ICIMOD

GRAPE
Green Resilient Agricultural Productive Ecosystems

POSTER PRESENTATION

Participatory Action Research on Climate-Resilient Agriculture

As part of the GRAPE (Green Resilient Agricultural Productive Ecosystems) project, ICIMOD has been leading the implementation of GRAPE Field of Action 2 – action research – in Karnali and Sudurpashchim provinces of Nepal. The focus is on participatory action research and demonstration of proven climate-resilient agricultural solutions to minimize climate and socioeconomic risks and vulnerabilities.

Currently, ICIMOD partners with four universities — Agriculture and Forestry University, Far Western University, Mid-West University, and Kathmandu University — and three key agencies: Local Initiatives for Biodiversity, Research and Development (LI-BIRD), Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED) and Global Institute for Interdisciplinary Studies (GIIS). In this exciting poster presentation, we invite you to explore the preliminary findings from our action research under GRAPE FA2.

Research partners

Agriculture and Forestry University, Chitwan, Nepal
CEAPRED
Global Institute for Interdisciplinary Studies
LI-BIRD
Mid-West University, Surkhet, Nepal

Supported by

Co-funded by the European Union
SUOMI FINLAND
जर्मन सहयोग DEUTSCHE ZUSAMMENARBEIT
Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

ICIMOD gratefully acknowledge the generous support of the European Union, the Ministry of Foreign Affairs of Finland, and the German Federal Ministry for Economic Cooperation and Development (BMZ) for programme funding. The authors are solely responsible for the poster content.

Yield and quality of cucumber as influenced by 3G cutting

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Introduction

Cucumber, an important vegetable crop, is mainly consumed as salad and pickles in Nepal. The productivity of this crop is less than half the world`s average productivity, which is associated with imbalance in male to female ratio. Hence, there is a need to increase female flowers for improving its productivity.

Research questions

- Is it possible to alter the male to female ratio by 3G cuttings?
- How do 3G cuttings affect productivity?
- What kind of problems arise during 3G cuttings?

Methodology

The field experiment aimed to evaluate the effect of 3G cutting on sex expression, yield and quality of cucumber cv. Malini. The research was performed using randomized complete block design (RCBD) with six replications and three treatments. The site had sandy clay loam soil with pH 7.32.

Key findings

The ratio of male to female flowers was significantly lower on the tertiary branch by 3G cutting with 78.50% and 26.10% over primary and secondary branch, respectively. Similarly, the fruit yield was significantly higher by 3G cuttings with 7.24% and 18.15% increase in yield over 2G and no cutting respectively

Figure 1 Male to female ratio of 3G cutting of cucumber in Godawari municipality, Kailali, 2024.

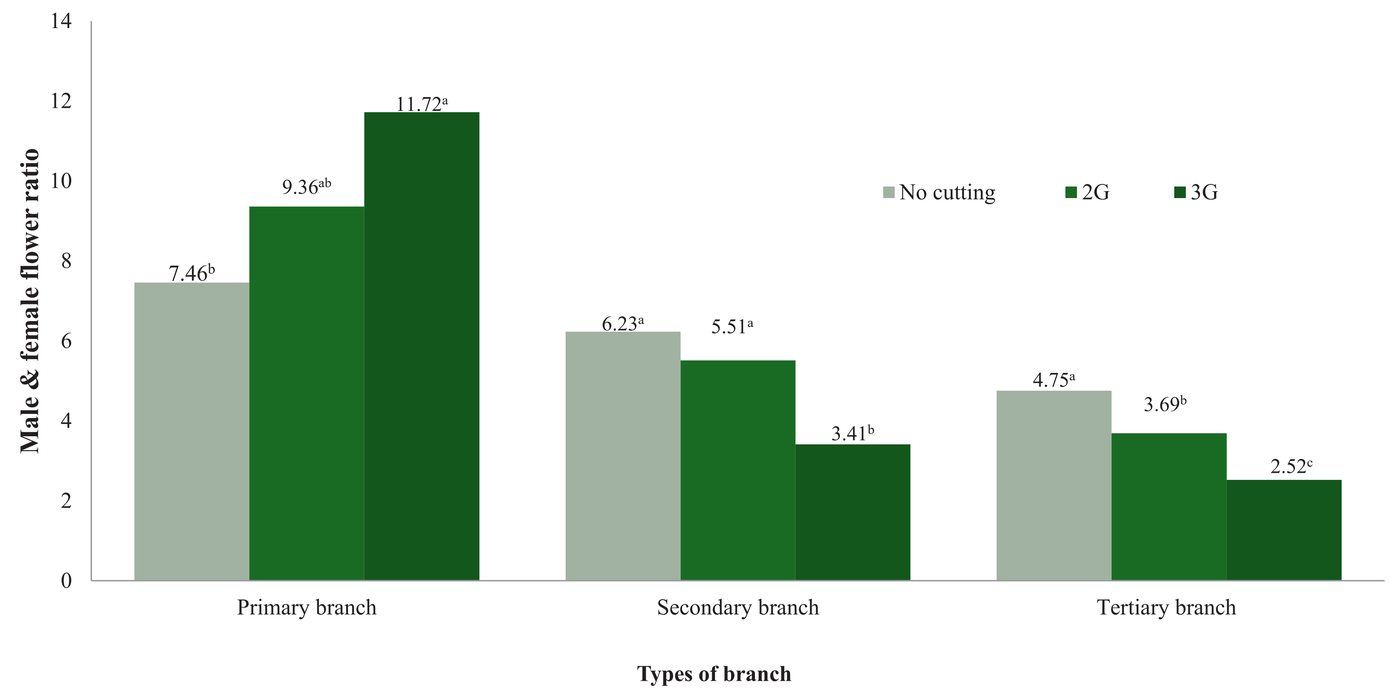
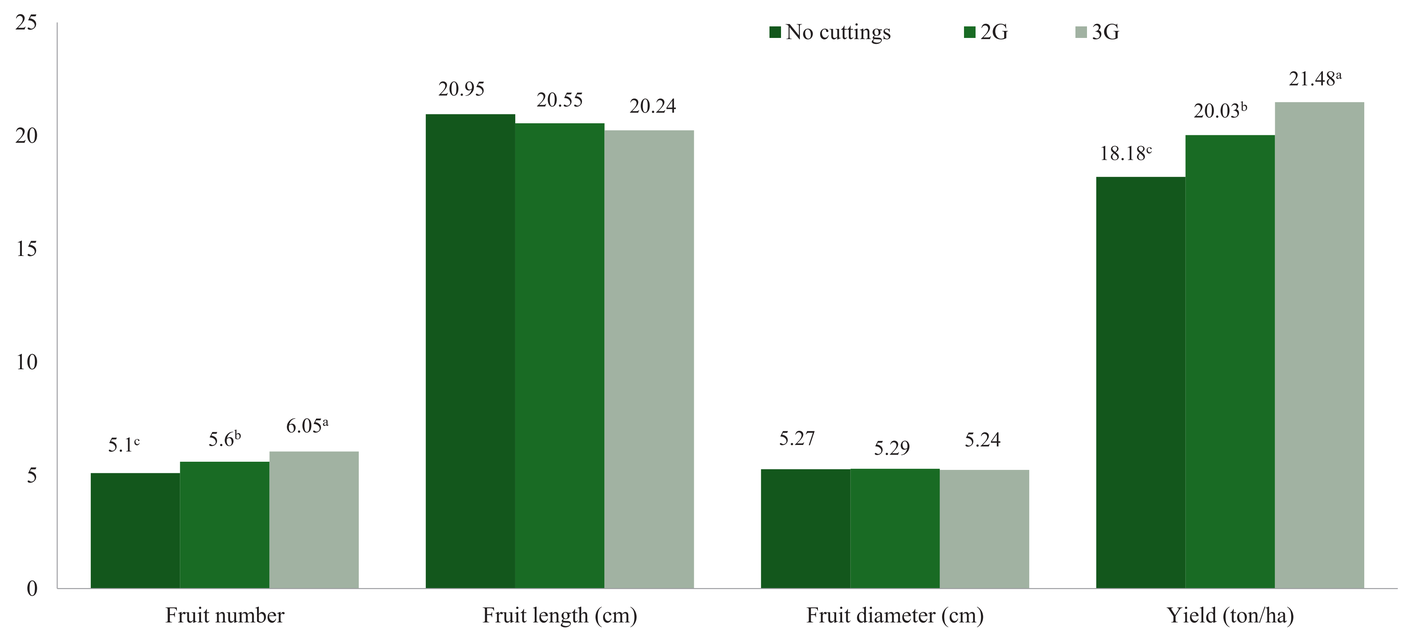


Figure 2 Yield and yield attribute traits of different generation cutting of cucumber in Godawari municipality, Kailali, 2024.



Conclusion

3G cutting has immense potential as it increases the number of female flowers in cucumber resulting in increased yield without using commercial chemical inputs.. Therefore, farmers can use this technique to improve productivity and the quality of cucumbers.

Efficacy of tricho-compost and vermiwash in the management of root knot nematode(*Meloidogyne incognita*) in okra

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Introduction

- Okra (*Abelmoschus esculentus* L. Moench): Summer vegetable crop grown in Terai, Inner Terai and Lower Hills of Nepal.
- Root knot nematode (*Meloidogyne incognita*): Causes galls on okra roots, leading to yield loss (up to 27%) and reduced quality (Sikora and Fernandez, 2005).
- Chemical control: Harmful to the environment and can develop resistance (Anastasiadis et. al, 2008).
- Trichoderma and vermiwash: Promising biocontrol agents.

Research questions

- To assess the efficacy of tricho-compost and vermiwash in combating root knot nematode in okra

Methodology

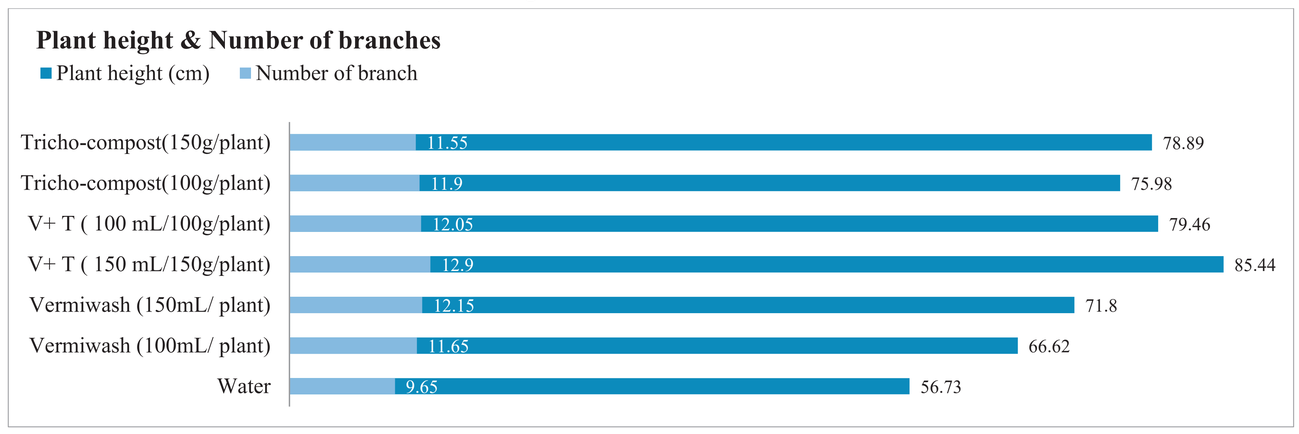
- Experiment site: Birendranagar Municipality-09, Chadanichowk Surkhet
- Design of experiment: Randomized Complete Block Design (RCBD) (4 replications and 7 treatments)
- Crop: Okra (variety: Arka Anamika)
- Data collected on plant height, number of branches, gall index, number of galls/plants, number of juveniles/100 gm soil, fresh root weight, shoot length, root length, yield and soil physiochemical parameters.
- Data analysis: Microsoft Excel, R-studio version 4.3.1 & Duncan's Multiple Range Test (DMRT)

Treatment	Details
T1	Control
T2	Vermiwash (100ml/plant)
T3	Vermiwash (150ml/plant)
T4	Vermiwash (150ml/plant) +Tricho-compost (150g/plant)
T5	Vermiwash (100ml/plant) +Tricho-compost (100g/plant),
T6	Tricho-compost (100g/plant)
T7	Tricho-compost (150g/plant)

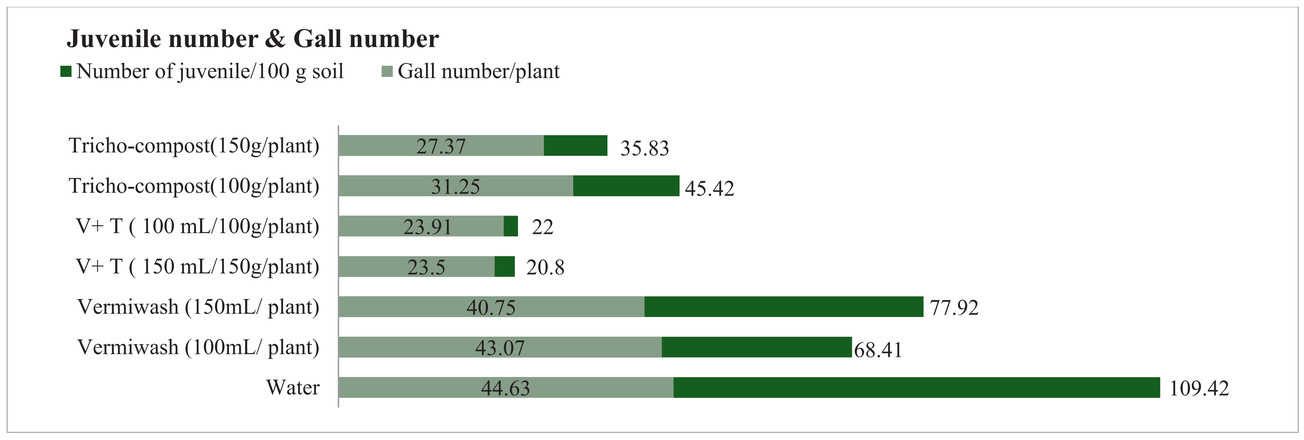
Key findings

The combination of vermiwash (150 ml/plant) and tricho-compost (150 g/plant) yielded the tallest plants, most branches, highest yield (31.25 t/ha), and improved soil organic matter (>3%) compared to the control. This treatment also reduced galls, juveniles, and root weight. T4, T5, and T7 had the highest Nitrogen content (0.17%), while T5 had the highest Phosphorus content (7.73%). Vermiwash-only plots had a higher pH (>7).

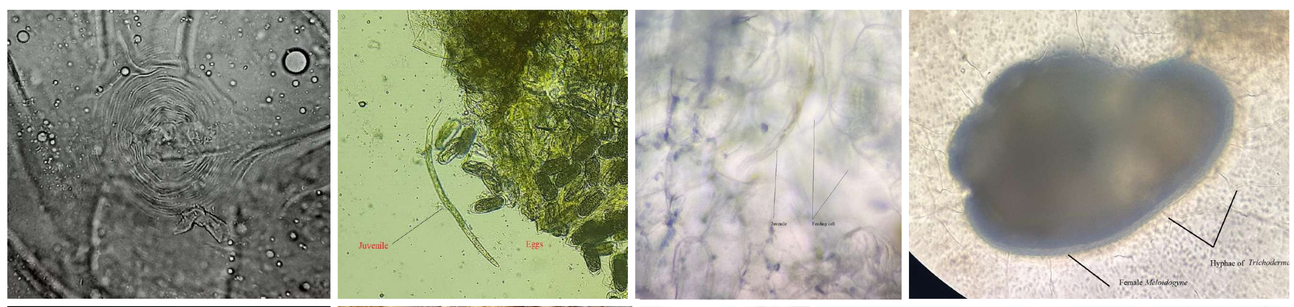
Effect of tricho-compost and vermiwash on plant height and the number of branches at 35 DAS.



Effect of Tricho-compost and Vermiwash on the number of juveniles in soil and number of galls.

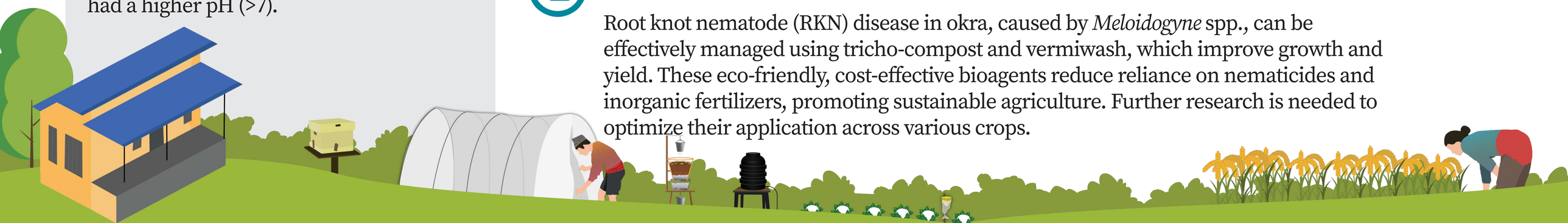


Effect of Tricho-compost and Vermiwash on yield of okra



Conclusion

Root knot nematode (RKN) disease in okra, caused by *Meloidogyne* spp., can be effectively managed using tricho-compost and vermiwash, which improve growth and yield. These eco-friendly, cost-effective bioagents reduce reliance on nematicides and inorganic fertilizers, promoting sustainable agriculture. Further research is needed to optimize their application across various crops.



Evaluation of various artificial protein sources for *Apis cerana* colonies

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Introduction

Beekeeping enterprise of Nepal faces significant challenges such as seasonal forage scarcity and nutritional stress among bees. Despite the use of various artificial diets and indigenous practices to address nutritional deficiencies, there is limited research on the effectiveness of these methods, especially for the local bee species, Apis cerana Fabricius.

Research questions

- How can artificial diets mitigate nutritional stress and improve hive productivity of *Apis cerana*?
- How effective are local beekeepers' diet administered during rainy dearth for optimum colony performance?

Methodology

Eight treatments with five replications were tested in 40 hives of local beekeepers. The diets were given at 3 days interval. The brood parameters, stored honey and pollen were measured every 15 days. The honey yield of first harvest during honey-flow season was taken. Data analysis was done using R4.3.2.

Treatments	Composition
Diet 1	Soyabean flour: Similac milk-based infant formula: Instant baker's yeast powder: Yolk: Honey: Sugar Syrup (2:1) @ 8: 2: 1: 1: 1: 2
Diet 2	Soyabean powder: Instant baker's yeast: Similac milk-based infant formula: Natural Multifloral Pollen: Honey @ 75g: 100g: 200g: 100 g: 500g
Diet 3	Chickpea powder: Instant baker's yeast: Similac milk-based infant formula: Natural Multifloral Pollen: Honey @ 75g: 100g: 200g: 100 g: 500g
Diet 4	Chickpea powder: Sugar powder: Instant baker's yeast: Similac milk-based infant formula: Water @ 75g: 100g: 45g :35g: as per need
Diet 5	Soyabean powder: Sugar powder: Instant baker's yeast: Similac milk-based infant formula: Water @ 75g: 100g: 45g :35g: as per need
Diet 6	Soyabean flour: Sugar powder: Similac milk-based infant formula: Instant baker's yeast powder: Yolk: Honey =75: 125: 25: 2: 15: 20
Farmers' Diet	Soyabean flour: honey: turmeric: drops of lemon: salt@ 600g: as per need: 0.1mg: 3 drops: 0.1mg
Diet 8	Sugar syrup @600g

Figure 1 Feed consumed by honeybee colony

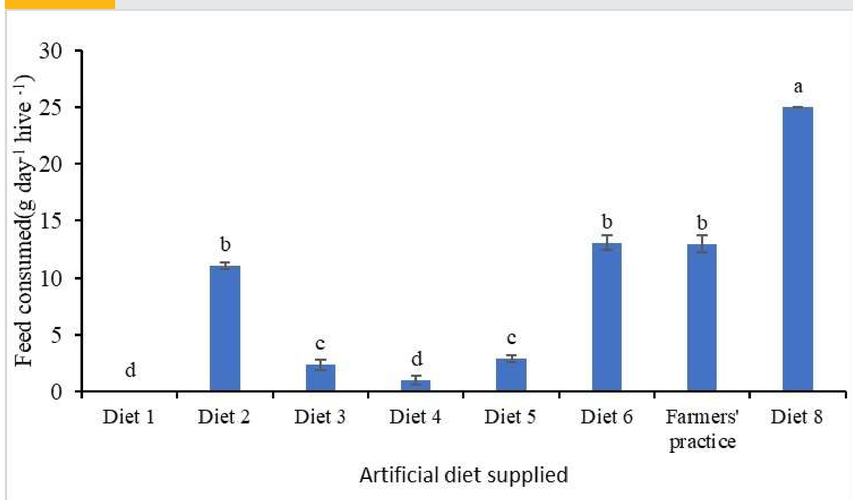


Figure 2 Honey yield as influenced by diet consumed (r=0.3, t = 2.367, p >0.05)

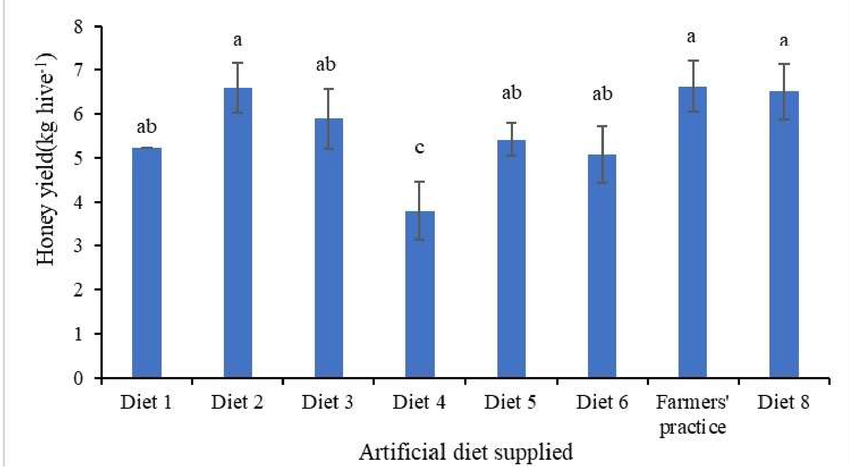
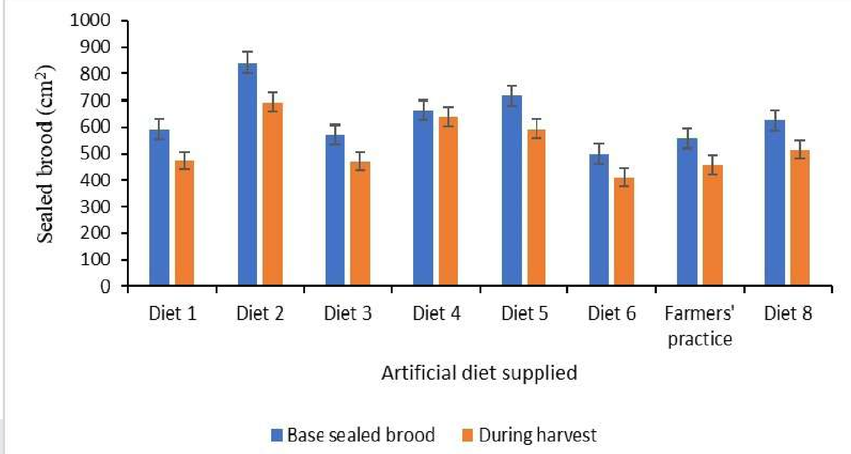


Figure 3 Sealed brood as influenced by artificial diet supplementation



Key findings

- Farmers' diet, Diet 2, and Diet 8 positively influenced the honey yield.
- The Diet 1 and Diet 4 were rejected. Diet 4 was treated as debris and thrown out of hive whereas Diet 1 was not consumed.
- The availability of even low-quality natural forage reduces preference for artificial diets.

Conclusion

In Dadeldhura district, the pollen-based diet and farmers' diet during rain dearth will ensure optimum honey yield. Artificial diets should be tailored to bee preferences and environmental conditions. Thus, the already established local practices should be explored, evaluated and scientifically supported for informed recommendations.

Understanding resilience and interlinkages in rural agri-food nexus

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Introduction

The nexus of Agriculture, Forest, Water, and Energy (AFWE) in the Hindu Kush Himalayan region is characterized by unique interlinkages influenced by biophysical, socio-cultural, and socio-economic factors. This study aims to identify strategies for enhancing this nexus to build climate resilience and promote environmental sustainability in the region.

Research questions

- What are the interlinkages between the different dimensions of AFWE nexus?
- How do the interlinkages between AFWE contribute to the resilience of the agri-food nexus?
- What best practices can enhance this resilience?

Methodology

Data was collected in Bheriganga Municipality and Bhairabi Rural Municipality of Karnali province and Budhinanda Municipality of Sudurpashchim province of Nepal using qualitative and quantitative methods (personal observation, household surveys-118, and focus group discussions-15). The study examined the interactions between the core elements of AFWE in respective areas.

Key findings

Positive and negative interactions between AFWE components were observed (Figure 1). For example, forest provides input to farmland (+) whereas it can have impacts such as wildlife intrusion, pest infestation, and forest fire (-). The key external drivers impacting the AFWE nexus are changes like climate, land use, socio-demographic, technological and ecological and institutional (Figure 2).

Conclusion

Resilience in these areas can be enhanced through targeted interventions that focus on both ecological (water and forest) and livelihood (agriculture and energy) components of the AFWE nexus, including improved water management, sustainable agricultural practices, forest restoration, and efficient energy introduction.

Figure 1 | Interactions between the components of the AFWE nexus

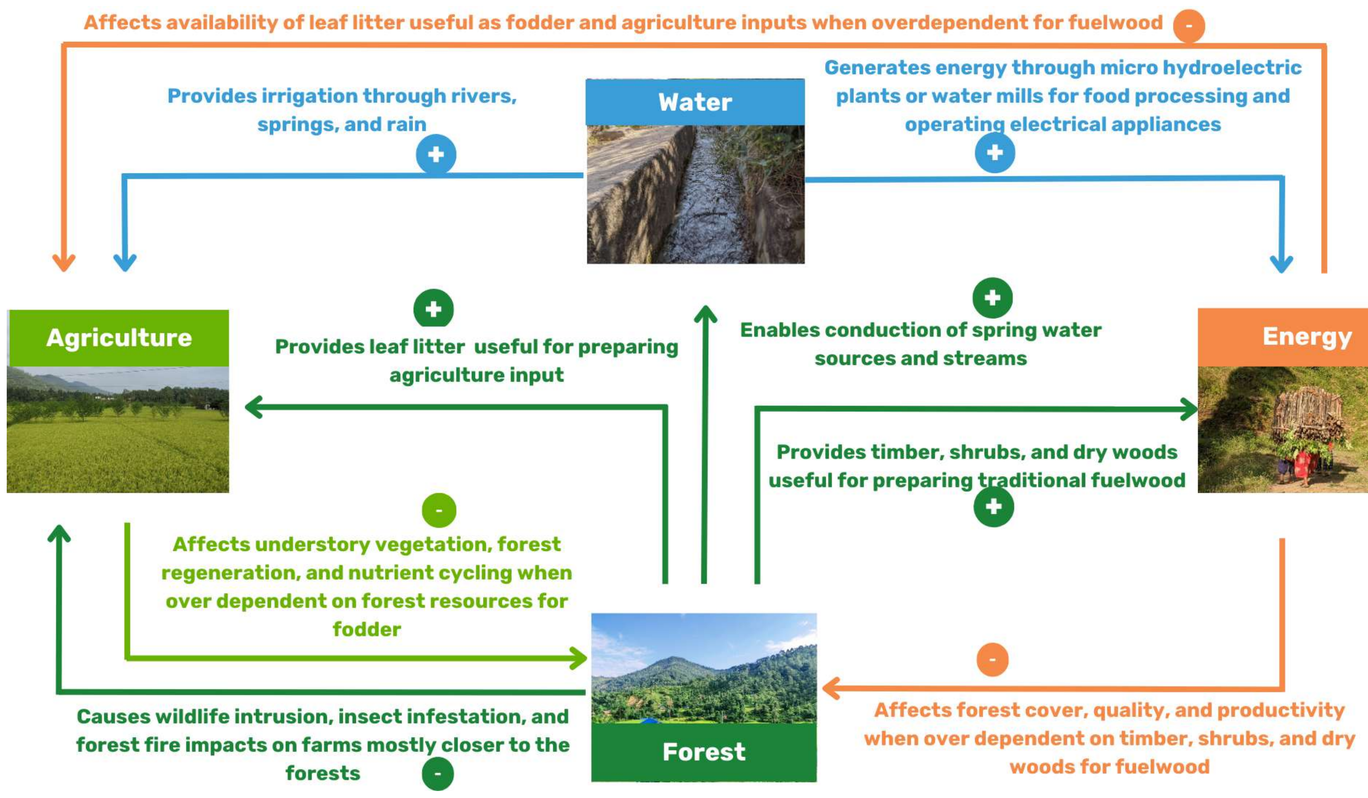
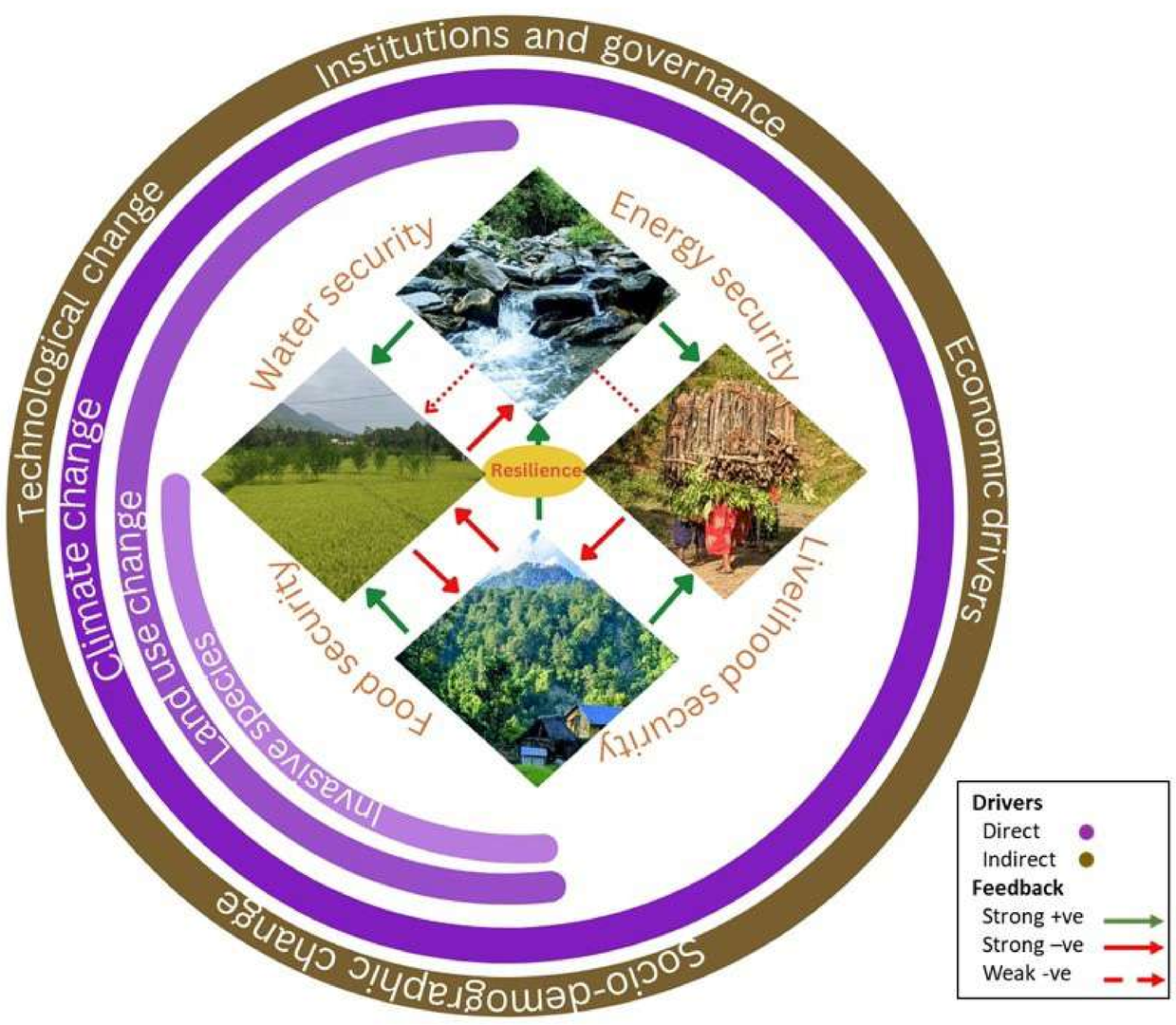


Figure 2 | External drivers impacting the AFWE nexus



Evaluation of proso millet germplasm traits in Kailali, Nepal

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Introduction

Proso millet, grown in the western mid-hill region of Nepal, is valued for its culinary uses. It has a short growing cycle (60-110 days) with tolerance to drought and heat. It is suitable for tropical and sub-tropical regions with low rainfall. Genotypes with a short duration and biotic stress are the key needs.

Methodology

Eight genotypes were evaluated using the RCBD design with three replications in Godawari Municipality, Kailali from February to April 2024. FYM was applied @ 12.5t/ha. Randomly selected sample plant was used to collect data on phenological, yield, and yield attributing traits. R (4.3.3) was used for ANOVA, correlation and genetic variability analysis.

Key findings

Results revealed significant variability for all traits. NGRCO7339 and NGRCO7338 exhibited superior plant height. Mal Chino recorded the highest grain yield (1.67 t/ha) and lowest sterility (35.30%). HI and grain yield (0.96) showed a strong positive relationship. Hbs and GAM for yield and effective tillers were high, suggesting a strong additive gene action.

Figure 1 One way ANOVA (mean) of traits under study

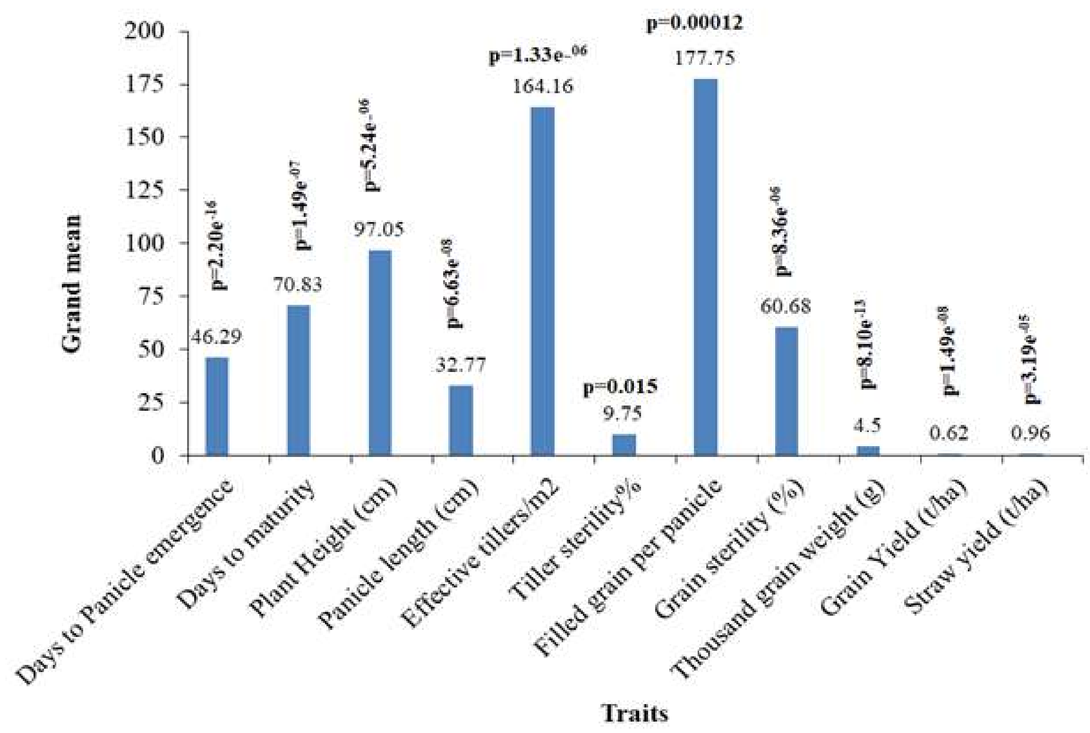
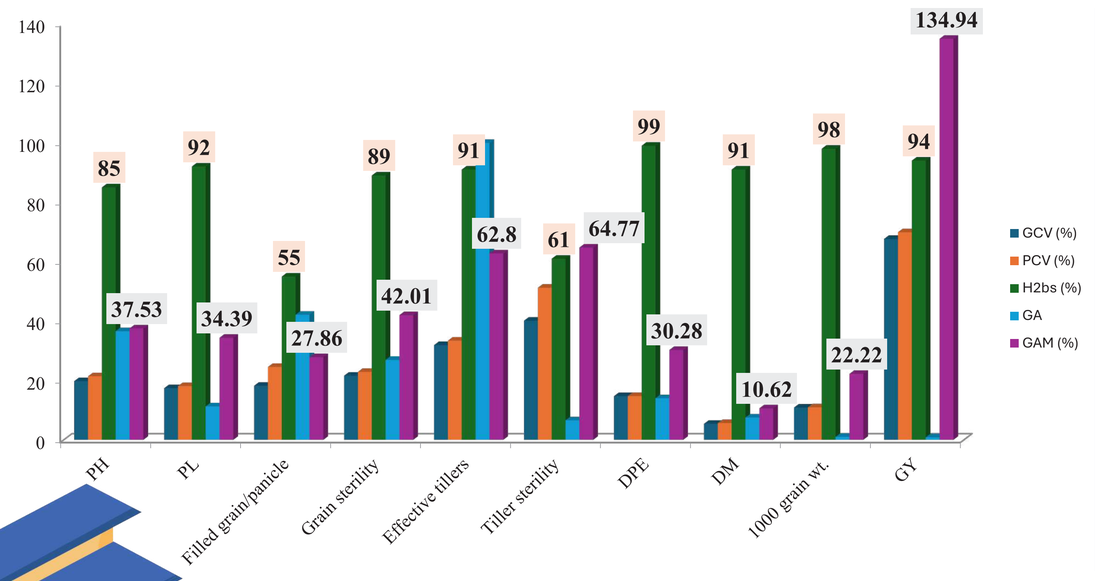


Figure 2 Genetic variability, heritability and genetic advance of quantitative traits

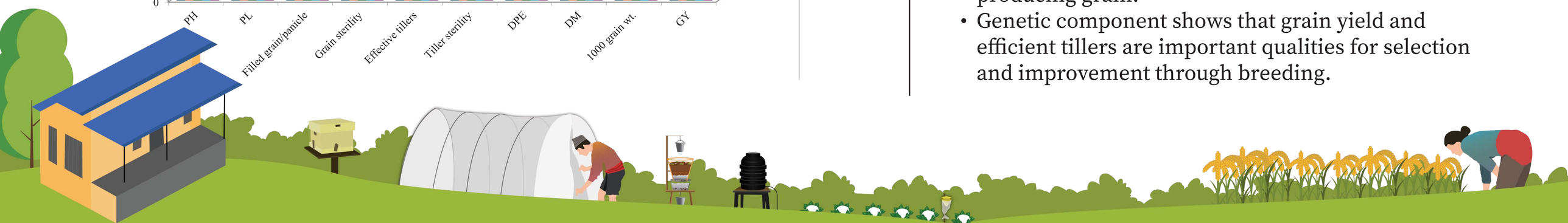


Research questions

- What is the feasibility of cultivating proso millet as a catch crop in Kailali?
- How much variability is present among genotypes in yield and traits?
- Which traits correlate strongly with yield?

Conclusion

- Days to maturity make proso millet an ideal catch crop in tropical regions.
- Mal chino was the most promising variety for producing grain.
- Genetic component shows that grain yield and efficient tillers are important qualities for selection and improvement through breeding.



Mapping of springs and springsheds in Dailekh and Bajura

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Introduction

Springs are vital for Nepal's mountain communities, with 80% of residents relying on them. Climate change and human activities threaten these resources, leading to significant water scarcity. This research offers crucial insights for policy improvement and strategic interventions to revive springs and ensure sustainable water use in the region.

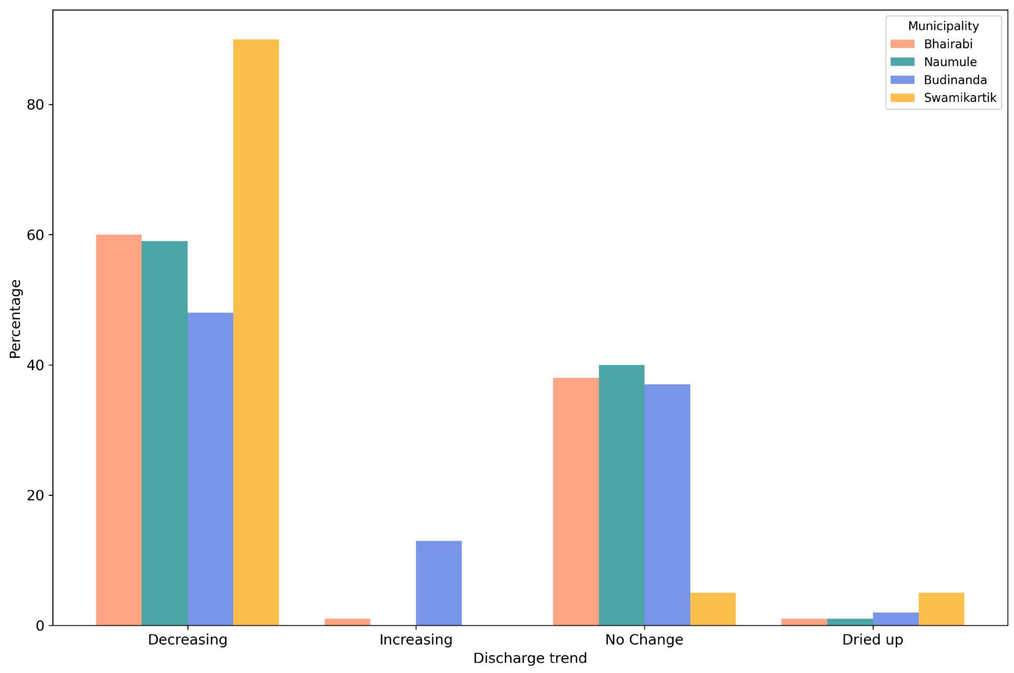
Methodology

Community and ward-level consultations were carried out to document spring characteristics, usage, and trends over the past decade. Key informant interviews were conducted to gather information on spring management, the impacts of human activities, and climate change. Groundwater recharge potential was modeled using a Random Forest algorithm in Google Earth Engine.

Key findings

The study reveals that 59.8% of the total surveyed springs (60% in Bhairabi, 58% in Naumule, 48% in Budinanda, and 90% in Swami Kartik) have witnessed reduced flow in the past decade (Figure 1). Key factors include climate change and anthropogenic activities. The Random Forest Model identified 24.21% of the area as highly suitable for groundwater recharge (Figure 2).

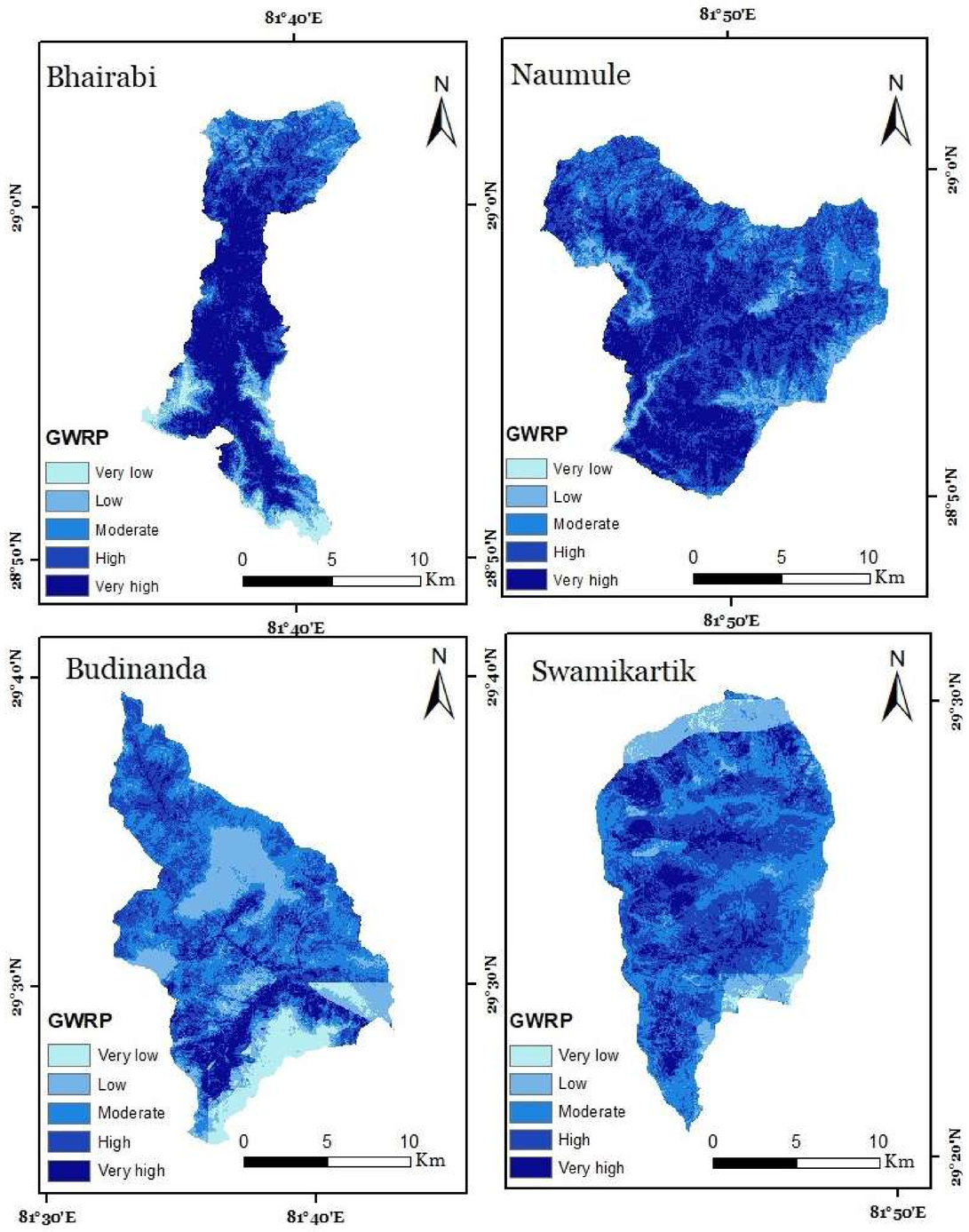
Figure 1 Figure showing discharge trend of springs in the study area



Research questions

- What is the current condition of springs in the selected area?
- What percentage of the total area exhibits high groundwater recharge potential, and what factors influence this potential?

Figure 2 Groundwater recharge potential map.



Conclusion

The study found a significant decline in spring discharge due to climate change and human activities, impacting water security and socio-economic conditions. It calls for targeted policy and strategic interventions to revive drying springs and enhance groundwater recharge and sustainability.

Comparative analysis of jholmol and vermiwash as liquid fertilizers

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Introduction

This study compares the effects of Jholmol, Vermiwash, and their combination on onion crop growth and soil nutrition in Nepal. By assessing these organic liquid fertilizers, the research aims to identify the most effective method for enhancing both crop yield and soil health.

Research questions

- How do jholmol, vermiwash, and their combination affect onion crop growth?
- What are the impacts of these fertilizers on soil nutrient content?
- Is there a synergistic effect when combining jholmol and vermiwash?

Methodology

A randomized complete block design was used with four treatments: control, Jholmol, Vermiwash, and their combination, applied bi-weekly. Growth parameters and soil nutrients were measured using ANOVA and Tukey's HSD tests to evaluate the effectiveness of each treatment.

Key findings

- Vermiwash resulted in the highest improvements in plant height, leaf area, biomass, and yield.
- The combination of jholmol and vermiwash significantly enhanced soil nutrients, particularly nitrogen, potassium, and organic matter.
- Results suggest vermiwash is best for immediate growth, while the combination offers long-term soil health benefits.

Figure 1 Yield by treatment

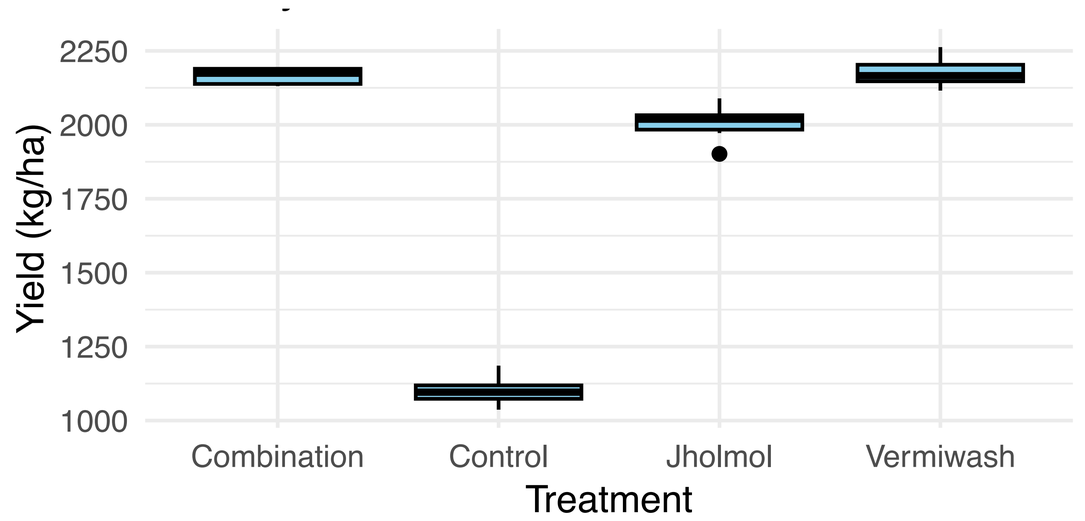
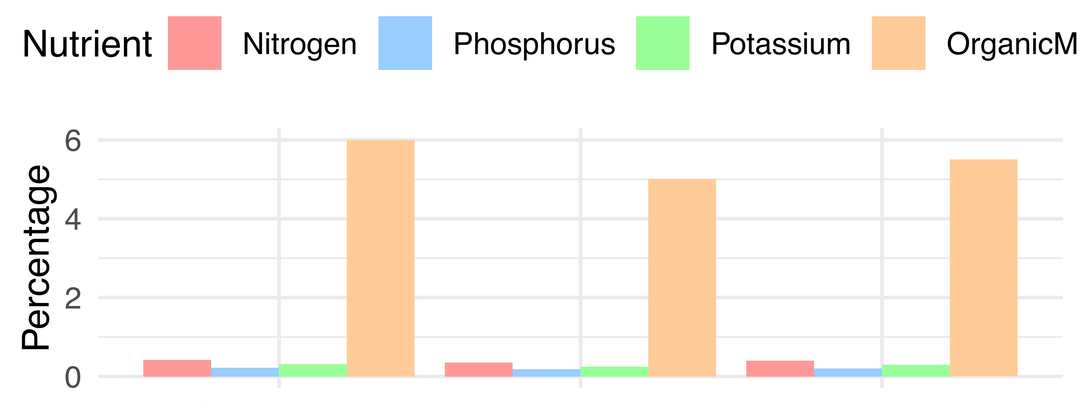
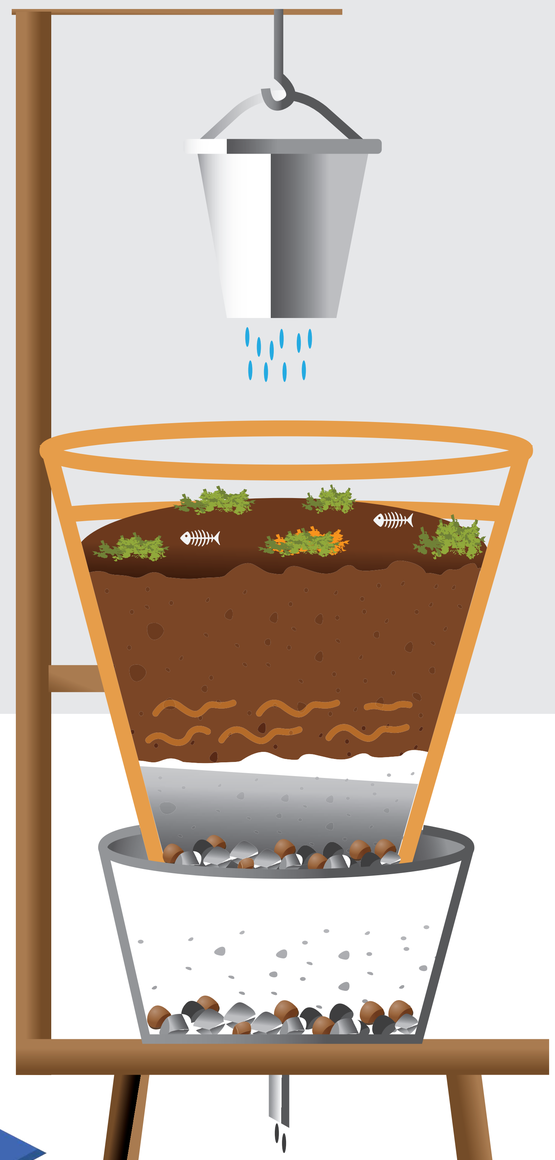


Figure 1 Nutrient content (%) across treatments





Conclusion

Vermiwash when used alone excels in promoting onion growth, but the combination of jholmol and vermiwash is superior for enhancing soil health. This study advocates for a balanced approach that considers both immediate agricultural productivity and long-term soil sustainability.

Effects of different bio-fertilizers and mulching materials on growth, yield, and post-harvest quality of cauliflower in Kailali, Nepal

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Introduction

- Bio-fertilizers such as Azotobacter and PSB are products derived from living microorganisms, capable of atmospheric nitrogen fixation and converting insoluble phosphorus in soil into soluble forms for easy plant uptake (Kumar et al., 2015).
- Mulching is a crucial component of organic farming, playing a vital role in weed control, soil conservation, and regulating the temperature of the soil.
- Furthermore, mulching adds essential nutrients for plants to the soil during decomposition, optimizing its physical, chemical, and biological qualities and elevating crop quality and quantity (Bhardwaj, 2013).

Research questions

- What is the effect of various mulching materials and bio-fertilizers on the growth, production, and post-harvest quality of cauliflower?
- What is the combined effect of bio-fertilizers and mulching materials on the growth, yield, and post-harvest quality of cauliflower?

Methodology

- Research site: Lisbeli, Chure RM-5, Kailali
- Research design: Two factorial Randomized Complete Block Design (RCBD) with 16 treatment combinations and three replications
- Research duration: September 2023 – January 2024

Treatment application

- Bio-fertilizers were applied through root dipping of cauliflower seedlings.
- Bio-fertilizers, Azotobacter, and PSB (Phosphorus Solubilizing Bacteria) were used at the rate of 250 ml/liter of water (Islam, Chatterjee, & Datta, 2014).
- Before transplanting cauliflower seedlings, the roots of the seedlings were dipped in bio-fertilizer solution with jaggery for about 10 minutes (Sharma, Regar, Ola, & Shivran, 2018).
- Black plastic mulch was applied before transplanting cauliflower seedlings. A black plastic mulch of 25 micron thickness was spread uniformly on the respective plots of size 2m* 2m and holes of 1 * 1 inch were made at a spacing of 60*45 cm.
- Two sorts of organic mulches such as paddy straw and sawdust were spread evenly on the respective plots to maintain the thickness of 5 cm and 2 cm respectively (Singh & Singh, 2019). These mulches were applied seven days after transplanting, once the seedlings were established.

Key findings

The growth, yield, and post-harvest quality of cauliflower were statistically affected by different bio-fertilizers and mulching materials while their combined effect was found to be insignificant. .

Figure 1 Plant spread of cauliflower affected by bio-fertilizers

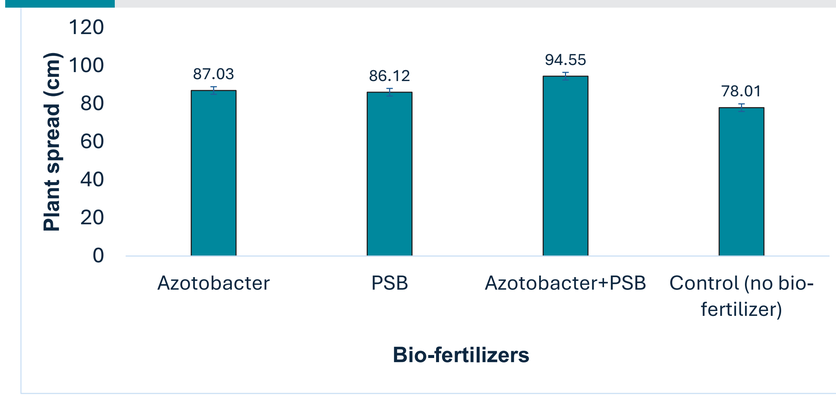

Figure 2 Plant spread of cauliflower affected by mulching materials

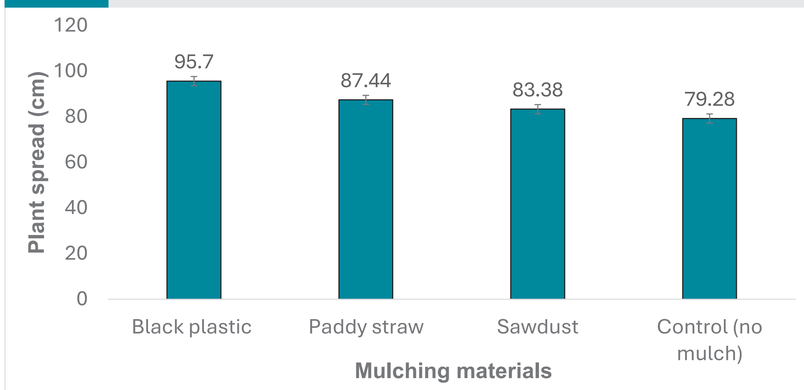

Figure 3 Economic yield of cauliflower affected by bio-fertilizers

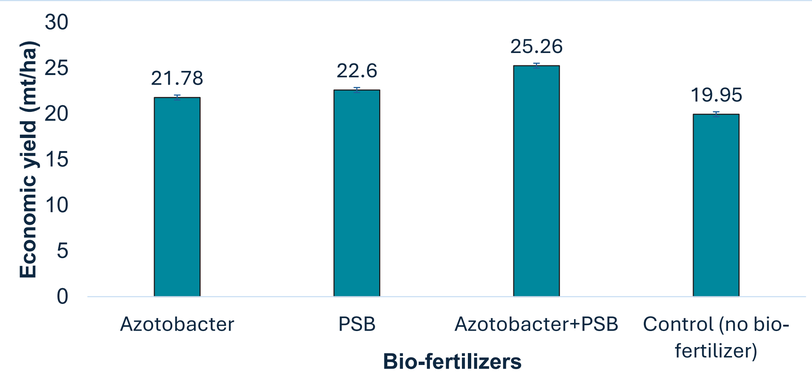

Figure 4 Economic yield of cauliflower affected by mulching materials

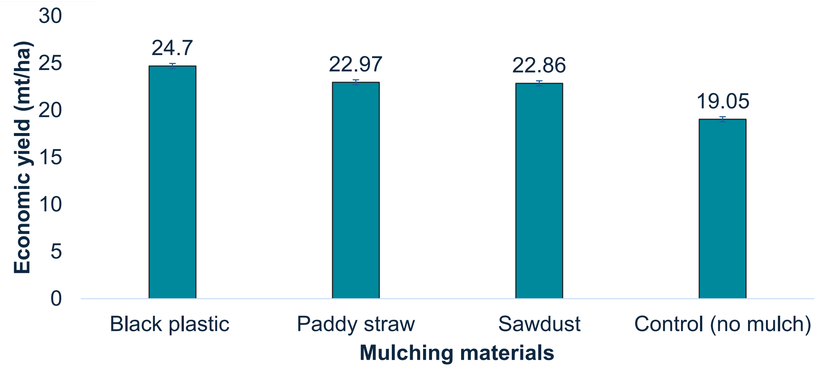

Figure 5 Vitamin C content of cauliflower affected by bio-fertilizers

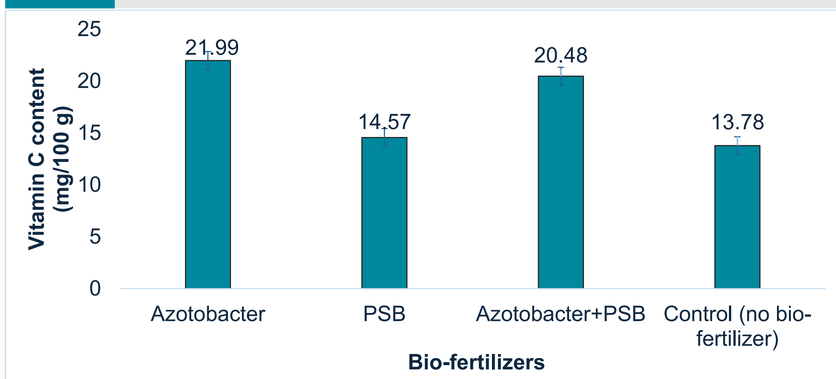

Figure 6 Vitamin C content of cauliflower affected by mulching materials

Conclusion

Compared to other bio-fertilizers, the combined application of Azotobacter and PSB produced superior growth, a higher yield, and an increased vitamin C content. Regarding mulching materials, black plastic mulch, and paddy straw mulch resulted in better growth, yield, and post-harvest quality. Therefore, based on the research findings, the combined application of Azotobacter and PSB in addition to paddy straw mulch is a better option for boosting the growth, yield, and post-harvest quality of cauliflower.

Factors affecting adoption of selected climate-resilient agriculture solutions

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Introduction

Climate change severely impacts agriculture, especially in Nepal's mountain regions, where the majority of people rely on farming. Climate Resilient Agriculture (CRA) solutions aim to enhance food production and farmer resilience in changing climatic conditions. This study explored socio-demographic and psychological factors affecting adoption of CRA solutions.

Research questions

- What are the socio-demographic and psychological factors influencing the adoption of CRA solutions?
- How do farmers perceive the benefits of CRA solutions and what challenges do they face while implementing them?

Methodology

Data on socio-demographic and psychological aspects were collected using a mixed method approach (key informant interviews, focus group discussions and household surveys) from 20 farmer groups of Karnali and Sudurpashchim provinces. The Theory of Planned Behaviour was used to assess the behavioural intention of adoption or non-adoption of CRA solutions.

Key findings

Six specific CRA solutions (Figure 1) among 23 (Figure 2) were identified as the most preferred by farmers. Male farmers had a higher likelihood of adopting improved cowsheds, nursery beds, and plastic tunnel farming, while Dalit and indigenous farmers were inclined towards traps and lures. Attitudes, perceived behavioural control, access to information, incentives, and knowledge strongly influenced adoption.

Figure 1 Most preferred solution among farmers by percentage

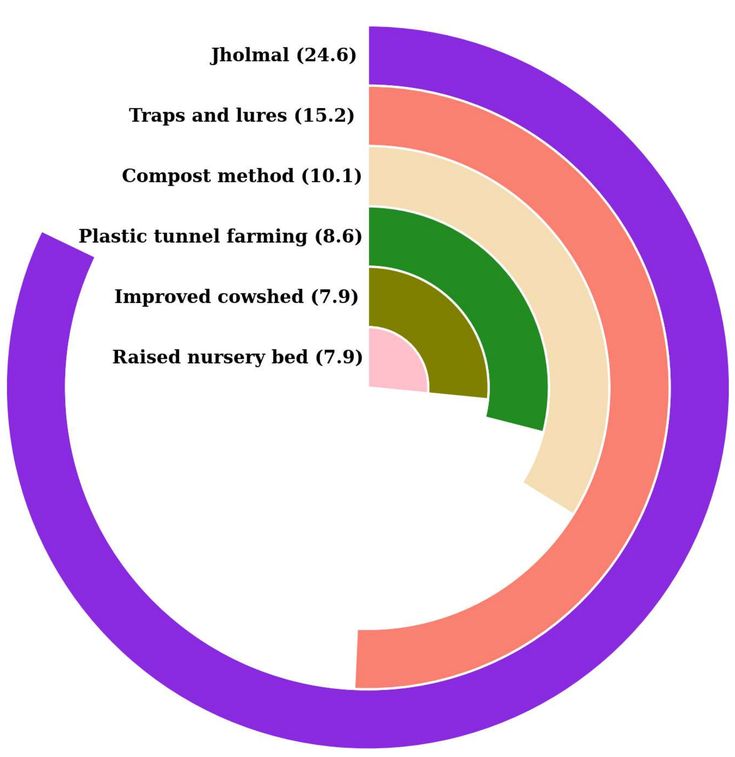
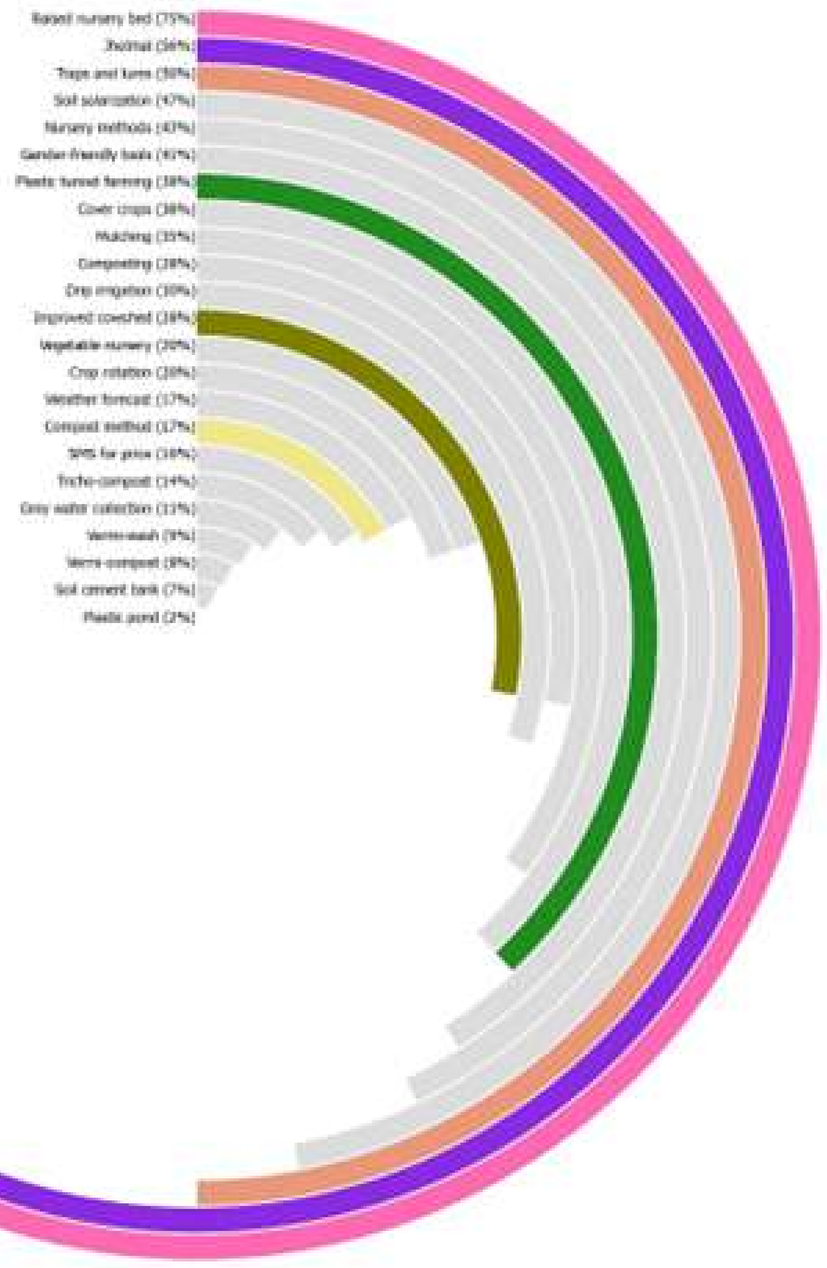
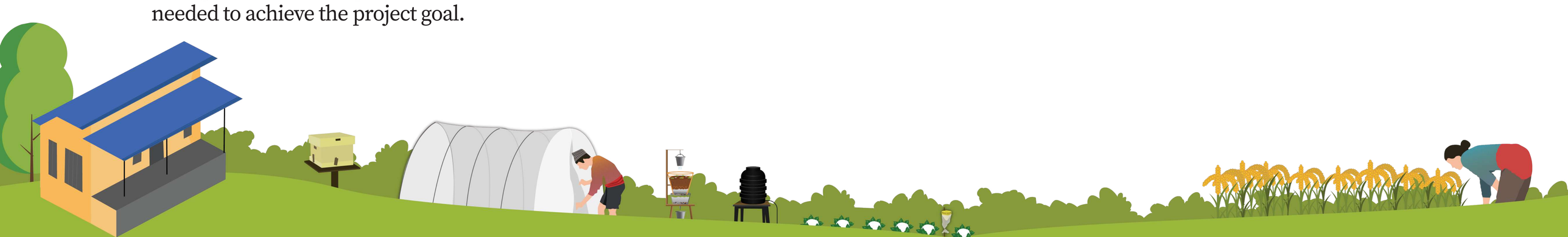


Figure 2 Percentage of use and continuation of CRA solution (the most preferred six solutions in colour)



Conclusion

Intensifying training and awareness programmes, providing economic incentives, ensuring market access, considering behavioural aspects, assessing and addressing constraints faced by marginalized communities, safeguarding environmental health, and building partnerships between local government and project teams are some of the actions needed to achieve the project goal.



Efficacy of botanical pesticides against *Eriosoma lanigerum* (Hausmann) under ambient conditions

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Introduction

Woolly apple aphid infestation is a threat to apple production globally. Pesticide residues in apple is raising health concerns in Nepal. Botanical pesticides extracted from local plants can be a sustainable alternative to chemical pesticide for managing woolly apple aphids in Bajura, a region with potential for commercial apple production.

Methodology

Botanical pesticides were prepared from locally available plants. Eight treatments with five replications were tested on woolly apple aphids collected from apple trees in Joru, Swamikartik-Khapar Municipality. Mortality was assessed at 24, 48, and 72 hours under ambient conditions. ANOVA and DMRT test were used for data analysis in R-studio.

Key findings

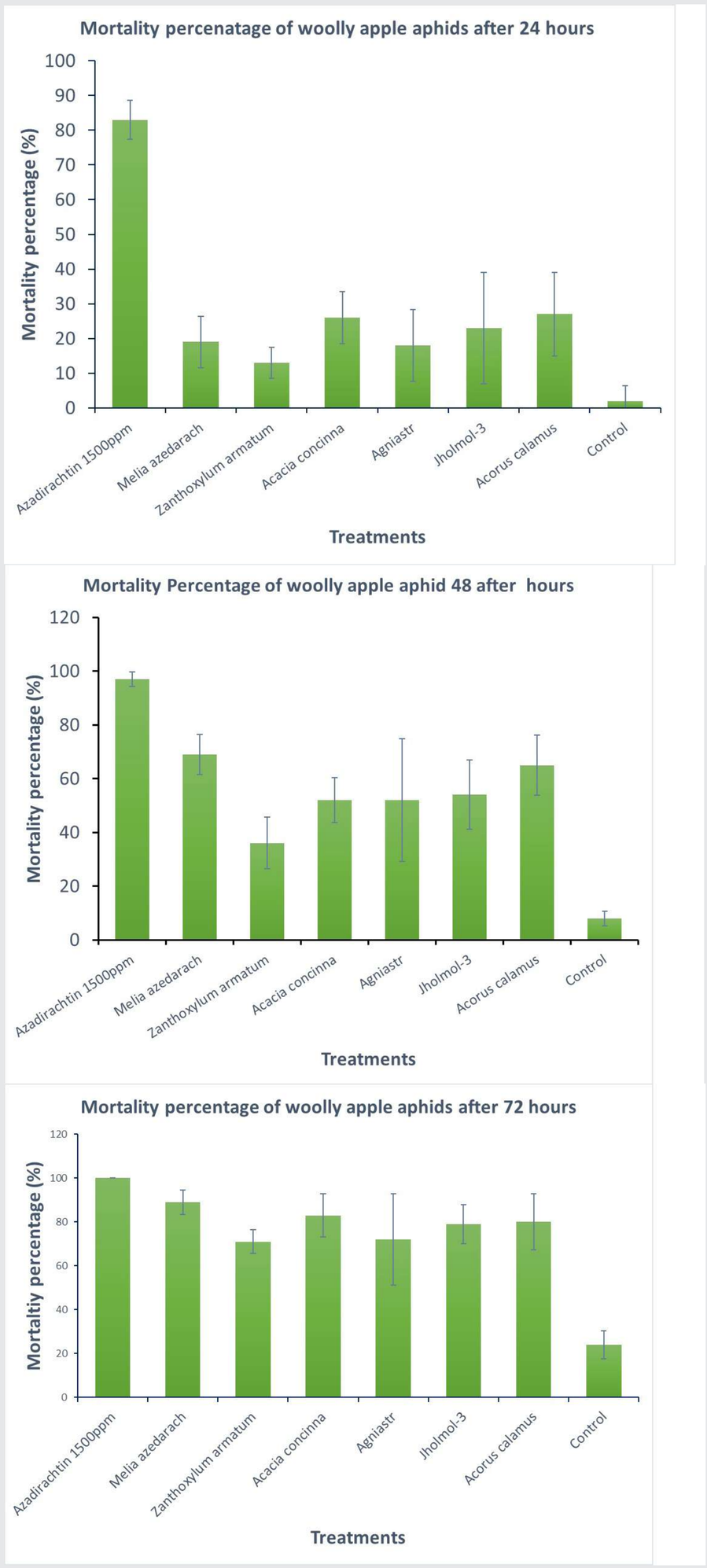
- Azadirachtin-1500ppm showed the highest woolly apple aphid mortality (100% at 72h).
- Among the botanicals prepared, extracts from *Melia azedarach*, *Acacia concinna* and *Acorus calamus* also performed well, with significant effects at 48h and 72h.
- All botanical treatments outperformed the control, highlighting their potential as alternatives to chemical pesticides.

Conclusion

Locally prepared botanical pesticides from Bajura can effectively control woolly apple aphids under ambient conditions. However, commercial neem-based Azadirachtin outperformed all tested botanicals and *Melia azedarach* showed comparable efficacy. Future research in field conditions is required to validate the results.

Research questions

- What local botanical pesticides can be used to manage woolly apple aphid?



Woolly apple aphid management: Farmers' perceptions and practices in Bajura, Nepal

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Introduction

Woolly apple aphid (WAA), a worldwide serious pest of apple orchards, has been reported as a major economic pest in many districts in Nepal. Aphid infestation leads to the development of hypertrophic galls in roots and crown of the tree. This results in loss of tree vigour, lowering of fruit yield and quality, and in extreme cases, tree death.

Research questions

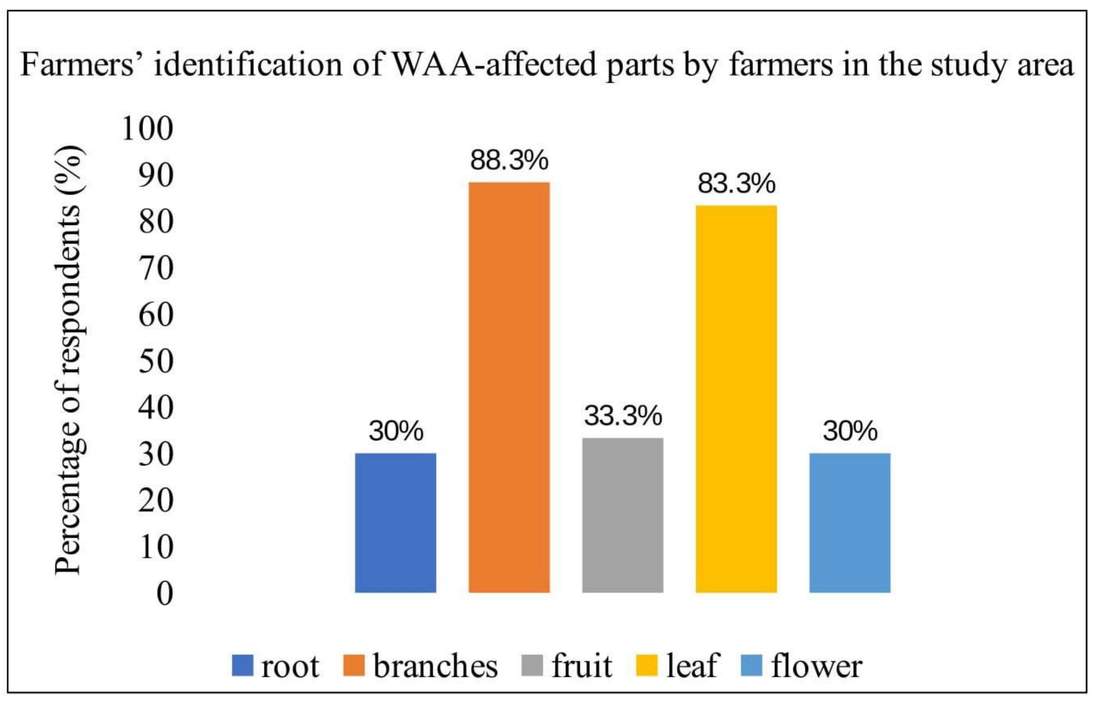
- What management practices do apple farmers adopt against woolly apple aphid in Bajura?
- What are the perceptions and knowledge of apple farmers regarding woolly apple aphid in Bajura?

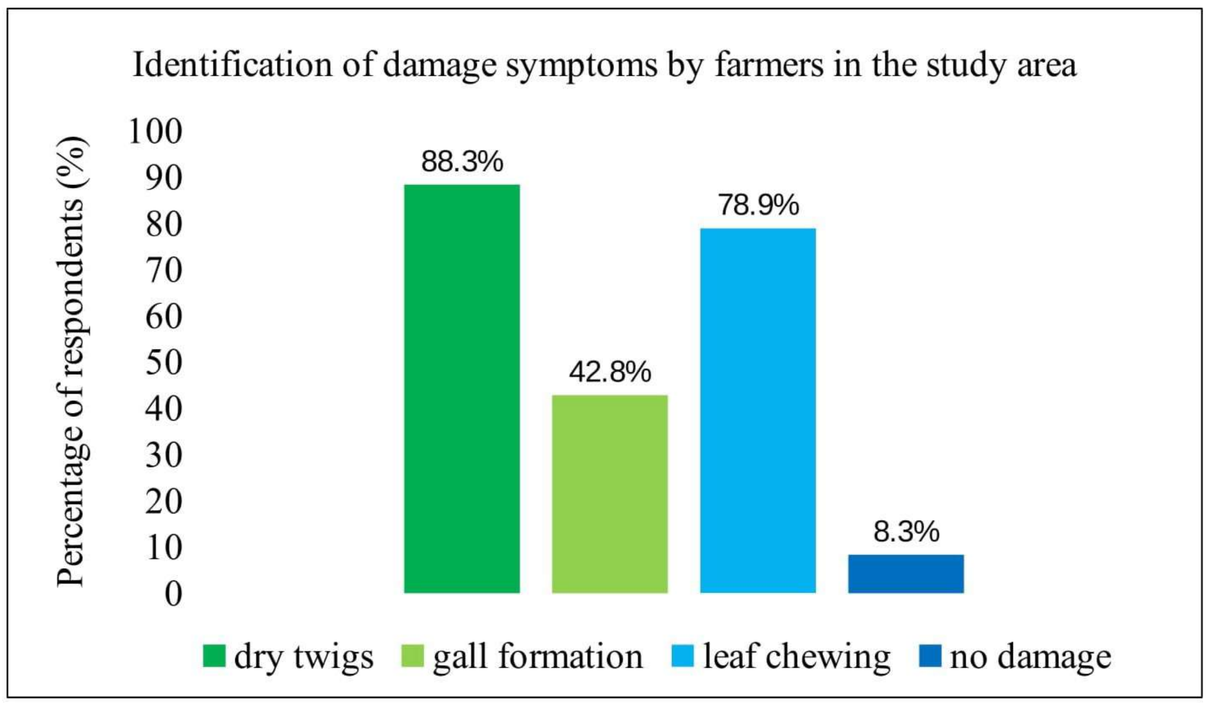
Methodology

A total of 180 apple farmers from three major apple-producing local bodies of Bajura, namely Budhinanda Municipality, Himali Rural Municipality, and Swamikartik-Khapar Rural Municipality, were surveyed for this research. Proportionate stratified sampling was employed to determine the appropriate sample size for each local body under study and simple random sampling was used to select the respondents for a face-to-face meeting. Key informant interviews and focus group discussions were conducted.

Key findings

- Farmers ranked WAA as the primary pest.
- 44% of the farmers followed no measures against WAA and 47.2% relied on mechanical measures (killing by hand, use of wet clothes, use of plastics and sticks)
- Only 6.7% used neem-based pesticide and 1.1% applied botanical measures such as cattle urine and jholmol along with mechanical measures.





Conclusion

Farmers lack sufficient knowledge for the effective management of WAA. Local stakeholders should consider direct interventions which include establishing and distributing pest-free saplings, promoting WAA-resistant rootstocks, and training farmers on integrated pest management for sustainable apple production.

Sowing dates and depth affects growth and yield of potato in Dailekh

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Introduction

In higher altitudes where it is difficult to grow other staple crops, potato is an excellent food source for communities. Inappropriate planting time, water scarcity, low quality seed potatoes, unsatisfactory input, disease and pest management result in low production and productivity of potato in Karnali (HRS, 2019).

Research questions

- Identify appropriate sowing date of potato for early summer season in Dailekh
- Optimum sowing depth for quality tuber yield of potato in Dailekh

Methodology

The experiment was conducted in the College of Natural Science Management (CNRM), Dullu, Karnali Province, Nepal. Experimental period: February-July, 2024

- Variety: Desiree
- Experiment design: Two-factor RCBD
- Factor A – Date of sowing (22ndFebruary, 3rdMarch, 13thMarch)
- Factor B – Depth of sowing (10cm, 15cm)
- Interaction effect – Date of Sowing*Depth of Sowing
- Planting Details:
  Plant to Plant Spacing = 25 cm
  Row to Row Spacing = 30 cm
  Hill Width = 50cm, Hill Height =30cm
  Individual Plot = 4 rows, each row with 6 plants/hill.

- Soil Parameters:
  Random soil samples were taken from various parts of the experiment site. Ph(6.9), EC (198dS/m), SOM (2.64%), Total N (0.042%), Available Phosphorus (29.19 kg/ha), Available Potassium (134.4 kg/ha) as per the soil analysis report at Lumbini AgroEnvironment Lab Pvt. Ltd., Nawalparasi.

Key findings

- Growth attributes (Days to 50% germination and no. of stems per plant) and yield attributes (Marketable yield and Total Yield per hectare) were specifically observed during the experiment.

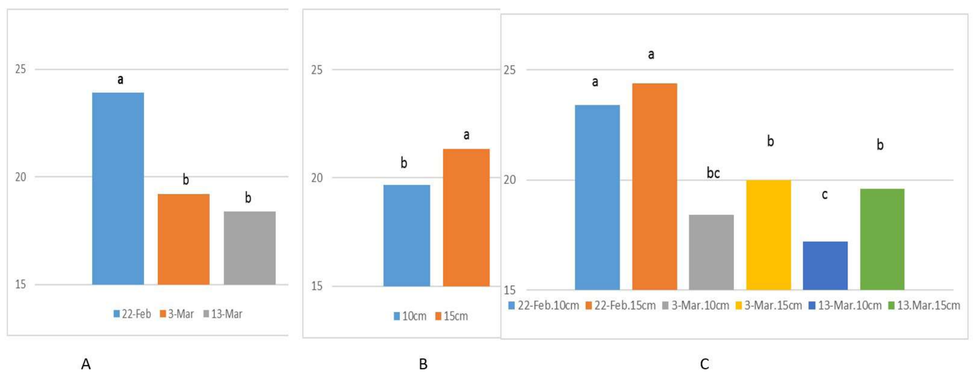


Figure 1: Effect of Date of Sowing (A), Depth of Sowing (B) and Interaction of Date and Depth of Sowing(C) on Days to 50% Germination in Early Summer Sown Potato in Dailekh, Nepal, 2024

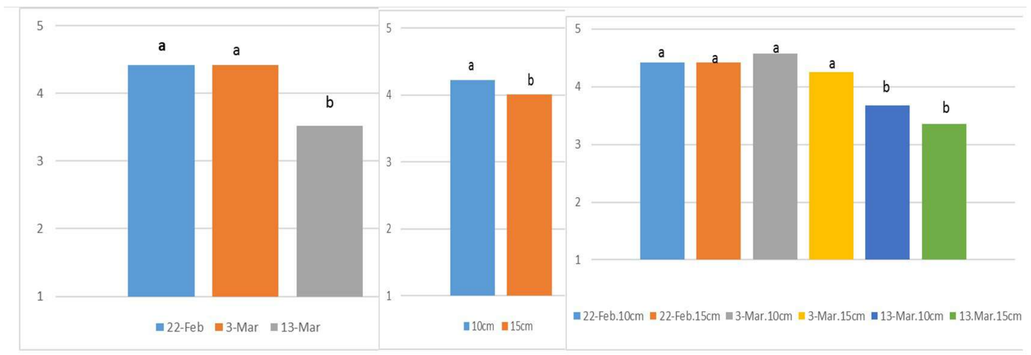


Figure 2: Effect of Date of Sowing (fig. A), Depth of Sowing (fig. B) and Interaction of Date and Depth of Sowing (fig. C) on No. of Stems per plant in Early Summer Sown Potato in Dailekh, Nepal, 2024

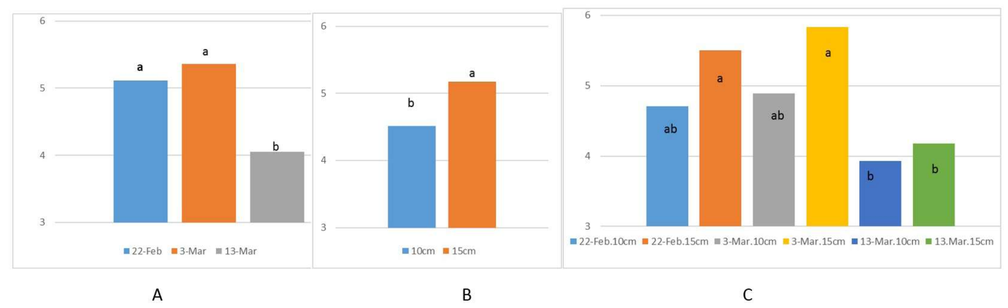
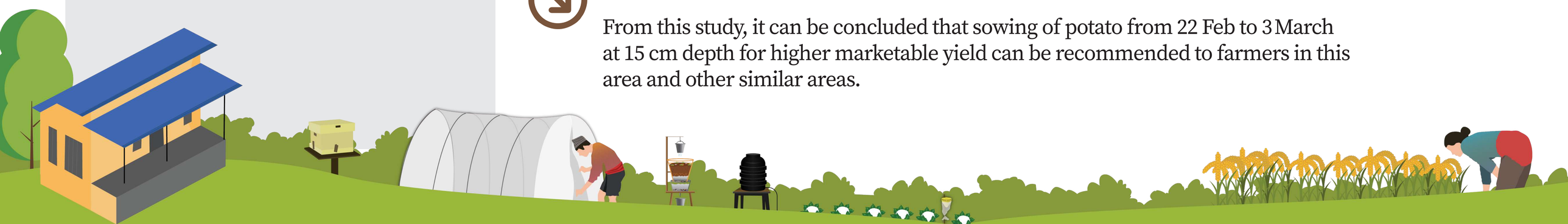


Figure 4: Effect of Date of Sowing (A), Depth of Sowing (B) and Interaction of Date and Depth of Sowing (C) on Marketable Yield per hectare in Early Summer Sown Potato in Dailekh, Nepal, 2024

Conclusion

From this study, it can be concluded that sowing of potato from 22 Feb to 3 March at 15 cm depth for higher marketable yield can be recommended to farmers in this area and other similar areas.



Adoption of women-friendly tools in Dailekh, Nepal

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Introduction

Due to male outmigration, women face the dual burden of managing farming and carrying out household responsibilities. In Nepal, agricultural tools are largely designed for men, creating challenges for women who now perform the majority of farming tasks. This mismatch exacerbates their struggles in adapting to climate change (Thakur, 2023; Yoder et al., 2010).

Research questions

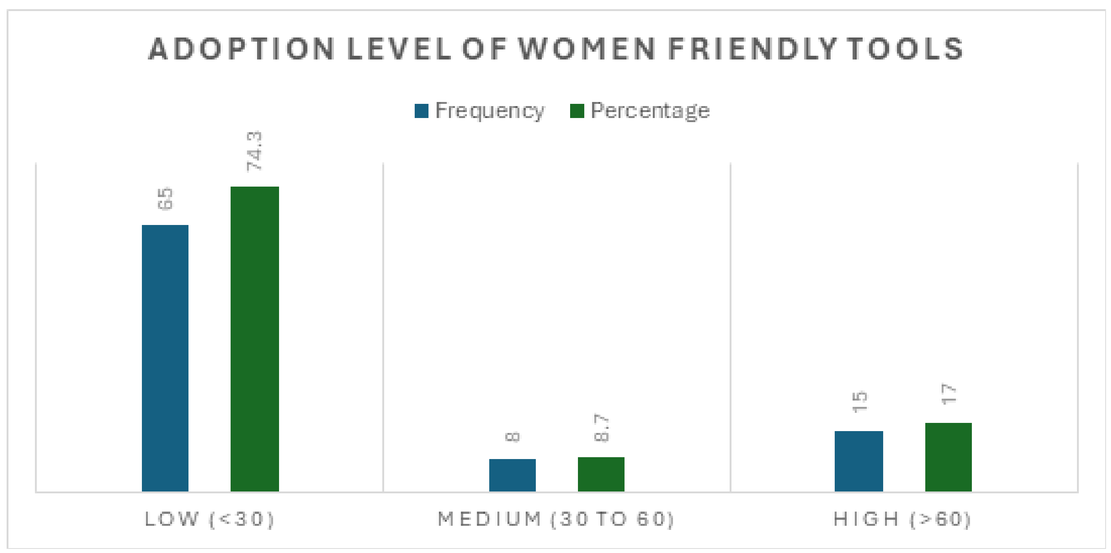
- Assess the availability and status of women-friendly tools, identify factors influencing the adoption.

Methodology

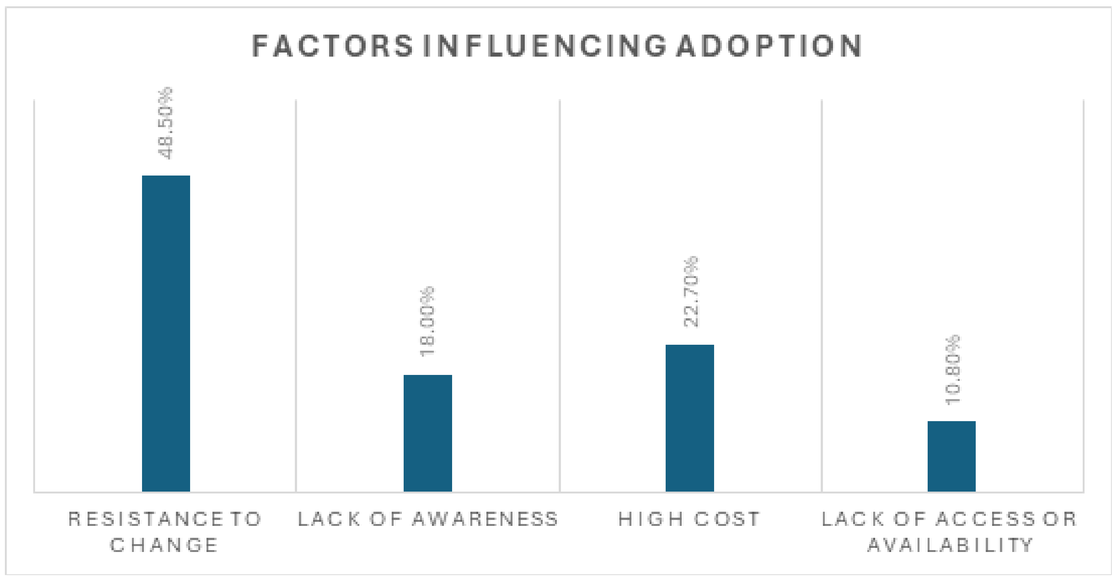
This study was conducted from July to December 2023 in Dullu Municipality and Namule Rural Municipality of Dailekh District, Nepal. Using purposive and simple random sampling, 87 women vegetable growers (44 from Dullu, 43 from Namule) were selected. Data was gathered through household surveys, key informant interviews, and focus group discussions. Both qualitative and quantitative data were analysed using descriptive statistics, frequency distributions, and indexing techniques.

Key findings

- Women are 100% involved in essential farming tasks such as hoeing, weeding, land levelling, and harvesting.
- 96.6% of respondents reported health issues caused by these activities.
- 51.7% of women were aware of women-friendly tools, but 48.3% were unaware, showing a significant gap.



The table shows the adoption levels of women-friendly tools among female farmers in Dailekh, Nepal. A majority 74.3% reported low adoption, while 8.7% had a medium adoption level, and only 17% demonstrated high adoption of these tools, indicating limited uptake across the community.



Conclusion

The study highlights women's crucial role in agriculture in Dailekh, but the mismatch between tool design and women's needs poses challenges. Limited awareness and adoption of women-friendly tools persist. Targeted interventions and collaborations are essential for promoting adoption and improving accessibility, reducing drudgery and enhancing productivity.

Integrated management of ginger rhizome rot using biochar and *Trichoderma* spps

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Introduction

Karnali Province was the third largest ginger producer in Nepal during the fiscal year 2021/22. The province's ginger value chain extends up to the European market. However, farmers are facing increasing challenges due to rhizome rot in ginger cultivation, leading them to consider switching to other crops. Rhizome rot is a soil and seed borne disease that has a significant economic impact, with potential losses ranging from 50-100%.

Research questions

- Does combined use of biochar and *Trichoderma spp.* significantly reduce the incidence of rhizome rot in ginger and improve the overall yield?

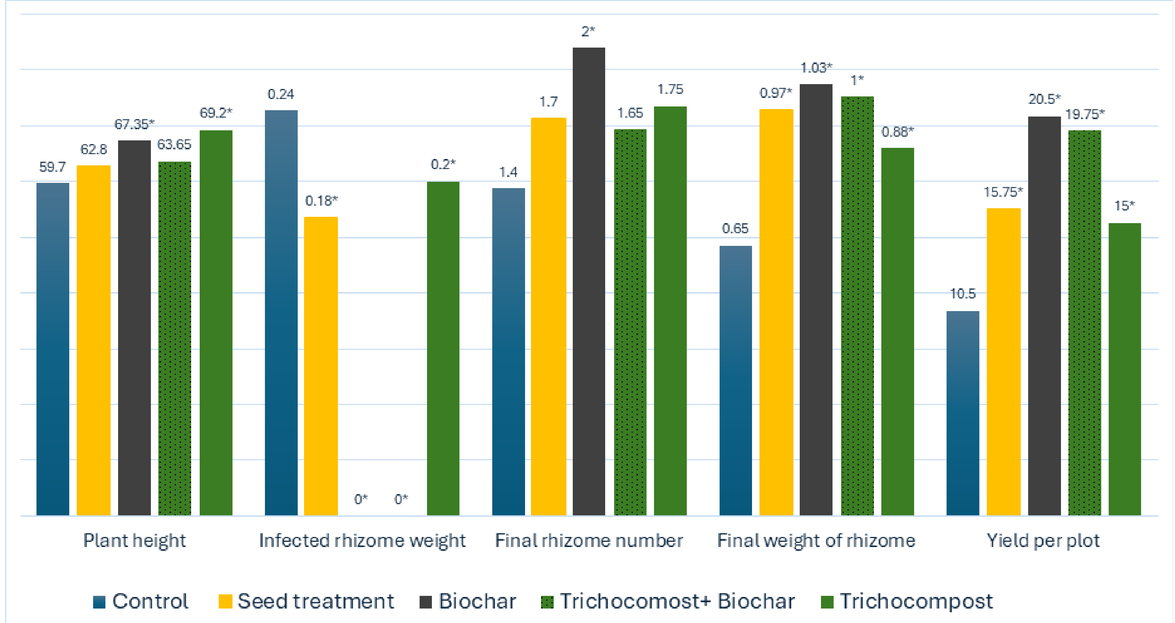
Methodology

- Action research in Bhairavi Rural Municipality-05, Dagargau, Dailekh
- RCBD design
- Shapiro Wilk, ANOVA and Tukey HSD

S.N	Treatment	Code	Description
1	Trichocompost	T1	1.5 kg in each plot of 6m^2 during land preparation
2	Biochar	T2	9 kg in a plot of 6m^2 during land preparation, it was slightly ground to increase surface area
3	Seed-rhizome treatment with Trichoderma	T3	100ml Trichoderma suspension (commercial name) was used alone. Seeds were dipped in the solution for 15 minutes and then placed in shade for one hour to remove excess moisture and then planted in the main fields.
4	Trichocompost + biochar	T4	1.5 kg trichocompost and 9 kg biochar in each plot of 6m^2 during land preparation
5	Control	T5	No input was added

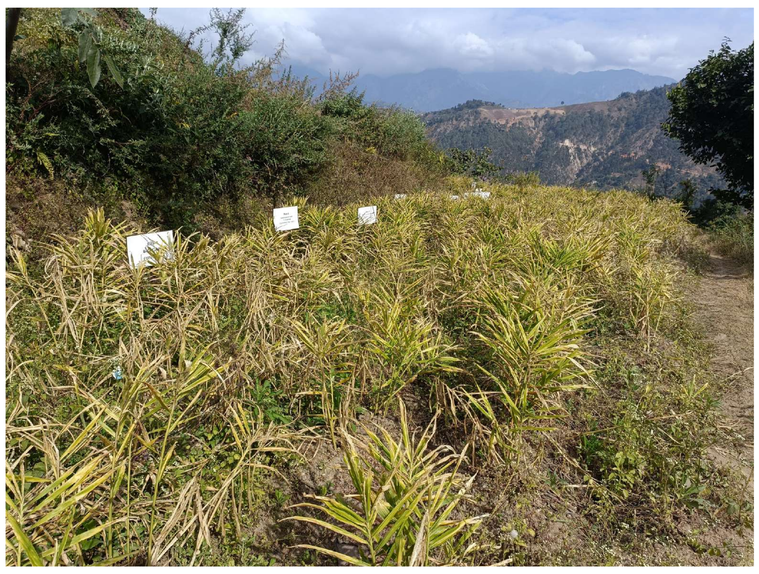
Key findings

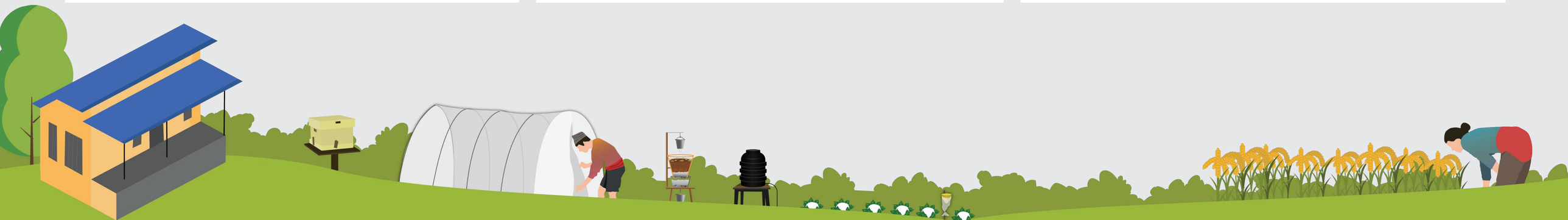
- Among the different treatments, biochar and combined application of trichocompost and biochar decreased infected rhizome and improved rhizome weight and consequent yield in ginger.



Conclusion

The study results indicate that application of biochar, either alone or mixed with trichocompost, can decrease ginger root rot infection and improve yield.





Exploring alternatives to conventional polybags for cucumber seedling production

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Introduction

Synthetic poly bags are mostly used to produce seedlings nowadays, but their use has led to environmental degradation since they are non-biodegradable, clog streams, and poison cattle and wild animals. This experiment intends to compare the performance of poly bags and biodegradable alternatives for raising quality seedlings.

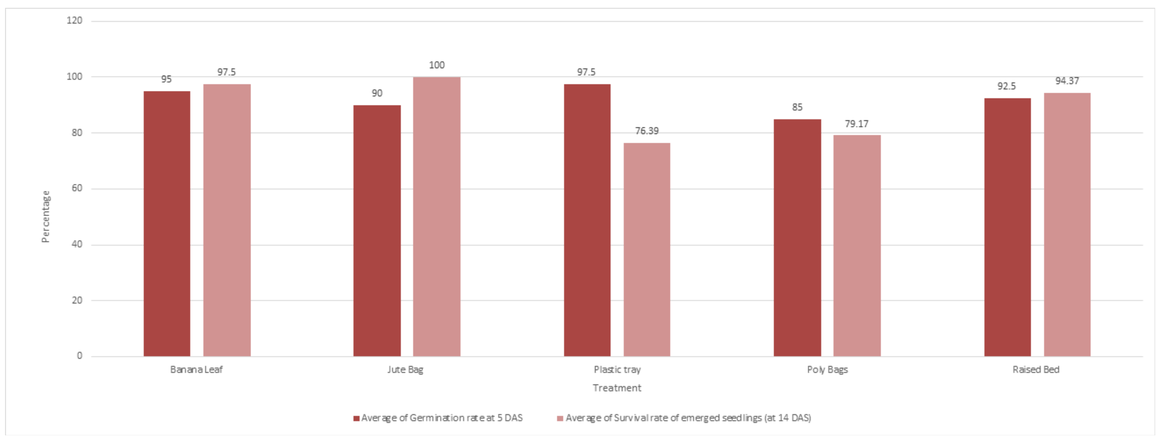
Research questions

- Why do we need alternatives to polybags for vegetable seedling production?
- What sustainable alternatives offer a comparable or superior performance in terms of seedling quality and environmental impact?

Methodology

The experiment was conducted in Dhangadhi-11 Bela, Kailali from 12th to 30th July, 2023. Randomized Complete Block Design was used, with five treatments (T1= Raised beds, T2= Poly bags, T3= Plastic trays, T4= Banana leaf bags, T5= Jute bags) and four replications.

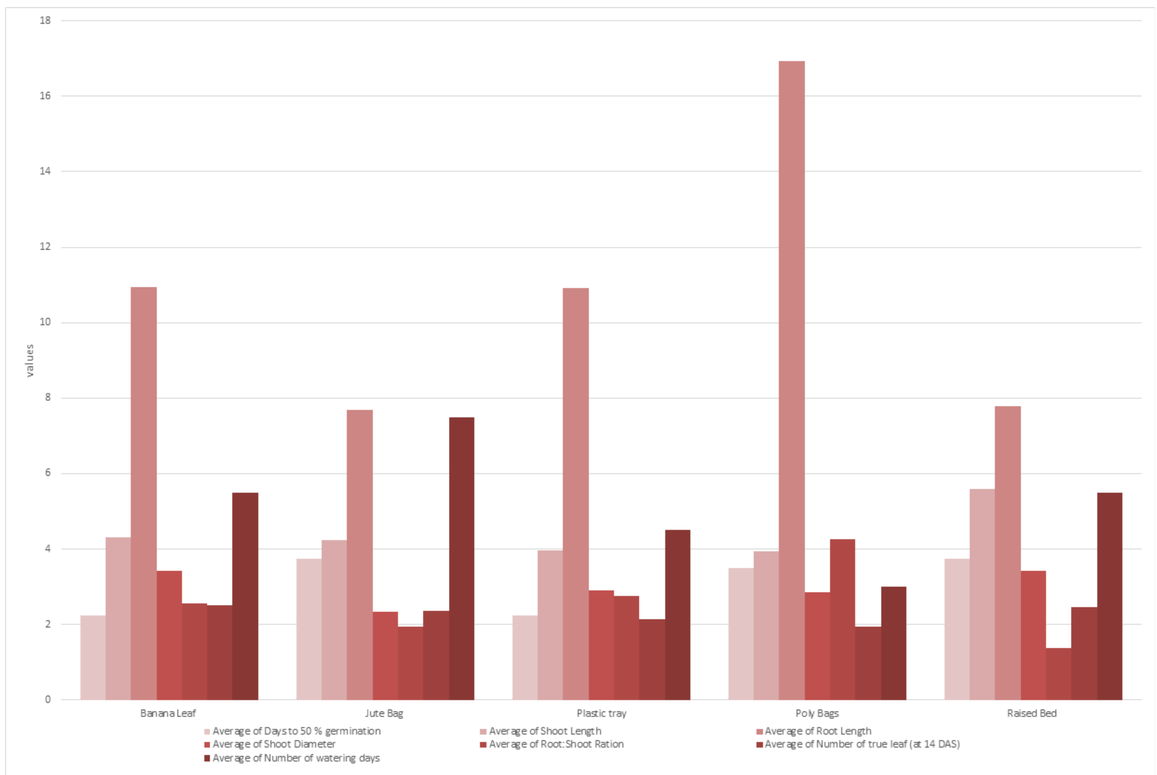
Parameters of cucumber seedlings influenced by nursery raising techniques



Key findings

Findings revealed that banana leaf bags showed promising outcomes in terms of days to 50% germination (2.25 days), germination rate at 5DAS (95%), shoot length (4.32cm), diameter of shoot (3.43mm), number of leaf (2.50) and survival rate (97.4%) at 0.05 significance level compared to poly bags, followed by jute bags and raised beds.

Parameters of cucumber seedlings influenced by nursery raising techniques



Conclusion

The study contributed valuable insights about nursery raising techniques for producing high-quality cucumber seedlings and offered potential solutions for reducing plastic waste.

Indigenous climate resilient practices for improving quality and yield of vegetables in Far Western

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Introduction

- Dependency on agricultural inputs such as seed, fertilizer, pesticide, external seed source is increasing which were previously managed by our ancestors from within the community
- There may be some specific indigenous technologies and practices that needs exploration
- Effective indigenous knowledge could enhance production and eliminate problems created by external inputs

Research questions

- Are there any indigenous technologies and practices in vegetable cultivation?

Methodology

Household Survey of 282 farmers and FGDs/KIIs of few individuals/ groups at Kailali, Doti and Bajura

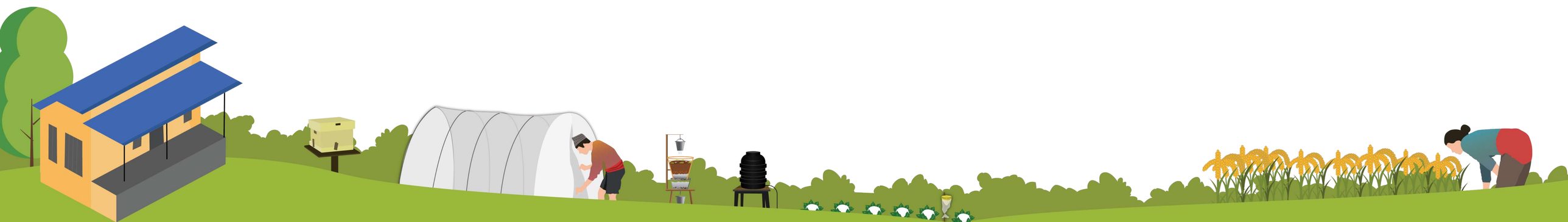
Qualitative analysis (content, thematic, etc.) of observed information supplemented by quantitative data

Key findings

Seed & Storage	Nursery management	Transplanting	Fertilizer and pesticide	Post harvest management
Farmers have abundant indigenous technologies and practices for seed collection and storage	Seeds are soaked in water 24 hours prior to sowing and placed on shade	Lightly irrigate saplings prior to uprooting	Farmers have abundant indigenous fertilizers and pesticides (everything that is bitter, sour, chilli hot, pungent, etc.)	Vegetables can be stored raw or after processing
Healthy and mature (sometimes induced) plant is the source of seeds	Forest soil along with fallen leaves (or Soil+FYM+Sand mixture) have best regenerative capacity and hence used	While uprooting precaution should be taken not to touch the middle portion of stem but the bottom	Use of local plant materials by decomposing them with or without cattle urine can be helpful to produce either liquid-based or slurry/solid-based jaibik fertilizers	Underground pits in the slopy land can store potato, ginger, radish, etc. in raw state
Seeds are collected and sun/shade dried before storage in cool, dry, shaded place	Neem-leaf powder and mustard-cake powder, etc. are added to have anti-pesticidal/fungal effect	Field/Pit is well tilled and fertilized with FYM 1-2 weeks prior to transplanting	Use of some specific plants (titepati, neem, etc.) to extract their content with the help of water or urine are done to prepare jaibik pesticides	Garlic, Onion, etc. can be stored by just hanging them in bundles in the roof, etc.
There are several storage mechanisms: Straw Bags, Leaves of Malu, Bamboo Baskets, Bhakari, Underground Pits, etc.	Closed nursery and heightened nursery housing are common in winter and rainy season, respectively	Light irrigation or mulching after the transplantation process is complete	Oil cakes, ashes, etc. can also be used for fungal diseases	Processing by making pickle, gundruk, sinki, chana, chips, etc. are also common

Conclusion

- There is a vast traditional knowledge related to vegetable production and management
- Due to easy availability of inputs on market this indigenous knowledge are gradually disappearing
- There is a dire need to document and validate these indigenous knowledge for their promotion in current context



Assessing climate change impacts and agro-climatic indices of potato cultivars in Far-Western Nepal

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Introduction

Climate change severely impacts agriculture, including potato cultivation, in Nepal's agro-ecological regions. Assessing the impact of climate change on potato cultivation is crucial for identifying its effects on potato tuber yield and agro-climatic indices of potato. The result will help to promote adaptation measures in different agro-ecological regions.

Research questions

- How do farmers perceive the impact of climate change on potato yield and does it match the climatic trend?
- What are the impacts of agro-climatic indices on potato phenology and yield?

Methodology

A mixed method approach was used to identify effective climate change adaptation measures for potato production. The questionnaire survey (90), climate trend analysis (1990-2024) and field experimentation (one season) were done in three agro-climatic regions: high hills (Budhinanda Municipality, Bajura), mid-hills (Naumule Rural Municipality, Dailekh), and Terai (Godawari Municipality, Kailali).

Key findings

About 80% of respondents noticed long-term shifts in temperature and precipitation, which aligned with the climate trend analysis and field experiment across three study sites (Figure 1). Potato tuber yield and physiological maturity were significantly influenced by the variation in cultivar and planting dates across the study sites (Figure 2).

Figure 1 Trend analysis of average seasonal total rainfall (mm) in Bajura, Dailekh and Kailali from 1990 to 2024.

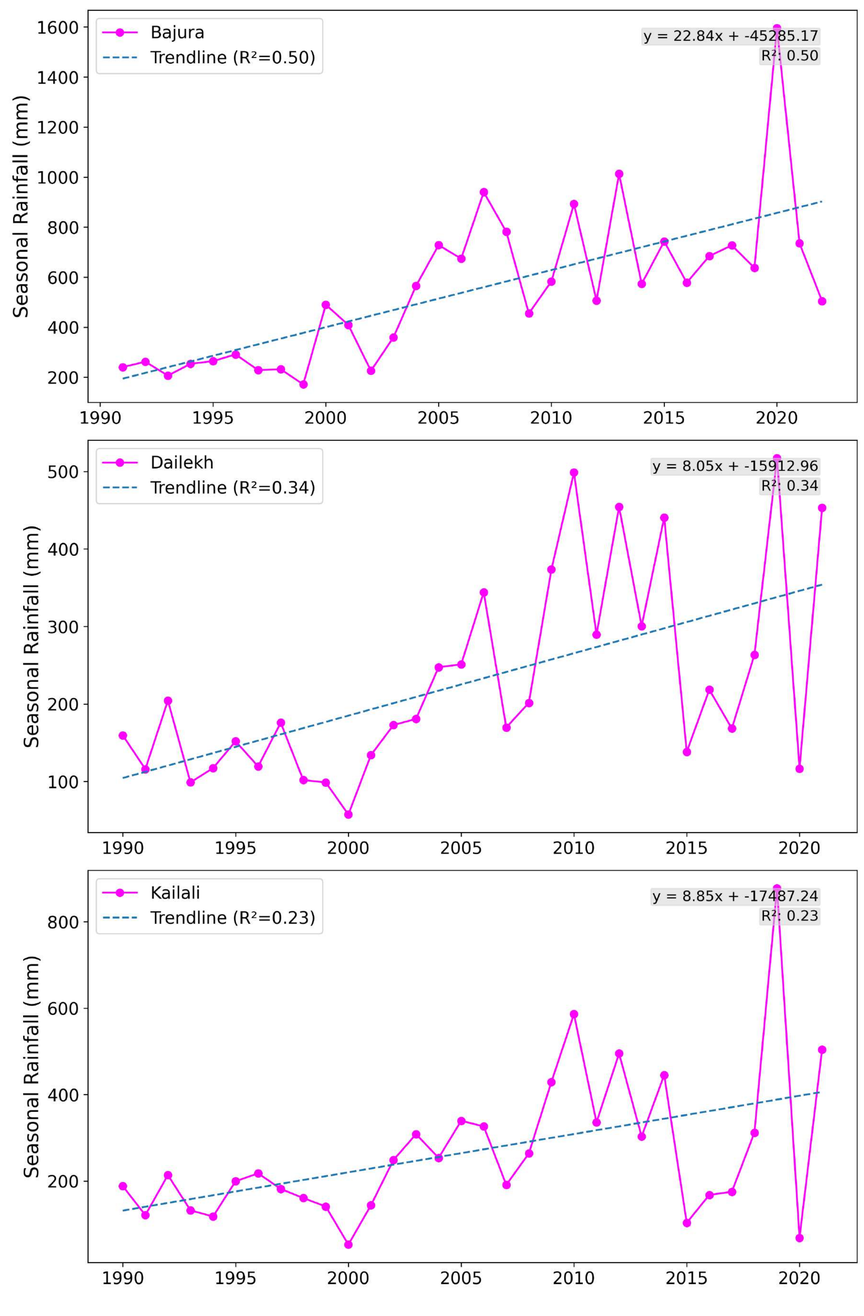
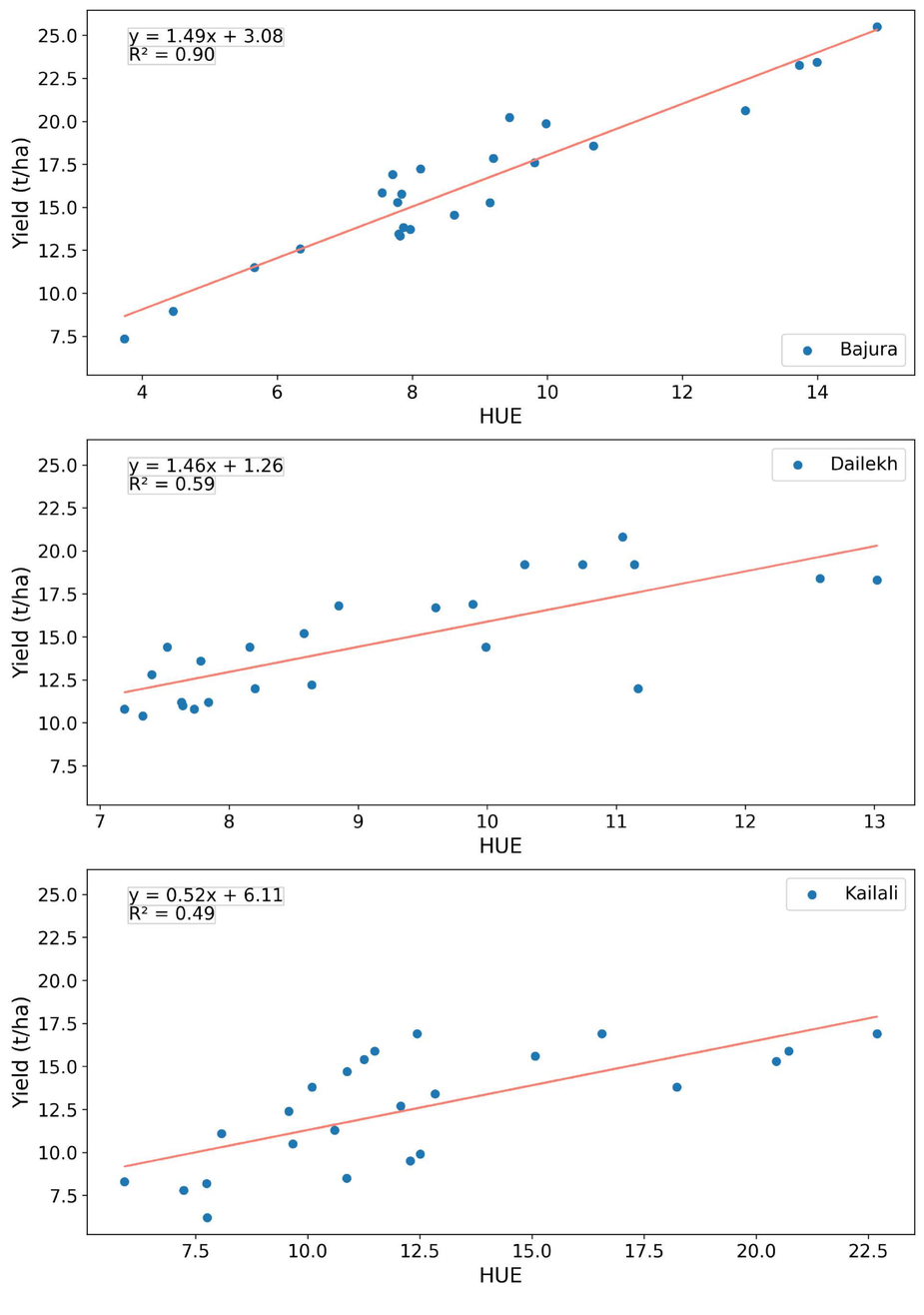


Figure 1 Correlation and regression analysis of potato tuber yield (t/ha) and HUE in Bajura, Dailekh and Kailali during 2023/2024



Conclusion

The reduction in potato tuber yield for high-yielding, early-planted cultivars highlighted significant yield gaps, which were more pronounced with changes in planting dates than with changes in potato cultivars. The mid-hill agro-ecology of Dailekh showed consistent yield gaps, suggesting its suitability for potato cultivation.

Evaluation of potential pesticides for the management of cabbage aphid in Dailekh, Nepal

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Introduction

Cabbage aphid *Brevicoryne brassica* (Linnaeus, 1758) is an economic pest that causes 30-40% yield losses. Their feeding behaviour and rapid reproductive potential makes it difficult to control. Integration of plant-based pesticides along with other biological-based pesticides into IPM approaches could be a preliminary strategy for reducing the use of chemical pesticides. Such pesticides are safe, biodegradable and eco-friendly, and they effectively combat target pests.

Research questions

- What could be the most effective pesticides for managing cabbage aphids under the climatic conditions of Dailekh, Nepal?
- How do different pesticides affect the overall yield of cabbage crops?

Methodology

Eight treatments each with three replications in RCBD were tested on transplanted seedlings. The sprays of treatments were applied at 30 days after transplanting them at 10-day intervals. The cabbage aphid populations at pre-spray, three, six and nine days post spray, and head weight at harvesting were recorded. Data were analysed using R-Studio.

Key findings

The lowest aphid population was recorded in plots sprayed with Azadirachtin 1500 ppm, which was very similar to plots treated with Azadirachtin 300 ppm, Metarhizium anisopliae, and botanical extracts.

The maximum population reduction over control was found in Azadirachtin 1500 ppm treated plot with the highest yield among other plots.

Figure 1 Effect of various pesticides on aphid population reduction over control (%)

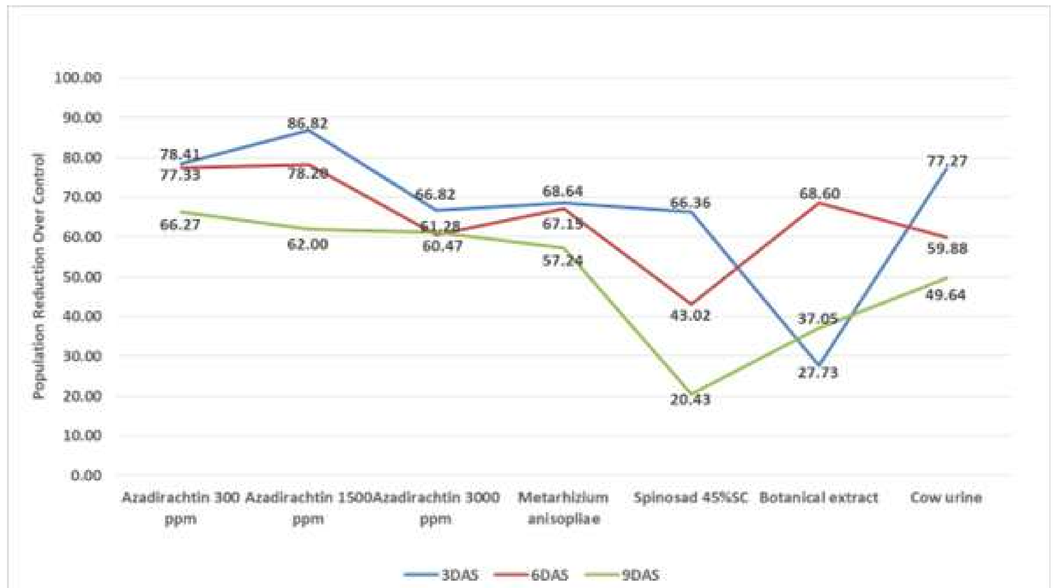
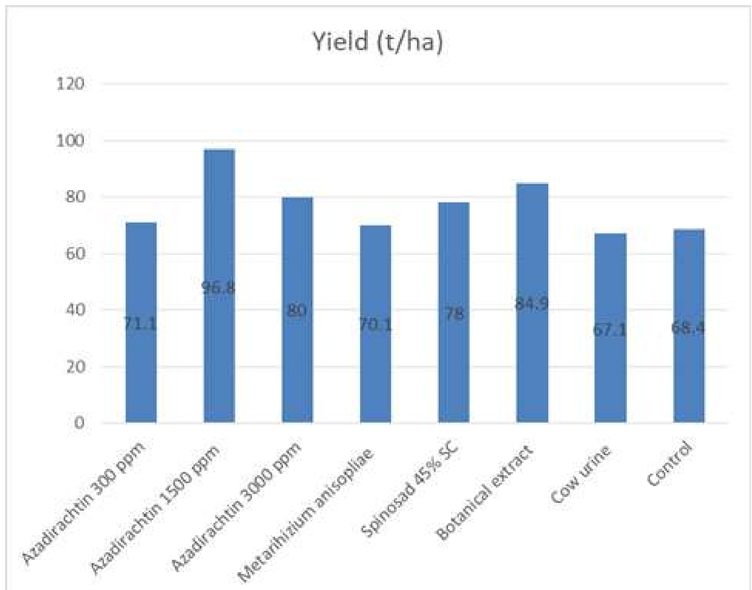


Figure 2 Effect of various pesticides on yield of cabbage



Conclusion

The use of Azadirachtin in different concentrations resulted in the highest reduction of cabbage aphid population and significantly outperformed Spinosad 45% SC. The maximum mortality was recorded on Azadirachtin 1500 ppm sprayed plots and so was the yield. For every spray, higher efficacy was observed for up to one week only.

CH_4 emission from enteric fermentation and manure management of domestic goats in Nepal

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Introduction

Goat farming plays a crucial role in Nepal's agricultural sector, but it produces carbon emissions that threatens the environment. Knowledge about feed characteristics and manure management practices is important to understand livestock's contribution to carbon emissions. Goat feeding practices, feed type and rearing pattern determines manure management practices and ultimately manure-related emissions.

Research question

- This study estimates methane (CH_4) emissions from enteric fermentation and manure management of domestic goats

Methodology

Data on goat body length, girth length, feed characteristics, and manure management practices were collected through direct field measurements and farmer surveys in two municipalities: Bheriganga in Surkhet district and Dullu in Dailekh district. Data were collected using Kobo – Toolbox for a questionnaire survey and direct observation of manure management practices by farmers. The country-specific emission factors for both CH4 enteric fermentation and manure management was computed using the Tier 2 approach of the IPCC 2019 refinement GHG inventory guidelines.

The study included a total of 529 goat farmers – 321 from Dullu and 208 from Bheriganga, who reared 3001 and 1883 goats respectively.

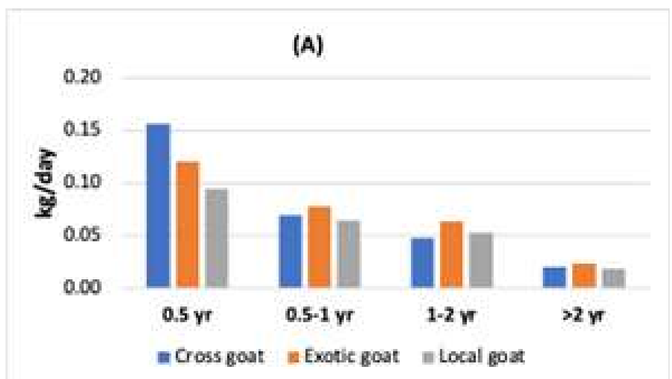
Key findings

Goat breed varies from indigenous, to exotic and even cross breeds.
The goat rearing system comprised intensive (64.11%), semi-intensive (35.08%), extensive and free ranges (0.81%).

The feeding systems included both confined (75.2%) and grazing (24.8%). The feed characterization resulted in both roughage and concentrated food.

Country-specific emission factor for enteric fermentation ranged from 2.3 kg CH_4 $head^{-1}$ yr^{-1} (for <0.5 yrs age group) to 8.1 kg CH4 $head^{-1}$ yr^{-1} (for >2 years' age group), and for manure management, it ranged from 0.03 kg CH4 $head^{-1}$ yr^{-1} (for <0.5 years' age group) to 0.32 kg CH4 $head^{-1}$ yr^{-1} (for >2 yrs age group). Total estimated CH4 emissions from goat farming in Nepal is 75.3 Gg $yr,^{-1}$ which includes 73.5 Gg yr^{-1} from enteric fermentation and 1.8 Gg yr^{-1} from manure management.

Figure 1 Growth rate of goats in Bheriganga (A) and Dullu (B) municipalities by age group



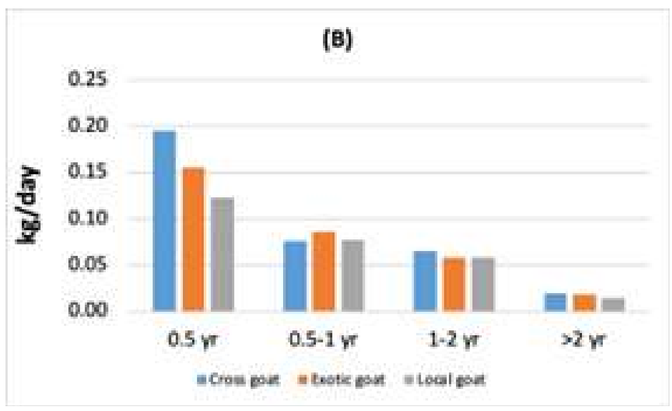


Table 1 Emission factor for goats in Dullu Municipality

Category	Sub-category (Age)	Gross Energy (GE)	Emission factor (EF)
Cross	0.5 yr	6.8	2.5
	0.5-1 yr	14.1	5.1
	1-2 yr	18.7	6.7
	>2 yr	22.7	8.2
Exotic	0.5 yr	6.4	2.3
	0.5-1 yr	16.4	5.9
	1-2 yr	19.9	7.2
	>2 yr	24.4	8.8
Local	0.5 yr	5.6	2.0
	0.5-1 yr	13.8	5.0
	1-2 yr	16.8	6.0
	>2 yr	20.8	7.5

Table 2 Emission factor for goats in Bheriganga Municipality

Category	Sub-category (Age)	Gross Energy (GE)	Emission factor (EF)
Cross	0.5 yr	6.8	2.5
	0.5-1 yr	14.1	5.1
	1-2 yr	18.7	6.7
	>2 yr	22.7	8.2
Exotic	0.5 yr	6.4	2.3
	0.5-1 yr	16.4	5.9
	1-2 yr	19.9	7.2
	>2 yr	24.4	8.8
Local	0.5 yr	5.6	2.0
	0.5-1 yr	13.8	5.0
	1-2 yr	16.8	6.0
	>2 yr	20.8	7.5

Conclusion

This study concludes that feed characteristics, the amount of manure produced, and manure management practices affect CH4 emissions. Given the need to expand goat farming for meat, milk, and wool in the country, it is necessary to introduce green farming methods and technologies.

Climate vulnerability and adaptation in Karnali and Sudhurpashchim provinces, Nepal

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Introduction

This study assesses the vulnerability of Karnali and Sudhurpashchim provinces in Nepal to climate change and explores adaptation strategies. The focus is on agricultural systems, which are crucial for the livelihood of local communities.

Research questions

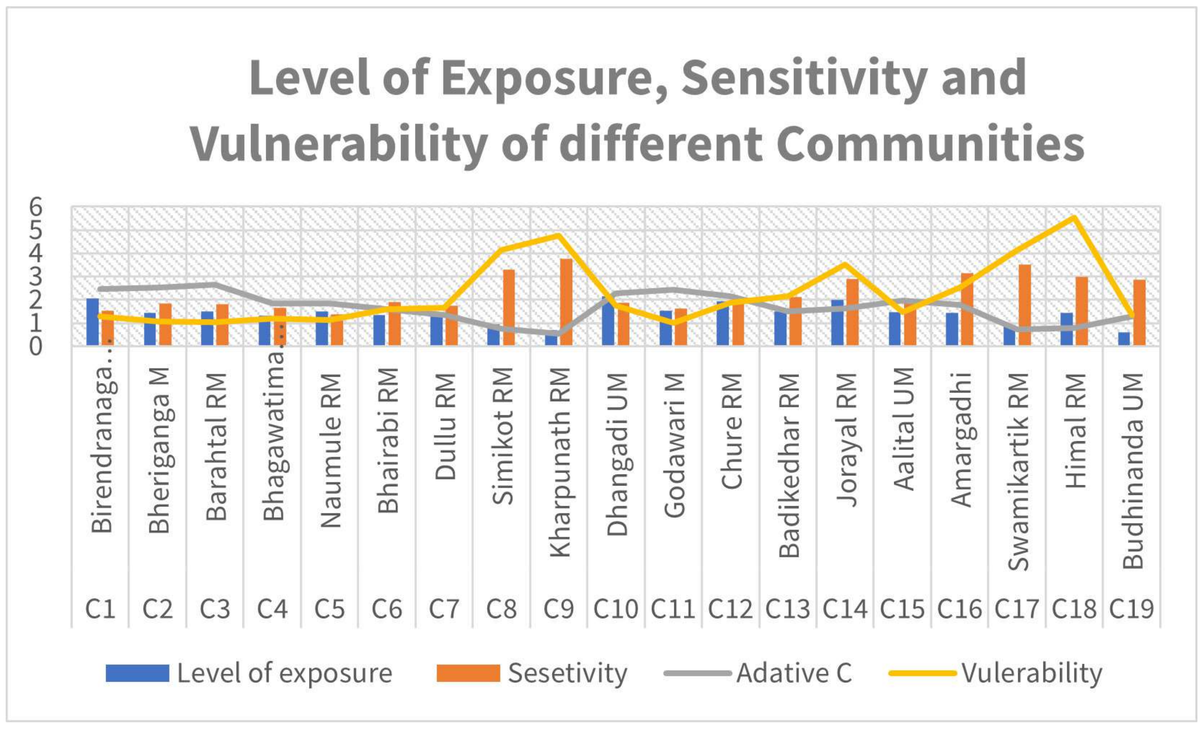
- What is the current level of climate change awareness among farmers in Karnali and Sudhurpashchim?
- How has climate change affected agricultural productivity in these provinces?
- What adaptation measures are currently in place, and what further measures are recommended?

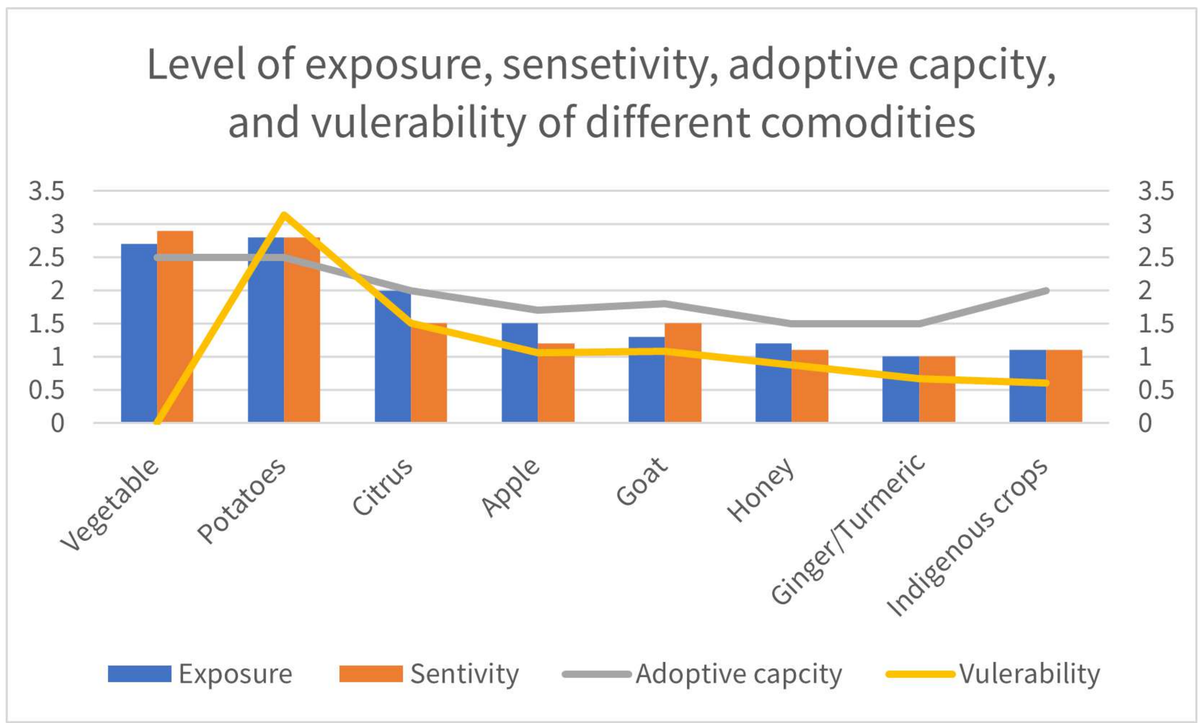
Methodology

Data were collected through focus group discussions (FGDs), key informant interviews (KIIs), and household surveys in 19 communities. Both qualitative and quantitative data were analysed to assess vulnerability and adaptation capacity.

Key findings

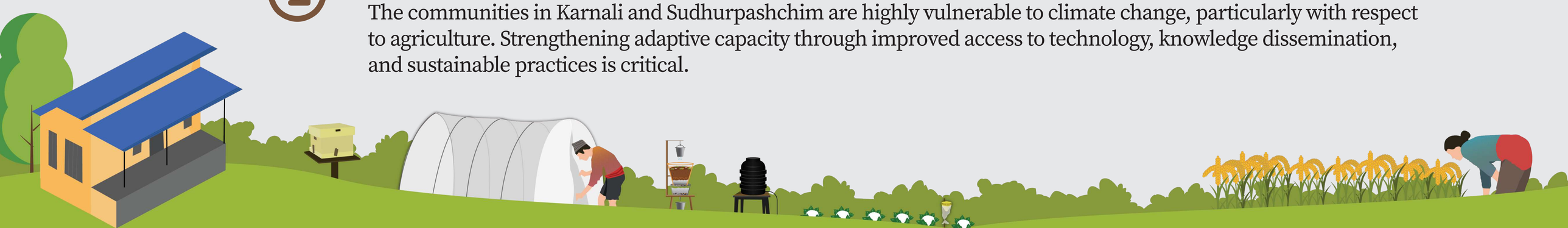
- High awareness of climate change (96%) among farmers, mainly through mass media.
- Increased temperatures and erratic precipitation patterns have negatively impacted agriculture, particularly affecting potato and vegetable yields.
- Existing adaptation strategies include the use of chemical inputs and traditional farming methods, but knowledge gaps and resource limitations persist.





Conclusion

The communities in Karnali and Sudhurpashchim are highly vulnerable to climate change, particularly with respect to agriculture. Strengthening adaptive capacity through improved access to technology, knowledge dissemination, and sustainable practices is critical.



Evaluation of women friendly agricultural tools and technologies

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Introduction

Women comprise 70% of the agricultural workforce (NPC, 2021) and 53% of the economically active women engage in agriculture (NSO, 2023). Women's work in agriculture is often labour-intensive, time-consuming, repetitive, and involving tasks that are both physically demanding and monotonous (Mishra et al., 2016). At least one family member per household, mainly men, are working overseas (NSO, 2023), which has further increased the workload for women. In this regard, the study aims to investigate women friendly agricultural tools and technologies available in Sudhurpaschim and to determine the major qualifiers for the adoption of such tools and techniques.

Research questions

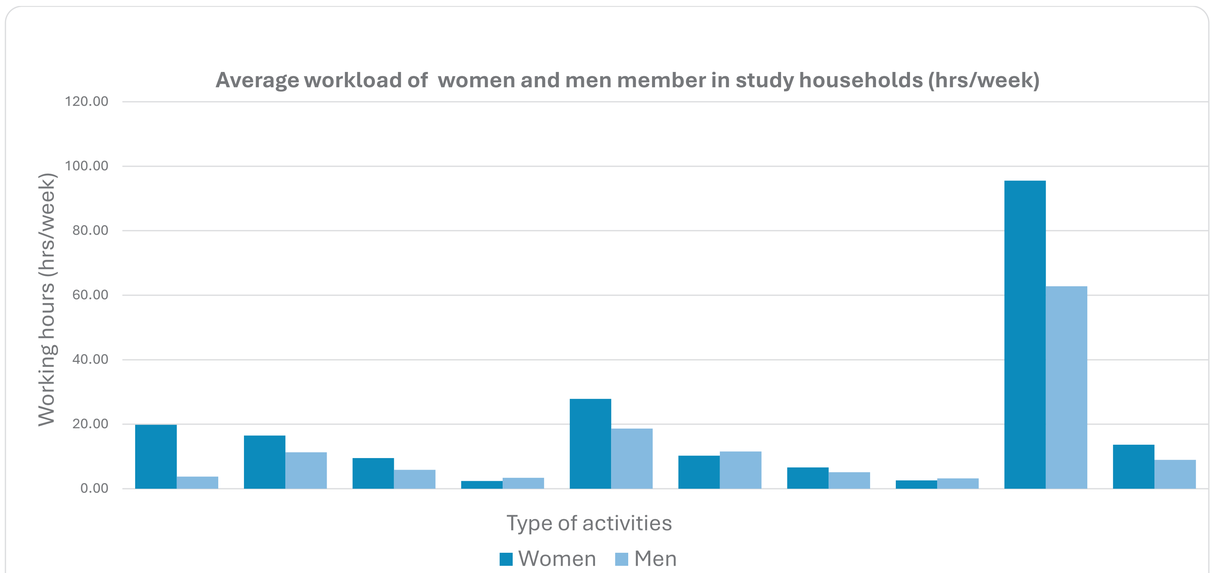
- What women friendly agricultural tools and technologies are being adopted by farmers in Sudurpashchim Province?
- What are the major qualifiers for women friendly agricultural tools and technologies in the study area?

Methodology

Study area: Doti, Bajura and Kailali
Data collection: Households survey, group discussion and field observation
Sampling: Simple random sampling
Data analysis: Descriptive statistics, diagramming and ranking

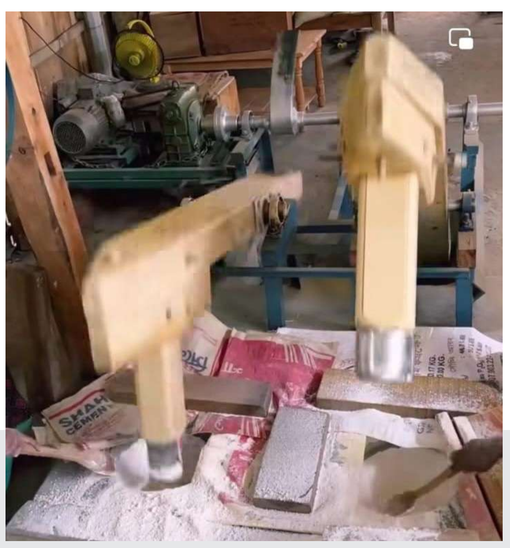
Key findings

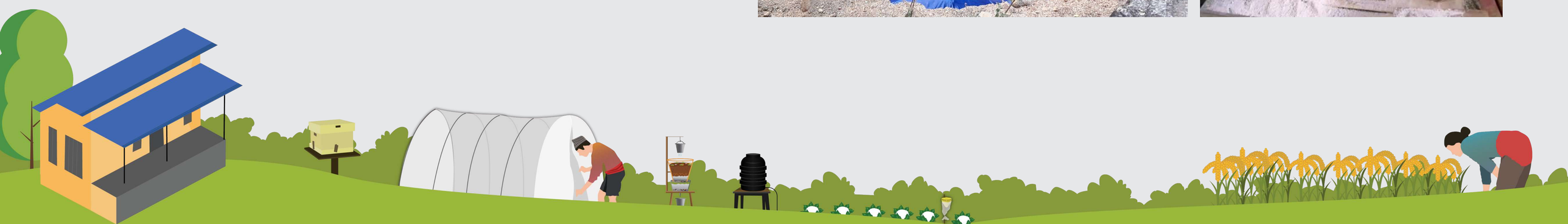
- Women have average daily workload of 13.65 hrs which is Women have average daily workload of 13.65 hrs which is significantly higher as compared with men (8.97 hrs). Weekly involvement of women is maximum (27.89 hrs) for performing agricultural activities.
- Current women friendly agricultural practices in the study areas are ghatta (water mills), grain processing mills, water collection tank, drip irrigation, pipe irrigation, water lifting electric pump, and thresher.
- Women friendly agricultural tools and techniques that need to be introduced and promoted are grain processing mills, water harvesting tank, drip irrigation, grass and chaff cutters, plastic mulching, ridge maker, herbicides, mini tractor and auto-rickshaw, dairy processing tools at household level, bio-pesticdes manufacturing at community level, nursery at community level, harvester, maize hauler, apple picking ladder, jab planter, thresher, automatic feeder and aerator for fish farming in Kailali, winnower, rice weeder, improved shed, on the spot composting, and fodder cultivation. Some non-agricultural tools like mixture/grinder, washing machine at community level, biogas (low altitude) and cooking gas (higher altitude), improved cookstoves, induction heater etc can also reduce their workload.
- Qualifiers for increased adoption and use are size (small), affordability, availability, knowledge/facility for repair and maintenance, daily/multiple use tools, drudgery reduction capacity, time saving, and productivity enhancement.
- Major determining factors for adoption of women friendly tools and techniques are the age of the senior woman in the family (-), the size of family (-), agricultural land (+) and livestock holding (+), absence of male member of the family (+).



Conclusion

- Women are overloaded with household, agricultural and social activities.
- People are aware about the women friendly tools and techniques and their role in time saving and drudgery reduction. However, only a few farming households are adopting them due to poor affordability and lack of alternative job opportunities.
- Adoption of most of the women friendly tools and techniques can be scaled up by developing mechanisms for ownership and use on a shared community basis.





A process of multistakeholder engagement for resilient agriculture value chain development

GRAPE
Green Resilient Agricultural Productive Ecosystems

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Introduction

The GRAPE project aims to enhance climate-resilience and sustainability of market-oriented agricultural ecosystems. Key issues faced by value chain actors include sustainable production, processing, and marketing. Ownership and participation of the value chain actors in resilient agricultural value chain development continues to be a concern. Engaging a wide range of stakeholders for developing standard guidelines to address issues and challenges is necessary for promotion of resilient value chain development.

Research questions

- How can locally adapted standard guidelines be developed for resilient agricultural value chains?

Methodology

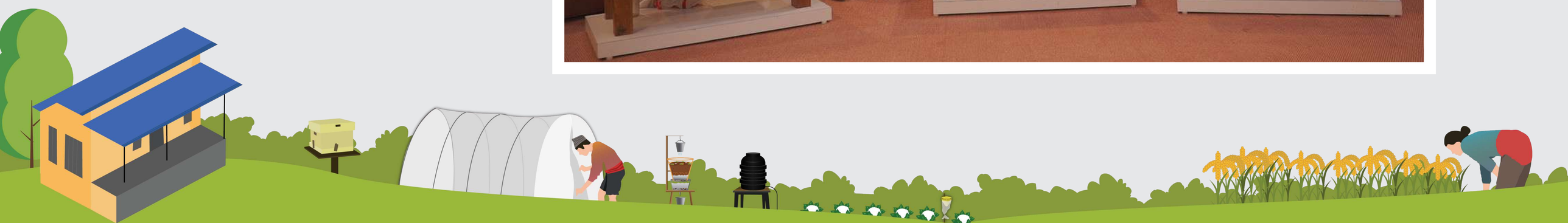
- Stakeholders' consultation and formation of value chain committee.
- Roles and responsibilities of the value chain committee developed.
- Capacity building – to discuss and finalise roles and responsibilities and with other chambers.
- Identify key issues and prospects for resilient agricultural value chain development.
- The step wise process followed was documented, agreed and shared.

Key findings

- The step wise guidelines on agriculture value chain development will help value chain actors for promotion of resilient agriculture value chains in western Nepal. It will promote:
  Enhanced stakeholder buy-in and ownership.
  - Increase market access and fair trade.
  - Sustainable resource management
  - Governance and policy
  - Monitoring and evaluation

Conclusion

The standard guidelines for developing resilient agriculture value chains brings together relevant value chain actors to address the issues and challenges faced by them.



Spatio-temporal graph neural networks for late blight disease forecasting

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Introduction

This study presents the development and deployment of a GNN-powered mobile application for predicting late blight risk in Nepalese tomato and potato crops. The application utilizes NASA satellite weather data and a GNN model to provide accurate forecasts for farmers. Field validation and laboratory analysis confirmed the app's effectiveness in identifying high-risk areas and detecting P. infestans.

Research questions

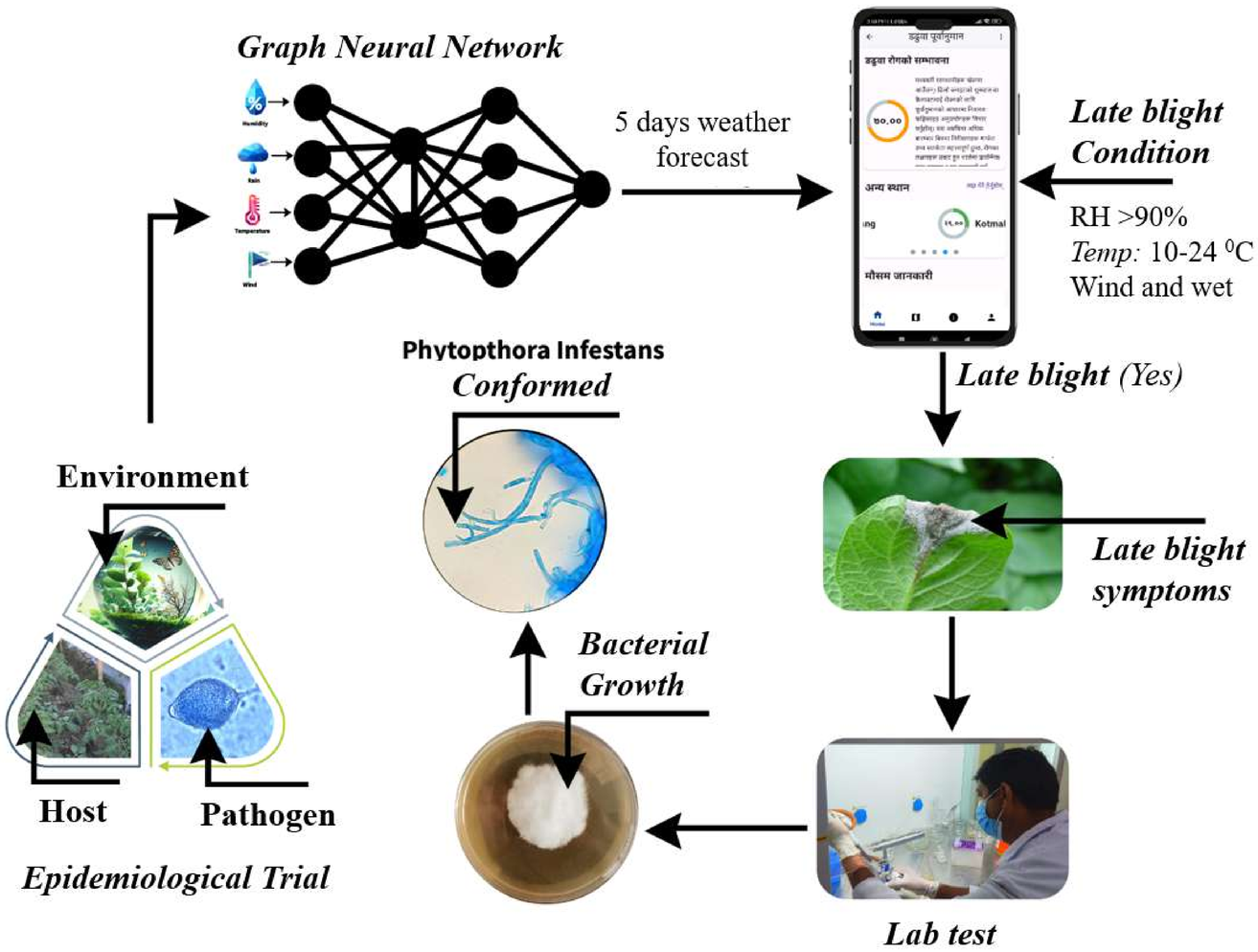
- Can a GNN model accurately predict late blight risk in Nepalese tomato and potato crops using NASA satellite weather data?
- How effective is the mobile application in disseminating late blight risk information to farmers?
- What is the impact of the application on late blight management practices in Nepalese agriculture?

Methodology

We have successfully developed a robust late-blight forecasting model powered by Graph Neural Networks. This user-friendly system helps Nepalese farmers reduce the overuse of chemical pesticides. The mobile application is now available for download on the Google Play Store.

Key findings

This study demonstrates the successful development and deployment of a GNN-powered mobile application for late blight risk assessment in Nepal. The application empowers farmers with accurate forecasts, reducing the need for excessive pesticide use and contributing to sustainable agriculture.



Conclusion

The combined application of chemical fertilizer, compost and bio-fertilizers increased crop growth and grain yield by 4.01% and 19.69% over control, while promoting sustainable agriculture and reducing reliance on chemical inputs. Local communities should be sensitized on using chemical fertilizers, compost manure and bio-fertilizers through workshops, seminars and public awareness programmes.

Effect of bio-pesticides on potato quality and yield

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Introduction

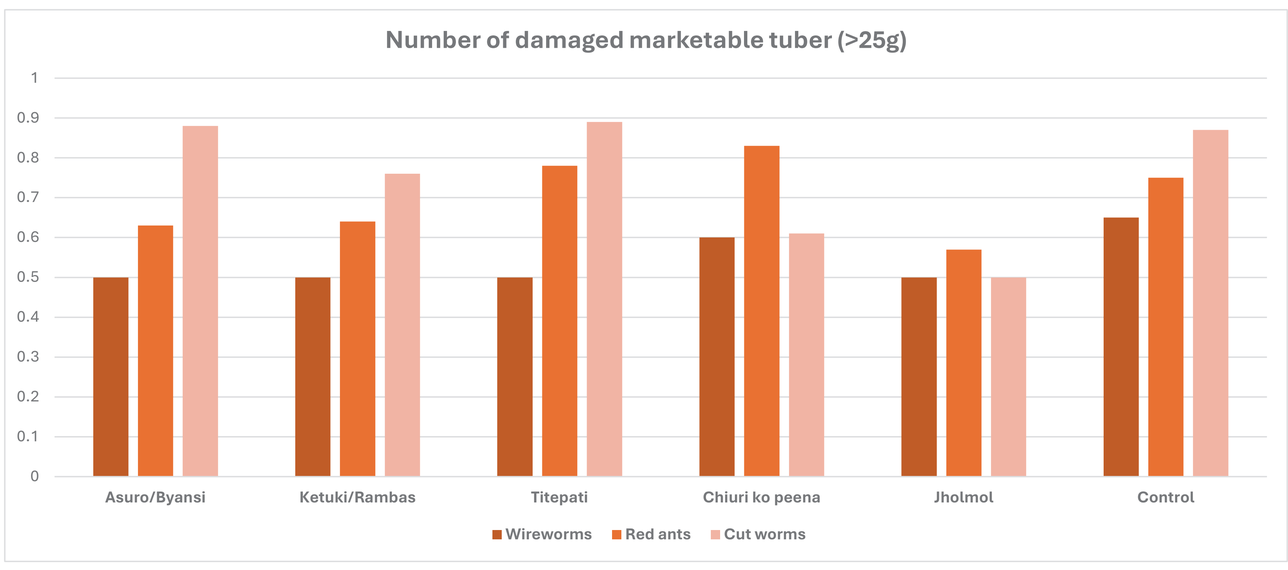
Chemical pesticide use in vegetable crops is high and potato is one of the key vegetable crops grown in Nepal. Providing alternatives to chemical pesticides for improving quality and quantity of potato tubers is a major concern.

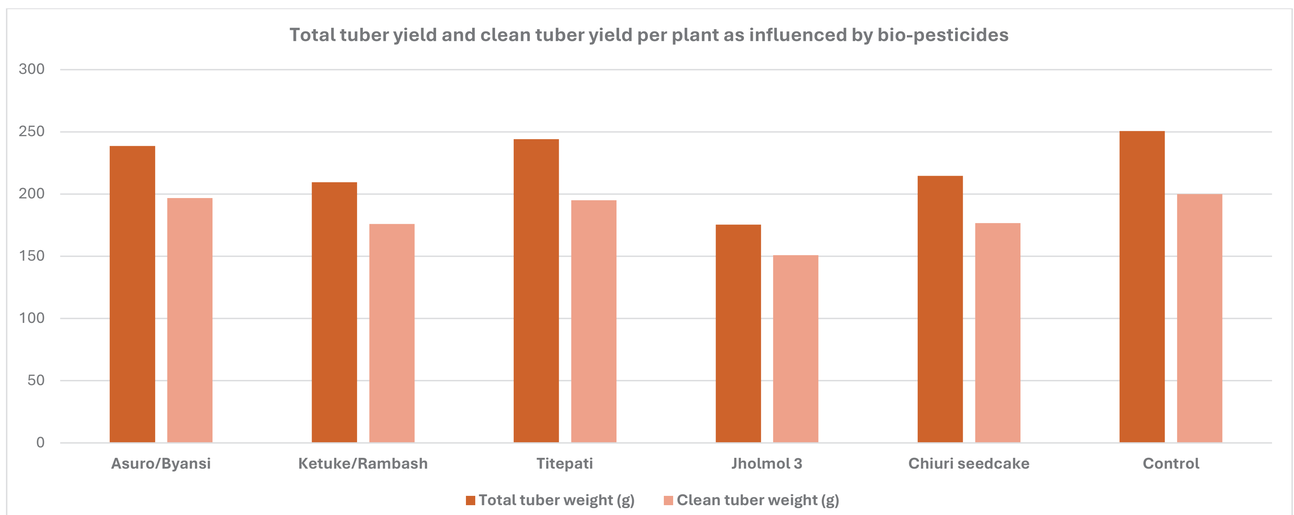
Research questions

- Are jholmol and botanicals equally efficient in managing damage by insects and pests?
- Which botanical is effective in managing damage and increasing both quality and yield of potato tubers?

Methodology

Potato was grown in Dhulachaur, Himali Rural Muncipality-6, Nepal to test the efficacy of asuro, titepati, ketuki, chiuri seedcake and jholmol in reducing damage by insect pests. The research was designed using RCBD with four replications. Data collected during the harvest were subjected to ANOVA and treatments were compared ($p<0.05$).





Key findings

Jholmol and Ketuki were effective in minimizing insect pest damage but posed negative effects on total tuber yield. Chiuri seed cake significantly reduced the damage by cutworms, but no such effects were observed on red ants and wire worms. Total tuber and undamaged tuber yields were higher in asuro and titepati, despite significant infestation by cutworms.

Red ant damage to tuber

Cut worm damage to tuber

Wire worm damageto tubers

Conclusion

Jholmol was the most effective bio-pesticide among the treatments but suppressed the yield of potatoes. Chiuri seed cake may be suggested for reducing cutworm infestation, but not for wireworms. Asuro and titepati improved yield despite the damage. Further studies are suggested on their use as green manuring crops.

Effect of planting dates on performance of different potato varieties

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Introduction

In Nepal, potatoes are cultivated as a vegetable in the lower hills and terai and as a staple in the higher hills. Bajura, in the far-western region, is a well-known potato growing district, but there is lack of appropriate planting dates and a suitable variety.

Research questions

- What is the optimal planting date for better yield of high-quality potato?
- Which variety is suitable for early and late planting in Dimmarpani, Bajura?

Methodology

The experiment was done in Dimmarpani, Bajura from March to August 2024 in 2 factorial randomized complete block design using six varieties (Axona, Blue Danube, Cardinal, Desiree, Local Seto, and MS-42.3) and 3 planting dates (8 February, 23 February, and 10 March). Various growth and yield parameters were recorded.

Key findings

Highest incidence of late blight (1.26) was observed in early planted Cardinal variety. Early planted Local Seto resulted in highest number of tubers (15.54). Axona showed lowest incidence of cutworm infestation (2.09), the highest average tuber weight (56.89), and the maximum sensory quality attributes (4.24).

Figure 1 Interaction effect of planting date and varieties on average tuber weight, tuber yield and blight incidence

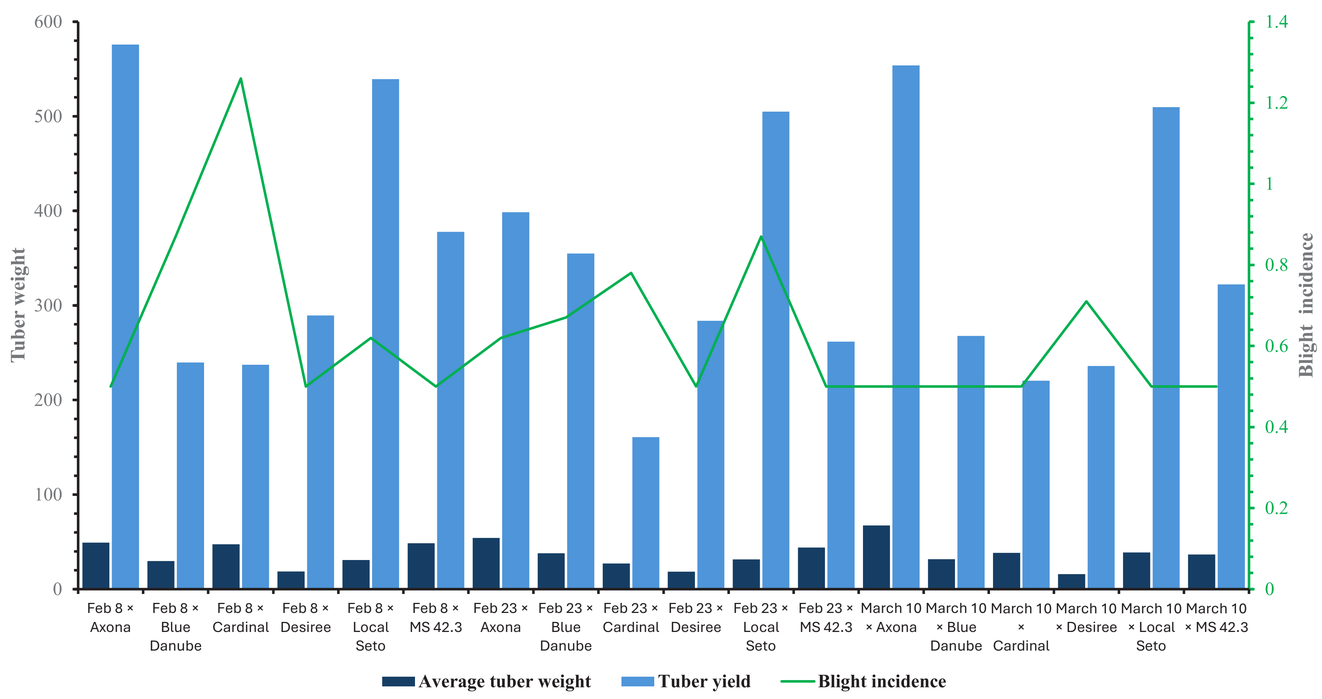
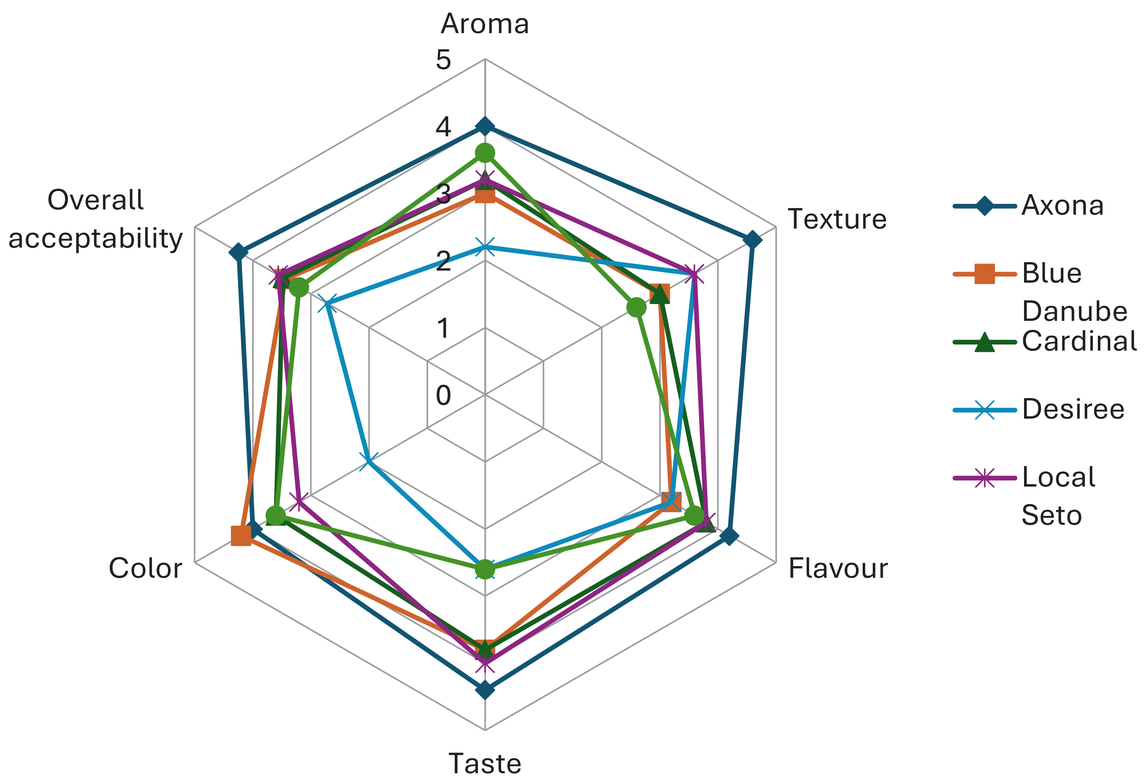
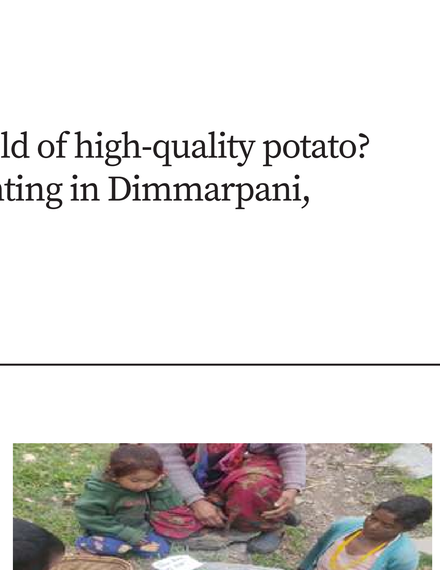


Figure 2 Sensory quality attributes of different boiled potato varieties





Conclusion

- Desiree is unsuited for its small size and low preference for sensory quality, and Cardinal for highest incidence of blight and lower tuber yield.
- Planting can be done late on March 10
- Axona is highly preferred by evaluators

Comparative economic analysis of polyhouse and open field method of vegetable production in Sudurpashchim Province, Nepal

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Introduction

Climate-resilient agriculture (CRA) techniques help in adaption to climate change, reduce or eliminate greenhouse gas emissions wherever possible, and help to increase agricultural productivity and income in a sustainable way (Reddy, 2015). CRA practices like polyhouse makes farming more absorptive, adaptive, and renovative from the effects of adverse changes in the climate (Sain et al., 2017). The open-field cultivation of vegetables growing has become more challenging during rainy and winter seasons. As a result, many farmers are constructing plastic houses to protect plants from rain (Kafle & Shrestha, 2017) either with their own investment or with support from various governmental and non-governmental organizations.

Research questions

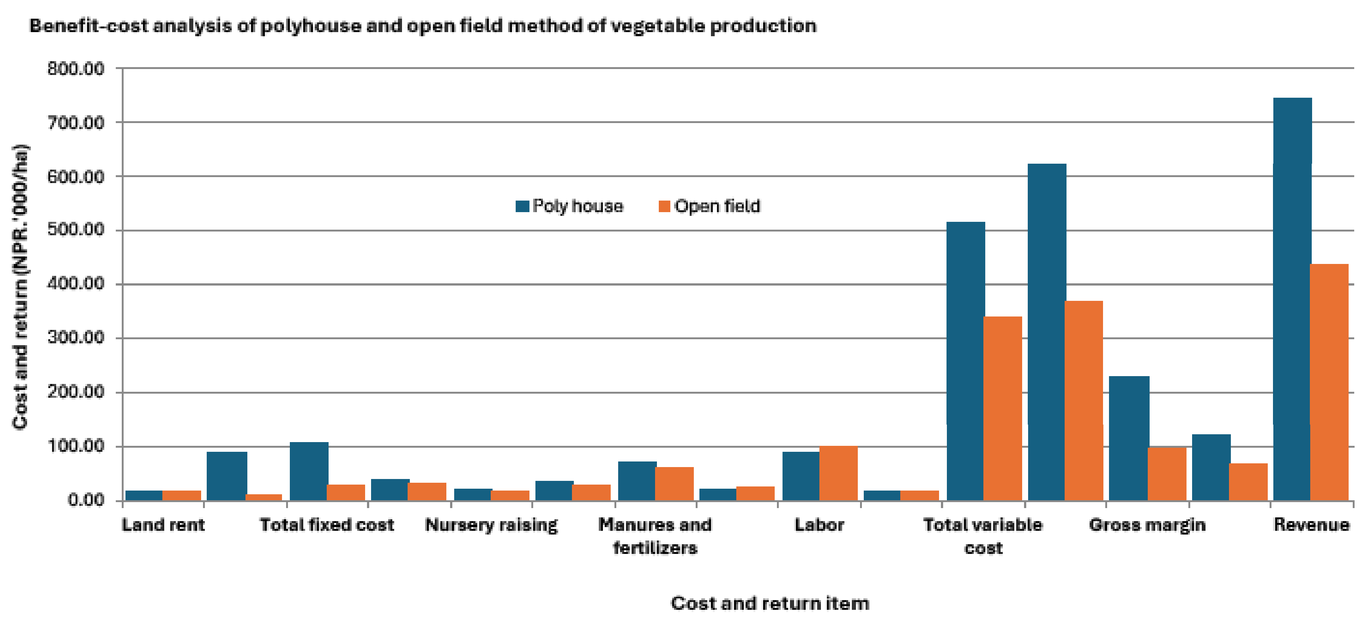
- What is the differences in cost of production in polyhouse and open field method of vegetable production?
- How does polyhouse method of vegetable production affect return and profitability compared to the open field method?

Methodology

Study area: Doti, Bajura and Kailali
Data collection: Households survey, group discussion and field observation
Sampling: Simple random sampling
Data analysis: Descriptive statistics, comparison of variable, fixed and total cost, gross and net margin analysis, benefit cost ratio

Key findings

- Major vegetable crops grown in the study areas were cauliflower, cabbage, coriander, tomato, cucumber and leafy vegetables
- Polyhouse system of vegetable production is adopted by about one-fifth of farmers and the average dimension of polytunnel is 11*5 sq. meter, and it costs about NPR. 45000 for a tunnel with local materials and NPR. 62500 for a tunnel with iron frame.
- Most polyhouses are equipped with drip irrigation and mulching (mostly plastic), and farmers produce organic vegetables with an average cropping intensity of 250%.
- Benefit cost ratio of vegetable production inside polyhouse was 1.83 and for open field method it was 1.39, with gross margin of NPR. 744160 and 435135 and total cost of NPR 623256 and 367691 on per ha basis, respectively for poly house and open field method.



Conclusion

- Cost of production of vegetable in polyhouse method is expensive due to higher initial investment for tunnel construction and drip irrigation structure establishment. However, the additional returns from poly house method sufficiently covers the cost of production making polyhouse method more profitable as compared to open field method of vegetable production.
- Support programmes should focus on training farmers to make the polyhouse structure with locally available materials, capacity building for establishment, repair and maintenance of drip irrigation system, mulching, bio-pesticide preparation, and awareness creation for commercial production.

Drought impact on agriculture and groundwater in Dhangadhi, Nepal

GRAPE
Green Resilient Agricultural Productive Ecosystems

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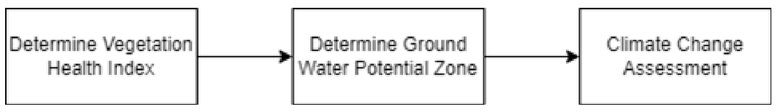
Introduction

Drought is a global issue affecting water and food security, leading to severe economic and social impacts. Drought can be classified under meteorological, agricultural, hydrological, and societal types. Vulnerable communities are most affected. Satellite-based remote sensing has advanced drought monitoring, improving global understanding of its effects.

Methodology

- The task was divided into three parts:



Determine Vegetation Health Index (VHI): Initially, Normal Differential Vegetation Index (NDVI) and Land Surface Temperature (LST) was determined using Google Earth Engine. Sentinel 2 Satellite imagery were used for the study. Then VCI and TCI were calculated accordingly.

NDVI = (NIR – RED)/ (NIR + RED)
VCI = VCI = 100 * (NDVI - NDVI min) / (NDVI max - NDVI min) (Kogan, 1990)

$$TCI_i = \frac{LST_{max} - LST_i}{LST_{max} - LST_{min}} \times 100$$

VHI = 0.5VCI + 0.5TCI (Luisa Febrina Emalo et al 2017)

Determine Ground Water Potential Index (GWPI)

Following parameters were used:
1.Fractional impervious surface (FIS)
The impervious surface denotes the environmental quality of any region. Initially, NDVI was derived from Sentinel 2 data. Fractional vegetation Cover (FVC) and (FIS) were calculated with the following formula:

NDVIs = (NDVI – NDVIlow) / (NDVIhigh – NDVIlow) (1)
FVC = (NDVIs)2 (2)
FIS = 1 – FVC (3)

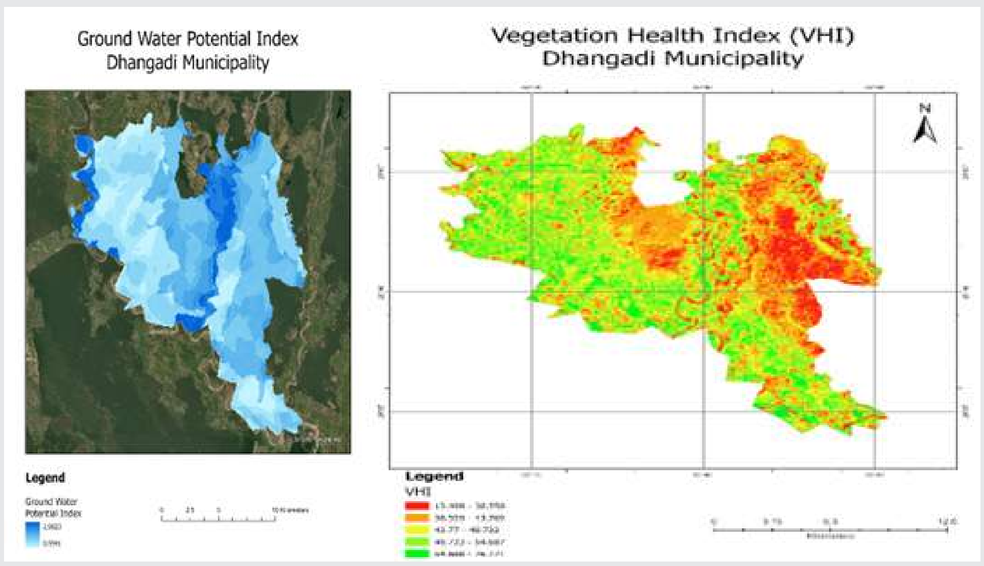
Understanding the drought pattern: After the determination of the VHI and GWPI values, areas are calculated as per the classes. The minimum value and maximum value are divided into 3 different classes, resulting in its area value to high, medium and low drought conditions

Research questions

- What are the VCI, TCI and LST patterns in the study area?
- What do Vegetation Health Index (VHI) and Normalized Differential Vegetation Index (NDVI) indicate about crop health?
- What are the groundwater potential zones

Key findings

- Vegetation Health Index (VHI) Distribution: Most of the land in Dhangadhi Municipality falls within the medium to very high VHI categories, indicating generally good vegetation health. Specifically, around 54.6% of the land is categorized as medium, 27.9% as high, and a small portion as very high; approximately 17% of the land is classified under very low VHI.
- Normalized Difference Vegetation Index (NDVI) Analysis: Land areas with NDVI values less than 0 cover approximately 1.063 km^2, while ranges between 0-0.1 cover 18.367 km^2. Higher NDVI ranges show greater vegetation health, with values exceeding 0.5 covering 2.263 km^2. The total area analyzed is 262.453 km^2.

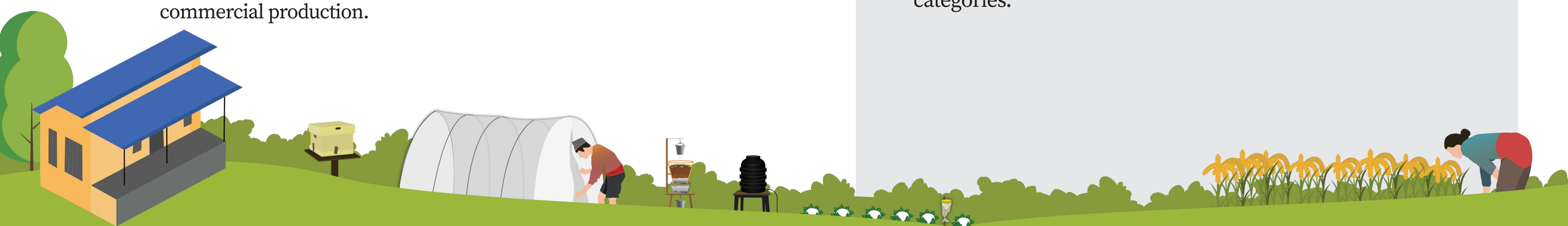


- Thermal Condition Index (TCI) Distribution: TCI ranges show significant variation in thermal conditions across land areas. The 0-15 range covers 61.810 km^2, while the 45-60 range includes 92.500 km^2. Values exceeding 60 cover a minimal area of 7.712 km^2.
- Land Surface Temperature (LST) Range: The majority of the land falls within the 30-35°C LST range, covering 154.585 km^2, with smaller areas in other temperature categories, including below 30°C (91.763 km^2) and exceeding 40°C (0.150 km^2).
- Groundwater Potential Index (GPI): GPI values range from 0.99 to 2.98, with most land areas falling into low potential categories.

Conclusion

Approximately 17% of the land exhibits very low vegetation health index values, indicating a high susceptibility to drought. The Groundwater Potential Index values range from 0.99 to 2.98, with most of the land falling into low index categories. Observations indicate that only areas proximate to rivers exhibit good groundwater potential.polyhouse method more profitable as compared to open field method of vegetable production.

- Support programmes should focus on training farmers to make the polyhouse structure with locally available materials, capacity building for establishment, repair and maintenance of drip irrigation system, mulching, bio-pesticide preparation, and awareness creation for commercial production.



Common predatory hornet species and their management using baited-coloured traps

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Introduction

Beekeeping is a profitable non-farm agricultural enterprise that has become increasingly popular in Nepal. *Apis cerana* and *Apis mellifera* are the common domesticated species. Hornets and wasps are considered the important enemies of bee colonies. Farmers do not have enough appropriate local technology to manage them. Hence this study aimed to develop the local management technology in Karnali, Nepal.

Research questions

- What are the common hornet predatory species in bee colony
- Are there any local techniques to trap hornets and wasps in Nepal?
- What are the common protocols for developing a hornet management technology

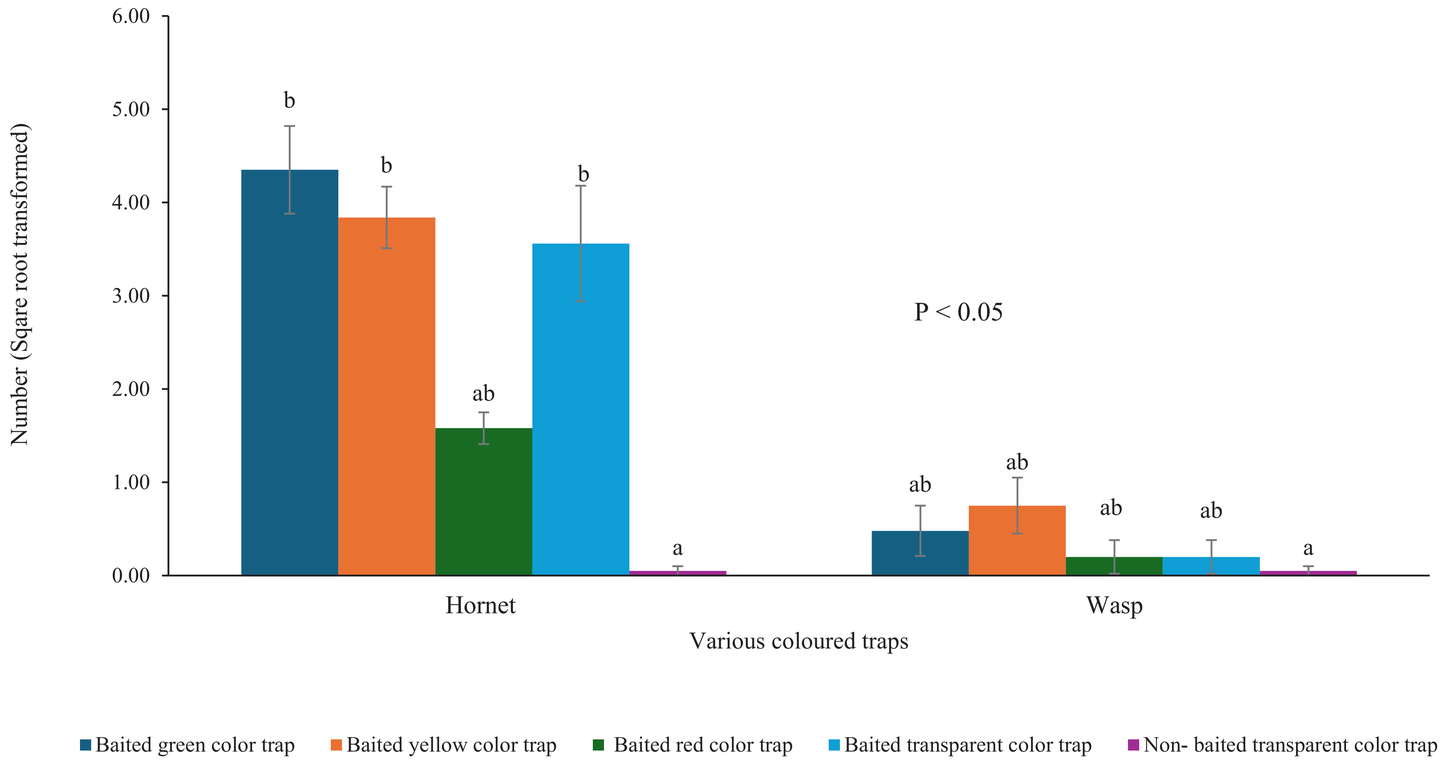
Methodology

The study was conducted in Aalital RM of Dadeldhura district from April to June 2024. Plastic bottles (2-liter capacity), measuring rulers (15 cm), markers, rotten fruits, sharp knives/blades/scissors, honey, local fermented products, rope, sugar, and water were first prepared. Various baited-coloured traps such as green, yellow, red, transparent, and non-baited traps were used to evaluate their effectiveness.

Key findings

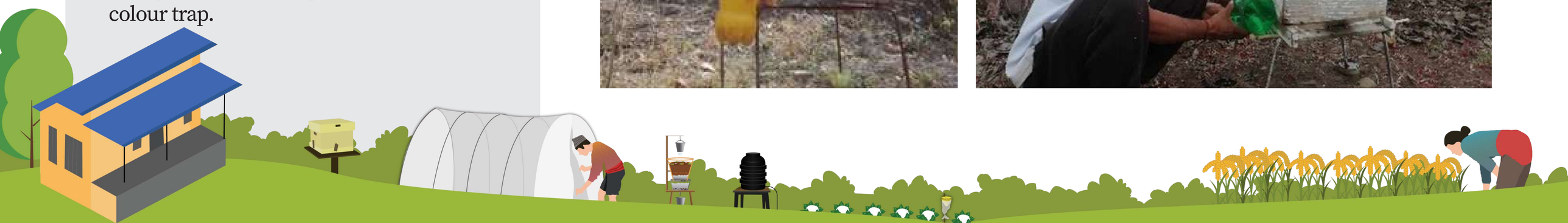
- *Vespa velutina* was the most abundant hornet predating the colonies of *A. cerana* . Other species are *V. basalis, V. tropica,* and *V. mandarinia* during the study period of May-April 2024.
- Baited green-coloured traps were found to be the most promising for all hornet species, followed by baited yellow, baited transparent, and baited red traps. *Vespa velutina* was the most trapped hornet species in these traps, followed by *V. basalis* and Vespa tropica.

Figure 1 Trapping efficiency of various baited colored traps for the hornets and wasps



Conclusion

Baited green-coloured trap was the most effective for trapping the hornet species which were similar to yellow colour trap and baited transparent color trap. The non-baited transparent trap was the least effective for trapping the hornet species which was similar to the baited red colour trap.
Similarly, the baited yellow colour trap was the most effective for trapping wasp species whose effectiveness is with that of baited green colour trap, baited transparent colour trap, and baited red colour trap.



Effect of Azotobacter and fertilizer combinations on soil and maize yield

GRAPE
Green Resilient Agricultural Productive Ecosystems

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Introduction

Nitrogen (N) is crucial for maize production and a key determinant of grain yield. Modern intensive agriculture's heavy reliance on chemical fertilizers not only degrades soil quality but threatens the ecosystem as a whole. Azotobacter, a biofertilizer, serves as a potential alternative to minimize chemical fertilizer use.

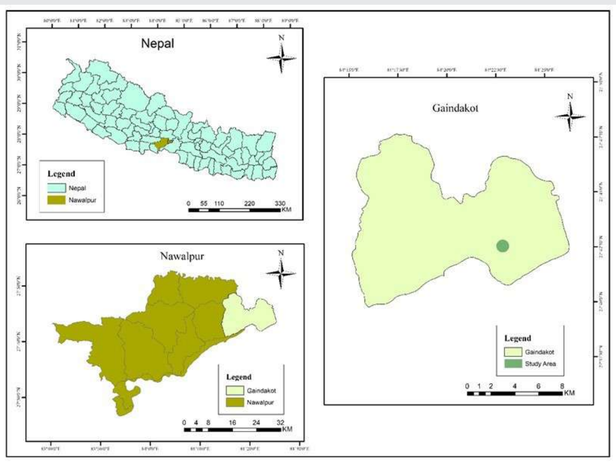
Research questions

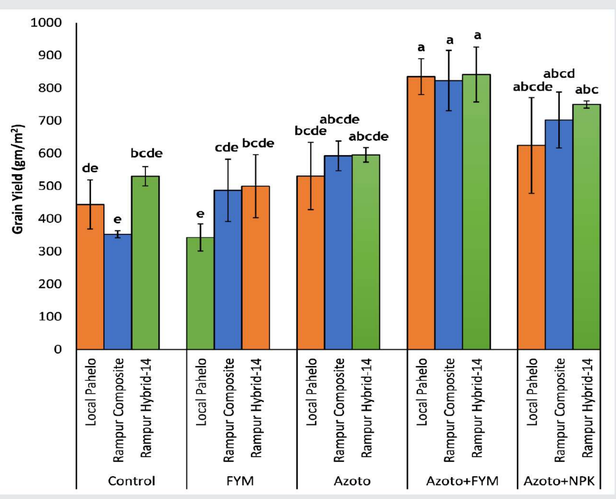
- How do different maize varieties respond to Azotobacter inoculation in yield and soil health?
- Can Azotobacter replace chemical fertilizers?
- Does Azotobacter improve nutrient uptake efficiency

Methodology

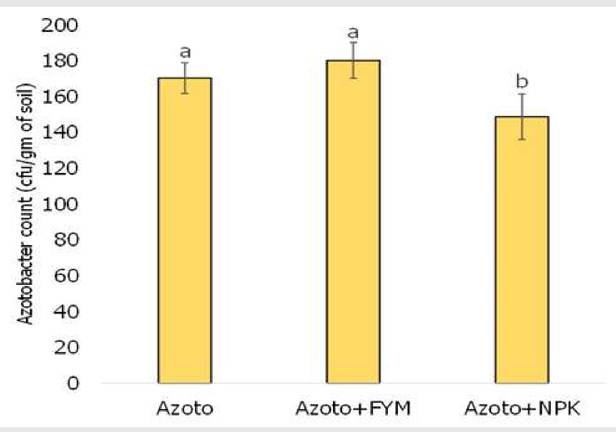
A two-factorial field experiment (RCBD) was carried out in Gaindakot, Ward No. 8, Nawalpur district. It consisted of 15 treatments (3 maize varieties and 5 different nutrient sources) with 3 replications. We studied the effect on soil fertility parameters, residual count, growth, and yield attributes.

Key findings





Average grain yield of maize as influenced by different nutrient sources. Error bar indicates the standard error of the mean. The lowercase letter above standard error bar indicates that mean values are not significantly different at 0.05% significance.



Residue of *Azotobacter* singly and in separate combination with FYM and NPK. Error bar indicates the standard error of mean. Same lowercase letters above the standard error bar indicate that mean values are not significantly different at 0.05% significance level (n=3).

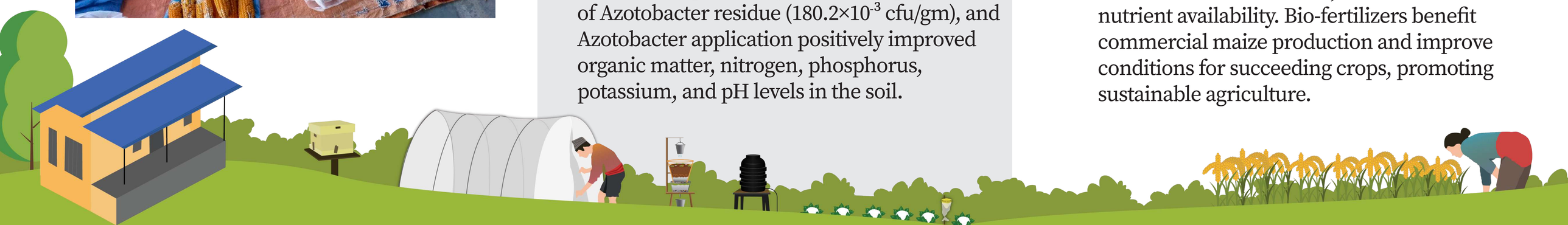
The results showed that Rampur Hybrid-14 performed best with treatment of Azotobacter + FYM, yielding 0.841 kg per square meter. Also, FYM significantly influenced population of Azotobacter residue (180.2×10^{-3} cfu/gm), and Azotobacter application positively improved organic matter, nitrogen, phosphorus, potassium, and pH levels in the soil.

Irrigation in peak vegetative stage

Colony formation

Conclusion

The study suggests, the use of Azotobacter with FYM in Rampur Hybrid-14 could result in higher yield, reduce excessive use of chemical fertilizers, and enhance nutrient availability. Bio-fertilizers benefit commercial maize production and improve conditions for succeeding crops, promoting sustainable agriculture.



Impact of river sediment yield on sustainable agriculture in Rajapur Municipality, Bardiya

GRAPE
Green Resilient Agricultural Productive Ecosystems

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Introduction

Rajapur Municipality in Bardiya District, Lumbini Province, Nepal, relies heavily on agriculture, benefiting from its fertile land and abundant water resources. However, river sediment yield presents a significant challenge to sustainable agricultural development, affecting the livelihood of the predominantly farming population.

Research questions

- How does river sediment yield impact the sustainability of agricultural practices in Rajapur, Bardiya?
- How does sediment deposition affect soil quality, water retention, and crop productivity?
- What are the socio-economic impacts of sediment yield on local farming communities?

Methodology

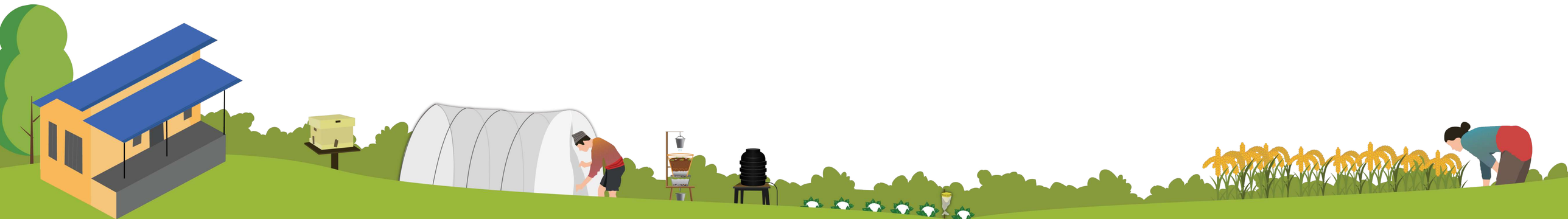
The methodology involves simulating sediment transport and deposition using HEC-RAS 6.4.1 based on DEM and cross-sectional data from the Karnali River in Rajapur Municipality. Hydro-meteorological data were used as inputs. Calibration and validation were done using statistical indicators (R^2, NSE, RMSE). Key informant interviews and household questionnaire surveys, along with field verification, were conducted for further validation.

Key findings

Sediment yield in Rajapur enriched soil but caused flooding and erosion, affecting soil quality, water retention, and crop productivity. The HEC-RAS 6.4.1 model identified significant sediment transport in Cross-Section 14000–753. Farmers adopted adaptive practices like crop diversification and sediment management, which improved soil fertility, productivity, and rural development.

Conclusion

The study shows that sediment yield from the Karnali River significantly impacts agricultural productivity and soil fertility in Rajapur Municipality. While some benefit from enhanced soil fertility, others face land and crop losses. Sediment transport patterns, driven by land use, affect erosion, deposition, and rural development.



Participatory varietal trial of potato cultivars against late blight in Bajura, Nepal

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Introduction

Late blight, caused by *Phytophthora infestans*, is a major threat to potato production in Nepal, especially in high-altitude regions like Bajura, where it can cause over 75% yield losses. Farmers in these areas largely depend on local cultivars that are vulnerable to recurring outbreaks. This study aims to assess the resistance of local potato varieties to late blight through a participatory varietal trial in Himali RM-7, Badhu, Nepal. By identifying resistant varieties, the research seeks to enhance potato productivity and support sustainable agriculture in the region.

Research questions

- Which cultivar has potential and is well suited to Himali RM Bajura with high yield and disease resistance traits?
- How can the identified varieties be a potential management strategy for late blight?

Methodology

The research was conducted in farmers' fields using a Randomized Complete Block Design (RCBD). The trial included five potato varieties: Cardinal, Axona, Desiree, Kuru Local, and Migu Local, with three replications.

- Date of 50% emergence & Plant growth (vigour – visual observation) – High, Medium and Low
- Plant height and no. of stems at 45, 60, and 75 DAS
- Disease severity (% disease infection and disease scoring: 1-10 scale)
- Days to maturity (days) and tuber yield per plot (kg/plot)

Key findings

- Axona showed statistically significant higher yield (19.82 MT/ha) and number of tubers (9.933) as compared to other cultivars.
- Axona and Migu Local showed significantly lowest percentage of disease incidence and disease severity than other varieties
- However, Axona, Cardinal and Desiree showed statistically similar yield.
- Accessing AUDPC resulted in Axona, Desiree and Migu Local as resistant cultivars.

Figure 1 Mean comparison of agronomic and disease incidence traits of potato cultivars

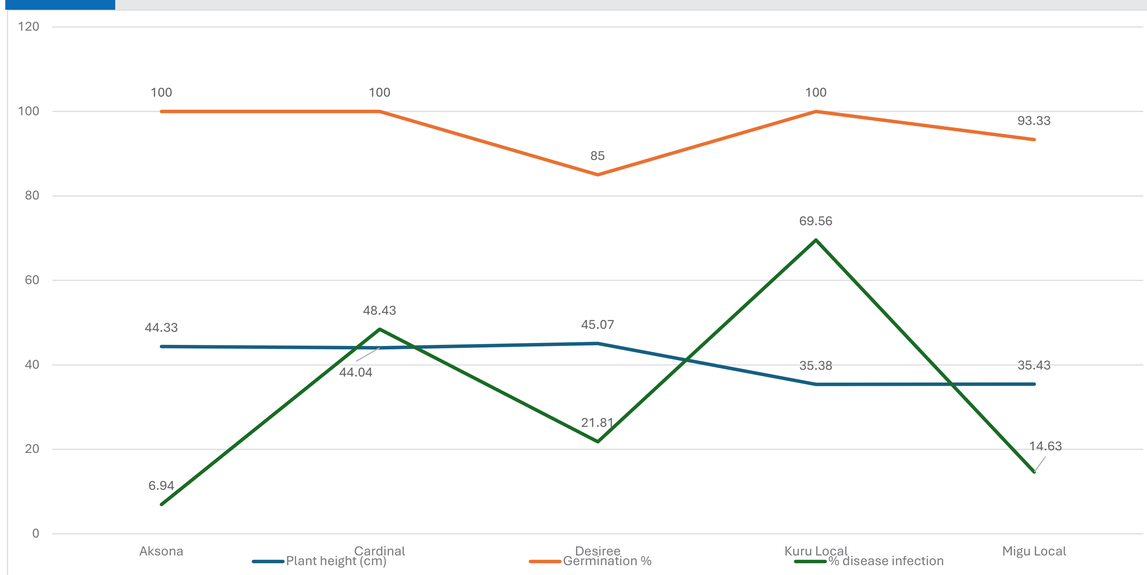

Figure 2 Mean Comparison of Area Under Disease Progression Curve and yield of of tested varieties

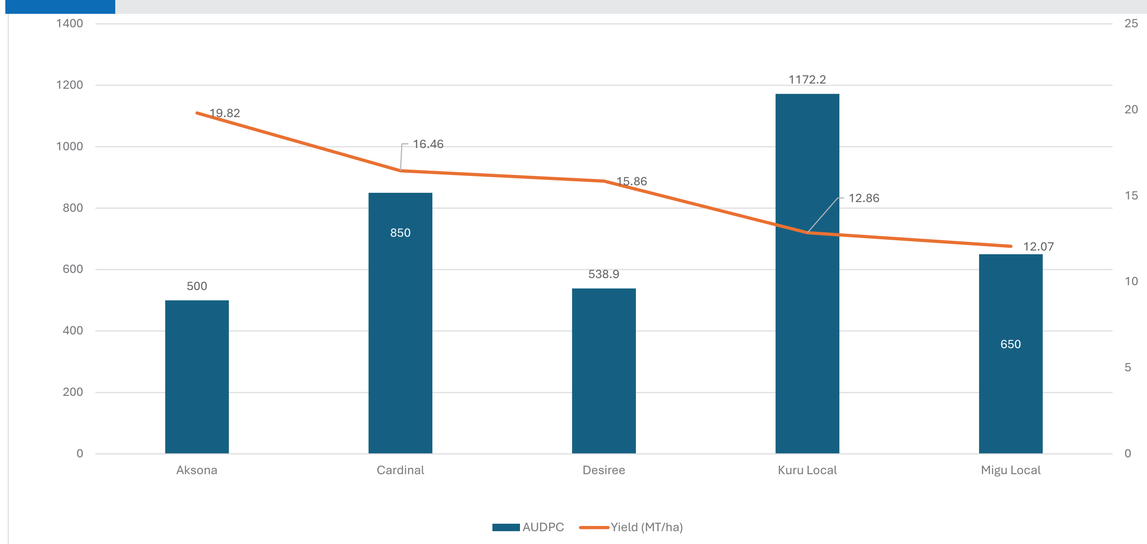

Table 1 Correlation analysis of agronomic traits and yield traits

	Yield	Days to 1st sprouting	Days to 50% sprouting	No. of stems per plant	Plant height
Yield	1				
Days to 1st sprouting	.768**	1			
Days to 50% sprouting	0.505	.765**	1		
No. of stems per plant	.590*	.873**	.670**	1	
Plant height	.562*	.696**	.785**	.617*	1

Table 2 Correlation analysis of disease resistant traits with yield traits

	% disease incidence	Disease severity	AUDPC	Yield
% disease incidence	1			
Disease severity	0.8**	1		
AUDPC	0.904**	0.898**	1	
Yield	-0.132	-0.136	-0.229	1

Conclusion

- Potato yield showed significant positive correlation with days to first sprouting, no. of stems per plant, and plant height.
- Multiple regression analysis showed that about 44% of the yield is governed by plant height, number of stems/ plants, % disease incidence, and disease severity.
- The Axona variety of potato exhibited the highest yield and lowest Percent Disease Incidence (PDI).
- Though *Migu* local had low yield performance, it showed lower disease incidence compared to other cultivars.
- This study suggested Axona as the best performing variety in the Himali RM and suggests *Migu* Local for further research on varietal improvement

Comparative effectiveness of biological treatments for management of damping off in cauliflower at Godawari, Fakalpur

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Introduction

Damping off is a major threat to cauliflower, causing up to 90% seedling mortality in just 48 hours under high temperature and moisture (Mukhopadhyay, 1987). Excessive use of chemical fungicides worsens the issue by harming plants, soil, and human health, while also leading to pesticide resistance (Mandal et al., 2020). Biological treatments, utilizing beneficial microorganisms, offer a sustainable alternative (Sharma et al., 2005). This study evaluates and compares different biological treatments and application methods, such as seed treatment and soil drenching, for effective damping off management in cauliflower.

Research questions

- Which organism and method of application is effective in management of damping off?
- How does the identified method prove sustainable in disease management?

Methodology

Treatments: 7 Replication: 4
Experimental design: RCBD

T1: *Trichoderma viridae* (Seed treatment)

T2: *Trichoderma harzanium* (Seed treatment)

T3: *Pseudomonas fluorescence* (Seed treatment)

T4: *Trichoderma viridae* (Soil drenching)

T5: *Trichoderma harzanium* (Soil drenching)

T6: *Pseudomonas fluorescence* (Soil drenching)

T7: Control

Parameters observed

1. Identification of pathogen (From laboratory test)

2. Germination % (at 25 DAS) G% = (No. of plants germinated)/(Total no. of plants used)*100

3. Disease severity (%) or percent disease intensity = sum of all rating/ total no. of rating x maximum disease grade *100

4. Total yield per plot (kg/plot) and yield (Mt/ha)

Key findings

- Germination rate of cauliflower seedling was significantly higher in all plots treated with *Trichoderma spp*. and *Pseudomonas fluorescens* as compared to control plots (Figure 5)
- Disease severity (%) and disease incidence (%) were significantly lower in all plots treated with *Trichoderma spp*. and *Pseudomonas fluorescens* compared to control plots
- Yield of cauliflower was significantly higher in all the plots treated with *Trichoderma spp*. and *Pseudomonas fluorescens* as compared to control plots.

Figure 1: Pre-emergence damping off spotted in cauliflower seedling and seed

Figure 2: Post emergence damping off spotted in cauliflower seedling and seed

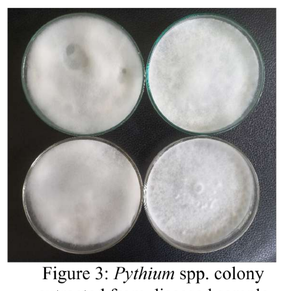


Figure 3: *Pythium* spp. colony extracted from diseased sample

Figure 4: Double walled spores and hyphae of *Pythium* spp.

Figure 5: *Rhizoctonia* spp. colony extracted from diseased sample

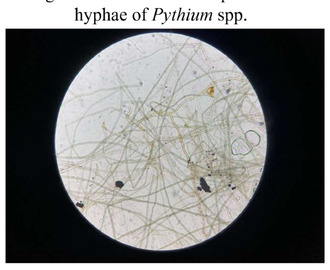


Figure 6: Hyphae of *Rhizoctonia* spp. under microscope

Figure 7 Mean Comparison of Area Under Disease Progression Curve and yield of of tested varieties

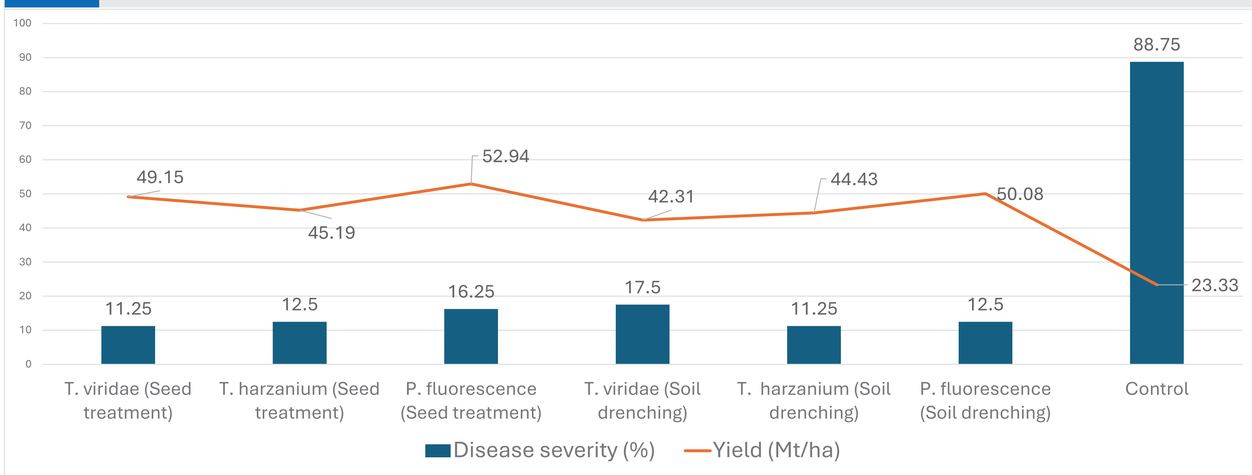
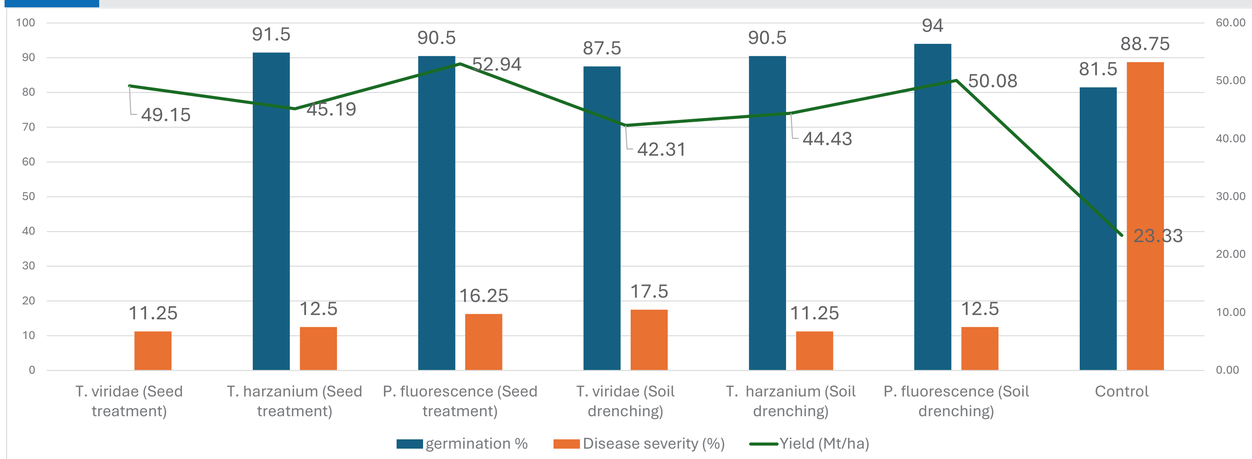


Figure 8 Mean comparison between germination%, disease severity (%) and Yield (MT/ha) for different treatments



Conclusion

Integrating beneficial microorganisms as part of a disease management strategy can help reduce the incidence and severity of damping off disease, leading to higher seedling survival rates and improved crop yield. Further research, such as seed coating, soil drenching, and foliar spraying, as well as assessing the optimal timing of application during seedling production and transplanting stages, can help maximize the beneficial effects of these microorganisms on plant growth and disease suppression.

Millet diversity and resilience in Nepal: An on-farm assessment

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Introduction

In response to declining millet cultivation in Nepal, an on-farm experiment in Bajura district assessed five millet types namely: finger millet, sorghum, foxtail millet, barnyard millet, and porso-millet and 14 landraces collected from the local farmers, diversity fairs, seed exchange, and the National Agriculture Genetic Resource Centre (Gene Bank), focusing on adaptability and yield under real-world conditions.

Research questions

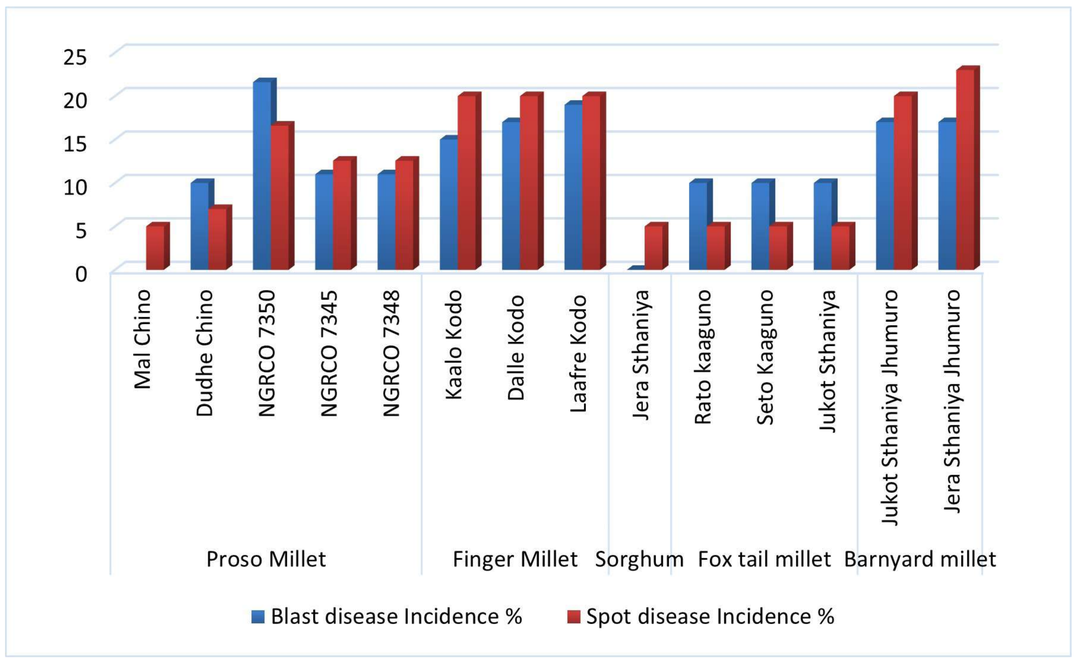
- How do different millet types and landraces perform in terms of yield and disease resistance?
- Which millet types and landraces are most suitable for cultivation in Nepal's challenging environments?

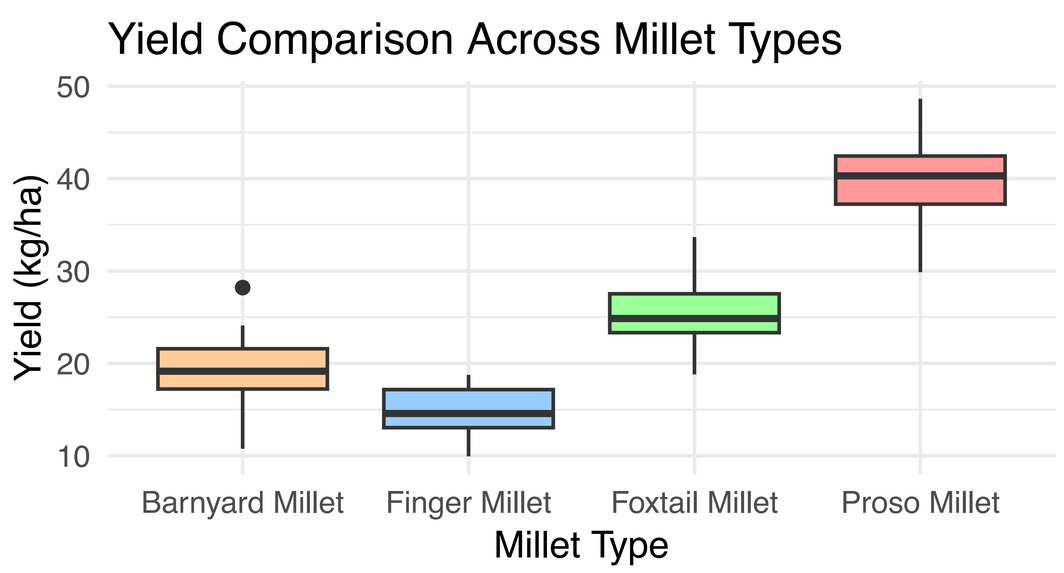
Methodology

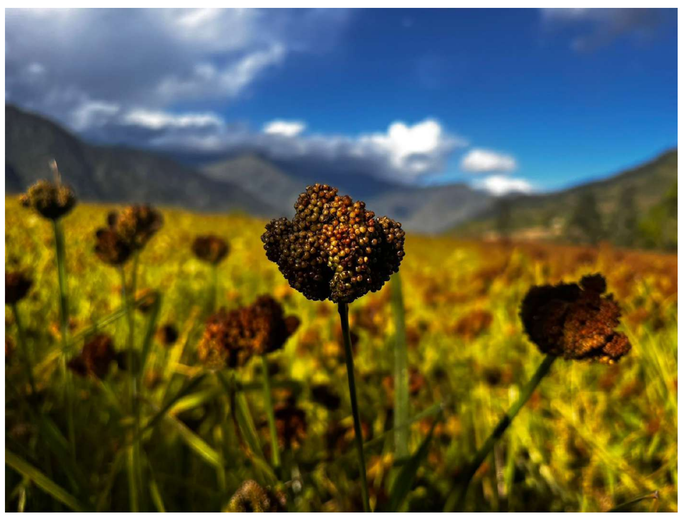
Conducted in Bajura, Nepal, this study employed an on-farm experimental approach using a Randomized Completely Block Design to assess agro-morphological parameters across 5 millet types and 14 landraces.

Key findings

- Proso-millet, particularly the Mal Chino landrace, showed high yield (1.7 tons/ha) and moderate disease resistance.
- Sorghum's Jera Sthaniya demonstrated strong disease resistance with no blast disease and moderate yield.
- Indigenous landraces outperformed other introduced millets varieties in both yield and disease resistance.

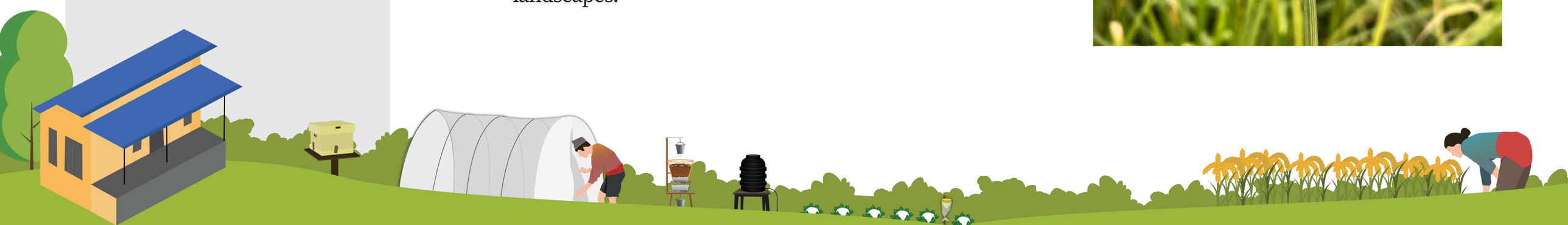






Conclusion

The on-farm experiment highlights the potential of certain millet types and landraces, especially local varieties, to enhance agricultural resilience and productivity in Nepal's diverse and challenging landscapes.



Effect of organic manure and panchagavya on potato quality and yield

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Introduction

Potato has a significant place as a cash crop in Nepalese farms, and in the kitchen as vegetable crop. Poor nutrient management is one of the key problems for low potato yields.

Research questions

- Which organic manure is effective in increasing both the quality and yield of potato tubers?
- What is the effect of *panchagavya* on quality and yield of potatoes?

Methodology

A field experiment was conducted using RCBD at Boldik, Bajura to identify the effect of locally available organic manure viz. farmyard manure, poultry manure, goat manure and panchagavya, a plant tonic, on the growth and yield of potato (var. Desiree) with four replications.

Key findings

Poultry manure outperformed all the applications in generating plant height, leaf count, total tuber yield and marketable tuber yield, followed by goat manure and farmyard manure. The percentage of marketable tuber numbers were significantly higher for poultry manure, goat manure and panchagavya than for farmyard manure, revealing potential of panchagavya as a biotonic.

Conclusion

Respondents trained by the GRAPE project exhibited higher levels of awareness and use of organic inputs compared to non-GRAPE sites. Local stakeholders could consider the project approach of knowledge dissemination to promote organic agriculture. However, unavailability of commercial organic inputs in the study area limits organic production.

Agriculture vulnerability assessment in selected municipalities of Karnali Province

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Introduction

Karnali Province is a region known for its challenging geography, agricultural systems, and climatic conditions that led the question of food security every year. Geospatial techniques, including remote sensing and geographic information system ease the decision-making process. The study areas comprises 34 wards from three Palikas with different geographical settings – Simikot in Humla, Dullu in Dailekh and Bheriganga in Surkhet.

Research questions

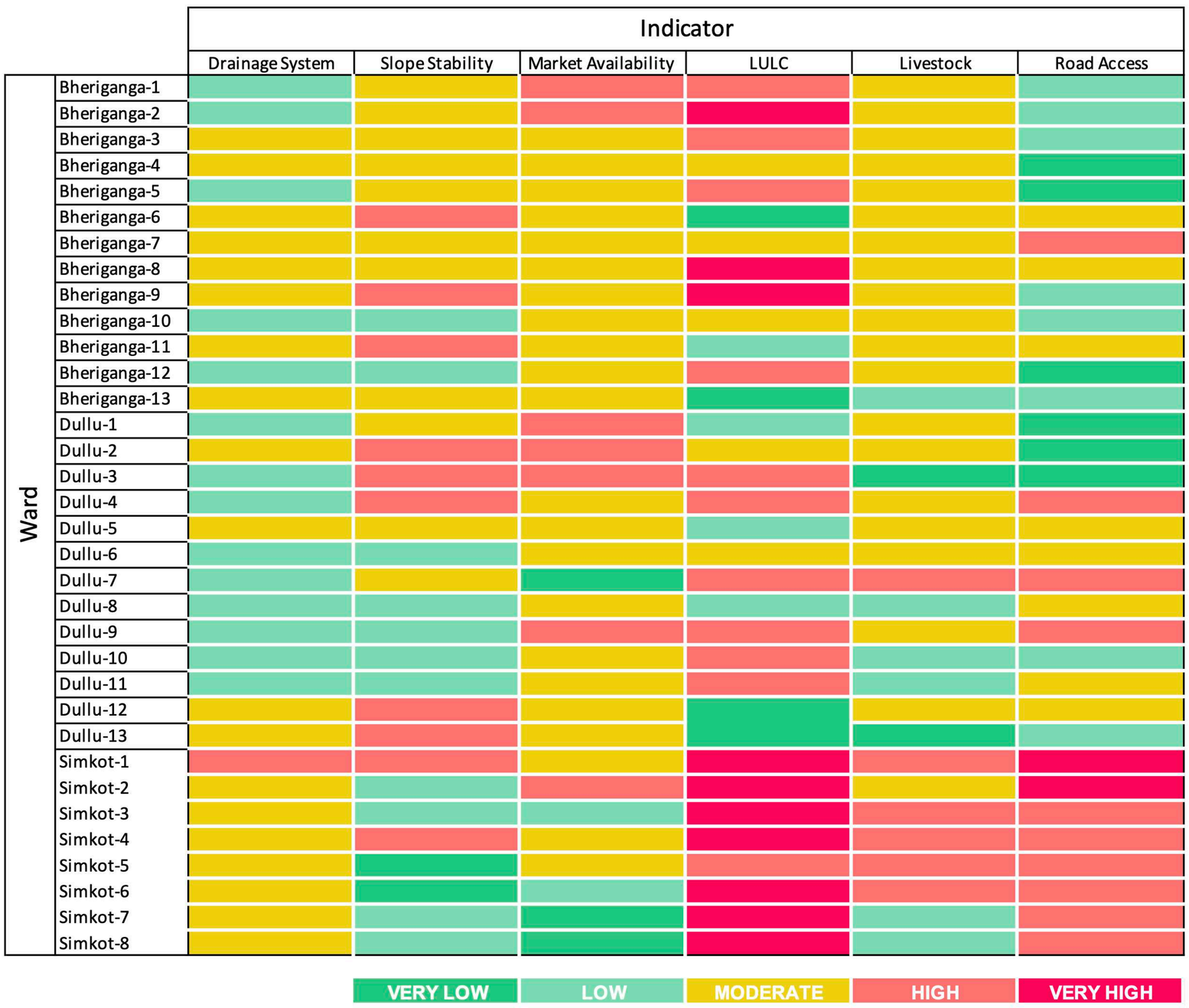
- To analyze agricultural vulnerability in the municipal wards and to prioritize them for agricultural planning using composite vulnerability index (VI).

Methodology

The checklist of vulnerability assessment indicators were prepared and surveyed among Palikas and Agricultural co-operatives. Secondary information about disasters were compiled and the vulnerability indicators were assessed using the categories- low, medium, high. Each factor was assigned a score from 1 to 5 based on its contribution to overall vulnerability. The Vulnerability Index (VI) was normalized between 0 and 1, and the total vulnerability score was calculated.

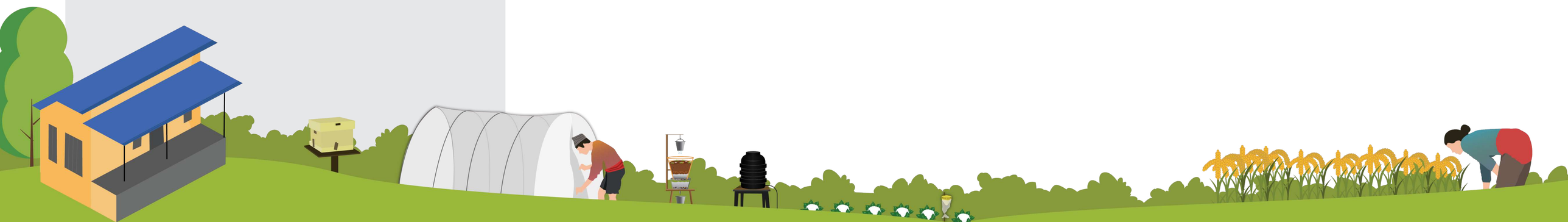
Key findings

The analysis reveals that agricultural vulnerability is significantly influenced by the factors-land use & land cover, drainage systems, slope stability, market access, livestock, and road accessibility. The VI value for Simikot-1 was found to be above 0.8, indicating it is extremely vulnerable among the 34 wards across the three municipalities. Wards 1, 8, and 13 in Dullu, Wards 4, 7, and 8 in Simikot, and Ward 13 in Bheriganga were identified with high VI scores, while Dullu-4 and Bheriganga-7 had the lowest VI scores.



Conclusion

The overall vulnerability index reflects the higher access or better conditions leading to lower vulnerability, and poorer access or unfavorable conditions resulting in higher vulnerability. The results support decision-making and prioritization of agricultural interventions, highlighting the importance of geospatial data for effective agricultural planning and management. Limited access to modern farming technologies, insufficient infrastructure, and pervasive poverty contribute to the overall fragility of agricultural systems.



Comparative assessment about knowledge of non-traditional organic inputs among female farmers in GRAPE implemented and non-implemented sites in Birendranagar

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Introduction

Organic inputs refer to organic fertilizers and organic pesticides produced without the use of any synthetic chemicals. Traditional organic inputs pertain to those produced from farm residues like farmyard manure, chicken manure, and compost containing appropriate levels of different nutrients. Non-traditional organic fertilizers refer to fertilizers produced in an improved manner to conserve nutrients and/or beneficial microorganisms.

Research questions

- How does training impact female farmers in adoption of organic inputs?
- How does frequent contact with agrovets by farmers contribute to their knowledge and use of organic inputs?

Methodology

The survey was carried out in Birendranagar Municipality of Surkhet district in Karnali province. A two stage sampling technique was used to collect information from respondents. In the first stage, purposive sampling was used to choose GRAPE FA2 implemented and non-implemented sites. This research considered GRAPE FA 2 implemented sites as treatment and the others as control sites. Two sets of semi-structured questionnaires were prepared to collect data from both farmers and agrovets.

Key findings

Total land size and education significantly impacted the adoption of organic inputs. Key Informant Interviews (KII) was performed with six agrovets; three in the study area and three in city area. KIIs revealed that almost 100% agrovets surveyed had negligible sale of commercial organic inputs in the study area but had larger sale from city area.

Figure 1 Awareness and use of non-traditional organic fertilizers

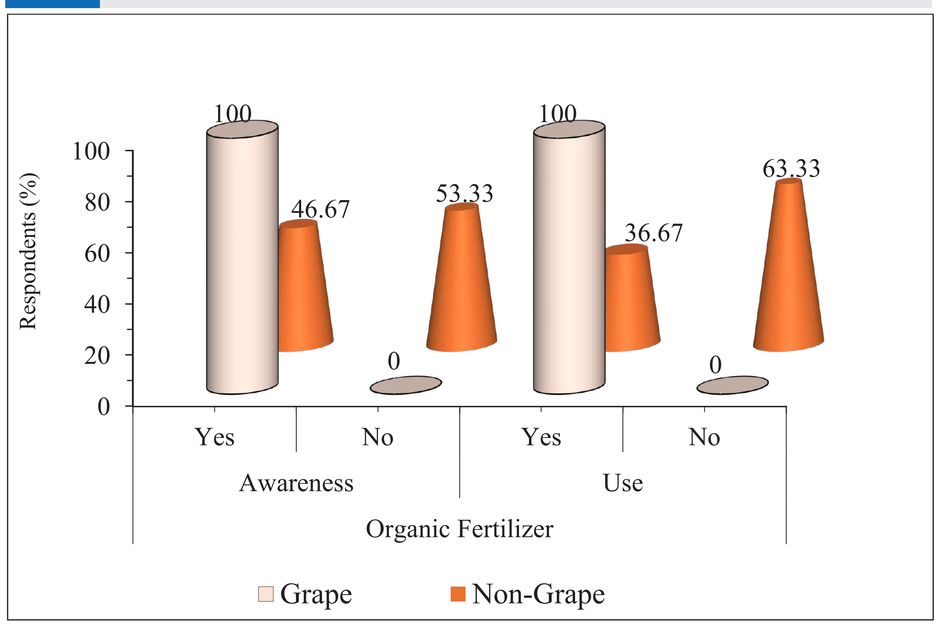


Figure 2 Predominantly used organic fertilizer in treatment and control sites

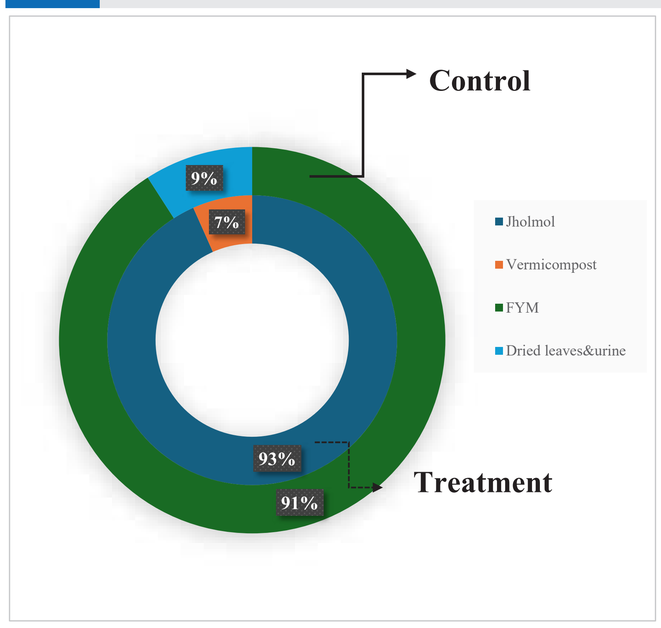
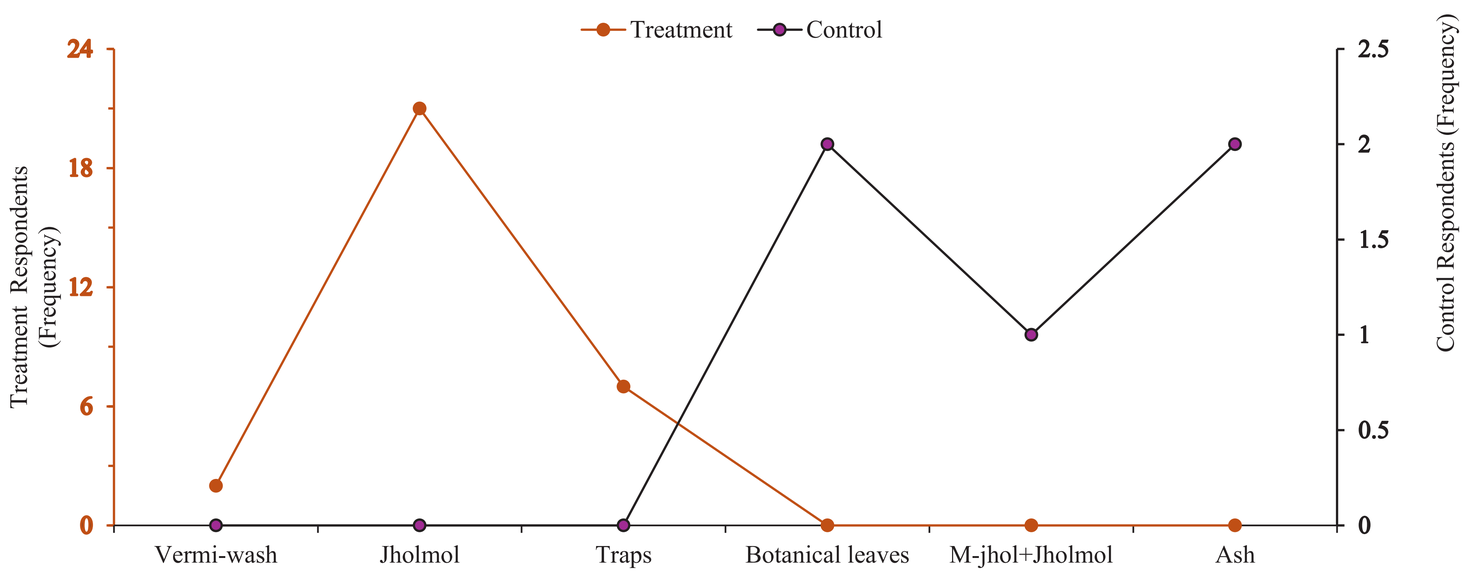


Figure 3 Mostly used organic pesticides in treatment and control sites



Conclusion

Respondents trained by the GRAPE project exhibited higher levels of awareness and use of organic inputs compared to non-GRAPE sites. Local stakeholders could consider the project approach of knowledge dissemination to promote organic agriculture. However, unavailability of commercial organic inputs in the study area limits organic production.