Review Article:

A CONSCIENTIOUS REVIEW ON UNDERGRADUATE PRACTICUM ASSESSMENT RESEARCH WORKS OF GAASC, BAITADI: PRIORITIES, GAPS AND IMPLICATIONS FOR FAR WESTERN PROVINCE, NEPAL

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ABSTRACT

The Far West Province (FWP), extending from the flatlands of Terai to high hills, is rich in untapped natural resources and offers a diverse agro-ecosystem with tremendous indigenous technical knowledge (ITKs). However, a vast number of bio-diversified resources are facing underutilization, while at the same time a handful are being over-exploited. Owing to a lack of proper documentation and disseminations of knowledge bases, the prosperity of the FWP is ruining to some extent. A systematic and rigorous review work was planned, executed and accomplished to appraise the undergraduate-practicum assessment (UPA) study conducted in the multi-disciplinary subjects of agriculture at Gokuleshwor Agriculture and Animal Science College (GAASC), Baitadi during 2014/15-2021/22 under Tribhuvan University. About 114 UPA theses accomplished by 359 agriculture graduates from the GAASC libraries were systematically arranged and categorized in chronological order based on the subject disciplines and themes, and recommended for their scale-up to the prosperity of farmers of the far western region in Nepal. The weighted term frequencies (TF-IDF) of the highest occurring terms appearing in the theses topics of B. Sc. Ag. students of GAASC, Baitadi during 2015- 2022 shows that crop specific research were more common in departments of Plant Pathology, Plant Breeding and Agronomy. The tracer study amongst the 237 graduate students of GAASC for the allotment of gazette (third class) Agriculture Service reported that an increasing tendency of agriculture graduates to continue with academia in spite of other career possibilities. The research review revealed that the maximum number of research were in the major production technologies in agronomical and vegetable crops and their marketing and value-chain analysis followed by the control of insect pests and diseases both in farms and storage, suggesting to follow integrated pest management (IPM). The value-chain analysis study of the low volume high price commodity products like Jumli Marshi rice, Himali beans, temperate vegetable seeds, banana value addition and sugarcane enterprises and Yarsagumba (*Ophiocordyceps sinensis)* collection and selling are the potential avenues to boost the economic prosperity of the far western region of Nepal. Large scale adoption of new innovation like crop-weather and yield forecasting, introduction of farmers' friendly agriculture machineries and value addition and marketing of the agriculture commodities tested in the province could be promoted in collaboration with the various agriculture related national and international organizations for harnessing congenial environment to the prosperity of Far West Region of Nepal.

सारांश

सुदूरपश्चिम प्रदेश प्राकृतिक स्रोत र साधनहरूले भरिपूर्ण तर उपभोगको अवस्था न्यून रहेको भूगोल हो । दक्षिणमा तराईका समथर फाँटहरूदेखि उत्तरमा अग्ला पहाडहरूको उपस्थिति रहेको यस प्रदेशमा पर्यावरणीय विविधताका साथसाथै स्थानिय मौलिक प्राविधिक ज्ञान प्रचुर मात्रामा पाईन्छ । तथापि यति ठूलो संख्यामा रहेका कृषिजैविक-विविधताका स्रोतहरू आजकल कम प्रयोगमा आइरहेका छन्, भने उपलब्ध सीमित स्रोतहरू पनि अत्यधिक दोहनमा पर्दैछन् । यथोचित दस्तावेजिकरण र ज्ञान प्रसारणको अभावका कारण सुदूरपश्चिम प्रदेशको समृद्धि कमजोर बन्दै गएको नकार्न सकिन्न । यस अवस्थाको मूल्याङ्कनका लागि गोकुलेश्वर कृषि तथा पशु विज्ञान कलेज, बैतडीमा सन् २०१४/१५ देखि २०२१/२२ सम्म त्रिभुवन विश्वविद्यालयको सहकार्यमा सञ्चालन गरिएका बहु-विषयगत कृषि क्षेत्रका स्नातक-अभ्यास मूल्याङ्कन अध्ययनहरूको व्यवस्थित समीक्षात्मक अध्ययन योजना तयार गरी कार्यान्वयन गरिएको थियो । कलेजको पुस्तकालयमा रहेका करिब ३५९ जना कृषि स्नातकद्वारा सम्पन्न ११४ वटा अनुशन्धानका शोध पुस्तकहरू विषयवस्तुका आधारमा वर्गीकृत गरिएको थियो । तिनै शोध प्रतिबेदनहरूको बृहत अध्यानबाट प्राप्त नतिजाहरूको आधारमा सुदूरपश्चिम प्रदेशको कृषि समृद्धिका लागि प्रयोगयोग्य विधि तथा प्रविधिहरू यस अध्यायनबाट यकिन गरिएको छ । अनुसन्धान समीक्षाबाट धेरै संख्यामा तत्कालीन अनुसन्धानहरू अन्नबाली तथा तरकारी बाली उत्पादन प्रविधि, तिनको बजार व्यवस्थापन र मूल्य शृङ्खला विश्लेषणमा केन्द्रित रहेको पाइएको थियो । त्यसपछि खेती तथा भण्डारण दुवै अवस्थामा कीराहरू र रोगहरूको नियन्त्रण सम्बन्धी अध्ययनहरू रहेका थिए, जसले एकीकृत कीरा व्यवस्थापन प्रणाली अपनाउन सुझाव दिएको पाईन्छ । जुम्ली मार्सी धान, समशीतोष्ण तरकारीका बीउ र यार्सागुम्बा जस्ता कम परिमाण – उच्च मूल्यका उपजहरूको मूल्य शृङ्खला उल्लेखित बाली वस्तुको उत्पादन व्यापककिकरणले सुदूरपश्चिम प्रदेशको कृषि अर्थतन्त्रमा टेवा पुग्ने देखाएका छन् । बाली-मौसम र उत्पादन पूर्वानुमान प्रविधि, किसानमैत्री कृषि मेशिनरीको उपयोग, तथा कृषि वस्तुहरूको मूल्य अभिवृद्धि र बजार विस्तार लगायतका पक्षमा अझ फराकिलो स्तरको प्रयोगलाई प्रोत्साहन गर्न सकिन्छ । यस्ता पहलहरूलाई राष्ट्रिय तथा अन्तर्राष्ट्रिय कृषि-सम्बन्धी संस्थाहरूसँगको सहकार्यमा अगाडि बढाइने हो भने सुदूरपश्चिम प्रदेशको समृद्धिको लागि अनुकूल वातावरण सिर्जना गर्न सकिने निष्कर्ष निकालिएको छ ।

Keywords: Adoption, GAASC, innovative agriculture technologies, marginal farmers, prosperity of FWP

INTRODUCTION

Natural resources; forests, agricultural vegetation and components and wildlife are intricately linked to the livelihoods of people of Far Western Province (FWP) and the whole far western region with the predominance of agro-horti-silvi-pasture system. Hilly districts of FWP are full of natural resource bases and have huge diversity of plants and medicinal herbs; nearly 434 species of plants including MAPs have been reported only in Bajhang, FWP (Pyakurel et al., 2019). Nepal claims 9th position among the Asian countries for the richness in floral resource base. This is estimated at 9,000 species of flowering plants (Paudel et al., 2011). Rich habitat of plant and animal bio-diversity co-exist in a particularly small portion of the country as almost 20% of traded volume of MAPs of Nepal are harvested only from Far-Western Province followed by Karnali Province in Nepal (Kunwar et al., 2013). Increasing trend in out-migration of people of mid-hills is unprecedented in Nepal and several developing countries (Skeldon, 2011). This urges for new and innovative outreach activities for securing better livelihood and food and nutrient security which demands collaborative research and development works. Therefore, it is imminent to prioritize the education, research and development endeavors for the holistic development of the agriculture and forestry sector of the region.

Gokuleshwor Agriculture and Animal Science College (GAASC), Baitadi, a community run college under Tribhuvan University is offering an undergraduate degree program in Agriculture Science for the first time in 2011/12 and continuously running for the decades and the

undergraduate practicum assessment (UPA) study done by the students from 2014/15 onwards are expected to be the huge chunk of research and academic works for the region. The current paper serves a broader purpose of identifying the prioritized agriculture research in the GAASC and highlighting their major findings with future directions for the prosperity of the farmers in the far western region of Nepal.

RESEARCH METHODS

This review employed a mixed-methods approach to systematically identify, categorize, and analyze undergraduate agricultural research conducted at GAASC, Baitadi, between the academic years 2014/15 and 2021/22. The methodology comprised three core components: (i) a systematic documentation and thematic analysis of undergraduate practicum assessment (UPA) theses; (ii) a quantitative text analysis of thesis topics to identify research priorities; and (iii) a tracer study of graduate career paths supplemented by an analysis of relevant public sector employment advertisements.

A comprehensive record of all B.Sc. (Agriculture) students who graduated from GAASC within the specified period of 2014/15 to 2021/22 was first compiled from institutional archives. The full text of each student's UPA thesis was retrieved from the GAASC library. The inclusion criteria while arranging the findings were: (i) theses submitted as a partial requirement for the B.Sc. (Agriculture) degree from GAASC and (ii) theses completed and archived within the period of 2014/15 to 2021/22. Exclusion criteria were: (i) incomplete, missing, or unavailable theses; and (ii) research projects not formally submitted as a UPA thesis (e.g., short-term reports). A total of 114 theses, produced by 359 graduates, were identified and included for full review.

A standardized data extraction form was developed in a spreadsheet to systematically catalog key information from each thesis. The form included fields for: (1) Bibliographic data (author(s), graduation year); (2) Department/Subject discipline (e.g., Agronomy, Horticulture, Agricultural Economics); (3) Primary and secondary research themes (e.g., varietal trial, value-chain analysis, integrated pest management); (4) Crops/ commodities studied; (5) Research methods (e.g., field experiment, survey, case study); (6) Key findings; and (7) Explicit recommendations. The researchers independently reviewed and coded a random subset of 20 theses to calibrate the extraction process and ensure consistency in theme identification. Discrepancies were resolved through discussion. Following calibration, the remaining theses were coded by one researcher and spot-checked by another.

To objectively identify prevailing research priorities from the corpus of thesis titles and abstracts, we performed an exploratory text mining analysis using the Tidy text package in R (Baeza-Yates & Ribeiro-Neto, 2011). The procedure followed are: i) Text preprocessing wherein all thesis titles were compiled into a single corpus. Text was converted to lowercase, and punctuation and numbers were removed, ii) Tokenization and Stop-Word Removal, in which the text was tokenized into individual terms (unigrams). A custom stop-word list was applied, combining standard English stop-words from the Tidy-Text library to filter out non-informative terms, and iii) TF-IDF Calculation, for the entire document collection (N=114 theses), the Term Frequency-Inverse Document Frequency (TF-IDF) weight for each term 't' (w_t) was calculated. The TF-IDF weight increases with the frequency of a term in a specific document, but is offset by the frequency of the term across the entire corpus, thus highlighting terms that are distinctive to particular documents or a subset of documents. Terms with the highest TF-IDF scores across the corpus were interpreted as representing the most distinctive and salient research topics during the review period.

A tracer study was also conducted to track the career progression of GAASC graduates. From each graduating batch (2015-2022), a varying number of graduates were purposively sampled to ensure representation across years. Personal correspondence (via email and telephone) was initiated with these graduates to collect data on their current employment status (e.g., further study, government service, NGO/INGO work, private agribusiness, abroad). Response rates were recorded for each batch. Concurrently, to contextualize graduate absorption into the public sector, an analysis of government job advertisements was performed. We queried the yearly notices and reports published by the Nepal Public Service Commission (PSC) from fiscal years 2072/73 to 2078/79 (approximately 2015/16 to 2021/22). The specific data extracted were the number of gazette (third-class) and non-gazette positions advertised under the "Agriculture Service" category that were applicable to B.Sc. (Agriculture) graduates. This data was tabulated to visualize annual trends in public sector demand against the number of graduates produced.

RESULTS AND DISCUSSION

UPA Theses, No. of Graduate Students and Tracer Study

In total, 114 UPA theses from 359 B Sc Ag graduates from 2015- 2022 have been produced and registered in the library of GAASC (Table 1), highlighting the significant research over the decades.

Table 1. Two way matrices of students passed out in different batches with their multi-disciplinary UPA research subjects from GAC, IAAS/TU, Baitadi as of 2022

Year	Number of batch	Number of thesis	Number of students
2015	1st	20	21
2016	2nd	16	48
2017	3rd	14	46
2018	4th	16	50
2019	5th	9	47
2020	6th	12	49
2021	7th	16	50
2022	8th	11	48
Total	**8**	**114**	**359**

The graph (Fig. 1) clearly depicts an increasing tendency of agriculture graduates to continue with academia in spite of other career possibilities. On one hand, students perceive that a general degree (B.Sc. Ag.) is less likely to land a suitable job, while the other job market also seems to be shrinking in proportion to the number of graduates being produced each year. The latter could be confirmed by referring to the number of candidates that Public Service Commission or organized institutions recommend amongst the candidates that apply for recruitment at job (Fig. 2).

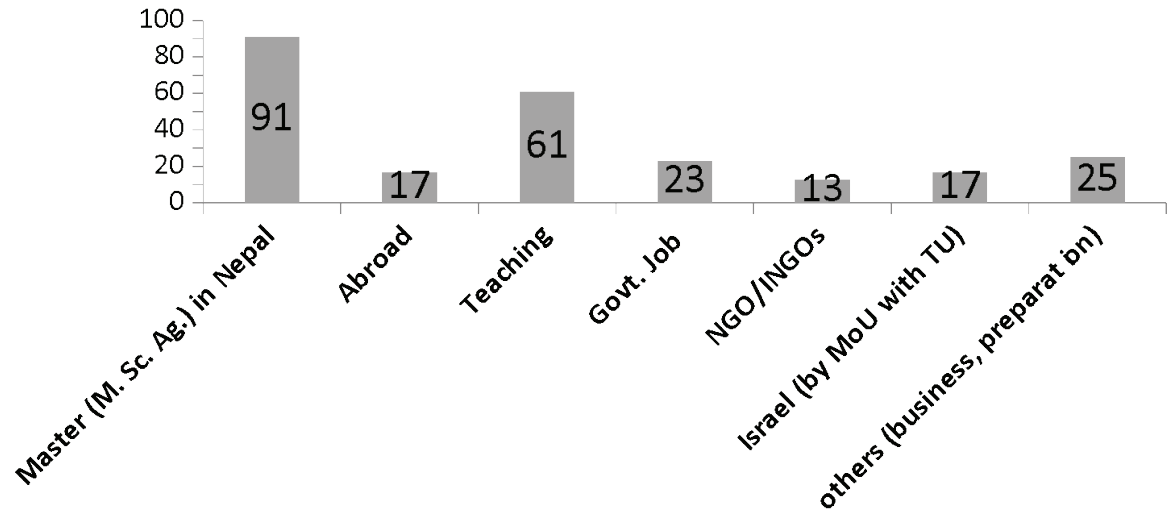

Fig. 1. Tracer study of B Sc Ag students of GAASC, Baitadi during 2015- 2021 (237 students)

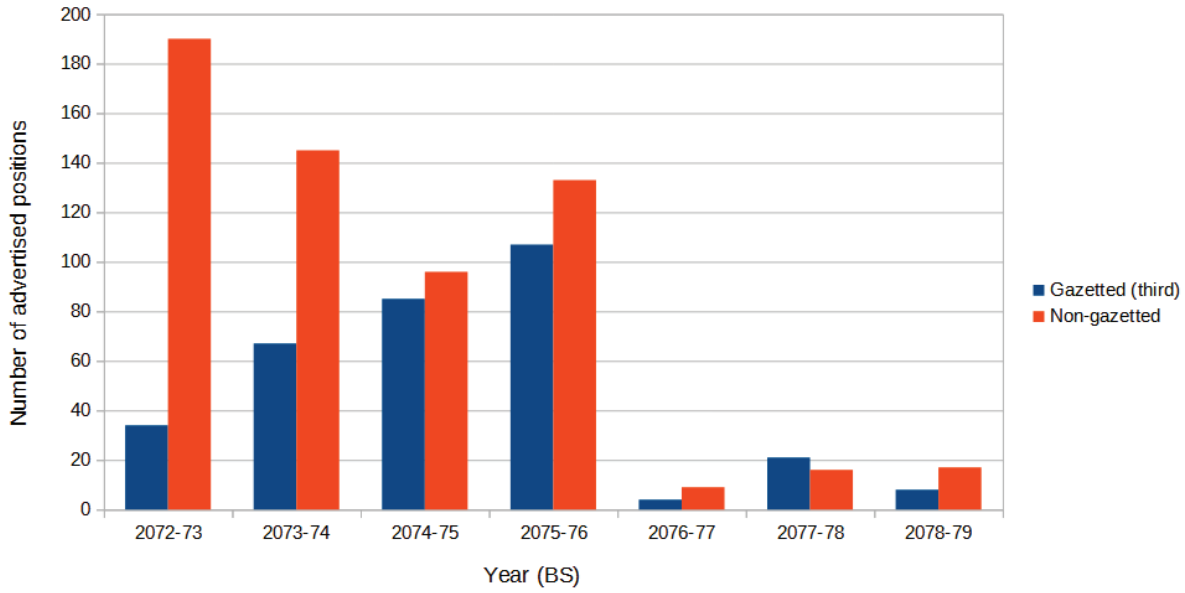

Fig. 2. Year wise allotment of gazette (third class) and non-gazette (first and second) positions for permanent recruitment by Public Service Commission between 2072/73 and 2078/79 for Agriculture service (advertisement numbers for Fiscal Year 2072/73 and 2075/76 also includes positions advertised for Veterinary sub-service)

Student's Research Choices in major Thematic Areas under various Departments

Department-wise breakdown of the thesis topics (Table 2) undertaken by the students at GAASC, Baitadi shows a fairly consistent trend in choice of some subjects more frequently than others over the 8 years' record period.

Table 2. Two way matrices of departmental subjects and UPA thesis produced by the B Sc Ag graduates of GAASC, Baitadi over the 8 years (2015-2022)

SN	Subjects	Years								Total
		2015	2016	2017	2018	2019	2020	2021	2022	
1	Agronomy	4 (5)	5 (15)	3 (13)	-	-	-	1 (2)	-	**13 (35)**
2	Horticulture	-	4 (9)	1 (2)	2 (8)	3 (15)	1 (5)	4 (14)	3(14)	**18 (67)**
3	Agricultural Economics	15 (15)	-	6 (15)	5 (15)	3 (11)	3 (12)	4 (15)	3(13)	**39 (96)**
4	Plant Pathology	-	3 (15)	2 (10)	3 (15)	-	1 (4)	3 (10)	-	**12 (54)**
5	Plant Breeding	-	2 (5)	-	-	2 (11)	3 (8)	1 (1)	2(8)	**10 (33)**
6	Entomology	1 (1)	1 (3)	2 (6)	3 (10)	3 (10)	3 (15)	2 (5)	1 (5)	**16 (55)**
7	Soil Science	-	-	-	-	-	-	1 (3)	1 (4)	**2 (7)**
8	Social science	-	1(1)	-	-	-	-	-	-	**1(1)**
9	Agri-Ecology	-	-	-	1 (2)	-	-	-	-	**1 (2)**
10	Animal Science	-	-	-	-	-	-	-	1(4)	**1(4)**
11	Aquaculture	-	-	-	-	-	1 (5)	-	-	**1 (5)**
Total		**20 (21)**	**16 (48)**	**14 (46)**	**14 (50)**	**11 (47)**	**12 (49)**	**16 (50)**	**11 (48)**	**114 (359)**

Note: Figures in parenthesis denotes the number of students involved in the particular research topics

In general, students are inclined more towards courses that have a higher total credit over the 8 semester B. Sc. Agriculture program, i.e. Agricultural Economics, Horticulture and Agronomy. The interest of individual researchers aside, one of the major determinants of the choice of subject is the availability of a mentor or faculty member that could offer guidance.

The record (Table 3) highlights a trend in research activities as well as perceived needs for experimental research in crop production, management and improvement. Studies extending well beyond the mid-hill region, that include Kailali and Kanchanpur to comprise terai region of the Far Western Province (FWP) have also been included (Bhandari et al., 2020). It has been noted here that the total number of publications is not the sum of individual thematic areas of the research. This is to account for the fact that researchers have frequently modeled more than one factor (i.e., variety and stress, variety and tillage conditions, variety and disease management, etc.) through experiments under a common research framework. For example, some varietal trials on rice and maize also aimed to distinguish between the germplasm for their tolerance to pests/diseases infestation (Sapkota & Singh, 2021; Wagle et al., 2018).

It is convenient to observe that most research recommendations on various crops published under Agronomy, Plant Breeding and Plant Protection departments have considered distinguishing between genotypes/varieties. Essentially, short term research objectives during the period were met with estimation of genotypes' effects under various settings.

Table 3. Two way matrices on no. of UPA thesis in various thematic areas under Agronomy, Plant Breeding and Plant Protection subjects at GAASC

SN		Major thematic areas of research					Total
	Crops	**Varietal trials**	**Fertilizer management**	**Irrigation management**	**Pest/Weed management**	**Tillage and other practices**	
1	Rice	7	2	1	7	1	**13***
2	Maize	6	-	1	2	2	**13***
3	Wheat	5	-	-	2	1	**4***
4	Buckwheat	-	-	-	-	-	**0**
5	Potato	1	1		2		**4**
6	Black gram, Mungbean	-	-	-	-	4	**4**
7	Sugarcane		-	-	1	-	**1**
Total							**39**

* Multiple thematic areas were covered by the thesis

Agronomic crops such as Black gram and Mung bean have been tested most predominantly for tillage and agronomic management practices (Adhikari et al., 2016; Dhakal et al., 2017; K. C. et al., 2016; Poudel et al., 2016).

Under the Plant Pathology department 12 thesis have been documented as of 2022. Most works have employed experimental design based approach to screen for or estimate genotypic response to naturally developing disease epidemic (Ephiphytosis) (Wagle et al., 2018; Bag et al. 2022; Giri et al., 2018; Neupane et al., 2017). Two of the studies were designed to determine the effects of various growth substrates on Pleurotus mushroom (Dhami et al. 2021; Thakur et al. 2016).

Likewise, studies (a total of 16) headed under department of Entomology have tested relative effectiveness of botanicals, which are plant derived formulations, against pests such as maize weevil, Aphid (in rice and rapeseed), *Sitophilus* weevil, insects of okra, potato tuber moth and cabbage butterfly. Likewise, lab based appraisal on effectiveness of chemical pesticide detection was also conducted in one of the studies (Budha et al., 2020). One study laid focus on the production status of honey in the Gokuleshwor, Baitadi region (Pandey & Singh, 2017).

Although research on some crops such as Potato and French bean were undertaken under Horticulture department, based on research objective of either varietal screening/characterization (Ghimire et al., 2021; Shrestha et al., 2022) or evaluation of effects of fertilizer input (agronomic management), the above mentioned crops have been enlisted under the heading that largely summarizes agronomic and plant breeding works (Table 3).

From Table 4, it is also evident that either or both the Apple and Mango fruits are of little significance to the mid-hill region of Far-western province; although students have explored the production economics of Apple in Jumla district (Sapkota et al., 2018). However, banana forms a major fruit for both subsistence as well as commercially oriented farm holds of mid-hills and terai agro-ecology of this region.

Table 4. Two way matrices on number of UPA theses in various thematic areas under horticulture subject at GAASC

SN	Crops	Major thematic areas of research			Total
		Varietal management	Sowing, spacing, fertilizer and in-season management	Post-harvest management	
Major Vegetables					
1	Cole crops		1	1	**2**
2	Root vegetables	1+1*	1*		**1+2***
3	Cucurbits	2	1		**3**
4	Solanaceous		2	1	**3**
	Total				
Major Fruits					
1	Citrus			2	**2**
2	Banana			2	**2**
	Total				
Flowers					
	Gladiolus, Marigold		1	1	**2**
Total					**17**

* Potato crop is repeatedly reported in here (undertaken under horticulture department), despite having already been reported in Table above.

Out of a total of 38 theses on Social sciences, published during 2015-2022, all have been assigned under the Agricultural Economics department. Studies have ranged from a wider appraisal of food and nutritional security situations (Rawal & Dhungana, 2015; Joshi & Dhungana, 2015) to those that lay conspecific focus on agricultural commodities and their economic aspect (Table 5). Two groups painstakingly undertook study on economics of households that earn their livelihoods with Yarshagumba harvest at Darchula (Kunwar et al., 2019; Malasi et al., 2022). One group undertook economic and marketing study of fish (Basyal et al., 2017). With a rationale that recent years have seen a surge in fruit and vegetable demand in terai region, a study performed in Kanchanpur district presents that household demand for costly fruits is more elastic with respect to income, in comparison to common food items. Likewise, the study reports that individuals consume more of the fruits during festive season and during illness (Bhatta et al., 2020). Production and marketing economics were focused on agronomic crops such as horse gram, maize, soybean, sugarcane and kidney bean. Few studies performed on rice marketing and value chain economics outside the FWP district also have wide implications for consumption demand creation and production planning in the Province (Sigdel et al., 2018, Singh et al., 2020).

Potato, cauliflower, cucurbit, tomato, rittha, apple and banana are the crops surveyed under horticultural economics theme (Chauhan et al., 2021; Bhatt & Dhungana, 2015; Nath & Dhungana, 2015; Jaisi et al., 2018; Poudel et al., 2017; Sapkota et al., 2018; Singh et al., 2019). Realizing the importance of crop risk management, two studies prospected the adoption and willingness of farming households to join the crop insurance programs (Bhandari et al., 2017; Thapa & Dhungana, 2017).

Unfortunately, despite the FWP having immense potential for livestock based production, research undertakings at GAASC have been fairly low. A recently built fish stocking pond with runway design, enabled a researcher group to study the growth aspects of Tilapia, a major invasive breed of fish in Nepal at various stocking densities (Chaudhary et al., 2020). Yet

another group performed socio-economic analysis of fish production in Terai (Basyal et al., 2017). Likewise, in an effort to test the effect of high roughage/fiber content in poultry diet, a studied the effects of grass meal on broiler chicken growth (Ghimire et al., 2022).

Table 5. Two way matrices on number of UPA thesis in various thematic areas under social science subjects (Agricultural Economics) at GAASC, TU

SN	Major thematic subjects of research					Total
	Subjects	Production economics and value chain	Organic production, integrated production, IPM	Climate change	Other	
1	Agronomic crops	8		4	1	**13**
2	Horticultural crops	9	1	1	1	**12**
3	Integrated cropping	2	7		4	**13**
	Total	**19**	**8**	**5**	**6**	**38**

Key Findings of UPA Researches in Agricultural Economics from GAASC during 2015/16 - 2021/22

Rice and maize are major contributors of food security in the region. Food access and storability is low during winter season, more so within the illiterate families (Rawal & Dhungana, 2015). Growers of hilly districts of FWP suffer production constraints in maize due to lack of quality seeds, high input and transport cost. B:C ratio, in average of all commercial or non-commercial growers is around 1.8 (Pandey & Dhungana, 2015). This is fairly high when we consider minimum external input use in the region.

Individuals of economically active age migrate more (57.7%) for earning opportunities. Gross production is significantly affected by land holding size and negatively affected by migration. Remittance share in household income among migrating households was 61.8 %. Irrigated land holding size, food sufficiency level, livestock holding and income from agriculture was negatively associated with out-migration (Kandel & Dhungana, 2015).

In the Baitadi district, average land size allocated to cauliflower cultivation is 3.59 ropani and average cost of production during 2015 AD was around NRs 6410 per ropani. Considering the return of NRs 11900 per ropani which amounts to a good B:C ratio of 1.87. It suggests that production of the crop could be further improved if major problems of the production viz. disease and weed are tackled properly (Bhatt & Dhungana, 2015).

Higher expenses on planting material, fertilizer inputs and membership of cooperative/groups have a positive effect on yield of bananas. The B:C ratio of banana production during the early 2-3 years is 1.83 years and increases steadily in later years (Singh et al., 2019).

FWP is endowed with a rich spectrum of climate enabled vegetation. Darchula district borders China in the North through a heavily rugged landscape which hosts alpine vegetation. The same region is also home to the medicinal fungi Yarshaagumba. It is reported that households at Khandeshwori region of Darchula are upto 68% dependent on Yarsha harvest (Kunwar et al., 2019). The harvest and sales of the fungi should be in synchrony with its natural cycle of growth. This leads to extreme limitations as to when and how extraction could be done, thus the cases of accidents leading to death are also reported in the events of Yarsha harvest.

With the average productivity of potato being 11.4 tons per ha and its B:C ratio of 2.06 in Dadeldhura, the district has a comparative advantage in potato production. Even in the state of government program such as PMAMP directly engaging in extensive production, innovation on value chain, marketing and storage as well as field based survey/surveillance of blight disease could further improve production and increase incentives for farmers (Chaudhary et al., 2017; Yadab et al., 2022).

Clustering of UPA Research works of GAASC as per the department and thematic area

The weighted term frequencies (TF-IDF) of highest occurring terms appearing in the theses topics of B. Sc. Ag. students of GAASC, Baitadi during 2015- 2022. A brief exploration of the graph (Fig. 3) shows that crop specific research were more common in departments of Plant Pathology, Plant Breeding and Agronomy.

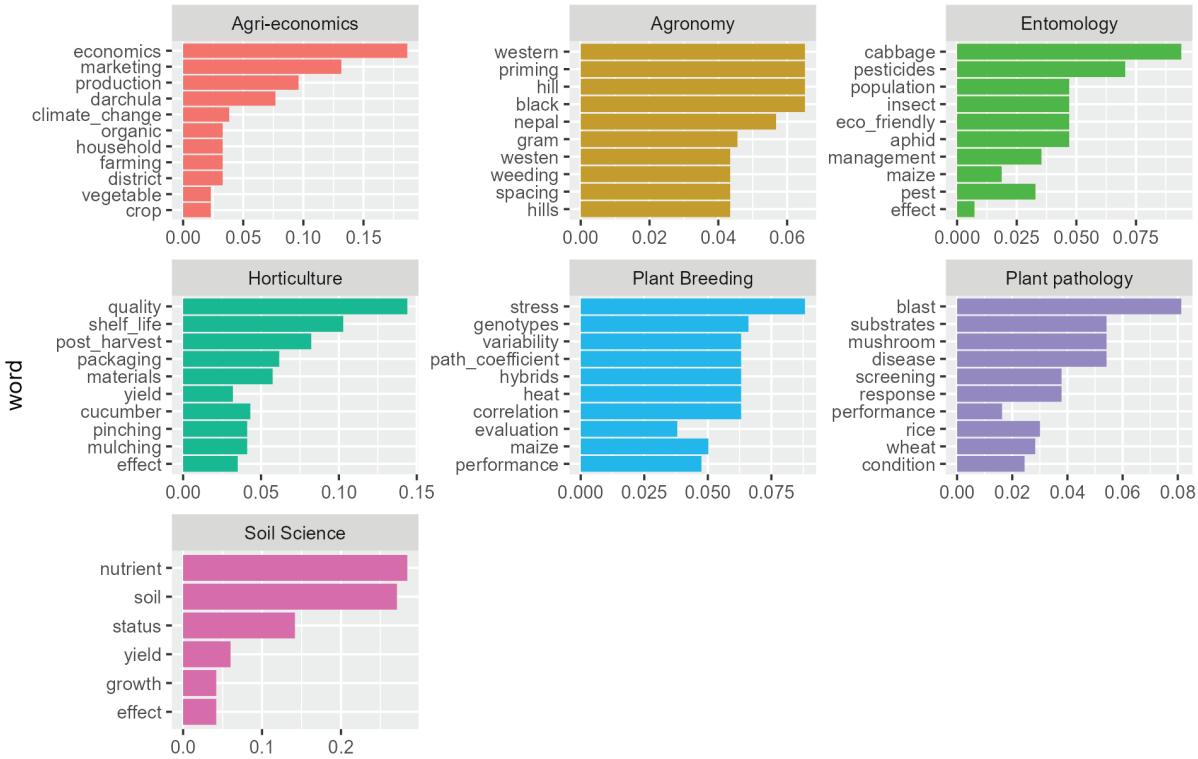

Fig 3. Weighted term frequencies (TF-IDF) of highest occurring terms appearing in the theses topics of B. Sc. Ag. students of GAASC, Baitadi during 2015- 2022

Crop Commodity wise major Research Findings Accomplished at GAASC, Baitadi

The recapitulative summary of the major research findings of various crop commodities in major themes has been presented in Table 6. Socio-economic research was more focused into production economics and marketing of high-value crops, i.e., vegetable and select organic products. Likewise, topic priorities for horticulture during the period of research were on post-harvest quality preservation and shelf-life of fruit and vegetables, mostly cucumber. Varietal trials focused on quantification of variation and estimating the coefficients having causal relationships. Research under the entomology department laid focus on vegetables, mainly cabbage and their pests. Also dosage and effects of pesticides which often included naturally available botanicals were determined for eco-friendly management of insect population.

Table 6. Major research findings of UPA Research of B Sc Ag students over the different departments at GAASC, Baitadi

Treatments opined and crops	Major research findings	References
Agronomic crops		
Sowing depth in maize	Arun-2 variety of maize has optimal early growth and establishment at sowing depth of 6 cm.	Poudel et al., 2015
Maize genotypes	Higher number of days to silking is negatively associated with the grain yield. Ear height, silk length, ear circumference and number of kernel row per ear and number of kernels per row are positively associated with yield.	Pahadi & Kohar (2016)
Seed priming with NaCl in maize	Seed priming with 5 g/l of NaCl solution improves length of shoot, and promotes germination under in-field salt stressed conditions.	Mahara et al., 2015
Nitrogen fertilization application techniques in rice	LCC based management saves 10 kg N per hectare compared to recommended dose application. Average yields of "Rato basmati" rice cultivar at recommended fertilizer management (100:30:30 kg NPK per ha) and LCC based nitrogen application are similar: 3850 kg per ha.	Yogi et al., 2016
Local rice genotypes in rice	Local germplasm of rice presents a high degree of phenotypic variation in yield, number of fertile grain per panicle and flag leaf length. Test weight and plant height at maturity have high heritability.	Bhatt et al., 2016
Improved rice genotypes	When compared to Sukkha-3 rice, local rice landraces performed better in test conditions. Local germplasm have a high heritability for yield contributing traits such as thousand kernel weight.	Dahal et al., 2020
Horticultural crops		
Fungicide or botanical derivatives in sweet orange and mandarin	Treatment of sweet orange/mandarin with Bavistin fungicide increases shelf life significantly, but for retaining the flavor and taste of fruit for short term storage of upto 28 days, treatment with cinnamon oil is suggested.	Acharya et al. (2019); Maharjan et al. (2019)
Botanicals against aphid in mustard	Use of Jholmol (250 ml per liter of water) is comparable to commercial botanical pesticide and other household measures for control of *Lipahis erysimi*.	Sharma et al. (2020)
Pinching in marigold	Both flower quality and yield of the marigold flower could be improved by the pinching operation done between 30 to 40 DAT.	Malla et al. (2020)
Mulching in cucumber	Vegetative growth is observed best when the cucumber grown plot is mulched with black polythene sheet, whereas reproductive growth and quality fruit development are better when rice straw is used as mulch.	Shah et al. (2021)
Varietal study in French bean	Highest seed yield occurs among Trishuli followed by Chaumase varieties of French bean, i.e. 2.6 ton per ha.	Ghimire et al. (2021)

Plant Protection		
Nitrogen and potassium fertilizer doses in rice	The severity of rice blast disease is higher in management which incorporated high nitrogen but less potassium fertilizer. Optimal dose of nitrogen and higher rates of fertilizer application when compared to recommended doses gives better yield.	Wagle et al. (2016)
Botanical and chemical fungicides in sugarcane	*Colletotrichum falcatum* (causative agent of red rot) is controlled as effectively with botanicals 50% *Azadirachta indica* or 50% *Datura stramonium* extract as with synthetic chemical fungicides.	Bhatt et al. (2021)

Implications of the Study

Most studies performed during the period of interest have focused on basic crop science research. Planned research on major cereals, fruits and vegetables have identified successfully some packages of practices to follow in intercultural operations and cropping system management. As most places in mid-hills of the FWP are now connected to road network (Sudurpaschim Provincial Road Network Masterplan, 2025), greater opportunity exists for marketing and export of vegetable such as cauliflower, radish and cucumber to the domestic market of Terai. In addition, with rising consumer awareness about benefits of organic products, the prospect for the region to go all-organic in high-value crops also seems to be very positive and encouraging.

Likewise, significant amounts of research have been performed to screen crop-varieties against diseases such as rice blast and wheat rust and blotch and insect-pests (weevil and aphids). Several studies have also made recommendations for the choice of rice, wheat and maize variety (or even landraces) based on their agronomic performance, despite disease, in mainly mid-hill agro-ecology. Application of plant harvests (Bojho and neem) or their derivatives (Cinamomum) are suggested for protecting grain legumes and fruits in their storage, respectively.

Another interesting aspect, reported by crop protection research, is the prevalence of disease and its expression in natural conditions at GAASC, Baitadi and its surrounding areas. This offers an opportunity for future research to exploit the natural disease-development process to undertake in-depth study on host, pathogen and environment interactions.

Administrative offices and government bodies of Darchula district need to be proactive with regard to ensuring that a quoted number of people with proper training and facility only harvest the Yarsha and should provide provision for the sustainable Yarsa harvest as opposed to over mining for short term benefit. Interventions and policies that strengthen the scientific value chain for the product need to be in place, for the region to prosper from this Himalayan gold rush.

CONCLUSION

The institute faced the problem of research grants to accomplish the research and request to the different national and international collaborative research and academic institutions and universities. Despite that, the completed works have suggested various measures for resolution of farming problems and promising innovative technologies. The majority of academic focus has traditionally been laid to assessment and validation of a “good” package of practices in agronomic and varietal research. Although studies provide only limited purview into subject-specific and interest-driven topics, the ideas thus generated are quickly conveyable and tested-ready. However, under current changing academic, developmental and research scenarios of global and national issues, the strategic research should be focused on the following major

points for the holistic development of the Far Western Province. Conformity of farming systems and supporting projects thereof to Sustainable Development Goals (SDG) in aspects of food security, zero hunger, climate change and value addition of the agricultural products as envisaged by United Nations (2015). Economic and value-chain studies identify several low-volume, high-value commodities (Jumli Marshi rice, Himali beans, temperate vegetable seeds, banana value-addition, sugarcane—and the Yarsagumba market) as promising channels for rural income growth. Income growth and economic dynamism in the region can nourish SDG goals and their indicators in the Province. A major shortcoming research studies in the region is the failure to comply national academic sector research guidelines, i.e. generated by University Grants Commission, Nepal, be as per the Research Development and Innovation Programs Implementation Guidelines, 2021 and PhD Research Policy in HEIs and Universities in Nepal as envisaged by University Grants Commission, Nepal. Further, the agriculture research should be more focused, and to the working guidelines of the provincial agricultural development strategies on the promotions of education, research and extension activities in collaborative ways. With regard to laboratory and field research operations, capacity enhancement of technical hands in research and extension is of utmost necessity, which seems also to be largely lacking. Likewise, scale-in and scale-out of agricultural technologies, their adoption and promotion has to be followed mandatory. Scale up of NTFPs, MAPs and Agro-forestry based farming system model should be launched in far western terai and hill. The climate resilient agriculture technology testing, development of CSA tools and their adaptations is the next area to get the targeted milestone of holistic development of the province. Conservation, utilization and promotion of natural resource bases is the next vital field to implement the new research in the academic and developmental research in the region.

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AUTHOR CONTRIBUTIONS

All authors contributed equally to designing of study, curating relevant documents, synthesizing the findings, reporting and writing the manuscript.

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