

NARDF Technical Paper Series Report

Quality Improvement, Post-Harvest Losses Reduction and Market Linkage Development of Karnali Apple (405)

Abstract

Apple a fruit of temperate origin was introduced to Nepal several years ago. It is best grown in Karnali zone. Government of Nepal has identified apple as a commercial fruit of comparative advantage of temperate zones. The construction of Surkhet-Karnali road has opened new opportunities to apple produced in this region. Despite farmers interest to grow more apples for their livelihood they have inadequate knowledge about orchard management and cultivation practices, post harvest handling including storage, transportation, wrapping and packaging. Apple cultivation can be more attractive and profitable by boosting the production and productivity (through better orchard management) and by minimising post harvest (grading, storage, packaging and transportation) losses. This project is designed to promote better orchard management practices, and identify the appropriate and cost effective post-harvest handling and packaging system through farmer's participation.

Through the farmers groups of Jumla (Tatopani -1 Raka, Lamra-6 Himkhola, Kartik swami-6, and Mahatgaun -9 Micha) and Kalikot (Phoemahadev – and Phoemahadev-3) better orchard management practices, transportation studies and grading and packaging studies were conducted. The following results have been obtained

1. Weeding, pruning and applying 10 kg FYM per tree increases the production of A grade apple as well as total yield per tree
2. The loss during transportation was lowest (2.75%) in polythene plus foam cushioning in 20 kg Doko transportation. When the quantity of apple were increased from 20 kg to 40 the loss during transportation increased to 7.25 % in polythene plus foam cushioning followed by plastic foam cushioning 8.5 % and highest 23.5 % in control no cushioning
3. In case of long distant transportation the loss was minimal when apples were wrapped with paper and cushioned with foam (2.3%) followed by grass straw cushioning (6.75 %) and highest in control (13.5 %). Therefore, for long distance transportation, if apples are wrapped with news papers and cushioned with soft foam the loss is minimal
4. Farmer's field days in successful farmer's field exposure visits to established commercial orchards have been the key components of transferring technology.

For wider dissemination tested, refined and verified orchard management practices and post harvest techniques has been published in the form of booklet and leaflet in Nepali language. These publications are

१. गुणस्तरिय स्याउ उत्पादनका सरल उपायहरु
२. स्याउ संरक्षण (चाना र जाम बनाउने तरिका)

Keyword

Orchard management, Agro-climate, Comparative-advantage, Market-linkage, Dissemination, Scaling-up, Bruising,

1. Introduction

Poor orchard management and attack of many diseases and insect pests lead to the production of smaller and diseased apple fruit. Such fruit do not get good price in the market. Despite the suitability of the area in terms of climatic requirements, farmers have

not been able to take full advantage of apple production. Proper orchard management, harvesting at appropriate time and proper wrapping and appropriate transportation system can help boost production, reduce post harvest losses and add value to the produce by improving quality thereby offering greater competitiveness in the market.

Department of Agriculture (DOA) had conducted several interactive meetings and review workshops to identify the problems of farmers Mid Western Development Regions of Nepal. Nepal Horticulture Promotion Center (NHPC) sent its technical staff in field for the verification of the problems. NHPC staff met District Agriculture Development staff and farmers of the proposed project areas and collected the problems and conditions of production and marketing. The problems described by the farmers and identified by NHPC coincided. The farmers were looking for new skills of orchard management and reliable post harvest technologies of packaging and transportation. Therefore this project was designed and research activities and development activities were implemented with the financial support of National Agricultural Research and Development Fund (NARDF) to address the production and market linkage development of apple.

Therefore, this project aimed to address the following objectives:

- To demonstrate better orchard management practices to apple farmers for improving production and post-harvest handling of apple.
- To support farmers to improve post harvest handling of apple
- To support in establishing collection sheds and market linkage, and
- To disseminate project findings for wider adoption in the region to contribute to poverty reduction

2. Materials and methods (conceptual framework, data, model, methodology)1 ?

The project activities have been divided into i) action research and ii) extension/development activities. The action research activities included orchard management demonstration at selected pockets of Jumla ns kalikot. *Pockets of Jumla (Tatopani -1 Raka, Lamra-6 Himkhola, Kartik swami-6, and Mahatgaun -9 Micha) and Kalikot (Phoemahadev – and Phoemahadev-3) for field work. Two sites in each district with two farmers in each pocket were selected for studies and demonstration. Eight cooperating farmers were selected based on preliminary survey at different pockets and activities were implemented. While selecting the pockets and farmers, concerned DADOs of the district were consulted.*

1) Orchard management demonstration

Orchard management demonstration cum study was conducted in two sites in Jumla and two sites in Kalikot. At each site two farmer's (Annex 1) orchards were selected for demonstration. In each orchard there were three sets of demonstrations comprising three treatments

1. Farmers practice (leaving trees unattended).
2. Weeding and applying 10 kg of compost/FYM per tree but no pruning.
3. Weeding, and applying 10 kg of compost/FYM per tree and tree pruning.

In each treatment there were four trees. Thus, there were four sites, eight orchards and 96

trees in total. For calculating the yield per tree 2 trees from each orchard were selected randomly and yield data for different grades of apples were recorded (Annex 1)

2) Study on the transportation of apples using different types of packaging materials.

This study was conducted in two stages. First study focused on local transportation, from orchard to the local market or collection centre. For local transportation, (i) small doko holding 20 kg apple each and (ii) large dokos that can hold about 40 kg apples were used. In both the cases, cushioning materials used were:

Grass or straw, 2) plastic foam cushioning, 3) polyethylene cushioning, 4) Polythene plus foam cushioning were compared with 5) control without any cushioning. Effects of different cushioning material to reduce loss during apple transportation were analyzed.

Second set was for In case of long distant transportation, cardboard boxes were used. The cushioning materials used were 1) Grass straw cushioning, 2) Plastic foam cushioning, 3) paper wrap cushioning, 4) Paper wrap plus foam cushioning and 5) control cardboard box no cushioning. The apple boxes were transported from Jumla and Kalikot to Surkhet in hired jeep. At the destination point Surkhet loss due to rotting, pressing and bruising were separated and percent losses were calculated.

3) Establish collection

Two collection centres (one in each district) manageably accessible to both sites of the district established with community collaboration.

4) Organize meetings/workshop for market linkage development

All related stakeholders were invited and project findings were discussed on relevant topics and decisions were taken.

5) Organise farmers training on Orchard management, post-harvest handling

For the training, a training curriculum was developed that included orchard management, fruit harvesting, grading, packing, transportation, storage and processing. Training materials together with audiovisuals were prepared and participatory trainings were conducted in each group.

Farmers were organised in the groups of 25 each in each site. Orchard managing practices and post harvest handling trainings have been given to the farmers groups in the demonstration sites. Orchard management training was given in February and training on post harvest handling, preservation and value addition were given in September-October. Trainings were repeated in the following year also to make them confident on entrepreneurship.

6) Organize field days for dissemination of the findings.

Field days on orchard management demonstrations and transportation were conducted during second and third year at each district. Farmers from different production sites were taken to the field demonstration sites on the field days.

7) Publication of booklet, leaflet and audio-visuals for wider dissemination of project findings.

Booklet and leaflets have been published incorporating the project findings and other relevant information useful for fruit farmers and other stakeholders

8) Workshop organization,

Regional level workshop to popularise the findings of the studies inviting all engaged on policy formation, technicians, researchers and other stakeholders of the region. Thus the findings were disseminated in the field as well as to the policy makers for further scale up in other apple growing areas

3. Results

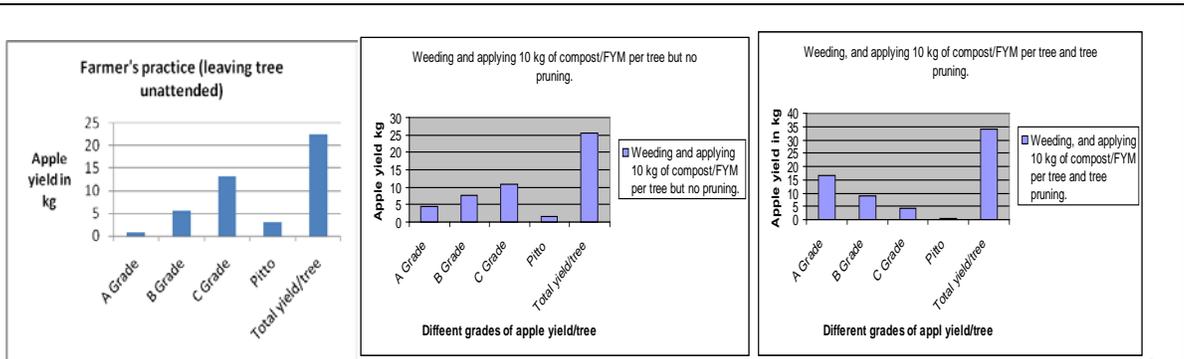
1) *Result 1: Orchard management demonstration*

Manuring and pruning of the apple tree improved both quality and yield of apple per tree. The results of the experiment is presented in Table 1 below:

Table 1: yield of different grades of apple per tree with different orchard management practices

Treatments	Different grade of apple production kg /tree				Total yield/tree
	A Grade	B Grade	C Grade	Pitto	Total yield/tree
Farmers practice (leaving trees unattended).	0.81	5.55	13.06	2.93	22.35
Weeding and applying 10 kg of compost/FYM per tree but no pruning.	4.35	7.69	10.82	1.72	24. 58
Weeding, and applying 10 kg of compost/FYM per tree and tree pruning.	16.48	8.8	4.29	0.46	30. 03

Weeding, pruning and applying 10 kg FYM per tree increases the production of A grade apple as well as total yield per tree (table 1 above) Farmers practice (leaving tree unattended produced an average of 22.35 kg of apples with 13.06 kg C grade fruits. Weeding and applying 10 kg FYM per tree yielded 24.58 kg apple with increased A and B grade fruits (4.35 and 7.69 kg respectively). Weeding and applying 10 kg FYM and pruning tree gave highest yield per tree of 30.03 kg with 16.48 kg of A grade apple fruits. The results are also presented in graphs below:



Result 2: Study on the transportation of apples using different types of packaging materials for local market

Objective: To identify the appropriate packaging materials for transportation of apples and find out the losses of apple during transportation with different kinds of packaging materials

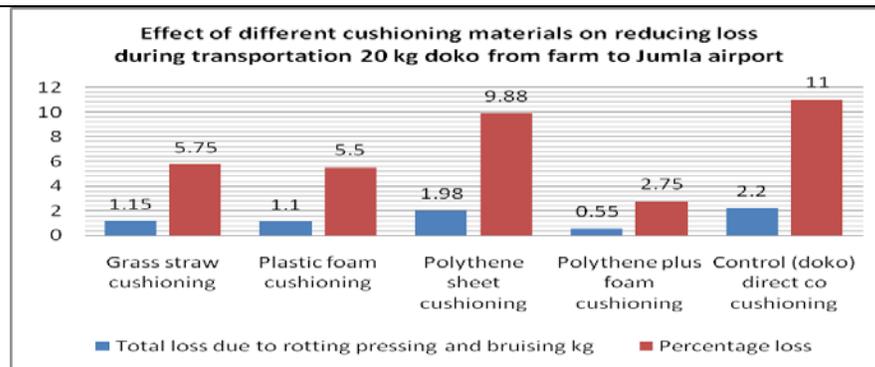
This study was conducted in two stages: First study focused on local transportation, from orchard to the local market or collection centre. For local transportation, (1) small dokos holding 20 kg apples each and (2) large dokos that can hold about 40 kg apples were used.

In both the cases, cushioning materials used were:

- 1) Grass or straw, 2) plastic foam cushioning, 3) polyethylene cushioning, 4) Polythene plus foam cushioning were compared with 5) control without any cushioning. Effects of different cushioning material to reduce loss during apple transportation were analyzed. Loss due to rotting, pressing and bruising were calculated on weight basis. The results are presented in Table 2 and Table 3 for Jumla and Table 4 and Table 5 for kalikot

Table 2: Effect of different cushioning materials to reduce loss during apple transportation from farm to local market Jumla 20 kg per doko

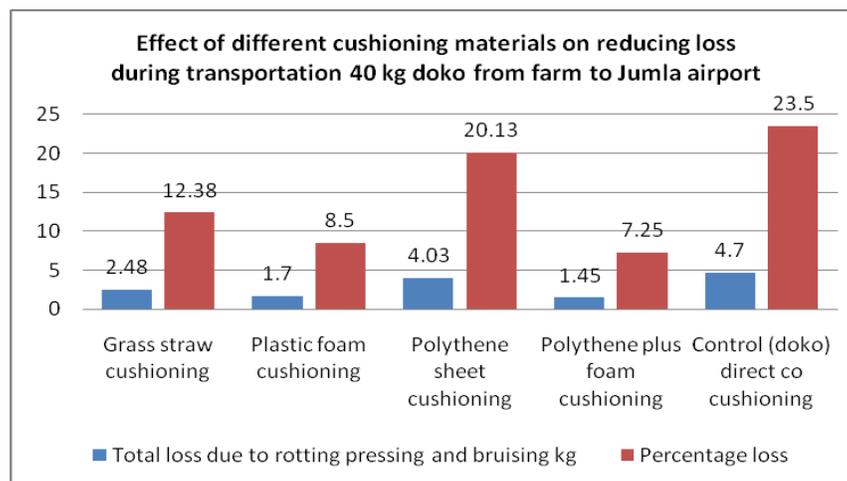
S.N	Treatments	Total loss due to rotting pressing and bruising kg	Percentage
1	Grass straw cushioning	1.15	5.75
2	Plastic foam cushioning	1.10	5.50
3	Polythene sheet cushioning	1.98	9.88
4	Polythene plus foam cushioning	0.55	2.75
5	Control (doko) direct no cushioning	2.20	11.00



The loss during transportation was lowest (2.75%) in polythene plus foam cushioning and highest in control no cushioning. Plastic foam cushioning and grass cushioning were at par with 5.5 % and 5.75% loss during transportation

Table 3: Effect of different cushioning material to reduce loss during apple transportation from farm to local market Jumla 40 kg per doko

S.N	Treatments	Total loss due to rotting pressing and bruising kg	Percentage
1	Grass straw cushioning	2.48	12.38
2	Plastic foam cushioning	1.70	8.50
3	Polythene sheet cushioning	4.03	20.13
4	Polythene plus foam cushioning	1.45	7.25
5	Control (doko) direct no cushioning	4.70	23.50



When the quantity of apple were increased from 20 kg to 40 the loss during transportation increased to 7.25 % in polythene plus foam cushioning followed by plastic foam cushioning 8.5 % and highest 23.5 % in control no cushioning. Plastic foam cushioning had 8.5 loss and grass cushioning was 12.38 % loss during transportation

Table 4: Effect of different cushioning material to reduce loss during apple transportation from farm to local market Kalikot 20 kg per doko

S.N	Treatments	Total loss due to rotting pressing and bruising kg	Percentage
1	Grass straw cushioning	0.90	4.50

2	Plastic foam cushioning	0.76	3.78
3	Polythene sheet cushioning	2.13	10.63
4	Polythene plus foam cushioning	0.55	2.75
5	Control (doko) direct co cushioning	2.43	12.13

The result of transportation loss study in case of Kalikot was in similar trend with Jumla. The loss during transportation was lowest (2.75%) in polythene plus foam cushioning and highest in control 12.13 % in no cushioning. Plastic foam cushioning and grass cushioning were at par with 3.78 % and 4.50% loss during transportation

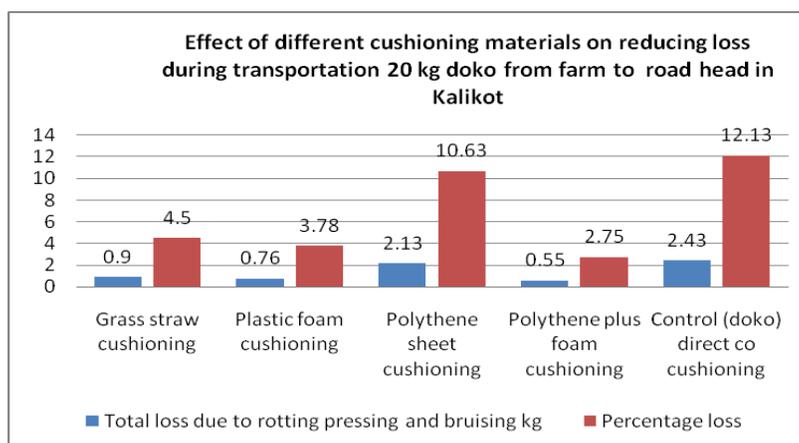
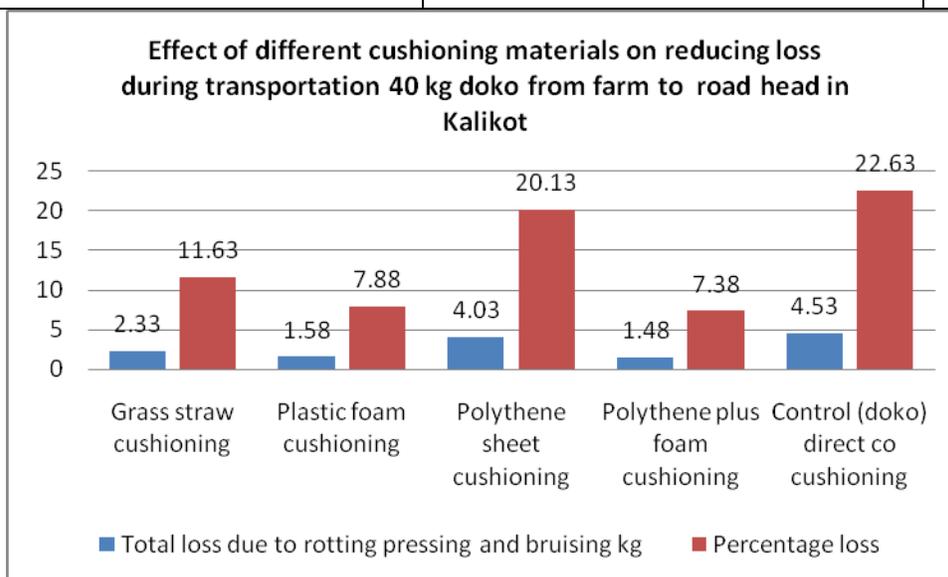


Table 5: Effect of different cushioning material to reduce loss during apple transportation from farm to local market Kalikot 40 kg per doko

S.N	Treatments	Total loss due to rotting pressing and bruising kg	Percentage
1	Grass straw cushioning	2.33	11.63
2	Plastic foam cushioning	1.58	7.88
3	Polythene sheet cushioning	4.03	20.13
4	Polythene plus foam cushioning	1.48	7.38
5	Control (doko) direct co cushioning	4.53	22.63



Similar to Jumla study, when the quantity of apple were increased from 20 kg to 40 the loss during transportation increased to 7.38 % in polythene plus foam cushioning followed by plastic foam cushioning 7.88 % and highest 22.63 % in control no cushioning. Plastic foam cushioning had 7.88% loss and grass cushioning was 11.63 % loss during transportation

In all the cases Polythene plus foam cushioning gave better results with minimum loss compared to control and other cushioning materials in local transportation.

Result 3: Long distance transportation study

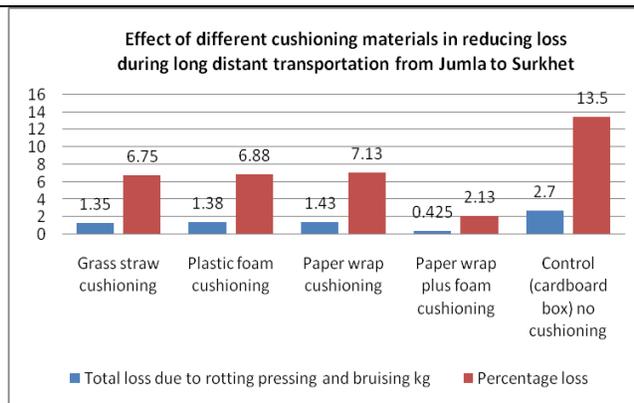
In case of long distant transportation, cardboard boxes were used. The cushioning materials used were 1) Grass straw cushioning, 2) Plastic foam cushioning, 3) paper wrap cushioning, 4) Paper wrap plus foam cushioning and 5) control cardboard box no cushioning. The apple boxes were transported from Jumla and Kalikot to Surkhet in hired jeep. At the destination point Surkhet loss due to rotting, pressing and bruising were separated and percent losses were calculated. The results are presented in Table 6 and Table 7



Apples packed in cardboard box for transportation to destination market

Table 6: Effect of different cushioning material to reduce loss during apple transportation from Jumla to Surkhet 15 kg per box

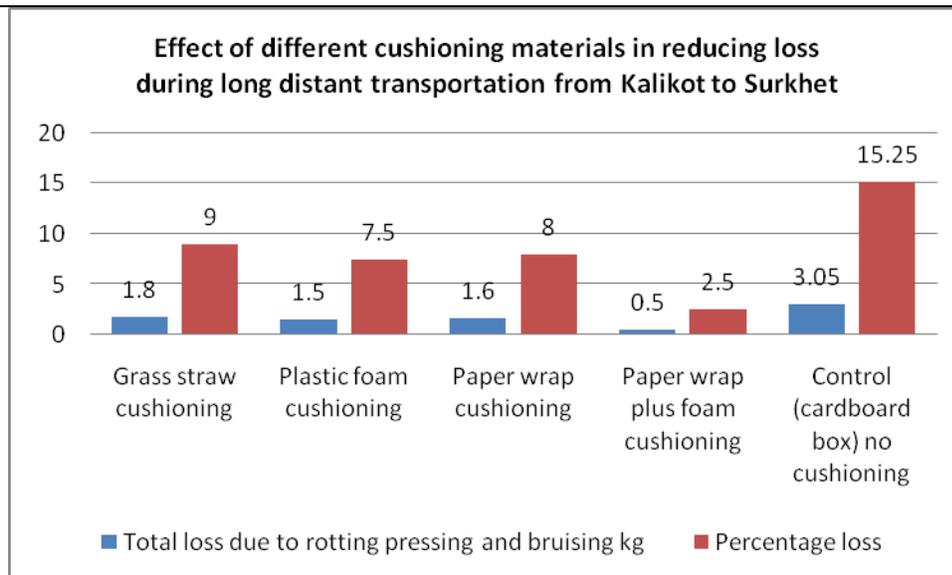
S.N	Treatments	Total loss due to rotting pressing and bruising kg	Percentage
1	Grass straw cushioning	1.35	6.7
2	Plastic foam cushioning	1.38	6.8
3	Paper wrap cushioning	1.43	7.1
4	Paper wrap plus foam cushioning	0.43	2.1
5	Control (cardboard box) no cushioning	2.70	13.5



From table 6 it is evident that the loss was minimal when apples were wrapped with paper and cushioned with foam (2.3%) followed by grass straw cushioning (6.75 %) and highest in control (13.5 %). Therefore, for long distance transportation, if apples are wrapped with news papers and cushioned with soft foam the loss is minimal and recommended

Table 7: Effect of different cushioning material to reduce loss during apple transportation from Kalikot to Surkhet 15 kg per box

S.N	Treatments	Total loss due to rotting pressing and bruising kg	Percentage loss
1	Grass straw cushioning	1.80	9.0
2	Plastic foam cushioning	1.50	7.5
3	Paper wrap cushioning	1.60	8.0
4	Paper wrap plus foam cushioning	0.50	2.5
5	Control (cardboard box) no cushioning	3.05	15.2



From table 7, it is evident that the loss was minimal when apples were wrapped with paper and cushioned with foam (2.5%) followed by plastic foam cushioning (7.5 %) and highest in control (15.25 %). In both study, for long distance transportation, if apples are wrapped with news papers and cushioned with soft foam the loss is minimal and is recommended

Result 4: Construction and maintenance of apple collection sheds

To facilitate collection, packaging and shipping of apple to the distant market project supported the construction of two collection sheds at Jumla and Kalikot and handed over to the marketing committee. Weighing machines and other necessary support also provided to ease the marketing of apple and other agricultural produce. Marketing linkage between the producer groups and traders established organizing meetings at production pocket and workshops at district level.

Result 5: Market linkage development between farmers and traders

Workshops organized in collaboration with DADO to share marketing and market information between producer farmers and apple traders at regional level at Jumla. The meetings reviewed existing marketing system and discuss practical ways to strengthen and improve marketing system to promote internal and external market of apple. The participants of the meetings and workshops were representatives of producer’s group and traders from major market centers from far western region.



Group works during dissemination workshop

Result 6: Technical capacity on orchard management, production skill, post harvest handling and market-linkage development enhanced of the farmers.

Within the scope of the project activities trainings and field days for farmers on different subjects as planned in the project have been provided. Farmer's knowledge and skill on orchard management, pruning and training of the trees and post-harvest handling and marketing enhanced. A technical booklet and leaflet based on the curriculum of training have been published. As a result of the trainings on orchard management, integrated plant nutrient management including compost making and FYM improvement farmers are able to adopt better production technology



Post harvest handling training was organized during harvesting time of apple. Practical exercises for cleaning, sorting, grading and packaging were demonstrated to the farmers comparing both traditional and improved packaging and transporting techniques. Farmers themselves participated in harvesting, packing and participated in carrying to the district headquarter market and distant market Surkhet. Now the post harvest handling process has been improved.

Result 7: Preparation and publication of extension materials.

The booklets and leaflets have been published incorporating the project findings and other relevant information useful for fruit farmers and other stakeholders

A short and comprehensive slide series has been prepared and made available to beneficiaries and concerned stakeholders.

The project has produced two extension and dissemination materials such as

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Initially these two publications have been helpful to disseminate the findings. Booklet and leaflet have been helpful in orchard management and post harvest handling during transportation, market management and appropriate packaging and transportation system to distant market.

4. Discussion

This project falls under agricultural sector, sub-sector horticulture i.e. apple production and marketing to contribute to livelihood improvement and poverty reduction. Reducing poverty has become a formidable task before the country and is the central objective of Government of Nepal, which the Poverty Reduction Strategy paper (PRSP) and periodic plans intends to address. The cooler climatic conditions found in the Karnali hills provide comparative advantage for temperate fruit production specially apple. This project intended to increase the income and improve livelihood of hill farmers through the improvement in apple production through improved orchard management and market linkage development between producers and traders.

Road construction from Surkhet to Jumla presents a congenial and favourable environment for the marketing of apple. Because of the high demand of quality apple it fetch higher prices in the Terai and even to bordering Indian market. However, due to inadequate technical knowledge, the farmers of the proposed areas had not been able to harness this opportunities fully. Despite the existence of comparative advantages of apple production in the hills and high hills, the excluded, deprived and poor farmers did not have access to the production techniques to harness these opportunities. Small quantities of apple produced by few farmers were limited to sell their produce in the local markets. Post harvest handling and transportation techniques were primitive. The produce was usually shipped in Doko without proper sorting, grading and packaging. As a result, post harvest handling losses were high. In the given situation, this project supported farmers to acquire production and post harvest-handling skills and organize them in groups for marketing for sustainable livelihood improvement. Thus the project has been successful in addressing fruit sub-sector to contribute to economic development.

5. Conclusion and implication

Increased pace of commercialization of high value perishable commodities such as apple involves integrated approach in production, post harvest operations and marketing. Unless all the three fronts are dealt with simultaneously, isolated effort in one front not only leads to wastage of resources but also creates negative environment and frustration

on the part of actors on the success of such High Value Crop (HVC) production program.

In the production front, a number of constraints are apparent. First, change in developmental attitude of the poor farmers to commercialization, change in skill and capacity of production, based on market demanded quality. Second, there is serious problem of orchard management and crop protection from emerging diseases and pests. Jumla has been declared as organic district, and requires a lot of study on organic pest management. Third, the institutionalization of production groups and its sustainability is a questionable after project phase out. Fourth, farmers groups formed to take up group marketing are weak in terms of possession of technical knowledge, skills in post harvest operations and marketing management. Their capacity to manage production inputs in package form and to link their production with markets is still need further external support. In the post harvest front, systems of packaging depend on the availability of appropriate packaging materials. Lack of special means of transportation for perishable commodities and bad road conditions are the major constraints. In the marketing front inadequate and timely market information system both for domestic and export markets exists.

The future impact and implication of the findings of this project will depend upon the dissemination and successful adoption of these technologies in the complex farming system of communities. It is therefore; the means of effective dissemination of technology skill training has been taken care in extension process. In the project areas technologies have been demonstrated in collaboration with GoN extension system through the support of NARDF. Therefore the rate of adoption of techniques of orchard management and its impacts on productivity and income will depend on the effective and practical training carried out in other areas and the extension materials developed and disseminated properly. Hence, any post evaluation of the project should be concentrated in the areas where such demonstration is carried out during uptake pathways.

6. Acknowledgement

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