

Template/Pro forma for Submission

NMHS-Himalayan Institutional Project Grant

**NMHS-FINAL TECHNICAL REPORT (FTR)**

Demand-Driven Action Research and Demonstrations

<b>NMHS Grant Ref.</b>	<b>GBPNI/NMHS-2020-</b>
<b>No.:</b>	<b>21/MG</b>

<b>Date</b>	<b>of</b>	0	7	0	8	2	0	2	3
<b>Submission</b>	<b>d</b>	<b>D</b>	<b>m</b>	<b>m</b>	<b>y</b>	<b>y</b>	<b>y</b>	<b>y</b>	<b>Y</b>

**PROJECT TITLE (IN CAPITAL)**  
**EXPLORING LIVELIHOOD POTENTIAL OF WILD GROWING STINGING NETTLE**  
**(URTICADIOICA) IN UTTARAKHAND**

**Project Duration:** *from* (15.07.2020) *to* (14.07.2020)

**Submitted to:**

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**Submitted by:**

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## NMHS-Final Technical Report (FTR) template

Demand-Driven Action Research Project

DSL: Date of Sanction Letter

DPC: Date of Project Completion

1	9	0	6	2	0	2	0
d	d	m	m	y	y	y	y

1	4	0	7	2	0	2	3
d	d	m	m	y	y	y	y

### Part A: Project Summary Report

#### 1. Project Description

i.	Project Grant Ref. No.:	<b>GBPNI/NMHS-2020-21/MG</b>					
ii.	Project Category:	Small Grant	Medium Grant *	Large Grant			
iii.	Project Title:	Exploring livelihood potential of wild growing stinging nettle ( <i>Urtica dioica</i> ) in Uttarakhand					
iv.	Project Sites (IHR States/ UTs covered) <i>(Location Maps attached):</i>	Almora district of state of Uttarakhand					
v.	Scale of Project Operation:	Local	* Regional	* Pan-Himalayan			
vi.	Total Budget:	INR 0.9706000 (in Cr)					
vii.	Lead Agency:	Green Hills Trust KrantiKutir. East Pokharkhali Almora-263601 www.greenhillsalmora.org					
	Lead PI/ Proponent:	Dr Vasudha Pant Founder Trustee and Secretary Green Hills Trust, Kranti Kutir East Pokharkhali, Dr Tularam Joshi Marg, Almora- 263601, Uttarakhand					

	Co-PI/ Proponent:	Dr Sunita T Pandey  Professor, Agronomy, GBPUA&T, Pantnagar
viii.	Implementing Partners:	National Collateral Management Services Ltd Team Towers, Plot No: A-1/2/A, - Industrial Park IDA - Uppal, Hyderabad - 500 039 www.ncml.com
	Key Persons (Contact Details, Ph. No., E-mail):	Ritu Singh Head Laboratory/T&C/Gurgaon/NCML <a href="mailto:ritu.s@ncml.com">ritu.s@ncml.com</a> Mb No- 9599088616

## 2. Project Outcomes

- Thorough nutritional testing of nettle
- Ready to eat and ready to cook edible, marketable products developed
- Awareness raising and capacity building in selected villages across all the blocks of Almora district regarding nutritional potential of nettle and its edible products
- Capacity building of selected, farmers across blocks of district Almora for using vrikshayurveda based herbal kunapajala, growth stimulant our legacy of 1000 years old vrikshayurveda.
- R &D validation of the application of herbal kunapajala and its variants in various horticultural and field crops of district Almora.

### 2.1. Abstract/ Summary

**Background:** Farmers are migrating away from agriculture due to uncertainties and risks associated with agriculture. Hence, it is imperative that researchers, policy makers, and other stakeholders must get-together to address problem. This project was proposed to address the dual challenges of ensuring sustenance of agriculture and focus on nutritious wild plants such as Stinging nettle for the welfare of mankind.

**Objectives/ Aim:** utilize the stinging nettle for improving the health and livelihoods of the hilly communities with awareness raising, skill development and product development.

Awareness, Training & Demonstration programme and Standardization and validation of application nettle-based preparation of herbal Kunap jala an important decoction of Vrikshayurveda based agriculture for its used in various selected crops of district Almora.

**Methodology/Approach:** 1. Plant research- • Field trial to standardize harvesting protocol, • product development • Field trials on the use of nettle based Vrikshayurveda concoctions on the various selected crops of district Almora

2. Extension work- Raising awareness regarding nutritional potential and livelihood generation potential of nettle” required thorough extension work to create awareness, transfer of technology developed and dissemination of information

**Results/ Outcomes:**

- Ready to eat and ready to cook edible, marketable products developed and working on market linkages
- Awareness raising and capacity building in selected villages across all the blocks of Almora district regarding nutritional potential of nettle and its edible products and also on vrikshayurveda based herbal kunapajala, growth stimulant
- R &D validation of the application of herbal kunapajala and its variants in various horticultural and field crops of district Almora.

**Conclusions:** nettle is a nutritious plant, suitable for the development of naturally fortified nutrition rich food products. On test basis it can be said that novel products are being relished by health conscious people primarily.

Not only for human nutrition, application of nettle based Vrikshayurveda concoctions for plant nutrition and plant protection enhanced the yield and quality of different horticultural and field crops.

**Strategy Recommendations/ Way Forward with Exit:** The nutritious nettle products have marketable potential. Some of these are novel products and will be launched first time in the

## 2.2. Objective-wise Major Achievements

S#	Objectives	Major achievements ( <i>in bullets points</i> )
1	Standardization of harvesting protocol.	<ul style="list-style-type: none"> <li>• Nettle leaf samples were collected from four different experimental plots over four different months</li> <li>• Samples comprise of harvesting from three different plant parts top, bottom and middle</li> <li>• <math>4 \times 4 \times 3 = 48</math> samples were tested for various nutritional components in 2 replications. Thus a total of 96 samples tested for nutritional components.</li> <li>• Significant nutritional variation does not occur when compared between different plant parts.</li> <li>• Yet it was realized the palatability varies and taste was best from the top when used either fresh leaves or dried leaves in different products.</li> <li>• Thus top soft portion of the shoots (6 inches maximum) were best for the use.</li> <li>• On the basis of taste for product development best harvest comes fresh germinating shoots or from monsoon harvest.</li> </ul>
2	Validation of traditional knowledge with regard to consumption and processes.	<ul style="list-style-type: none"> <li>• Traditional use of nettle leaves as green leafy vegetable was validated with the nutritional testing of leaves</li> <li>• Taking a clue from this the marketable edible products were developed</li> </ul>

3	Raising awareness regarding nutritional potential and livelihood generation potential of nettle.	<p>Awareness raising pertaining to food value</p> <ul style="list-style-type: none"> <li>• A total of 38 meeting were held in 38 different villages covering all the blocks of Almora district</li> <li>• More than 1413 people participated including 840 females and 573 males</li> <li>• Participation from SC/ST was nearly 20%.</li> </ul> <p>Awareness raising pertaining to Kunapjal</p> <ul style="list-style-type: none"> <li>• 16 programmes on Awareness, Training and Demonstrations on Nettle based Herbal Kunapajala (a Vrikshayurveda based preparation) has been conducted in eight blocks(Dwarahat, Lamgarah, Chokhutia, Dholadevi, Pilkholi, Hawalbagh, Takula and Baisiachana.) of District Almora, since inception of the project till date.We have done the Demonstration and imparting knowledge in villages covering eight developmental blocks of Almora district.</li> </ul>
4	Standardization and validation of nettle-based preparation of Kunapjala an important decoction of Vrikshayurveda based agriculture for its used in various selected crops of district Almora.	<ul style="list-style-type: none"> <li>• Vrikshayurveda based herbal kunap jal was standardized and validated by using in different field crops, horticultural crops in farmers field and by laboratory testing in varied combinations.</li> </ul>
5	To test the decoction for its medicinal and nutritional values.	<ul style="list-style-type: none"> <li>• Nettle based herbal kunapajala as per the principle of vrikshayurveda has been develop and tested for plant growth promoter and for plant protection in different crops</li> </ul>

Note: Further details may be summarized in DPR Part-B, Section-5. Supporting materials may be enclosed as annexure/ appendix separately to the FTR.

### 2.3. Outputs in terms of Quantifiable Deliverables\*

S#	Quantifiable Deliverables*	Monitoring Indicators*	Quantified Output/ Outcome achieved	Deviations, if any, & Remarks thereof:
1	Plantation of <i>Urtica dioica</i> in wasteland (20 ha)	Area in ha	Plantation done in >20 ha in patches in fields, in waste lands, on boundaries of fields across Almora district and some area in Pithauragarh district	Survival is very poor
2	Document on nutritional profiling of stinging nettle and its products	Documents on nutritional profiles of stinging nettle and its products (No.)	One product catalogue One nettle product recipes one booklet on nettle use in hindi	
3	Developing value added food products, supplements and processes using stinging nettle (at least 8 nos)	Number of products developed(No.)	60 products in 13 different categories	
4	Demonstration and imparting training to 1000 people including 600 women and 400 youth. Among these 1000		.Creation of Awareness on vrikshayurveda based natural farming through, Trainings & Demonstrations at farmer's field. Preparation of vrikshayurveda based	

	people to be trained we would include at least 300 people from SC and ST.		<p>decoctions viz. Nettle based , and other ,decoctions.</p> <p>2.16 programmes on Awareness, Training and Demonstrations on Nettle based Herbal Kunapajala (a Vrikshayurveda based preparation) has been conducted in eight blocks (Dwarahat, Lamgarah, Chokhutia, Dholadevi, Pilkholi, Hawalbagh, Takula and Baisiachana.) of District Almora, since inception of the project till date.We have done the Demonstration and imparting knowledge in villages covering eight developmental blocks of Almora district.</p>
5	Development of nettle based kunapjala and its testing as plant growth promoter and plant protector	Development of VariousVrikshayurveda based herbal concoctions to nourish soil and plant and ecology.	Production, development, testing and standardization of nettle based Vrikshayurveda concoctions for plant nutrition and plant protection to enhance the yield and quality of different crops of district Almora.
6	Demonstration and imparting knowledge in 25	Number of people to participate in awareness/training	Awareness raising pertaining to food value



	villages covering at least one village in all 11 developmental blocks of Almora district.	and demonstration program (No.)  No. of Stakeholders benefitted (No. of Rural Youth, No. of Women, and Total No. of Beneficiaries)	<p>A total of 38 meeting were held in 38 different villages covering all the blocks of Almora district</p> <p>More than 1413 people participated including 840 females and 573 males</p> <p>Participation from SC/ST was nearly 25%.</p> <p>16 programmes on Awareness, Training and Demonstrations on Nettle based Herbal Kunapajala (a Vrikshayurveda based preparation) has been conducted in eight blocks(Dwarahat, Lamgarah, Chokhutia, Dholadevi, Pilkholi, Hawalbagh, Takula and Baisiachana.) of District Almora, since inception of the project till date.We have done the Demonstration and imparting knowledge in villages covering eight developmental blocks of Almora district.</p>
7	Creating awareness on	Technology Transfer Manual for Rural	

	benefits amongst local population (at least 5000 people mainly from SC community)	Entrepreneurs/ Eco-entrepreneurs etc. and other Publications and Knowledge Products (Nos.).		

\*As stated in the Sanction Letter issued by the NMHS-PMU.

#### 2.4. Strategic Steps with respect to Outcomes (in bullets)

S#	Particulars	Number/ Brief Details	Remarks/ Attachment
1.	New Methodology/ Technology developed, <i>if any</i> :	>60 ready to cook/ ready to eat nettle based products developed of which 30 will be new to the market	List attached
2.	New Ground Models/ Process/ Strategy developed, <i>if any</i> :	-	
3.	New Species identified, <i>if any</i> :	-	
4.	New Database established, <i>if any</i> :	-	
5.	New Patent, <i>if any</i> :	-	
	I. Filed (Indian/ International)	-	
	II. Technology Transfer, <i>if any</i> :	-	
6.	Others, <i>if any</i>	-	

*Note:* Further details may be summarized in DPR Part-B, Section-5. Supporting materials may be enclosed as annexure/ appendix separately to the FTR.

#### 3. New Data Generated over the Baseline Data: NO

S#	New Data Details	Status of Existing Baseline	Addition and Utilisation New data


*Note:* Further details may be summarized in DPR Part-B. Database files in the requisite formats (Excel) may be enclosed as annexure/ appendix separately to the soft copy of FTR.

### 3. Demonstrative Skill Development and Capacity Building/ Manpower Trained

S#	Type of Activities	Details with number	Activity Intended for	Participants/Trained		
				SC/ST	Women	Total Including General
1.	Workshops	Numbers of trainings to create awareness and to train 642 Farmers on vrkshayurveda based Kunap jal	Awareness, Training and Demonstration programme	141	377	642

		38 meetings were held in 38 different villages covering all 11 developmental blocks of Almora district. More than 1413 people participated including 840 females and 573 males on nettle based edible/marketable products	Awareness, Training and Demonstration programme	283	840	1413
2.	On-Field Trainings					
3.	Skill Development	On farm preparation of nettle based liquid fermented Product and its variants	Farmers of various blocks of district Almora			

4.	Academic Supports	i) Training, & demonstration ii) Distribution of pamphlets on product development. iii) Seven Masters & one PhD thesis have been submitted across the disciplines in agriculture	Farmers of various blocks of district Almora  Researchers & acamedicians			
	Others (if any)					

*Note:* Further details may be summarized in DPR Part-B. Supporting materials may be enclosed as annexure/ appendix separately to the FTR.

#### 4. Linkages with Regional & National Priorities (SDGs, INDC, etc.)/ Collaborations

S#	Linkages /collaborations	Detail of activities (No. of Events Held)*	No. of Beneficiaries
1.	Sustainable Development Goals (SDGs 1,3,13)/ Climate Change/INDC targets addressed	Attended Meetings and conferences at State Agriculture Universities, ICAR, CSIR-NIScPR, Attended and presented in 54 <sup>th</sup> Annual conference of nutrition society of India, UCoST and many other local platforms Attended Civil 20 India 2023	
2.	Any other:		

Note: Further details may be summarized in DPR Part-B, Section-6. Supporting materials may be enclosed as annexure/ appendix separately to the FTR.

## 5. Project Stakeholders/ Beneficiaries and Impacts

S#	Stakeholders	Support Activities	Impacts in terms of income generated/green skills built
1.	Line Agencies/ Gram Panchayats:	Awareness, Training, & Demonstration for product development and its application in various crops.	Yet to be realized
2.	Govt Departments (Agriculture/ Forest/ Water):	.....do.....	
3.	Villagers/ Farmers:	.....do.....	
4.	SC Community:	.....do.....	
5.	ST Community:	.....do.....	
6.	Women Group:	.....do.....	
	Others, <i>if any</i> :		

Note: Further details may be summarized in DPR Part-B, Section-6. Supporting materials may be enclosed as annexure/ appendix separately to the FTR.

## 7. Financial Summary (Cumulative)

Please attach the consolidated and audited Utilization Certificate (UC) and Year-wise Statement of Expenditure (SE) separately, *ref. Annexure I*.

## 8. Major Equipment/ Peripherals Procured under the Project\*\* (*if any*)

S#	Name of Equipment	Quantity	Cost (INR)	Utilisation of the Equipment after project
1.	Bomb Calorimeter	1	1,80000	
2.	RI Detector	1	5,20,169	
3.	Water activity meter	1	4,40000	

\*\*Details should be provided in details (ref. Annexure III & IV).

## 9. Quantification of Overall Project Progress

S. No.	Parameters	Total (Numeric)	Remarks/ Attachments/ Soft copies of documents
1.	IHR States/ UTs covered:	<i>Uttarakhand</i>	
2.	Project Sites/ Field Stations Developed:	<i>Almora district/ 1.D7 block of crop research center, of GBPUAT, Pantnagar 1. Field lab</i>	
3.	Scientific Manpower Developed (PhD/M.Sc./JRF/SRF/ RA):	<i>1 JRF 1 Phd Thesis 7 MSc Thesis</i>	
4.	Livelihood Options promoted	<i>Yes</i>	
5.	Technical/ Training Manuals prepared	<i>UNDER PROCESS</i>	
6.	Processing Units established, if any	<i>No.... (attach photos)</i>	
7.	No. of Species Collected, if any	<i>NA</i>	
8.	No. of New Species identified, if any	<i>NA</i>	
9.	New Database generated (Types):	<i>NA</i>	
	Others (if any)	<i>NA</i>	

*Note:* Further details may be summarized in DPR Part-B. Supporting materials may be enclosed as annexure/ appendix separately to the FTR.

## 11. Knowledge Products and Publications:

S#	Publication/ Knowledge Products	Number		Total Impact Factor	Remarks/ Enclosures
		National	International		

S#	Publication/ Knowledge Products	Number		Total Impact Factor	Remarks/ Enclosures
		National	International		
1.	Journal – Research Articles/ Special Issue:	2  +  1		Impact Index: 6.38  NAAS rating 7.03	
2.	Book – Chapter(s)/ Monograph/ Contributed:	1 under process			
3.	Technical Reports:				
4.	Training Manual (Skill Development/ Capacity Building):	2+1, under process			
5.	Papers presented in Conferences/Seminars:	3+2=5			
6.	Policy Drafts/Papers:	-			
7.	Others, if any:	-			

**Note:** Please append the list of KPs/ publications (with impact factor, DOI, and further details) with due Acknowledgement to NMHS. Supporting materials may be enclosed as annexure/ appendix separately to the FTR.

## 12. Recommendation on Utility of Project Findings, Replicability and Exit Strategy

Particulars	Recommendations
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<p>Utility of the Project Findings:</p>	<p>The detailed and thorough nutritional analysis of dried nettle leaf samples across months and across plant parts has successfully established the nutritional significance of stinging nettle. Numerous products developed out of the project have marketable potential in long term that will be able to provide good livelihood option with good market linkages.</p> <p>Nettle based herbal Kunap jal application in agricultural fields and horticultural crops fruit trees as well as vegetables is encouraging that will be helpful in adopting natural farming successfully.</p>
<p>Replicability of Project/ Way Forward:</p>	<p>The benefits of nettle plant and its products are with us. The data clearly indicates Stinging nettle is rich in elemental composition which is essential for wellbeing of humans it can be consumed by all for improving their health and also for product development. The beneficiaries have been trained well in collection of quality nettle harvest. The forward linkage work for the products is in pipeline and hope to achieve in next few months. The results of nettle based kunapjal are quite encouraging for providing good nutrition to crops, improve soil health and plant protection. That shows promise for wide scale adoption of natural farming.</p> <p>The project has been implemented only in Almora district. By undertaking wider awareness and training programs across the hilly areas of Himalayas, it has a good potential for replicating the success obtained in Almora.</p>

**Exit Strategy:**

Since the project focuses to address socio-economic development of the local populations, there is a greater chance that the stakeholders will continue to get benefited. The project outcomes are also geared towards addressing the needs of local populace including creating additional sources of income for women of Himalayan region for upliftment of their socio-economic status. These will encourage success and continued adoption of the project objectives.

There should be continuous refinement in the tools and technologies of Indian knowledge system w.r.t. crop production technologies and their dissemination particularly plant production and protection through continuous R&D. Funds need to be allocated in good amount by Govt. & private agencies to conduct the R&D.

**(PROJECT PROPONENT/ COORDINATOR)**

**(Signed and Stamped)**

**(HEAD OF THE INSTITUTION)**

**(Signed and Stamped)**

**Place:** .....

**Date:** ...../...../.....

## PART B: DETAILED PROJECT REPORT

1. **EXECUTIVE SUMMARY** (not more than 2–3 pages)- Presently the state of Uttarakhand is reeling under two major problems: Abandonment of agriculture because of animal menace and low productivity, causing mass migration of people from villages in search of livelihood. Another equally important problem which requires immediate intervention is malnutrition. The activities to meet out the objectives of the project entitled “Exploring Livelihood Potential of Wild Growing Stinging Nettle (*Urtica dioica*) in Uttarakhand” funded by Ministry of environment, forest, and climate change Govt. of India for National Mission of Himalayan Studies (NMHS) were launched with the aims & objectives to utilize the stinging nettle for improving the health and livelihoods of the hilly communities with awareness raising, skill development and product development and also to validate the nettle based preparation of modified version of kunapajal, known as herbal kaunap jal, a 1000 yrs old legacy of our vrikshayurveda ,under the advisement and technical guidance of Dr. Sunita T Pandey as the collaborator of the project.

The specific objectives were:

1. Standardization of harvesting protocol
2. Validation of traditional knowledge with regard to consumption and processes.
3. Raising awareness regarding nutritional potential and livelihood generation potential of nettle.
4. Standardization and validation of nettle-based preparation of Kunapjala an important decoction of Vrikshayurveda based agriculture for its used in various selected crops of district Almora.
5. To test the decoction for its medicinal and nutritional values for plant protection.

To achieve the objectives of the proposed project following activities were taken up

- Thorough nutritional profiling of nettle leaves was done to validate the traditional use of nettle as green leafy vegetables and to standardize the harvesting protocols.
- Ready to eat / cook product development using nettle as primary component for nutrition. Varied products ranging from nettle infusions, pan cake mixes, soup mixes, namkeen, flour mixes etc.
- Creating awareness and imparting training to villagers in Almora district through interaction in village meetings/ small group of villagers/ regarding nutritional value of the nettle, its marketable products, Vrikshayurveda practices and use of nettle in preparation of various concoctions to be used for plant nutrition and plant protection.
- Nutritional, chemical and biological profiling of the nettle based Vrikshayurveda concoctions
- Field trials to test the performance of nettle based Vrikshayurveda concoctions on growth and development of various selected crops of district Almora.
- Recording observations of growth and development parameters of crops on application of nettle based Vrikshayurveda concoctions. of various trials

The targeted outcomes achieved within the time frame

1. 48 dried nettle leaf samples were analyzed in two replications that suggested nettle is rich source of protein and minerals. Significant variation does not occur for these components.
2. Samples collected from 12 different locations were analyzed in two replications for protein and other minerals. Variation for these nutritional components was non-significant.
3. Significant nutritional variation does not occur when compared between different plant parts.
4. Yet it was realized the palatability varies and taste was best from the top when used either fresh leaves or dried leaves in different products.
5. Thus top soft portion of the shoots (6 inches maximum) were best for the use.
6. On the basis of taste for product development best harvest comes fresh germinating shoots or from monsoon harvest.
7. Traditional use of nettle leaves as green leafy vegetable was validated with the nutritional testing of leaves
8. Taking a clue from this the marketable edible products were developed
9. For Awareness, demonstration and training pertaining to food value a total of 38 meetings were held in 38 different villages covering all the blocks of Almora district
10. More than 1413 people participated including 840 females and 573 males
11. Awareness, Training and Demonstration programme on Nettle based Herbal Kunapajala have been conducted in various blocks of District Almora.
12. We have conducted the demonstrations and imparted trainings to 642 people including 195 men and 297 women. among these 642 people 141 people from SC and ST.
13. 16 programmes on Awareness, Training and Demonstrations on Nettle based Herbal Kunapajala (a Vrikshayurveda based preparation) has been conducted in eight blocks (Dwarahat, Lamgarah, Chokhutia, Dholadevi, Pilkholi, Hawalbagh, Takula and Baisiachana.) of District Almora, since inception of the project till date. We have done the Demonstration and imparting knowledge in villages covering eight developmental blocks of Almora district.
14. Nettle based herbal kunapajala as per the principle of vrikshayurveda has been developed and tested for plant growth promoter and for plant protection in different crops. The results are quite encouraging.

Three different variants of vrikshayurveda based modified herbal kunapajala were developed, analysed and used to see its effect on growth, development and quality parameters of various field and horticultural crops viz. chickpea, mustard, potato, Tulsi, gladiolus, the medicinal crop *Metricaria chamomilla*, etc. All variants of herbal kunapajala resulted significant nutrient content and beneficial microbial population. The microbial community of the herbal Kunapajala has a significant impact on its nutrient content. Application of different variants of herbal kunapajal on mustard crop resulted better soil properties in comparison with control (conventional practices)

treatment. However, nettle based herbal kunapajala showed yield advantage and better soil health and economics compared with other herbal kunapajala and their doses in Uttarakhand *tarai* region. In another study response of chickpea (*Cicer arietinum* L.) to seed treatment and foliar application of vrikshayurveda based herbal kunapajala under different doses of nutrients "was assessed and it was concluded that seed priming with 10% herbal kunapajala (50% Nettle+50% local weeds) was found superior to enhance the seedling vigour of chickpea seed. Further seed invigoration with 10% herbal kunapajala along with the foliar application of 10% herbal kunapajala was the most effective method over no priming to improve crop establishment, productivity and profitability of chickpea. A Study on Nettle based "Herbal *Kunapajala*" on crop establishment, productivity and seed quality of late sown wheat (*Triticum aestivum* L.) was conducted and it was concluded that seed priming with 10% or 25% herbal kunapajala (50% Nettle+50% local weeds) followed by foliar application of 10% herbal kunapajala at different growth stages was found advantageous to improve quality and quantity of wheat in laboratory as well as in the field and was found at par with existing low-cost hydro priming technology. One of the study on "Effect of various bio-stimulants and three variants of herbal kunapajal was conducted on survival percentage, vegetative growth and biochemical characteristics (viz total chlorophyll content, carotenoides, phenols, flavonoides, proline) of air layers in litchi cv. Rose Scented" was carried out and found that Herbal kunapajala (50% Nettle+50% local weeds) @ 100ml/L was the best over all other bio-stimulants solutions. Positive response in terms of survival, vegetative growth, biochemical parameters and leaf nutrients content were recorded from all three variants of herbal kunapajal in comparison to control. An another study on "Eco-friendly management of Black Scurf potato by nettle based Herbal Kunapajala, caused by *Rhizoctonia solani* Kuhn" was conducted and it was concluded that out of seven plant extracts evaluated *Urtica dioica* (stinging nettle) was the best. Further five Vrikshayurveda based liquid fermented organic formulation were tested under *in vitro* condition, and found that all the five herbal Kunapajal based formulations are effective against all the pathogens inhibiting fungal growth. Herbal Kunapajal have the potential to induce host defence activity which may lead to resistance development against the pathogen. "Response of gladiolus cv. *Jessica* under *Tarai* region of Uttarakhand" to herbal *kunapajala*, on vegetative, flowering and corm attributes was assessed and concluded that corms treated with 10% dilution of herbal kunapajala and foliar spraying of different doses of herbal kunapajala have been found to be best for improving vegetative growth, early spike emergence, longer flowering duration, spike length, rachis length, number and size of florets, vase life, corm and cormels characters in gladiolus cv. *Jessica*. A study was conducted to see the "Effect of herbal Kunapajala (Liquid Bio-Fertilizer) on Growth, Flower Yield and Essential Oil Quality of *Matricaria chamomilla* L." an important medicinal crop and concluded that nettle based herbal Kunapajala( 600 l/acre) promoted early bud initiation

and flower diameter. Oil content (0.27 %) as well as number of bioactive compounds obtained (33) in essential oil were highest in nettle based herbal kunapjala.

The project was taken up extensively in Almora district covering more than 50 villages in all the development blocks of the district. People are aware of the benefits of the nettle. June 14 the day our team held a meeting with villagers in Bhikiyasen block, is being celebrated by them as nettle day, however still a lot remains to be done till it grabs the market share.

## 2. INTRODUCTION-

**2.1 Background (max. 500 words)-** Agriculture has been on the decline across India due to various reasons. Unless interventions are made on an urgent basis, it may be “too little and too late”. The situation in the hilly areas of Uttarakhand is no exception. Farmers are migrating away from agriculture due to uncertainties and risks associated with agriculture. But, weaning away from agriculture is not a solution. Hence, it is imperative that researchers, policy makers, and other stakeholders must get-together to address the problem.

Biodiversity is essential for ensuring food and nutritional security. All across India, there has been erosion in crop biodiversity with very few crops forming majority of the human diet resulting in nutritional deficiencies. Till few years ago, situation was quite different at least in the hilly areas. But today things are quite different and following the national trend. Unless it is reversed, there will be dire consequences for Indian agriculture. It is very well known that most of the neglected and underutilized crops are rich in essential compounds that are required by human body. But they are being lost to modern day crops. Similarly almost all the non-wood/weed plants have high medicinal and nutritive values to be harnessed for the wellbeing of humans, animals and plants also and thus the biodiversity of the ecosystem can be maintained in this context this is highlighted that these weeds/economic plants including nettles are important component of Vrikshayurveda based concoctions which are time tested and time honored need to be validated in the present scenario of agriculture for making the sustainable by conserving the biodiversity and other local resources.

**2.2 Overview of the major issues addressed (max. 500 words)-** Presently the state of Uttarakhand is reeling under two major problems: Abandonment of agriculture because of animal menace and low productivity, causing mass migration of people from villages in search of livelihood. Another equally important problem which requires immediate intervention is malnutrition. Results of various studies revealed inadequate dietary intake especially among women of villages causing significant health problems and also having an effect on the new-borns eventually leading to higher rates of malnutrition amongst children. Studies also reported that overwhelming population of women in the hilly region are in the grip of severe to moderate malnutrition due to various reasons including lack

of nutritional knowledge and interventions are required to address these burning problems. Himalayan region is one of the centers of origin of crops and there exists a wide-ranging biodiversity in the region. There are many lesser known species in local diets that are rich in nutrients, metabolites, antioxidants, phytochemicals that regulate biological processes for preventing and controlling diseases that can be used for improving nutritional status of local populace. The issue of low productivity may be patched up by using nettle based Vrikshayurveda preparation (Kunapajala) on various selected crops of district Almora and thus facilitates in raising the cost-benefit ratio of the farming. Apart from this the quality of produce, soil and biodiversity will also be enhanced. The hill region of state also lacks sources of livelihood, apart from the agriculture in small landholdings. Therefore, additional efforts towards improving economic conditions of farm families especially women are also required for improving their livelihoods. The hills of Uttarakhand have a distinct advantage in terms of livelihood generation and agricultural potential. The primary resource of the hills is rich biodiversity and its ancient knowledge heritage and Stinging Nettle is one of the plants of rich biodiversity of Uttarakhand. It has multiple uses ranging from food, fiber, medicinal etc. With adequate research followed by creating awareness among locals, Nettle has the potential to be an answer to the existing problems.

**2.3 Baseline Data and Project Scope** (max. 500 words)- Nettle is a common plant of rich biodiversity in Uttarakhand, India. *Urtica dioica* is commonly known as stinging nettle or simply nettle. Vernacular name of the plant is Bichu, Butti in Hindi and Vrishchhiyaa shaaka in Sanskrit. In local language of Kumaun region, nettle is also known as 'shishun', apart from having many other names in different parts of Uttarakhand.

Plant pesticides have been used for food preservation for hundreds of years. Nettles serve as a home for bugs' natural predators. Planting nettles resulted in a higher number of aphid predator species. Nettle extract can be used as an insecticide, fungicide, and acaricide under Basic Substance laws. As an insecticide, nettle extract can be used to control codling moths, diamondback moths, and spider mites. This fungicide can be used to prevent pythium root rot, powdery mildew, early blight, late blight, septoria blight, alternaria leaf spot, and grey mould.

A climate resilient, perennial herb, nettle has a long history of being used as an alternative medicine and as a rich source of nutrition world over including our Himalayan state of Uttarakhand. Existing problems in the agricultural sector in Uttarakhand underline the need for alternative nutritive crops that are hardy and can be cultivated with minimum inputs in the ever-changing erratic climatic conditions. Hence, it is proposed that "with adequate research, product development, and awareness the nettle can be used as an alternative future cash crop to the declining agricultural scenario of Uttarakhand for generating sustainable livelihood.

## **2.4 Project Objectives and Target Deliverables** (as per the NMHS-Sanction Order)

Project Objectives	Quantifiable Deliverables	Monitoring Indicators
<ul style="list-style-type: none"> <li>• Standardization of harvesting protocol.</li> <li>• Validation of traditional knowledge with regard to consumption and processes.</li> <li>• Raising awareness regarding nutritional potential and livelihood generation potential of nettle.</li> <li>• Standardization and validation of nettle-based preparation of Kunapjala an important decoction of Vrikshayurveda based agriculture for its used in various selected crops of district Almora.</li> <li>• To test the decoction for its medicinal and nutritional values.</li> </ul>	<ul style="list-style-type: none"> <li>• Plantation of <i>Urtica dioica</i> in wasteland (20 ha)</li> <li>• Document on nutritional profiling of stinging nettle and its products</li> <li>• Developing value added food products, supplements and processes using stinging nettle (at least 8 nos)</li> <li>• Development of nettle based Kunapjala and its testing as plant growth promoter and plant protector.</li> <li>• Demonstration and imparting training to 1000 people from 25 villages (covering 11 blocks), including 600 women and 400 youth (&gt; 300 people from SC community).</li> <li>• Creating awareness on benefits amongst local population (at least 5000 people mainly from SC community)</li> </ul>	<ul style="list-style-type: none"> <li>• Area planted (ha.)</li> <li>• Number of products developed(No.)</li> <li>• Documents on nutritional profiles of stinging nettle and its products (No.)</li> <li>• Number of people to participate in awareness/training and demonstration program (No.)</li> <li>• No. of Stakeholders benefitted (No. of Rural Youth, No. of Women, and Total No. of Beneficiaries)</li> <li>• Technology Transfer Manual for Rural Entrepreneurs/ Eco-entrepreneurs etc. and other Publications and Knowledge</li> </ul>



### 3. METHODOLOGIES/STARTEGY/ APPROACH – supporting documents to be attached.

#### 3.1 Methodologies used

- Nutritional profiling of nettle leaves
- Ready to eat / cook product development using nettle as primary component for nutrition
- Creating awareness and imparting training to villagers in Almora district through interaction in village meetings/ small group of villagers/ regarding nutritional value of the nettle, its marketable products, Vrikshayurveda practices and use of nettle in preparation of various concoctions to be used for plant nutrition and plant protection.
- Nutritional, chemical and biological profiling of the nettle based Vrikshayurveda concoctions
- Field trials to test the performance of nettle based Vrikshayurveda concoctions on growth and development of various selected crops of district Almora.
- Recording observations of growth and development parameters of crops on application of nettle based Vrikshayurveda concoctions. of various trials

##### 3.1.1.Preparation of Herbal Kunapajala (details are giving in AnnexureX)

Three different types of herbal Kunapajala KJ1, KJ2 and KJ3 were prepared using different kinds of local vegetations along with 10-15 Kg of cow dung, 10-15-liter cow urine (desi and cross bred), 2 kg jaggery (spoiled and unfit for consumption), 2 kg sprouted urddal, 2 kg of mustard or neem cake, 1/2-1 kg milk, 1/2-1 kg curd, 3-5 liters paddy straw water, and extract of 2 dried dung cake (upla) water. The vegetation used in different kinds of herbal Kunapajala are as follows

1. **In KJ1:** 20 kgs of finely chopped plants of only stinging nettle were used as vegetation,
2. **In KJ2:** Mixture of stinging nettle and weeds around the field in 50:50 ratio (10 kgs each) was used as vegetation
3. **In KJ3:** 20 kgs of weeds growing nearby the field excluding stinging nettle were used as vegetation.

### Various components of Herbal Kunapajala



### 3.1.2. Standard Methods used to carry out the various studies in the project

S. No.	Properties	Method
1	pH	Beckman Glass Electrode pH meter (Jackson, 1973)
2	EC (dS/m at 25°C)	EC meter (Bower and Wilcox, 1965)
3	Organic carbon (%)	Walkley-Black Modified method (Jackson, 1973)
4	Nitrogen (ppm)	Microkjeldhal method, Jackson (1973)
5	Phosphorus (ppm)	Phosphorus by Nitric-Perchloric digestion and colorimetry using vanado-molybdo phosphoric yellow colour method (Olsen et al., 1954)
6	Potassium (Kg/ha)	potassium by Nitric-perchloric digestion and flame photometry (Hald, 1947)
7	Sulphur	Nitric-perchloric digestion and Turbidimetry Massoumi and Cornfield (1963)
8	Iron,	Nitric-perchloric digestion and AAS Jackson (1973).

	Manganese, Zinc and Copper	
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### 3.1.3. Biological parameters of herbal Kunapajala

S.No.	Microbes	Parameters Reference	Methods	References.
1	Bacteria	Nutrient Agar medium		Atlas and Parks (1993)
2	Fungi	Martin's rose Bengal Agar		Martin (1950)
3	Actinomycetes	Ken knight's Agar medium		Cappuccino and Sheman (1996)

## 3.2 Data collected and equipment utilized (500 words max.)

**3.2.1 Data collected:** Experiments wise data for the following observation has been collected on herbal kunap jal.

### Trial No. 1

### Annexure-1

**"Response of (*Cicerarietinum*L.) to seed treatment and foliar application of vrikshayurveda based herbal kunapajala under different dose of nutrients "** .

Observations recorded on

- I. Lab studies: Field studies
- Growth studies:
- Yield and yield attributes

### Trial No. 2

### Annexure-II

**"Response of late sown wheat (*Triticum aestivum* L.) to seed treatment and foliar application of herbal kunapajala under different dose of nutrients"**

**Observations have been recorded on**

1. Soil studies
2. Seed germination and seedling vigour emergence studies
3. Growth study;
4. Yield and yield attributes

### **Trial No. 3**

### **Annexure-III**

#### **“Response**

**of herbal kunapajala, an organic fermented fertilizer on vegetative, flowering and corm attributes of gladiolus cv. Jessica under Tarairregion of Uttarakhand”**

**Observations recorded and data has been collected:**

1. Growth parameters
2. Flowering and yield parameter
3. Vase life study
4. Corm and cormels characters
5. Soil characters: Quantification of available macro and micro nutrients before and after harvest of the crop.

### **Trial No. 4**

### **Annexure-IV**

**“Eco-friendly management of Black Scurf potato by nettle based Herbal Kunapajala, caused by *Rhizoctoniasolani* Kuhn”**

**Observations and data on-**

*In vitro trial:*

Field trial : Germination per cent of tubers in different treatments; Soil analysis for nutrients before sowing and after harvesting of potato tubers; Inspection for aerial symptoms of the disease; Yield analysis of potato in different treatments; and Rating of disease in tubers using 0-3 disease rating scale.

### **Trial 5**

### **Annexure-V**

**“Effect of Vrikshayurveda based herbal Kunapjala (Liquid Bio-Fertilizer) on Growth, Flower Yield and Essential Oil Quality of *Matricariachamomilla L.*”**

Observations and data on

1. Vegetative Characters
2. Floral Characters
3. Soil Studies
4. Oil Character

### **Trial 6**

### **Annexure-VI**

**Effect of biostimulants on survival percentage, vegetative growth and biochemical characteristics of air layers in *litchi cv. Rose Scented.***

**Observations Recorded:**

A. Vegetative Growth Parameters

B. Biochemical parameters

C. Nutrient content of leaves

**Trial: 7**

**Annexure-VII**

**“Antifungal properties of Vrikshayurveda based herbal kunapajal against seed borne fungi”**

**Methodology -Food Poisoned technique**

**Five kunapajal formulation used:**

**Target Pathogen**

1. *Alternaria solani*
2. *Colletotrichum capsici*
3. *Macrophomina phaseolina*
4. *Helminthosporium oryzae*
5. *Fusarium oxysporum*

**Trial No. 8**

**Annexure-VIII**

**“Screening of various doses of nettle based liquid fermented organic *Vrikshayurveda* concoction (Herbal Kunapajala) on growth, development and yield of mustard crop.”**

**Following Observations have been recorded and data has been collected**

- I. Growth parameters:
- II. Yield attributes and yield
- III. Soil and Kunapajala properties (Initial and at harvest): Physical, chemical and biological properties of soil and Kunapajala
- IV. Nutrient studies: Nutrient status of soil and uptake by crop
- V. Analysis of kunapajala:
  1. EC, pH, N, P, K, Ca, Mg, S and micro and macro nutrients
  2. Total bacterial population ( $\times 10^6$  CFU g soil<sup>-1</sup>)
  3. Total Fungal population ( $\times 10^4$  CFU g soil<sup>-1</sup>)
  4. Total Actinomycetes ( $\times 10^5$  CFU g soil<sup>-1</sup>)

### **3.2.2 Equipments utilized**

S. No.	Name of Equipment	Make	Used For
1	ICP-MS	Agilent	Elemental analysis
2	Protein Analyzer	Kel Plus	Protein & Nitrogen
3	Hot Air Oven	Bio-Technis	Moisture
4	Muffle Furnace	Bio-Technis	Ash
5	UV-Spectrophotometer	Agilent	Polyphenols
6	UV-Spectrophotometer	Agilent	Antioxidants activity
7	Balance	Mettler Toledo	Weigh of sample
8	Refrigerator	Whirlpool 330L	Product development
9	MID-SS 5 Tray Dehydrator	Magnum	Product development
10	Weighing balance		Product development
11	Food processor	Inalsa	Product development
11	OTG	LG	Product development

**Following Equipments or Instruments were utilized to collected data.**

Instrument	Manufacturer
Electronic balance	Adair dutt Ltd.
Centrifuge	Eppendrof
Spectrophotometer	Perkin- elmer
Water bath	Sanco
Incubator cum shaker	Unilab
Hot air oven	Sanco
BOD Incubator	Sanco
Soxhletapperatus	Unilab

Distillation unit	Unilab
pH meter	Eutech
Autoclave	Scientific Equipment Lab
Laminar air flow	Klenzaid
Microwave oven	LG
Refrigerator	LG

**Note :** Further details and Supporting materials enclosed as, Annexure.I, II,III,IX, X ,XI, XII, XIII, IX, X, XI, XII etc.

### **3.3 Details of Field Survey conducted, if any (max 500 words)- NA**

### **3.4 Strategic Planning for each activity with time frame (max. 200 words)-**

Nettle plantation - mid July 2020 to September 2020, July 2021-September 2021, July 2022-september 2022

For the nutritional testing of the nettle leaves continued from September 2020 and continued till December 2021

Nutritional testing of Nettle leaves- November 2020 to January 2022

Product development started from August 2020 and continued till

Nutritional testing of nettle products- December 2021- April 2023

Awareness raising, training on nettle benefit and product development- 2020- January 2023

Purchase of nettle for product development- Started from August 2020 to April 2023

Recipes development of nettle- August 2020- June 2023

Time frame for application of liquid fertilizer herbal Kunap jal

#### **1. Procurement and human resource involvement**

- Engagement of all the human resource viz JRF etc. need to be completed timely (first quarter)following all the rules and regulation of university, starting approval for engaging JRF from Director of Research up to joining of JRF in the project.
- Strategic Planning: For Site Selection : As per requirement of crops to be tested the site should be selected well in time.

#### **2. Awareness Creation**

Strategic Planning is to continue this component throughout the project activity to cover as many farmers as possible by conducting training and workshops.

#### **3. Experimentation:**

- Strategic Planning is to plan & conduct all the experiments well in time and data/ observations need to be recorded timely to maintain accuracy.
- Concoctions to be developed well in advance for its testing for physical, chemical ,and biological properties, and also for its selves life for its efficient use of bichhu grass /herbal kunap jal.
- Nutrition and Plant protection profiling of concoctions :Study of vrikshayurveda to provide idea w.r.t tree spp. The biopesticides need to be developed well in time

4. Data Analysis and Report preparation : As soon as the post harvest observations gets completed, data analysis will be done using suitable experimental statistical design to prepare and submit the report timely.

### **4. KEY FINDINGS AND RESULTS – supporting documents to be attached.**



**4.1 Major activities/finding** (max. 500 words) : Following major activities were carried out to achieve the objectives and goals of this project:

1. Plantation of nettle trial
2. Collection of nettle leaves from the different plant parts top, middle and bottom for the nutritional profiling
3. Collection of nettle samples from the wild stands growing in varied altitudes to check the nutritional variation
4. Drying nettle samples in different drying conditions to know the impact of drying method on nutritional content
5. Nettle product development and recipes finalization
6. Plantation of nettle in barren land
7. Awareness raising and training campaigns on nettle benefits and nettle products
8. Collection of stinging nettle for preparation of Vrikshayurveda concoction
9. Collection of other raw material viz cow urine, cow dung (desi and cross bred), weeds etc. required for the preparation of Vrikshayurveda concoction
10. Preparation and standardization of nettle based Vrikshayurveda concoctions to be used in various crops.
11. Testing of product for its physical, chemical and biological properties of herbal kunapajala.
12. Conducted field trials on important identified crops to assess the effect of nettle based Vrikshayurveda herbal kunapajala on growth and development of various selected crops.
13. 3 kinds of Vrikshayurveda based herbal kunapajala were developed using stinging nettle as one of the ingredients and other locally available weeds.
14. Recording observations of various trials
15. Conduct of training and awareness campaign
16. Statistical analysis of data and report preparation.

#### **4.2 Key Results (max. 500 words in bullets covering all activities)**

15. 48 dried nettle leaf samples were analyzed in two replications that suggested nettle is rich source of protein and minerals. Significant variation does not occur for these components.
16. Samples collected from 12 different locations were analyzed in two replications for protein and other minerals. Variation for these nutritional components was non-significant.
17. Significant nutritional variation does not occur when compared between different plant parts.
18. Yet it was realized the palatability varies and taste was best from the top when used either fresh leaves or dried leaves in different products.
19. Thus top soft portion of the shoots (6 inches maximum) were best for the use.
20. On the basis of taste for product development best harvest comes fresh germinating shoots or from monsoon harvest.
21. Traditional use of nettle leaves as green leafy vegetable was validated with the nutritional testing of leaves
22. Taking a clue from this the marketable edible products were developed
23. For Awareness, demonstration and training pertaining to food value a total of 38 meeting were held in 38 different villages covering all the blocks of Almora district
24. More than 1413 people participated including 840 females and 573 males
25. Awareness, Training and Demonstration programme on Nettle based Herbal Kunapajala have been conducted in various blocks of District Almora.
26. We have conducted the demonstrations and imparted trainings to 642 people including 195 man and 297 women. among these 642 people 141 people from SC and ST.
27. 16 programmes on Awareness, Training and Demonstrations on Nettle based Herbal Kunapajala (a Vrikshayurveda based preparation) has been conducted in eight blocks(Dwarahat, Lamgarah, Chokhutia, Dholadevi, Pilkholi, Hawalbagh, Takula and Baisiachana.) of District Almora, since inception of the project till date.We have done the Demonstration and imparting knowledge in villages covering eight developmental blocks of Almora district.
28. Nettle based herbal kunapajala as per the principle of vrikshayurveda has been develop and tested for plant growth promoter and for plant protection in different crops. The results are quite encouraging.

#### **4.3 Conclusion of the study(max. 500 words in bullets):**

- Dried nettle leaves are rich source of protein in all stages of its growth
- Dried nettle leaves are reservoir of macro and micro minerals required by the humans
- Dried nettle can be used for the edible/marketable product development and several products have been developed

- Nettle products are new to the people and market hence will take time to have a definite impact on livelihood
- A lot of hand holding is required for the production of quality products
- Production and analysis of nettle based Vrikshayurveda concoctions for plant nutrition and plant protection to enhance the yield and quality of different crops of district Almora.
- Creation of Awareness on vrikshayurveda based natural farming through, Trainings & Demonstrations at farmers field. Preparation of vrikshayurveda based decoctions viz. Nettle grass based , and other decoctions.
- Dissemination the use of nettle based Vrikshayurveda preparation technologies in various blocks district Almora of Uttarakhand for the benefit of farmers to enhance their capacity building
- Increase the cost-benefit ratio of farming because of least/no dependency of farmers on market for the purchase of inputs of agriculture
- Bring the underutilised crop species, Stinging nettle, into mainstream agriculture thereby contributing towards biodiversity conservation.

## **5. OVERALL ACHIEVEMENTS – supporting documents to be attached.**

**5.1 Achievement on Project Objectives/ Target Deliverables** - the project has been successfully implemented to achieve the deliverables targeted for the project objectives. Nettle leaf samples comprising of harvest from three different plant parts top, bottom and middle were collected over four different months of the year. A number of samples were tested for various nutritional components in 2 replications. Significant nutritional variation does not occur when compared between different plant parts. Yet it was realized the palatability varies and taste was best when used either fresh leaves or dried leaves in different products. Thus top soft portion of the shoots (6 inches maximum) were best for the use. On the basis of taste for product development best harvest comes fresh germinating shoots or from monsoon harvest. Traditional use of nettle leaves as green leafy vegetable was validated with the nutritional testing of leaves and taking a clue from this the marketable edible products were developed.

Awareness raising pertaining to food value a total of 38 meeting were held in 38 different villages covering all the blocks of Almora district where more than 1413 people participated including 840 females and 573 males and participation from SC/ST was nearly 20%.

On the other hand for awareness raising pertaining to Kunapjal 16 programmes on training, demonstrations and imparting knowledge on Nettle based Herbal Kunapajala (a Vrikshayurveda based preparation) has been conducted in eight blocks(Dwarahat, Lamgarah, Chokhutia, Dholadevi, Pilkholi, Hawalbagh, Takula and Baisiachana.) of District Almora, since inception of the project till date. Vrikshayurveda based herbal kunap jal was standardized and validated by using in different field crops, horticultural crops in farmers field and by laboratory testing in varied combinations.

**5.2 Interventions-** believing on the statement the medicine is not the health, food is your health; traditionally consumed as green leafy vegetable, wild growing nettle was selected to validate its consumption. It was found as nutrition reservoir available in our backyard. Nutrition rich food products have been developed. The locals have been made aware of its nutrition power. With rigorous interaction villagers have been trained in taking good quality of harvest. It was witnessed that some are aware of nettle value and supplying the dried nettle leaves but of very poor quality. Even we faced this problem in the beginning. Realizing the drawback people were trained in taking good harvest. Now backward and forward supply chain is being explored.

Not only the edible food products but the food for soil and plant was also tested-

LOW COST BIO FERTILIZER CUM BIO STIMULANT

SAFE, ECOFRIENDLY PRODUCTS

LOW CARBON EMISSION PRODUCTS

- Two fermented vrikshayurveda based nettle products for crop production and protection have been developed , tested and the technology was disseminated among the farmers in various blocks of district Almora.
- Being the low cost technology and very simple methodology farmers are producing these products in situ and harnessing safe, sustainable and qualitative produce from their farm for themselves, and for others also.
- Being an anaerobically fermented product, there is least carbon emission which helps to mitigate the effect of global warming and also enrich the soil and ground water resources.

**5.3 On-field Demonstration and Value-addition of Products-** Nettle based more than 60 marketable infusions and ready to cook and ready to eat products have been developed. On field knowledge has been imparted to villagers in selected villages of all the blocks of Almora district.

Demonstration of the methods of liquid fertilizer kunap jal formulations to the farmers of the various blocks of Almora

-Demonstration trials conducted KVK, Matela , Almora for assessing the performance of nettle based kunap jal application on various seasonal crops and vegetables for training and visit programme of the farmers and scientists also.

-Demonstration of the methods of product formulations to the students as well as farmers at farmers fair for its large scale dissemination

-Demonstration at Research experiments blocks of various Research Centres of university to the farmers as well as scientific fraternity.

**5.4 Green Skills developed in State/ UT-** Being an anaerobically fermented product, there is least carbon emission which helps to mitigate the effect of global warming and also enrich the soil and ground water resources, thus a green skill for safe, sustainable , and low cost intervention in farming. This anaerobically fermented products for crop production have been included in the syllabus and curriculum of the UG and PG program of the in Natural farming in state Agriculture Universities with its generic name “herbal kunap jal” and also as jeevamrit, ghan jeevamrit, beejamrit etc.

**5.5 Addressing Cross-cutting Issues-** The projects aimed to address issues in two broad areas – Scientific and Health & Livelihood. In general, local citizens do not care much about scientific applications of the project. By addressing needs of the community and at the same time working towards the society had been a significant aspect of this project. By addressing these two wide-ranging aspects, each with sub-aspects, the projects addressed cross-cutting issues. With the scientific data generated for scientific community, there is a better understanding of the nettle species so that further research in this area can be taken up for welfare of the society. For local population, it helps in addressing malnutrition amongst children and improves the nutritional health of adolescent girls and women. The application of liquid fertilizer nettle kunap jal in farmer’s fields

for improved soil health, plant protection and plant nutrition is helpful in addressing the challenges of farming.

In cutting across these issues, the findings also achieve three of UN's Sustainable Development Goals (SDGs):

- No poverty
- Good health and well-being
- Climate action

## **6. PROJECT'S IMPACTS IN IHR – supporting documents to be attached.**

**6.1 Socio-Economic impact-** Over the last few decades Uttarakhand has been experiencing steady exodus of its populace due to the lack of opportunities for employment. As conventional agriculture has failed to sustain livelihood in the hills, new avenues need to be explored for commercial utilization of Uttarakhand's natural resources. With dedicated research on nettle leaves and product development we are in a position to emphasize, with marketing focus nettle can provide a source of income for the rural masses. Its utility is many fold: Firstly, it can be consumed by the local people as an additional source of high quality protein/vitamin and minerals. The nettle plant has tremendous potential to be processed and packaged as an edible item for soups, pan cake mixes, flour mixes, snacks etc. As an environmental resource, the plant would help in enhancing the green cover in the hills. Its organic qualities would be of immense help in boosting the soil fertility and would add another dimension to hill agriculture. Vikshayurved based nettle kunapjal has been found effective in enhancing the yield of agricultural crops, horticultural crop and also some herbs. Being rich in protein and mineral content the nettle kunapjal is good source of nutrition for crops in field. This is also helpful in enhancing the bacterial population in the soil that helps in improving the overall soil health. The microbial activity present in kunapjal also provides plant protection by checking the plant pathogens and insects. Most important its application in the field will minimize or bring to zero the dependency on poisonous plant protection chemicals and chemical fertilizers. Hence it has the potential to generate more income for the poor farmers of the region. Being rich in nitrogen in preparation from nettle, can be used as organic fertilizer to enhance the growth of crops in organic fields.

Our focus and priority during the research and development of the nettle plant had been to introduce nettle as economic plant for the benefit of local rurals. Lot of effort has been placed on

training, demonstrations and imparting knowledge on uses of nettle for personal wellbeing, agricultural benefits etc to the rurals involving women, youth and SC community, product development, challenge still remains to work on such 'farm to table' strategy, where an underutilized plant such as the nettle is packaged glamorously and introduced in the market as a health food.

**6.2 Impact on Natural Resources/ Environment (max. 500 words)-** Uttarakhand lacks sources of livelihood, apart from the agriculture in small landholdings. Therefore, additional efforts towards improving economic conditions of farm families are also required. Farming which was being followed traditionally is not economically viable today. Some of the reasons are depleting soil fertility and other erratic climatic conditions. Villagers are abandoning their fields as productivity has gone down, apart from animals like monkeys, wild boars and porcupines damaging their fields. Even with all these detrimental factors nettle stands well even on the roadsides.

This whole scenario requires the new strategies involving local resources. We need to focus on these resources if progress in development is to be lasting.

Nettle is well established local plant of Uttarakhand that grows in the wild without human interference. Since it has already established itself as a local herb of the Himalayan region for an unknown time now and will not be an alien introduction from an unrelated geographic area. So there is no danger of alien species interfering with other local species.

Nettle does not require much human effort as far as prime objectives of the project; development of edible/marketable nettle products and application of nettle kunap jal in farmer's field are concerned, it is available in nature abundantly. Only the nutrition rich nettle leaves or green parts are being used for the product development and liquid fertilizer making. These green parts rejuvenate easily with more vigour on each harvesting and multiple harvestings can be taken. The natural stand or the population is not being disturbed hence no danger to existing wild population of nettle. The need of the times is for the local people to utilise this utility plant for their wellness as also to generate employment for the younger generation.

This is the first time that not only Uttarakhand, in India as such nettle has received the required scientific, agricultural and economical attention for exploring its enormous potential as today's superfood, as a solution for depleting and climate endangered agriculture and as a supplement for nutritional insufficient food.

With this project finding I have been able to introduce already existing but untouched plant for the holistic development of this Himalayan region.

**6.3 Conservation of Biodiversity/ Land Rehabilitation in IHR-** At any stage of implementation project did not interfere or caused any harm to the environment neither commercial application of the findings of the project are likely to cause any harm in future. Yet keeping in mind the excessive

exploitation of the nettle for project findings or other benefits of the nettle plant for that the objectives have not been framed the nettle plantation on barren land was taken up as an activity. In lieu of the targeted plantation in 20 ha (1000 nali) a total of 1230 nali land area was planted with the nettle roots. In the year 2020 plantation was taken up in Maini, Panchgaon (personal land banjar field 120 nalis and van bhoomi 80 nali), Paparsaili (personal land 30 nali), Kasardevi (van bhoomi 50 nali) and Bamanswal (personal land banjar fields 50 nali); 2021 Kosi Maini (personal land 100 nali van bhoomi 100 nali), Almora Naini Kumshyal (Banjar bhoomi 10 nali), Jud Kafoon (gram sabha land 100 nalis), sheetalakhet (Syahidevi personal land 50 nali), Majhkhali-Turkauda (SC village personal land 40 nali), Daulaghat-Rankhilla (200 nali), Kafadkhan (50 nali personal, 50 nali gram sabha bhoomi) in Almora district. In Pithauragarh Moonakot block- Meharkhola, Kanakot and Gaina villages (personal land 60 nali and 40 nali gram sabha land), Kanalichhina block- Mus gaon, Raisapata and Bhandari gaon (personal 70 nali and 30 nali gram sabha) 200 nali land was planted with nettle. However the success is very poor that calls for concentrated research focus in future.

**6.4 Developing Mountain Infrastructures-** The nettle products developed within the project primarily use the other constituents growing in the hills. Thus the production unit planned in hills will add to the mountain infrastructure. Other than the edible products developing bio-resource units for kunapjal in the mountainous regions using stinging nettle may add the value to mountain infrastructure. When all the ingredients of the products like vrikshayurveda concoctions to be used for natural low cost, sustainable and safe farming are eco-friendly and thus there is no harm to the ecology of the hills by adding and creating an bio resource infrastructure for the benefit of soil health and ultimately one health. This creation of bio-resource units, a potential infrastructure will also generate and enhance the livelihood potential in hills and will facilitate to reduce the migration from the mountainous region of Uttarakhand. The findings will have wholistic implications in the mountains.

**6.5 Strengthening Networking in State/ UT-** During the project, while disseminating knowledge of benefits of wild growing nettle for health, and for livelihood through product development, the technology of production and application of vrikshayurveda based concoctions to promote low cost, safe and sustainable natural farming, lots of everlasting interactions were held with the directorate of agriculture Uttarakhand , SAMETI, ATMA staff, & NGOs working in the field, federations, villages and most importantly with the villages in Almora district which will definitely create an impact for reducing the migration from the agriculture by utilization of nettle as their source of livelihood .



## **7. EXIT STRATEGY AND SUSTAINABILITY – *supporting documents to be attached.***

**7.1 Utility of project findings (max. 500 words)-** this project was aimed at generating scientific knowledge, improving nutritional health of the local population, enhancing soil fertility levels, providing organic solutions for plant protection and enhancing income generating opportunities through use of local resources. Since the overall objectives of the project are focused keeping welfare of the local population and the Himalayan region in mind, it is bound to be continued by the stakeholders even beyond the project duration. Plethora of scientific knowledge has been generated on nutritional aspect of the nettle leaves and also on the application of nettle based herbal kunapjal for enhancing the soil fertility, plant protection and plant nutrition. This data can be used by the scientific community indefinitely for betterment of the society irrespective of the funding scenario. Second goal of this project is to conserve and popularise the locally grown, underutilised plant species for improving nutritional health. A lot of effort has been placed on reaching to the interior villages for creating awareness on the utility of nettle. Feedback suggests that some of the people are using it for the health benefit. Particularly in area of Bhikiasen block and Syaldey block residents are taking lot of interest on nettle products. The day 14 June 2022 our team held meeting in their area, the Nayadaur organization has started celebrating that day as Nettle day. This is the beginning. Once the masses understand and see the benefits – nutritional health improvement, in this case, human tendency is to continue its consumption without any further interventions. Also, as the nettle products are expected to provide means of income enhancement it further wouldn't require any encouragement to the society for the populace to grow and better utilise the crop for improving their livelihoods. Since all three expected outcomes of this project result in betterment of local population, the outcomes are sustainable even beyond the project duration. Apart, the outcomes can easily be scalable to other locations.

**7.2 Other Gap Areas-** The nettle project was focused on its food potential, its agricultural application and also on its plantation in barren land for biodiversity conservation and increasing the green cover. The project area was primarily Almora district. The nettle was planted in more than 20 ha of barren land as well as on the edges of cultivated fields across the Almora district and some area in Pithauragarh district over the project period. To our disappointment the survival of the nettle had been very poor. General reading suggests that the survival of common nettle is very poor. While we were in a village an old gentleman suggested it is a family plant and grows by itself near human establishment, cannot be cultivated in other areas. This seems to be his observation and traditional knowledge. However it implies that concentrated research focus is required to the planting technology.

Increasing the range and refinement in the product development is required along with the hand holding for production as well as marketing.

Lot of research data has been generated on the value of nettle based kunap jal that needs to reach the more and people concerned and utilized by the farmers for their own benefit as well as of society of society.

**7.3 Major Recommendations/ Way Forward (max. 200 words)-** The nutritious nettle products have marketable potential. Some of these are novel products and will be launched first time in the market. However being new to the market their acceptance will be slow in short term. But in long term they hold promise. During next few months some of the products will be brought to the market involving 1-2 SHGs for production and market linkages. Refinement as well as development of new products will be needed in future. Now is the time for focusing on attractive packaging and reliable marketing channel.

There should be continuous refinement in the tools and technologies of Indian knowledge system w.r.t. crop production through continuous R&D. Funds need to be allocated in good amount by Govt. & private agencies to conduct the R&D.

**7.4 Replication/ Upscaling/ Post-Project Sustainability of Interventions (max. 500 words)-** Projects are normally sustainable when they address societal problems and provides effective and economical solutions for the same. This project had been able to do the same apart from generating information for scientific community. Malnutrition including Protein Energy Malnutrition (PEM) is one of the major societal problems plaguing the communities including those in the hills. Thorough nutritional profiling work suggests that Stinging nettle is a good source of protein. Hence, food products made from this plant species are also a good source of protein and be able to address the PEM problem in children. Another societal problem that needs attention is the dietary requirements of adolescent girls who have to bear the responsibility of motherhood in coming years. The nutrition data indicates Stinging nettle is rich in elemental composition which is essential for wellbeing of humans. Now since the full nutritional profile is on hand, it can be consumed by women for improving their health resulting in better health. It is well known that the socio-economic condition of hilly communities is below average. One of the many reasons for this is minimal opportunities for increasing incomes. Since Stinging nettle is a good source for improving human health, organically protecting agricultural crops, improving soil fertility, enhancing biodiversity, and development of value-added food products for commercialization, the developed products with nettle as major component due to their superior nutritional quality will find market and will serve as additional income generation source for the local communities in coming years. Considering these, we need to believe that this project has a good potential to be sustainable and now focus on marketing with expert's advice.

With up scaling of the products it can be utilized as processing into coir matting, clothing and furnishing; finally, this plant has tremendous potential for its herbal medical qualities which could also be used for developing medicines and cosmetic products .

By undertaking wider awareness programs across the hilly areas of Himalayas, it has a good potential for replicating the success obtained in Almora to other districts of not only in Uttarakhand but pan Himalayan region. Since detailed nutritional profile of nettle leaves and its products are on hand, it is only a matter of disseminating the knowledge through scientific community as well as KVKs, NGOs etc.

**ACKNOWLEDGEMENTS-** We sincerely acknowledge and appreciate grant-in-aid provided by National Mission on Himalayan Studies, Ministry of Environment, Forestry and Climate Change, Government of India. Support received from the authors' organizations is also acknowledged.

## **APPENDICES**

Appendix 1 – Details of Technical Activities

Appendix 2 – Copies of Publications duly Acknowledging the Grant/ Fund Support of NMHS

Appendix 3 – List of Trainings/ Workshops/ Seminars with details of trained resources and dissemination material and Proceedings

Appendix 4 – List of New Products (utilizing the local resources like NTFPs, wild edibles, bamboo, etc.)

Appendix 5 – Copies of the Supporting Materials like Manual of Standard Operating Procedures (SOPs) developed under the project

Appendix 6 – Details of Technology Developed/ Patents filled, if any

Appendix 7 – Any other

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## Annexure-I

### Consolidated and Audited Utilization Certificate (UC) and Statement of Expenditure (SE)

For the Period: .....

1.	Title of the project/Scheme/Programme:	Exploring livelihood potential of wild growing stinging nettle ( <i>Urticadioica</i> ) in Uttarakhand
2.	Name of the Principle Investigator & Organization:	Dr VASUDHA PANT GREEN HILLS TRUST, ALMORA
3.	NMHS-PMU, G.B. Pant National Institute of Himalayan Environment, Kosi-Katarmal, Almora, Uttarakhand  Letter No. and Sanction Date of the Project:	<b>Ref. No.:</b> GBPNI/NMHS-2020-21/MG/  Date- 19-06-2020
4.	Amount received from NMHS-PMU, G.B. Pant National Institute of Himalayan Environment, Kosi-Katarmal, Almora, Uttarakhand during the project period (Please give number and dates of Sanction Letter showing the amount paid):	Sanctioned letter no. GBPNI/NMHS-2020-21/MG/36  Amount Rs. 22,02,334.00  UTR No. CBINR5202007101003195  Date: of Transaction: 10.07.2020  (We received the information

		on 13 <sup>th</sup> July 2020 by E mail)
5.	Total amount that was available for expenditure (Including commitments) incurred during the project period:	<b>INR 0.9706000 (in Cr)</b>
6.	Actual expenditure (excluding commitments) incurred during the project period:	-
7.	Unspent Balance amount refunded, if any (Please give details of Cheque no. etc.):	
8.	Balance amount available at the end of the project:	
9.	Balance Amount:	
10.	Accrued bank Interest:	

Certified that the expenditure of **Rs.**\_\_\_\_\_ (**Rupees** \_\_\_\_\_) mentioned against Sr. No. 6 was actually incurred on the project/scheme for the purpose it was sanctioned.

Date:

(Signature of  
Principal Investigator)

(Signature of Registrar/  
Finance Officer)

(Signature of  
Head  
of the Institution)

OUR REF. No.

ACCEPTED AND COUNTERSIGNED

Date:

COMPETENT AUTHORITY  
NATIONAL MISSION ON HIMALAYAN STUDIES (GBP NIHE)

## Statement of Consolidated Expenditure

[Institution Name here]

Statement showing the expenditure of the period from

Sanction No. and Date :

1. Total outlay of the project :

2. Date of Start of the Project :

3. Duration :

4. Date of Completion :

a) Amount received during the project period :

b) Total amount available for Expenditure :

S. No.	Budget head	Amount received	Expenditure	Amount Balance/ excess expenditure
1	Salaries			
2	Permanent Equipment Purchased (Item-wise			
3				
4				
5				
6				
7				
8				
9				
10	Institutional			



	charges			
11	Accrued bank Interest			
12	<b>Total</b>			

Certified that the expenditure of **Rs.**\_\_\_\_\_ ( **Rupees:**\_\_\_\_\_ )  
mentioned against Sr. No.12 was actually incurred on the project/ scheme for the purpose it was  
sanctioned.

Date:

(Signature of  
Principal Investigator)

(Signature of Registrar/  
Finance Officer)

(Signature of Head  
of the Institution)

OUR REF. No.

ACCEPTED AND COUNTERSIGNED

Date:

COMPETENT AUTHORITY  
NATIONAL MISSION ON HIMALYAN STUDIES (GBP NIHE)

## **Annexure-II**

### **Consolidated Interest Earned Certificate**

Please provide the detailed interest earned certificate on the letterhead of the grantee/ Institution and duly signed.

**Annexure-III**

**Consolidated Assets Certificate**

Assets Acquired Wholly/ Substantially out of Government Grants

**(Register to be maintained by Grantee Institution)**

Name \_\_\_\_\_ of \_\_\_\_\_ the \_\_\_\_\_ Sanctioning \_\_\_\_\_ Authority:

1. Sl. No. \_\_\_\_\_

2. Name \_\_\_\_\_ of \_\_\_\_\_ Grantee \_\_\_\_\_ Institution:

3. No. \_\_\_\_\_ & \_\_\_\_\_ Date \_\_\_\_\_ of \_\_\_\_\_ sanction \_\_\_\_\_ order:

4. Amount \_\_\_\_\_ of \_\_\_\_\_ the \_\_\_\_\_ Sanctioned \_\_\_\_\_ Grant:

5. Brief \_\_\_\_\_ Purpose \_\_\_\_\_ of \_\_\_\_\_ the \_\_\_\_\_ Grant:

6. Whether any condition regarding the right of ownership of Govt. in the property or other assets acquired out of the grant was incorporated in the grant-in-aid Sanction Order: \_\_\_\_\_

7. Particulars of assets actually credited \_\_\_\_\_ or acquired \_\_\_\_\_

8. Value \_\_\_\_\_ of \_\_\_\_\_ the \_\_\_\_\_ assets \_\_\_\_\_ as \_\_\_\_\_ on \_\_\_\_\_

9. Purpose \_\_\_\_\_ for \_\_\_\_\_ which \_\_\_\_\_ utilised \_\_\_\_\_ at \_\_\_\_\_ present \_\_\_\_\_

10. Encumbered \_\_\_\_\_ or \_\_\_\_\_ not \_\_\_\_\_

11. Reasons, \_\_\_\_\_ if \_\_\_\_\_ encumbered \_\_\_\_\_

12. Disposed \_\_\_\_\_ of \_\_\_\_\_ or \_\_\_\_\_ not \_\_\_\_\_

13. Reasons and authority, if any, for disposal \_\_\_\_\_

14. Amount realised on disposal \_\_\_\_\_

Any Other Remarks:

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**(PROJECT INVESTIGATOR)**

**(FINANCE OFFICER)**

**(Signed and Stamped)**

**(Signed and Stamped)**

**(HEAD OF THE INSTITUTION)**

**(Signed and Stamped)**

**Annexure-IV**

**List or Inventory of Assets/ Equipment/ Peripherals**

S. No.	Name of Equipment	Quantity	Sanctioned Cost	Actual Cost	Purchased	Purchase Details


**(PROJECT INVESTIGATOR)**

**(Signed and Stamped)**

**(FINANCE OFFICER)**

**(Signed and Stamped)**

**(HEAD OF THE INSTITUTION)**

**(Signed and Stamped)**

**Annexure-V**

**Letter of Head of Institution/Department confirming Transfer of Equipment Purchased under the Project to the Institution/Department**

To,

The Convener, Mountain Division

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Ministry of Environment, Forest & Climate Change (MoEF&CC)  
Indira Paryavaran Bhawan  
Jor Bagh, New Delhi-110003

**Sub.:** Transfer of Permanent Equipment purchased under Research Project titled “....” funded under the NMHS Scheme of MoEF&CC – reg.

Sir/ Madam,

This is hereby certified that the following permanent equipment purchased under the aforesaid project have been transferred to the Implementing Organization/ Nodal Institute after completion of the project:

1. ....
2. ....
3. ....
4. ....
5. ....
6. ....
7. ....

Head of Implementing Organization:  
Name of the Implementing Organization:

Stamp/ Seal:  
Date:

**Copy to:**

1. The Nodal Officer, NMHS-PMU, National Mission on Himalayan Studies (NMHS), G.B. Pant National Institute of Himalayan Environment (NIHE), Kosi-Katarmal, Almora, Uttarakhand-263643

## **Annexure-VI**

### **Details, Declaration and Refund of Any Unspent Balance**

Please provide the details of refund of any unspent balance and transfer the balance amount through RTGS (Real-Time Gross System) in favor of **NMHS GIA General** and declaration on the official letterhead duly signed by the Head of the Institution.

Kindly note the further Bank A/c Details as follows:

**Name of NMHS A/c:** NMHS GIA General

**Bank Name & Branch:** Central Bank of India (CBI), Kosi Bazar, Almora, Uttarakhand 263643

**IFSC Code:** CBIN0281528

**Account No.:** 3530505520 (Saving A/c)

In case of any queries/ clarifications, please contact the NMHS-PMU at e-mail: [nmhspmu2016@gmail.com](mailto:nmhspmu2016@gmail.com)