NMHS – Himalayan Institutional Project Grant

NMHS-FINAL TECHNICAL REPORT (FTR)

Demand-Driven Action Research Project Grant

NMHS Reference No.:	**GBPNI/NMHS-2017-18/SG-26, 23-02-2018**

Date of Submission:	**0**	**1**	**0**	**1**	**2**	**0**	**1**	**8**
	d	**d**	**m**	**m**	**y**	**y**	**y**	**y**

Project Title

LIVELIHOOD IMPROVEMENT THROUGH QUALITY CORM PRODUCTION VIZ-A-VIZ PROMOTION OF SAFFRON (*CROCUS SATIVUS* L.) CULTIVATION IN COLD ARID REGIONS OF LADAKH

Project Duration: 01-04-2018 to 31-03-2021

***Submitted to*:**

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NMHS-Final Technical Report (FTR) *template*

Demand-Driven Action Research Project

DSL: Date of Sanction Letter							
3	1	0	3	**2**	**0**	**1**	**8**
d	d	m	m	y	y	y	y

DPC: Date of Project Completion							
3	1	0	3	**2**	**0**	**2**	**1**
d	d	m	m	y	y	y	y

Part A: Project Summary Report

1. Project Description

i.	Project Reference No.	GBPNI/NMHS-2017-18/SG-26, 23-02-2018							
ii.	Type of Project	Small Grant	✓	Medium Grant		Large Grant			
iii.	Project Title	Livelihood improvement through quality corm production viz-a-viz promotion of saffron (*Crocus sativus* L.) cultivation in cold arid regions of Ladakh							
iv.	State under which Project is Sanctioned	Jammu and Kashmir							
v.	Project Sites (IHR States covered) (Maps to be attached)	**Annexure I**							
vi.	Scale of Project Operation	Local		Regional		Pan-Himalayan	✓		
vii.	Total Budget/ Outlay of the Project	37.588 lacs (in Cr)							
	Lead Agency	Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar, J&K							
	Principal Investigator (PI)	Dr. Mudasir Hafiz Khan Assistant Professor (Genetics & Plant Breeding) Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar, J&K							
	Co-Principal Investigator (Co-PI)	Dr. S. A. Dar Professor (Genetics & Plant Breeding), SKUAST-Kashmir Dr. B. A. Alie Professor (Agronomy), SKUAST-Kashmir Dr. G. H. Mir Assistant Professor (Plant Pathology), SKUAST-Kashmir							
ix.	Project Implementing Partners	Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar, J&K							

	Key Persons / Point of Contacts with Contact Details, Ph. No, E-mail	Dr. Mudasir Hafiz Khan Assistant Professor (Genetics & Plant Breeding) Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar, J&K E-mail: drmhkhan8@gmail.com Contact: +91-7006356653

2. Project Outcome

2.1. Abstract (not more than 500 words) [it should include background of the study, aim, objectives, methodology, approach, results, conclusion and recommendations).

Background:

Saffron (*Crocus sativus* L.) is an important spice, known for its aroma, colour and medicinal properties and is regarded as the costliest spice in the world. Despite its wide popularity which has enabled all saffron producing countries to increase production during the last 3-4 decades, there has been a decrease in saffron production in almost all the countries. One of the major causes for such a decline in the productivity of saffron is the use of low-quality planting material. Corm accounts for single most costly input in saffron cultivation. Saffron is sterile plant that does not produce seeds and are reproduced by corms. Therefore, selection of corms for propagation intention is an important factor in saffron production. Yield and quality of stigma and corms are affected by corm size. The determination of most suitable corm size would contribute to application of cultivation practices and ultimately yield and quality. An attempt to modernize saffron cultivation will therefore require efficient mass production of corms. Saffron research at Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar, India have also confirmed importance of corm size as one of the important component in improving saffron productivity. Thus, it is realized that the study of behavior of saffron corms for daughter corm production is of paramount importance for economizing the commercial scale corm production and making corms available for area expansion.

Therefore, the selection and quality corm production are crucial factors for saffron cultivation. Commercial corm production of saffron under both open and protected conditions is an important economic activity for farmers all over the world providing assured returns and additional employment. Its economic impact assessed at individual and aggregate levels provides stability, equity in income distribution across the groups and helps in improvement of family

welfare. Corm production/ multiplication of saffron under both open and protected conditions has been taken up only in recent years on experimental basis and the returns realized were more or less equal to the returns obtained from the economic yield (stigmas) of the saffron**.**

Since the project work was carried out at cold arid regions of Ladakh viz., Kargil and Zanaskar in a participatory mode with farmers and later its cultivation was carried by the village communities thereby has lead to economic improvement of the societies. UT of J&K has a high demand for quality planting material but the present availability is very meager to suffice only a part of the demand. More area expansion for corm multiplication / development at cold arid regions of Ladakh and availability of the quality material with farming community for its cultivation would largely minimize the ever-rising demand.

Aim:

The basic aim behind the project was to make available the quality planting material so that farming community would cultivate the saffron in their farms which otherwise in the coming years would become extinct. This leads to the overall improvement in the living standards of these communities besides generating the employment to the rural youth especially women. Furthermore, saffron cultivation has become a new introduction / crop having high value returns to the cold arid region of Ladakh.

Objectives:

1. Demonstration of saffron trials and agro-technologies under both open and protected conditions on farmer's fields;
2. Human resource development by imparting training to the farmers and unemployed rural youths on corm production/ multiplication;
3. To increase awareness, knowledge and capacities of farmers and rural unemployed youth through trainings and other programmes on the concept and principles of cultivation of saffron under both open and protected conditions.

Methodologies:

The project was implemented at two pilot sites of Kargil and Zanaskar areas of Ladakh (Site Map Annexure I). A survey of the area was made by Principal Investigator, Co-Principal Investigators, scientists of Research stations and KVK's of SKUAST-K and Officers of Development Department for identification of interested farmers / locations for formulation of

self-help groups of farmers each group consisting of 8-12 farmers. They were upraised of the programme of work and were made aware about the benefits of the cultivation of corm production/multiplication of saffron. It was focused that production of corms will bring much higher returns than other farming enterprises. Low-cost polyhouses were constructed at the selected locations at the farmers field which was followed with the purchase of the planting material. The sowing of the corms was carried in presence of the farmers side by side imparting them with the knowledge for cultivation of corms under both open and protected conditions. The women folk were equally involved in the programme as they being the main worker for such work in the UT. Various crop management practices including intercultural operations were carried as and when required in presence of the farmers. This was followed by harvesting of produce and its sale as per the approved rates. The farmers were also linked with India International Saffron Trade Centre for e-marketing of their saffron produce. During 3rd year of the project, corms were uprooted at some location (planting during 1st year of project). Farmers used a portion of uprooted corms for further cultivation while rest of the uprooted corms were sold to the other interested farmers in a participatory mode on the approved rates who too got involved into the cultivation business. Most of farmers planted the material in the expanded area leading to increased employment generation.

Approach*:*

The project activities were started by forming the self-help groups in Kargil and Zanaskar for adoption of latest saffron technologies developed by SKUAST-Kashmir for corm multiplication /development which were disseminated through awareness programmes and demonstration of trials under open and protected conditions in a participatory mode with the farmers. Local partner from Development Department of Agriculture, Research Stations and KVK's of SKUAST-Kashmir were also involved in demonstration of trials and conducting training programmes to acquaint the farmers with the knowledge of saffron cultivation for corm production on scientific lines.

Results

Objective 1

Demonstration of saffron trials and agro-technologies under both open and protected conditions on farmer's fields

Deliverables	Overall Achievements
Field Models (3) in cold desert areas (Ladakh) on involvement of local rural youth and women in corm production, processing, testing and distribution and transportation activities	6 low-cost Poly-houses were constructed out of which 4 were constructed in District Kargil at Sankoo, Batalik, Trespone and Panikhar and 2 in District Zanaskar at Nerok for corm multiplication under protected conditions (Annexure III). During the project period a total of 77 demonstration trials were conducted at farmers fields involving local rural youth and women in two Districts of Ladakh viz., Kargil and Zanaskar covering total area of 21.65 kanals. Improved Saffron technologies developed by SKUAST-Kashmir viz., High Density Production System Module, Irrigation module, Nutrient Management Module etc. were used for raising good crop. In addition, two trials one each at Research Farm of MAR&ES Kargil and KVK Kargil were laid on ½ Kanal each for show casing the improved SKUAST-Kashmir technologies to the farmers. Foliage and flowering of the demonstration trials under cold arid conditions were comparable to the temperate regions of Kashmir valley. During demonstration of trials Saffron kits were also distributed amongst the beneficiaries covered under both open and protected conditions (Annexure IV & IVa)

Objective 2 & 3:

Human resource development by imparting training to the farmers and unemployed rural youths on corm production/ multiplication

To increase awareness, knowledge and capacities of farmers and rural unemployed youth through trainings and other programmes on the concept and principles of cultivation of saffron under both open and protected conditions.

Deliverables	**Overall Achievements**
Increased knowledge and practices as a result of increased beneficiaries, awareness and understanding of crop production and management activities.	Various training cum awareness camps were carried out at KVKs, Farm Centres and farmers fields. Identified farmers as well as the farmers surrounding the project locations were acquitted with the scientific knowledge of Saffron cultivation for corm production/multiplication which has created the entrepreneurship within the farmers and the unemployed rural youth. The success of this endeavour can be inferred from the facts that the area under the saffron cultivation has been expanded to a large extend (Annexure V). Area expansion under the saffron cultivation and adoption of crops by the surrounding farmers clarifies that the project has improved the living standard of the farmers which can also be assessed from the economic analysis of the crop. Further, climatic conditions of the project locations during the flowering season showed improvement in yield attributes and quality of the produce (saffron) viz., crocin, picro-crocin and safranal content over temperate conditions (Table 1 & 2). With regard to corm traits, Multiplication Index and Big corm index was also very high. These parameters finally increased the household income thereby improved living standards of the farmers. The corms produced were sold to the other interested farmers in a participatory seed production programme at the sale rates as approved by the university. This is clear from the economic analysis Table 3. (Annexure VI). The corms produced during the 3rd year were uprooted

	and sold to the surrounding/ interested farmers in a participatory seed production programme at the sale rates as approved by the university. This is clear from the economic analysis Table. 3. There is a huge demand for the planting material of saffron across the country and the Development Department of Agriculture Kashmir also contacted the farmers for supply of planting material for area expansion in the Kashmir Valley so as to meet out the national demand which otherwise is imported from Iran and Spain.

Conclusions

From the current study it is concluded that expansion of saffron cultivation in other potential areas of UT Ladakh using improved agro-technologies would not only increase the earnings from the farm produce but also create the employment generation and thereby improvement in the livelihood of the farmers. Further, transfer of improved technologies by continuing to undertake testing, training and demonstration on farmers' fields and using all established extension methods would increase the total production thereby reduce the burden on the import of saffron side by side stabilizing the UT Ladakh economy.

Recommendations

The project findings can help the youth/woman farmers to explore livelihood options in saffron cultivation because the region has great potential for saffron & corm production under both protected and open field conditions as a sole or intercrop.

2.2. Objective-wise Major Achievements

Agriculture in Cold Arid Regions of Ladakh is a way of life for the agrarian population and nearly 70% population is directly or indirectly dependent on this sector. Despite the vast geographical area, 62% of the households has less than 1 ha cultivable land. Single-cropping is dominant, as double-cropping is possible only in a limited area falling below an altitude of approximately 3000 m. This farming system fetches average net returns of Rs. 25000 to 40000 per ha per annum. The returns are too meager to sustain a family partially or fully dependent on such cropping. Saffron is a high value crop fetches average net returns of Rs 2.5-3.0

lakhs/ha/annum thereby provides a better means of livelihood to the farming families. The demand of quality planting material (corms) of saffron at UT as well as National level assumes a great significance for its area expansion both vertical and horizontal to meet out the national demand. The major achievements under the project were:

- During the project period viz., 2018-2021, 9 Self-help groups were formulated each constituting of 9-12 farmers. As per the objective of the project, 6 low-cost Poly-houses were constructed out of which 4 were in District Kargil and 2 in District Zanaskar for corm multiplication under protected conditions. The saffron produce (stigma) under the protected conditions showed higher contents of crocin, picro-crocin and saffranal contents as compared to the open field conditions.
- A total of 77 demonstration trials (open field) were conducted during 2018-2021 covering total area of 21.65 kanals. Improved Saffron technologies developed by SKUAST-Kashmir viz., High Density Production System Module, Irrigation module, Nutrient Management Module etc. were used for raising good crop. These production technologies were well adapted at the project locations and the yield and quality of the farm produce showed significant improvement over the traditional practices.
- Area expansion under the saffron cultivation and adoption of crops by the surrounding farmers clarifies that the project has improved the living standard of the farmers which can also be assessed from the economic analysis of the crop (Table 3). Further, climatic conditions of the project location during the flowering and vegetative seasons improved the corm yield and quality of the produce (saffron) viz., crocin, picro-crocin and safranal content over temperate conditions. With regard to corm traits, big corm index at most of the locations under both open and protected conditions was 70-80% and the corm multiplication index was 1:3-4 which is comparatively higher as compared to the temperate conditions. These parameters finally increased the household income thereby improved living standards of the farmers.
- Adoption of new technologies by the farmers viz., intercropping of vegetables with saffron has increased the cropping intensity of the area upto 150-160% which otherwise was limited to 106%. Further, the corms produced during the 3rd year were uprooted and most of the farmers didn't agree to sell their produce rather they expanded their own area under saffron cultivation.

- Under the project, saffron crop was introduced to other parts of the country viz., Almora and Ranikhath Uttrakhand, where the crop shows good flowering as well as corm production /multiplication. The SOP of saffron has also been formulated for these areas (Annexure IX).
- A total of 9 training programmes were organized during the project period in which 270 farmers participated. These farmers were acquainted with the knowledge of scientific cultivation of saffron for stigma and corm production under both protected and open conditions.
- On seeing the results from the demonstration trials, most of the farmers have started the saffron cultivation in the surrounding areas. The farmers have started the saffron cultivation of their own which is the big achievement of the project.

2.3 Outputs in terms of Quantifiable Deliverables

Objectives	**Quantifiable Output against each objective**	**Progress made against Monitoring Indicators (specified in Sanction Letter)**	**Remarks**
Construction of Poly-houses/poly tunnels for corm multiplication in cold arid regions of Ladakh	All the polyhouses / poly tunnels were constructed as per the objective of the project. A total of 6 polyhouses were constructed out of which 4 were constructed in District Kargil and 2 in Zanaskar	Corm multiplication index and Big corm index under the protected conditions was significantly higher as compared to open conditions. Farmers have constructed a number of poly tunnels at their own in view of benefits accrued from high corm multiplication under protected conditions	Annexure III
Demonstration of saffron trials and agro-technologies under both open and protected conditions on farmer's fields	During the project period a total of 77 demonstration trials were conducted covering total area of 21.65 kanals. Improved Saffron technologies viz., High Density Production System Module, Irrigation module,	Adoption of saffron cultivation using improved technologies have significantly increased their farm income as compared to their traditional cultivation of grasses and some cereals	Annexure IV and IVa

	Nutrient Management Module etc. were used for raising good crop have been well adopted by the farmers.		
Human resource development by imparting training to the farmers and unemployed rural youths on bulb production and quality control.	Various training cum awareness camps were carried out at KVKs, Farm Centres and farmers fields. Identified farmers as well as the farmers surrounding the project locations were acquitted with the scientific knowledge of Saffron cultivation for corm production/multiplication which has created the entrepreneurship within the farmers and the unemployed rural youth.	The success of this endeavour can be inferred from the facts that the area under the saffron cultivation has been expanded to a large extend. Further, farmers have approached for vertical expansion of the crop due to non-availability of the suitable soil for saffron cultivation	Annexure V
Imparting technical knowhow with regard to scientific cultivation of saffron for corm multiplication to farmers, unemployed rural youth especially women folk so as to develop the human resource.	Area expansion under saffron cultivation and adoption of latest technologies developed by SKUAST-K by the farmers	Area expansion under the saffron cultivation and adoption of crops by the surrounding farmers clarifies that the project has improved the living standard of the farmers which can also be assessed from the economic analysis of the crop. Further, climatic conditions of the project locations during the flowering season showed improvement in yield attributes and quality of the produce (saffron) viz., crocin, picro-crocin and	Annexure VI

		safranal content over temperate conditions (Table 1 & 2). With regard to corm traits, Multiplication Index and Big corm index was also very high. These parameters finally increased the household income thereby improved living standards of the farmers. The corms produced were sold to the other interested farmers in a participatory seed production programme at the sale rates as approved by the university. This is clear from the economic analysis Table 3.	
Distribution of corms at reasonable price through farmer's participatory seed production programme	Ensuring corm production and distribution at reasonable price through participatory seed production programme	The corms produced during the 3rd year were uprooted and sold to the surrounding/ interested farmers in a participatory seed production programme at the sale rates as approved by the university. This is clear from the economic analysis Table. 3. There is a huge demand for the planting material of saffron across the country and the Development Department of Agriculture Kashmir also contacted the farmers for supply of planting material for area expansion so as to meet out the national demand.	

Methodology (in brief)	➢ Formation of self-help groups ➢ Construction of polyhouses/ poly tunnels ➢ Demonstration of trails in the farmers field under both open and protected conditions ➢ Human resource development through Trainings and awareness camps ➢ Corm production and distribution at reasonable price through farmers participatory seed production programme.

2.4 Strategic Steps with respect to Outcomes (in bullets)

S.No.	Particulars	Number/ Brief Details	Remarks/ Enclosures
1	New Methodology developed	Introduction of new crop	Introduction of saffron under cold arid conditions of Ladakh
2.	New Models/ Process/ Strategy developed	Techno Economic Viability.	1. The cultivation of saffron by the farmers under both open and protected conditions using improved agro-technologies developed by SKUAST-K proved that the saffron is highly economic and viable in view of the returns accrued from the produce of the crop (stigma and corms) compared to cultivation of traditional crops viz., grasses and some cereals.
		Improvement in productivity	2. Productivity per unit area of saffron showed manifold increase over the traditional crops. Apart from the production, the quality of the produce viz., crocin, picro-crocin and saffranal content was also higher under cold arid conditions as compared to the temperate areas (Table 2). Moreover, Multiplication Index and Big Corm Index under both protected and open conditions under cold arid conditions was much high than under temperate conditions.

		Income generation /living standard	3. Cultivation of saffron by the farmers under both open and protected conditions showed higher returns as compared to the traditional crops thereby improved their living standards. Continued production of the crop would not only improve the living standards of the farmers but has also created employment generation amongst unemployed youth and women folk.
3.	New Species identified	-	Nil
4.	New Database established		
5.	New Patent, if		

3. Technological Intervention

S.No.	Type of Intervention	Brief Narration on the interventions	Unit Details (No. of villagers benefited / Area Developed)
1.	**Production technology**	High Density Production System Module for Saffron: High Density Module (10 lakhs corms/ha) yields 8-10 kg saffron/ha with BC ratio of 4.28:1 as compared to 3.99:1 in normal plating (5 lakh corms/ha)	8
		Irrigation Module: Irrigation Module in saffron increased yield by 40%	22
		Nutrient Management Module: During final ploughing of filed, application of FYM @ 15 T/ha, Sheep Manure @ 6 q/ha and Vermicompost @10 q/ha alongwith RFD showed improvement in yield of saffron and corms	31
		Weed Management Module: Application of Mertibuzin in December followed by Mertibuzin in February @ 560 g/ha showed significant improvement in controlling	77

		winter saffron weeds which leads to good growth and development of crop.	
		Quality Improvement: Picking of unopened or one day old flowers and separation of pistil from flowers within 10-12 hours of picking followed by drying using dryers (Solar/Hot Air) improves quality by 60 %.	26
3.	Publication of Technological / Process Manuals	➢ 2 research paper ➢ 2- literatures for famers (SOP) ➢ 1-Manual (under process)	
4.	Induction of New Technology in the region	➢ Indoor Saffron cultivation ➢ Intercropping of Saffron with Kalazeera	

4. New Data Generated over the Baseline Data

S. No.	New Data Details	Status of Existing Baseline	Additionality and Utilisation New data
1.	Saffron cultivation has been introduced in various areas of Zanaskar District of UT Ladakh	Till 2018, only few farmers were cultivating the saffron.	-
2.	New areas viz., Batalik, Sankoo, Shergol, Thanzgam and Sanachey were covered under saffron cultivation in Kargil District.	Saffron cultivation was confined to few areas of the district which includes Trespone, Panikhar and Minjee	-
3.	New technologies developed by SKUAST-Kashmir viz., High density production system module, Irrigation module, Disease and Inspect pest module etc were introduced in Kargil and Zanaskar and are well adapted by the farmers	Saffron cultivation by traditional practices	-
4.	270 farmers trained with regard to saffron cultivation on scientific lines	Farmers were using traditional practices	-

5. Demonstrative Skill Development and Capacity Building/ Manpower Trained

S. No.	Type of Activities	Details with number	Activity Intended for Participants/	Manpower Trained	Total
1	Workshops	3	Scientific Saffron cultivation using improved technologies	120	120
2	On Field Trainings	9		270	270
3	Skill development				
i.	Demonstration of saffron cultivation using improved agro-technologies	77		180	180
ii.	Famer meetings/ Awareness programmes	10		60	60
iii.	Outreach programmes	6		60	60
4	Academic Supports	-		-	-
5	Others (if any)				

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

S. No	Linkages /collaborations	Details	No. of Events Held	Beneficiaries
1.	Sustainable Development Goal (SDG) S	The project is itself sustainable. Multiplication and corm development rate at the project sites was very high. Moreover, the produce from the trials i.e., saffron was also superior in quality and yield which has made the project sustainable.		
2.	Climate Change/INDC targets			
3.	Internation. Commitments			
4.	Bilateral engagements			
5.	National Policies			

6.	Others collaborations	The project is linked with the Development Department of Agriculture, Research Stations and KVK's, SKUAST-K. Development Departments of Agriculture of Ladakh and J&K are ready to take the farm produce (corms) for area expansion of the crop in order to meet out the national demand.		

7. Project Stakeholders/ Beneficiaries and Impacts

S. No.	Stakeholders	Support Activities	Impacts
1	Gram panchayat		
2	Govt Departments (Agriculture/ Forest)	The project is linked with the Department of Agriculture and KVK's of SKUAST-Kashmir and both these agencies are very keen to expand the crop in other areas of cold arid regions of Ladakh. Further, the project beneficiaries have been linked with the India International Saffron Trade Centre for quality analysis and e-marketing of their produce (saffron) so as to fetch the higher prices.	Development Deptt. of Agriculture and KVK's of SKUAST-K are making keen efforts to disseminate the project outcomes amongst farmers through conduct of Trainings programmes, awareness camps etc.
3	Villagers	Farmers were found more involved in Saffron cultivation. They were demanding for mega project in order to expand the crop in other areas of the region	Farmers showed keen interest in Saffron cultivation in order to get high benefits as compared to their traditional crops
4	SC Community		
5	ST Community		
6	Women Group	Women were equally involved in this business as they are the main	They also showed keen interest in saffron

		workers for agriculture production in the region	cultivation because of much higher returns than other crops.
	Others (if any)		

8. Financial Summary (Cumulative) (Rs.)

S. No.	Financial Position/Budget Head	Funds Received	Expenditure/ Utilized*	% of Total cost
I.	Salaries/Manpower cost			
II.	Travel			
III.	Expendables &Consumables	**UC SUBMITTED**		
IV.	Contingencies			
V.	Activities & Other Project cost			
VI.	Institutional Charges			
VII.	Equipments			
	Total			
	Interest earned			
	Grand Total			

* Final UC will be submitted after expenditure of balance amount

9. Equipment/ Peripherals Procured under the Project (if any)**

S. No	Name of Equipments	Cost (INR)	Utilisation of the Equipment after project
1.		NA	

10. Quantification of Overall Project Progress

S. No.	Parameters	Total (Numeric)	Remarks/ Attachments/ Soft copies of documents
1.	IHR States Covered	Jammu and Kashmir	
2.	Project Site/ Field Stations Developed	A total of 77 project sites were developed out of which 6 sites were under protected conditions as per the technical programme	
3.	New Methods/ Modeling Developed	Corm multiplication under protected conditions is a new method which has increased the	

		returns to the farmers. Adoption of this method on larger scale would improve the livelihood of the farmers in Cold Arid regions of Ladakh. Further, intercropping of vegetable with saffron cultivation is a new innovation	
4.	No. of Trainings arranged	9	
5.	No of beneficiaries attended trainings	270	
6.	Scientific Manpower Developed	1	
7.	SC stakeholders benefited		
8.	ST stakeholders benefited		
9.	Women Empowered		
10.	No of Workshops Arranged along with level of participation	3 (120)	
11.	On field Demonstration Models initiated	77	
12.	Livelihood Options promoted	Higher returns from the produce of the crop (Saffron and corms) have improved the livelihood options of the farmers. Farmers are now diversifying their traditional crops with saffron and are also expanding the area under its cultivation	
13.	Technical/ Training Manuals prepared	Manual on scientific cultivation of saffron (SOP) under cold arid conditions of Ladakh have been published	.
14.	Processing Units established	Annexure IV	
15.	No. Species Collected	-	
16.	New Species identified		
17.	New Database generated (Types) Project Site/ Field Stations Developed	A total of 77 project sites were developed out of which 6 sites were under protected conditions as per the technical programme	
18.	Others if any		

11. Knowledge Products and Publications:

S. No.	Publication/ Knowledge Products	Number		Total Impact Factor	Remarks/ Enclosures
		National	International		
1.	Journal Research Articles/ Special Issue:	02	-		
2.	Book Chapter(s)/ Books:	-	01		
3.	Technical Reports	-			
4.	Training Manual (Skill Development/ Capacity Building)	1			
5.	Papers presented in Conferences/Seminars	-	01		
6.	Policy Drafts/Papers				
7.	Others:				

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

Particulars	Recommendations
Utility of the Project Findings	The project findings have immense potential as baseline information to help the youth/woman farmers to explore livelihood options in saffron cultivation.
Replicability of Project	The outcome of the project has wide replicability for corm production in other areas of cold arid regions of Ladakh as well as in country.
Exit Strategy	The farmers have already expanded the area under saffron cultivation, distributed the planting material to the farmers in other areas in a participatory mode for its area expansion. Since the returns from this cultivation are much higher so they do not need further assistance from the project. Further, the outcome of the project will be disseminated amongst other farmers through the Department of Agriculture and KVK's of SKUAST-K as they have already been liked with them. The transferable technology under the project will always inspire the farmers especially the youth for developing entrepreneurship in saffron cultivation. So sharing the outcomes of the project with Department of Agriculture and by support of beneficiary farmers under the project will give a strategic exit.

(**PROJECT PROPONENT/ COORDINATOR**)
(Signed and Stamped)

(**HEAD OF THE INSTITUTION**)
(Signed and Stamped)

Place: SKUAST Shalimar

PART B: PROJECT DETAILED REPORT

1 EXECUTIVE SUMMARY

Agriculture in Cold Arid Regions of Ladakh is a way of life for the agrarian population and nearly 70% population is directly or indirectly dependent on this sector. Despite the vast geographical area, 62% of the households has less than 1 ha cultivable land. Single-cropping is dominant, as double-cropping is possible only in a limited area falling below an altitude of approximately 3000 m. This farming system fetches average net returns of Rs. 25000 to 40000 per ha per annum. The returns are too meager to sustain a family partially or fully dependent on such cropping. Saffron is a high value crop fetches average net returns of Rs 2.5-3.0 lakhs/ha/annum thereby provides a better means of livelihood to the farming families. The demand of quality planting material (corms) of saffron in the Valley assumes a great significance. In view of limited availability of quality planting material, the production of saffron is declining year by years. Due to the non-availability of the quality planting material the farmers are now shifting their cultivation from saffron to some other crops as a result of which the crop is becoming endangered in the country. The crop is shade loving and thrives best in the cold climate for its corm multiplication and development. Moreover, there is great demand of the quality planting material across to country for its area expansion both vertical and horizontal to meet out the national demand. It has been determined that by using quality planting material applied with recommended production technology, an average saffron yield of 11.87 kg/ha (4 years planting cycle) has been produced as compared to a low yield of 2.5 kg/ha produced by the farmers using their own produced seed material applied with their traditional practices. So, for realizing higher yields both quality plant material and use of improved technologies is essential.

In the present project cultivation of saffron for corm production using improved agro-technologies under both open and protected conditions resulted in higher corm and saffron production with high Big corm index and quality of saffron thereby gave high returns to the farmer as compared to growing traditional crops. The project yields livelihood improvement of the rural people especially women and employment generation amongst rural youth through production of quality saffron and corms and their availability at right time to the farming community. The results of the project bring a drastic change in economic status of the farmers. The employment generation especially to women folk improved the living standards of the community. Further, the traditional crop cultivation of low value crops has been replaced by the

high value crop viz., saffron to a large extent thereby the returns are higher which attracted other farmers to get involved in saffron cultivation.

2. INTRODUCTION

2.1 Background of the Project

Saffron (*Crocus sativus* L.) is an important spice, known for its aroma, colour and medicinal properties and is regarded as the costliest spice in the world. Despite its wide popularity which has enabled all saffron producing countries to increase production during the last 3-4 decades, there has been a decrease in saffron production in almost all the countries. One of the major causes for such a decline in the productivity of saffron is the use of low-quality planting material. Corm accounts for single most costly input in saffron cultivation. Saffron is sterile plant and does not produce seeds and are vegetatively reproduced by corms. Therefore, selection of corms for propagation intention is an important factor in saffron production. Yield and quality of stigma and corms are affected by corm size. The determination of most suitable corm size would contribute to application of cultivation practices and ultimately yield and quality. An attempt to modernize saffron cultivation will therefore require efficient mass production of corms. Saffron research at Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar, India have also confirmed importance of corm size as one of the important components in improving saffron productivity. Thus, it is realized that the study of behavior of saffron corms for daughter corm production is of paramount importance for economizing the commercial scale corm production and making corms available for area expansion. Therefore, the selection and quality corm production are crucial factors for saffron cultivation. Commercial corm production of saffron under both open and protected conditions is an important economic activity for farmers all over the world providing assured returns and additional employment. Its economic impact assessed at individual and aggregate levels provides stability, equity in income distribution across the groups and helps in improvement of family welfare. Corm production/ multiplication of saffron under both open and protected conditions has been taken up only in recent years on experimental basis and the returns realized were more or less equal to the returns obtained from the economic yield (stigmas) of the saffron**.**

The production technologies developed by Advanced Research Station for Saffron and Seed Spices, SKUAST-Kashmir viz., high density production system module, irrigation module and management of diseases and rodents has increased the yield of saffron and corms to

approximately 40 per cent over the traditional practices used by the farmers. These technologies were used in the farmers fields so as to fetch good returns from saffron cultivation which lead to the improvement in the living standards of the farming communities, besides increasing employment generation amongst unemployed rural youths. The brief of some of these technologies are hereunder:

a) High Density Production System Module

High Density Production System module developed by SKUAST-Kashmir ensures high productivity of about 8-9 kg/hectare. Corms planted at 12 lac/ha exhibited superiority by 45-50% over-normal density of 5 lac corms/ha. Plantation of mixed grade corms under high density fetches more economic benefits compared to normal density from 1st year of planting cycle. On an average high density production system module produces 7-8 kg saffron/ha compared to 4-5 kg saffron/ha achieved under normal density during 3 years of saffron cultivation.

b) Irrigation Module

Saffron is sensitive to water particularly during active stags of crop growth viz., August to November. Irrigation schedule based on 7 irrigations (980m^3=98mm) @ 140m^{3}1 irrigation starting from 20th August to 25th October and 7th November to 4th December has been standardized for saffron and is being adopted by Mechanical Engineering Division for Saffron Irrigation. Water requirement is in addition to 131 mm (1310m^3) available to saffron through rains during August to November, confirming total water requirement of 229 mm (2290m^3) for saffron. Application of 1310 m^3 water/ha using sprinkler system of irrigation recorded saffron yield of 7.5 kg/ha confirming relevance of irrigation at critical stages of saffron cropping cycle.

c) Management of Corm rot

Recently a bio-fungicide has been developed by Advanced Research Station for Saffron and Seed Spices, SKUAST-Kashmir, SKUAST-K against corm rot a deadly disease of saffron. Use of this bio-fungicide has shown good results against corm rot disease.

Since the project work was carried out at cold arid regions of Ladakh viz., Kargil and Zanaskar in a participatory mode with farmers and later its cultivation was carried by the village communities thereby has led to economic improvement of the societies. UT of J&K has a high demand for quality planting material but the present availability is very meager to suffice only a part of the demand. More area expansion for corm multiplication / development at cold arid

regions of Ladakh and availability of the quality material with farming community for its cultivation would largely minimize the ever-rising demand.

2.2 Overview of the Major Issues to be Addressed (max. 1000 words)

Following were the major issues for saffron production which have been addressed under the project:

1. **Crop diversification and cropping intensity:** Ladakh is a mono cropping region and double-cropping is possible only in a limited area falling below an altitude of approximately 3000 m which indicates the low cropping intensity of the region. Wheat, barley and grasses are the major crops which are grown in the region and this farming system fetches average net returns of Rs. 25000 to 40000 per ha per annum. The returns are too meager to sustain a family partially or fully dependent on such cropping. Further, low returns have disinterested the farmers for crop cultivation and most of the farmers have kept their fields fallow. Saffron is a high value crop fetches average net returns of Rs 2.5-3.0 lakhs/ha/annum thereby provides a better means of livelihood to the farming families. With implementation of the present project, the farmers have shown keen interest in saffron cultivation because of higher returns from the crop and most of the fallow land at the project locations is now under saffron cultivation. Further, cropping intensity of the adopted area has also been increased because of intercropping of vegetables with saffron as the cropping cycle of the saffron is completed in the month of May-June and the farmers are easily cultivating the vegetable in-between the ridges of the saffron crop.
2. **Non-availability of Quality planting material**: Adoption of latest technologies developed by SKUAST-Kashmir by the farmers under both open and protected conditions have led to availability of assured quality planting material with the farmers covered under the project.
3. **Improvement in livelihood of the farmers**: Production of quality produce of saffron and planting material (corms) has resulted in manifold increase in the profits thereby improved the livelihood of the farmers to a large extent.
4. **Skill development of farmers and unemployed youth**: Under the project, the farmers and unemployed youth were imparted with the trainings and workshops in the field which developed skill in them for scientific cultivation of saffron. This is clear from the fact that

area under saffron cultivation has increased and there is further demand for horizontal and vertical expansion of the crop in other areas of the region.

2.3 Baseline Data and Project Scope (max. 1000 words)

Livelihood of the majority of the population of the UT Ladakh revolves around the agriculture and allied sectors. These sectors constitute the mainstay of the UT's economy and contribute nearly 50 per cent to GSDP. Over 70 per cent of the population of the region depends directly or indirectly on agriculture and its allied sectors. Agriculture in the UT faces several challenges that include inherent constraints of remoteness and inaccessibility, marginality and fragility in terms of moisture stress and poor soil conditions and a short growing season. Added to this, are socioeconomic constraints that, includes small land holdings, poor productivity, poor production management, labour shortages, poor post-harvest management, poor market networks (lack of market development) and lack of entrepreneurship. All these factors have led to underutilization of available resource base leading to limited generation of surpluses. Though area, production and productivity of different crops have increased over time, the rate of development has been very slow. The cropping intensity in Ladakh region is reported to be 106%, high cropping intensity is typically constrained by the incidence of moisture stress at the sowing time, inundation of fields in low lying areas after winter, harsh winters and short growing season. The diversification in the physiographic features and agro-climatic variation at macro- and micro-level involving cold arid climate indicates the inherent agricultural potential of the UT. Over the years, farmers have adopted several areas- specific and time specific cultivation practices to meet the requirement of their staple food crops. Wheat, barley, grasses and some vegetables are the main crops of the UT. There is currently a shift towards cultivating low-volume high-value cash crops such as saffron, kalazeera, aromatic & medicinal plants, mushrooms etc. which fetches higher returns.

Saffron is the most expensive spice crop and is known all over the world for its colour taste, aroma and medicinal properties. At present the total saffron production in the country is 16.5 MT when the actual national demand is 100 MT. The deficit of 84 MT of saffron in the country is mostly imported from Iran which drains the national income worth Rs 12450 crores annually. The important means to reduce this gap between demand and supply could be achieved by bringing the potential non-traditional areas under saffron cultivation, however, the major constraint for area expansion of the crop is non-availability of quality planting material. The

demand of quality planting material (corms) of saffron across the country assumes a great significance. In view of limited availability of quality planting material, the production of saffron is declining year by years. Saffron cultivation is done on limited areas of the country particularly under the temperate and cold arid conditions and the areas where the project has been implemented suits best for its corm multiplication. Primary goal of the project was to produce quality corms for making them available to the farming communities so that they get much higher returns from the sale of their produce. Secondary goals were to disseminate the production technologies developed by SKUAST-K viz., high density production system module, irrigation module, plant protection and post-harvest modules etc. which would boost up the saffron production in the UT Ladakh. At the project locations it was noticed that by using quality planting material along with recommended production technologies, the farmers harvested an average saffron yield of 5.5-6.0 kg/ha compared to 2.5 kg/ha being produced by the farmers using low quality planting material applied with their traditional practices. Further, it was observed that the quality of the saffron viz., crocin, picro-crocin and saffranal content produced under open and protected condition in cold arid regions was more as compared to the temperate conditions.

The rural masses are always involved in agri-business from which they just earn to fill their bellies keeping in view that both men and women work in the fields. Saffron a high value crop is much more remunerative and thereby brings higher returns. As corm production has great demand across the country and therefore engagement of rural masses both men and women folk in the business would lift-up their wretched condition and make their life honorable. Having the assured market, the production technologies disseminated under the project for production of corms under both protected and open conditions would realize much higher returns as compared to the cultivation of traditional low value crops.

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

Project Objectives	Quantifiable Deliverables	Monitoring indicators
➢ Demonstration of saffron trials and agro-technologies under both open and protected conditions	➢ Field Models (3) in cold desert areas (Ladakh) on involvement of local rural youth and women in corm production,	**1. Region-specific best practices/ models developed for corm production;** ➢ Under protected conditions – 6 ➢ Under open field conditions – 71

<table>
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<td>on farmer's fields;
➢ Human resource development by imparting training to the farmers and unemployed rural youths on corm production/ multiplication;
➢ To increase awareness, knowledge and capacities of farmers and rural unemployed youth through trainings and other programmes on the concept and principles of cultivation of saffron under both open and protected conditions.</td>
<td>processing, testing and distribution and transportation activities;
➢ Increased knowledge and practices as a result of increased beneficiaries, awareness and understanding of crop production and management activities.</td>
<td>2. No. of Stakeholders benefitted
➢ 77 farming families which constitutes approximately 180 beneficiaries were benefitted under the project besides 510 farmers including rural youth and women were trained with regard to corm production under protected and open field conditions
3. No. of Capacity Building Trainings/ Awareness Programmes
<table>
<tr><th>Program</th><th>No.</th><th>No. of Beneficiaries</th></tr>
<tr><td>Workshops</td><td>3</td><td>120</td></tr>
<tr><td>On-farm training</td><td>9</td><td>270</td></tr>
<tr><td>Farmers meetings</td><td>10</td><td>60</td></tr>
<tr><td>Outreach programmes</td><td>6</td><td>60</td></tr>
<tr><td>Total</td><td>28</td><td>510</td></tr>
</table>
4. Other Publications and knowledge products
➢ Research Papers – 2
➢ SOP – 2
➢ Manual – 1
➢ Book Chapter - 1</td>
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3 METHODOLOGIES, STARTEGY AND APPROACH

3.1 Methodologies used for the study

The project was implemented at two pilot sites of Kargil and Zanaskar areas of Ladakh. A survey of the area was made by Principal Investigator, Co-Principal Investigators, scientists of Research stations and KVK's of SKUAST-K and Officers of Development Department for identification of interested farmers / locations for forming of self-help groups of farmers each group consisting of 8-12 farmers. A total of 9 self-help groups were formed comprising of 90 farmers were upraised of the programme of work and were made aware about the benefits of corm production/multiplication of saffron. It was focused that production of corms will bring

much higher returns than other farming enterprises. Low-cost polyhouses were constructed at the selected locations at the farmers field which was followed with the purchase of the planting material. The sowing of the corms was carried in presence of the farmers side by side imparting them with the knowledge for cultivation of corms under both open and protected conditions. The women folk were equally involved in the programme as they being the main worker for such work in the UT. Various crop management practices including intercultural operations were carried as and when required in presence of the farmers. This was followed by harvesting of produce and its sale as per the approved rates. The farmers were also linked with India International Saffron Trade Centre, Pampore for e-marketing of their saffron produce. During 3rd year of the project, corms were uprooted at some location (planting during 1st year of project). Farmers used a portion of uprooted corms for further cultivation while rest of the uprooted corms were sold to the other interested farmers in a participatory mode on the approved rates who too got involved into the cultivation business. Most of farmers planted the material in the expanded area leading to increased employment generation.

3.2 Preparatory Actions and Agencies Involved

- The project was executed in collaboration with Developemnt Department of Agriculture, KVK's of the concerned areas and MAR&ES Kargil.
- Local panchayat members were also included as partners for dissemination of outcomes.
- Under this project, awareness programmes for knowledge and skill development in selected villages were conducted for saffron cultivation and corm production

3.3 Details of Scientific data collected and Equipments Used

- 6 Poly-houses were constructed at 06 project locations viz. Kargil at Sankoo, Batalik, Trespone and Panikhar and 2 in District Zanaskar at Nerok.
- 9 Self-Help groups each comprising of 9-12 members were constituted various project location. The details are given in Annexure II
- A total of 77 demonstration trials were conducted in two Districts of Ladakh viz., Kargil and Zanaskar covering total area of 21.65 kanals. In addition, two trials one each at Research Farm of MAR&ES Kargil and KVK Kargil were laid on ½ Kanal of land each for show casing the improved SKUAST-Kashmir technologies to the farmers.

- Improved Saffron technologies developed by SKUAST-Kashmir viz., High density production system module, Irrigation module, Nutrient management etc. were used for raising good crop.
- Quality estimation of saffron viz., crocin, picro-crocin and safranal through Spectrophotometry was done for samples collected from each project location.
- Saffron corms and Farm Kits were distributed among the farmers for demonstration of trials.
- After uprooting of corms during 3rd year of the project, the material was sold in a participatory mode at the rates as approved by the SKUAST-Kashmir
- During the project duration, awareness programmes for knowledge and skills developed among local community were conducted with regard to scientific saffron cultivation fr yield and corm production which helped the farmers to start saffron cultivation.
- Economic analysis of the saffron cultivation was done and the results revealed the B:C ratio of 1:2.27 and 1:2.01 under protected and open conditions, respectively.

3.4 Details of Field Survey arranged (max 500 words)

During 2018-19 a survey of the area (Kargil and Zanaskar) was made by Principal Investigator, Co-Principal Investigators, scientists of Mountain Agriculture Research & Extension Station, SKUAST-K, Kargil, KVK's of SKUAST-K and Officers of Development Department for identification of interested farmers / locations for formation of Self-help groups and laying out of demonstration trials under both protected and open conditions. The farmers were upraised of the programme of work and were made aware about the benefits of using improved technologies for saffron cultivation. It was focused that improved technologies will bring much higher returns than using the traditional practices for saffron cultivation. The sowing of the corms was carried in presence of the farmers side by side imparting them with the knowledge for cultivation of corms under improved technologies developed by ARSSSS, SKUAST-Kashmir. The women folk were equally involved in the programme as they being the main worker for such work in the UT. Same type of survey was again repeated during 2019-20 and 2020-21.

3.5 Strategic Planning for each Activities

Key activity	Description on how it will be done, with whom etc.
Construction of polyhouses and poly tunnels	All the polyhouses as well as poly tunnels were constructed as per the objective
Purchase of planting material	Most of the planting material was purchased from SKUAST-Kashmir
Planting of corms	The demonstration trials of saffron were laid under open and protected conditions on farmer's fields. The standardized agro-technologies were adopted for raising a good crop. Both High density and normal density planting were adopted at different project locations
Intercultural operations	Intercultural operations were done as per the recommended package of practices and improved technologies developed by SKUAST-Kashmir were followed for raising good crop
Harvesting, testing and distribution of material	Corm uprooting and distribution was done through farmers participatory seed production programmes and on the rates as fixed by SKUAST-Kashmir
Trainings	Training programmes were conducted at each project location.

3.6 Activity wise Time frame followed [using Gantt/ PERT Chart (max. 1000 words)]

S. No	Description	1st year 2018-19		2nd year, 2019-20		3rd year, 2020-21	
		April-Sep.	Oct-March	April-Sep	Oct-March	April-Sep	Oct-March
1.	Survey of the pilot areas for identification of interested farmers						
2.	Formation of self-help groups						
3.	Construction of polyhouses / poly tunnels						
4.	Purchase of planting material						
5.	Preparation of the field for planting of corms						
6.	Planting of corms						
7.	Picking of flowers and separation of stigmas						
8.	Recording of data for floral and vegetative traits						

9.	Recording of data for corm traits						
10.	Quality analysis of saffron						
11.	Analysis of the data						
12.	Human resource development through Trainings and awareness camps						
13.	Corm uprooting						
14.	Distribution of corms through farmers participatory seed production programme						
15.	Working out of economics						
16.	Submission of progress reports						
17.	Publication of papers						

4 KEY FINDINGS AND RESULTS

4.1 Major Research Findings

- Corm Multiplication Index and Big Corn Index under cold arid conditions of Ladakh were high as compared to the temperate conditions
- Quality of the produce (stigma) viz., crocin, picro-crocin and safranal contents were recorded higher under protected conditions as compared to the open field condition.
- Farmers adopted the SKUAST-Kashmir technologies for raising the saffron crop and are keen to expand their area under saffron cultivation
- With regard to economic analysis, the returns from saffron cultivation were much higher as compared to the traditional crops grown by the farmers.
- Due to high returns from the crop, large numbers of farmer were attracted to this endeavor. The impression was huge among the educated youth.

4.2 Key Results

1. **Availability of quality planting material**: Adoption of latest technologies developed by SKUAST-Kashmir by the farmers under both open and protected conditions have led to availability of assured quality planting material with the farmers covered under the project.
2. **Increase in family income:** Due to higher yields and better quality, much higher returns were realized by the farmers (Table 3).
3. **Increase in livelihood/ employment opportunities:** The higher returns from the produce of saffron (stigma and corms) under both open and protected conditions

enabled expansion of the crop in larger areas thus provided employment generation especially to unemployed youth and women folk.

4. **Improved linkages with market/ enterprises:** A safe market linkage with Indian International Saffron Trade Centre, Pampore for sale of saffron produce (stigma) through e-marketing and linkage with Development Department and Private agencies for disposal of the produce (corms) have been established by the Principal Investigator and associated team.

4.3 Conclusion of the study

- Saffron production is confined to a limited geographical area in the country. At present the total saffron production in the country is 16.5 MT when the actual national demand is 100 MT. The deficit of 84 MT of saffron in the country is mostly imported from Iran which drains the national income worth Rs 12450 crores annually.
- Livelihood of the majority of the population of the UT Ladakh revolves around the agriculture and allied sectors. Over 70 per cent of the population of the region depends directly or indirectly on agriculture and its allied sectors. The present farming system adopted in cold arid region is generally wheat, barley, grasses and some vegetable cultivation which fetches average net returns of Rs. 50000 to 60000 per ha per annum. The returns are too meager to sustain a family partially or fully dependent on such cropping. The rural youth both men and women are fed-up with the present farming systems in the area because of low earnings from the farm produce.
- Saffron being a high value crop has bring an average net returns of Rs 2.5-3.0 lakhs/ha /annum thereby has provided a better means of livelihood to the farming families of the region as compared to cultivation of traditional crops.
- Dissemination of improved SKUAST-Kashmir technologies viz., High Density Production System Module, Irrigation module, Nutrient Management Module etc. have been well adopted in the region and has increased the yield and quality of the produce (saffron and corms) under both protected and open field conditions. Big corm index at most of the locations under both open and protected conditions was 70-80% and the corm multiplication index was 1:3-4. Similarly, crocin, picro-crocin and safranal contents of the produce under protected conditions were much higher as compared to open field conditions because of the influence of cold arid conditions.

- Higher returns from the produce have increased the interest of the farmers in saffron cultivation and most of the farmers/ beneficiaries didn't agree to sell their produce rather they expanded their own area under saffron cultivation
- The cropping intensity in Ladakh region is reported to be 106% and adoption of new technologies under the project viz., intercropping of vegetables with saffron has increased the cropping intensity of the area 150-160%.
- Hence, it is concluded that, expansion of saffron cultivation in other potential areas of UT Ladakh using improved agro-technologies would not only increase the earnings from the farm produce but also create the employment generation and thereby improvement in the livelihood of the farmers. Apart from socio-economic issues organic farming and bi-product utilization, water and fertilizer use efficiency would sustain the environment without any degradation.
- Further, transfer of improved technologies by continuing to undertake testing, training and demonstration on farmers' fields and using all established extension methods would increase the total production thereby reduce the burden on the import of saffron side by side stabilizing the UT Ladakh economy.

Table 1: Yield attributes of Saffron under open and protected conditions at different locations of cold arid regions of Ladakh

Location	Style length (cm)	Pistil length (cm)	Fresh Weight of pistil (mg)	Dry weight of pistil (mg)
Under open field conditions				
Panikhar	2.40 ± 0.06	5.57 ± 0.09	28.73 ± 0.27	5.55 ± 0.05
Sankoo	1.80 ± 0.06	4.70 ± 0.06	26.67 ± 0.33	5.17 ± 0.03
Batalik	2.07 ± 0.03	5.03 ± 0.03	33.00 ± 0.29	6.53 ± 0.03
Trespone	1.87 ± 0.03	5.27 ± 0.03	32.00 ± 0.58	6.23 ± 0.03
Nerok	2.03 ± 0.03	5.07 ± 0.07	24.67 ± 0.33	5.03 ± 0.03
Shergol	2.30 ± 0.06	5.70 ± 0.06	27.67 ± 0.33	5.53 ± 0.03
Under protected conditions				
Panikhar	2.10 ± 0.06	5.77 ± 0.03	33.97 ± 0.03	6.97 ± 0.03
Sankoo	2.13 ± 0.03	5.40 ± 0.06	34.50 ± 0.29	6.80 ± 0.12
Batalik	2.37 ± 0.03	5.77 ± 0.03	38.77 ± 0.15	7.75 ± 0.14
Trespone	2.43 ± 0.03	6.43 ± 0.03	37.60 ± 0.31	7.47 ± 0.03
Nerok	2.07 ± 0.03	5.30 ± 0.06	33.00 ± 0.58	6.37 ± 0.03
Shergol	2.28 ± 0.06	6.40 ± 0.06	40.07 ± 0.58	7.97 ± 0.03

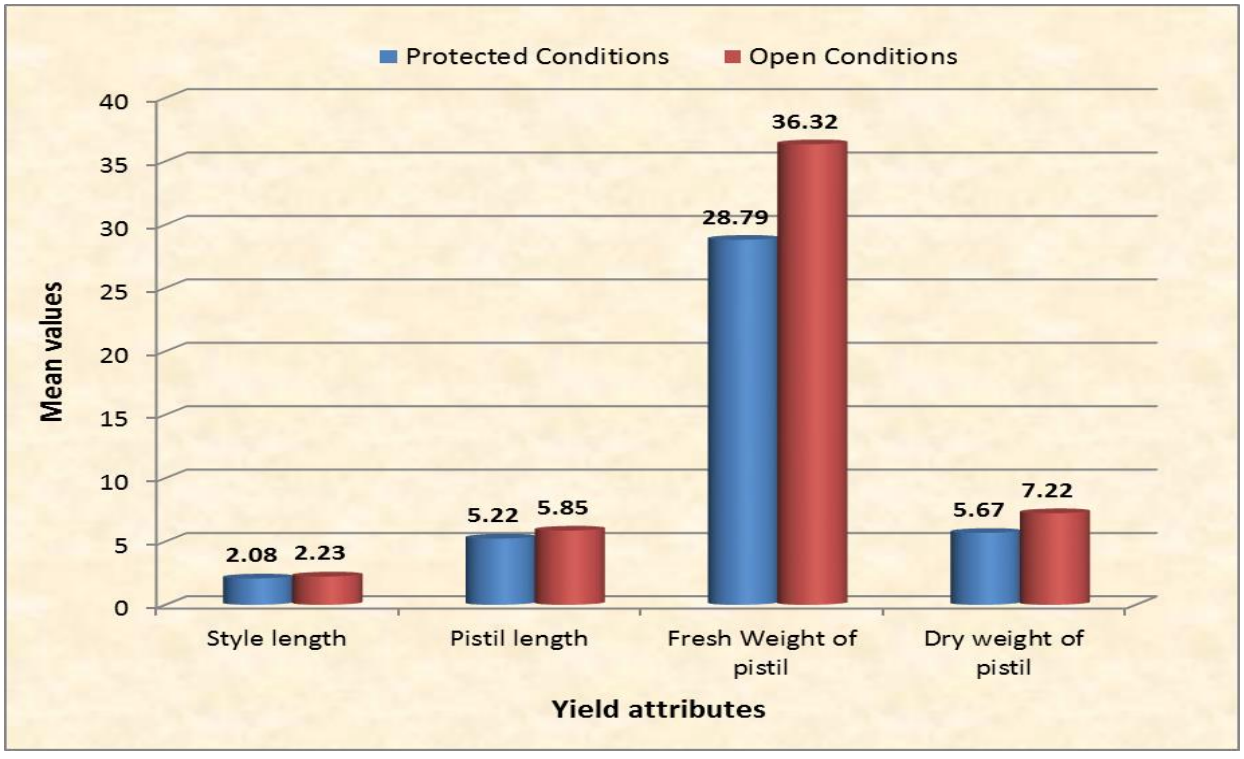
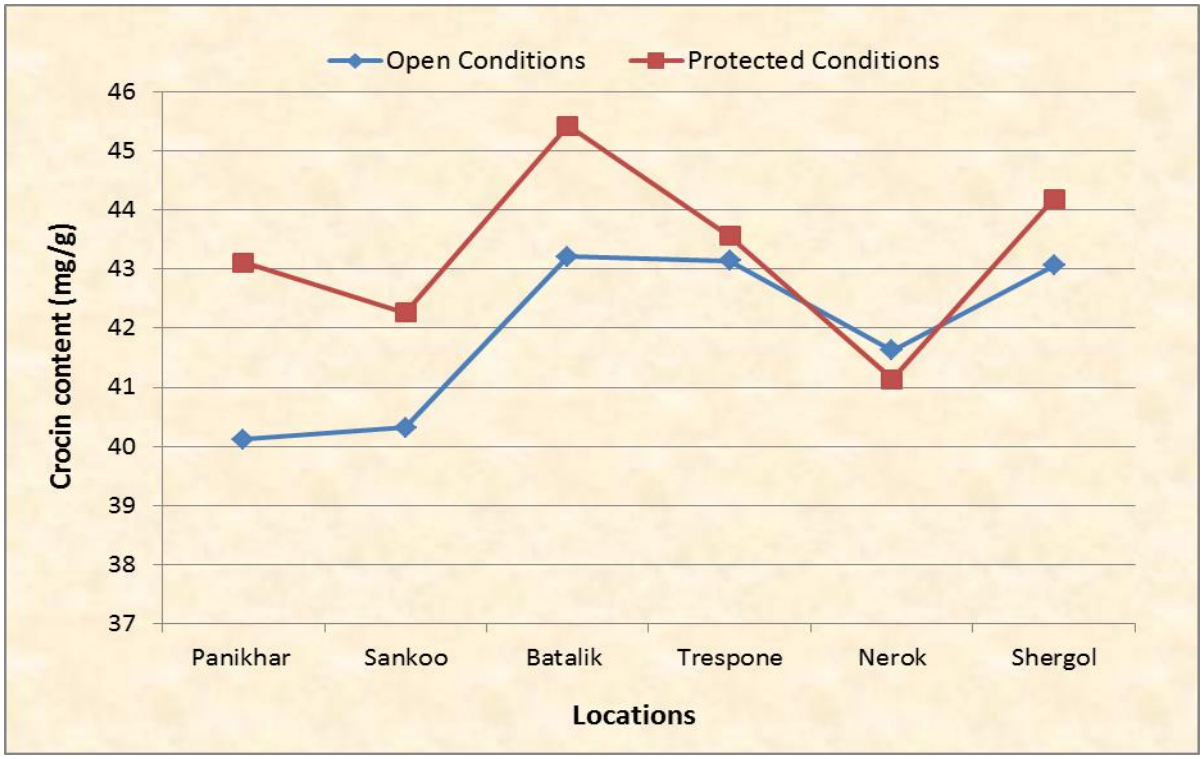
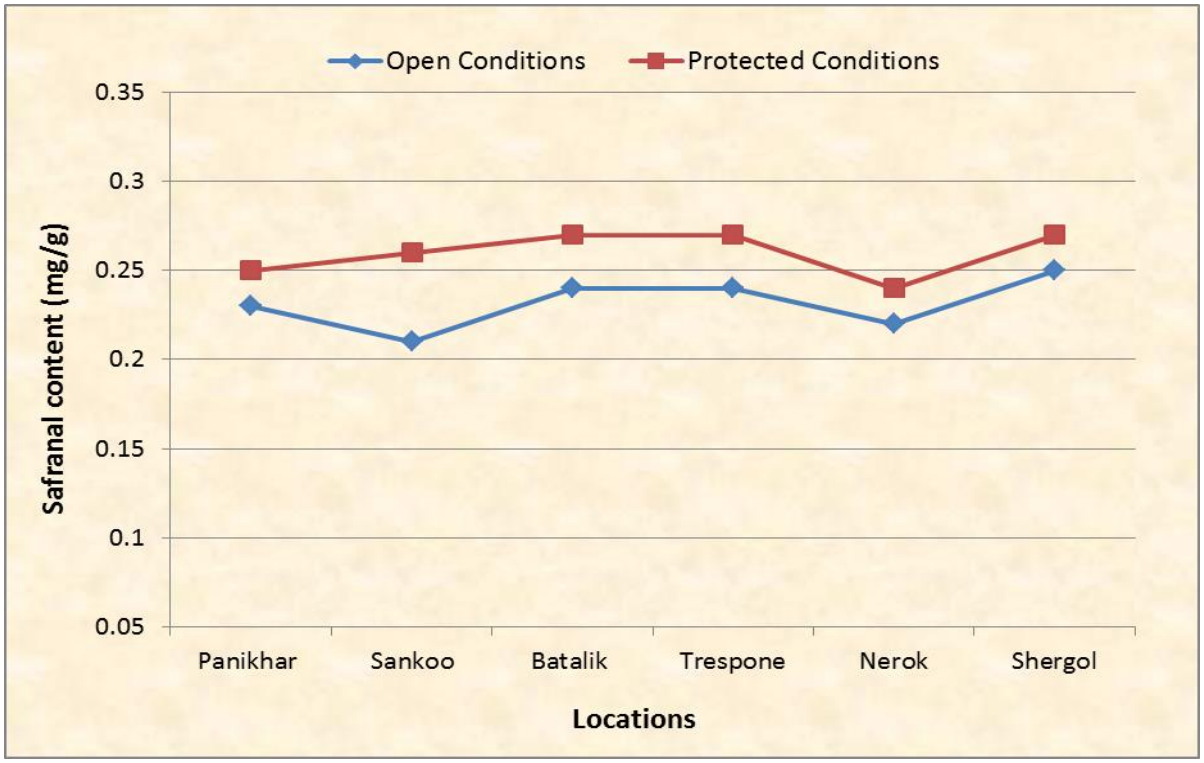


Table 2: Quality traits of Saffron under open and protected conditions at different locations of cold arid regions of Ladakh

Location	Crocin (mg/gm)	Safranal (mg/g)	Picrocrocin (mg/g)
Under open field conditions			
Panikhar	40.12 ± 1.15	0.23 ± 0.003	0.94 ± 0.07
Sankoo	40.32 ± 0.57	0.21 ± 0.006	0.87 ± 0.06
Batalik	43.21 ± 1.15	0.24 ± 0.005	1.01 ± 0.007
Trespone	43.14 ± 1.15	0.24 ± 0.01	1.08 ± 0.03
Nerok	41.62 ± 0.57	0.22 ± 0.003	1.07 ± 0.018
Shergol	43.06 ± 0.57	0.25 ± 0.003	1.00 ± 0.11
Under protected conditions			
Panikhar	43.11 ± 0.57	0.25 ± 0.005	1.13 ± 0.05
Sankoo	42.26 ± 1.15	0.26 ± 0.00	1.13 ± 0.08
Batalik	45.42 ± 0.88	0.27 ± 0.003	1.14 ± 0.08
Trespone	43.56 ± 0.57	0.27 ± 0.005	1.15 ± 0.02
Nerok	41.13 ± 0.57	0.24 ± 0.011	1.12 ± 0.006
Shergol	44.19 ± 1.15	0.27 ± 0.003	1.14 ± 0.012




Open Conditions
Protected Conditions
0.35
0.3
0.25
0.2
0.15
0.1
0.05
Safranal content (mg/g)
Panikhar
Sankoo
Batalik
Trespone
Nerok
Shergol
Locations

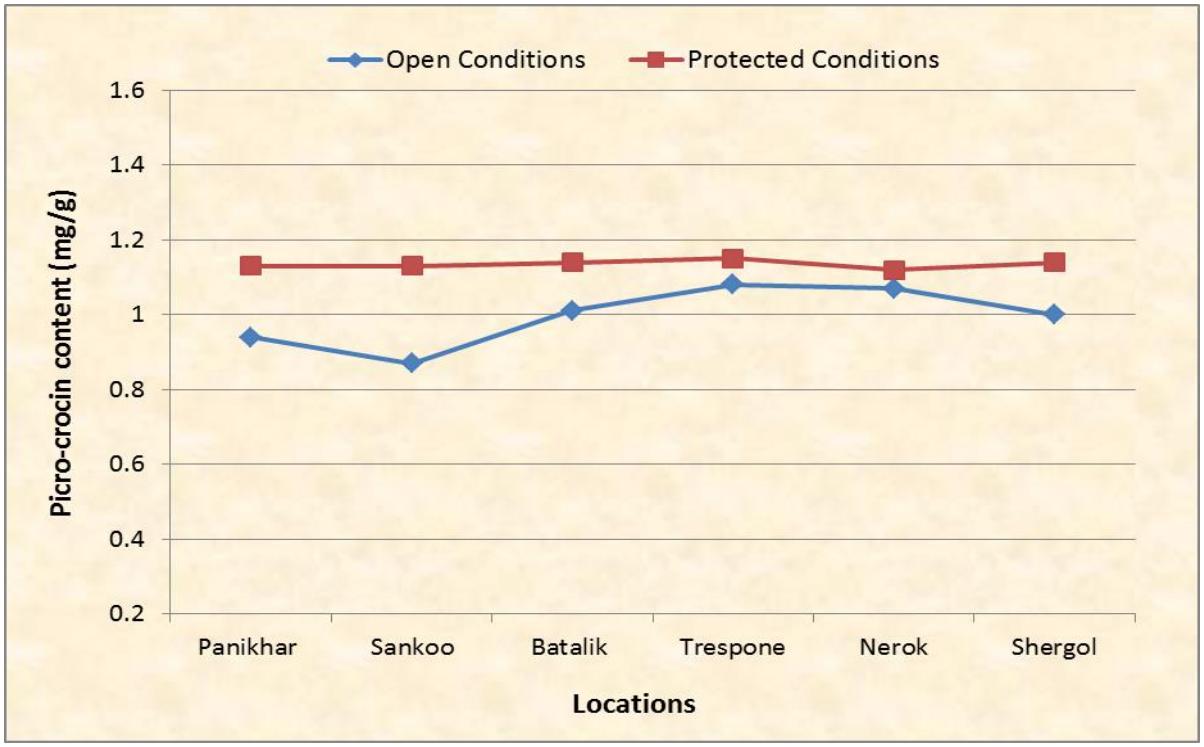

Open Conditions
Protected Conditions
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
Picro-crocin content (mg/g)
Panikhar
Sankoo
Batalik
Trespone
Nerok
Shergol
Locations

Table 3: Economics analysis of Saffron under open and protected conditions under 2 years of planting cycle

S.No	Operation	Protected (Rs.)	Open field (Rs.)
A.	**Cost of cultivation**		
1.	Land Preparation @ Rs.500/-Kanal	500	500
2	Cost of corms @ 4.0 q/kanal (10 lakh corms /ha)	60000	60000
3.	**Nutrients/Protectants**		
i.	Urea	168	168
ii.	DAP	77	77
iii.	MOP	38	38
iv.	Vermicompost	1000	1000
v.	Farm Yard Manure	6000	6000
4	Planting & Intercultural operations (15 Labour days @ Rs. 225/day	3375	3375
5	Harvesting of saffron, separation of stigmas and uprooting of corms (8 & 7 Labour days)	1800	1575
	Total	**72958**	**72733**
B.	**Gross Income/Output**		
1.	Saffron yield (kg/kanal) (583 & 458 g /Kanal for 2 years)	116600	91600
2.	Corm yield (10.5 q and 8.5 q) (@ Rs. 15000/q)	157500	127500
	Total	**274100**	**219100**
C.	**Net Profit (Rs.)**	**201142**	**146367**
D.	**B.C. ratio**	**1:2.76**	**1:2.01**

5. OVERALL ACHIEVEMENTS

5.1. Achievement on Project Objectives [Defining contribution of deliverables in overall Mission]

The achievements of the project objectives are:

- During the project period viz., 2018-2021, 9 Self-help groups were formulated each constituting of 9-12 farmers. As per the objective of the project, 6 low-cost Poly-houses were constructed out of which 4 were in District Kargil and 2 in District Zanaskar for corm multiplication under protected conditions. The saffron produce (stigma) under the protected conditions showed higher contents of crocin, picro-crocin and saffranal contents as compared to the open field conditions.
- A total of 77 demonstration trials were conducted during 2018-2021 in two Districts of Ladakh viz., Kargil and Zanaskar covering total area of 21.65 kanals. Improved Saffron technologies developed by SKUAST-Kashmir viz., High density production system module, Irrigation module, Nutrient management module etc. were used for raising good crop. These production technologies were well adapted at the project locations and the yield and quality of the farm produce showed significant improvement over the traditional practices.
- Area expansion under the saffron cultivation and adoption of crops by the surrounding farmers clarifies that the project has improved the living standard of the farmers which can also be assessed from the economic analysis of the crop. Further, climatic conditions of the project location during the winter months improved the quality of the produce (saffron) viz., crocin, picro-crocin and safranal content over temperate conditions. With regard to corm traits, Big corm index at most of the locations under both open and protected conditions was 70-80% and the Corm multiplication index was 1:3-4 which is comparatively higher as compared to the temperate conditions. These parameters finally increased the household income thereby improved living standards of the farmers.
- Adoption of new technologies by the farmers viz., intercropping of vegetables with saffron has increased the cropping intensity of the area upto 150-160% which otherwise was limited to 106%. Further, the corms produced during the 3rd year were uprooted and most of the farmers didn't agree to sell their produce rather they expanded their own area under saffron cultivation.

- Various training cum awareness camps were carried out at KVKs, Farm Centres and farmers fields. Identified farmers as well as the farmers surrounding the project locations were acquitted with the scientific knowledge of Saffron cultivation for corm production /multiplication which has created the entrepreneurship within the farmers and the unemployed rural youth. The success of this endeavour can be inferred from the facts that the area under the saffron cultivation at the project locations has been expanded to a large extend. In general, the adoption of saffron cultivation under standardized SKUAST-Kashmir agro-technologies has drastically improved the quality and quantity of final produce thereby resulted in human resource development and improvement in livelihood and the living standard of farmers.

5.2. Technological Intervention (max 1000 words)

- Large numbers of farmer were attracted to this endeavor. The impression was huge among the unemployed youth particularly women.
- Adoption of SKUAST-Kashmir technologies have improved the yield as well as quality of the produce as compared to the traditional practices.
- Adoption of new technology viz., intercropping of vegetables with saffron has increased the cropping intensity of the area upto 150-160%

Keeping in view the potential of such kind of programmes, the technologies need to be expanded to other areas of the region or even at national level. The cultivation of saffron by the farming community at their farms has improved the living by earning higher profits. Thus, the results of the project would not end after its completion but would rapidly spread for adaption by farmers in the adjoining areas.

5.3. On field Demonstration and Value-addition of Products

The awareness programmes for knowledge and skills developed among local community in selected villages were conducted for corm multiplication of saffron. Farmers in general and women folk in particular were the main targets of capacity building programmes and live demonstrations at the established units in different villages during the project duration. Further, monitoring of the units and conducting of awareness programmes will be taken care by the KVK's of SKUAST-Kashmir and Development Department of Agriculture at Kargil and Zanaskar. The farmers have also been linked with Indian International Saffron Trade Centre, Pampore to sell their produce through e-marketing in order to earn the higher profits.

5.4. Promoting Entrepreneurship in IHR

Development of economy of any nation depends primarily on the important role played by entrepreneurs. The entrepreneur is an economic man, who tries to maximize his profits by innovations. However, the entrepreneurs are not simply innovators but are the persons with a will to act, to assume risk and to bring about a change through organization of human efforts. The part played by such entrepreneurs in agriculture is of vital importance in developing country like India, where there are ample opportunities for using innovations to exploit the available resources. Thus, there is great importance of entrepreneurs in agriculture for adoption of new technologies in crop production.

5.5. Developing Green Skills in IHR

The project demonstrations have been mostly conducted in open conditions which have developed a feasible ecosystem. The findings of the project will be very useful for future skill development and establishment of training institutions to redesign and restructure their curriculum based green skills in the Himalayan ecosystem.

5.6. Addressing Cross-cutting Issues

The rights of indigenous peoples, gender equality and a sustainable Himalayan environment are of utmost importance. There is need to protect rights of the indigenous people especially to mitigate the impact of poverty on child labour. Children in between the age of 12-18 have been seen mostly engaged in the labours work of sheep rearing, agriculture activities etc.

6. PROJECT'S IMPACTS IN IHR

6.1. Socio-Economic Development

Socio-economic development, thus, is a process of improvement in a variety of ways. Social development is a process which results in the transformation of social institutions in a manner which improves the capacity of the society to fulfill its aspirations. The project played an important role in biding the people socially. The higher productivity and quality of saffron and corms under open conditions in the area could be ascribed to better environment and soil condition under the protected conditions which needs further investigation to arrive at the final conclusions.

6.2. Conservation of Biodiversity in IHR

- Conservation of biodiversity is an important aspect of agriculture sector so that this wealth can be handed over to the next generation without any loss.

- To facilitate researchers to inventories plant-rich areas and to develop strategies for conservation of existing plant diversity in the UT of Ladakh.

6.3. Developing Mountain Infrastructures

Saffron cultivation depends on a carefully designed and scientific infrastructure. Lack of knowledge on scientific production techniques and lack of infrastructure, non-availability of quality planting material and changing climatic effects are the major causes of the backwardness of the industry. Avoiding erratic rains, temperature effects and humidity by growing the saffron crop under protected conditions for corm production reduces the risk of fungal and other diseases which otherwise is a major threat for the crop, is the need of the hour to flourish the industry as well as to improve the livelihood of the farmers. Saffron growers in the study area usually employ traditional techniques for saffron cultivation as well as its post harvest management which deteriorates the quality of the produce. They should be given proper trainings regarding the modern and scientific ways of saffron cultivation and post harvest management of the produce that will enhance the production of improved planting material and quality of the produce thereby improvement in livelihood and entrepreneurship among them.

7. EXIT STRATEGY AND SUSTAINABILITY

The farmers have already expanded the area under saffron cultivation including distribution of the planting material to the farmers in other areas. Since the returns from saffron cultivation (Saffron and Corms) are much higher so they do not need further assistance from the project. Further, the outcome of the project will be disseminated amongst other farmers through the Department of Agriculture and KVK's of SKUAST-K. The transferable technology under the project will always inspire the farmers especially the youth for developing entrepreneurship in saffron cultivation (Saffron and corm production). So sharing the outcomes of the project with Department of Agriculture and by support of beneficiary farmers under the project will give a strategic exit.

7.1. How effectively the project findings could be utilized for the sustainable development of IHR

- The programme was successful in inspiring the community for expanding the area under saffron cultivation. Many families are now involved in saffron corm production business.

- The adoption and cultivation of saffron by the farmers has provided them much higher profits and thus brought more than stable income to them. The continuation of the cultivation will go a long way in improving the economic stability to the farmers.
- There is a tremendous scope for corm production in the region as well as across the temperate regions of the country for fetching more and more profits.
- The cultivation of the crop in identified areas by the farmers has forced the nearby farmers to replace the traditional cultivation of cereals by the protected and open cultivation of saffron in view of realizing much high profits from the crop.

7.2. Identify other important areas not covered under this study needs further attention

- Intercropping of Saffron and Kalazeera is a possible intervention under cold arid regions of Ladakh for doubling the farmers income.
- Vertical expansion of crop "Indoor Saffron Cultivation" is also a viable opportunity for increasing the saffron production to meet the National demand
- Under the project almost all the areas of the region showed superior performance of corm production. In view of this a Mega project is the need of hour to meet the demand of planting material for area expansion across the temperate areas of the country.

7.3. Major recommendations for sustaining the outcome of the projects in future

- The project findings can help the youth/woman farmers to explore livelihood options in saffron cultivation because the region has great potential for saffron & corm production under both protected and open field conditions as a sole or intercrop.
- Cropping intensity in Ladakh region is reported to be 106%. Intercropping of vegetables with saffron as the cropping cycle of the saffron is completed in the month of May-June and the farmers can easily cultivate the vegetable in-between the ridges of the saffron crop and thereby the cropping intensity of the area could be increased to 150-160%.
- Transfer of improved technologies by continuing to undertake testing, training and demonstration on farmers' fields and using all established extension methods would increase the total production thereby reduce the burden on the import of saffron side by side stabilizing the UT Ladakh economy.
- Hence, it is concluded that, expansion of saffron cultivation in other potential areas of UT Ladakh using improved agro-technologies would not only increase the earnings from the

farm produce but also create the employment generation and thereby improvement in the livelihood of the farmers. Apart from socio-economic issues organic farming and bi-product utilization, water and fertilizer use efficiency would sustain the environment without any degradation.

8. ACKNOWLEDGEMENT

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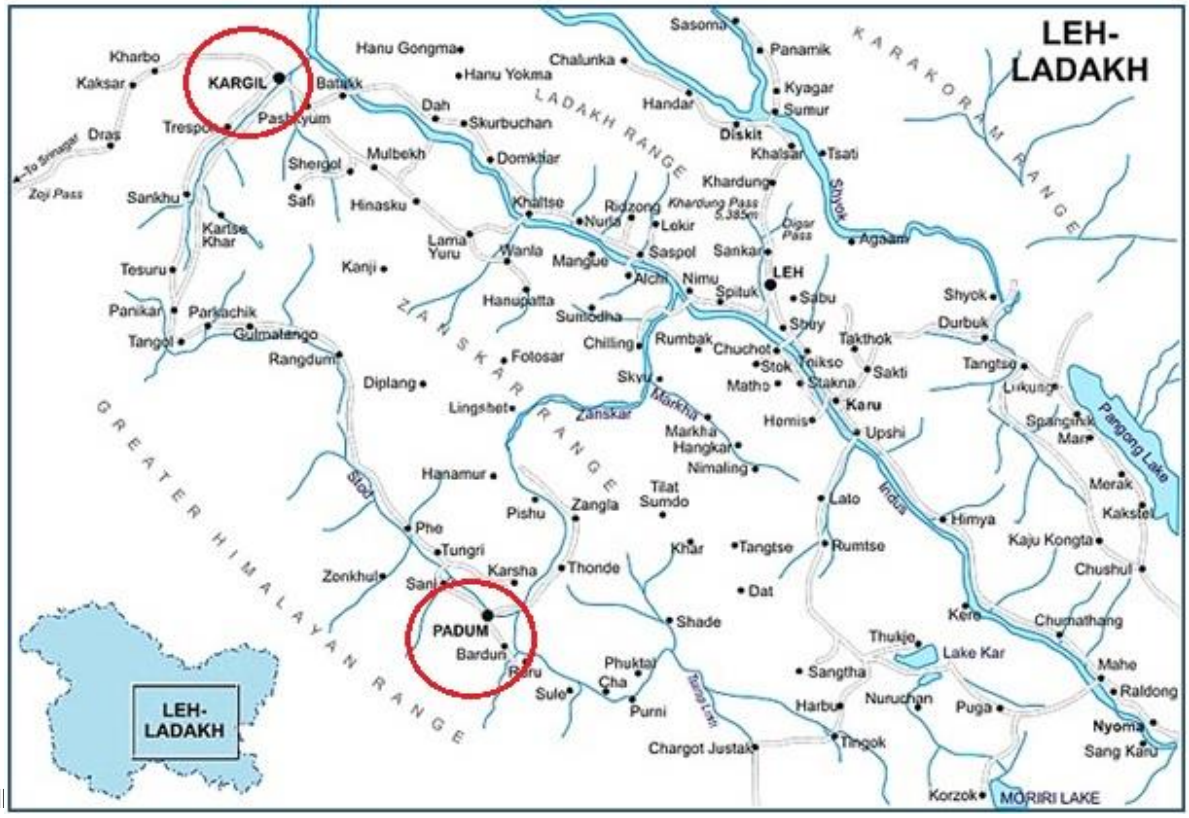
Annexure I (Site Maps)

Site Maps/Study Area

Kargil is located 204 km from Srinagar to the west, 234 km from Leh to the east and 240 km from Padum to the southeast. Kargil has an average elevation of 2,676 meters and is situated along the banks of the Suru River (Indus). It has cool and temperate climate. Summers are warm with cool nights, while winters are long and cold with temperatures often dropping to −20-30 °C.

Zanskar is a subdistrict of the Kargil district, which lies in the eastern half of the state of J&K. The average height of the Zanskar Range is about 6,000 m. Much of Zanskar's vegetation is found in the irrigated villages, and on the upper slopes which receive more precipitation and where it consists of alpine and tundra species. Zanskar is a high altitude semi-desert lying on the Northern flank of the Great Himalayan Range. Most of the precipitation occurs as snowfall during the harsh and extremely long winter period. These winter snowfalls are of vital importance, since they feed the glaciers which melt in the summer and provide most of the irrigation water. Parts of Zanskar valley are considered some of the coldest continually inhabited places in the world.




Batalik
34°65' N 76°33' E
Sankoo
34°28' N 75°94' E
Shargole
34°23' N 76°18' E
34.55° N 76.13° E

Annexure II

List of Self-help groups and beneficiaries

List of self-help groups (*Group leaders)

Self Help Group -1

Group Leader: Tyaub Ahmad S/o Abdul Khaliq **Address:** Panikhar, Kargil

1. Syed Mubarak Shah S/o Syed Najamdin
2. Zehra Bano W/o Ghulam Ahmad
3. Mohd Shafi S/o Gh Rasool
4. Abdul Hamid S/o Abdul Ahad
5. Zakir Hussian S/o Haji Abdul Rehman
6. Hina Bano W/o Abdul Salam
7. Fatima W/o Rafiq Ahmad
8. Safiya W/o Shameem Ahmad
9. Zanib W/o Zamaan Ahmad
10. Zareena Akhter W/o Abdul Majeed

Self Help Group -2

Group Leader: Tsering Dolma W/o Toshi Tundup **Address:** Nerok Zanskar

1. Dorjay Palmo W/o Tseway Phuntsok
2. Nyimo Putit W/o Rinzin Chordan
3. Sonam Lamo W/o Phuntsok Sandup
4. Tsering Garkith W/o Gurmath Sonam
5. Sonam Kunzom W/o Tsering Motup
6. Tashi Dolma W/o Tashi Morup
7. Thukjay Dolkar W/o Ldepo Tsering
8. Yanchan Dolma W/o Tashi Phuntsole
9. Terzin Nankha D/o Tseway Faber
10. Padma Yauychen W/o Tundep Phuntsole

Self Help Group -3

Group Leader: Haji Mohd S/o Mohd Ali **Address:** Trespone Kargil

1. Nikhat D/o Mushtaq Ahmad

2. Asif S/o Ghulam Hassan
3. Hussain Bano W/o Bashir Ahmad
4. Khalida W/o Manzoor Ahmad
5. Safiya W/o Gulzar Ahmad
6. Kulsum W/o Farooq Ahmad
7. Saroo W/o Mansoor Ahmad
8. Farida W/o Raj Mohd

Self Help Group -4

Group Leader: Mohd Hasnain S/o Haji Mohd Mussa **Address:** Batalik Kargil

1. Liyakat Ali S/o Mohd Musa
2. Mohd Yaseen S/o Haji Ali
3. Ghulam Mohd S/o Mohd Abdullah
4. Imtiyaz Hussian S/o Mehboob Hussian
5. Ahmad Ali S/o Ghulam Hussian
6. Mohd Ibrahim S/o Mohd Hassan
7. Irfan Mohd Mukhtar S/o Ghulam Ahmad
8. Zakir Hussian S/o Mohd Ali

Self Help Group -5

Group Leader: Ghulam Mustafa S/o Yousf Ali **Address:** Sankoo Kargil

1. Abdullah Khan S/o Mohd Ali Khan
2. Sher-u-Din S/o Sheikh Hussian
3. Sheikh Mohd Hussian S/o Sheikh Gulam Hassan
4. Mohd Hussian S/o Mohd Jaffar
5. Nisar Hussian S/o Mohd Akbar
6. Ali Mohd Mir S/o Ghulam Mohd
7. Ahmad Hussian S/o Mohd Hussian
8. Ghulam Mohd S/o Mohd Hussian

Self Help Group -6

Group Leader: Mohd Hussian S/o Salman Ali **Address:** Shergol Kargil

1. Mohd Younus S/o Mohd Amin
2. Haji Ghulam Hussian S/o Ghulam Mohd

3. Haji Satar S/o Haji Hussian
4. Hina Bano W/o Abdul Salam
5. Mohd Mustafa S/o Yousf Ali
6. Mohd Mehdi S/o Mohd Hussain

Self Help Group -7

Group Leader: Mohd Mehdi S/o Mohd Hussain **Address:** Minjee, Kargil

1. Mohd Ibrahim S/o Mohd Hassan
2. Mohd Abbas Kachu S/o Mohd Baqir
3. Mohd Hadi S/o Mohd Abbas
4. Ahmad Ali S/o Ghulam Hassan
5. Mohd Ishaq S/o Mohd Musa
6. Fayaz Ahmad S/o Mohd Ali
7. Mohd. Aziz S/o Yousuf Ali

Self Help Group -8

Group Leader: Sheikh Mohd Hussain S/ o Sheikh Ghulam **Address:** Thanzgam, Kargil

1. Mohd Hussain S/o Salman Ali
2. Mohd Ali S/o Mohd Jaffer
3. Ghulam Hussain S/o Haji Gh. Mohammad
4. Ahmad Ali Khan S/o Mohd Hussain
5. Mohd Hussain S/o Haji Abbas Khan
6. Ghulam Hussain S/o Haji Mohd Musa
7. Haji Ali Raza S/o Jaffar Ali
8. Umbar Amina S/o Ali Naqi
9. Mohd. Aziz S/o Yousuf Ali

Self Help Group -9

Group Leader: Stanzin Norboo S/o Tashi **Address:** Sanachey, Derchiks, Kargil

1. Dawa Tashi S/o Fail Tseringl
2. Tashi Tsering S/o Sonam
3. Stanzin Tarpoo S/o Phuntsug Namgyal
4. Tsering Yangskit S/o Kunchok Rafstan
5. Haji Mohd Javad S/o Wazir Mohd Akbar

6. Mohd Hussain S/o Yousuf Ali
7. Liyaqat Ali S/o Mohsin Ali
8. Villayat Ali Munshi S/o Haji Mohd Hassan

List of demonstration trials laid during 2018-19, 2019-20 and 2020-21

S.No	Name of Farmer with parentage	Location	Area Covered
	2018-19		
1.	Motup Tsering S/o Tseway Faber	Stara, Zanaskar	5 marlas
2.	Abdul Samad S/o Abdul Gani	Ufti, Zanaskar	5 marlas
3.	Tsering Dolma W/o Sonam Rigtol	Gyapak, Zanaskar	5 marlas
4.	Tsering Yauchen W/o Thukjay Gyatso	Gyapak, Zanaskar	5 marlas
5.	Lobzang Rimcher S/o Sonam Rigtol	Gyapak, Zanaskar	5 marlas
6.	Tsering Dolma W/o Tashi Tundup	Nerok, Zanaskar	5 marlas
7.	Lobzang Nidol D/o Tsering Namgyal	Salapi, Zanaskar	5 marlas
8.	Lobzang Ladol D/o Labzang Ganwa	Salapi, Zanaskar	5 marlas
9.	KVK, Zanaskar (Open and Polyhouse)	Zanaskar	5 marlas
10.	Mohd Hussian S/o Haji Hassan	Manji, Kargil	½ marlas
11.	Sadiq Ali S/o Fida Hussian	Manji, Kargil	5 marlas
12.	Haji Ghulam Ahmad S/o Mohd Isa	Manji, Kargil	5 marlas
13.	Haji Mohd Ali S/o Ali Ghulam	Manji, Kargil	5 marlas
14.	Haji Mohd S/o Haji Ghulam Mohd	Poyen, Kargil	5 marlas
15.	Mohd Musa S/o Mohd Ali	Baroo, Kargil	5 marlas
16.	Akhoon Hanifa S/o Akhoon G. Mehdi	Baroo, Kargil	5 marlas
17.	Mohd Hasnain S/o Haji Mohd Mussa	Batalik, Kargil	½ marlas
18.	Mohd Ali S/o Haji Mohd Mussa	Batalik, Kargil	5 marlas
19.	Mohd Ali S/o Mohd Jaffar	Karpothang, Kargil	5 marlas
20.	Gh. Nabi S/o Haji Mohd Musa	TV Colony, Kargil	5 marlas
21.	Haji Mohd (Group Leader)	Trespone, Kargil	½ kanal
22.	Syed Mubarak Shah S/o Syed Najamdin	Rarik, Panikhar	5 marlas
23.	Zareena Akhter W/o Mohd Hassan	Pranthi, Panikhar	5 marlas
24.	KVK, Kargil	Kargil	½ kanal
25.	MAR&ES, Kargil	Kargil	½ kanal
	2019-20		

26.	Mohd Hasnain S/o Haji Mohd Mussa	Dah, Batalik	10 marlas
27.	Liyakat Ali S/o Mohd Musa	Dah, Batalik	5 marlas
28.	Mohd Yaseen S/o Haji Ali	Hanu, Batalik	5 marlas
29.	Ghulam Mohd S/o Mohd Abdullah	Garkon, Batalik	4 marlas
30.	Imtiyaz Hussian S/o Mehboob Hussian	Garkon, Batalik	7 marlas
31.	Ahmad Ali S/o Ghulam Hussian	Chulichan, Batalik	5 marlas
32.	Mohd Ibrahim S/o Mohd Hassan	Sharchay, Batalik	4 marlas
33.	Irfan Mohd Mukhtar S/o Ghulam Ahmad	Sharchay, Batalik	5 marlas
34.	Zakir Hussian S/o Mohd Ali	Darchak, Batalik	5 marlas
35.	Ghulam Mustafa S/o Yousf Ali	Trespone, Sankoo	3 marlas
36.	Abdullah Khan S/o Mohd Ali Khan	Trespone, Sankoo	5 marlas
37.	Sher-u-Din S/o Sheikh Hussian	Kanoor, Sankoo	5 marlas
38.	Sheikh Mohd Hussian S/o Gulam Hassan	Saliskote, Sankoo	6 marlas
39.	Mohd Hussian S/o Mohd Jaffar	Lankarchey, Sankoo	5 marlas
40.	Nisar Hussian S/o Mohd Akbar	Tambis, Sankoo	5 marlas
41.	Ali Mohd Mir S/o Ghulam Mohd	Barsoo, Sankoo	8 marlas
42.	Ahmad Hussian S/o Mohd Hussian	Barsoo, Sankoo	9 marlas
43.	Ghulam Mohd S/o Mohd Hussian	Khachey, Shergol	5 marlas
44.	Mohd Hussian S/o Salman Ali	Karamba, Shergol	4 marlas
45.	Mohd Younus S/o Mohd Amin	Karamba, Shergol	5 marlas
46.	Haji Ghulam Hussian S/o Ghulam Mohd	Tingdoo, Shergol	10 marlas
47.	Haji Satar S/o Haji Hussian	Mulbekh, Shergol	5 marlas
48.	Hina Bano W/o Abdul Salam	Wakha, Shergol	6 marlas
49.	Mohd Mustafa S/o Yousf Ali	Phoo, Shergol	10 marlas
50.	Mohd Mehdi S/o Mohd Hussain	Phoo, Shergol	5 marlas
	2021-22		
51.	Mohd Mehdi S/o Mohd Hussain	Goma, Minjee	5 marlas
52.	Mohd Ibrahim S/o Mohd Hassan	Goma, Minjee	5 marlas
53.	Mohd Abbas Kachu S/o Mohd Baqir	Goma, Minjee	5 marlas
54.	Mohd Hadi S/o Mohd Abbas	Sarchey, Kannaur	6 marlas
55	Ahmad Ali S/o Ghulam Hassan	Sarchey, Kannaur	4 marlas
56.	Mohd Ishaq S/o Mohd Musa	Sarchey, Kannaur	4 marlas

57.	Fayaz Ahmad S/o Mohd Ali	Sarchey, Kannaur	5 marlas
58.	Mohd. Aziz S/o Yousuf Ali	Goma, Minjee	5 marlas
59.	Sheikh Mohd Hussain S/ o Sheikh Ghulam	Humbri, Thanzgam	4 marlas
60.	Mohd Hussain S/o Salman Ali	Humbri, Thanzgam	5 marlas
61.	Mohd Ali S/o Mohd Jaffer	Brakoo, Samroo	5 marlas
62.	Ghulam Hussain S/o Haji Gh. Mohammad	Brakoo, Samroo	4 marlas
63.	Ahmad Ali Khan S/o Mohd Hussain	Sharbat Gund	5 marlas
64.	Mohd Hussain S/o Haji Abbas Khan	Sharbat Gund	5 marlas
65.	Ghulam Hussain S/o Haji Mohd Musa	Gur, Gurgoda	4 marlas
66.	Haji Ali Raza S/o Jaffar Ali	Sharbat Gund	5 marlas
67.	Umbar Amina S/o Ali Naqi	Sharbat Gund	5 marlas
68.	Mohd. Aziz S/o Yousuf Ali	Dachay, Thanzgam	7 marlas
69.	Stanzin Norboo S/o Tashi	Sanachey, Derchiks	5 marlas
70.	Dawa Tashi S/o Fail Tsering	Sanachey, Derchiks	5 marlas
71.	Tashi Tsering S/o Sonam	Sanachey, Derchiks	6 marlas
72.	Stanzin Tarpoo S/o Phuntsug Namgyal	Sanachey, Derchiks	7 marlas
73.	Tsering Yangskit S/o Kunchok Rafstan	Sanachey, Derchiks	5 marlas
74.	Haji Mohd Javad S/o Wazir Mohd Akbar	Akchamal, Grong	6 marlas
75.	Mohd Hussain S/o Yousuf Ali	Pushkum, Thanzgam	5 marlas
76.	Liyaqat Ali S/o Mohsin Ali	Pushkum, Thanzgam	5 marlas
77.	Villayat Ali Munshi S/o Haji Mohd Hassan	Pushkum, Thanzgam	5 marlas
Total area covered			**433 marlas (10825 mt^2)**







LAHDC Kargil

Annexure III

Construction of low-cost polyhouses

Annexure IV

Demonstration of trials under both open and protected conditions

1. Under open conditions


REDMI NOTE 5 PRO
MI DUAL CAMERA


REDMI NOTE 5 PRO
MI DUAL CAMERA


REDMI NOTE 5 PRO
MI DUAL CAMERA

2. Under protected conditions



Annexure IVa

Flowering and Foilage of demonstration trials under open and protected condition

Annexure V

Training cum Awareness camps

Annexure VI

Corm production of demonstration trials under open and protected condition