to scale at 0.889, implying that ginger production exhibited decreasing returns to scale. A study on resource allocative efficiency revealed that farmyard manure and total labor were underutilized resources while seed rhizome was overutilized resource. Thus, for optimal allocation of resources, expenditure on farmyard manure and total labor need to be increased by 87.374% and 39.908%, respectively.

**Keywords:** benefit-cost ratio, Cobb-Douglas production function, ginger, market margin

## **NAPA202: Cereal Demand and Production Projections for 2050: Opportunities for Achieving Food Self-sufficiency in Nepal**

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Cereals are a major source of food security, income, livelihood, and employment in Nepal. However, there is a lack of assessment to fully understand the level of growth of cereal demand, production, productivity, and self-reliance in the country. This paper aims to assess patterns and dynamics of cereal production, productivity, and import growth and analyze food demand and self-sufficiency in Nepal. Time-series data were used to estimate demand growth, production projection, and self-sufficiency ratios of cereals for the next 30 years until 2050 using different production scenarios, population, demand growth, and the effect of climate change. An auto-regressive regression model was used to analyze the relationship between domestic production and income growth with imports. We used a compound growth rate estimation, coefficient of variation, and instability index techniques for analyzing the dynamics and variability of the growth of food production and productivity over time. The major data sources for this paper came from national statistics, published and unpublished research papers, and policy documents. The findings revealed that the present production and productivity of cereals are low to meet current and future food demands and tackle increasing imports. Limited marketable surplus available at the farm household level is the fundamental reason for a steady increase in food imports. In the context of the increasing trend of import demand, the country cannot achieve cereal self-sufficiency until 2030 under the current growth rate of production and population and the negative effects of climate change. The government needs to increase investment in agricultural research and development to generate new and higher-level technologies and production practices for sustainable intensification of cereals with adequate policy support and services for ensuring national and household level food and nutrition security to meet SDGs 1 and 2 by 2030.

**Keywords:** cereal demand, food security, food import, productivity growth, self-sufficiency

## **NAPA203: Achieving Food Security and Gender Equality through Adapting Climate-Resilient Agriculture Practices: A Case of the Koshi River Basin, Nepal**

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Nepal is one of the most vulnerable countries to the impacts of climate change, with food security being one of them. A study was carried out among women farmers, including those from marginalized communities such as indigenous people/Janjatis and Dalit in the six districts of the Koshi River Basin (KRB) representing three ecological regions—namely, Dolakha, Udayapur (Mountain Region); Ramechhap, Sindhuli (Hill Region); and Sunsari, Saptari (Terai Region). Extensive literature review and field consultations with stakeholders conducted during September-October 2021 revealed that climate variability had caused a significant loss in agricultural production, severely threatening the food security in the KRB region. This phenomenon has impacted women more than men. In addition, the increase in male outmigration and the resultant feminization of agriculture has further added drudgery among women farmers. Women, especially those from excluded communities, have borne the brunt of climate change as it has exacerbated their vulnerabilities to domestic violence, stress, health problems, and malnutrition among children. Therefore, a need to promote the adaptation of Climate-Resilient Agriculture (CRA) practices lies at the heart of ensuring food security, sustainable livelihoods, social inclusion, and gender equality. Removing barriers to women's involvement in CRA practices is the key to this process.

**Keywords:** food security, climate-resilient agriculture, social inclusion, gender equality, Koshi river basin

## **NAPA204: Impact of Cooperative Membership on Market Performance of Nepali Goat Farmers**

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Farmers can exert some level of market power through cooperatives in the input and output market. As a result, agricultural cooperatives are gaining traction in many developing countries. This paper assesses the impact of cooperative membership on the selection of market channels and prices obtained by smallholder goat farmers in Nepal using in-person interview data collected from 661 goat farmers in 2019-2020. We analyze the data using an endogenous switching probit model to assess the impact on market selection and an endogenous switching regression model to assess factors affecting price fetched in selected goat market. Findings show that cooperative membership has a positive and significant result in selecting a cooperative as a market channel. Cooperatives help farmers receive higher prices for their goats while the price fetched from collectors is the lowest. Cooperative members sell their goats to cooperatives, and they can receive a higher price than selling goats to goat collectors or in the local market. Households with fewer members, far from paved roads, and with larger landholding sell their goats to the collectors. Also, farmers selling their goats to the collectors sell their goats at a lower age. Farmers with price information can sell their goats at higher prices and refrain from selling goats to the collectors. Findings also show that bargaining power is higher among the higher aged farmers while geographically distant farmers have lower bargaining power. The findings conclude that cooperation plays a significant role in the better market performance of smallholder goat farmers. Cooperatives can be an effective way to commercialize goat farming.

**Keywords:** smallholder producers, market channel, endogeneity, price

## **NAPA206: Scope and Opportunities of Youth Employment in Agriculture in Nepal**

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The high unemployment rate of 35% is alarming in the case of Nepal Agriculture is the largest sector that employs more than 60% of the economically active labor force. However, youths are reluctant to engage in agriculture due to the lack of rewarding profit margin and also due to the lack of entrepreneurial skills. Conversely, their migrating trend in the employment search is in geometric progression across the globe. This study was conducted to assess the factors influencing youth employment and predict scenarios to optimize jobs in the agricultural sector. The study deployed triangulation research to validate the phenomenon through a theoretical convergence approach. The agriculture sector substantially retains skilled, semi-skilled and unskilled adult and youths labor force available in the market. Modernization of agriculture opens an abundance of employment opportunities through mechanization, comparative advantage, export promotion, and import substitution policies. Popular belief reveals that modernizing the agricultural sector will lead to a prosperous economy. Demand-driven technical and vocational education will enable millions of youths to develop employable skills as a ready –workforce to initiate agri-based entrepreneurship that may offer opportunities for experiential learning for millions of job seekers. Nepalese agriculture is embedded with a multi-faceted employment model supported by domestic and world markets. Policy focused on export promotion can increase access to the global market and can create millions of jobs along the food supply chain. Similarly, domestic policy focused on import substitution empowers local producers and industries to increase production and productivity enormously—the foundation of creating millions of jobs. Other avenues of agri-employment are conservation of natural resources, niche marketing, medicinal herbs, agri-tourism, etc. The study will further analyze agriculture's direct, indirect, and induced economic impact on creating employment in terms of income, output, employment, and value addition.

**Keywords:** entrepreneurial skills, youth employment, comparative advantage, workforce

## **NAPA207: Returns to Investment in Rice Research in Nepal**

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Many empirical works have been documented on the contributions of agricultural research to productivity growth, food security, and poverty reduction in developing countries. Low investment in research has negatively impacted the technology generation and out-scaling of farmers. The government of Nepal (GoN) has poorly realized the importance of investment in agricultural research as GoN has allocated a very low budget to the Nepal Agricultural Research Council, which never exceeded 0.3% of the Agricultural Gross Domestic Product (AGDP). This study attempts to estimate the benefits generated from agricultural research investment by taking a rice research investment case in Nepal. The study adopted the concept of the economic surplus model. Parameters such as a change in yield, change in variable cost, adoption rate, supply elasticity, demand elasticity, probability of success of the technology, and depreciation were used to estimate the benefits of technology. Moreover, research costs from 2000 to 2019 for rice research were obtained from official records of NARC and different indicators such as net present value (NPV), benefit-cost ratio (BCR), producer surplus, consumer surplus, and internal rate of return (IRR) were estimated. Results showed that the average varietal age of rice varieties in the farmer's field was found to be more than 20 years. Over the last two decades (2000/01-2018/19), the total surplus of rice was found to be NRs (Million) 2773 with an internal rate of return (IRR) of 82 percent. The results suggest that further investments in rice research will generate significant returns and contribute to reducing imports in the country. To sustain the benefits in the future, there will be a need to allocate more resources for rice research and foster linkages between stakeholders and development agencies to accelerate the dissemination of new technology. Furthermore, ex-ante analysis of investment in newly released rice varieties would be the areas for further research in the future.

**Keywords:** Research, returns, economic surplus approach

## **NAPA208: Survey Study of Button Mushroom *Agaricus bisporus* has on Production and Profitability in the Farmer's Level of Chapagaun Village Development Committee (VDC), Lalitpur Nepal**

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Button mushroom *Agaricus Bisporus* has been an emerging and the most demanded valuable protein food among Nepalese people. Hence, a survey study was conducted using randomly selected 120 household farmers of Chapagaun Village Development Committee (VDC), Lalitpur, Nepal, to determine the production and economic profitability related to the farmer's livelihood from February to February March 2015. The study showed that the mean age of farmers involved in mushroom cultivation was 34.94 years, and the mean experience level was 4.97 years in mushroom production. Each farmer had an average of 7.35 mushroom tunnels with an occupied land area of 137.35 square meters per tunnel. Even though 29.4% of farmers involved in mushroom production were found to be illiterate, they had good knowledge of mushroom cultivation practices because of their experiences in the field as well as the periodic training provided by Nepal Government to them. The average quantity of mushroom production was 1220.59 kg per farm, and the selling price was NRs 255.44 per KG mushroom. On average, each farmer's net income per farm was NRs 103742.64 with a gross income of NRs 295051.47 and the benefit to cost (B:C) ratio of 3.04. Thus, this study showed that mushroom farming could improve the daily life of farmers both by generating income and improving health with the consumption of button mushroom to some extent in the Chapagaun Village Development Committee Lalitpur Nepal.

**Keywords:** button mushroom, value chain, B:C ratio

## **NAPA209: Women Participation in Cardamom Production: A Study of Ilam District**

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This paper analyses impact of women in cardamom production in Ilam district. It reflects on women's role, the challenges they face; the factors that influence women's engagement in cardamom production; and their access to productive assets. One hundred cardamom growers from Ilam district were chosen at random and interviewed using qualitative and quantitative questionnaires. Women made up 57% of those who responded. The majority of women, 44.0%, act as helpers, followed by the worker, laborer, and entrepreneur, even though if male outmigration role of women is an entrepreneur. According to the survey, 57% of men, 11% of women, and 32% of both men and women spend more time working on cardamom production. Women's engagement in cardamom production is limited most prior to primary processing and intercultural operation. Work burden (57 %) is a major as well, as educational status, experience, age, perception, and migration are all key determinants of women's engagement in cardamom production. Major constraints reported among the cardamom grower women are physical, psychological, technological, socio-cultural, and agronomical constraints. Although 68% are participating in organizations, they have limited access to productive assets, technology, and innovation. Women's participation in farm and non-farm activities has increased to some extent. About 15% of women are actively involved in farm decisions, and 29% are decided similarly by men and women. Cardamom marketing is actively practiced by 19% of women and 14% of men and women together. Women's participation played a crucial role in the care and maintenance of orchards and the quality of cardamom. Both men and women play a significant role in certain tasks; however, they generally appear to be working together. Enhancing women's agricultural awareness and technical skills and adopting a women-friendly agricultural production system would help boost the participation of women in cardamom.

**Keywords:** women, cardamom, production, participation

## **NAPA210: Climate-Induced Migration and Food Security in Upper Mustang, Nepal**

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Migration is one of the adaptive mechanisms adopted by humans for sustaining their livelihood. Of the various factors, scholars have linked migration to climate change both as a push and a pull factor. Studies also show that high altitude (Himalayan and trans-Himalayan regions) and high latitude regions are vulnerable to climate change that has adversely affected the food security of people in those areas. This paper aims to present the nexus between climate-induced migration and the food security situation among the trans-Himalayan Lobas of Lo-manthang, Upper Mustang, Nepal. This study is based on a review of existing as well as anecdotal evidence to uncover the relationships between the two, primarily focusing on the sustainable livelihood (SL) framework. Existing evidence shows that the trans-Himalayan region of Lo-Manthang has been experiencing climate change; temperature data show the minimum annual average temperature of Upper Mustang increased by 0.048 degrees, and the maximum temperature increased by 0.1391 degrees Celsius per year from 1974 to 2015. The rainfall (from 1974 to 2015) has decreased by 3 mm per year. Although migration is an age-old practice of Upper Mustang, the new trends of migration are associated with climate change related phenomena such as recent temperature rise and decreasing rainfall. The information collected through a qualitative approach using KII and observation shows that the frequency of extreme weather events has been increasing, and the region is getting drier. Due to climate change related factors, the livelihood assets of Loba have become weaker. The Loba have either changed or stopped their crop cultivation practices, such as leaving their land fallow, which has influenced their food security as well as overall livelihood. For example, the Loba livelihood is dependent upon single seasonal high altitude crop cultivation, livestock raising, seasonal trade, and tourism, which the changing climate has influenced through changes in their access to various livelihood assets. Such a change in climate has induced out-migration, and Lobas have resorted to seasonal labor migration. Moreover, the Loba migration patterns are closely associated with geography, climate, language, and culture that play a significant role in their lives and food security.

**Keywords:** fictive kinship, livelihood, Loba, migration, Nepal, seasonal

## **NAPA211: Climate Change Impacts on Agroecosystem: a Case Study of South Asia**

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This paper evaluates how climate change directly impacts agricultural development and broader economic growth in the global context and South Asia (Bangladesh, India, Nepal, and Pakistan). Paper unveils the climate change-induced agriculture challenges with empirical evidence and elaborates on the consequences to the farmer's livelihoods and food security. There is a need for scope analysis and considering relationships: including household socioeconomic conditions in relation to climate changes at various scales. Studies in these scales can provide insight into the influence of biophysical and other factors on food production. Based on secondary information, this paper provides a general scenario of current climate change impacts on food security and provides a pathway for future research.

**Keywords:** agriculture, food insecurity, climate change, subsistence farming, livelihood

## **NAPA212: Learners' Perceptions of Online Learning on Food Safety under COVID-19 Pandemic**

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Food safety is a complex system involving multi-stakeholders. Knowledge and skills gaps among these stakeholders are noted as the most critical factors affecting food safety systems in developing countries. Competent professionals who could help identify and address those gaps either by themselves or by informing and educating others are critical to improving food safety situations. Within these contexts, Michigan State University held a week-long food safety short course virtually in November 2020. Grounded on Kirkpatrick's four-level training evaluation model, a descriptive study employing web surveys was administered among course participants to study the effectiveness and lessons learned from this course. Thirty-seven of 42 participants attending the food safety course filled out pre-and post-course surveys. The findings revealed a significant increase in the knowledge of participants on the topics taught compared to their knowledge prior to the course. Participants appreciated the course management, course contents, and course offering; however, they suggested this course be offered in-person, providing opportunities for interactions with faculty and professionals, visits to the food processing industries, and, importantly, the hands-on practices. If it is to be offered online, they suggested making it more interactive and participatory. The findings reemphasize that learners' active engagement during the learning process, including pre-, during, and post-course phases, and with the personnel involved is paramount for effective delivery of any course.

**Keywords:** learners, effectiveness, evaluation, level of knowledge, engagement

## **NAPA213: Participants' Evaluation of an Online International Food Safety Short Course**

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Food safety system is a complex process involving multi-stakeholders. The knowledge and skills gap among these stakeholders is noted as the most critical factor affecting food safety systems in developing countries. Competent professionals who could help identify and address those gaps either by themselves or by informing and educating others are critical to improve food safety situations. Within this context, Michigan State University (MSU) held a week-long food safety short course virtually in November 2020. A descriptive study employing a web survey was administered to study the effectiveness of and lessons learned from this course. Thirty-seven out of 42 participants attending the course filled out pre-and post-course surveys. The findings revealed a significantly higher level of knowledge among participants regarding the topics taught compared to their knowledge prior to the course. Participants appreciated the course management, course content, and course offering. However, they preferred this course to be offered in person because of more opportunities for hands-on learning, interactions with faculty and professionals, and visits to the food processing industries. If it is to be offered online, they suggested making it more interactive and participatory.

**Keywords:** food safety, online course, knowledge gain, effectiveness, evaluation

#### **NAPA214: How Are Egyptian Undergraduate Agricultural Students Prepare for a Career?**

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Egypt has made substantial progress in making education accessible to the public. However, a high unemployment rate among university graduates and employers not being able to find a skilled workforce is of great concern. A pragmatic approach to education that enables students to participate in career preparedness in and outside the classrooms and prepare them for a job following their graduation is of paramount importance. In 2019, as part of a needs assessment aimed at defining determinants that could improve Egyptian agriculture students' employability, web-based and in-person surveys were conducted at five universities in Egypt to gather information from current agriculture university students and professors. The overarching goal of the study was to examine how undergraduate students in agriculture colleges in Egypt prepare themselves for a career. The objectives were to i) determine programs and resources available for career preparation to students and how they were utilizing these resources for career preparedness; ii) assess student and professor's perceptions of the teaching of soft skills through coursework; and iii) examine differences in students' involvement in career preparation services by their demographics. Data from two survey modes were merged and analyzed using descriptive statistics, independent sample t-tests, and one-way ANOVA with Tukey post hoc separation of means or least square differences. The findings revealed that students had limited opportunities to practice their career skill-building through their coursework activities. For a majority of the students, professors and university graduates were the primary sources for career advice. Students seldom visited career service offices and did not quite utilize their services but frequently browsed websites of potential employers. Career advising services appeared to be below the students' expectations across the universities. Strategies and policies are needed to strengthen career advisory services at universities to improve graduates' chances of obtaining meaningful employment in their fields of study.

**Keywords:** Career preparedness, sources of career advice, undergraduate students, skills

#### **NAPA215: Green synthesis of zinc nanoparticles using *Amaranthus spp.* extract and evaluating its activities on environmental, agricultural, and medicinal aspects.**

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The common summer annual weed of the *Amaranthus* species is prevalent in almost every agricultural field (especially in the hot and dry climate). Those noxious weeds undermine the beauty of the highway and spread seeds at a rapid rate, creating several health hazards. Furthermore, these weeds directly affect the yield of the main crop. Billions of dollars are being invested in managing these weeds, which often involve chemical herbicides. We, in this project, synthesized and used zinc nanoparticles to control *Amaranthus* weed species. To synthesize zinc nanoparticles, the water extraction was performed from the aerial parts of *Amaranthus*, which was then mixed with 0.02 M Zinc Acetate at a 1:25 v/v ratio. Interestingly, the result showed a characteristic peak at 350 nm in a UV-VIS spectrophotometer, confirming the formation of zinc nanoparticles. Furthermore, zinc nanoparticles obtained showed promising results in dye degradation, antibacterial, antidiabetic, and seed priming experiment.

**Keywords:** Zinc Acetate, noxious, spectrophotometer, priming



## **NAPA216: No Wealth, Poor Health: Socio-economic Impact of COVID-19 on Marginal Communities of Nepal**

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While the effects of the COVID-19 pandemic have yet to be fully documented, it is evident that the pandemic disproportionately impacts marginalized populations throughout the world, and Nepal is no exception. This research was conducted during April-October 2020 to analyze how some of the poorest and marginalized communities in Nepal were affected by this global Pandemic. The results show that marginalized communities were feeling the impact through two predicaments: direct exposure to the virus itself and economic lock-down imposed by the government as a measure to contain the spread during its initial phase. On the one hand, low-income communities of Nepal were at the risk of being severely exposed to diseases and were likely to have a high mortality rate due to inadequate resources. On the other, the two-month-long economic lockdown led to unintended social and economic consequences. Daily-wage workers, street vendors, construction workers, and small retailers were mostly left without daily income and were unable to sustain themselves or their families. Women and girls who were already living in poverty, from disadvantaged caste groups, or in rural, isolated locations faced more extreme consequences. As the economic lockdown prolonged, domestic violence cases also surged across the country. By the time this research was being finalized, the country witnessed the unfortunate death of 56 new mothers in two months (March 29 - May 27) due to a lack of effective maternity and infant childcare services, while 60,000 women were deprived of access to prenatal services. The study highlighted the socio-economic impact and identified immediate short and long-run action plans as policy recommendations.

**Keywords:** Nepal, COVID-19, socio-economic impact

## **NAPA217: A Review on Land Consolidation for Farming in Nepal**

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Reallocation and readjustment of small and fragmented blocks of land to a larger operational unit is called land consolidation. Fragmentation is a common reality of agricultural land in Nepal. It is considered a major obstacle to mechanization in agriculture, causing inefficiencies in production. Land consolidation is considered a favorable means to facilitate the use of modern technologies for mass production of agricultural products, thereby reducing the labor and their working hours in the field, contributing to increased net profit. This study aims to assess the need, governmental initiatives, and challenges for land consolidation in Nepal and discuss a possible way to address those challenges. Literature, including academic papers, reports, and federal/provincial/local level laws, related to land consolidation in Nepal are reviewed. The analysis can identify plausible solutions for land consolidation either by cooperative or leasing or purchasing of land as per the ground situation. There should be the full right to land consolidation and related issues at one tier of government, specifically the provincial government. Inheritance provision that asks for an equal division of property to their successors and individuals' right to sell and buy the land parcels resulted in continuous land transactions and fragmentation. Land-related jurisdiction falls under all three tiers of the government, namely, federal, provincial, and local levels. However, provincial and local governments still lack the institutional capacity to plan, strategize and manage land consolidation. Hence, private land ownership and disputes between governments at federal, provincial, and local levels complicate the land consolidation. Land transactions in recent decades, especially in peri-urban areas, are booming, and those investors on land might also be a barrier.

**Keywords:** land fragmentation, agriculture, mechanization

## **NAPA218: Understanding the Nature of Urban Food Insecurity in Nepal and the Prospective Role US Foreign Aid Can Play**

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This dissertation project is the first comprehensive study focused on understanding the nature of urban food insecurity in Nepal and the prospective role US foreign aid can play. Urban food insecurity poses challenges that are unique from those posed by rural food insecurity. As a result, solutions to mitigate rural food insecurity do not apply in an urban setting, necessitating creative approaches to feed the growing urban population. This research attempts to highlight urban food insecurity as a challenge that needs urgent attention and to shift the discourse from a rural-only focus to a more balanced urban-rural discourse on food security. Given it is the first study of its kind, it employs an exploratory research technique using both qualitative and quantitative data. The research will review existing literature on food insecurity, reports by the USAID and other multilateral organizations, comparative case studies of what is already being done to alleviate urban food insecurity in other developing nations, and interviews and focus groups with key stakeholders and low-income populations to get a better sense of the nature of urban food insecurity in Nepal. To analyze the primary data, thematic analysis framework is employed. Ultimately, the dissertation endeavors to produce generalizable research that could serve as a framework for other scholars and practitioners, especially in developing nations, to study and craft urban food in/security policies and understand the potential role foreign aid can play.

**Keywords:** urban food insecurity, US foreign aid, unplanned urbanization, USAID, urban Nepal

## **NAPA219: Assessment of the Status of Rooftop Garden and Determinants of Adoption of Urban Green Roofs in Nepal**

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In recent years, rooftop gardens have increased in urban areas of developing countries. However, successful adoption of well-equipped green roofs is still lacking and limited. A survey was conducted from February 3 to April 6, 2021, to understand the status of the rooftop garden in the Morang and Sunsari districts of Nepal. A total of 116 respondents were randomly selected to estimate the role of socio-economic factors in the adoption of rooftop gardens (RTG) in urban areas. The survey area in Morang and Sunsari districts had 30.5 and 33.2 % of the roofs under farming, respectively. Also, the size of the roof of rooftop adopters was significantly larger than non-adopters in the study area. Locally available farming materials were given preference to grow around 50 nutritionally important crop species. A binary logit model was used to determine the factor affecting RTG adoption. Of which, growers` age, sex, schooling year, training, and farming experience significantly affected RTG adoption. Lack of adequate training and extension services were the major hindrance in RTG adaptation. Thus, gardening training and financial support to expand or extend RTG with adequate extension services from concerned organizations and local governments are needed to establish and promote urban RTG.

**Keywords:** rooftop garden, training on RTG, nutritional supply, reduced urban waste

## **NAPA220: Factors Affecting the Adoption of Proper Postharvest Activities of the Vegetable Crops in the Major Highway Corridors of Nepal**

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To assess the socio-demographic characteristics of vegetable growers, their knowledge of proper postharvest practices, factors affecting the adoption of proper postharvest activities, and economic calculation of postharvest loss by vegetable growers in Nepal were studied in 2019. The study sites were purposively selected based on area coverage, production, number of growers, and commercialization status at Hetauda, Khairahani, Bharatpur, and Kawasoti, municipality of Nepal. One hundred seventy-two vegetable-producing households were sampled using a simple random sampling technique. Descriptive statistics, economic analysis, and the Logit model were used in data analysis. The result indicated that vegetable harvesting was mainly performed by hand with intermittent knife use during cauliflower and cabbage harvesting. The damaged vegetables, in general, were discarded during grading. In the case of tomatoes, grading was done based on color and size. Few farmers used calcium, zinc, and potash to increase the shelf-life of vegetables. The logit econometric model revealed that education, ethnicity, demand information, household type, training on activities, and vegetable production land area were the significant determinants of proper postharvest activities adoption. On average, a total postharvest loss is valued at \$2382.67 per season. The adoption level of farmers was primarily determined by growers existing traditional knowledge. Thus, further educational aspects (knowledge, attitude, skill, and aspiration) and training on postharvest handling and storage could help farmers and traders to minimize the postharvest loss of vegetable crops.

**Keywords:** vegetables, adoption, economic loss, postharvest

## **NAPA221: Profitability and Determinants of Protected Vegetable Farming in Nepal**

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Fresh vegetable production is one of the important sub-sectors of Nepalese agriculture, contributing around 12 percent of GDP. Protected vegetable farming has emerged as a potential approach to improve the yield and quality of produce around the globe. However, Nepal has a short history of protected vegetable farming. This paper discusses the findings of the study in the area of profitability and determinants of protected vegetable farming in Nepal. Based on durability, the protected structures were broadly categorized into three different types, namely temporary, semi-permanent, and permanent. The study was conducted in 7 districts of Nepal by selecting 90 respondents. Descriptive statistics and multinomial logistic regression was used to analyze data. The financial analysis done for the project life of ten years showed a significantly higher benefit-cost ratio and payback period in temporary structures than that of semi-permanent and permanent structures, whereas the net present value was found statistically similar in all types. The productivity of vegetables under semi-protected structures (218.87 mt./ha/year) was found to be higher than that of the average productivity (191.55 mt./ha/year) of vegetables under the protected structure. The multinomial logistic regression studied among 15 explanatory variables found ten explanatory variables significant, whether at 1% or 5% or 10% probability level. The variables, namely gender, education, family type, household members involved in agriculture, experience in vegetable farming, and subsidies received, were found to have a significant and positive influence on the adoption of semi-permanent and permanent structures, whereas the variables, namely age, membership in farmers group, record keeping and technician visit was found to have a significant and negative influence.

**Keywords:** protected structures, profitability, determinants, adoption, multinomial logit

## **NAPA222: Analysis of Consumers' Preference, Behavior, and Willingness to Pay for Quality Meat in Pokhara-Lekhath Metropolitan, Nepal**

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In what level of consumer's behavior, the meat consumers have and intend to pay for quality products was an important issue of the study area. This survey research was conducted from April-June 2021 to analyze the consumers' preference, behavior, and willingness to pay for quality meat, along with satisfaction levels with meat attributes. The study collected primary information from the randomly selected 120 respondents including 6 key informants of Bindabasini, Pokhara. This study used both descriptive and empirical analytical tools including the binary logistic model. Results revealed that Chicken was the most preferred meat followed by chevon, buff, and pork. The ethnicity and religious beliefs of the respondent were found significant for the preference for chevon, pork, and buffalo meat but not for chicken. Taste and quality were found to account more for meat consumption while the opposite was found in the case of age and disease factor, and freshness. The per capita meat consumption was found to be 24 kg/year. Results of multiple regression revealed that household meat consumption is driven by factors associated with the years of education, number of earning members, yearly family income, and average meat value. The majority of meat-consuming respondents (69.83%) were found to have the willingness to pay (WTP) for quality meat. Results of binomial logistic regression revealed a significant effect of age of respondent, years of education, and yearly family income on willingness to pay for quality meat. The high current price was the main reason behind no WTP for quality meat. 27.44% of meat-consuming respondents were found to be highly satisfied and a few (1.44%) were highly unsatisfied with different meat attributes. Respondents ranked poor quality meat and high pricing as the first and second problems. The study suggests conducting frequent inspections of livestock farms and butcher shops by the concerned agencies to overcome these problems.

**Keywords:** Binary logistic model, buff, chevon, meat attributes, pork

## **NAPA223: Non-compliance and Moral Hazard in Agricultural Conservation Programs**

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Cost-share contracts, offered through working lands programs, have been instrumental in addressing environmental concerns arising from resource-intensive agricultural production practices. However, the persistent trend of non-compliance with cost-share contractual obligations has become a problem for funding agencies, including Natural Resources Conservation Service. This paper aims to study existing non-compliance within agricultural conservation programs and provide empirical evidence on the presence of moral hazards in cost-share contractual relationships. Using annual county-level panel data (1997-2019) about contract payments in working lands programs within Louisiana, we find that market and non-market factors influence the non-compliance rate. The findings provide useful insights into the key (non)market factors behind the high and steady level of non-compliance and underlying perverse incentives in the cost-share programs.

**Keywords:** contracts, cost-share, moral hazard, non-compliance

## **NAPA224: Prime Minister Agriculture Modernization Programme in the Context of Rice Commercialization: Effectiveness and Challenges**

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Nepal's Agriculture sector contributes more than one-third of the country's Gross Domestic Product (GDP), and it is a backbone of the Nepalese economy, where more than two-thirds of the population's livelihood depends on it. Prime Minister Agriculture Modernization Project (PMAMP) was initiated in 2016 for ten years (BS 2073-2082) to transform agriculture from subsistence to commercial, sustainable, and modernized agriculture. The main aim of the PMAMP is to create opportunities for sustainable industrial agriculture ensuring food security through integrated value chain systems and its mobilization to help the overall development of the country. The PMAMP seeks to modernize agriculture through concentrated efforts on production, processing, and marketing as the game-changer for the agricultural development of the country. Nepalese government emphasizes increasing agricultural productivity from the beginning of the first five-year plan. Nevertheless, the economic growth rate remains low per annum. Therefore, it is vital to critically examine government agricultural programs and policies for agricultural development in Nepal and identify gaps and constraints. Rice, which contributes more than 15% to the national GDP, covers 47% of the total agricultural land, and is the major staple crop of Nepal, is highly prioritized by the PMAMP. The main objective of this research includes evaluating the Rice program by PMAMP in terms of its relevancy, effectiveness, and sustainability and identifying the constraints and recommendations for future strategies for effective implementation of programs and policies. The research outcomes provide feedback on the implementation of the rice project and decide on the relevancy of the project. Furthermore, it helps to formulate new approaches or amend the PMAMP to achieve the national agriculture development goal.

**Keywords:** Agriculture, National policies, Modernization, and mechanization, evaluation, commercialization

## **NAPA225: An Economic Analysis of Potato Production and Marketing in Achham District of Nepal**

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Achham district holds huge potential for potato production and increased productivity as the potato cultivation in this district yields good returns due to favorable agro-climatic conditions. However, the production and productivity of potatoes in Achham (15.35 t/ha) are lower as compared with the national average (16.65 t/ha). So, this study was carried out to assess the economics of production and marketing activities of potatoes in the Achham district. A total of 120 farmers' samples were obtained using a simple random sampling method and ten traders through the snowball sampling method in Ramaroshan and Jayagadh Rural Municipality. The data were analyzed using MS-Excel 2019, SPSS version 26, and STATA 12 software. Results showed the total average cost of production was NRs. 269438 per hectare, average household production of 1470.97 kg, and average productivity of 10.97 t/ha. The benefit-cost ratio was 1.3, and the gross margin was NRs. 81,486 per hectare. The high cost of production was mostly contributed by high labor costs and seed costs. Cobb Douglas's production function showed the return to scale value (1.17) was higher than the return to scale value (0.842) obtained by (Bajracharya & Sapkota, 2017) in the Baglung district, indicating an increasing return to scale in potato production. From Key Informant Interview (KII), Focus Group Discussion (FGD), and Rapid market appraisal showed that lack of storage houses, seasonal roads that hinder transportation facilities, import of potatoes from India at a lower price, lack of marketing knowledge on farmers, and distant market leading to higher costs of transportation as major problems related to marketing. Incidence of insects/pests (red ant, grubs) followed by lack of irrigation and poor rainfall were problems in production. An immediate need for farm mechanization with the increased adoption of new technologies, potato product-based processing industries, and maximum extension activities are seen in the area.

**Keywords:** Economics, Potato, Production, Marketing

## **NAPA226: Study on Price Determinants of Onion at Kalimati Fruit And Vegetable Market**

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Onion is a commercial vegetable crop that has unstable pricing strata in the market. The survey research was conducted in Kalimati fruit and vegetable market and Namobuddha Municipality of Kavrepalanchok district between February and March 2020 to study the factors determining the price fluctuation of onions. The study collected primary information from 75 wholesalers at Kalimati Fruits and Vegetable Market, ten farmers, ten retailers, ten consumers, and two collection centers from Namobuddha municipality of Kavrepalanchok by administering a semi-structured questionnaire. Secondary data were collected from the Kalimati fruit and vegetable market development committee at Kalimati, Balkhu. The study ranked the fluctuation in the market price of onion with an index of 0.86 as a major marketing problem in the research area. Results revealed that change in demand with correlation coefficient -0.68, -0.95 and Likert scale index value 0.89, 0.84 is found to be a major factor affecting annual and monthly price fluctuation, respectively. Similarly, eight different types of marketing channels with maximum price spread (i.e.) Rs39.28 per kg) are observed. Total marketing cost is found to be high per kg of onion, i.e., Rs10.77 for Indian onion and Rs 9.65 for Nepalese onion. Total Gross Market Margin, Gross Market Margin intermediaries, and Net Market Margin per kg onion for Indian onion observed are 57.7%, Rs15.4, Rs46.93, and 55.779% Rs11.55, and Rs46.12 for Nepalese onion, respectively. The study showed producers' share of Rs 42.3 and Rs 42.2 and market efficiency of 4.27 and 4.88, respectively, for Indian and Nepalese onions. Herfindahl- Hirschman index of the research market obtained was 143.74. Research indicated fluctuation in market price is a major marketing problem, and change in demand is a prominent factor determining price fluctuation of onion. The study suggested the selection of the shortest marketing channel.

**Keywords:** Ineffective marketing, Marketing channel, Marketing problem, Price fluctuation, the Price spread

## **NAPA227: Community Engagement in Livestock Development: A Study of National Agriculture Development Company (NADC), Ranikot, Salyan, Nepal**

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The National Agriculture Development Company (NADC), established (in 2019 A.D.) in Salyan of Karnali province, has its own unique community engagement model. However, it is less known about the model/approach and perception within the community. Using the recently collected data (in 2021) from Ranikot, Salyan, this paper empirically investigates (a) the establishment scenario and operational mechanism of NADC, (b) the mode of community engagement, and (c) the perception of NADC members and non-members about the role of NADC. Qualitative data were collected through key informant interviews (KII), and quantitative data were collected from surveys (186 households). NADC has its primary purpose of developing goat farms in a participatory and contributory business model (also called the Start With Available Resources (SWAR) model). The shareholders (20 in total) joined NADC through their contribution in cash and/or goats and/or labor, or a combination of each. Of the 12 shareholders in the survey, 11 (92%) contributed cash, 5 (41.7%) contributed goats, and 2 (16.7%) contributed labor. Slightly over 90% of the respondents were either very confident or confident that NADC will increase the income of farmers; 87% of them were confident about improving the food security, and nearly 86% of them reported that NADC will utilize barren land to increase production. Only about 9 percent of households were not satisfied with the service provided by NADC. Overall, both NADC members and non-members are confident about its positive contributions to livestock development and food security in the village. The government's promotion of such type of community-based models will be instrumental in overcoming the socio-economic challenges of Karnali province. This survey will be helpful to assess the perception of people towards the agricultural company and suggest future ways to incorporate new modalities for community engagement.

**Keywords:** Community, livestock, members, perception, shareholders

## **NAPA228: Agricultural Problems Hierarchy and Rational Decision-Making: A Case of Minority Urban Farmers in Maryland**

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Smallholder/Small-scale minority farms (SMF) are declining in the state of Maryland. Urban agriculture (UA) has engaged many SMF. However, it does not entice ‘Generation Z’ due to a lack of rewarding margin per unit area of production. This study was to identify and understand the problems of small-scale minority and beginning farmers in five counties of Maryland. A semi-structured survey conducted with 14 purposively selected farmers revealed a long list of problems they have been encountering for the past several years. The demographic characteristics classified these farmers into five races (Asian, African American, Latino, Caucasian, and Non-Latino, in order). Thirty-six percent of them were females. Eighty-six percent of these farmers practiced urban agriculture and 14% community gardening. This study followed Maslow’s hierarchy theory and farmers’ rational decision-making while investigating farmers’ needs and problems. Of the 21 identified problems, farmers grouped them in a hierarchy of 12 based on reported index values using a 5-point Likert scale. The average indices show that they cannot afford farm machinery and equipment, with a 4.5 score on top, followed by a lack of capital (4.4), access to land (4.4), credit (4.4), internet (4.4), and not enough land (4.4). Other problems were a lack of direct access to markets and sales outlets (3.9) and product knowledge and skills (3.9). The least important problems reported were access to relevant educational materials (2.9), products processing facility and skills (2.7), family labor to support farming (2.6), and shortage of labor in the market (2.5). Both preference ranking and the problem hierarchy approach demonstrated a similar ranking of the problems. The study intends to analyze the problem hierarchy to optimize the farm revenue by adapting Von Thunen’s model of agricultural land use and market accessibility.

**Keywords:** urban gardening, agricultural problem hierarchy, rational decision-making, Extension education

## **NAPA229: The Social Acceptability of Hemp amongst Farmers: A Case Study of a Mountainous Community in Western Nepal**

Thomas Kloepfer

Hiroshima University, Higashi-Hiroshima, Hiroshima, Japan

Correspondence Email: [higherground11@gmail.com](mailto:higherground11@gmail.com)

The hemp, *Cannabis sativa*, has a long history of utilization in various regions around the world. The uses of hemp are embedded in many agricultural practices, religious practices, and rural economic practices. In western Nepal, hemp is specifically used as a staple food crop and cash crop; however, the Nepali Narcotic Drug Control Act of 1976 ultimately prohibits Nepali farmers from sowing, trading, or selling their hemp crop. Regardless of this act, farmers are continuing these practices illegally, especially in remote regions where hemp has grown for centuries. The purpose of this study was to understand the current social acceptability of hemp cultivation in rural Nepal and consider the future potential for legitimate cultivation. We tested two interconnected behaviors associated with hemp farming in the hill regions of Western Nepal. The item count technique was applied to estimate the number of farmers that actively sow or plant hemp and which of them may also be selling hemp husks, a byproduct used in illicit drug production, for income generation. We compared our item count treatment with a direct questionnaire for farmers within the same region. Our results indicate that planting hemp is not a sensitive behavior, where more than 97% of farmers plant hemp. However, the item count technique did indicate that selling hemp husks is a sensitive behavior, where 29% were shown to sell husks when asked using the item count technique compared to the 2% of farmers when asked directly. Our contribution to the ongoing debate in Nepal and around the globe regarding hemp cultivation for fuel, fiber, food, and medicine is founded on issues pertaining to human rights, development, and alternative development.

**Keywords:** Item Count Technique, rural development, hemp, development policy

## **NAPA230: Interactions on a Diverse Aspects of Agriculture Development in Nepal: Potential Implication for the Agriculture Transformation**

Dilip R. Panthee<sup>1</sup>, Khushi R. Tiwari<sup>2</sup>, Ramjee Ghimire<sup>3</sup>, Megh N. Parajulee<sup>4</sup>, Pradeep Wagle<sup>5</sup>, and Maha P. Gelal<sup>6</sup>

<sup>1</sup>North Carolina State University, USA; <sup>2</sup>Bayer Crop Science, Madison, Mississippi, USA; <sup>3</sup>Michigan State University, MI, USA; <sup>4</sup>Texas A&M University, Texas, TX, USA

<sup>5</sup>USDA-ARS, Oklahoma, OK, USA; <sup>6</sup>Atlanta, GA, USA

Correspondence Email: [Dilip\\_Panthee@ncsu.edu](mailto:Dilip_Panthee@ncsu.edu)

Association of Nepalese Agricultural Professionals of Americas (NAPA) organized a series of talks through webinars conducted from 2020 to 2022. The objective of the webinar was to foster the discussion on various aspects, including science and technological advancement, national policy, agribusiness, and entrepreneurship primarily related to Nepalese agriculture. Efforts were made to identify the speakers by keeping the above areas in mind. Fourteen presentations, each lasting for about an hour, were made virtually through Zoom and live-streamed on Facebook to maximize participation. On average, 50 participants attended the Zoom sessions, and more than 200 were viewed on Facebook. The number of viewers for Livestream videos on Facebook grew by thousands over time. Senior officials from the Government of Nepal and universities in Nepal for policy-focused presentations were invited. For the presentation on agribusiness and entrepreneurship, experts with experience and understanding of Nepalese agriculture market systems were invited. Experts made technological presentations from the U.S., Canada, and Australia. Based on the interaction and feedback provided by the audience, it is our impression that the webinars covered a wide range of topics and provided invaluable information ranging from agriculture, academics, and technology to its economic translation, which is necessary for the environmentally friendly and sustainable food security agricultural transformation in the nation.

**Keywords:** agricultural development, issues, and opportunities, policy measures, webinar



## New Executive Committee

**Association of Nepalese Agricultural Professionals of Americas (NAPA)**  
**Executive Committee 2022-2024**



					
<b>Dr. Pradeep Wagle</b> President	<b>Dr. Ramjee P. Ghimire</b> Vice-President	<b>Dr. Nityananda Khanal</b> General Secretary	<b>Dr. Sushil Thapa</b> Joint Secretary	<b>Dr. Bishwo Adhikari</b> Treasurer	<b>Dr. Buddhi Gyawali</b> Member
					
<b>Dr. Dev Paudel</b> Member	<b>Mr. Dol P. Dhakal</b> Member	<b>Dr. Kripa Dhakal</b> Member	<b>Dr. Pramod Pokhrel</b> Member	<b>Dr. Uma Karki</b> Member	<b>Dr. Megha N. Parajulee</b> Immediate Past President

[www.napaamericas.org](http://www.napaamericas.org)    [www.facebook.com/NepaleseAgriculturistAmericas](https://www.facebook.com/NepaleseAgriculturistAmericas)    [www.facebook.com/napa2072](https://www.facebook.com/napa2072)

For details, please visit NAPA website: <https://napaamericas.org/>

## Various Conference Sub-committees

### Conference Organizing Committee

#### Chair

Dr. Nanda P. Joshi

#### Co-Chairs

Dr. Megha N. Parajulee

Dr. Lila B. Karki

#### Secretary

Dr. Sushil Paudyal

#### Members

Dr. Pradeep Wagle

Dr. Ramjee Ghimire

Dr. Santosh Dhakal

Dr. Dev Paudel

Dr. Uma Karki

Dr. Sushil Thapa

Dr. Shyam Kandel

Ms. Gita Koirala

Dr. Nitya N. Khanal

Dr. Aditya R. Khanal

Dr. Prem B. Bhandari

### Scientific Committee

Dr. Rajan Ghimire, Chair

Dr. Manoj Karkee

Dr. Raju Adhikari

Dr. Bishwo Adhikari

Dr. Bal Krishna Joshi

Dr. Santosh Dhakal

Dr. Kalpana Khanal

Dr. Niraj P. Joshi

Dr. Krishna Puri

Dr. Bharat Shrestha

Dr. Sita Thapa

Dr. Shital Paudel

Dr. Nitya N. Khanal

### Fundraising Committee

Dr. Pradeep Wagle, Chair

Dr. Purna Kandel

### Research Mini Grant Symposium

Dr. Nitya N. Khanal, Chair

Dr. Pramod Pokhrel

Dr. Buddhi Gyawali

Dr. Rajan Ghimire

Dr. Manoj Karkee

Dr. Aditya R. Khanal

Dr. Bharat Shrestha

Dr. Sharad Marahatta

Dr. Sonisha Sharma

### Local Organizing Committee

Mr. Chandra Kanta Dhakal, Chair

Dr. Prakash Malla

Dr. Mukti Ghimire

Mr. Madhav Parajuli

Mr. Ananda Tiwari

Mr. Bhuwan Shrestha

Mr. Gautam K. Joshi

Mr. Deepak Khanal

Dr. Santoshi Chaudhary

Dr. Khim Ale

Mr. Nabin Bhandari

Mr. Sailesh Bhattarai

Mr. Maha P. Gelal

Mr. Bikash Ghimire

Dr. Sadikshya Lamsal

### Communication and Media Committee

Dr. Pramod Pokharel, Chair

Mr. Bipin Neupane

Mr. Sadikshya Poudel

### IT Committee

Dr. Dev Paudel, Chair

Dr. Ananta Acharya, Co-Chair

Dr. Pramod Pokhrel

Ms. Asmita Nagila

Mr. Bishwoyog Bhattarai

### Logistic Committee

Mrs. Ambika Tiwari, Chair

Dr. Megha N. Parajulee

Dr. Pradeep Wagle

### Agri-poem Committee

Dr. Manoj Karkee, Chair

Dr. Bharat Shrestha, Co-Chair

Mr. Dhananjaya Dhakal, Co-Chair

Dr. Buddhi Gyawali

Mr. Govinda Baral

Mr. Padma Nath Atreya

### Student Essay Committee

Dr. Bharat Pokharel, Chair

Dr. Gandhi Bhattarai

Dr. Lila Khatiwada

Dr. Mukti Ghimire

Dr. Omkar Joshi

Dr. Prakriti Bista

Mr. Shaligram Aryal

Dr. Shyam Adhikari

### Cultural Committee

Dr. Manoj Karkee, Chair

Dr. Pradeep Wagle

Mr. Sailesh Bhattarai

### Sports Committee

Ms. Kemika Bhandari, Chair

Dr. Mukti Ghimire

## Various Awards and Awardees

Award Distribution (in USD)				
EVENTS / PRIZE (USD)	FIRST	SECOND	THIRD	TOTAL
Student Oral Presentation	250	150	100	500
Student Poster Presentation	250	150	100	500
Student Essay Writing Contest	250	150	100	500
Agri-poem Recitation	200	150	100	450

Student Oral Competition		
Rank	Name	Affiliation
First	<b>Uddhav Bhattarai</b>	Washington State University, USA
Second	<b>Kabita Poudel</b>	Kentucky State University, USA
	<b>Sadikshya Poudel</b>	Mississippi State University, USA
Third	<b>Madhav Parajuli</b>	Tennessee State University, USA
	<b>Rudra Baral</b>	Kansas State University, USA

## Student Poster Competition

Rank	Name	Affiliation
First	<b>Bipin Neupane</b>	North Dakota State University, USA
Second	<b>Santoshi Chaudhary</b>	Tuskegee University, AL, USA
Third	<b>Sandesh Thapa</b>	Gokuleshwor College, Baitadi, Nepal
	<b>Santosh Pathak</b>	Louisiana State University, USA

## Student Essay Writing Competition

Rank	Name	Affiliation
First	<b>Amrit Sharma</b>	Agriculture and Forestry University, Nepal
Second	<b>Sagar Bhandari</b>	Agriculture and Forestry University, Nepal
Third	<b>Aadesh Subedi</b>	University of Georgia, USA

## Agri-poem Competition

Rank	Name	Title
First	<b>Rojina Pandey</b>	मेरो देश र मेरो खेती
Second	<b>Roshan Pun</b>	मझधारको जिन्दगी
Third	<b>Ramesh Ranabhat</b>	मानो रोपेर खेतमा

# Conference Sponsors

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



**NAPA**  
is grateful to

**Liam Corporation Canada**  
**Adaptive Trading Company Canada**



for generous donation of


**\$1,000 (One Thousand USD)**  
to

**NAPA Conference Fund**



Conference Fundraising Committee, NAPA  
<https://www.napaamericas.org/conference-2022.php>

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**NAPA**  
is grateful to

**LI-COR**  
Impacting Lives Since 1971

for sponsoring student poster presentation awards of


**\$500 (Five Hundred USD)**  
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<https://www.napaamericas.org/conference-2022.php>

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is grateful to


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Conference Fundraising Committee, NAPA  
<https://www.napaamericas.org/conference-2022.php>

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Association of Nepalese  
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Americas (NAPA)



**NAPA**

is grateful to

Life member Mr. Balkrishna Regmi &  
Mrs. Kusum Aryal Regmi from Maryland

\$500 (Five Hundred USD)

to

**NAPA Conference Fund**



Conference Fundraising Committee, NAPA

<https://www.napaamericas.org/conference-2022.php>

Association of Nepalese  
Agricultural Professionals of  
Americas (NAPA)



**NAPA**

is grateful to

Life members Mr. Ramesh Pandit &  
Mrs. Sarita Pandit from Iowa

for sponsoring Agri-poem awards of

\$500 (Five Hundred USD)

to

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Conference Fundraising Committee, NAPA

<https://www.napaamericas.org/conference-2022.php>

Association of Nepalese  
Agricultural Professionals of  
Americas (NAPA)



**NAPA**

is grateful to

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Edmonton REALTOR  
[www.SarjuRanjit.ca](http://www.SarjuRanjit.ca)  
eXp Realty, Canada

\$250 (Two Hundred and Fifty USD) to

**NAPA Conference Fund**



Conference Fundraising Committee, NAPA

<https://www.napaamericas.org/conference-2022.php>

## **Service Award Recipients**

- Sushil Thapa, Agri-Connection Editor-in-Chief (**Superior Service Award**)
- Shital Poudyal, Student Poster Competition Coordinator
- Aditya Khanal, Student Oral Paper Chair
- Pramod Pokharel, RMG Coordinator
- Prem Bhandari, EFAB Director and Member Secretary
- Khushi R. Tiwari, Webinar Chair
- Nityananda Khanal, RCBC Chair
- Bharat Shrestha, Ag Poetry Program Chair
- Bharat Pokharel, Student Essay Program Chair
- Kemika Bhandari, Sports Events Chair
- Ananta Acharya, IT Coordinator
- Ambika Tiwari – Conference Logistics Chair
- Suby Sharma, Student Coordinating Committee Chair
- Dev Paudel, IT Committee Member and Joint Secretary
- Gita Bhandari, WAAP Chair, EC Member
- Uma Karki, EC Member
- Ambika Tiwari, Conference Logistic Chair
- Shyam Kandel, EC Member
- Santosh Dhakal, EC Member

### **Rubber Promotion Excellence Award:**

Tilak B. Bhandari, Dallas, Texas, USA

### **Election Commission:**

Prof. Gopi Upreti, Chief Commissioner

Mr. Dhanajay Dhakal, Commissioner

Ms. Kemika Bhandari, Commissioner

### **Outstanding Volunteer Award**

Madhav Parajuli, Tennessee State University

Bipin Neupane, North Dakota State University

## Pioneer Award

Dr. Ananta B. Shrestha (first Horticulture Ph.D. from Nepal) was awarded the "*Agriculture Pioneer Award*" and "*Honorary Membership*" by NAPA during the 3<sup>rd</sup> Biennial Conference for his pioneering work on Apple in Nepal.





# Progress Report of NAPA 2020-2022

Presented by Megha N Parajulee, President, NAPA

## Introduction of NAPA

- Founded on January 6, 2016
- A non-profit, non-governmental, non-religious, and non-political professional organization of agricultural and allied discipline

**Vision:** Prosperity through agricultural transformation

**Goals and Objectives:** Achieve Food Security through Agricultural Transformation

- Research
- Teaching
- Service
- Compatible Agriculture Policy

## Executive Meeting Summary:

Fourteen EC meetings were held on the following dates:

Jun 7, 2020	Jul 19, 2020	Aug 16, 2020	Sep 23, 2020
Oct 31, 2020	Dec 20, 2020	Feb 28, 2021	May 7, 2021
Jun 26, 2021	Jul 28, 2021	Oct 13, 2021	Jan 22, 2022
Mar 15, 2022	May 22, 2022		

- NAPA's maiden book on Food Safety published/launched – August 1, 2020
- Endowment Fund Advisory Board Established (\$107,597)
- Research Mini-Grant Program expanded/enhanced 16 proposals funded
- Existing committees restructured and new committees formed/mobilized
- Celebrated NAPA Day and Nepali New Year (Jan 2021 and Jan 2022)
- Scaled up outreach activities with the US and Nepal-based media
- Interacted with Nepal-based educational institutions
- President/EC members chaired/participated in 10 international meetings/conferences hosted by professional organizations such as NRNA, NACA, UNCON, and others
- Social and charity services, including regular blood donations, Covid-19 Relief Fund for Nepal, and others

## NAPA Committees

- Advisory Council
- Resource and Capacity Building Committee
- Agri-Connection Editorial Board
- Research and Policy Brief Editorial Committee
- Women in Agriculture and Allied Professions
- Student Coordination Committee
- Membership Drive Committee
- Information and Technology Committee

- Communication Committee
- Webinar Committee
- Distance Teaching Committee
- Publication Committees (GJAAS, Book, Proceedings)
- NAPA Nepal Liaison

## Major Accomplishments

### Resources and Capacity Building Committee

#### Research Mini-grants:

- 2018-2019:
  - 18 research project funded
  - Total funding provided: NRs. 3,78,115/\$3,450
- 2020-2021:
  - **Proposals received:** 35 (32+3)
  - Undergraduate (20)
  - Masters: 7
  - Doctoral: 3
  - University faculty: 2
- **Competitive proposals selected:** 16
  - AFU: 8
  - TU/IAAS: 3
  - KU: 1
  - College of Live Sciences, Dang: 3
  - 16 research project funded
  - Total fund approved: NRS. 429,425:00

#### Activities/Orientations by RCBC Committees

- RMG introductory session: March 4, 2021
- Research & Publication Ethics session: March 11, 2021
- Experimental & Social Research Design session: April 23, 2021
- Survey and Questionnaire Design session: July 2, 2021
- Project Status Review Meeting: July 30, 2021
- Good Practices in Statistical Analysis session: August 20, 2021
- Data Analysis Using R: March 18, 2022
- RMG Symposium: to be held on May 29, 2022.
  
- Proposal solicitation: November 1, 2020
- Proposals reviewed: January 25, 2021
- Awardees informed: February 10, 2021
- Awardees received first half of the grant: March 1, 2021
- Mid-term review held: July 30, 2021
- Awardees received second half of the grant: August 1, 2021
- Awardees submitted final report: April 30, 2022
- **Final review held: May 29, 2022**

## Teaching and Graduate Student Mentoring

**Teaching and Graduate Student Mentoring**

**An Introduction to Survey Data Analysis**  
(June 21-September 27, 2020)

**Prem Bhandari, Ph.D.**

Organized by:



- Dhaulagiri Multiple Campus, Baglung
- Myagdi Multiple Campus, Myagdi
- Central Department of Anthropology and Sociology, Kirtipur

- Mentoring graduate students
- Serving on doctoral research and thesis evaluation



**Workshops and Symposia**

**Applied Bioinformatics in Agriculture and Medicine**

**Careers in Agriculture**

**Public Speaking and Science Communication**

**Grant Writing**

**APPLIED BIOINFORMATICS IN AGRICULTURE & MEDICINE**  
(With hands-on workshops, genomics and evolution of SARS-CoV-2)

Program Dates: July 19 to 20 AM, 10:00 AM, NST  
July 20 to 22 AM, 10:00 AM, NST  
July 23 to 24 AM, 10:00 AM, NST  
July 25 to 26 AM, 10:00 AM, NST

Organized by:

- Shobana Prasad, PhD - Agricultural and Forestry University
- Megha N. Parajulee, PhD - President, NAPA
- Arjun Prasad, PhD - President, AFU
- Prakash Devkota, PhD - President, AFU
- Ujjwal Shrestha, MS - President, AFU

**CAREERS IN AGRICULTURE**  
PANEL DISCUSSION

FEDERAL JOBS	STATE JOBS	INDUSTRY	NON-PROFITS
Dr. Prakash Singh, USAID	Dr. Robert E. Kelsey, Oklahoma State of Mexico	Dr. Ananda Karmali, Geneva AgriBusiness	Dr. Rajendra Kumar, CIMMYT
Dr. Prakash Singh, USAID	Dr. Prakash Singh, Louisiana State of America	Dr. Ananda Karmali, San Jose State University	Dr. Taru Bhandari, NABA Research Institute

ACADEMIA	EXTENSION SERVICES	POSTDOCTORAL JOBS
Dr. Rajendra Kumar, NABA Research Institute	Dr. Ananda Karmali, University of California	Dr. Laxman Bhandari, Kansas State University
Dr. Prakash Singh, NABA Research Institute	Dr. Ananda Karmali, University of California	Dr. Rajendra Kumar, NABA Research Institute

Open only to NAFA members.  
Zoom link will be sent prior to the event.

## Workshop and Symposium

**UNC ON**  
USA-NEPAL COMMUNITY OUTREACH NETWORK

In Collaboration with




Center for Biotechnology Agriculture and Forestry University (AFU) | Association of Nepalese Agricultural Professionals of Americas (NAPA)

**Presents**

Contact: [info@usanepalnetwork.org](mailto:info@usanepalnetwork.org)

For Registration visit: [www.afu.edu.np](http://www.afu.edu.np) | [www.usanepalnetwork.org](http://www.usanepalnetwork.org)

Zoom link will be provided to registered participants only.

**Public Speaking Workshop & Seminar**  
(For Scientists and Science Students who want to improve their presentation skills)

**AUGUST 22-24, 2020**  
(8:00 AM - 9:30 AM NST)

**Opening Remarks**



Sharada Thapaliya, PhD  
Vice Chancellor  
Agriculture and Forestry University

Megha N. Parajulee, PhD  
Regents Fellow Professor, Texas A&M University  
President, NAPA

Bilas Upadhyay, CPA  
President  
UNC ON

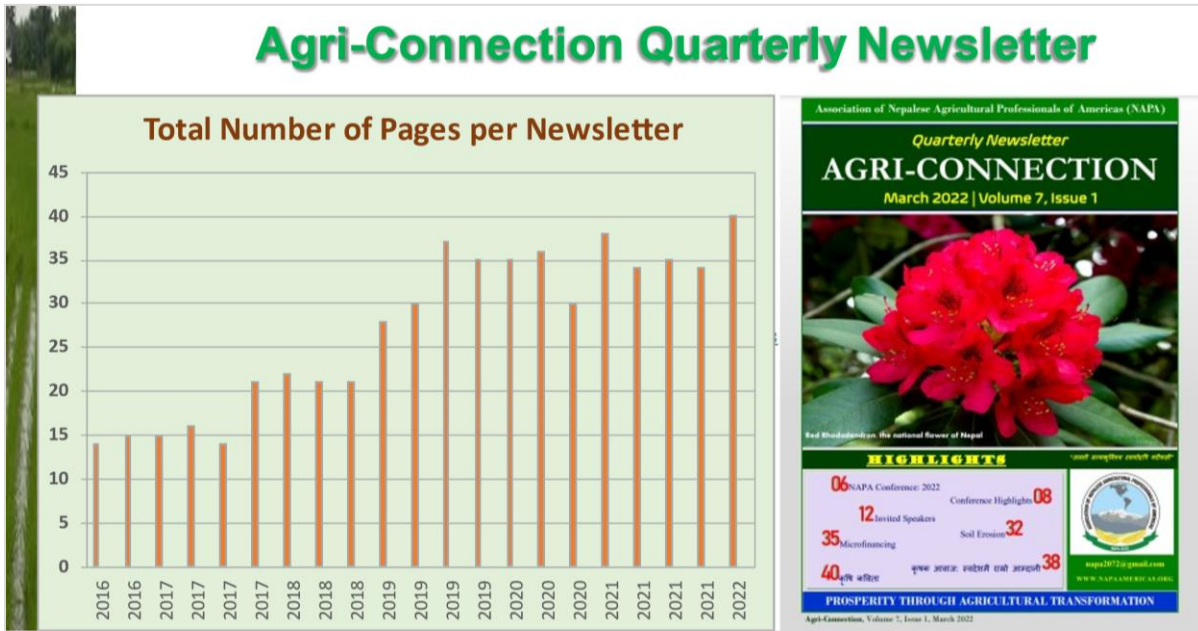
**Panel Discussion**

Megha N. Parajulee, PhD - Panelist  
Naba Raj Devkota, PhD - Panelist  
Hitesh Bhalala, DTM - Panelist  
IP Kadariya, PhD - Moderator  
Batak Bista, DTM - Moderator

**Speakers**

Batak Bista, DTM  
Jeffrey Cornell, ACG  
Devendra Shah, IP2  
Dr. Vishnu Maya Upadhyay, IP2  
Rajan Ghimire, PhD

Publications



## NAPA Book Publication

Book Publication Leadership Acknowledged

Book release August 1, 2020

Author copies are mostly delivered

KU – 5

AFU -25

NAPA Nepal Liaison – 20

Prof. Naba Devkota (HICAST/GU)– 25

This Conference – 45

Current Stock- 64

## Research and Policy Briefs

### 2020-2022

- [Policy/Research Brief #7](#)
- [Policy/Research Brief #6b](#)
- [Policy/Research Brief #6a](#)

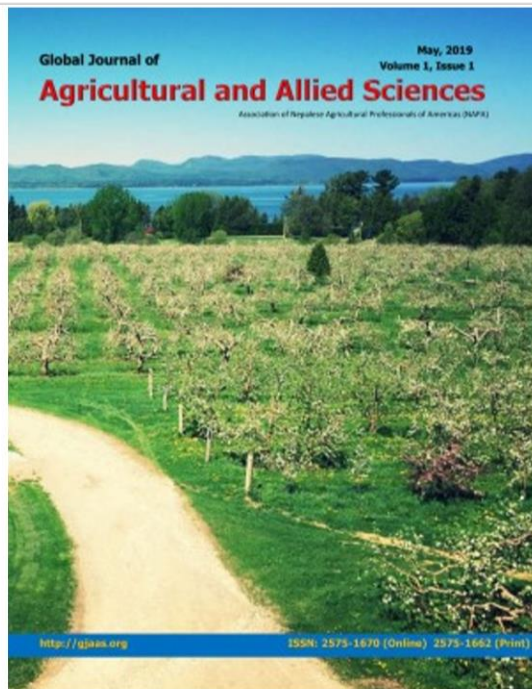
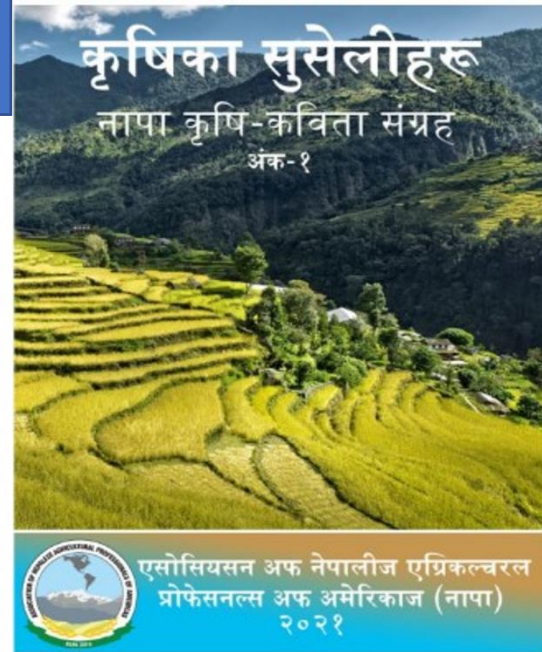
### 2018-2020

- [Policy/Research Brief #5](#)
- [Policy/Research Brief #4](#)
- [Policy/Research Brief #3](#)

### 2016-2018

- [Policy/Research Brief #2](#)
- [Policy/Research Brief #1](#)

कृषिका सुसेलीहरू : नापा कृषि-कविता संग्रह



## Global Journal of Agricultural and Allied Sciences (GJAAS)



**GJAAS**  
Global Journal of Agricultural and Allied Sciences




**8 manuscripts published  
during this EC term**

## Webinar Committee

- NAPA organized a series of talks through webinar during 2020 to 2022.
- The objective of the webinar was to foster the discussion on various aspects of Nepalese agriculture.
- Fourteen presentations, each lasting for about an hour were made virtually through the Zoom and live streamed in Facebook.
- On an average, 50 participants attended the Zoom sessions and more than 200 viewed on Facebook.
- For policy focused presentations, senior officials from the Government of Nepal and universities in Nepal made the were invited, whereas for the presentations on agribusiness and entrepreneurship and technologies, experts with experience and understanding of Nepalese agriculture development and market systems were invited.
- Technology related presentations were made by the experts from the U.S., Canada, and Australia.
- The objectives of this presentation are to highlight the presentations by various speakers and share the lessons-learned from these presentations.




## Women in Agricultural and Allied Professionals (WAAP)



**Women in Agricultural and Allied Professions (WAAP)**

<https://www.napaamericas.org/waap.php>

'NAPA highly encourages women members to come forward and contribute in WAAP and other committees of NAPA'

 Ambika Tiwari Member	 Gita Koirala Bhandari, Chair	 Kripa Dhakal Member
--	--	---

## Student Coordination Committee

Panel and Workshops organized: 4

- August 29, 2020: Careers in Agriculture
- February 13, 2021: Scientific Writing and Publication
- July 31, 2021: Graduate School Life Management
- October 31, 2021: Legal Issues, Visa Status, Work Eligibility, and Permanent Residency

## Membership Status

Member categories	Numbers
Founding Life	5
Regular Life + Senior life	115
General/Regular	16
Student	100
Associate Life (Nepal)	63
Associate Life (International)	5
Joint Life	5
<b>Total</b>	<b>309</b>
<b>Under EC term of 2020-2022:</b>	
• <b>Total life members: 39</b>	
• <b>Other members: 125</b>	

## Student Coordination Committee

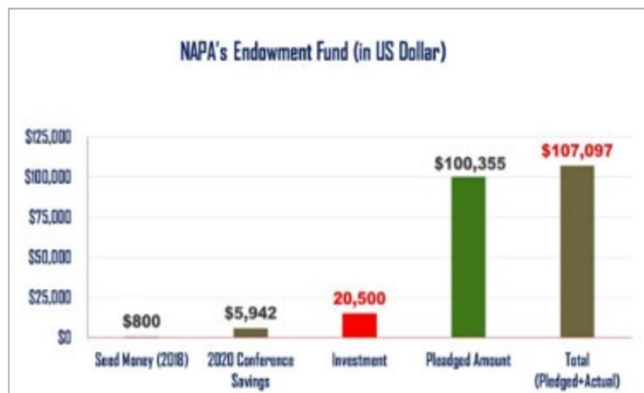
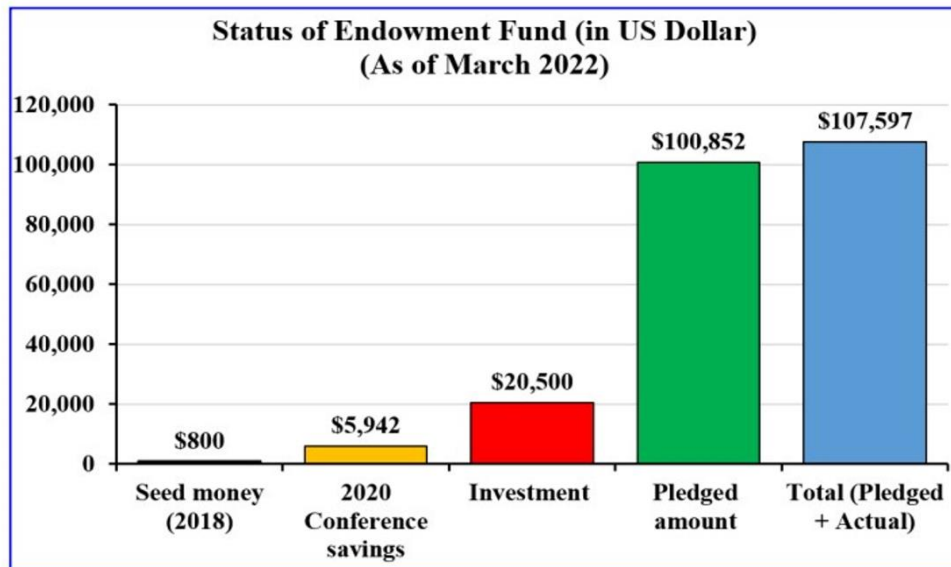
- Total no. of meetings: 8; Programs organized: 4
- August 29, 2020: Panel discussion – Careers in Agriculture
- February 13, 2021: Panel discussion – Scientific Writing and Publication
- July 31, 2021: Panel discussion – Graduate School Life Management
- October 31, 2021: Webinar and Discussion – Legal Issues, Visa
- Status, Work Eligibility, and Permanent Residency

## Financial Status

Regular transactions	Regular Chase bank		PayPal		Total		
Category	Debit	Credit	Debit	Credit	Debit	Credit	Balance
<b>Prior carryover</b>		28882.78			0	28882.78	<b>28882.78</b>
Member		2443		8098.88	0	10541.88	10541.88
2020 Conference	2952.84	5109.01		1888.2	2952.84	6997.21	4044.37
COVID Relief Fund	4051.4	3507.71		545.79	4051.4	4053.5	2.1
RMG	3621.67	4372		1376.79	3621.67	5748.79	2127.12
Endowment fund	13646.99	6000		990.23	13646.99	6990.23	
NAPA Book	1587.56	20		83.21	1587.56	103.21	-1484.35
Amazon smile donation		50.38		0	0	50.38	50.38
2022 Conference	2541.92	4890		962.62	2541.92	5852.62	3310.7
Miscellaneous	13897.69	3085.97	10	485.20	13907.69	3571.17	
Transfer from Paypal		14,107.28			0	14107.28	
Bank transfers	25941.38	2500	14107.28		40048.66	2500	
Subtotal	68241.45	74968.13	14117.28	14430.92	82358.73	89399.05	
<b>Total</b>		<b>6726.68</b>		<b>313.64</b>		7040.32	
Regular Chase Savings						28886.19	
EF checking account						2100	
EF savings account						2367.46	
Vanguard investment						20500	
<b>Total</b>						<b>60893.97</b>	

## Endowment Fund and Sponsors

Since the formal establishment of the NAPA Endowment Fund in January 2021, with the goal of achieving NAPA's economic and programmatic sustainability, as of March 31, 2021, the 51 generous sponsors have pledged a total amount of \$100,852.00 in the Endowment Fund as shown below (green bar).



**Gold Sponsors**

**NAPA Endowment Fund**  
**Gold Sponsor**  
**Dr. Prem Bhandari**  
**Mrs. Usha Bhandari**  
Total Pledged Amount: \$5,000 (Five Thousand USD over 10 Years)  
\$500/year starting in 2021

**NAPA Endowment Fund**  
**Gold Sponsor**  
**Mr. Dhananjaya Dhakal**  
**Mrs. Shakuntala Khanal Dhakal**  
in honor of Dr. Prem Bhandari & Mrs. Usha Bhandari  
Total Pledged Amount: \$5,000 (Five Thousand USD over 5 Years)  
\$1,000/year starting in 2021

**NAPA Endowment Fund**  
**Gold Sponsor**  
**Mr. Rishi Punnakhar Dhakal**  
**Mrs. Bimala Dhakal**  
Total Pledged Amount: \$5,000 (Five Thousand USD over 10 Years)  
\$500/year starting in 2021

**Platinum Sponsors**

**NAPA Endowment Fund**  
**Platinum Sponsor**  
**Dr. Nanda Prakash Joshi**  
**Mrs. Mani Joshi**  
Total Pledged Amount: \$10,000 (Ten Thousand USD over 5 years)  
\$2,000/year starting in 2021

**NAPA Endowment Fund**  
**Platinum Sponsor**  
**Dr. Pradeep Wagle**  
**Dr. Monika Ghimire**  
Total Pledged Amount: \$10,000 (Ten Thousand USD over 10 years)

**NAPA Endowment Fund**  
**Platinum Sponsor**  
**Dr. Lila B. Karki**  
**Dr. Uma Karki**  
Total Pledged Amount: \$12,000 (Twelve Thousand USD over 10 years)  
\$1,200/year starting in 2021

**NAPA Endowment Fund**  
**Platinum Sponsor**  
**Prof. Gopi Upreti**  
**Mrs. Samita Upreti**  
Total Pledged Amount: \$12,500 (Twelve Thousand & Five Hundred USD over 11 years)  
\$1,136 in 2021 & \$1,100/year thereafter



## Information and Technology Committee

- Update and maintenance of NAPA website: [www.napaamericas.org](http://www.napaamericas.org) (82,425 visits)
- Modernized membership form and update member directory
- Developing database of agriculture experts
- Co-ordinated two Biennial International Scientific Conferences 2020 (Virtual) 2022 (Hybrid Program)
  - Prepared registration forms for conference
  - Developed/managed abstract/video submissions for talks and posters
  - Organized/catalogued videos and presentations for the conference
- Led 5-day Applied Bioinformatics Workshop
  - Cloud computing for 300 participants
  - Archived all videos from the workshop
- Coordinated presentations of RMG Symposium
- Archived videos from NAPA webinar series

## Website Visits

[WWW.NAPAAMERICAS.ORG](http://WWW.NAPAAMERICAS.ORG): 1,12,465

Page	Pageviews	Country ?	Acquisition	
			Users ?	↓
/assistantship.php	18,145			
/	12,118			
/conference-2022.php	4,824			
/research-mini-grants.php	3,923			
/newsletter.php	1,966			
/join-napa.php	1,817			
/conference-2020.php	1,371			
/membership-directory.php	1,354			
/executive-committee.php	1,281			
/endowment.php	1,194			
May 21, 2020 - May 27, 2022 ▼		PAGES		
			<b>16,386</b>	% of Total: 100.00% (16,386)
		1.  United States	<b>7,465</b>	(45.59%)
		2.  Nepal	<b>6,499</b>	(39.69%)
		3.  Canada	<b>289</b>	(1.77%)
		4.  India	<b>285</b>	(1.74%)
		5.  Japan	<b>244</b>	(1.49%)
		6.  Australia	<b>239</b>	(1.46%)
		7.  China	<b>133</b>	(0.81%)
		8.  Nigeria	<b>100</b>	(0.61%)
		9.  Philippines	<b>91</b>	(0.56%)
		10.  Germany	<b>79</b>	(0.48%)

**Lesson-learned**

- Presentations were diverse in term of the gender and expertise/fields of speakers, topics/issues addressed.
- How effective and impactful these webinars have been to foster discussion, collaborations and actions on stated areas/issues are yet to be evaluated.
- Preparation including promotion starting several months ahead of the scheduled webinars is essential.
- Identifying thematic areas to be addressed and [possible] expert speakers who can talk on those areas, preparing an annual calendar of the webinars in advance and follow-up/implementation of the resolutions of the webinars could add value and make webinars more effective.

**Acknowledgement**

NAPA's Conference Organizing Committee truly appreciated all the Committee or Program Coordinators, Judges, Student volunteers, Presenters, Service providers, Registration desk, Food/beverage, members, and all others who helped to successfully organize this conference.

# Conference Snapshots



















# 3<sup>rd</sup> NAPA BIENNIAL INTERNATIONAL SCIENTIFIC CONFERENCE

MAY 27-29, 2022 (MEMORIAL WEEKEND)

*“Advancing Agriculture in a Changing World”*

VENUE:



 SONESTA ATLANTA AIRPORT NORTH  
1325 Virginia Avenue  
Atlanta, GA 30344, USA



For more information:

[www.napaamericas.org/conference-2022.php](http://www.napaamericas.org/conference-2022.php)

# NAPA 3<sup>rd</sup> Biennial International Scientific Conference

“Advancing agriculture in a changing world”



May 27-29, 2022 (Memorial Day Weekend)



SONESTA Hotel and Resorts  
1325 Virginia Ave., Atlanta, GA 30344, USA

## Conference Highlights

- Keynote speech
- Scientific oral and poster presentations
- Competitive student presentations (oral & poster)
- Student essay writing competition
- Agri-poem contest
- Ag policy panel discussion
- Ag-entrepreneurs panel discussion
- Financial literacy/education session
- Seniors' roundtable discussion
- Professional development sessions with representatives from industry and academia
- Research mini-grant symposium
- Roundtable (joint and student members)
- Pre/post-conference tours
- Cultural night
- Sports, social, and networking events
- Volunteer appreciation
- Annual general meeting and announcement of new leadership

For details: <https://napaamericas.org/conference-2022.php>

