Background Paper

An Assessment of IDE-Nepal's Low Cost Drip Irrigation Technology

Mr. Indralal Kalu
RITI Consultancy Pvt. Ltd, Nepal

IDE
international development enterprises

Poverty – Focused Smallholder Water Management
Promoting Innovative Water Harvesting and Irrigation Systems to Support Sustainable Livelihoods in South Asia

An IWMI Research Project Supported by DFID (Department for International Development- UK)

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Abbreviation Used

ADB/N	-	Agriculture Development Bank/Nepal
cm.	-	Centimeter
DADO	-	District Agriculture Development Office
DAO	-	District Agriculture Office
FGD	-	Focus Group discussion
Ha.	-	Hectare
HDPE	-	High Density Poly Ethylene
IDE	-	International Development Enterprise
INGO	-	International Government Organization
IPM	-	Integrated Pest Management
Km	-	Kilometer
m.	-	Meter
mm.	-	Millimeter
Mt.	-	Metric tone
NGO	-	Non-Government Organization
°C	-	Degree Celsius
PRA	-	Participatory Rural Appraisal
PVC	-	Poly Vinyl Chloride
Rs	-	Rupees (Nepalese Currency)
SDC	-	Society Disadvantaged Center
Sq. m	-	Square Meter
US $	-	Dollars (US)
VDC	-	Village Development Committee

Section 1: Introduction to the study

1.A. Introduction to DFID's Sustainable Livelihoods Framework

DFID's Sustainable Livelihoods Framework is largely an adaptation of work done at the Institute of Development Studies such as that of Scoones, 1998.

The following definition of livelihood is used for the purpose of the livelihoods analysis framework:

"A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base".

The central point of the framework is an analysis of the five different types of assets that individuals draw upon to build their livelihoods. These capital assets are:

- Natural Capital
  The natural resource stock from which resource flows useful for livelihoods are derived.(e.g. land, water, wildlife, biodiversity, environmental resources).

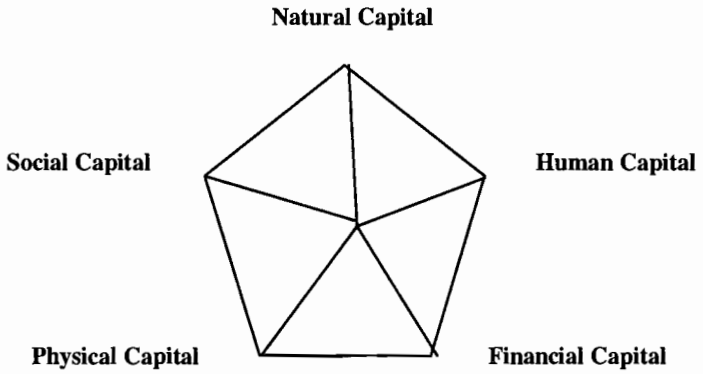
- Social Capital
  The social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods.

- Human Capital
  The skills, knowledge, ability to labour, and good health important to the ability to pursue different livelihood strategies.

- Physical Capital
  The basic infrastructure (transport, shelter, water, energy and communications) and the production equipment and means that enable people to pursue their livelihoods.

- Financial Capital
  The financial resources which are available to people (whether savings, supplies of credit or regular remittances or pensions) and which provide them with different livelihood options.

Figure 1: Capital assets central to the DFID livelihoods analysis framework.



The different types of assets are presented in the shape of a pentagon, indicating the importance of a holistic rather than a sectoral approach to the analysis of livelihoods. The framework is expected to highlight strengths of the households rather than the needs. The framework is generally used in order to identify the most appropriate type of intervention for a particular project. However, sustainable livelihoods approaches have been used in different ways; in project design, programme design, project review and impact assessment, review of programme, and assessment of sectors.

Within the sustainable livelihoods framework, Scoones identifies three broad clusters of livelihood strategies. These are agricultural intensification/extensification, livelihood diversification, and migration. Most rural households pursue a combination of strategies together or in sequence. The combination of activities that are pursued can be seen as a "livelihood portfolio". Some portfolios may be highly specialized, with a limited set of activities, while others may be highly diverse. The types of livelihoods pursued will vary by season and could change over the years, as new options replace existing ones. Over generations, substantial shifts may occur as external and local conditions change.

The degree of specialization or diversification of livelihoods is influenced by resources available to the household and the degree of risk associated with the different livelihood options. The livelihood strategies of the households, particularly the poorer households, usually take into account risk factors. It is observed that members of the households take up different activities so that at least one source of income is available to the household at any given time of the year. The mix of activities undertaken by different members of the household protects the household from risk of loss of income that may occur during the course of the year. Rural livelihoods rely heavily upon the natural resource base, and the mix of activities undertaken by a household is influenced by the degree of access and availability of the natural resources on which their livelihoods depend.

Socio-economic factors and livelihood resources are inter-dependent. Socio-economic factors impact access to livelihood resources, and successful livelihood strategies can change the socio-economic status of the household. Within the Indian context, caste, class and religious affiliations can often determine the livelihoods that are pursued by the household and the level of

access to various resources. It is important therefore to take these aspects into account while analyzing the livelihood strategies of the household.

Further, the degree of access to resources is either facilitated or restricted by institutional arrangements at the micro and macro levels. Different forms of institutional arrangements exist which support or deny access to households, for example; members of the village governing body at the local level may have greater access to resources, membership to the local cooperative dairy may ensure availability to fodder resources, membership to a savings group may facilitate access to credit from financial institutions, etc. Livelihood strategies of households are influenced by institutional arrangements and processes and an analysis of these is important to understand why specific livelihood portfolios are pursued by different households.

1.B. Background

Poverty alleviation is a major thrust of all development-minded institutions and concerns. Most low-income countries have agriculture-based economies. Poverty is a major problem, particularly where most farmers are small holders and land distribution is not equitable. How does one raise the living standards of such a group and combat poverty? This is a challenging task both for government planners and executives as well as development institutions. Different institutions are striving hard to alleviate poverty. These days poverty alleviation is one of the main development slogans. Advances have been made in agriculture. But most technologies developed generally benefit large farms and farmers. Appropriate technology needs to be developed for adoption by small and marginal farmers. One problem which hinders year round agriculture is lack of irrigation in the dry months. Drip irrigation technology has proven to be an appropriate irrigation method for water scarce areas and has been spread over many developed and developing countries. The main problem of adopting drip irrigation is the high initial cost, which makes it difficult for farmers to adopt. To deal with this problem, the International Development Enterprise-Nepal (IDE-Nepal) an INGO has worked on the simplification of the technology and has adopted this in the field-testing. Based on their field results, IDE now has developed small drip irrigation systems, which, though laborious, is economic and affordable by smallholder farmers. Now this technology has been spread in a few hill districts of Nepal. IDE reports that the program is accepted with encouraging success.

Such development and application of innovative approaches to irrigation and water management are taking place all over the world, usually spearheaded by NGOs and similar grassroots organizations. But their innovations are often not known or disseminated beyond a very local domain. These are many reasons for this failure to spread. There could be problems related to the credibility of the message as well as the messenger. On one hand, the information presented in support of the claims to success of an innovation may not be complete or convincing, indeed, crucial but inconvenient pieces of information may sometimes be omitted. On the other hand, the promoters, who are often the innovators themselves, may be perceived as exaggerating the merits of their innovations. As a result, even outstanding local innovations with potential for wider application and impact may remain relatively unknown and unutilized nationally and regionally. Uptake, if any, tends to be slow and random. Hence, there is significant scope for carrying out systematic scientific scrutiny of promising poverty-focused innovations in irrigation and water management with a view to refining and promoting wider dissemination of those that show high potential for adoption and positive

impacts among poor people. Among such technology, low cost drip irrigation technology developed by IDE-Nepal appears to be gaining popularity there. But all farmers are not buying the innovations giving rise to several questions like "is the innovation really worth it? If it is, for whom and under what condition is the technology worth it? Are there any deficiencies in technology, which require further improvements for widespread adoption?"

While seeking answers to these questions has been urgent, it is necessary to learn whether the innovation has actually been successful. If it has been successful, where is it worth spreading and under what type of environment? With a view to seek answers to these questions and also to establish a sound database regarding the IDE-Nepal drip irrigation innovation, this research study has been carried out. Accordingly, the purpose of this study has been set to identify the impacts of the adoption of promising innovations particularly the drip irrigation technology for small holders, water management on the poor, identify the determinants of their successes and learn the causes for limiting the spread of this innovation on a wider scale.

1.C. Objectives

The main objective of the study is to create an elaborate knowledge base which will allow one to assess the success or otherwise of the drip irrigation innovation besides facilitating development of practical mechanisms for promoting the innovation in small-holders water management units for improving their livelihoods. Specific objectives are:

1. Prepare a detailed database of the innovation in the three districts through sample survey of adopters and non-adopters of the innovation.
2. Evaluate the impact of this particular innovation on the livelihoods of the poor people in the three districts.
3. Identify factor or combination of factors (physical, hydrological, socio-economic, and institutional) contributing to the successes of particular technological choices and innovations.
4. Ascertain whether the innovation was used by itself or in association with water-harvesting or lifting techniques.
5. Assess necessary and possible improvements in the design of the innovation itself or its associated activities such as water lifting and distribution to further enhance the attractiveness of the innovation in terms of returns to land, water and labor.
6. Suggest necessary strategies to facilitate the dissemination of the knowledge gained and promote the uptake and replication of the innovation with high promise.

1.D. Rationale of the Study

Nepal is one of the least developed countries with over 40 percent of population living below the poverty line (Ninth plan, 1999). Hence poverty alleviation is one of the main focuses of the government planners, and how to reach to the real poor with ease is yet to be learnt. The Ninth Plan of Nepal has put poverty alleviation as its main goal.

Most poor people live in the rural area and are dependent on agriculture for their livelihood. These people own/cultivate less than one-hectare land. Most development efforts done in general do not reach small farmers. IDE's drip irrigation technology designed to serve a small area is considered to be able to increase agricultural production and thereby contribute to the household income of poor farmers and alleviate poverty. The potential of drip irrigation technology to alleviate hunger and poverty is elaborated in detail by Postel et al. (2000). Since 1996/97, IDE is promoting the use of the drip kit, and its adoption is gradually increasing in the mid-hill districts of Nepal. There is still a large area in that belt where this technology may be spread. Side by side there are many people in the community not adopting the technology. To learn the reason for not adopting, to evaluate the impact of the kit on the livelihood of the adopters and understand perceptions of the existing problem and possible improvements will be valuable for the implementation of the drip kit promotion programme. It is also very timely since a sizeable number of farmers have been using the drip kits for the past few years.

1.E. Study Area

The study area is limited to 12-village development committee (VDC) of three districts Dailekh, Palpa and Tanahun. The sample VDCs is representative for the general socio-economic and physical conditions of hills in the Nepal. The study area is the mid-hill region and the places are relatively more accessible in the context of Nepal. The purpose of this study is limited to understand the socio-economic, institutional and physical environment where drip has succeeded and its impact. Relatively less precise information was obtained on the crop production and income from upland and lowland fields other than the field where the drip kit is installed. Therefore, the total income of household (HH) and profitability of agriculture is less elaborated.

Section 2: Methodology

2.A. General

This study focuses on understanding the existing situation of the drip kit users' socioeconomic conditions, physical setting particularly water resource situation, the motivation to adopt the kit, their observation and impact of the drip kit on their livelihood. Questionnaire survey of sample farmers is done to obtain information and prepare database. To obtain general finding participatory rural appraisal (PRA) tools namely focus group discussion, key informant survey and economic well being ranking were done in the sample area. To substantiate the research review of available literature pertaining to drip irrigation development in Nepal, progress reports of IDE and evaluation studies were done.

2.B. Selection of the Study Area

The drip irrigation program was implemented in some districts in the mid-hills region of Nepal. As stipulated in the terms of reference, three districts Tanahun, Palpa and Dailekh district were

chosen for the research study. The list of 2000 farmers from these districts using drip irrigation was obtained from IDE central office, Lalitpur. Sampling was done to select the villages called Village Development Committee (VDC), a small political unit comprising small villages and hamlets in the district. Each VDC is divided into nine wards.

In this study, list of villages with number of users were sorted and then two villages with large cluster and two with low cluster were chosen with another objective to meet planned sample size of 30 % users in these four VDCs in each district. Also the security situation in that VDC was also considered while choosing. Furthermore, a target was set to interview about one fourth of the non-users in each district along with few people who dropped the technology wherever they were encountered. The sample VDCs selected in the districts are given in Table 2.1 showing the number of drip users, dropper and non-user sample surveyed.

2.C. Approach

The structured questionnaire for household interview and checklist for focus group discussion were prepared. Three qualified research assistants and eight enumerators were employed to conduct the survey work. One-day orientation training was provided to them on the approach to be taken to visit the village and conduct focus group discussion and questionnaire survey. Also, guidelines for economic well being ranking and transect walk was given by the professionals.

The survey team visited Bhimad VDC of Tanahun district and contacted IDE staff and leader of drip users group there. The team then briefed the purpose to a group of 15 to 25 farmers at Bagtar ward in that VDC. The team conducted economic well being ranking and focus group discussion there to demonstrate common approach to be adopted at the three districts. This meeting gave a general idea of the drip users and non-users. This also became a database for the team to choose sample drip users. Droppers are not common. Very few farmers have stopped using the kit some reason. Few such droppers were interviewed to learn the reason for stopping to use of the drip kit. Nearly one forth of farmers living near the drip users but not using the kit were chosen as the sample non-users. They were asked separate questions.

Table 2.1 Sample sizes of Users, Droppers and Non-Users Interviewed

District	*VDC*	*Users*	*Dropper*	*Non-user*
Dailekh	Dadaparjul	12	1	3
Dailekh	Goganpani	62	2	15
Dailekh	Kalbhairava	15		4
Dailekh	Narayan	27	1	7
	Subtotal	116	4	29
Palpa	Chirtungdhara	50		14
Palpa	Darlamdanda	34	2	9
Palpa	Kaseni	13		3
Palpa	Nayarnamtales	17		4
	Sub total	114	2	30
Tanahun	Anbukhaireni	25		16

Tanahun	Bhimad	27	3	2
Tanahun	Khairenitar	27		6
	Subtotal	**159**	**3**	**38**

2.D. Sources of Data

- **Secondary Information**
  Secondary information includes IDE reports and publication related to drip irrigation system, evaluation reports and personal communication with IDE and other related staff. An engineer responsible for the drip irrigation in the Agricultural Development Bank (ADB/ N) explained their works.

- **Primary Data**
  Primary data were collected from field level household interview conducted in the 12 VDCs adopting structured questionnaire survey of sample households and using other PRA tool as described below.

2.D.1 Primary Data Collection Techniques

- **Questionnaire Survey:**

  Main source of database is the information obtained from the structured questionnaire survey conducted to selected sample users, droppers and nonusers in the chosen VDCs. Individual sample HH was met at his/her house and questionnaire was administered after introducing the enumeration purpose and enumerator himself. It was intended to interview finite proportion of droppers. But a dropper is a user who stopped adopting the drip kit in that period or longer. There are few droppers in many places. Separate questionnaire survey forms were used to interview droppers and non-users in that community to include sample of same socio-economic condition. Sample questionnaire forms are presented in Annex A.

  The adoption of drip irrigation kit is at the beginning stage, hence there are only limited users in the community. Some neighbor farmers living near the users but not adopting the drip kit were chosen as non-users.

- **Focus Group Discussion (FGD)**

  Focus Group Discussion (FGD) was done to gather general information about the prospects of using drip kits, benefits, constraints and potential improvement needs. IDE personnel and/or key farmers in the VDC were requested to inform the farmers to assemble in the specified place next day to discuss about the kit. They were told to make the gatherings more or less representative of the socio economic and cultural groups residing in these pockets including women as far as possible. To obtain an in depth study of the impacts, such discussions were held in the location most suited for the drip users. At the same time economic well being ranking was also conducted to see the proportion of drip users by their perceived economic class.

- **Key Informants Interview**

  The IDE staff in the field and the representative of the VDC related to drip kit were interviewed to know the approach of IDE's drip implementation and its impact in the area. Also the assemblers and few retailers of drip kits were met for learning their observation. The list of persons met is given in Annex B.

- **Direct Observation**

  The research team walked around the sample VDC to observe the physical setting of the area where drip kit is being adopted. A transect walk was done in the area. Functioning of drip kit was observed.

Section 3: Description of Study Districts

3.A. Location

Dailekh, Palpa and Tanahun selected for the study are all mid-hill districts located in the mid western region and western region of Nepal (Figure 3.1). Two highways namely Prithvi highway and Sidartha highway pass through Tanahun and Palpa districts. There are other gravel link road connecting some villages to the districts and villages. Tanahun district is the nearest of all to Kathmandu and Pokhara municipality, potential vegetable markets. Palpa district is close to Butwal in Terai and Pokhara where demand of hill vegetable exists.

In Dailekh there is only one seasonal gravel road connecting Narayan municipality, the district headquarter of Dailekh, to Surkhet, regional headquarter town connected to Nepalgunj. There is no other road other than trails in the district. Dailekh is thus relatively remote district compared to Palpa and Tanahun.

Four-village development committees (VDC) were selected in each district. These VDCs are shown in Figure 3.2 – 3.4. IDE is promoting drip irrigation service only in areas that are about two hours walking distance from the road head. Road passes through Anbukhaireni, Khairenitar, Kaseni, Narayan and Nayarnamtales while others are slightly far away.

3.B. Physical setting

The study area lies in the mid-hill region of Nepal ranging in altitude from 500m to 2500m above mean sea level. Due to variation in altitude there is variation in the temperature and rainfall in each district. Accordingly, vegetation also varies. Monthly average temperature, humidity evaporation and rainfall in these districts are given in Table 3.1. Average annual rainfall varies from 1500mm to 2000mm and average minimum and maximum temperature ranges from 5 to 35^0C. General climate of these districts varies from subtropical humid at low altitude river terraces to temperate humid at hilltops/ridges.

Most of the area is a sloppy terrain with some river terraces. Hence, only a portion of the total area is arable. Distribution of total physical land, arable and cultivated land, actual irrigated area and population in three districts are shown in Table 3.2.

Cultivated land is mostly upland sloping bench terrace made by cutting the hill slope. Such upland terrace land is called *bari* and low land level terrace as *khet*. *Khet* is a flat bench terrace located at low level where water can be retained. Paddy is cultivated there in the monsoon season. Dry foot crops like maize, mustard, millet, etc are grown in upland during summer. Soil is mostly sandy or sandy loam mixed with gravel while soil in *khet* it is comparatively fine not mixed with gravel. Soil in the hill is mostly shallow in depth underlain by soft or hard rocks.

Table 3.1 General Climatological Information

	Temperature		*R.H*	*Rainfall mm*	*Temperature*		*R.H*	*Rainfall mm*	*Temperature*		*R. H*	*Rainfall mm*
	Max.	*Min.*			*Max.*	*Min.*			*Max.*	*Min.*		
Jan.	18.3	7.7	75	2	22.6	7.6	98	8	19.3	7.9	56	0
Feb.	20.4	9.1	73	10	25.3	8.8	95	20	17.2	6.8	78	113
Mar	23.5	11.8	62	8	28.6	12.5	85	50	19.9	9	74	106
Apr	27.6	15.4	60	58	32.4	15.2	77	84	27.3	13.1	53	45
May	28.2	16.9	60	52	33.9	17.9	73	164	28.1	16.1	77	223
Jun	27.9	18.7	81	110	33.8	22.4	81	330	29.3	19.8	79	267
Jul	25.9	18.6	90	643	31.6	23.5	87	916	27.7	19.5	91	823
Aug	27.2	18.3	88	288	32.1	22.9	89	479	28	18.2	88	488
Sep	27.8	17.7	88	129	31.8	22.5	87	229	27.3	18.6	88	328
Oct.	26.4	13.8	81	73	29.7	18.4	87	128	23.4	13.1	69	24
Nov	25.5	11.9	77	0	27.2	13.5	96	19	22	9.9	67	0
Dec.	21.8	10.2	75	14	23.2	10.3	95	23	18.7	7.4	79	18
Year	**25.1**	**14.2**	**76**	**1378**	**29.4**	**16.3**	**87**	**2449**	**24**	**13.3**	**75**	**2436**

3.C. Access to market

Anbukhaireni, Khairenitar of Tanahun and Kaseni and Nayarnamtales of Palpa lie near the road head. Bhimad is connected to highway at Khairenitar by a seven-kilometer long gravel road. Darlamdanda and Chirtungdhara are connected to road head by gravel road. There is a gravel road from Surkhet to Narayan, which is closed during rainy season. People from Goganpani, Kalbhairav and Dadaparajul have to walk for two to three hours to reach to nearest road head. Drip users of Narayan also have to walk about one hour to reach to the market.

Table 3.2 Distribution of Land Area and Population

Area	*Dailekh (1)*	*Palpa (2)*	*Tanahun (3)*
Total physical	151000	146200	156877
Arable land	58338	48469	40309
Cultivated land	46000	47520	33939
Forest	100900	89199	85362

Irrigated Area	3058	4209	10,411
Year round	10	1172	NA
Population	162290	215924	268073

Source:

1. WECS (1990)
2. WECS (1988)
3. IAAS (1994)

Farmers of Majhkot walk for about two hours to come to Bhimad to sell vegetables. From there vegetables are taken to Pokhara. Vegetables produced in Tanahun and Palpa can be sold. And vegetables produced in Goganpani are also sold at Ratonangle (three hours walk from Goganpani) in Surkhet. As fresh vegetable consumption is not a habit in other areas in Dailekh they find it difficult to sell vegetables in the local market.

3.D. Demography

Nepalese village is a mixed ethnic society consisting of *Brahmin, Chetri, Magar, Gurung, Newa* communities. Occupational castes (blacksmith, tailor, cobbler, potter, etc.) are the main groups residing in the hills.

3.E. Agriculture

Maize mixed with legumes is a major summer crop in upland (*bari*). Millet is planted as a relay crop in July in some fields. In others, potato, mustard or buckwheat is grown as a second crop. In some places, upland paddy called *ghaiya* is grown as dry paddy in place of maize/millet. Ginger or potato is also grown as a cash crop at some place.

In the *bari*, near by the home in a kitchen garden, maize used to be grown mixed with vegetables like bean, cucumber, pumpkin, ginger as rain fed crop for domestic consumption. In winter, broad leafy vegetable (*rayo*), radish, turnip onion, garlic cauliflower and cabbage are grown. If irrigation facility is available other high value vegetable vegetables like cauliflower, cabbage, onion and garlic are cultivated.

In the lowlands (*khet*), paddy is the general summer crop grown in all area. Wheat, potato, mustard, peas etc. are grown in winter. Vegetables: potato, peas, cauliflower/ cabbage are also grown in the winter in a limited area. In places where water is available throughout the year, spring paddy is grown in some *khet*.

Farming is the main occupation and most farmers rear cow, buffaloes, bullocks, etc to supplement farm income. A few farmers also rear pig and poultry birds as a source of side income.

3.F. Off – farm Income

Income from farming is low hence most farmers do other jobs too. They get income from other non crop-agriculture activity like livestock, poultry and horticulture. Also a few are employed in government and private jobs. People try to get other civil or military jobs. The military pensioners are the ones getting good off-farm incomes in these districts. Those who get such jobs get good income and are highly regarded in the community. Farmers owning less land work as wage earners. There is no large industry in the districts to employ people in off-season. Hence, many people go to local towns or even to India to earn an income.

Section 4: Innovation and Adoption of the Technology

4.A. Nature and Function

Drip irrigation is the frequent slow application of water to soil through mechanical devices or holes called emitters located along the water delivery line. It eliminates spraying or running water down furrows and allows water to dissipate under low pressure. Water is carried through a pipe network to each plant. Emitters dissipate the pressure by means of a small diameter orifice or along flow path and thereby decrease water pressure to allow discharge of about two to three liters per hour. After leaving the emitter, water is distributed by its normal movement through the soil profile. The objective of drip irrigation is to continuously supply each plant with sufficient soil moisture to meet transpiration demands. Drip irrigation offers unique agronomic, agro-technical and economic advantages for the efficient use of water (Pairs et al. 1975). Drip irrigation kit is a device to distribute limited water uniformly to individual plants. Water application can be done with relative precision. Limited water can be applied to plants distributing water filled in the tank permitting deficit irrigation. Water stored by means of rainwater harvesting can be applied by drip irrigation kit.

4.B. Description

IDE promoted low cost drip irrigation kit (drip kit) consists of a field water application unit (Figure 4.1) comprising following three units.

a) Head unit (Tank and Filters)
b) Pipe system (Main Pipe, Adjuster, Drip Pipe and Vent Pipe)
c) Fittings and others.

- **Head unit**
  This comprises a plastic water tank integrated with filtration system. Tanks of different capacity are available. A 50-liter tank is commonly used. There are two types of filters namely a disk filter and jerry can. A disk filter is placed at the lid of the tank to prevent coarse particles from entering into the tank and Jerry can filter made by wrapping

perforated two litre plastic Jerry can with nylon net fabric is provided at the outlet to prevent fine particles from entering into the pipeline.

Two plastic valves are provided in two pipelines coming out from the tank to control water flow. The tank also has outlet and overflow arrangements. Recommended head for head unit is one meter.

- **Pipe system**
  Functionally there are 3 types of pipes made of soft PVC material. Main pipelines connect the tank outlet to the bifurcation point of the drip pipe. Its size is 13-mm diameter. A drip pipe or lateral is the actual water application pipe. Small holes of about 0.075-mm diameter are accurately punched normally at 60-cm spacing. A lateral pipe is 12 m long with 20 holes perforated at 60 cm spacing. Baffles to drip water as drops cover holes. The ends of lateral pipes are closed with end plugs.

  Hole spacing is chosen to irrigate crops spaced at 60 cm intervals. However, if plant to plant spacing is short say 30 cm, then to adjust water application in such condition, a small piece of pipe called adjuster is provided between main pipe and drip pipe so as to facilitate shifting of drip lines. The diameter of both adjuster and lateral is 8 mm.

  To remove the air blocking in the pipe and also to observe the water level inside the tank, a 60-cm long transparent tube is attached near the outlets. Discharge from one hole is 2 to 3 liters/hr (IDE, 2000).

  T and L connectors are the important pipe fittings needed to assemble the drip irrigation kit. End plugs are used to close pipe end. Pegs fix the lateral tightly in position.

4.C. Historical Development

Conventional drip irrigation system was originally developed on a commercial scale in Israel in the early 50s. It was later widely adopted in other countries like India, USA, Australia and European Countries (WALMI, 1988). Drip Irrigation then was costly and beyond reach of common farmers. It was used for high value crops only where water is scarce and water management was important. Most Countries adopting drip irrigation are the developed ones. The main factors for slow adoption or non-adoption of conventional drip irrigation in developing and under developed countries are:

1) Relatively High Capital Investment Cost
2) Complex Irrigation Management Process.

His Majesty's Government of Nepal entrusted Agricultural Development Bank, Nepal, (ADB/N) tc promote the micro irrigation program like sprinkler, drip along with the development of shallow tube well, treadle pumps etc in early 1980s. ADB/N is a major agricultural lending agency anc funds for a subsidy was also allocated to the bank. A micro-irrigation development cell wa: established to provide technical support where needed. To promote the drip system, ADB/N developed a low cost set and put that for testing at Letang VDC of Morang district in Eastern Nepal

It was learnt that no more effort was made to promote drip irrigation except providing loans to farmers.

International Development Enterprises (IDE/Nepal) an INGO later made an agreement with ADB in 1994 to promote micro irrigation particularly drip and treadle pump. IDE developed a low cost drip irrigation technology suited to small plots. It conducted research on the modification of the drip irrigation system in Tanahun district on 1995/96. The research was continued during which alternate design was developed and tested by simplifying the conventional drip irrigation technology with modification. The main modifications are:

- Shiftable drip lines (one drip line to be used for several rows by shifting)
- Changed to a low pressure system (1 to 2 meters)
- Simple low cost filtration system
- Simple and inexpensive pipefitting.

Since then, IDE/Nepal has been implementing the low cost drip irrigation program in some hill districts of Nepal targeting poor and marginal farmers holding less than 1 ha land. Poor people are farming in the rural area. Hence, mid-hills district where water is scarce for surface irrigation was selected to launch drip irrigation program. In the early stage, 1994/95 IDE used High Density polyethylene (HDPE) pipes as lateral. In the beginning there were no valves in the kit to regulate the flow. In 1998/99 IDE used black soft Poly Vinyl Chloride (PVC) pipes as the lateral pipes and introduced valves in the tank to regulate the flow. In 1999/2000, that model was also replaced by changing the color of pipes to green to help locate the baffles and holes easily. Continuous monitoring was done and the feedback from users on the needed improvement was learnt. And possible improvements were made. IDE has introduced three models of drip irrigation kit.

IDE distributes kits of three sizes: small, medium, and large to water 125, 250, and 500, sq. m area. These kits have 4, 8 and 16 numbers of 12 m pipes with 80, 160 and 320 holes costing roughly US $ 13, 19 and 32 respectively. To irrigate the mentioned area lateral pipes should be shifted four times to irrigate close spaced (60 * 60 cm) vegetables like cabbage and cauliflower and be shifted two times for wide spaced (120 * 60/cm) vegetables like cucumber, gourds etc.

4.D. Promotion Activity

IDE has been promoting low cost drip Irrigation program in the study area with the support from other donor agencies. NGO, INGO and private entrepreneurs are the main partners in the implementation of the program.

It distributes brochures and displays billboards to communicate information to the community. It contacts potential farmers and establishes demonstration plots on farmer's land to advertise the impact of drip irrigation kit. IDE has established field office at Pokhara and Surkhet for the drip program. In Dailekh, another NGO working to promote vegetable cultivation have advertised the need of drip kit. IDE field staff provides necessary demonstration and presentations.

The beneficiaries are made aware of the potential advantage of drip kit use for vegetable growing. IDE has motivated to adopt drip kit in most cases. It was learnt that the technical assistance on vegetable growing given by IDE field staff to drip users has been an attraction for farmers to promote drip kit. Almost all HH reported that they got first hand information from IDE. After collecting demand, the kits are supplied through dealers or distributors. IDE has motivated for vegetable farming by installing drip irrigation kit. Later some farmers adopted drip kit after looking at their neighbour.

It can be installed easily with little changes to suit field size and shape. IDE has trained technicians at local level to properly install systems and advise users about the technology. IDE provide technical support for drip installation/ management and gives training on agricultural know-how especially the vegetable cultivation.

4.E. Geographical Spread

The kits are mostly spread in rural and semi-urban area. The kits are now being widely demanded in the area where IDE or other NGOs are promoting this technology along with vegetable growing programs. As drip kit is cheap and benefits poor, other NGOs and INGOs are also promoting its spread. Several donors have assisted IDE to promote drip kit and high value vegetable cultivation in different area. The kits have now spread to 28 districts. Table 4.1 shows the number of drip kits adopted over the year in the country. Of them most farmers (79 %) own small kits leaving 12 % owning medium and 9 % large kits. This program is mostly in the mid hill of central, western and mid-western regions of Nepal, which has now been extended to eastern region too. Table 4.2 gives the number of drip kits spread by year in the study area. In Tanahun, drip kit was introduced from the beginning and adoption is increasing while in Palpa and Dailekh, drip was introduced since 1998/99 only.

4.F. Marketing

IDE has developed marketing system for the distribution of the kit. It has selected three manufactures and assisted them to fabricate the components of the drip kit, tank pipes and fittings. It has also appointed assemblers/distributors to assemble the kits and sell directly or through its approved retailer/dealer. It is thus promoting marketing network in controlled way. Technology is made available to the farmers through local dealers who purchase technology from assembler/ distributors. IDE is also promoting the adoption of drip irrigation kit by conducting various extension programs to promote vegetable farming using drip irrigation kit. While distributing the kits, it ensures that the follow up service program will be provided after sale.

Table 4.1 Geographical Spread of Drip Irrigation Kits

S.N	District	Program Year						Total
		1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	
1	Gorkha	4	25	67	0	0		96
2	Lamjung			18	23	36		144
3	Tanahun	6	46	55	206	248		879
4	Kashki	1		18	93	144		388
5	Syangja					69		92
6	Palpa				154	214		610
7	Surketh				53	202		432
8	Dailekh				88	278		552
9	Dhankuta				3			3
10	Nuwakot				32			32
11	Baitadi			3				3
12	Dadeldhura			3	10			13
13	Rasuwa				10			10
14	Chitwan			30		22	20	72
15	Kavre					44		44
16	Dhading				13			13
17	Kathmandu					5	1	6
18	Lalitpur				1			1
19	Dhanusha					2		2
20	Jhapa				2			2
21	Gulmi				4	23	27	54
22	Rupandehi				3			3
23	Mugu						1	1
24	Panchthar						37	37
25	Tehrathum						9	9
26	Bhojpur						22	22
27	Okhaldhunga						7	7
28	Solu							0
Grand Total		**11**	**71**	**194**	**695**	**1287**	**124**	**3527**

Source: IDE, Nepal

4.G. Target group

IDE has chosen small landholder as its target group for drip irrigation and hence developed low cost drip kits suitable for them It considers farmers with less than the land as small holder. Study also shows that most farmers have adopted small drip kits in Chirtundhara, Dadaparjul, Darlamdanda, Nayarnamtales, Bhimad and Majhkot (Table 4.3). In Palpa there are more small size kits followed by some medium. In the VDC of Dailekh and Anbukhaireni few farmers have installed large kits. A farmer in Goganpani installed a kit for 3000 sq m and a farmer at Anbukhaireni installed that for 1500 sq m.

Table 4.2 Number of Drip Kit Installed by Year

District	*VDC*	*1995/96*	*1996/97*	*1997/98*	*1998/99*	*1999/00*	*2000/01*
Dailekh	Dadaparjul				5	7	
Dailekh	Goganpani				18	42	1
Dailekh	Kalbhairava					15	
Dailekh	Narayan					27	
	Sub total				23	91	1
Palpa	Chirtundhara		1	1	25	18	3
Palpa	Darlamdanda				2	30	2
Palpa	Kaseni				12	1	
Palpa	Nayarnamtales					15	2
	Sub total		1	1	39	64	7
Tanahun	Anbukhaireni				2	9	13
Tanahun	Bhimad	1	2	3	1	10	7
Tanahun	Khairenitar		1	4	18		4
Tanahun	Majnkot	4	1	15	17	16	21
	Sub total	5	4	22	38	35	45
	Total	**5**	**5**	**23**	**100**	**190**	**53**
	Percent	**1**	**1**	**6**	**27**	**51**	**14**

Source: Field Survey, 2001

More than half of the drip users own less than one hectare. As land is fragmented and moreover the plot near the house is not large, large landholder owning more than one hectare is also adopting small or medium size drip kit.

4.H. Preconditions

No special preconditions are set to adopt drip kit. A farmer should have land suitable to install drip kit and there be some water sources at manageable distance. Water availability is an important factor for deciding whether to adopt drip kit or not for most farmers. Where water is adequate farmers irrigate by other method and where there is no water for irrigation; drip tank cannot be filled for water application. So drip kit is used in moderate water availability situation. IDE analyses the water supply situation in the feasibility study. If that is scarce and seems to create problem in future, drip irrigation kit is not promoted. About a quarter HH has reported occurrence of water shortage related problem.

Another factor is availability of under employed /surplus manpower in the house. In many families, some members can spare one or two hour time daily to look after vegetable cultivation. Such HH are adopting the drop kit. Some droppers revealed that manpower is a critical deciding factor. Few HH dropped drip kit when male member went out of village for wage earning. Such situation arises when water has to be fetched from a long distance.

Table 4.3 Distribution of Sizes of Drip Kit in VDCs

District	*VDC*	*Number of HH*	*Percent of Drip Kit Size*			
			Small	*Medium*	*Large*	*Very Large*
			<=125	*>125-250*	*250-<500*	*>=500*
			m2	*M2*	*m2*	*m2*
Dailekh	Dadaparjul	12	75.0	16.7		9.3
Dailkeh	Goganpani	62	41.9	35.5	9.7	12.9
Dailkeh	Kalbhairava	15	13.3	40.0	6.7	40.0
Dailkeh	Narayan	27	22.2	51.9	18.5	7.4
	Sub total	116	37.1	37.9	10.3	14.7
Palpa	Chirtundhara	50	62.0	36.0	2.0	
Palpa	Darlamdanda	34	88.2	11.8		
Palpa	Kaseni	13	30.8	46.2	23.1	
Palpa	Nayarnamtales	17	94.1	5.9		
	Sub total	114	71.1	25.4	3.5	
Tanahun	Anbukhaireni	25	16.0	44.0	28.0	12.0
Tanahun	Bhimad	27	96.2	3.8		
Tanahun	Khairenitar	27	33.3	66.7		
Tanahun	Majhkot	80	72.5	27.5		
	Sub total	159	60.4	32.7	4.4	1.9
	Total	**389**	**56.6**	**32.1**	**5.9**	**5.1**

Source: Field Survey, 2001

Another point to consider before installing kit is potential market for vegetable sale. Motivation to install bigger kit and produce more vegetable is mainly controlled by market. Where market demand is limited, farmers produce only for domestic consumption. Almost all (90%) HH reported the purpose of installing drip kit is to meet vegetable for domestic consumption and to sell extra that remains. And only 10% said it is for mainly market sale.

Few farmers of Dadaparjul, Kalbhairav and Narayan of Dailekh district have stopped using drip kit due to lack of market and left to earn wage elsewhere. On the contrary farmers in Goganpani have good market at Ratonangle, Surkhet at three hours walking distance. Though they complain of less price and more cost to carry vegetable they are still motivated to grow more vegetables. Similarly farmers of other VDCs in Palpa except Darlamdanda have easy access to market.

4.I. Spares and service backup

Drip kit needs less number of spare parts to be replaced. Mostly fittings like valve, T and L connector, end plug, pegs and baffles are required to be replaced. These are available at approved dealers only. Since their location is far from some area like Majhkot for example, farmers expressed problem to get spare parts in time. They requested to appoint more local dealers. Farmers face problem in travelling long to buy small parts rather than to pay the price.

Back-up service is generally provided for one year after installation of drip kit. Guidance and advice are provided by IDE field staff and group leader/installers (*mistri*) trained by IDE technicians. If farmers visit to dealer, he also gives needed advice. There are no complicated parts requiring skilled service. Major technical problem is clogging of holes in lateral pipes and replacement of spare parts.

Most HH praised the quality of follow up service. Generally IDE provides the service for one year. But farmers wish follow up service to continue for at least two more years. And a dealer remarked that motivation to adopt drip kit is for the good follow up service and training provided on vegetable cultivation.

4.J. Cost

- **Capital**

  Cost for adopting drip irrigation kit is the capital cost to buy drip kit, transport and install that in the field. Price of drip kit is fixed by IDE. It varies from Rs 916 to Rs 2415 (US $ 13 to 32) depending upon the size of the kit. Transport and installation cost is less and the farmer does this. If the farmer cannot install the kit he may secure the service of an installer by paying Rs 25 (33 cents). Other than that there is no cost to install a drip kit.

- **Operation and Maintenance**

  The operating cost should include cost for carrying and applying water in the field. But HH members do this and it is not accounted. There is no charge for water in the villages. Taps are installed at a common place for public use. People go there and fill buckets for use in the drip tank. This labour is not considered as the cost, which if considered is considerable. Even at the rate of low labour input of one hour daily for four months, the man hours required is 120 hours equivalent to roughly 17 person-days. Hence, labour requirement for absentee farmer is very high for the operation of drip kit when water has to be fetched from long distance. Therefore only HH members who work themselves use drip kit. Maintenance cost is quite minimal, which is required simply to replace fittings like valve, L and T connectors, baffle and plugs.

4.K. Finance

Price of drip kit is not much and is affordable for most farmers. Yet investment to buy drip kit is reported to be limiting for many small and marginal farmers. To promote drip irrigation system, the government was providing 60% of the total cost as assistance for procuring drip irrigation kit as *subsidy* to farmers installing drip kit. And loan can be obtained for the remaining amount from Agricultural Development Bank (ADB/N). Table 4.4 shows that proportion of people receiving loan and subsidy for drip kit purchase. As the investment is small and bank procedure is long and tedious, hence most farmers did not try to get the facility and rather paid their own money.

Table 4.4 Proportion of People receiving loan and subsidy for Drip Kit purchase

District	*VDC*	*Respondent No.*	*Self cash*	*Loan*	*Subsidy*
Dailekh	Dadaparjul	12	91.7	8.3	8.3
Dailekh	Goganpani	62	100.0	4.8	8.1
Dailekh	Kalbhairava	15	80.0	0.0	26.7
Dailekh	Narayan	27	100.0	0.0	26.7
	Sub total	116	96.6	3.4	10.3
Palpa	Chirtundhara	50	92.0	10.0	2.0
Palpa	Darlamdanda	34	100.0	26.5	97.1
Palpa	Kaseni	13	92.3	7.7	0.0
Palpa	Nayarnamtales	17	100.0	5.9	17.6
	Sub total	114	95.6	14.0	32.5
Tanahu	Anbukhaireni	25	100.0	0.0	0.0
Tanahu	Bhimad	27	100.0	0.0	0.0
Tanahu	Khairenitar	27	96.0	0.0	0.0
Tanahuu	Majhkot	80	100.0	0.0	0.0
	Sub total	159	98.7	0.0	0.0
	Total	**389**	**290.9**	**17.4**	**42.8**

Source: Field Survey, 2001

In Dailekh about one tenth received subsidy and few received loan. Most large drip kit users have received subsidy and loan.. In Palpa, few farmers have taken loan to buy drip. Darlamdanda VDC in Palpa has provided 33 % subsidy to all drip users. The proportion of drip users receiving loan in Dailekh is only 3.4% and that receiving subsidy is 13 % while that is 14 % and 32 % respectively in Palpa but nil in Tanahun. Subsidy provision motivates people to adopt new technology. The government subsidy for the farmers adopting drip irrigation is now discontinued from July 2000. Now in place of that, some village development committee and NGOs provide some subsidy to adopt drip kit.

4.L. Skill and Training

Proper installation of drip kit and planting seedling at the proper place by the holes is the important skill need to be acquired. IDE staff has trained few installers and leaders of the groups in VDCs to help new farmers to install drip kit. Some skill to place the tank, layout laterals and connect fittings is required. This knowledge is simple and has been imparted to almost all farmers. Necessary skills for operating the kit is to fill water in tank, open valve, check clogged holes in the lateral and maintain them. This knowledge has been given to all group leaders and many users. IDE field staff provides guidance on these skills. Also farmers learn from fellow farmers. Survey showed that almost all users knew these skills

IDE conducts various training sessions on installation and operation of drip kit. The discussions are on opening gate valves, blocked holes, shifting of lateral pipes, cleaning of debris from lateral by opening end plugs, etc. These necessary operation skills are given to the users. Farmers learn these simple works by one time observation. Other training is given on agricultural aspects like vegetable farming technique time to time.

4.M. Kit Life span

All farmers know that drip kit will last for few years only. Expected life reported by sample HH varied mostly above 4.5 to 6 years. Average life of drip kit as estimated to be 5.6 years. None allot fund for replacement owing to lack of budgeted expenditure system at home. Also the whole kit need not be replaced at one shot. Rather repair and replacement of parts will be required at different time. So there is no need to reinvest for replacement by new kit. Three old user of Bhimad using old (HDPE model) seeks to buy new model kit saying that new soft PVC model is better. It shows that other farmers will use the kit continuously.

Section 5: Practitioners and the Practices

5.A. Socio-economic condition of the Practitioners

All drip kit users have land near the house and are interested to grow vegetable. Innovative traditional vegetable farmers with high risk bearing capacity were the early users. There are many non-users, some of them are willing to adopt drip kit in near future. Socio-economic characteristics of drip users and non-users are analysed in this chapter. While selecting non-users, enumerators approached the house near by the sample user and asked the questionnaire to the person met there irrespective of consideration to gender caste/ethnicity and age.

Most users are semi-urban and rural people. Very few drip users are living in urban market. Urban people have less land and use drip kit to grow vegetables mainly for home consumption purpose. There is little chance of expansion of drip area. Among the sample sites, only one ward of Bhimad VDC can be considered urban lying in the market area. All other areas surveyed were either semi-urban or rural area.

- **Gender**

  Both man and woman are actively engaged in drip irrigation. Table 5.1 shows the distribution of male and female drip users. Proportion of male user at Dailekh and Tanahun is about two third while that is reverse in Palpa with two third female users showing more female participation. In Kalbhairav VDC, all users are male. In Narayan, Bhimad and all VDCs of Palpa there are more female drip users compared to male. The sample non-users are mostly male although the proportion is slightly lower at Palpa.

  There were different groups formed by different government and NGO for assorted purposes like poverty alleviation, saving credit or woman empowerment etc. Some of these are men's group, other women's group and some mixed groups. IDE field staff contacted members of both men and women group, which ever was present. They came forward, and requested to install drip kits. Therefore, at some places there are more women and in some more men involved.

- **Education**

Drip users comprised both educated as well as illiterate members. The literacy levels were divided into five categories namely graduate, intermediate and secondary, literate and illiterate. There are more illiterate users at Tanahun and Dailekh compared to them at Palpa (Table 5.2). Slightly more proportion of drip users in Palpa and Tanahun are intermediate and/or graduate. In Majhkot and Narayan large proportion of drip users are illiterate. When compared to non-user samples, overall proportion of illiterate people is almost similar. In fact illiteracy does not hinder to use drip irrigation kit.

Table 5.1 Gender Distribution among Users and Non-users

District	*VDC*	*Users*					*Non-users*				
		Female No.	*Male No.*	*Number NN*	*Female Percent*	*Male Percent*	*Female No.*	*Male No.*	*Number NN*	*Female Percent*	*Male Percent*
Dailkeh	Dadaparjul	1	11	12	8.33	91.67	1	3	4	25.00	75.00
Dailekh	Goganpani	17	45	62	27.42	72.58	1	16	17	5.88	94.12
Dailekh	Kalbhairava	0	15	15	0.00	100.00	0	4	4	0.00	100.00
Dailekh	Narayan	16	11	27	59.26	40.74	3	5	8	37.50	62.50
	Sub total	34	82	116	29.30	70.70	5	28	33	15.20	84.80
Palpa	Chirtundhara	35	15	50	70.00	30.00	5	9	14	3.71	64.29
Palpa	Darlamdanda	24	10	34	70.59	29.41	3	8	11	27.27	72.73
Palpa	Kaseni	7	6	13	53.85	46.15	3	0	3	100.00	0.00
Palpa	Nayarnamtales	12	5	17	70.59	29.41	2	2	4	50.00	50.00
	Sub total	78	36	114	68.40	31.60	13	19	32	40.60	59.40
Tanahun	Anbukhaireni	6	19	25	24.00	76.00	5	11	16	31.25	68.75
Tanahun	Bhimad	16	11	27	59.26	40.74	2	3	5	40.00	60.00
Tanahun	Khairenitar	10	17	27	37.04	62.96	1	5	6	16.67	83.33
Tanahun	Majhkot	23	57	80	28.75	71.25	6	8	14	42.86	57.14
	Sub total	55	104	159	34.60	65.40	14	27	41	32.00	74.00
	Total	167	222	389	43.00	57.00	32	74	106	30.00	70.00

Source: Field Survey, 2001

Table 5.2 Proportional Distribution Literacy level of Users and Non-users

District	*VDC*	*User*						*Non-user*					
		NN	*Graduate*	*Inter mediate*	*Secondary*	*Primary*	*Illiterate*	*NN*	*Graduate*	*Inter mediate*	*Secondary*	*Primary*	*Illiterate*
Dailekh	Dadaparjul	12	0.0	8.3	25.0	41.7	25.0	4	0.0	0.0	0.0	100.0	0.0
Dailekh	Goganpani	62	0.0	1.6	17.7	61.3	19.4	17	0.0	0.0	17.6	76.5	5.9
Dailekh	Kalbhairava	15	6.7	0.0	26.7	53.3	13.3	4	0.0	0.0	0.0	0.0	100.0
Dailekh	Narayan	27	0.0	0.0	29.6	29.6	40.7	8	0.0	0.0	12.5	37.5	50.00
	Sub total	116	0.9	1.7	22.4	50.9	24.1	33	0.0	0.0	12.1	60.6	27.3
Palpa	Chirtundhara	50	2.0	2.0	8.0	70.0	18.0	14	14.3	7.1	14.3	50.0	14.3
Palpa	Darlamdanda	34	2.9	5.9	14.7	55.9	20.6	11	9.1	9.1	9.1	54.5	18.2
Palpa	Kaseni	13	7.7	23.1	7.7	53.8	7.7	3	0.0	0.0	0.0	100.0	0.0
Palpa	Nayarnamtales	17	0.0	11.8	17.6	70.6	0.0	4	0.0	0.0	25.0	25.0	50.0
	Sub total	114	2.6	7.0	11.4	64.0	14.9	32	9.4	6.3	12.5	53.1	18.8
Tanahun	Anbukhaireni	25	0.0	4.0	12.0	64.0	20.0	16	0.0	0.0	18.8	56.3	25.0
Tanahun	Bhimad	27	7.4	3.7	7.4	66.7	14.8	5	20.0	0.0	0.0	80.0	0.0
Tanahun	Khairenitar	27	7.4	11.1	29.6	29.6	22.2	6	0.0	0.0	33.3	50.0	16.7
Tanahun	Majhkot	80	0.0	1.3	25.0	32.5	41.3	14	0.0	0.0	14.3	78.6	7.1
	Sub total	159	2.5	3.8	20.8	42.8	30.2	41	2.4	0.0	17.1	65.9	14.6
	Total	**389**	**2.1**	**4.1**	**18.5**	**51.4**	**23.9**	**106**	**3.8**	**1.9**	**14.2**	**60.4**	**19.8**

Source: Field Survey, 2001

- **Caste/Ethnicity**

A village is a mixed caste/ethnic society comprising people of different castes. *Brahmin, Chetry*, occupational caste belong to Indo-Aryan ethnic groups, while *Magar, Newar, Gurung*, etc belong to Tibeto-Burmese ethnicity. They have their own caste system. Here caste and ethnic group is taken interchangeably. *Brahman, Chetry* and *Magar* are the dominant caste in the sample VDCs with some *Gurung, Newar*, and occupational caste (OC).

Proportional distribution of drip users and non-users by caste is presented in Table 5.3. There is a large proportion of *Thakuri/Chetry* at Dailekh in Goganpani and Kalbhairav VDC. At Dadaparjul, *Magar* users are in the majority. *Brahmin* represented majority at Narayan with some *Newar* and SDC people. Among the non-users sample HH were mostly *Chetry* in three VDCs except at Nayarnamtales where more occupational castes were included.

In Palpa, the *Brahmin* are in the majority at Darlamdanda and Kaseni while *Magar* is more at Chirtungdhara and Nayarnamtales with some *Chetry* and *Gurung* in the VDCs. All sample non-users were *Brahmin* at Darlamdanda and Kaseni while all non-users at Nayarnamtales were *Magar.*

In Bhimad, Khairenitar and Majhkot the majority users were *Brahmin* followed by occupational caste at Bhimad and *Magar* in other VDCs. Magar dominates users sample in Anbukhaireni followed by *Gurung*. It shows people of all castes are using drip kits. People of all castes get an equal chance to adopt the technology. Caste is no barrier to adopting the drip kit.

- **Social Status**

The social status of the drip users and non-users were analysed to see the effect of social position on drip use. A few people were interviewed who are elected or nominated to some political position, or hold active membership to political parties or are an employee of government or private organisation. Such persons are relatively exposed to outside of the village and they are usually well informed of the programs in the district.

Table 5.4 gives the proportion of users and non-users holding such positions. In Dailekh, one sixth of the users are elected/nominated, about one-quarter active political workers and 10 % employees leaving two third users with no such position. When checked by VDC, more proportion of users from Kalbhairav holds some positions. In Palpa proportion of elected/nominated members are low and there are about one sixth active member and another one-sixth employee of private company.

Table 5.3 Proportional Distribution of Users and Non-users Caste

District	*VDC*	*Users*						*Non-users*					
		Brahman	*Chetry*	*Gurung*	*Magar*	*Newar*	*Occp.*	*Brahman*	*Chetry*	*Gurung*	*Magar*	*Newar*	*Occp.*
Dailekh	Dadaparjul	8.33	33.33	0.00	58.33	0.00	0.00	25.00	50.00	0.00	25.00	0.00	0.00
Dailekh	Goganpani	1.61	77.42	0.00	9.68	1.61	9.68	5.88	82.35	0.00	0.00	0.00	11.76
Dailekh	Kalbhairava	0.00	93.33	0.00	0.00	0.00	6.67	0.00	100.00	0.00	0.00	0.00	0.00
Dailekh	Narayan	37.04	33.33	0.00	0.00	18.52	11.11	12.50	12.50	0.00	0.00	0.00	75.00
	Sub total	13.48	84.27	0.00	14.61	6.74	11.24	9.09	63.64	0.00	3.03	0.00	24.24
Palpa	Chirtundhara	18.37	2.04	2.04	77.55	0.00	0.00	57.14	7.14	0.00	35.71	0.00	0.00
Palpa	Darlamdanda	82.35	11.76	0.00	5.88	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Palpa	Kaseni	53.85	0.00	15.38	30.77	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Palpa	Nayarnamtales	23.53	17.65	0.00	58.82	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	Sub total	60.94	10.94	3.13	25.00	0.00	0.00	77.78	0.00	0.00	22.22	0.00	0.00
Tanahun	Anbukhaireni	4.17	0.00	41.67	50.00	4.17	0.00	37.50	12.50	18.75	12.50	0.00	18.75
Tanahun	Bhimad	69.23	11.54	0.00	0.00	3.85	15.38	100.00	0.00	0.00	0.00	0.00	0.00
Tanahun	Khairenitar	48.15	7.41	22.22	14.81	3.70	3.70	0.00	0.00	16.67	66.67	0.00	16.67
Tanahun	Majhkot	38.75	13.75	0.00	31.25	11.25	5.00	21.43	14.29	0.00	50.00	14.29	0.00
	Sub total	46.62	12.03	4.51	21.80	8.27	6.77	32.00	8.00	4.00	44.00	8.00	4.00
	Total	**123.00**	**99.00**	**19.00**	**108.00**	**18.00**	**19.00**	**39.00**	**26.00**	**4.00**	**23.00**	**2.00**	**12.00**
	Percent	**32**	**25**	**5**	**28**	**5**	**5**	**37**	**25**	**4**	**22**	**2**	**11**

Source: Field Survey, 2001

Table 5.4 Proportional Distribution of Users and Non users Social Status

District	VDC	No. of Users NN	Political							Employee			No. of Non users NN	Political		Emplo
			No.	Elected %	No.	Nominated %	No.	Active Mem %	No.	Govt. %	No.	Pvt %		Elected	Active	Govt.
Dailekh	Dadaparjul	11	1	9.09	0	0.00	3	27.27	0	0.00	0	0.00	4	0.00	0.00	0.00
Dailekh	Godanpani	62	5	8.06	2	3.23	7	11.29	4	6.45	2	3.23	17	5.88	0.00	0.00
Dailekh	Kalbhairava	9	9	66.67	0	0.00	4	44.44	2	22.22	0	0.00	4	0.00	0.00	0.00
Dailekh	Narayan	26	1	3.85	1	3.85	11	42.31	3	11.54	2	7.69	8	0.00	0.00	0.00
	Sub total	108	13	12.04	3	2.78	25	23.15	9	8.33	4	3.70	33	3.03	0.00	0.00
Palpa	Chirtundhara	50	5	10.00	1	2.00	2	4.00	0	0.00	4	8.00	14	0.00	0.00	0.00
Palpa	Dariamdanda	343	4	11.76	1	2.94	12	35.29	4	11.76	9	26.47	11	9.09	0.00	0.00
Palpa	Kaseni	13	0	0.00	2	15.38	4	30.77	3	23.08	1	7.69	3	0.00	0.00	0.00
Palpa	Nayarnamtales	17	1	5.88	1	5.88	2	11.76	2	11.76	5	29.41	4	0.00	0.00	0.00
	Sub total	114	10	8.77	5	4.39	20	17.54	9	7.89	19	16.67	32	3.13	0.00	0.00
Tanahu	Anbukhaireni	25	0	0.00	0	0.00	8	32.00	4	16.00	3	12.00	16	6.25	6.25	25.00
Tanahu	Bhimad	27	3	11.11	1	3.70	6	22.22	1	3.70	4	14.81	5	0.00	0.00	0.00
Tanahu	Khairenitar	27	0	0.00	1	3.70	6	22.22	5	18.52	6	22.22	6	0.00	16.67	33.33
Tanahu	Majhkot	80	6	7.50	0	0.00	31	38.75	8	10.00	2	2.50	14	0.00	0.00	28.57
	Sub total	159	9	5.66	2	1.26	51	32.08	18	11.32	15	9.43	41	2.44	4.88	24.39
	Total	**381**	**32**	**8.40**	**10**	**2.62**	**96**	**25.20**	**36**	**9.45**	**38**	**9.97**	**106**	**2.83**	**1.89**	**9.43**

Source: Field Survey, 2001

Likewise in Tanahun district, one-fifth are employees and one-third active political members. In total, about one third to one half drip users are active and have social status leaving the remaining half as simple farmers. There is equal number of users holding no such positions among drip users. Among non-user sample the proportion of people holding such position is much less. Drip users are relatively more innovative and risk bearing farmers who have land near the house.

- **Family Composition**

Family size varied among the sample household. Average number of family members is 7. One family has 25 members in Majhkot VDC. Family members were classified into two sexes: male and female and four age groups as: Old above 59 year age, Adult 16-59, Young 10 - 15 years and Child below 10 years.

This classification is made to estimate the proportion of working members in the VDC. It is considered that old fellows and child will not work while the young will contribute partly and adults will be the main labour force. The proportion of male and female is nearly identical in each age group with slight variation. Old male and female population is less than 10% and over half is from the adult age group (16-59 years), thus providing enough workforce and the young population is about 15% and is useful for partial support. Child population is 20%. Thus over 2/3rd of the population can contribute to drip work. The study shows that more proportion of higher economic rank people are adopting the drip kit compared to lower rank. Generally more people with high social status or exposure are using drip kit than others with no exposure. It may be for their ability to bear the risk and buy the kit.

5.B. Land Holding

Cultivated land in hills is mostly upland (*bari*). It is more so among drip users in Dailekh and Palpa than in Tanahun. In Tanahun, there is more low land *khet*, most of those are irrigated too. In fact there is relatively more river terrace in Tanahun and Palpa districts where irrigation facility has been created. They grow three crops throughout the year.

The farmers' cultivated land holding were analysed by dividing total land holding into four categories as below:

Marginal	-	< 0.5 ha
Small	-	0.5 - < 1.0 ha
Medium	-	1.0 -<3 .0 ha
Large	-	3.0 ha and above.

The proportion of users and non-users by land holding class is given in Table 5.5. Proportion of farmers of other than large is almost about one third each. There are very few having more than 3 ha. One farmer owns maximum land of 5 ha. In general a farmer owning one-hectare plot has more pieces. Most farmers are owner cultivators. Few have rented others land and similarly few

have leased land to others. All sample drip kit user were landowners except one tenant, who was renting the house as an exception.

Table 5.5 Land Holding of Sample Farmers by class

District	*VDC*	*Users*					*Non Users*					
		NN	*Marginal*	*Small*	*Med-ium*	*High*	*NN*	*Land less*	*Marginal*	*Small*	*Medium*	*Hig*
								0 ha	*<0.5 ha*	*0.5 - < 1 ha*	*1- < 3 ha*	*> 3 h*
Dailekh	Dadaparjul	12	33.3	25.0	33.3	8.3	4	0.0	0.0	0.0	100.0	
Dailekh	Goganpani	62	16.1	40.3	38.7	4.8	17	0.0	11.8	76.5	11.8	
Dailekh	Kalbhairav	15	0.0	33.3	66.7	0.0	4	0.0	100.0	0.0	0.0	
Dailekh	Narayan	27	25.9	48.1	18.5	7.4	8	12.5	12.5	62.5	12.5	
	Sub total	116	18.1	39.7	37.1	5.2	33	3.0	21.2	54.5	21.2	
Palpa	Chirtundhara	50	34.0	40.0	24.0	2.0	14	0.0	28.6	50.0	14.3	
Palpa	Darlamdanda	34	64.7	20.6	14.7	0.0	11	0.0	9.1	45.5	45.5	
Palpa	Kaseni	13	30.8	15.4	53.8	0.0	NA					
Palpa	Nayarnamtales	17	52.9	5.9	41.2	0.0	4	0.0	50.0	0.0	50.0	
	Sub total	114	45.6	26.3	27.2	0.9	29	0.0	24.1	41.4	31.0	
Tanahun	Anbukhaireni	25	32.0	32.0	36.0	0.0	16	18.8	18.8	25.0	31.3	
Tanahun	Bhimad	27	70.4	7.4	18.5	3.7	5	0.0	20.0	20.0	20.0	
Tanahun	Khairenitar	27	29.6	22.2	48.1	0.0	6	0.0	16.7	83.3	0.0	
Tanahun	Majhkot	80	10.0	41.3	47.5	1.3	14	0.0	64.3	7.1	21.4	
	Sub total	159	27.0	30.8	40.9	1.3	41	7.3	34.1	26.8	22.0	
	Total	**389**	**29.8**	**32.1**	**35.7**	**2.3**	**103**	**3.9**	**27.2**	**39.8**	**24.3**	

Source: Field Survey, 2001

5.C. Farming System

Farmers adopt a traditional mixed farming system dependent on human and animal power. Farmers grow crop as well as rear cattle, buffaloes, poultry, pigs, etc using animal waste as farmyard manure in the fields, and feeding grass and forage. Small farmers apply more farmyard manure (FYM) and less chemical fertiliser. Animal power is used to prepare the land but not for transportation there. For other works, human labour is used. Other mechanical power source is not introduced yet.

Farmers used to sow local seed. After the adoption of drip kit, farmers started to use hybrid seed, optimal dose of fertiliser and pesticides to grow vegetables in drip irrigated area.

5.C.1 Crops and Cropping Pattern

In lowland (*khet*), paddy is the main monsoon crop followed by wheat, maize or pulse in winter. Some farmers grow potato and vegetable in small plots. In upland (*bari*), maize is grown mixed with legume (pulse) in the summer followed by millet, mustard, vegetable, pulse, or potato in the

winter season. At few places ginger or barley is also grown as cash crop to an extent. Crop choice is made mostly based on traditional food habits and the market prospects. Now few farmers have begun to grow potato as cash crop in place of maize in summer.

In the drip plot, maize and legume are grown in summer followed by winter vegetable like radish, onion, garlic, spinach, *rayo* etc. After the adoption of drip kit, cauliflower and cabbage are being grown in the winter followed by cucumber, ridge gourd, bitter gourd, etc and zucchini in the summer. Earlier few gourds and cucumber plants were grown mixed with maize to harvest in July/August. But now these are being grown early to harvest by March/ April as off-season vegetable for market sale. Common cropping pattern is:

Land Type	**Monsoon**	**Winter**	**Spring**
Khet	Paddy	Wheat/Potato/pulse	Paddy
Bari	Maize/paddy	wheat/mustard/millet/potato	
Drip Plot			
Before Drip	Maize with legume	Leafy vegetable	
After Drip	Maize	Cauliflower/cabbage	Cucumber / gourd

5.D. Agricultural Production

Most farmers have less land and do farming to produce food for family consumption. Table 5.6 shows total quantity of crop produced by the drip user sample. Total annual paddy produced is 412 MT and maize is 193 MT. Few sell paddy and maize in small quantity. Most farmers produce less food than that is needed for home-consumption. But on the other hand two third sold vegetables totalling 344 MT while about one-fifth HH sold some 55 MT fruits (mostly oranges) in Dailekh. Similarly, farmers sell ginger and potato too.

Now drip users sell surplus vegetables produced in the near by market. Medium and large drip kit users in particular grow vegetable for sale and sell most of their produce in the local markets or carry that produce to the nearest market area to fetch more value. Maximum quantity is sold from Abukhaireni. The large drip kit user has cultivated vegetables in a large area and so vendors come to buy the crop there. Next large seller is from Goganpani.

5.E. Occupation and Income

Farming is the mainstay of sample farmers. All produce cereal crop for their livelihood. But the production is not enough; hence they do mixed farming rearing livestock, pigs and/or poultry as source of off-farm income. In most HH, some members do business, or serve in government or private company or work as wage earners. Proportion of HH engaged is about ten percent of total HH members. Crop farming does not provide full employment and give adequate income due to less land, low yield and low crop price, hence whenever possible, farmers strive to work in off farm jobs to earn more. Total income from off farm jobs including animal husbandry is almost three times of the total earning from crop production. It shows the importance of crop farming in total HH income is low.

Table 5.6 Land Holding of Sample Farmers by Landholding Class

District	*VDC*	*Users*					*Non Users*					
		NN	*Marginal*	*Small*	*Medium*	*High*	*NN*	*Landless*	*Small*	*Marginal*	*Medium*	*High*
								0 ha	*<0.5 ha*	*0.5 - < 1 ha*	*1- < 3 ha*	*> 3 ha*
Dailekh	Dadaparjul	12	33.3	25.0	33.3	8.3	4	0.0	0.0	0.0	100.0	0
Dailekh	Goganpani	62	16.1	40.3	38.7	4.8	17	0.0	11.8	76.5	11.8	0
Dailekh	Kalbhairav	15	0.0	33.3	66.7	0.0	4	0.0	100.0	0.0	0.0	0
Dailekh	Narayan	27	25.9	48.1	18.5	7.4	8	12.5	12.5	62.5	12.5	0
	Sub total	116	18.1	39.7	37.1	5.2	33	3.0	21.2	54.5	21.2	0
Palpa	Chirtundhara	50	34.0	40.0	24.0	2.0	14	0.0	28.6	50.0	14.3	1
Palpa	Darlamdanda	34	64.7	20.6	14.7	0.0	11	0.0	9.1	45.5	45.5	0
Palpa	Kaseni	13	30.8	15.4	53.8	0.0	NA					
Palpa	Nayarnamtales	17	52.9	5.9	41.2	0.0	4	0.0	50.0	0.0	50.0	0
	Sub total	114	45.6	26.3	27.2	0.9	29	0.0	24.1	41.4	31.0	1
Tanahun	Anbukhaireni	25	32.0	32.0	36.0	0.0	16	18.8	18.8	25.0	31.3	1
Tanahun	Bhimad	27	70.4	7.4	18.5	3.7	5	0.0	20.0	20.0	20.0	2
Tanahun	Khairenitar	27	29.6	22.2	48.1	0.0	6	0.0	16.7	83.3	0.0	0
Tanahun	Majhkot	80	10.0	41.3	47.5	1.3	14	0.0	64.3	7.1	21.4	1
	Sub total	159	27.0	30.8	40.9	1.3	41	7.3	34.1	26.8	22.0	4
	Total	**389**	**29.8**	**32.1**	**35.7**	**2.3**	**103**	**3.9**	**27.2**	**39.8**	**24.3**	**5**

Source: Field Survey, 2001

Section 6: Physical and Hydrological Features

6.A. Land

The drip kit is installed on an upland field near the house. In the villages, few farmers may have sizeable land near the house. But in semi urban area or near the market, landholding by the house is less. Further, farmers' fear that if a drip kit is installed away, it may be stolen along with vegetable produced. Therefore even large landholders are installing them in small farmstead.

Upland soil is mostly coarse sandy or sandy loam mixed with gravel. Soil depth is also mostly less than half meter, somewhere less than 25 cm. too. And organic matter content and soil fertility is also low due to erosion problem.

6.B. Climate

Moderate humid temperate subtropical climate prevails in the sample districts. Rainy (monsoon) season starts from June/July and continues until October, during which over three-quarter of annual rainfall takes place. Four months November to February is cold winter season with about low barely 10 % rainfall. Among three districts there is relatively more rainfall at Dailekh district. The summer season starts from March and continues until June. Temperature is high, humidity is low with occasional rainfall.

- **Water Resources**

  Water supply is not adequate for drip kit where installed for growing vegetable in large area particularly, during the dry months. Where water is available in abundance, farmers use hose or micro sprinkler irrigation there. The drip kit is used only where water availability is moderate. Since only about 50 litres is required to fill drip tank to irrigate each time, water is carried in bucket. Therefore even water short area drip irrigation has been practiced.

  In the study area, water is adequate during rainy season and scarcity is felt at some area later. Most drip farmers face water shortage in dry summer months though they had enough water in winter months. Response to water availability by VDC is given in Table 6.1. Three fourth of total sample farmers felt water shortage in summer and one third of them faced water shortage even in winter. In Tanahun especially at Majhkot, Khairenitar and Abukhairani, about one quarter said to have adequate water supply in summer. In Abukharani many farmers have constructed water collection tanks to collect water from their natural private spring water source. So they are more assured of water. There are few farmers to say adequate water in other VDC. In winter majority feel adequate water supply.

Table 6.1 Distribution of Water Availability Situation for Drip Irrigation by Season

District	*VDC*	*Respondent*	*Winter Season*			*Summer Season*		
		Number	*Adequate*	*Moderate*	*Scarce*	*Adequate*	*Moderate*	*Scarce*
Dailekh	Dadaparjul	12	58.3	41.7	0.0	0.0	58.3	41.7
Dailekh	Goganpani	60	50.0	10.0	40.0	5.0	8.3	86.7
Dailekh	Kalbhairava	14	42.9	42.9	14.3	0.0	57.1	50.0
Dailekh	Narayan	24	0.0	37.5	62.5	12.5	25.0	58.3
	Sub total	110	39.1	23.6	37.3	5.5	23.6	70.9
Palpa	Chirtundhara	50	34.0	66.0	0.0	6.0	12.0	82.0
Palpa	Darlamdanda	34	100.0	0.0	0.0	0.0	0.0	100.0
Palpa	Kaseni	13	84.6	15.4	0.0	7.7	30.8	61.5
Palpa	Nayarnamtales	17	94.1	5.9	0.0	5.9	0.0	94.1
	Sub total	114	68.4	31.6	0.0	4.4	8.8	86.8
Tanahun	Anbukhaireni	25	28.0	0.0	72.0	28.0	0.0	72.0
Tanahun	Bhimad	27	96.3	3.7	0.0	3.7	0.0	96.3
Tanahun	Khairenitar	27	14.8	11.1	74.1	18.5	11.1	70.4
Tanahun	Majhkot	80	26.3	8.8	65.0	26.3	12.5	61.3
	Sub total	159	36.5	6.9	56.6	21.4	8.2	70.4
	Total Percent	**383**	**46.7**	**19.1**	**34.2**	**11.7**	**12.8**	**75.5**

Source: Field Survey, 2001

In Bhimad farmers have to fetch water from public taps, they have to stand long hours at the tap stand to get water. In Darlamdanda, Goganpani, Narayan where there is no public water supply, farmers spend almost 1-3 hours to bring water from the near by source.

Water application time is almost the same for same amount of application. Most farmers apply about one tank (50 litres) water for small and medium size drip kits. Drip tank is filled by bucket of water carried from public tap stand or other distance water sources. All family members adult and sometimes-young members bring water. All members can apply water easily. Difficult task is to bring water for filling tank.

- **Water Requirement**

Crop stage is divided into two phases for the purpose of irrigation water requirement estimation. In the first month plant is small and crop foliage diameter is taken as 30 cm (1 ft) and that stage is expected to last one month, and then after one moth crop will grow and its foliage diameter is expected to be about 45 cm (1.5 ft) diameter. The water requirement for vegetable is computed as:

	Winter				*Summer*			
Months	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Water Requirement mm/day	3.25	2.5	1.75	2	3	4.25	5	5.75

Source: IDE (2000)

Water application amount and frequency is recommended based on this. Taking irrigation efficiency of 90 %. They are instructed to apply water as shown below.

Plant phase	*Winter (Oct. – Jan.)*	*Spring (Feb – May)*
First One month	50 lt./ 200 plants	50 lt/ 200 plants
After one month	50 lt/ 150 plants	50 lt/ 50 plants

Source IDE (2000)

They apply one to two times depending upon the weather and water availability situation. Large size drip kit users have large tanks to apply water for irrigation. In winter season water is applied sparingly on alternate day or daily depending on the crop stage; while in summer water is applied one to two times daily.

- **Sources of Water**

About one third of the farmers irrigate by bringing water from tap, canal, spring and stream earlier. They used hose pipe or by pouring from the bucket to irrigate. Of them about half early irrigators used tap water to irrigate the *bari* before. Common source of water used for drip irrigation is drinking water supply from taps. Table 6.2 shows the proportion of respondents using various source of water before and after drip kit. Some farmers have separate private water source (spring) at the field and developed private water supply system from there. After the introduction of drip kit and vegetable farming, many farmers developed their own water supply system in particular at Anbukhaireni of Tanahun where water collection tanks were constructed with the assistance of IDE. All of them use tap water. Users of Kaseni, Nayarnamtales, Bhimad many in Khairenitar Majhkot Chirtundhara and Darlamdanda use tap water. Narayan and Dadaparjul farmers use canal water.

On the whole about two third users apply tap water, others use water from spring or canal or stream directly whichever is available near by. Taps in these villages are public tap fed from natural spring water supplied through pipe. Water is free. Some farmers get water from spring, which is also, the source of drinking water supply especially at Dailekh district and village area of other districts where piped supply is not developed.

6.C. Water Quality

Table 6.2 Proportion of Farmers using Irrigation by Water Source before and after Drip Use

	VDC	Number	Source of water for Irrigator before Drip Kit				Source of water for Irrigator after Drip Kit			
		of HH	Canal	Spring	Stream	Tap	Canal	Spring	Stream	Tap
Dailekh	Dadaparjul	12	0.0	0.0	0.0	0.0	50.0	8.3	16.7	25.0
Dailekh	Goganpani	60	0.0	0.0	0.0	5.0	1.7	21.7	1.7	31.7
Dailekh	Kalbhairava	14	50.0	21.4	14.3	0.0	28.6	7.1	14.3	35.7
Dailekh	Narayan	24	20.8	20.8	8.3	0.0	66.7	4.2	37.5	0.0
	Sub total	110	10.9	7.3	3.6	2.7	24.5	14.5	12.7	24.5
Palpa	Chirtundhara	50	0.0	0.0	0.0	14.0	4.0	0.0	36.0	60.0
Palpa	Darlamdanda	34	0.0	0.0	0.0	2.9	0.0	5.9	26.5	67.6
Palpa	Kaseni	13	0.0	0.0	0.0	7.7	0.0	0.0	0.0	100.0
Palpa	Nayarnamtales	17	0.0	0.0	0.0	82.4	0.0	0.0	0.0	100.0
	Sub total	114	0.0	0.0	0.0	20.2	1.8	1.8	23.7	72.8
Tanahun	Anbukhaireni	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Tanahun	Bhimad	27	0.0	0.0	0.0	92.6	0.0	0.0	0.0	100.0
Tanahun	Khairenitar	27	0.0	0.0	0.0	0.0	0.0	22.2	0.0	74.1
Tanahun	Majhkot	80	0.0	0.0	0.0	0.0	0.0	32.5	0.0	66.3
	Sub total	159	0.0	0.0	0.0	15.7	0.0	20.1	0.0	78.6
	Total	383	3.1	2.1	1.0	13.3	7.6	13.1	10.7	61.4

Source: Field Survey, 2001

As drinking water is used to fill tank, water quality is generally clean. Most (81 %) had clean water quality while 16% users reported water to be of moderate quality. Only two farmers said their water supply as dirty.

6.D. Distance to water source

Major factor governing the adoption of drip kit is the water availability at near by distance from where water can be brought. Average distance to different water sources: tap water, spring, canal and stream averaged for all districts is 0.24, 0.66, 0.89 and 1.3 kilometre. Tap is naturally the shortest source. Average distance by VDC is shown in Table 6.3. It presents the time taken to haul water too. Average distance to water source is about a kilometre in Narayan, Khairenitar and Majhkot. While the water source is near at Anbukhaireni and Bhimad. When average time to haul water was considered, almost 60 % farmers took more than half an hour to

bring, while a quarter needed more than an hour. As water supply system has not been developed in Darlamdanda and Narayan, farmers spend more time to fill and haul water there.

About one-third non-users said the distant water source is the main reason for not adopting drip kits. Actually, manpower shortage is also related to time needed to bring water from far-off source. Since water source is very small, there is no hydrological data series. Yet to describe water supply situation in general, one can say there is abundant water everywhere in rainy season, there is medium water availability situation in winter accompanied by less water demand. And in summer water is in scarcity at most places but there is more water demand.

Table 6.3 Average Distance to Water source and time taken to bring water

District	*VDC*	*Number of HH*	*Average Distance M*	*Average Time Min.*
Dailekh	Dadaparjul	12	59.6	21
Dailekh	Goganpani	62	179.5	37
Dailekh	Kalbhairava	15	320.7	54
Dailekh	Narayan	27	1142.5	110
	Sub total	116	409.5	
Palpa	Chirtundhara		NA	25
Palpa	Darlamdanda	34	144.6	74
Palpa	Kaseni	13	556.0	27
Palpa	Nayarnamtales		NA	31
	Sub total	47	258.4	
Tanahun	Anbukhaireni	25	20.0	30
Tanahun	Bhimad	27	35.6	37
Tanahun	Khairenitar	27	997.6	24
Tanahun	Majhkot	80	1016.7	24
	Sub total	159	690.1	
	Total	**389**	**526**	

Source: Field Survey, 2001

6.E. Impact on Soil and Water Conservation

Drip irrigation is a controlled water application method that permits to apply water in very small amount. Hence it does not cause soil erosion at all during water application. Also the installation of drip does not directly control the soil erosion caused by rainfall. However, as there is some growing crop already in place in the summer months when preseason monsoon rain falls, plant leaves intercept rain and splash erosion is controlled to an extent. Thus the benefits on soil and water conservation accrue indirectly from the raindrop interception by growing plant foliage. Previously such land was not fully covered by plants.

6.F. Scope for Improving Water Productivity and Water Conservation

In the shallow soil of upland fields, scope to raise water productivity by drip irrigation kit is much. Deficit irrigation application through drip makes possible of life saving irrigation with small quantity of water, which increases effective use of rainwater. This is not possible by surface irrigation methods. Also the irrigation efficiency by drip is much high 90 % due to reduced (or even no) percolation just concerned to let the crop grow satisfactorily, produce yield and increase the income from sale of vegetable. In this way they seem to maximise productivity in totality of land and labour using the water they can bring.

In the summer month, farmers apply 50 liters water for 80-plant cucumber covering a space of 63-sq m, which amounts to 0.83 mm/day, which is much less. In the winter too farmers apply 50-liter water to 63-sq m area alternate day. The potential water requirement then is 1.75 – 2 mm/day while the water applied is 0.83 mm/day. There is under irrigation being practiced for the difficulty to bring water. Farmers see plant symptom and manage water by applying more if stressed.

6.G. Association with other Technique

Drip kit is simple small equipment to apply water filled in its tank through pipe holes to plants. It is used alone and not in association with water harvesting or water lifting techniques. Human labor is used to carry water from the near by source tap, spring, stream and canal. Since this is adopted at water short area, introduction of water harvesting and water lifting technique will be of support to promote drip. Furthermore wastewater recycling could be another attraction for farmers to adopt more drip kit.

6.H. Suitable Environment

In short farmers having water short at the field near by house but available at near by distance are adopting drip kit in warm (low altitude) area with potential to grow three crops in a year.

Section 7: Farming systems and Profitability

7.A. Farming practice

Farming practice is traditionally low cost and labor-based. Farmers use animal or use manual labor to prepare the land and carry out weeding, harvesting etc. Farmers also use local seeds and little fertilizer.

7.B.Farm budget

Major crops affect the total farm income. The drip-installed plot being small, it influences less on the overall income of the HH.

Paddy is the staple food crop with high market demand. Further its straw is also useful to feed animals. Hence all farmers grow paddy on all low land fields in rainy season. If possible, it is grown in spring too and in some places it is grown in upland field in rainy season. Another main crop grown in low land after paddy is wheat. Some farmers grow it on upland field too. Few grow mustard, maize, vegetable, potato etc in small area. Average yield of paddy shown by the survey is about 3.4Mt /ha and that of wheat is about 1.3 Mt/ha.

Cost and benefit for growing maize, wheat, millet, mustard and vegetable in upland (*bari*) and paddy and wheat in lowland (*khet*) are analyzed. It is presented in Table 7.1. Here cost of farmyard manure is considered taking nominal rate of Rs.1/kg, which is available, free at home. Farmers actually may not account its price. Also the HH member is not paid, hence first labor cost is ignored to estimate net benefit and later estimate is made considering total labor in the same table.

It shows that growing most upland crops maize, millet, vegetable and wheat is not a beneficial activity. Millet is not beneficial even ignoring the cost of labor due to more FYM application. Among them leafy vegetable is relatively beneficial, but this is grown in limited area for home consumption. When labor cost of considered, then it is loss to grow all crops.

For low land, paddy is more beneficial than wheat and other upland crops if labor is considered free. Price of straw is not included to estimate benefit here. But as soon as labor charge is accounted it is also a loss. Therefore, absentee farmers prefer sharecropping.

However, farmers have no other job to earn hence they cultivate to produce food for self-consumption. Some farm economy conscious farmers grow ginger and potato for sale. If labor charge has to be paid in market rate, then most crop farming is not economic in the hills. It shows a pathetic situation of hill farmers. Fragmented land holding traditional farming under rainfed condition, distant transportation and low market value have made farming less attractive occupation. There is need to introduce improved farming technology.

In the drip area, farmers used to grow other crops and vegetable before introduction of drip kit. Now they grow different crops although in small area. Area and production of crops grown before and after adopting drip kit is shown in Table 7.2. Earlier leafy vegetables constitute major share followed by potato, pulse. Most of these were used for self-consumption and little was sold. Now different vegetables like cauliflower, cucumber, cabbage, tomato, etc are grown in place of traditional leafy vegetables, gourd, potato, pulse, etc. The area of under vegetables has increased by 137 hectares. There is increase in the production by 125 MT. The worth of additional vegetable produced is about Rs 1.53 million.

After introduction of drip kit, farmers cultivate cauliflower and cabbage in the winter. If water is available, they grow cucumber, gourds, and tomato in the summer. Cucumber is the most preferred crop yielding more benefit.

Drip users group establishes the nursery collectively and seedlings are distributed to the member farmers later. They do all operation like ploughing, harrowing, planting, weeding and harvesting manually. At least few hours manual labor is required almost daily to bring water for irrigation. In drip plots due to reduced wet surface and there are less weeds.

Table 7.3 gives a farm budget analysis scenario of the present drip plot before introduction of kit. Ginger is the most beneficial crop followed by leafy vegetables and wheat ignoring cost of labor. But few farmers grow ginger. Maize is less beneficial and so are others. When the labor cost is accounted, non other than ginger is yielding profit. But farmer may account differently.

Table 7.4 presents the farm budget analysis scenario for vegetable cultivation after drip kit. If labor cost is ignored, farmer can earn Rs 84,217 per ha by growing cauliflower in winter season. This is equivalent to earning Rs 1053 for a small kit user irrigating 125 sq m. Even if labor is paid, still the net benefit is Rs 52,217 which is much more than benefit that occurs from other crops. In the same plot cucumber can be grown in summer. This gives net benefit of Rs 128,385 (ignoring labor cost) and Rs 96, 885/ha considering labor cost. Thus in two seasons, a farmer can earn up to Rs 149,102 /ha by cultivating two vegetable crops. It is equivalent to Rs 1,864 from a 125 sq m plot irrigated by small size drip kit. It shows that a farmer can earn more than the purchase price of drip kit in one season.

Similar observation was noted in focus group discussion too. HURDEC has also shown potential income of Rs 207,600 /ha from vegetable cultivation in one year. But if the labor has to be paid for bringing water to fill the tank and for applying water, then the additional cost will be Rs 25,500. Hence only those households having free people in the home are adopting drip kit.

Table 7.1 Cost and Benefit of Crop in Upland and Lowland

Input	*Unit*		*Up Land (Bari)*										*Low Land (Khet)*			
		Rate	*Maize*		*Millet*		*Vegetable*		*Wheat*		*Mustard*		*Paddy*		*Wheat*	
		Rs/unit	*Qty*	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*
				Rs	*Mt/ha*	*Rs*	*Mt/ha*	*Rs*	*Mt/ha*	*Rs*	*Mt/ha*	*Rs*	*Mt/ha*	*Rs*	*Mt/ha*	*Rs*
Labour																
Male	pd	100	100	10,000	100.00	10,000	100.00	10,000	120.00	12,000	160.00	16,000	220.00	22,000	120.00	12,000
Female	pd	75	80	6,000	140.00	10,500	190.00	14,250	80.00	6,000	80.00	6,000	220.00	16,500	80.00	6,000
FYM	MT	1000	17.63	17634	46.23	46229	24.25	24254	8.77	8770	15.89	15888	6.61	6608	6.10	6096
Urea	Kg	10	92.6	926	70.7	707	114.5	1145	63.9	639	60.7	607	50.2	502	65.6	656
DAP	Kg	20	54.1	1083	38.3	767	90.5	1810	50.0	999	36.7	733	42.0	839	28.7	575
MOP	Kg	10	20.8	208	0.0	0	24.9	249	5.8	58	60.0	600	23.3	233	18.5	185
Pest	Rs		0	0	0	0	0	0	0	0	0	0	0	0	0	0
a) Labor cost ignored																
Total Cost	Rs			19851		47702		27459		10466		17828		8183		7511
Farm gate Price	Rs/Kg		10		12		4		10		20			10000		10000
Avgas Yield	MT/ha		2.22		2.72		12.38		1.22		1.68		3.39		1.31	
Total Benefit	Rs		22182		32592		49517		12202		33687		33908		13084	
Net Benefit	Rs			**2331**		**-15110**		**22059**		**1737**		**15858**		**25725**		**3084**
b) Labour cost included case																
Total Cost	Rs			35851		68202		51709		28466		39828		46683		25511
Net Benefit	Rs			**-13669**		**-35610**		**-2191**		**-16263**		**-6142**		**-12775**		**-12428**

Source: Field Survey, 2001

Table 7.2 Area and Production of Vegetables before Drip Kit Use

Vegetables	Before			After			Difference	
	HH No.	Area Ha	Production Mt	HH No.	Area Ha	Production Mt	Area Ha	Production MT
Leafy vegetable	59	55.38	17.18	43	32.00	11.63	-23.38	-5.55
Gourd	37	49.00	14.47	1	0.25	0.15	-48.75	-14.32
Potato	18	39.33	6.69	6	7.44	3.57	-31.89	-3.12
Pulse	19	36.75	1.76	44	24.63	8.69	-12.13	6.93
Chilli	5	16.25	0.78	36	14.13	3.21	-2.13	2.43
Cauli	26	9.35	1.97	331	118.22	58.16	1.97	56.19
Radish	19	5.81	0.98	6	1.88	0.68	-3.94	-0.30
Cucumber	6	5.62	4.43	217	75.63	44.64	70.01	40.21
Cabbage	0	3.17	1.17	0	33.66	14.79	30.49	13.62
Tomato	2	1.50	0.45	83	39.69	25.09	38.19	24.64
Garlic	2	0.50	0.01	4	1.50	0.52	1.00	0.52
Yam	1	0.50	0.27	1	1.00	0.65	0.50	0.38
Onion	1	0.25	0.01	6	2.38	0.89	2.13	0.89
Ladies Finger		0.00	0.00	1	0.13	0.01	0.13	0.01
Pumkin		0.00	0.00	5	1.38	0.21	1.38	0.21
Brinjal				19	6.19	1.97	6.19	1.97
Carrot				1	0.25	0.03	0.25	0.03
Total	**195**	**223**	**50**	**804**	**360**	**175**	**30**	**125**

Table 7.3 Cost and Benefit from Crop cultivation before Drip Kit Use

Item	*Unit*	*Rate*	*Maize*		*Leafy Vegetable*		*Wheat*		*Ginger*	
			Qty	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*
Input			*Mt/ha*	*Rs*	*Mt/ha*	*Rs*	*Mt/ha*	*Rs*	*Mt/ha*	*Rs*
Labour										
Male	Pd	100	100.00	10,000	100.00	10,000	120.00	12,000	240.00	24,000
Female	Pd	75	80.00	6,000	190.00	14,250	80.00	6,000	200.00	15,000
FYM	MT	1000	0.76	762	0.79	790	0.56	564	2.22	2,215
Urea	Kg	10	144.58	1,446	142.67	1,427	104.73	1,047	130.00	1,300
DAP	Kg	20	110.16	2,203	88.51	1,770	76.90	1,538	40.00	800
MOP	Kg	10	95.91	959	46.00	460		-		
Pest	Rs.		6000	6,000	4275.00	4,275		-		
a) Labour cost ignored										
Total Cost	Rs.			11,370		8,722		3,149		4,315
Price	Rs/Kg			10		4		10		10
Avg Yield	MT/ha		1.47		6.50		1.41		5.82	
Total Benefit	Rs			14,665	57	26,002	62	14,127	32	58,206
Net Benefit	Rs			3,294		17,280		10,978		53,891
b) Labour cost included										
Total Cost	Rs.			27,370		32,972		21,149		43,315
Net Benefit	Rs			(12,706)		(6,970)		(7,022)		14,891

Table 7.4 Cost and Benefit of Vegetable cultivation after Drip Kit Use

Input			*Cauliflower*		*Cabbage*		*Cucumber*		*Tomato*		*Leafy Vegetable*	
	Unit	*Rate*	*Qty*	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*	*Qty*	*Amount*
		Rs		*Rs*		*Rs*	*Mt/ha*	*Rs*	*Mt/ha*	*Rs*	*Mt/ha*	*Rs*
Labour												
Male	pd	100	140.00	14,000	140.00	14,000	120.00	12,000	160.00	16,000	100.00	10,000
Female	pd	75	240.00	18,000	240.00	18,000	260.00	19,500	240.00	18,000	190.00	14,250
FYM	MT	1000	1.149	1,149	1.149	1,149	1.149	1,149	1.026	1,026	1.247	1,247
Urea	Kg	10	107.27	1,073	107.27	1,073	133.68	1,337	157.44	1,574	194.22	1,942
DAP	Kg	20	118.61	2,372	118.61	2,372	131.07	2,621	100.71	2,014	113.50	2,270
MOP	Kg	10	74.90	749	74.90	749	87.28	873	45.00	450	30.00	300
Pest	Rs.		4720.40	4,720	4720.40	4,720	6920.84	6,921	18240.00	18,240	5083.17	5,083
a) excluding labor cost												
Total Cost	Rs.			10,063		10,063		12,901		23,305		10,842
Price, Rs/Kg	Rs/Kg		10.000		6.000		10.000		10.000		4.000	
Avg Yield	MT.		9.43		9.43		14.13		11.94		10.84	
Total Benefit	Rs		94280		56568		141286		119436		43349	
Net Benefit	Rs			84,217		46,505		128,385		96,131		32,507
Benefit / 125 sq m.	Rs			1,053		581		1,605		1,202		406
b) Labour cost included												
Total Cost	Rs.			42,063		42,063		44,401		57,305		35,092
Net Benefit	Rs			52,217		14,505		96,885		62,131		8,257
Benefit / 125 sq m.	Rs			653		181		1,211		777		103

7.C. Financial Viability

From the farmer's perspective, vegetable cultivation using drip kit is highly beneficial. Presently there is less alternate job for unemployed people to earn. Two farmers of Goganpani even reported that they have stopped going to India for wage earning after the drip was introduced. Drip has permitted them to earn almost same amount of money by vegetable cultivation at own field.

Farmers consider the actual money paid directly for buying seed, fertilizer, pesticides etc as cash investment and consider money earned from sale reducing those as the benefit. They, therefore, apply more FYM and home labor. They do not account their effort. Farmers are getting reasonable prices for their vegetables. Thus, adoption of drip kit is considered financially attractive currently. If market situation changes abruptly, same rate of benefit may not be possible. But yet as most farmers are adopting small kit, there should be no much risk.

7.D. Reconciliation with off farm Jobs

Drip irrigated farming is not a stand-alone activity of most farmers. They rear cattle, buffalo, and goat as a source of off-farm income. Also if opportunity is available people do other jobs as employee or as wage earner. Only those who get no opportunity live on agriculture alone. From the available information, total off-farm income is three times more than income from crop farming alone. Some activities like livestock, poultry, and pig rearing is rather complimentary to crop farming. These require regular attention while crop farming require occasional labor input peaking at some period and no work at other time. Hence there is not much competition. Peak labor requirement occurs during June-July for paddy cultivation. Then most HH members working as wage earner elsewhere return home and help in paddy transplantation. Other activity does not make longer peak labor shortage. Further due to small land holding size, crop operation activity is not much affected.

Drip irrigation requires regular manpower input to bring and apply water. So the HH with no under-employed manpower is not adopting drip kit. Few farmers who stopped the use of drip kit also mentioned that manpower shortage has forced them to do so after some HH member went out for wage earning.

Section 8: Organizational and Institutional Setting

8.A. Group Formation

Agricultural Development Bank, District Irrigation Office, District Agriculture Office, IDE and other NGO are working in the promotion of vegetable cultivation and drip irrigation. They have field office to look after the field level activity. Of them only IDE is presently actively engaged in the promotion of drip kit. IDE establishes a market network to sustain the program even after its withdrawal.

IDE asks interested farmers to adopt drip irrigation kit to form an informal group of about 4 to 10 people for facilitating follow up service effective. In many places there were already other informal groups for other purposes as prompted by participatory development approach to launch development programs. Several NGOs have emerged to conduct different activities. Few such objectives are women empowerment, poverty alleviation, micro-credit co-operative, forest, drinking water supply, irrigation water use, and mothers association, socially disadvantaged caste uplift etc. At many places few farmers from such earlier groups, have formed drip users' group to install drip kit. They select one of the members as the leader of the group. Therefore in some VDCs women groups were already there like the ones at Darlamdanda and Bhimad. In Dailekh, RSDC, a NGO is forming farmers association and FORWARD, a NGO is promoting vegetable cultivation and supporting agricultural activities. IDE is supplying drip kit there to facilitate irrigation. Thus the program is a joint activity. Similarly in Palpa, different NGO and INGO are involved and have formed groups for related purposes.

Majority respondents are members of drip irrigation group leaving only one fifth as non-members. Most of them are from Dailekh, where other NGOs have formed groups for other purpose.

8.B. Group Activity

Drip irrigation group is collections of people interested to procure drip kit, install and use it. The group is mostly informal and meets as and when needed. IDE generally calls the leader of each group to attend training. Leader attends training, which in turn is taught to general member farmers. To use drip kit, group formation is not essential. However, where there is a group, communication from IDE is easier and the group is able to solve existing problem by joint efforts. Especially, since most farmers are adopting small size kits, involvement of group to raise seedling in common nursery, procurement of inputs in bulk etc. are good points of the group. Collective marketing could also be an added advantage. However, since sale amount is a small quantity and is done individually so far.

Drip irrigation group does not have individual rules and regulation. Such group being a subset of large group, members follow parent organisation's rules. The drip group members meet as needed to decide on the raising seedling, planting and procurement of inputs. Active participation is involved in the group nursery.

8.C. Performance of Group

Farmer's response to the performance of group in different VDC was obtained. Two third members rated performance of the group "fair" demonstrating there is some improvement need, while one third was satisfied saying the performance as "good". Members from small groups are generally more satisfied. Only few members of Darlamdanda and Bhimad remarked the performance of group as bad. Drip users group is large in Darlamdanda and some farmers may not have received attention from their group leader.

The group should be developed further as a cooperative to be able to handle vegetable sale as well so that users can benefit adequately. Moreover they may work collectively to develop water supply as well.

Section 9: Impacts of Drip Irrigation Kit

Introduction of drip irrigation kit has brought several changes in the life of rural people in the program area. It is more significant particularly among poor and small farmers. It has influenced household in general and women in particular.

9.A. Household Impact

Before introduction of drip, farmer used to grow maize mixed with some summer vegetables in the monsoon season and broad leafy vegetable, onion, etc in the winter season for home consumption. They used to store surplus vegetable for summer when they get only dry vegetable like potato, onion, yam etc or eat fermented vegetables. Green vegetable was not available in the dry month. But now after the adoption of drip kit, farmer learnt the technology of growing vegetable and they have fresh green vegetable through out the year for their consumption. This has affected food sufficiency and security, increased nutrient intake and thus improved family health and living standard. Many farmers grow more vegetable than their family need. They sell surplus vegetables. It has enabled them to increase cash income. HURDEC and Devkota (1999) have noted similar observation in more detail. Area of cucumber, cauliflower, cabbage, tomato etc has increased while the area of local vegetable like leafy vegetable, gourd, potato, pulse has decreased. Also vegetables like carrot, eggplant etc have been introduced. People have shifted to market oriented high value vegetable cultivation. There is increase in the total crop area by 137 ha and in the production by 125 MT. The worth of total vegetable production has increased by Rs1.53 million.

Farmers feel the changes in different effects. They felt increase and improvement in income, health, education and living standard (Table 9.1). Almost saw an increase in income, education and living standard, while about four fifth felt improvement in health as well.

All (**98%**) farmers reported increase in income from vegetable sale. Many poor farmers are now able to pay fees and expenditure for children's education by income received from vegetable sale. Most (**85%**) HH responded improvement in education has been affected by drip kit. Employment has been generated for the needy farmers. In Chirtundhara about 40 % farmer reported getting additional employment. Drip irrigation provided job for underemployed and unemployed people to work at field and earn their livelihood. Two Goganpani farmers who use to go India for job have now stopped to go and have begun vegetable cultivation. They feel that they can earn same money in their own village. In this way life style of rural mass has improved. All respondents affirmed improvement in living standards.

Table 9.1 Benefit Perceived by Drip Users

District			*Benefit Perceived Percent*			
	VDC	*Respondent No*	*Income*	*Health*	*Education*	*Life standard*
Dailekh	Dadaparjul	12	100	83	83	58
Dailekh	Goganpani	62	94	94	94	94
Dailekh	Kalbhairava	15	100	100	100	100
Dailekh	Narayan	27	100	96	96	93
	Subtotal	116	97	94	94	91
Palpa	Chirtundhara	50	100	70	96	86
Palpa	Darlamdanda	34	97	88	74	82
Palpa	Kaseni	13	100	92	100	100
Palpa	Nayarnamtales	17	100	100	100	100
	Subtotal	114	99	82	90	89
Tanahun	Anbukhaireni	25	100	88	100	100
Tanahun	Bhimad	27	93	78	93	93
Tanahun	Khairenitar	27	96	67	96	96
Tanahun	Majhkot	80	100	69	100	100
	Subtotal	159	98	73	98	98
	Total	389	98	82	95	93

Source : Field Survey 2001

Table 9.2 shows the response to effects brought by drip kit. It indicates that most farmers affirmed that there is saving of water and time besides loosening soil and reducing weed growth. Sharma (2000) also observed similar results from drip kit at Kuhun VDC of Kaski district.

Most farmers are satisfied with drip use. Drip kit permits to apply less water to many plants in less time. Now improved vegetable farming technique has also been initiated. Farmers have started to use hybrid seeds, chemical fertilisers and pesticides. Use of fertiliser and pesticides is a positive change, but from the health perspective, this can be a threat too.

Negative remarks is the concern on the over application of pesticides and drudgery in filing water in the tank when water has to be brought from long distance carrying on the back and to observe and correct holes clogging.

Table 9.2 Distribution of Response to Benefits Perceived by Drip Users

District	*VDC*	*Area*	*Income*	*Time save*	*Labor save*	*Soften soil*	*Water save*	*No weed*	*Employment*
Dailekh	Dadaparjul	100	83	83	58	67	100	50	67
Dailekh	Goganpani	95	95	95	95	92	95	95	77
Dailekh	Kalbhairava	100	100	100	100	100	100	100	100
Dailekh	Narayan	100	96	96	93	89	100	89	85
	Sub total	97	95	95	91	90	97	90	81
Palpa	Chirtundhara	100	70	96	86	82	100	84	40
Palpa	Darlamdanda	100	100	100	100	100	100	100	100
Palpa	Kaseni	100	92	100	100	100	100	100	100
Palpa	Nayarnamtales	100	100	100	100	100	100	100	100
	Sub total	100	86	98	94	92	100	93	74
Tanahun	Anbukhaireni	100	100	100	100	100	100	100	100
Tanahun	Bhimad	93	93	93	93	93	93	93	93
Tanahun	Khairenitar	100	100	100	100	100	100	100	100
Tanahun	Majhkot	100	100	100	100	100	100	100	100
	Total	**384**	**360**	**378**	**367**	**362**	**384**	**363**	**323**

Source: Field Survey, 2001

9.B. Gender Impact

Impact of adoption of drip kit and vegetable growing is clearly visible on women members from the raising of their importance in the family. Initially, women had no special tasks to earn money directly. A woman assisted the family in HH agriculture activities as unpaid labour. Income was low and the woman member had less work to show her contribution. But the installation of drip made them fully employed for fetching water and also selling vegetable. This has increased the workload but made them more productive. Table 9.3 presents the changes in distribution of workload to male, female and to both male and female. It shows that drip kit has added more workload mostly to male and to "both women and men" at Tanahun. In Palpa many women felt increase in workload. In fact, both free male and female staying at home do the work. In general, women carries water from tap and man supports in field application. This has added workload in general. But even then increased food supply and income has made them satisfied, making them capable to maintain family expenses now.

Table 9.3 Proportional Distribution of Changes in workload on Women and Men by Drip Irrigation

District	*VDC*	*Women*			*Men*			*Both**		
		Decrease	*Increase*	*Same*	*Decrease*	*Increase*	*Same*	*Decrease*	*Increase*	*Same*
Dailekh	Dadaparjul	0.0	9.1	9.1	0.0	36.4	27.3	0.0	0.0	18.2
Dailekh	Goganpani	0.0	4.8	1.6	0.0	41.9	3.2	0.0	33.9	14.5
Dailekh	Kalbhairava	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Dailekh	Narayan	0.0	7.4	14.8	0.0	18.5	7.4	18.5	14.8	18.5
	Sub total	0.0	5.2	5.2	0.0	43.5	6.1	4.3	21.7	13.9
Palpa	Chirtundhara	0.0	3.8	11.5	0.0	28.8	7.7	0.0	9.6	38.5
Palpa	Darlamdanda	0.0	26.5	0.0	0.0	73.5	0.0	0.0	0.0	0.0
Palpa	Kaseni	0.0	38.5	0.0	0.0	53.8	0.0	0.0	7.7	0.0
Palpa	Nayarnamtales	0.0	60.0	0.0	0.0	33.3	0.0	0.0	6.7	0.0
	Sub total	0.0	21.9	5.3	0.0	45.6	3.5	0.0	6.1	17.5
Tanahu	Anbukhaireni	0.0	8.0	0.0	0.0	40.0	0.0	0.0	52.0	0.0
Tanahu	Bhimad	0.0	8.3	0.0	0.0	37.5	0.0	0.0	54.2	0.0
Tanahu	Khairenitar	0.0	7.7	0.0	0.0	26.9	0.0	0.0	65.4	0.0
Tanahu	Majhkot	0.0	3.8	0.0	0.0	10.0	0.0	0.0	86.3	0.0
	Sub total	0.0	5.8	0.0	0.0	21.9	0.0	0.0	72.3	0.0
Total		**0.0**	**10.4**	**3.1**	**0.0**	**35.4**	**2.9**	**1.3**	**37.5**	**9.4**

* Man and woman

Further this made them more vocal to speak out their issues. They earn cash income through vegetables. Vegetable farming is women's job in many HH. It gave an opportunity for most women to show her contribution. This raised her importance in her family. She is involved in much decision-making activity.

The respondents were asked the question "who makes the decision on buying drip kit, crop choice, fertiliser use, sale, use of income?" This was to learn the impact on woman's role in the family. Both man and woman do the decision-making in almost all issues. Usually the man goes out for other work and hence women do the decision-making.

9.C. Community

Less productive land has been used to grow high value vegetable crops. The cropping intensity has increased by growing one more vegetable crop in the summer season after the drip is installed. High value vegetables are grown in the winter season besides cultivation of usual monsoon crop in the same plot. People have fresh vegetables now. This made farmers regularly busy. Vegetable production in the area has increased and as the side effect of surplus vegetable production, vendors have emerged for the sale of vegetable. Off-season out-migration has reduced. People got jobs and this has improved general well being of the community.

Group formed for drip has gave opportunity for social interaction among members. Since, vegetable is cultivated in limited land, there is still possibility of extension.

Few farmers have started to face social conflict with neighbours over water, where water is scarce.

9.D. Conclusion

Introduction of low cost drip irrigation has promoted many farmers to adopt drip kit to grow vegetables. The kit made them produce adequate vegetable for home consumption and as well as sell the surplus to make an earning. It has helped to reduce unemployment, education expense, improve health and raise overall living standard.

Also farmers started to use fertilisers, pesticides and improved seeds. Concept of commercial farming has been introduced.

Women have benefited from drip use by having a job to help the family. This has raised workload but with increased importance. They are now involved in several decisions.

From the community perspective, more unemployed people became busy in productive work. Unemployment has been reduced to an extent. There are green plots looking better even in dry summer months. Observing the improvements in the livelihood of early users, the neighbour farmers have also expanded the drip kit in adjoining area. This technology is successful to influence working people's livelihood. Record of up grading by small size users also shows the positive impacts of the kit.

Thus, the impact of drip kit is effective to alleviate hunger and poverty. In general the user is satisfied with the technology.

Section 10: Problems, Improvement Need and Strategy for Promotion

10.A. Problem

Respondents said they faced some problem in the use of drip kit. Of the respondents, most of the farmers (82%) have problems concerning drip kit use. Response to the problem type by VDC is displayed in Table 10.1. Many farmers of Abukhaireni, Chirtundhara, Majhkot and Kalbhairava reported technical problem, which relates to the drip kit like clogging of holes, breakage of pipefitting and low tank capacity etc. Some farmers who have upgraded the kit (increase number of pipe to irrigate more) feel the capacity of old tank is inadequate. Few farmers feel pipe cut/break as a problem.

Table 10.1 Proportion of Problem Faced by Drip Users

District	VDC	Total No of Respondent	Problem Related To (%)			
			Agriculture	Finance	Technical	Water Supply
Dailekh	Dadaparjul	12	66.7	50.0	41.7	58.3
Dailekh	Goganpani	62	11.7	26.7	31.7	15.0
Dailekh	Kalbhairava	15	73.3	73.3	100.0	0.0
Dailekh	Narayan	27	22.2	7.4	22.2	0.0
	Subtotal	116	28.1	30.7	39.5	14.0
Palpa	Chirtundhara	50	34.0	0.0	100.0	78.0
Palpa	Darlamdanda	34	41.2	8.8	35.3	85.3
Palpa	Kaseni	13	76.9	7.7	100.0	46.2
Palpa	Nayarnamtales	17	29.4	0.0	0.0	64.7
	Subtotal	114	40.4	3.5	65.8	74.6
Tanahu	Anbukhaireni	25	42.3	26.9	80.8	19.2
Tanahu	Bhimad	27	14.8	22.2	11.1	33.3
Tanahu	Khairenitar	27	40.7	33.3	63.0	66.7
Tanahu	Majhkot	80	61	22	62	53
	Subtotal	159	54.4	27.5	64.4	53.1
	Total	**389**	**26.8**	**13.5**	**36.2**	**30.2**

Source: Field Survey, 2001

Another important problem is related to water supply. Water source is at a distance and hence carrying water is a major problem. It takes half an hour or more to bring a bucket of water. So many users apply less water for this difficulty. Large number of respondents from Darlamdanda, Chirtungdhara, Dadaparajul, Majhkot, Nayarnamtales and Khairenitar expressed water-related problem as main concerns. They wish to lay pipeline to bring water from the source. They expect some financial assistance in this effect. Many non-users have also described water shortage is the problem preventing them to adopt drip kit. Table 10.2 shows the problems faced by non-users.

Table 10.2 Problem Type for not adopting Drip by Non-users

Problem	*Number saying Yes*	*Proportion (%)*
Lack of water supply	30	36
Financial shortage	24	29
Manpower shortage	22	26
Land shortage	13	15
Lack of knowledge	6	7

Source: Field Survey, 2001

Another equally significant problem is related to the vegetable farming technology and input. This is termed as agriculture problem. Majority respondents of Kaseni, Kalbhairav, Dandaparajul and Majhkot have expressed agriculture related problem. Quality input particularly quality seed and timely support for pest management are major concern. IDE has withdrawn its field staff from Majhkot and Bhimad, which is resented by many farmers there. They expect continued support longer until they learn well. Also

some farmers particularly from Darlamdanda seek dealer service near by. Kalbhairav and Dandaparajul farmers also expressed financial problem to procure.

Farmers with adequate water source prefer to shift to other easy and more water consuming technique. They feel drip irrigation is more labor consuming where water is to be hauled from long distance and hence farmers feel it drudgery. Still for the poor due to low value of their labour, it has permitted self-employment and helped them to produce vegetables to eat. Hence it is a way to reduce hunger and to earn some income. In other sense if the objective to foster poor only, leaving water supply problem as such encourage more poor and deprived.

10.B. Improvement Need

The drip kit is effective to meet its purpose of enabling farmers to grow vegetable with less water. It is continuously improved taking feedback (response) of the users. Most problems are now very much reduced. Yet farmers have expressed wishes for further improvement, which may help in the promotion of drip kit. These are:

a) Improved filter- net of Jerry can filter should be well stitched.
b) Quality fitting: Fitting parts, like baffle, connector etc should be of quality plastics. Also they want iron pegs in place of plastic one.
c) Socket is needed to join lateral pipes.
d) Assistance in water resources development to relieve farmers from drudgery of bringing water.
e) Continued support to farmers on agriculture activity.
f) Help Group strengthening.

10.C. Strategy for Promotion

IDE use billboards and demonstration plot to promote adoption of drip kit in the rural areas. However, to benefit even the poorest of the poor, a small fixed amount subsidy flatly of about Rs 500 may be provided to each users irrespective of the size to encourage many poor and disadvantaged people to adopt drip kit. Or else loan should be availed easily to buy through local credit institution. This will benefit poor with less money.

Assistance in bringing water to field from source should also be tackled by concerned agency preferably through participatory approach along with the drip irrigation group. This will encourage many people to grow vegetable farming in large area. Alternate techniques like rainwater harvest tank construction to store water and use of wastewater recycling technique to reuse wastewater by drip kit should be promoted. These will also attract farmers to adopt drip kit and make water requirement lower. There is enough water at many villages in the vicinity but difficult to develop with less expenditure. Hence, support to develop water sources like water lifting and construction of water collection tank shall promote to use more drip kits.

Non-user should also be taken to drip user on observation tour and let them interact themselves. Now a days vegetable farming is done at most places, and water is main constraint. This will promote more demand for drip.

Informal drip users groups should be made formal by providing institutional supports and be made active enough to develop and establish water rights on the water they are using now. Local institution VDC and District Development Committee should also be involved in the promotional activity of drip kit.

Also the drip kit should be improved to handle large area with less labour input by developing ways to reduce clogging.

Section 11: Summary, Conclusions and Recommendation

11.A. Summary

Poverty alleviation is a major concern of most developing countries and hence national plans and programs are prepared to tackle poverty. However many programs do not reach to the target group in practice. IDE-Nepal an INGO is promoting low cost drip irrigation technology in few mid-hill districts of Nepal aiming to serve even poor small landholders. It claims to have reached to the small landholders and helped them alleviate their poverty. To prepare a database of their program and to evaluate the impact of the program this study was carried out. Four villages: Two with high drip users cluster and two with low were chosen as simple study villages in three mid-hill districts. Few villages Anbukhaireni and Khairenitar of Tanuhun, Nayarnamtales, Chirtundhara and Kaseni of Palpa lie on the national highways, while Goganpani, Kalbhairav, Narayana and Dadaparajul of Dailekh and Majhkot are not liked to the road and are within 2-3 hours walking distance from Bhimad and Darlamdanda. Therefore, vegetables can be easily sold in the market.

In Nepal farmers own two types of land low/and upland. At present farmers have installed drip irrigation kit only in upland fields lying near the house. These fields are often sloping bench terrace used to grow maize mixed with legume following by millet, mustard or local vegetable. Most farmers have installed drip kit for home consumption and to sell if surplus remains. They are growing now high value vegetables like cauliflower, cabbage, tomato, cucumber and gourds in place of leafy vegetable and radish. There is no discrimination on the basis of caste, gender, age group and social status for the use of drip kits. Many farmers having suitable land and water source in the villages are using drip kit after having a look at its benefit.

Drip kit has been installed in plots where water availability is not adequate to irrigate by other irrigation methods. Farmers either apply water delivered from public taps or water carried from other source like spring, stream and canal. Carrying water is a difficult task for most farmers having no direct private water supply. Hence, most farmers have installed small size drip kit only. Vegetable area has increased from 223 ha to 360 ha and correspondingly the total production has jumped from 50 mt to 175 mt totally sample respondents.

Economic analysis showed that on an average a farmer can earn about Rs 84,217/ha from a crop of cauliflower in winter and about Rs 128,385 from cucumber crop in the summer when family labor is used. But so far the largest drip user farmer is cultivating only 1/3 ha and many are using small kit for 125 sq m. In general, even

small kit users can earn Rs 1053, which is sufficient to pay the cost of a drip kit (Rs 916) in one season.

Drip kit is a small contrivance that promotes rural underemployed farmers able to do vegetable cultivation with limited water in marginal upland field. Fresh vegetable is available for home consumption as well as sale. Thus, family health as well as earning has improved. Few poor farmers have been able to support their children education. Rural women are encouraged to use the drip kit as it provides them a valuable role in the family. Women using drip kits have now developed leadership quality as well. Thus, the drip kit is supporting rural small holders to meet their food needs, providing employment and earnings from vegetable sale.

The analysis of strengths, weaknesses, opportunities and threats of drip irrigation kit is presented below.

Strength

- Vegetable production and income has increased after the use of drip kit.
- Limited water helped to irrigate high value vegetable crop.
- Leisure time is properly utilized doing work in vegetable garden, keep people active; create employment.
- All HH members both male and female fill water in the tank and apply water by drip kit.
- Need less investment.
- Waste/barren land can be utilized for vegetable productive purpose.
- Soil becomes loose
- Demonstration effect – "spill-over effect" to the proximity.
- Improve Family nutrition,
- Women empowerment,
- Development of market

Weakness

- Supervision, guidance and monitoring to the drip kit users are insufficient in interior area.
- Training given to the leader farmers is felt inadequate.
- Increase use of pesticides may endanger health.
- Shortage of water to fill tank has made farmers subject to more workload.
- Water filter system in the DI Tank is found not so effective as it should have been.
- Rats cut the pipe and fittings

Opportunity

- Potential for increase in production of off vegetable.
- Transfer of drip kit technology is simple and can be spread at a winder scale.
- This technology can also be applied for cash crops (coffee etc.)
- This technology can be promoted in dry upland areas if rainwater harvesting and/ or wastewater recycling technique could be introduced.

- There are ample opportunities to substitute vegetable imports from outside if off-season vegetable production could be encouraged
- Women and socially disadvantaged people can be supported.

Threat

- Some conflict may arise in the use of water between users and non-users.
- There is fair competition to fetch water either from the tap stands as the number of users increases.
- If vegetable production is increased more than the demand, then market problem may arise.
- Increased use of pesticide may endanger health.
- Low quality seed supply may discourage users

11.B. CONCLUSION

Low cost drip irrigation technology is being promoted in Nepal for last six years with encouraging success. The drip kit is a low cost technology affordable even by poor farmers. Its spread is continually increasing and helping farmers to increase income avail fresh nutritious vegetable for consumption and thus improve health. It has also increased the workload of a family member. In other words, it has provided an employment opportunity to underemployed member in the HH enabling them to earn by cultivation or working as the vendor. This has also contributed indirectly to children's education as well. It has raised the living standard of most drip users.

The drip irrigation technology is highly efficient water application method, which permits to apply less water. It also permits to apply soluble fertiliser like urea with water. However, where farmer has to haul water from distance, they find it drudgery particular when there is no underemployed member in the HH to look after drip irrigation.

The price of drip kit is less than $ 13 for small kit (80 holes), which can be used to grow vegetables in 125-sq. m area. Most farmers sold vegetables worth more than the price of the kit. If the labour cost for bringing water is not accounted (due to involvement of HH members), high value vegetable cultivation with drip irrigation is beneficial yielding a net benefit of up to Rs 212,602 in one year when only family members work with no charge. In one summer season, a farmer can earn Rs 96,885/ ha by growing cucumber.

Most non users and users face water shortage problem. Hence, if improvement in water availability situation and system quality particularly filters can be made, more farmers will adopt the kit. This technology is helping hill people to remain there by permitting farming in fragile poor soil with inadequate water to develop irrigation system of conventional type.

IDE has been successful to address the problem of poor farmers of the hills. Still there are many poor who are deprived to benefit from the opportunity due to lack of fund for bringing water closer to home. If this concern is also taken care, all small landholders will be benefited. Many women and some socially disadvantaged caste in the area are adopting drip kit.

Women users have developed self-reliance and are now vocal to express demands. The program is at an early stage and is entering into interior areas where most of the socially disadvantaged caste people live. In future, participation by many SDC and women can be expected. However, the extent of drip promotion should be guided by the quantity of vegetable production that shall be produced so that marketing problem does not emerge.

11.C. Recommendation

Drip irrigation area can and will be expanded to large area. To expedite its adoption some improvement shall be helpful. These are:

Technical Aspects

- Improved filter- net of jerry can filter should be properly stitched.
- Quality fitting: Fitting parts, like baffle and connector should be made of quality plastic. They want iron pegs in place of plastic ones.
- Need socket to join pipes.
- Assistance in water conveyance will help promotion of drip kit use and also relieve farmers from drudgery to bring water.

Agricultural Aspects

- Continued support to farmers on agriculture activity particularly supply of quality seed, fertiliser and pesticide.
- Frequent follow up service be provided during vegetable season.

Institutional Aspects

- Group should be formally registered and be provided back stopping.
- Linkage with other related line agencies ADO, ADB, VDC, DDC should be established through groups
- Women, very poor and occupational caste should be encouraged by providing subsidy and easy loan facility.

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Annex A

Household Survey

Household Questionnaire
(Adopters and Non-adopters and Droppers)

Interview No:

Date of interview:

District: Tanahun	
VDC: Bhimad	
Ward No **Tole**	
Location **Road distance Near 1 – Far - 2**	
Name of the interviewer	
Name of the supervisor/consultant	
Respondent type (Adopter/Dropper/Non-adopter)-	

Household Questionnaire -Users

SN	Questions	Responses and code
1.	Name of the respondent	
2.	Sex	Male 1 Female 2
3.	Age (Years)	
4.	Are you head of the household?	Yes 1 No 2
5.	If you are not head of the household (HH), who is he/she of the HH Head?	
6.	Caste	
7.	Educational background of the respondent	Illiterate 1 Primary 2 Secondary 3 Higher Secondary 4 Graduate 5
8.	Family Size	Male / Female / Total
	Old (60 years and above)	
	Adult (16 to 59 years)	
	Child a (10 to 15 years)	
	Child b (Below 10 years)	
	Total	
9.	Social position (Please check, if any family member of the respondent is)	• Elected to VDC/DDC 1 • Nominated to VDC/DDC 2 • An Active member of political party (leadership position) 3 • Working for the Government 4 • Working for the private sector 5 • Others, specify 5
10.	Identify who is the respondent, Please check (Characteristics of the respondent) Multiple responses, possible	• Farmer/Local resident 1 • Service holder 2 • Elected Representative 3 • Nominated Representative 4 • A member in Users Group 5 • Others 6
11.	Is any family member of the respondent a member in any User Groups formed in the VDC by any other agencies such as DIO, DFO, DADO and NGO	Yes 1 No 2
12.	If Yes, specify them (Likely Multiple responses)	Drinking water user group 1 Forest user group 2 Irrigation user group 3 Women group 4 Agriculture group 5 Other (specify) 6
13.	Household occupation (Likely to have multiple responses)	Agriculture 1 Crops 1.1 Livestock 1.2 Horticulture 1.3 Poultry 1.4

		Service 2 Wage earning 3 Business 4 Others, specify 5
14.	What are the sources of income? Agriculture 1 Crops 1.1 Livestock 1.2 Horticulture 1.3 Poultry 1.4 Service 2 Wage earning 3 Business 4 Others, specify 5	Specify annual income (Rs/year) _____ _____ _____ _____ _____ _____ _____ _____
15.	Land details	

18.2 Land holding size, Specify Unit of measurement	Low land				Bari			
	Irrig		Rainfed		Irrig		Rainfed	
	Area	Pcs.	Area	Pcs.	Area	Pcs.	Area	Pcs.
Farming by self								
Rented in								
Rented out								

16.	Cropping system in Bari	a) _____ b) _____ c) _____ d) _____
17.	Cropping system in Khet	a) _____ b) _____ c) _____ d) _____
18.	Cropping system in Drip Plot Specify the name of vegetables and area	a) _____ b) _____ c) _____ d) _____
19.	Livestock owned by the household species a. Cattle b. Buffalo c. Goat d. Pigs e. Poultry f. Others, specify	Number

20.	Livestock Production	Unit	Production Qty	Sold Qty	Income
	Milk				
	Ghee/Butter				
	Meat				
	Egg				
	Wool				

21.Production and consumption details

Crops	Amount (Quintals)			Sales Details		
	Production	Consumed	Sold	Place	Price/Unit	Months
Paddy						
Maize						
Wheat						
Pulse						
Oilseed						
Vegetable						
Fruit						
Other						

22. Who gives you agricultural extension services?

District Agriculture office	1
District Livestock Office	2
Agriculture/Livestock Service Center/Sub-center	3
Any other source	4

23. How do you rate their serves?

Source of Service	Good	Normal	Poor
District Agriculture office	**1**	**2**	**3**
District Livestock Office	**1**	**2**	**3**
Agriculture/Livestock Service Center/Sub-center	**1**	**2**	**3**
Others	**1**	**2**	**3**

24. From where do you get agricultural credit services for general agriculture?

ADB/N	1
Sajha	2
Commercial banks	3
Saving Credit Groups	4
Others (specify)	

25. How do you rate their services?

Source of Service	Good	Normal	Poor
ADB/N	**1**	**2**	**3**
Sajha	**1**	**2**	**3**
Commercial banks	**1**	**2**	**3**
Saving Credit Groups	**1**	**2**	**3**
Others (specify)	**1**	**2**	**3**

If poor, specify reasons.

26. On Drip Irrigation

26.1	What is the main purpose of installing drip irrigation?	a) Increased home consumption 1 b) Market sales 2 c) Both 3
26.2	Did you irrigate the present drip plot before? If yes how was it irrigated?	Sources: a) ..... b) ..... d) .....
26.3	Did external agency play any role to introduce drip system Yes – 1, No-2? If yes, specify who and what role?	Organization_____ Role_____
26.4	How did you know about the system (innovation) for the first time?	
26.5	Since when you are using the drip system?	
26.6	How did you install the system?	
26.7	Do you use the system alone?	Yes No
	If no, do you use that in association with?	1. Water harvesting 2. Water lifting 3. Both 4. If others .....
26.8	Approximate area under irrigation through DI system Summer Winter Spring	Area in Ropani _____ _____ _____
26.9	Are you planning to extend the system?	Yes/No
26.10	If no, what limited you to restrict to the present size?	
26.11	What did the system cost to you?	Rs.
26.12	How was that paid? Self Loan Subsidy Any other	Amount in Rs _____ _____ _____
26.13	Was up-front payment necessary?	_____ Yes No
26.14	If yes, how much?	_____
26.15	What skills are needed for O&M of the technology?	
26.16	How did you get that skill and from whom?	Training 1 Self learned 2 Others 3
26.17 26.18 26.19 26.20	If training, who got the training in the family? Who provided the training? How long was the training period? What specific messages were given?	Person trained:_____ Trainer :_____ Duration:_____ Training message
26.21	What is the expected life of the DI system?	
26.22 26.23	Do you allocate fund for replacement cost to replace after? If yes how much?	Yes/No _____
26.24	Was it necessary to modify the system to suit your land size?	Yes No

26.25	If yes what modification was needed and how did you did that?	Modifications specify _____ _____
26.26	What is the water resources and distance? 1. Reservoir, 2. Spring/pond 3. River/stream 4. tap 5. Others, specify	Distance _____ _____ _____ _____
26.27	Do you get enough water?	Yes - 1 No - 2 Water availability situation

25.28	Please tell water adequacy by months?	Plenty	Just right	Scarce
	Baisakh			
	Jestha			
	Asad			
	Srawan			
	Bhadra			
	Aswin			
	Kartik			
	Marga			
	Poush			
	Magh			
	Falgun			
	Chaitra			

26.29	Did water scarcity lead to any social problem? If yes what was it?					
26.30	Who does fill the tank?	Person involved				
	How many times a day by months?				Number of times a tank is filled	
	Time required for bringing water to fill the tank ?					Time reqd to bring water
	Month	Men	Women	Children	Times a day	Hours/time
	Baisakh					
	Jestha					
	Asad					
	Srawan					
	Bhadra					
	Aswin					
	Kartik					
	Marga					
	Poush					
	Magh					
	Falgun					
	Chaitra					

26.31	What is the quality of water?	Clean Medium Dirty
26.32	How is your system performing?	Excellent Good Fair Bad Worst
26.33	If the response is fair, bad and worst, why has it been so? Specify reasons.	
26.34	Can you tell about working of the drip ?	
26.35	Uniformity in water distribution in the drip system	a) Yes b) No c) Sometime uniformity is not there d) No applicable e) No response
26.36	Filter in the drip system	a) Work well b) Don't work well c) No response d) Not applicable
26.37	Clogging of the drip system	a) Most of the times b) Some times c) No clogging d) Not applicable e) No response
26.38	Have you received any follow up support from IDE or the promoter?	Yes No
26.39	If yes, specify the support and frequency. System operation and maintenance Agriculture extension Any other specify	Frequency (No/months)
26.40	What specific messages were delivered during the support visit? Messages in system operation and maintenance Messages in agricultural extension Messages in other support	
26.41	How do you rate follow up support services made available through Promoter?	Excellent 1 Good 2 Poor 3
26.42	Reasons for the response to the above	
26.43	Would you have adopted the system without these supports?	

26.44	Under what conditions the drip system can be expanded and used more efficiently and effectively? Conditions for expansion: Conditions for enhanced efficiency:	
26.45	Do you have any particular problems in your drip system? If yes, What is the major problem?	Yes No
	Explain problems: Technical problems faced: Agricultural problems: Financial problems: Water crisis problems:	
26.46	Please suggest "how can your system can be improved?"	

26.47 Labor Used on for Drip Irrigated Crops by Gender

SN	Crops (Name)	Summer				Spring				Winter					
		Crop 1		Crop 2		Crop 1.....		Crop 2		Crop 1		Crop 2		Crop 3	
	Operation	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	Land Prep														
2	Seeding														
3	Planting														
4	Manuring														
5	Fert. appl														
6	Irrigation														
7	Plant prot.														
8	Intercult														
9	Harvesting														
10	Threshing														
11	Storing														
12	Selling														

(Get responses for this question from about 15-20 respondents per district for all crops grown in the drip plot)

26.48 Have you formed any association related to drip technology of your own? Yes/ No

26.49 If yes, when was it formed and for what purpose?

Year Formed:_____

Purpose of forming the association:

_____

_____

_____

26.50 How is the association performing: Well Average Bad

26.51 Are you satisfied? Yes/No

26.52 How can this association be made more effective?

26.53 If the, group is not good do you think the need to form another such association? Please elaborate.

26.54 Have you perceived any improvement as a result of the drip technology? If yes what are these?

Income
Health
Education
Life style

26.55 What help do you expect to help in the promotion of this technology and agriculture?

A. Details of Input Use and Crops Production

SN	Crops	Area	Irrigation	Season	Variety	Seed	Manure and Fertilizers (Kg)				Pesticide	Production
		(Ropani)				Kg	FYM(D)	Urea	DAP	MOP	(Rs)	(Kg)
Lowland												
Upland												
Total												

Season- summer, winter, spring,
Note: All crops are to be included (Cereal and vegetable crops)
Inputs to be recorded
Conversion Factor Manures *in Doko* 1 *Doko* = ... Kg, If other specify conversion rate

Price in NRs per Kg of:

Urea:_____

DAP:_____

MOP_____

For Dropper Only

26. Details on the reason for dropping of and necessary situation to readopt the drip technology

26.1	When had you adopted the innovation and for how long?	Time adopted:_____ Time dropped:_____
26.2	Who advised you to adopt the system/innovation?	
26.3	What made you to discontinue the system? Please explain.	
26.4	Under what condition do you think that you will readopt the technology? Please elaborate.	

Thank you very much for your cooperation

For NON-USER

26. Details from non-users of drip technology

26.1	Are you aware about the innovation?	Yes	No
26.2	If yes when and how did you know? Source of information Since how long you know about the technology?		
26.3	What were your constraints to adopt the innovation?	**Economic** 1. 2. 3. **Social/community** 1. 2. 3. **Institutional** 1. 2. 3. Any other specify	
26.4	Are you looking for opportunity to adopt the innovation?	Yes No	1 2
26.5	Will you adopt the system?	Yes No	1 2

26.6	If yes, why and under what conditions you would adopt the innovation? Please elaborate.
26.7	If no, why? Please elaborate.

27.

A. Manpower (Labor) involved in crop production (by gender)

SN	Crops	Summer				Spring				Winter					
		Crop 1		Crop 2		Crop 1		Crop 2		Crop 1		Crop 2		Crop 3	
	Operation	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1.	Land Prep														
2.	Seeding														
3.	Planting														
4.	Manuring														
5.	Fert. appl														
6.	Irrigation*														
7.	Plant prot.														
8.	Intercult														
9.	Harvesting														
10.	Threshing														
11.	Storing														
12.	Selling														

* get this information for per ropani

(Get responses for this question from about 10-15 respondents per district for each crop except for crops grown in drip plot for which separate sheet has been provided)

B. Impact Drip Irrigation on Crops

Crops details -before and after- drip irrigation on drip plot

SN	Crops	Area	Season	Variety	Seed	Manure (Doko) and Fertilizers (Kg)				Pesticide	Production
		(Ropani)			Kg	FYM	Urea	DAP	MOP	(Rs)	(Kg)
Before											
After											
Total											

Season- Summer, Winter, Spring,
Note: All crops grown in the present drip plot are to be included

Conversion Factor I *Doko* = Kg

Price per Kg of:

Urea:_____

DAP:_____
MOP_____

C. Changes brought by drip irrigation.

Changes	No. Difference	Increased	Decreased
Use of fertilizer			
Use of seeds			
Vegetable sold			
Income			
Vegetable consumption in the family			
Health			
Living standard			

D. Benefits of drip irrigation. (Please Check)

a) More land irrigated with less water
b) Increased income
c) Water saved
d) Time saved
e) Less weeds
f) Labor saved
g) Increased employment
h) Loose and soft soil
i) .....

E. Impact on Decision-Making by Gender.

Activities		Male	Female	Both
1. Purchase of drip irrigation				
2. Decision on				
a) Crops Selection	Before			
	After			
b) Use of Fertilizer	Before			
	After			
c) Sales of Crops (when and where)	Before			
	After			
d) Use of income	Before			
	After			
e) Sales of Product				
f) Control over income				
3. On the whole, how has installation of drip irrigation affected workload of men and women? Increased (+) Same (=) Decreased (-)				

Annex B

List of persons met

IDE Staff

Mr. Bob Nanes	Kathmandu
Mr. Bhimsen Gurung	Kathmandu
Mr. Dipak Adhikari	Kathmandu
Mr. Chiranjivi Rijal	Khairenitar
Mr. Sankhar Gairi	Bhimad
Mr Ain Bdr Shahi	Surkhet

B: Related persons

1. Mr. Chandu Thapa	Manufacturer Of Fitting Gwarko Lalitpur
2. Mr. Dilli Prasad. Pandey	Assembler/Dealer Surket
3.Mr Narayan Gautum	Assembler/Dealer Pokhara
4.Mr Upendra Devkota	Dealer Aabukhaireni