Support to National Integrated Pest Management Programme in Nepal
(UTF/NEP/055/NEP)

Proceedings of Officer Level Training of Facilitators in Vegetable IPM

(June 13 - September 25, 2004)

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Plant Protection Directorate
Department of Agriculture
&
Food and Agriculture Organization of the United Nations
Kathmandu
2005

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Field Document

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Compiled by

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Plant Protection Directorate
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Few Words

This report is the output album of day-to-day activities conceded during the "Training of Facilitators in vegetable IPM" held at Budol in Kavre district from 13th June to 25th September 2004. It is collated with an intention that the trained facilitators when they get trapped with some technical or management problem, while conducting the FFS in their respective fields, this album can help them to unfasten the knot. This report is expected to act as the "reminder stick" to them of what they discovered during the TOF and also as a memoir of what they become skilled at or achieved when they were in "Guru Ashram" learning technical or management aspect of IPM FFS.

In fact, during the leisure period from field work the facilitators can turn some of the pages of this album and get recharged with the sprit they had acquired during their learning by doing days. My experiences prove that the facilitators often need to be reminded of IPM Guru Ashram days. And this report can make it possible.

The experimental data, and the views expressed by the visitors as well as training facilitators documented in this report could be a good reference material for similar type of future trainings.

I have had pleasure to observe the enthusiasm shown by the participants during the training period and they need appreciation.

The support provided by the facilitators and coordinators and their friendly cooperation in making the training success need admiration. I would like to thank the training coordinators, Ms. N.S. Upadhayay, Ms. Nabin C.T.D. Shrestha, Mr. B.R. Palikhe and permanent facilitators, Mr. Madhusudan Poudel and Mr. P. Dawadi for their contribution in making the training successful.

I am also thankful to other facilitators, farmer participants, group leaders, team members of various training management committees, as well as to all those who directly or indirectly supported in completing the training with great success.

I also express my thanks to the management team and chief of Chetana Kendra Training Center, Mr. RamaHari K.C. for their excellent logistic support. I cannot stop my few words without appreciating the real heroes of the TOF- the 35 participants for their understanding, support and cooperation extended during the implementation of the training activities.

Dr. Binod Saha, National Programme Manager of IPM Programme deserves special thanks for his meticulous efforts in editing of the report.

Ms. Devi Poudel, secretary of the programme deserves special appreciation for her constant effort and support in bringing this report to this form.

Finally, I must thank Mr. Kazuyuki Tsurumi, the FAO Representative in Nepal and his staffs as well as, the First and Second Secretaries of The Royal Norwegian Embassy in Nepal for their valuable suggestion, encouragement, and support for the successful execution of the training.

"JAI IPM"

(Ganesh Kumar K.C.)
Co-ordinator, National IPM Programme
&
Programme Director, PPD

ACRONYMS AND ABBREVIATIONS

AESA	:	Agro-Ecosystem Analysis
ARS	:	Agriculture Research Station
BBT	:	Ballot Box Test
Bt	:	Bacillus thuringiensis
BW	:	Bacterial Wilt
CATC	:	Central Agriculture Training Center
CARE	:	Cooperation of American Relief Everywhere
CB	:	Community Behavior
CBO	:	Community Based Organization
CDP	:	Crop Diversification Project
CRD	:	Completely Randomized Design
CV	:	Coefficient of Variation
DADO	:	District Agriculture Development Office
DAP	:	Diammonium Phosphate
DAS	:	Days After Seeding
DAT	:	Days After Transplanting
DBM	:	Diamond Black Moth
DOA	:	Department of Agriculture
EM	:	Effective Micro-organism
FAO	:	Food and Agriculture Organization
FFD	:	Farmer's Field Day
FFS	:	Farmer's Field School
FP	:	Farmer's Practice
FT	:	Farmer Trainer
FYM	:	Farm Yard Mannure
GAM	:	Gender Analysis Matrix
GRA	:	Gender Role Analysis
GD	:	Group Dynamics
GV	:	Grannulosis Virus
IDM	:	Integrated Disease Management
INGO	:	International Non-Governmental Organization
IPM	:	Integrated Pest Management
IPPC	:	International Plant Protection Convention
IPs	:	Insect Pests
LSD	:	Least Significant Difference
M&E	:	Monitoring and Evaluation
MOAC	:	Ministry of Agriculture and Cooperatives
MOP	:	Muirate of Potash
NARC	:	Nepal Agriculture Research Council
NE's	:	Natural Enemies
NGO	:	Non Governmental Organization
NPC	:	National Project Co-ordinator
NPK	:	Nitrogen, Phosphorus & Potash
NPV	:	Nuclear Polyhedrosis Virus
PD	:	Participatory Discussion
POPs	:	Persistent Organic Pollutants
PP	:	Plant to Plant
PPD	:	Plant Protection Directorate
PPO	:	Plant Protection Officer
PRA	:	Participatory Rural Appraisal
RCBD	:	Randomized Complete Block Design
RPPL	:	Regional Plant Protection Laboratory
RR	:	Row to Row
RRN	:	Rural Reconstruction Nepal
SAD	:	Sustainable Agricultural Development
SDP	:	Sericulture Development Project
SPS	:	Sanitary & Phytosanitary
TCP	:	Technical Cooperation Programme
TFDC	:	Tropical Fruit Development Center
TOF	:	Training of Facilitators
TOT	:	Training of Trainers
VDC	:	Village Development Committee
VDD	:	Vegetable Development Division
WTO	:	World Trade Organization

1. INTRODUCTION

1.1 Background

The indiscriminate use of pesticide both in agriculture and health sector has alerted many who have directly or indirectly come across from its adverse effect.

During the green revolution period, pesticides were considered as one of the yield increasing inputs and so being used widely even without its real need to manage the pests. Consequently it caused frequent pest outbreak, pest resurgence and pesticide resistance issues and to handle this, "Integrated Pest Management" (IPM) has proped up as an important approach of pest control strategy, which encourages applying measures that causes least disruption of agro- ecosystem.

IPM adopters' i.e farmers' understanding of crop and its interaction with environment and other biotic factors is further strengthened through field experimentation that will gradually make farmers comfortable to adopt technical recommendations only after field verification on their own participation and critical analysis of the results. This makes a paradigm shift from a top down to more participatory approach of agricultural education and extension system once farmers believe that they can do scientific studies in their own field and by their own initiatives.

To the above context IPM facilitators has a critical role in moving on farm studies in right track. It is the facilitators' responsibilities to make the farmers develop ownership feeling of the program, along with their capability to think critically and analytically while observing the experimental plots. This finally leads them towards becoming capable to know who they are and what they can do.

1.2 IPM in Nepalese Scenario

Agricultural development program of His Majesty's Government of Nepal (HMG/N) has adapted IPM as crop protection strategy since 1990 and incorporated the IPM as an integral component of agriculture program which aims at achieving the poverty alleviation goal through its development particularly focusing on farmer's empowerment.

The IPM Programme in Nepal was initiated in rice crop in May 1997 through Technical Cooperation Programme (TCP) of Food and Agriculture Organization (FAO) of United Nations and further continued with the support from FAO Programme for Community IPM in Asia. During this period three season long trainings for 139 officers and 907 Farmers Field Schools (FFS) were conducted and about 25191 Farmers were trained and exposed to various aspects of IPM, of which 60 percent were women farmers.

The success of IPM FFS in rice over the past years has resulted in increased demand for FFS in other high value crops. In view of this, HMG/N requested the Royal Norwegian Government for financial and technical support. Towards this, the Government of the Kingdom of Norway in 2003 agreed to donate a grant to His Majesty's Government of Nepal totaling US$1,284,444 to provide "Support to the National Integrated Pest Management (IPM) Programme" in Nepal. In turn, His Majesty's Government of Nepal signed an agreement with the Food and Agriculture Organization of the United Nations to provide technical assistance services under UTF/NEP/055/NEP project inorder to realize the following objective and outputs.

1.3 Objectives and Expected Outputs of National IPM Programme in Nepal

The main objective of the programme is to contribute to sustainable broad-based poverty alleviation and food security while contributing to environmental protection

The immediate objectives of the programme are:

- à To contribute to institutionalise a sustainable national IPM Programme by strengthening the capacity of the PPD, collaborating national, regional and district level training and extension institutions in the governmental and non-governmental sector strengthened to integrate IPM training and support programmes for smallholder farmers.

- à To empower farmers to increase production and productivity efficiently while protecting environment, conserving the biodiversity and avoiding health hazards for betterment of their livelihood

The programme envisages to achieve following out puts:

- à More efficient crop management, resulting in improved food security and incomes;
- à Reduced use of pesticides, resulting in improved biodiversity and human health;
- à Farmers empowered to take greater control of their lives, resulting in better response to adversity;
- à Better bargaining position, resulting in improved support from Government and reduced threats from corporate interests.
- à Strong community inter-action

2. Planning and Implementation of Training of Facilitators in Vegetable IPM

In line with the objectives of the programme, a season-long IPM Training of Facilitators (TOF) on vegetables was organized at Budol of Banepa in Kavre district in which 35 officers from the Department of Agriculture (DOA), Nepal Agriculture Research Council (NARC) and Non-government Organizations (NGOs) participated.

The training was conducted with the objectives:

- à To make the participants acquainted with the basic principles and process of IPM.
- à To make the participants acquainted with the ecological approach of crop management.
- à To make the participants capable in facilitation & decision-making skills and discovery based learning.
- à To make capable the participants in designing and conducting the trials and organizing collaborative approaches in implementing need based farmer's participatory field research based on Farmers and Science concept.
- à To refine and adjust the FFS as a tool to educate farmers on the process of IPM in vegetable.
- à To prepare IPM Master Trainers for efficient support delivery to the farmers in the implementation of IPM FFS.

Three training coordinators, 14 master trainers were involved to make the training fruitful. This TOF had been designed for the period of 105 days and implemented from June 13 to September 25, 2004. The TOF was conducted on vegetable crops like cauliflower, cabbage, tomato, and cucumber.

The core intention of this TOF was to expand the nucleus group of quality facilitators in IPM.

2.1 Training Design

2.1.1 Training Management Team

To support and run the training successfully, a management team was formed and equipped with basic facilities viz. the computer, photocopy machines, over head & slide projectors and vehicles along with other required facilities. The team was continuously supported with close surveillance, facilitation and backstopping from the management experts. The management team included 3 training coordinators, 14 facilitators, 3 training assistants and 4 drivers (working on rotation). Supply of necessary inputs and service was made to the best possible of high quality. The logistics and food management provisions were of appreciable standards.

The 3 training coordinators were Mrs. Nalini Singh Upadhayay, Mrs. Nabin Chand Tara Devi Shrestha and Mr. Bhakta Raj Palikhe who continuously guided the facilitators for quality session delivery and provided their valuable backstopping support to the participants during the sessions. Facilitators and coordinator all took crucial decisions while confronting with the problems and showed ways for appropriate solutions.

2.1.2 Training Curriculum Modules

In Nepal TOF in vegetable *IPM* was conducted for the first time in year 2000. The training process, exercises and the concepts and methodology of agro-ecosystem analysis adopted then were basically the same that were used in Rice IPM. And, the curriculum for TOF in Vegetable IPM was also designed based on the curriculum adopted for rice crop, though the phenology and behavior of rice plant and its ecosystem (aquatic) is completely different from that of vegetable crop.

In the initial TOF conducted in vegetable, various technical as well as management problems popped up and remained unresolved from the perspective of training. However, from the time then, Nepalese IPM program has crossed many remarkable journeys and enriched with experiences that contributed to the programme to reach at level of maturity. Now the National IPM program in Nepal has its own well-experienced IPM master trainers capable of developing the training manuals, curriculum modules and conducting the national and international level of IPM trainings for facilitators and farmers. The program has gained long (almost 4 years) field experiences through conducting several FFSs and scientific experiments and has become capable of making improvements based on the observed weaknesses.

In view of the above the IPM strategy has been reformed, restructured and revised from time to time and accordingly the TOF curriculum also been updated. The curriculum for this TOF in vegetable IPM has also been refined and upgraded taking into account of all the above issues.

The training module and training approaches in this training were designed using the recent and available advanced methodologies to the extent possible level. Besides this, very practical exercises that can elaborate the new horizons of ecosystem and ecological concepts along with sociological aspects were delivered. Like wise concepts and principles of IPM along with FFS process including important aspects of farmers' empowerment was also emphasized.

The modules that were adopted for the training are as follows:

- à FFS preparatory meetings
- à Cropping calendar and gender role analysis
- à Trial design and layout
- à Adult learning
- à Facilitation skills
- à Agro-Ecosystem Analysis (AESA)
- à Study of insects' biology and disease ecology
- à Group dynamics and team building exercises
- à Management skill along with monitoring and evaluation of IPM activities
- à New and basic concepts as special topics by the experts

The approach and techniques to deliver these modules of TOF were mainly on the principle based on learning by doing concept and consisted the following:

- à Season long trials and studies in TOF
- à Agro-Ecosystem Analysis
- à Special Topics
- à Team building exercises
- à Simulation studies, games and role play
- à Participatory discussions based on classroom sessions
- à Conduction of season long farmers' field schools
- à Brain storming exercises
- à Cup and Insect zoo studies
- à Farmers' Field Day

These modules were addressed on the specific days of each week on a routine basis. The details of weekly work schedule adopted in the training are as follows:

- à Every Wednesday of a week, Agro-Ecosystem Analysis i.e. field observation and data collection from comparative trial conducted at the main TOF field was carried out. Similarly the findings of the observation were processed and presented by the paricipants. Based on the outcome of the AESA appropriate decisions were taken regarding the immediate activities to be performed and implemented in the field.

- à The evening session of each Thursday, preparations for FFS to be facilitated by the participants next day were done. The preparations included development of lesson plan and arrangements of training materials, inputs, equipments and the stationeries etc. required for the FFS.

- à On Fridays in the morning session, participants visited the FFS sites and facilitated the farmers in the implementation of FFS as per the adopted lesson plan. In the evening session performance and evaluation of each FFSs facilitated by the participants were carried out through presentation and participatory discussion.

- à Every Monday was Holiday. Every Thursday, monitoring of trial and studies along with fieldwork at the trial plots were conducted.

- à Once in a week a special topic was delivered on the subject area felt necessary by the participants.

- à On the remaining four days i.e. on Sunday, Tuesday, Thursday, and Saturday, technical sessions, case studies, special topics, insect zoo and cup studies, simulation games, role-play and team building exercises as well as group dynamics activities were carried out.

2.1.3 Pre –TOF Activities

Prior to launching of the actual TOF activities, a 12 days Curriculum Development Workshop was organized with the objective to refine the curricula on vegetable IPM for the TOF. The workshop was organized from 1 to 12 May 2004 at National Staff College, Jawalakhel of Lalitpur district.

Among the other preparatory activities that were conducted prior to the actual implementation of 105 days *Officer Level Season Long Training for Facilitators on IPM of Vegetables* are as follows:

- à Participatory Rural Appraisal (PRA) in the potential sites where FFS had to be conducted.

- à Nursery bed establishment and TOF Field Management activities

Participatory Rural Appraisal

PRA was essential to support the TOF, especially for the following purpose:

- à To set comparative trial as farmers practice against IPM practice including other relevant trials & experiments at TOF and FFS field.

- à To select Farmers' Field School (FFS) sites and suitable farmer participants for participation in the season long FFS to be facilitated by the TOF participants parallel to the season long training.

- à PRA was also carried out for farmer's need assessment, gender role analysis, resource mapping and preparation of cropping calendar to find out the existing practices followed by the farmers in vegetable growing as well as to appraise on the situation of gender equity along with assessment of local resources of that locality.

It was implemented in selected 3 VDCs of Kavre and 3 VDCs of Bhaktapur distrcts where FFSs had to be conducted by the TOF participants.

Establishment of Nursery Bed and TOF Field Management Activities

23 days before the start of TOF, Plant Protection Officers (PPO) from Plant Protection Drectorate (PPD), Post Harvest and Losss Management Directorate (PHMD), District Agriculture Development Offices (DADO) of Bhaktapur and Kavre districts and an Horticulture Development Officer from Panchkhal Horticulture Farm of Kavre District were mobilized to establish vegetable nursery at the TOF site at Budoole of Banepa located in Kavre district.

Nursey was established in 150 m^2 of land area where seeds of 4 varieties of cauliflower, 3 varieties of cabbage, 8 varieties of tomato and 2 varieties of cucumber were sown. Along with the establishment of the nursery bed the officers were also enagaged in preparation of TOF field. Field preparation activities included ploughing, drainage channels preparation and procurement of farmyard manure, treatment with effective microorganism and compost amendment. In the TOF field plots soil test was also carried out to asses the level of major available nutrients and PH level. The results of soil test revealed low level of nitrogen and PH at the level of 5.5 to 4.1. In order to minimize the acidic soil reaction, lime was incorporated into the soil about 20 days before the start of the training.

2.2 Training Proceeding

2.2.1 Opening and Start of the Training

The season long training of IPM facilitators was started with a formal opening session. Mrs. Nalini Singh Upadhyaya , the training coordinator assigned for the initial first month of the training and Chief of the Regional Plant Protection Laboratory of central region welcomed the participants, facilitators and guests to the opening session of the training.

The chief guest, Director General of the Department of Agriculture Mr. Shiva Sunder Shrestha inaugurated the opening ceremony by lighting Panas (oil lamp).

Mr. Shrestha in his inaugural speech stressed that the behavioral change helps to bring about the changes in individual action and this ultimately helps to bring about the changes in social action. He hoped that this training will contribute towards achieving this.

Mr. Ganesh Kumar K.C, Director of Plant Protection Directorate closed the opening ceremony enunciating that IPM can uplift the economic status of rural farmers. He further highlighted that pest management for empowerment of farmers is the main stem of present day IPM and expressed hope that 35 latest Heroes of IPM (participants of the training) will support in achieving the goal of IPM.

Expectation Matching and Norms Setting

The actual startup of the training begun with participant's expectations matching and a norms setting by the participants themselves.

Some general rules adopted were:

- à Participants must depart for IPM/FFS in their respective field at 7am.
- à The first session will start at 7:30am.
- à Lunch time 12:30 to 2pm.
- à The second session will start from 2 to 5pm
- à Monday will be the holiday.
- à No leave is allowed in normal condition.

Hostel Rules

- à Smoking, drinking is strictly prohibited
- à The participants must return to their respective room before 9 pm.
- à The concrete roof of the hostel can be utilized for drying wet clothes.
- à The guests of the participants are not allowed to stay in the hostel, though they can meet their relatives/friends

After this, pre-test was conducted to estimate the initial level of knowledge of the participants relevant to IPM inorder to make the training effective and fruitful.

Some of the training formalities including registration, introduction among the participants, facilitators and management groups were also completed in time.

The designed course and the expectations of the participants were of similar nature and so no additional efforts were needed to meet the expectations of the training participants.

2.2.2 Subsequent Training Sessions and Exercises

From the second day onwards-regular sessions, exercises and special topics were performed routinely as per designed training curriculum.

During the first week, main focus was put on the concept of IPM, principles & approaches and IPM feelings in the present context of agriculture development. The sessions were dealt with participatory discussions, brainstorming, and polling by each individual towards enriching with IPM feelings and finally deliberating lectures. Field based practical exercises and discovery based learning exercises viz. case study on nursery management, exercises on seed germination and seed purity & soil tests were also carried out. Likewise the management of nursery and TOF field, it's lay out, field preparation, discussion on trials design, it's process

and methods of implementation, orientation on FFS concept and its working procedures, along with presentation on PRA report of FFSs selected in Kavre and Bhaktapur districts were done. Participatory discussions on process of FFS preparatory meeting such as preparation of cropping calendar, gender role analysis were discussed. Apart from these, a common consensus was built for the comparative trial of tomato and cauliflower. Six sub groups consisting of 6 participants in each were formed to take charge of the each FFS.

From the second week onward planning & implementation of different trials at TOF field, and FFSs sites, monitoring and management of the trials, facilitation of FFS, attending special classes, participatory discussion, visit by special guest & other visitors to the TOF venue, case studies, organizing Farmers' Field day were the main activities completed in the remaining 90 days of the training period.

Highlights of the major activities conducted are as followings:

Participatory Discussions

These sessions basically dealt with the technical problems faced in the course of conducting the trials and on some new topics that was felt relevant to IPM and process of farmers' field schools. Some sessions were also allocated to identify the complex aspects of rural social system and ways of simplifying them. Devoted IPM facilitators considered as social mobilizer and as a change agent of the society played key role in facilitating the sessions. So in these sessions both technical and social aspect of rural development was dealt. These sessions were conducted with rigorous participatory discussions. About 80 to 90% of the participants participated according to their subject interest in the discussion.

In the TOF, facilitators facilitated to evoke the discussion area and bring into the subject matters and also draw the conclusions. The participatory discussion (PD's) exercises were very much liked by the participants and was quite fruitful.

The major topics that included in the participatory discussion sessions were the following:

- à Field plot techniques
- à Trial/study design
- à Cropping calendar preparation
- à Gender role analysis
- à Eco-system and agro- eco-system
- à Biodiversity and food chain
- à FFS and its process and approaches
- à Living soil
- à Grouping of insects
- à Disease triangle and Damping off disease
- à Growth stage of cauliflower and tomato
- à Cutworms –life history, nature of damage and management
- à Experiential learning cycle
- à Aphids - life history, nature of damage and management
- à Spodoptera litura- life history, nature of damage and management
- à Training method – group discussion
- à Flea beetle - life history, nature of damage and management
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- à Vermiculture
- à Aphid - life history, nature of damage and management
- à IPM TOF at glance
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- à Community behaviors
- à Growth of groups
- à Predators, parasites and parasitoids
- à Community behaviors
- à Diamond Black Moth (DBM)- life history, nature of damage and management
- à Effects of bio-agents-Nuclear Polyhedrosis Virus (NPV), Bacillus Thuringiensis (Bt), Trichoderma, Pseudomonas etc and their methods of use.
- à Spider- Species, feeding habit, habitat and reproduction behavior
- à Indicators of monitoring and evaluation of FFS
- à Post TOF what and advocacy of IPM, IPM product management
- à Statistical analysis of experimental data

Group dynamics, Team building, Climate setting and Problem solving exercises

In order to make the sessions lively and create the learning environment, various group dynamics & team building, climate setting and problem solving exercises were arranged. These exercises played catalytic role in increasing the level of participants' facilitation skills. In addition, these exercises also helped in enhancing group cohesiveness, building intimacy and solidarity among the participants and FFS farmers, and motivated them towards working for the community development. Leadership skills as well as sense of ownership feeling among the group could also been created through these exercises. Apart from this, some of the problem solving exercises was also carried out with an aim of empowering the farmers.

Since FFS participants live in villages, influenced with traditional customs & habit and so it was not easy to get innovative ideas at the very out set of the program. These exercises helped to get them out from their traditional thinking.

The Team building and Group dynamics exercises included the following:

- Nine dot game
- 7 up
- Identify your friend
- Human ecosystem game
- Tower making
- IPM questions and answer game
- Water bridging
- Divide equal parts of lands for 3 brothers
- Self-evaluation exercise
- Searching food Bulb and switch
- How many squares
- Creating a problem and finding a solution
- Access and utilization of resources
- Identifying the leader
- Divert clapping
- Target game
- Collecting goods
- Garlands of paper
- Titanic
- Rabbit wall and hunter
- Rubber band pass
- Memory game
- Making a photo frame
- Self portrait exercise
- Monitto game
- Hunter eye clapping
- Puzzle games
- Standing with digit numbers
- Resource management
- Drawing of marble
- Nail (Hatkadi) game
- Self Evaluation
- Admire group

Special Topics

The special topics were selected as per the expectation expressed by TOF participants. These topics were brought into discussion mainly with the objective to broaden the horizon of participant's knowledge and expose them to new concepts, vision and strategy in order to face new challenges that may be encountered in the development of agriculture sector. The special topics included the followings:

- IPM FFS and present context
- Organic farming
- Communication, Presentation and Facilitation skills
- Concept and principles of adult learning
- Risk and Conflict management
- Stress management and Tantra Yoga
- New research finding on insects and their identification
- Vegetable disease identification and management
- Weeds, their identification and management
- Phytosanitary measures in Nepal in the context of WTO/SPS agreement
- Future vision of IPM
- Report writing styles
- Proposal writing
- Monitoring and evaluation
- Post harvest management
- Recent development in pesticides and their options

Practical exercises

Simple, compatible and relevant exercises that address to fill in the gap in the farmer's knowledge, skill and attitude were carried out. Following exercises also suitable to farmers' field situation were taken in TOF to evaluate, reconfirm, as well as to simulate in the FFSs.

- à Soil sample collection
- à Exercise on suitable soil media
- à Multiplication of Trichoderma spp. in compost medium
- à Seed purity test
- à Seed germination test
- à Nursery soil treatment by using different methods to manage soil borne diseases.
- à Performance of earth worm in different soil quality
- à Effect of mulching to control soil erosion
- à What is this? & what is that?–exercise on discovery learning process.
- à Insect drawing
- à AESA synopsis
- à Insect zoo preparation
- à Collection of specimens and preservation
- à Simulation of defoliators damage on crop
- à Exercise on soil "identification of texture by feel method"
- à Root and plant vessel experiment
- à Effect of pesticide on Insects Pests(IPs) and Natural enemies (NEs)
- à Pesticide monologue
- à Pesticide Spraying techniques
- à Soil exercise on soil PH test by N-strip and H_2O_2
- à Role play on the seed exercise "While buying seed"
- à Setting technique of leaf and tiller cutting trials
- à Nuclear Polyhedrosis Virus (NPV) based exercise
- à Filling technique of FFS checklist and financial documents

Case studies

Some of the technical sessions were conducted by arranging visits to problematic field in a form of practical case study exercise.

Case study was followed by group work and presentation of the report prepared on the study carried out.

The case studies conducted during the TOF were:

- à Nursery management at Budoole, Kavre district
- à Late blight of tomato at Panchkhal VDC, Kavre, district
- à Bacterial wilt of tomato at Panchkhal VDC, Kavre, district
- à Helicoverpa armigera at Panchkhal VDC, Kavre district
- à Club root of crucifers at Bhaktapur district
- à Black rot of crucifers at Tukucha Nala and Tathali of Kavre district
- à Problem solving exercise on tomato, chilli, cucumber and brinjal at Panchkhal and Hokse areas of Kavre district.

Video shows

In order to expose the participants on the various IPM techniques and IPM FFS practiced in other countries were shown.

The visuals were as follows:

- à Techniques of using sterile insect
- à Potato IDM FFS
- à Extraction and multiplication techniques of NPV
- à IPM on pigeon pea in INDIA
- à IPM of CARE Bangladesh
- à Experience of Indonesian IPM programme
- à The School Programme in Thailand

- à Local Heroes; Farmers and IPM in Cambodia
- à IPM FFS's in Kavre and Bhaktapur districts

Rice based exercises

The FFS participants desired to have some exposure on rice AESA as the timing of the TOF coincided with the main rice season. FFS in rice is a major activity yet in many of the districts during this period of time. Though, the fundamental principles and process of IPM both in rice and vegetable are same, however owing to some unique nature of rice ecosystem, some discussion on basic issues of rice IPM was felt to be useful. Accordingly, some sessions and practical field based exercises on IPM of rice were conducted. Participatory group discussion was carried out on the parameters for the agro- ecosystem analysis in rice and necessary trials & supporting studies were designed. The standard format for the presentation of rice AESA and the treatments to be included in the studies were developed. Identification of the pests and natural enemies in the rice field was done along with the establishment of some insect zoo and cup studies. Similarly set up of simulation trials of detillering and defoliation on rice was also designed and conducted.

Agro-Ecosystem Analysis (AESA)

Comparative field studies of tomato and cauliflower cultivation practices was established for practicing the AESA in the field. The participants organized in six subgroups consisting of 6 participants in each sub-group. Each group was assigned task to collect information on weekly basis about the plant height, leaf numbers, canopy area, girth, type and number of insects, disease infestation, weather conditions, plant health, general field conditions and consequences of current management treatments from the sampled plants. The information was processed by the participants and transfered in chart paper citing all the collected data on agro-ecosystem of trial field, and presented in the plenary for discussion. Rigorous question answer session happened to take place where there has been change/deviation observed in the plant health, pest damage, large numbers of population, appearance of new insects, its possible causes and effects, relations with the plant, role of temperature & sunlight on the plant health and ultimately their impact on yield. The discussion also focussed on the effect of various components of agronomic practices such as high dose of chemical fertilizer and pesticides, application of pesticide, use of compost and fertilizers in the soil and the differences observed in between IPM & Farmers practice plot and why?

Master facilitators played key role in moderating the discussion and facilitated in drawing conclusions as well as reaching towards a final consensus for better crop management decisions. Through this process the participant's academic knowledge on ecosystem and food chain, insect and crop biodiversity was refreshed and consolidated to put into action.

During the training period participants' know-how of collecting and analyzing the data critically, scrutinizing the complex interaction between the plant and other components of ecosystem, participants skills of observation, critical thinking, analysis technique and process of drawing conclusion on the basis of scientific facts were strengthened. Participants were also empowered in terms of ecological basis of crop management, importance of each and every variables of agro-ecosystem for growing healthy crop, conservation of natural enemies and biodiversity as well as transforming themselves into creative & innovative IPM facilitators.

AESA in Tomato and Cauliflower were conducted every Wednesday.

Number of AESA conducted during the whole training period is as following

- à Tomato - AESA No. 1,2,3 to 4,5,6,7 and 8
- à Cauliflower - AESA No. 1,2,3,4,5,6 , 7,and 9
- à Rice - AESA No. 1,2,3

2.2.3 Field based Trials and Studies

Fundamental concepts and philosophies of present day IPM is creative learning through understanding of changes in crop based on theory of learning by doing. And, to the best extent possible for this purpose pragmatic trials & studies on different aspects of crop management were conducted. Participants were encouraged to make findings through discovery based learning approaches and to this where ever and whenever felt necessary, technical assistance from the master facilitaors were ensured.

Trials and studies conducted in the TOF were mainly of 3 types: *comparative*, *problematic* and *supportive* in nature. The season long trials and studies were the main soul of the TOF. Participants identified problems, set hypothesis, established trials & studies, made regular observation, collected information, analyzed the data and made conclusions on the findings.

Altogether 12 trials were conducted that are as follows:

- à Shade vs. non shade trial against blight of tomato
- à Varietal trial of tomato
- à Varietal trial of cauliflower
- à Management of Helicoverpa and Spodoptera in tomato
- à Comparative trial on IPM vs. Farmers' practices of Tomato cultivation
- à Comparative trial on IPM vs. Farmers' practices of Cauliflower cultivation
- à Effect of overdose of micronutrients (Boron) in cauliflower
- à Effect of overdose of pesticide in tomato
- à Bacterial wilt management in tomato
- à Effect of different growth media in tomato production
- à Monitoring of cucumber fruit fly and Spodoptera litura
- à Late blight management trial

Some salient features and the findings made out of the trials /studies conducted during the TOF are elaborated below.

Comparative Study on IPM Vs. Farmers' Practices of Cauliflower

Cauliflower is a major vegetable crop of Nepal and is associated with frequent occurrence of insect pests. However its cultivation still goes along with the issues like:

- à Miss-use and haphazard use of pesticides for the pests control
- à Lack of knowledge on hybrid varieties of cauliflower and off-season production,
- à Inadequate availability of quality seed and other necessary inputs.

Thus the objective of this trial was to compare the IPM practice of cauliflower cultivation with that of existing farmers' practices.

Methods

The variety used for the comparative trial was NS – 60. The seedlings were transplanted at the spacing of 45 x 45cm in IPM practice plot, whereas planting spacing of 45cm x 30 cm was maintained in the farmers practice. The total area taken for the trial was 400 m^2.

The major components of the practices compared as follows:

- à IPM practice:
  - FYM was broadcasted and incorporated into the soil @ 2 Mt. per Ropani i.e. equivalent to 500 m^2,
  - Chemical fertilizer was applied @ 4: 8: 5 kg per 500 m^2, (based on the rate of 40: 30: 30 kg NPK per hectare).
  - First top dressing was done @ 3: 0: 0 kg NPK per 500 m^2 and second top dressing was done @ 3: 0: 0 kg NPK per 500 m^2
- à Farmers practice (FP):
  - FYM was applied @ 30 dokos (Bamboo baskets having capacities of 25 kg) per 500 m^2 i.e.750 kg. per 500 m^2.
  - Chemical fertilizers @ 2.5 gm each DAP and urea per hill. Altogether 5 gm chemical fertilizer was applied per hill as basal dose.
  - DAP was applied @ 5 gm per pit at 10 Days After Transplanting (DAT) as first top dress and - urea was applied @ 5 gm per pit at 25 DAT as the second top dress. The dose of fertilizers applied corresponded with the PRA report.
  - *Borax (Boron containing micronutrient) was applied @ 750 gm per ropani in both practices.*
  - Regular cultural operations such as weeding, earthing up and gap filling were carried out in both practices.

In the comparative trials parameters such as plant growth pattern and population dynamics of insects and their damage, severity of diseases, effect of fertilizer, irrigation and climatic factors as well as effect of pesticides in the plant health was compared.

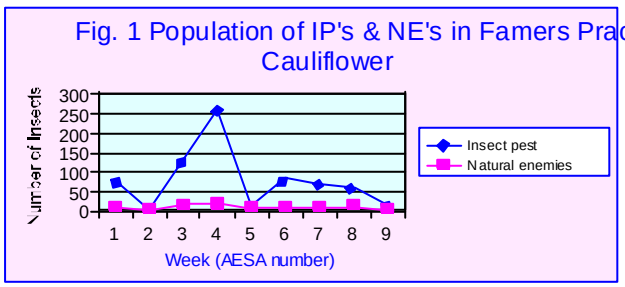
Problems encountered

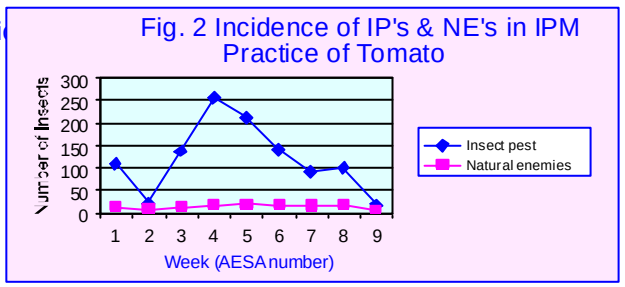
- à From the early stage of planting, the outbreak of flea beetle and red ant was alarming with the damage caused to leaves and roots in both plots. To control the flea beetle botanical pesticides *Melia azaderach* and *Hamal Jhol* were sprayed, and sticky traps were used at the plots.
- à In the FP plot pesticide Fen Fen (*fenvalerate*) was sprayed @ 2 ml per liter of water. As red ant was not controlled with twice use of botanical pesticides hence as a last resort Dursban (*Chloropyriphos*) was drenched @ 2 ml per liter of water.
- à In the early stage of crop, plants showed molybdenum and calcium deficiency symptom. The plants were severely affected and could not take usual and vigor growth. For a couple of days this problem brought lots of confusion and perplexities among the facilitators and participants. One of the experienced facilitator checked the pH of the soil, which were at the level of 4.1 in both plots. This led to guess that due to low soil pH (about 4) the availability of micronutrients in the soil might been disturbed. Therefore, "*Penshibao"*- multifunctional nutritive foliage fertilizer developed in China was sprayed @ 5 ml per 8 liters of water on 15th July on both plots. Similarly, spraying of calcium rich micronutrient was also sprayed @ 0.5 gm per liter of water on August 5th 2004. On the same day, lime @ 2.5 gm per liter of water drenched around the plant and hydro calcium nitrate was sprayed @ 5 gm per liter of water. Hydro calcium nitrate caused some burning effect on leaves but at the latter stage the plants had taken the normal growth rate.
- à By mid July crop was affected by wire stem (*Rizoctonia solani*). The favorable climate for the growth of this pathogen followed by heavy moisture logging in the field damaged the plant roots. This is a common problem in the rainy season crops as there occured excessive moisture in the field and the flea beetles and red ant's damage also favors for the disease development. Drainage of the excess water from the field did help in managing the wire stem to some extent. As a last weapon, a systemic fungicide namely Carbendazim @ 2 gm per liter of water was mixed with Atonic @ 2 ml per 5 liters and sprayed in both plots. Atonic, which is a hormone, also induced the secondary roots.

Findings

The Agro-Ecosystem Analysis (AESA) was carried out at weekly interval up to the 9th weeks. Randomly, 30 sample plants were taken for data collection and analysis.

3 replications were made. AESA data were taken on plant height, stem girth, canopy area, insect pests and number of natural enemies.





The average height of the plant in IPM practice was found 34.5 cm where as in Farmers' practice this height was 28.5. In case of insects pest's (IP's) and natural enemies (NE's) the population density were increased from third AESA to fifth AESA (Fig. 1 and 2).

Though the population of insect flea beetle was high but the damage and injury was below economic level. Plant height increased up to 6th week then remained irregular in IPM practice. Likewise leaf number was on increasing trend up to 7th week then declined slightly. In case of canopy area it increased up to 6th week, then remained stable. Regarding the stem girth, it was found increasing up to 7th week, and then remained the same.

Similarly, in the Farmer's practice, plant height increased up to sixth week then remained almost constant where as the leaf number was increased up to seventh week then it declined slightly. Canopy area was at increasing rate up to the 5th week and was on decreasing trend up to 7th week and then declined. Stem girth went on increasing slightly up to seventh week then remained almost constant. Relation between

curd diameter and curd weight was not found significant where as the relation between biomass and curd weight, was strong. The relation between the population dynamics of IP's and NE's was also observed.

During the last stage, the crop infestation by *Pieries brassicae* was largely reduced by the entomo-pathogenic fungi the *Beauveria bassiana*. Likewise predation behavior and also spider played important role in reducing the population of Diamond Black Moth. Similarly *Spdoptera litura* and Carbide beetles, Earwigs were found crucial NE's to reduce the soil pests but these predators were found at latter stage.

IPM and FP field both had a few similar treatments for control of red ants, wire stem disease and micronutrients treatments. In contrast more organic manure was applied in IPM field.

Conclusion

Participants were able to explain the role of various factors in the agro- ecosystem like soil, climate, moisture level, disease & insects, their effect on plant health and inputs that were used in different doses in both the practices. Like wise participants also acquired new skills, knowledge, and developed attitude about the principles of crop phenology and their requirements. Learning process was found effective on testing the hypothesis, observation skills, way of critical thinking, processing & analysis of collected information and decision-making. The crop was successful so it was good learning opportunity for the participants. The production, productivity and curd weight of cauliflower was observed higher in farmers practice. One of the reasons guessed towards this was the frequent use of pesticide in the farmers' plot than in IPM plot. However in the market the crop produce from the IPM plot fetched little more prices.

Comparative Study on IPM Vs. Farmers' Practices of Tomato

Average national production and productivity of tomato in Nepal is comparatively low. One of the reasons identified for low production is heavy incidence of insect pests, diseases and improper production practices. Therefore the demonstration and verification of the improved packages of the practices of tomato cultivation was felt essential.

Elements of cultivation practices in IPM plot were adopted according to the national recommendation and in the farmers' practice, it was choosen based on the findings of Participatory Rural Appraisal (PRA). As per the PRA report the farmers use pesticide directly in the field even at low level of the pest population appearing in their field.

Thus overuse and misuse of pesticides is usually found in farmer practice. In IPM practice only as a last stick safe pesticides are used.

Methods

The main field was prepared and then tomato seedlings were transplanted. The spacing of 75 X60 cm was maintained in the IPM practice, whereas in the farmers' practice it was maintained at 50 X 30 cm.

The area of 200 Sq m each was taken for both IPM and farmer practice. In IPM practice the farmyard manure (FYM) was used@ 2 mt./500 m^2, where as in farmer practice 750 kg/ 500m^2 was utilized. In case of chemical fertilizer 4:1.5:4 kg NPK/ 500 m^2 were taken for the IPM practice. Of these fertilizers 2:1.5:4 kg NPK/500 m^2 were used as basal application and remaining 2 kg/500 m^2 of nitrogen was splitted into two equal parts for top dressings. The first was applied at 25 days after transplanting and second one was applied after 50 days after transplanting.

In the farmer practice of cultivation, DAP @15 kg /ropani was applied as basal application. Three Top-dressings were done with Urea @ 5 gm/plant at the stages: 10-15 days after transplanting, flower initiation stage and after first fruit harvesting. Weeding, stacking and gap filling were done as and where necessary.

10 sample plants were chosen for observation in each replication of both IPM and farmer practices plot. The farmer and IPM practices plot were equally divided into 3-sub unit. The sample plants were chosen through random sampling method. In both the practices agro-ecosystem analysis was done at weekly interval. During AESA observations/measurements were taken on plant height (cm), no of branches, stem girth (cm), no of floral bunch, no of fruit bunch, total no of fruits, total no of insect pests, total no of natural enemies, and disease scoring. After agro-ecosystem analysis the recommendation were made for the crop management.

Problems encountered

The heavy outbreak of insect pests and diseases took place in experimental plots. The presence of diseases was most critical one.

In IPM practice the bacterial wilt and fungal blight were observed serious, but the plants in the farmer practice were also suffered from the same.

Efforts were made to manage the wilting of plants through various treatments such as drenching of 2 rows of tomato plants with Blitox 50 @ 2gm/lit. of water and carbendazim @1.5 gm/lit.of water. Next 2 rows were drenched by prevental BV@ 1gm/2 lit water. In another two rows cow urine and water at the ratio of 1:1was used. The remaining 2 rows were kept without any treatment. None of the treatments showed positive results in manging the wilt.

The other problem faced in tomato cultivation was late blight. In IPM plot picking of blight infected leaf was practiced up to four times, where as in the farmer practice plot fungicide Krylaxyl @ 1.5 gm/lit water with sticker was sprayed up to 8 times during the entire crop duration. Picking of blight infected leaf was also practiced two times in farmer practice plot.

Spodoptera, white fly, monolepta and field cricket were observed in the tomato cultivation of the both practices. The natural enemies were mirid bug, carabid beetles and dragon fly. There was not any significant loss by the insect pests. In farmer practice plot single spray of cypermethrin mixed with fungicide carried out.

Findings

In Farmers practice the total yield, average yield and average fruit weight of sample plants was 19.395 kg, 0.929 kg and 0.033 kg respectively, where as in IPM practice the total yield was recorded 10.655 kg. The average yield/plant and average fruit weight was 0.798 kg and 0.026 kg respectively.

In the IPM plot, insect pest population was increased up to 5th weeks and the highest numbers of insects pests were observed at the 9th week. The natural enemies' population was highest in numbers at 5th week and thereafter it decreased (Fig. 3). In farmer practice plot up to the 4th week both insect pests and natural enemies were found in the increasing trend (Fig.4). The application of the pesticide lowered the population of both types of insects. At the 4th week the natural enemies numbered highest and at that period the occurrence of Carabid beetle was highest. At the 8th-week period the numbers of IPs and NEs were at par. Application of cypermethrin fungicide caused decreased in populations.

Fig. 3 Population of insect pests in tomato compara

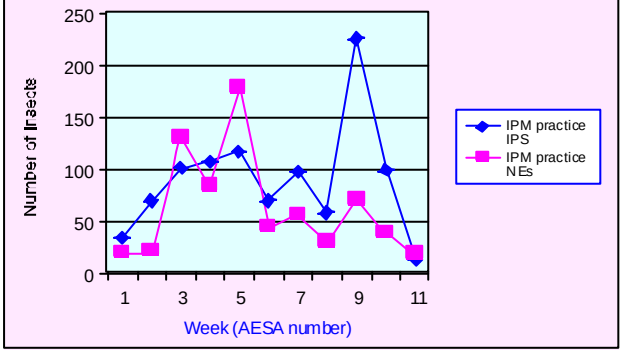
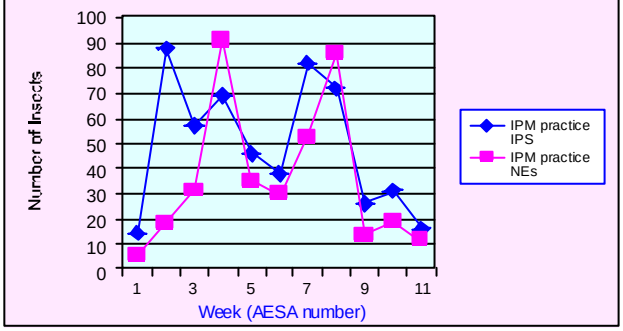


Fig. 4 Population dynamics of IP's and NE's in Farmers practice of Tomato



The growth rate of tomato plant in both practices was alike. After 8 weeks the growth rate in farmer practice was still in increasing trend but in IPM practice the growth rate was constant. Thus the plant height in farmer practice was recorded higher than that of IPM practice. In regards to numbers of branches, it was found maximum (14) in the IPM practice, whereas in the farmer practice it was bit lower (12).

Conclusion

The production, productivity and average fruit weight of tomato in farmers' practices was recorded higher than in IPM practice. It was mainly because of the severe attack of the bacterial wilt in IPM practice. The previous crop in the IPM plot was also tomato and was heavily infected with wilt. In the off-season tomato, the attack of late blight is unavoidable and so it appears that there is need of judicious use of fungicide spray.

There was not any significant correlation observed in plant height, branch and leaves number as well as in fruiting and flowering. But the effect of temperature, relative humidity, weeding, fertilizers' dose, crop geometry, soil condition on crop performance was clearly understood by the participants. Learning techniques

and process of AESA was clearly demonstrated. An immediate and long-term effect of crop management practices, varieties of insect pests, their predators, parasitoids including their functions & behaviors on plant health, knowledge and skills to use bio-pesticide and botanical pesticides were also learnt. Participants were empowered through the exposures on different aspects of ecological crop management as well as on discovery based learning procedures.

Use of disease management techniques other than pesticides like picking of infected leaves was very effective to manage the blight disease and found interesting to the participants. For off- season crop this need to be adopted. The role of proper variety in this regard was felt very crucial.

Varietal Trial of Cauliflower

Silver cup – 60 is most common cauliflower variety in Kavre district and is grown both in off as well as in rainy season. But the farmers were not found satisfied with the production potential of this variety. Taking in account of this, varietal trial was conducted in order to locate appropriate variety meeting the demand of the farmer.

The specific objectives of this trial were:

- à To study the performance of various potential variety available in the market.
- à To select the high yielder variety preferred by the farmers.
- à To know the IPs & NE's varietal preferences.

Methods

Five different cauliflower varieties tested. Silver cup- 60 was kept as a control. Other varieties were Silver cup – 65 (Treatment1), White flash (Treatment 2), NS – 60 (Treatment 3), Ramie (Treatment 4) and Silver cup – 60 (Treatment 5). All these varieties were hybrid recommended for off. and rainy season production.

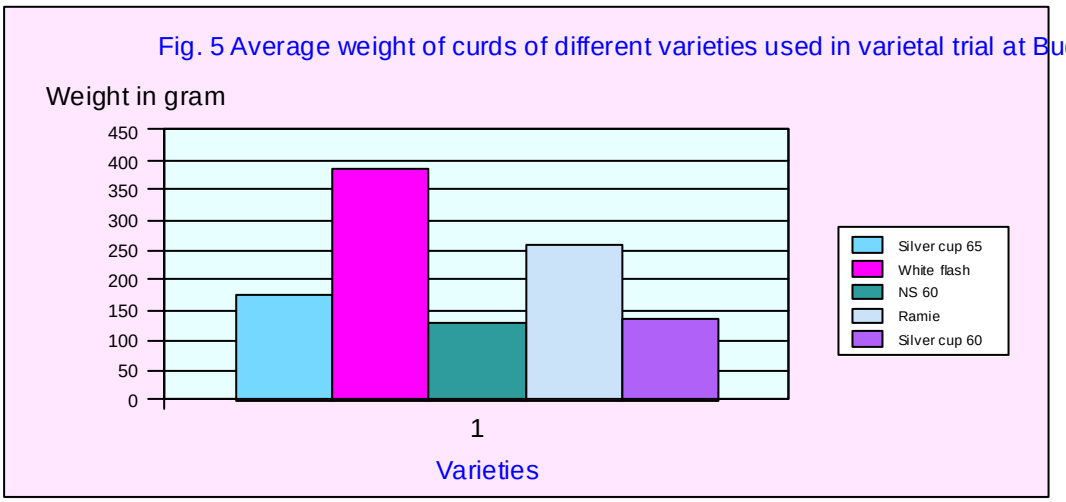
Problems encountered

- à Transplanting was delayed due to the excessive rainfall occurred during land preparation and because of this the age of seedling had crossed its appropriate age (22 days). In the trial seedlings having age of 28 days were transplanted
- à Drainage system as well as the fertilizer mixing was not properly followed in the field.
- à Heavy attack of red ant, white grub and wire stem diseases were limiting factors.
- à Varietal mix-up observed in the nursey.

Findings

Among the varieties compared Ramie had shown highest plant height (54.2 cm.) followed by White flash (52.5cm). This variety also produced the highest numbers of leaves (23), followed by White flash (22.7), Silver cup 65 (22) and so in NS-60. Ramie variety gave largest girth size than other tested variety. Silver cup – 60 was the smallest one. In general there is relation between girth size of the plant, weight and size of curd, but in this study no significant result was noticed in this regard.

Fig. 5 Average weight of curds of different varieties used in varietal trial at Budol



In cauliflower, among the IPs Flea beetles, Aphid, Spododptera, Monolepta, DBM, Hellula and Red ant were observed, whereas Spider, Lady bird beetle, Black ants, Ground beetle, Dragon fly etc were recorded as NEs. IPS and NEs populations increased and decreased simultaneously.

The data from TOF field at Budoole showed the highest curd yield (400 gm) in White flash variety which ranked first and also produced highest yield per plant (358 gm) compared to other varieties (Fig. 5). Coefficient of variation (CV) is 32.1%. (not governed only by the varietals factor). The variety White flash is long duration variety. The color of curd was light pink and the curds were more compact. Despite the higher yield and good compactness of the curd, faded curd colour & somewhat clustered (sticky rice like) character, it could not fetch price to the level of Silver cup – 60, Silver cup, 65 & NS – 60.

Varietal Trial of Tomato

The farmers of Kavre and Bhaktapur districts grow mostly CL-cross, NCL-1 and Lapsi Gede (Local) varieties of tomato. These varieties have been in use for several years, and the yield of these varieties is in decreasing trend. They are also susceptible to various diseases such as late blight (Phyptopthora infestans) and Bacterial wilt. Though, a number of good varieties are available in the market for both green salad and pickle purpose. However, Farmers of both the districts were not familiar with the yield potential and other characters of new varieties. So the new varieties were tested in local condition to examine their performance.

The objective of this trial was to identify new appropriate high yielding varieties that are late blight and bacterial wilt tolerant in local condition.

Methods

The trial was established using RCBD design. Number of plants per plot kept was 12 . A total of 8 varieties were compared i.e. Bishes, Bhim, CL-Cross, NS-81, Manisha, NCL-1, N-162 and Suraksha. The observations were made on the parameters such as plant height, number of branch, date of first flowering, number of floral bunch, number of fruit bunch, date of first fruiting, fruit number, number of IP's, number of NEs, other insects and disease severity etc.

The varieties were grown using compost @ 2 mt./Ropani that was incorporated in to the soil during field preparation. Chemical fertilizer was used @ 80:30:80 Kg. NPK / ha., out of this half of nitrogen, full dose of Phosphorous and Potassium (40:30:80 Kg. of N PK / ha) was applied as basal dose. The remaining amount of nitrogen was applied during top dressing in two split doses. The first top dress was carried out at 25 days after transplanting wheras the second was done at 50 days of transplanting. Five manual weeding was done in the field plots. Mancozeb + Metalaxyl @ 2 gm / lit. of water was sprayed three times against late blight. Simple statistical analysis was also done for other attributes.

Findings

The yield data analysis revealed no significant difference in yield among the varieties compared. However, direct observation showed that variety N-162 out performed other varieties and gave the highest yield (25.42Mt/ha) followed by Suraksha (22 Mt/ha).

Effect of shed and non-shed conditions on Tomato blight

Late blight is a serious disease in tomato, which may cause total loss of the crop within a short period of time. When humidity decreases below 80% then only the spores die quickly. Infection mostly occurs when a layer of water is present on the leaf. A long wet period of the rainy season is conducive for heavy late blight infection. For the management of this disease, Tumwine, (1999) has reported that sanitation combined with other management practices is best. He has further suggested that the polyethelene shelters also reduce leaf wetness period and act as barriers for spores, thus reducing or delaying late blight infection. The combination of polyethelene tunnels and sanitation proved effective in controlling tomato late blight in Uganda.

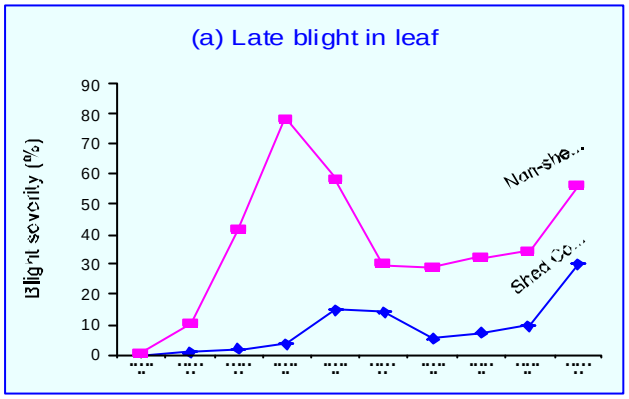
The trial was conducted with the objectives to compare the severity of tomato blight in shed and non-shed condition and to find out whether the shed condition is economically viable or not.

Methods

Two simple comparative plots i.e. shed condition and non-shed condition were established. Plots were of the area of 3 m X 2.4 m. Number of plants per plot was kept at 20. Variety used for the study was C.L. Cross.

Findings

The late blight severity varied with rainfall and the blight development was found directly proportional to rainfall. Among different parts of the tomato plant most sensitive part was leaf, followed by stem and fruit but very low on apex (Fig.6 & 7).



Date of Scoring

Fig. 6 Severity of blight on leaf under shed and Non-shed condition

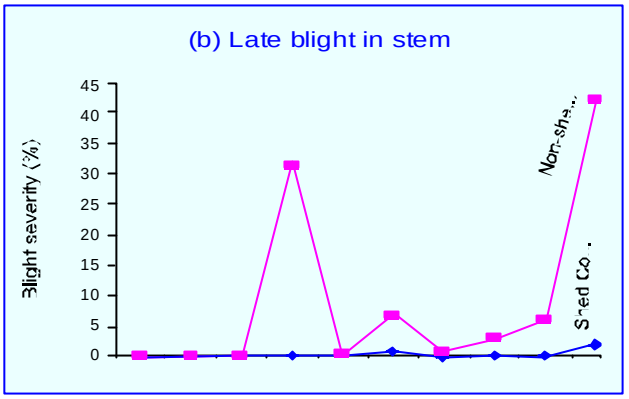


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Fig. 7 Severity of blight on stem under shed and Non-shed condition

In open condition, the blight severity was observed to be 78% in leaf , 41% in stem (Fig. 6), 31% in apex and 27% in fruit while it was 15% in leaf, 2% in stem, and 1% in fruit and nil in apexes under the plastic shed condition.

In relation to the plant height, it was recorded 108 cm in shed condition, but the same was 92 cm only outside the shed (Fig.8). Significant difference was observed in blight occurrence. However minimum difference was observed in total yield, as there was also infestation of powdery mildew in the plants inside the shed.

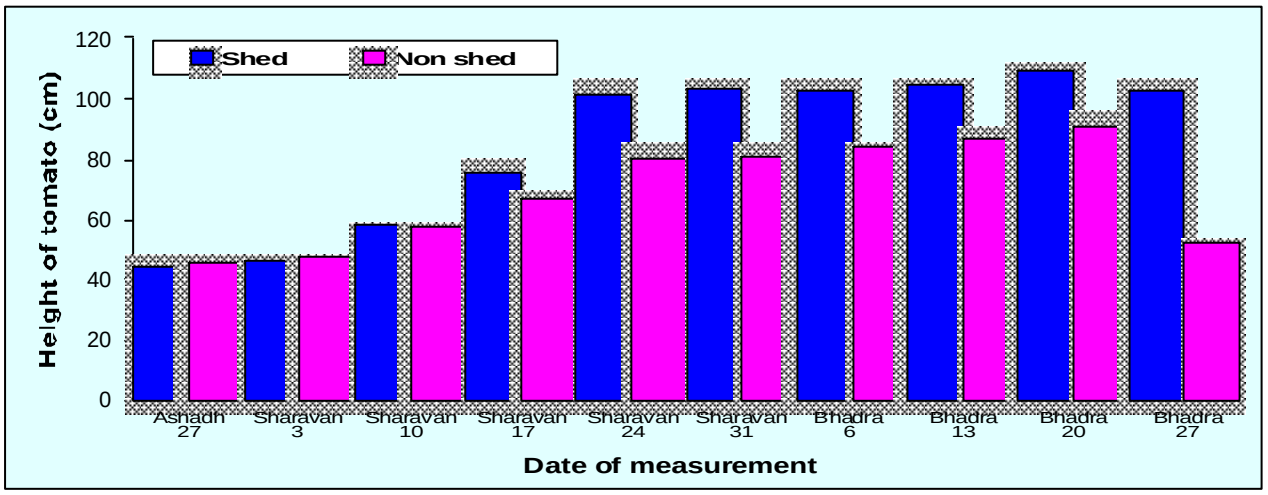


Fig.8. Effect of shed and non shed condition on the plant height of tomato

Bacterial Wilt Management in Tomato

Bacterial wilt disease is characterized by sudden plant wilting without leaf yellowing. Stem centers and roots become water soaked and turn brown. The stem centers may become hollow. Roots are formed on the stem. With the progress of browning and root decomposition, the amount of wilting and dying of the leaves increases until the plant is killed.

Participants of the training had set a wilt management trial in an infested plot with wilt disease at Panchkhal Horticulture Farm in Kavre district.

Methods

Design was RCBD and 6 treatments were tested (T1=Tetra cycline hydrochloride spraying at 7 days interval @ 1 gm/10 liter of water, T2= Agri-lime + urea @ 150 kg + 25 kg /ropani, T3= Prevental bv @ 1.5 gm/ liter of water spraying 7 days interval, T4= Pseudomonas florescens @ 2 gm/liter spraying 7 days interval,T5= Bleaching powder @ 1 kg per ropani – 15 days before transplanting and T6= Control). Tomato variety used was N-9568, plant spacing was 60 cm X 60 cm and number of plants per plot was 10. Weekly observation was taken on crop stage, weather condition, total number of plants, number of wilted plants, plant height, canopy disease, No. of IP's and NE's.

Findings & Recommendation

Almost 82% plants were wilted within 11 days of transplanting. Severity of plant damage from wilt infestation was high.

It was recommended to follow the following:

- à Cultural management and varietal selection to be encouraged.
- à Apply soil treatment preferably solarization
- à Crop rotation, with non solanceous crop.
- à Grow seedlings in polybags to avoid sort injury
- à Prior to the plantation of off-season vegetables, the history of the plot needs to be clearly understood

Effect of different Growth Media on Tomato Production

In the urban area, where space availabilities is limited, cultivation of tomato in the earthen pot are very useful.

A trial to observe the effectiveness of various growth media on tomato yield and on disease & insects' occurrence was established. Five different types of growth media like a. ordinary compost (FYM), b. FYM treated with EM., c. Bokasi, d. Vermi compost & plain, e. soil (as control) were used. The trial was replicated five times with 2:2 ratio of soil & media i.e. 8 kg per pot. The CL – cross variety of tomato was used.

Methods

CRD was adopted for testing of following treatments:

T1 = Ordinary FYM + soil @ 1:2 i e. 8 kg soil+4 kg FYM/pot	
T2 = Bokasi + Soil	,, ,, ,,
T3= EM treated FYM + Soil	,, ,,
T4 = Vermi complost	,, ,, ,,
T5 = Soil only (control)	12 kg soil only.

Plant height, number of branch, number of floral bunch, number of fruit bunch, and number of fruits per plant, average weight of fruit along with over all plant health was recorded.

Findings

The results showed highest average plant height in treatment T1 (88) cm. The lowest height of the plant recorded in T3 i.e. in (EM treated compost.). T4 showed the highest branching numbers at initial growth stage & also more number of branching (up to 13 on an average), where as the lowest nos of branching was in T5 (soil). Highest number of fruits per plant was in treatment T2, though Coefficient of Variation (CV) was very high (64.28%).

The average number of fruits per plant was 107 & total no. of fruits on whole plants was 264 in the treatment that contained Bokasi, where as in the control plot (soil) least number of fruiting (87 fruits in total) was recorded. The average fruit weight in T1 (containing the media soil) was 30 gram, where as the same was 21 gm in E.M. treated compost. The highest production per plant was on Vermi – compost (568 gm/plant).

Some fruits were slightly damaged by spodoptera spp. In Bokasi, late blight incidence in the early & mid growth stages of plants were observed. At the latter stage of the crop development, plants in EM & vermi were found susceptible to wilt than the plants in other media.

Tomato Blight Management Study

Late blight (*Phytopthora infestance*) is most serious disease of tomato. It is transmitted through infected fruit or crop stubbles, infected soil or in combination of all. Its severity is aggravated more during rainy season.

The specific objective of this trial was to find out the effective alternatives to chemical fungicides for the management of blight.

Methods

The design of the study was RCBD with 4 treatments having 5 replications. Plots size was 3m x 2.4m = 7.2 Sq. m and net area used for the study was 20 plots x 7.2 sq.m. = 144 Sq. m. The treatments were: Trichoderma @ 10gm/lit. of water dipping of seedling as T_1 and Mulching by straw after Transplanting as T_2, and in T_3 use of 25% Fresh Cattle Urine foliar spray at Seven-day interval was made. T_4 was Control. Tomato variety used in the study was NS-815. Foliar spray of Trichoderma and cattle urine was done 4 times in the respective plots. Manual weeding was carried out twice.

Findings

- à Trichoderma: Average leaf blight score was found 3.7, and in the stem it was 3.3.
- à Mulching by wheat straw: On an average leaf blight score was 4.3 whereas stem blight scored at the level of 4.1.
- à Fresh cattle urine (25%): Leaf blight score was 4.4 and stem blight score was 4.2.
- à Control: the tomato plants heavily infested by blight.

All the four treatments were found not effective against late blight disease of Tomato.

Study on the Mangement of *Helicoverpa armigera* and *Spodoptera litura* on Tomato

The *Spodoptera litura* and *Helicoverpa armigera* are serious insects of tomato. In PRA report, it was prioritized as problematic insects in tomato. It has also been reported that there are haphazard use of pesticides against insects and diseases. Farmers neither follow the appropriate dose nor do they maintain the intervals in using pesticides. The compatibility aspects of pesticides were totally ignored. In practice, farmers mix fungicides & insecticides all together along with growth stimulants and make cocktail for spraying the crop. Despite all this efforts, it is widely believed that more than 50% yield of tomato is decreasing due to confined effect of disease and insect in this district.

A field trial was carried out in TOF field at Boodle to study the prevalence of insect, its nature of damage & loses and to find out appropriate control measures.

Methods

The experiment was carried out in three replication having five treatments in each replication. Field was manured with chemical fertilizer @ 4:1.4:4 NPK kg/Ropani and FYM @ 2 t/Ropani. The variety used was CL Cross.

The treatments were as below:

T1: Multineem@ 2ml/lit. of water as foliar spray at 10 days interval.
T2: Use of botanical pesticide (Tobacco leaves 200gm & soap 30 gm boiled in 4 lits. of water. After cooling, it was mixed with granded solution of 200gm of garlic, 300gm of onion and 100gm of dried chilly. The solution was then filtered, diluted with water and sprayed (at 1:4 ratio) as foliar spray on the plants.
T3: Use of Nuclear Polyhydrosis virus (Spodo-lure) @ 0.4 ml/lit. of water as foliar spray at 10 days interval
T4: Fen-fen (Fenvalerate 10 E.C.) @ 2ml/lit. of water as foliar spray at 10 days interval.
T5: Farmer's practice (control)

On weekly basis, the date of fruiting, number of fruiting per plant, number of insect per plant, date of prevalence, number of fruit damaged by insects & by other factors and yield were recorded.

Findings

No *Heliocoverpa* sp. was observed in the field. A few numbers of Spotoptera sp. were seen, though the damage was negligible. Larvae of *Spodoptera litura* were seen in densly foliated plants than in less foliated plants. No other insects' damage was observed. Few plants (around 5% plants) were infected by viral disease. No wilt disease was observed. Damage of *Spodoptera litura* was seen more in cauliflower field than tomato field. The less prevalence of *Spodoptera* in the tomato plot was probably due to cauliflower plantation done at both side of the trial field.

In rainy season tomato production, late blight disease was minimized by spraying systemic fungicide (Metalxyl 8% + Mencozeb 64%) @ 1.5 gm/lit. of water at weekly interval up to 3-4 times followed by leaf picking. Around 10% yield loss was recorded due to late blight disease.

Similarly, Collar rot fungal disease was controlled by using copper oxychloride @ 4 gm/lit. of water by drenching around the root zone after earthing up. Around 4% yields were damaged by *Spodoptera litura*. Yield loss was 0.54, 1.36 & 3.84 percent in NPV, botanical pesticide and farmer's practice (control) respectively.

In rainy season tomato, there is chances of heavy infestation of late blight disease so application of fungicide and picking up of infected leaves should be judiciously used for the maintenance of plant health in the field even in the case, when insect pest management trial are conducted.

Simulation Study of Defoliators' damage on Cauliflower

Cauliflower harbors various insect pests feeding on various parts from seedling to harvest stage. Flea beetle, Cabbage butterfly, Tobacco caterpillar, Mustard saw fly and Red ant were reported damaging leaves, root and curd at different growth stages. However, these insect pests when occurred at certain population density and at certain crop stage, the pesticide application may not be required to control them. Majority of the cauliflower growers in Nepal frequently use various insecticides even when the pest is below injury level thereby causing environmental pollution of the eco-system. Therefore, to create awareness among the farmers on the above aspects, one of the relevant trials was conducted to eliminate the myth of pesticides.

The specific objective of the trial was:

- à To familiarize with the simulation of defoliators' damage by adopting artificial technique of defoliation.
- à To assess the per unit yield loss due to defoliators, and appraise the compensation ability of cauliflower against defoliators' damage.
- à To recommend the farmers to apply insecticides judiciously if at all needed.

Methods

The experimental trial was conducted on the TOF field. Randomized Complete Block Design was used for the experimental design of the experiment.

25 days old seedlings of Silver cup-65 variety were transplanted. One seedling was taken as one experimental unit and replicated 8 times for each treatment. Defoliation was done to the level of 10%, 20%, 30%and 40% at 14 and 21 DAT.

Findings

The results have clearly shown that cauliflower posses the compensation ability in terms of biomass and curd yield up to the level of 40 % damage till 21 DAT. Thus there is no need of spraying of insecticides on cauliflower to control insect up to 40 % foliage loss. Spraying with insecticides for this will not only be un- economical to the farmers but simultaneously will also destroy the natural enemies.

Monitoring of Fruit fly on Cucumber

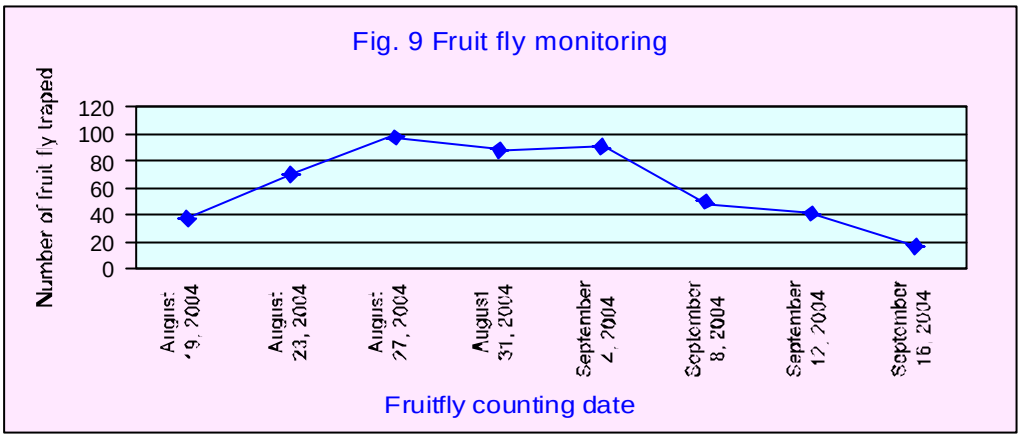
Fruit fly is serious pests of cucumber and therefore the objective of this trial was to identify the population of this insect during fruiting stage.

Methods

Pheromone traps were used with 2 drops of cu-lure and 5 drops of Malathion on cotton placed inside the plastic bottle. Fruit fly counting was done at 4 days interval.

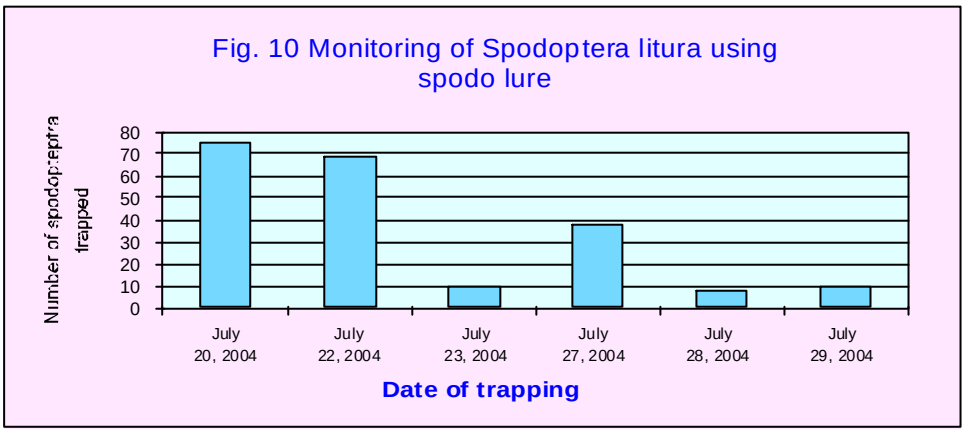
Findings

The population of fruit fly was highest in numbers during the last week of August and first week of September, when fruiting of cucumber was in peak (Fig. 9). It was also found that the populations of fruit fly differ with the location of trap setting. The highest number of fruit fly was found at the center of the cluster of cucumber plants.



Monitoring of *Spodoptera litura* using spodo lure

Similar to the above trial, monitoring of Spodoptera litura was also done in the varietal trial plot of Tomato conducted at TOF field. The trap was setup on July 17, 2004. For the trapping purpose spodo lure was used inside the trap.



Findings:

- à Spodo lure worked effectively even up to 44 days of setting,
- à Number of spodo count was in decreasing trends after mid July.

The population dynamics of *spodoptera litura* monitored is reflected in fig. 10

Effect of various doses of Boron on Cauliflower

Both Boron and Molybdenum are very essential micronutrients for cauliflower production. However, it was found deficient in most cases. If Boron is not supplied externally into soil used for growing of cauliflower, the symptom of browning with violet tinge occurs that reduces the quality and market value of the curd. In one hand, many farmers were not aware of this phenomenon, where as in the commercial cauliflower production pocket area, the farmers were found using high doses. Generally, there is no need of applying boron-containing fertilizers in the soil, that is rich in boron. Over dose of Boron may cause negative effect on the growth of cauliflower.

Hence, it was essential to conduct a study on the effect of different dose of boron application in cauliflower in order to recommend the right dose of its application.

Methods

Treatments were designed using various doses of Boron that were: a.T1=2 gm/lit of water (control), b.T2=4 gm/lit of water, c.T3= 6 gm/ lit of water, d.T4=8gm/ lit of water. For each treatment one row of cauliflower was selected. Application of Boron having a.i. of 19% was carried out twice through foliar spray. The first was applied at 12 DAT, whereas the second application was done at 31 DAT.

Findings

Average curd weight and biomass weight of cvauliflower in T1 was higher than others. After the 2nd application of Boron, plants in T2 and T3 showed retarded growth for 20 – 25 days, but at the latter stage the growth was compensated. Among the treatments, the dose of Boron (19%) @ 2 gm/lit. of water was found most effective.

Study on over application of Pesticides on Tomato

In the commercial vegetable growing areas, farmers generally apply different kinds of pesticides on Tomato. The number of spray and its frequency is also high. The PRA report of Kavre and Bhaktapur district showed that farmers used more pesticides from 30 DAT at weekly interval and the frequency of spray goes up to 16 times depending upon the variety of tomato. It was also found that tomato growers sell their product in the market immediately after the pesticide application without waiting for the recommended interval for harvesting after the application. This has been caused mainly because of the lack of awareness on the prevalence of pesticide residue in the crop products and their effect on human & animal health and environment.

The main objective of this trial was to study the prevalence of pesticide residue in tomato and based on create awareness on waiting period after the pesticide use.

Methods

Following treatments were included for the study:

- à On July 7, 2004 Krilaxyl @ 2 gm/lit of water and Cypermethrin @ 2 ml/lit of water was applied
- à On July 14, 2004 Krilaxyl @ 2 gm/lit of water was sprayed
- à On July 17, 2004 Alphamethrin @ 2 gm/lit of water was sprayed
- à On July 21, 2004 Krilaxyl @ 2 gm/lit of water and again on July 27th Cypermethrin @ 2 ml/lit. of water were applied

1 kg of ripen tomato fruit was harvested and was sent to Food Laboratory for pesticide residue test.

The results of pesticide residue could not be made available till the time of preparing this report.

Cup and Zoo Studies

Cup and zoo studies helped the participants to know the behavior of insects, their feeding nature, population dynamics, and their relationship with plants and their natural enemies in the experimental location. This discovery based learning approach followed throughout the training period which added curiosity to the participants and influenced them to further study and carry out experiments in the form of insect zoo and cup studies. Different parasites, predators and insect pests at their various stages of life cycle were identified and collected by the participants at and around Budoole ecosystem. They also recorded many important parasitoids from the collection that are outlined in the bellow table.

Table 1 The results of cup and zoo studies conducted by the participants of TOF.

No.	Observation	Results
1	10 Flea beetle were introduced with 1 spider	After 24 hours of setting, there was no flea beetle in the cup. Spider was found active. The observation revealed that spider predated all 10 flea beetle.

2	Identification of unknown Egg mass	Larvae (uncountable) of spodoptera.
3	Feeding behavior of Spodo	Spodo eating cauliflower leaves and new growing tip.
4	Life cycle of unknown insect	Adult of cabbage butterfly (Pieris rape) found.
5	Identification of unknown insect	Adult of DBM
6	Identification of unknown larvae	Pupa of DBM found.
7	Identification of unknown insect	Adult of cluster caterpillar found.
8	Identification of unknown pupa	Adult of hover fly found
9	Identification of unknown egg cluster	Spider found
10	Identification of unknown grub	Adult of earwig found
11	Identification of unknown parasite on caterpillar of Tussock moth.	Unknown wasp found
12	Feeding behavior of praying mantid-10, grasshoppers released with a mantid	All grasshoppers eaten up within two days
13	Feeding habit of Katydids- Larvae of soybean hairy and tobacco caterpillar released	Immediately fed upon 4 larvae of tobacco caterpillar and 2 larvae of soybean hairy caterpillar
14	Feeding habit of Spider- 5 grasshoppers released with a large spider	Spider fed on the grass hopper
15	Diseased larva collected from the field	White mold developed, Beuveria
16	Dead larvae with white mold dried and the applied in the egg mass of spodoptera	The emerged larvae were killed at 2-3 rd instars dust and white mold developed
17	Unknown puparia collected from the field with carcass of spodo larva	Brachonid wasp- Cotesia spp. emerged
18	Larva of brinjal fruit borer collected and reared	Pupa and then adult identified as Lucinda's orbonalis
19	Semilooper larvae collected and reared	Adult identified as Thysanoplusia orychalcea
20	Unknown puparium collected	Adult identified as Telenomus sp. Diadromus collaris emerged from DBM pupae after

2.2.4 Facilitation of Farmers' Field School by TOF Participants

Farmers' Field School - a learning field, where 25-30 enthusiastic farmers gathered for 12-15 weeks during the entire growing period of off -season cauliflower and Tomato and carried out entire aspects of cultivation practices starting from land preparation to harvesting. These FFSs served as the practical field and tool for the participants of the TOF to disseminate range of activities through IPM approach. The participants assigned as facilitators of the FFS were able to utilize the experiential and discovery based learning achieved during their training period.

Agro- Ecosystem Analysis (AESA) considered as the heart of FFS in which the farmers together with the facilitators conducted observation and analysis of the overall plant health, growth and development aspects of plants, population density of insect pest and natural enemies and type & degree of disease infestation on the crops. In the AESA, they also observed various components of agronomic practices such as weather condition, water and nutrient management, weed density and established their influence on the general health of the crop. Through these observations, the farmers along with the facilitators could make their own interpretation of the field condition and it was felt that they were able to develop self-confidence and a vision of balanced ecological processes.

In addition to this, they got the opportunity for a joint group discussion and critical thinking. They also shared their own experiences and feelings. The facilitators created learning environment by introducing the elements of non-formal education, group dynamics exercises and participatory discussions. There was free and open communications, confrontation, respect, and acceptance of the decision of the mass.

The participants tested and verified the knowledge and experiences gained in the TOF in the farmers' field condition through implementation of 6 Farmers' Field School (FFS) in Kavre and Bhaktapur districts.

Table 2 FFSs facilitated by the TOF participants in Kavre and Bhaktapur districts

S.N.	Name of FFS	No. of Participants		
		Male	Female	Total
1	Milan Chautari IPM FFS, Patlekhet, Kavre	1	29	30
2	Chamunda IPM FFS, Nala, Kavre	14	11	25
3	Netra Prakash IPM FFS, Kharibot, Kavre	7	24	31
4	Chhata Pukhu IPM FFS, Shipadol, Bhaktapur	12	13	25
5	Uddyamshil Namuna IPM FFS, Nalachhap, Bhaktapur	14	11	25
6	Taikabu IPM FFS, Tathali, Bhaktapur	11	19	30
	Total	59	107	166
	Participation as per the sex	(39%)	(61%)	100%

The brief description, findings and achievements of each FFS's are as follows:

Milan Chautari IPM FFS, Patlekhet –2 , Sitabasti, Kavreplanchok District

The FFS site was located along the B.P. highway about 11 km from Dhulikhel.

Farming system

Farmers produce maize, rice, wheat, onion, cucumber, soybean, tomato, cauliflower, cowpea and finger millet etc. As off-season crop, farmer produces tomato, cauliflower and cucumber. They also raise buffalo, cow & goat. Off-season cauliflower cultivation was new in this area.

FFS Regular Activities

PRA and two preparatory meetings were conducted prior to the start up of the FFS. In the subsequent period after the start up of the FFS, activities such as naming of FFS, introduction of FFS participants, introduction of IPM and FFS concepts, selection of FFS participants, formation of sub groups, and their naming, FFS leader selection, study & trial plot selection, selection of venue for class activities, selection of FFS day & time for FFS were carried out. Similarly, cropping calendar and gender role analysis matrix also prepared and made ready to be put into action. FFS was regularly conducted on every Friday from 7 am to 12:30 pm.

As Cauliflower was identified as a highly profitable off-season crop in this area, it was selected for comparative study as well as for other trials.

Following procedure were adopted during each FFS session:

Gathering and attendance: signature or role calling.
Recapitulation: by sub group.
Climate setting: story-telling, jokes, songs and dances by sub groups.
Special topic: Selected through participatory group discussion.
AESA: (a) Observation, processing & presentation by each sub-group of FFS.
(b) Field activities done based on AESA recommendation in both IPM & Farmer practices plots.
Tea–Break
Group dynamics: Informative team building exercises and games.
Next day planning: Group Discussion & preparation.
The participants presented summary of the activities.
Vote of thanks & departure.

Trials and Studies conducted in the FFS

A. Comparative Study on IPM Vs Farmer's Practices of Cauliflower

IPM practice helped the farmers to improve their decision-making on a wide range of agronomic issues not limiting to pest control only. It also helped the farmers to change the outdated and incorrect ideas and practices related to management & use of pesticides.

This study was designed to introduce AESA in cauliflower ecosystem and to develop expertise among the farmers for observing and analyzing the factors influencing the crop performance in their own field.

During the participatory meetings following major problems on existing crop management practices were reported by the farmers:

- à Poor knowledge on pesticide use and methods of application.
- à Unbalanced use of fertilizers. Ignorance about different type of fertilizers and its importance in agriculture
- à Improper planting spacing.
- à Lack of know-how on improved cauliflower varieties.
- à Lack of knowledge about method and timing of fertilizer application.
- à Lack of irrigation and unavailability of quality seeds.
- à Lack of marketing.
- à Lack of adequate linkages with DADO officials.

Methods: Seedlings of *Silver* cup – 60 variety of cauliflower was planted in the plots. The area of 90 m^2 each was allotted for farmer and IPM practice. Components of farmers' practice were decided during participatory meeting through cropping calendar exercise, while IPM practices were selected as per the national recommendation on improved practices. AESA was started from 5^{th} day of FFS. Total no. of AESA conducted was 5. Farmers collected information from the field, processed & analyzed the data.Then it was presented in the plenary for discussion and comments and after group's recommendation the decisons were put into action.

Findings: The gross income in IPM practice was found higher than in the farmer practice. The average and per plant weight was slightly more in IPM practice. In the farmer practice, because of the higher spacing of plants, the yield was reduced. Molybdenum deficiency was seen on the plants grown under farmer's practice.

Recommendation: Following general recommendations were made from the above trial for better production:

- à Transplant 18-21 days old seedling.
- à Use recommended dose of fertilizers.
- à Use Trishakti micronutrient containing Fe, B, Mo, Mu, Zn.
- à Maintain planting spacing at 45x 45 cm.
- à Use pesticide judiciously.

B. Simulation study of Defoliators' damage on Cauliflower

The objective of this study was to create awareness among the farmers on the compensation ability of cauliflower against defoliator's damage at early stage of 14 & 21 DAT and based on encourage them to decrease the frequency of pesticide use and thereby control pesticide pollution in the environment.

Methods: Four treatments consisting of 10%, 20% and 40% artificial defoliations done after 14 days after transplanting.

Findings: No significant difference in yield between the treatments was observed. From general observation and farmer perception, cauliflower plant had shown compensation ability up to 40% defoliators' damage.

Recommendation: In the early stage of cauliflower, there is compensation of up to 40% defoliator's damage. Therefore, it was recommended not to to spray any type of pesticide until the damage is high.

C. Varietal Trial of Cauliflower

Farmers of this area were producing cauliflower as main season as well as off-season crop. For off-season cauliflower production suitable variety of cauliflower was found lacking. Therefore, it was felt essential to identify cauliflower variety suitable to the local condition having potential to produce more yields in short period of time.

Findings: The general findings on the performance of different varieties of cauliflower included in the study are as follows:

- à White grub and red ant infestation totally damaged the White flash variety.
- à Silver cup – 60 variety was ready for harvest in 65 days after seeding and gave better yield than others.
- à Silver cup – 65 variety was ready to harvest in 75 days having similar yield to that of Silver cup- 60.
- à Ramie variety of cauliflower was ready to harvest at the age of 85 – 90 days after seeding and gave low yield as compared to others.
- à Both Silver cup – 60 and Silver cup – 65 varieties performed well, but Silver cup – 60 was much earlier than others and was also high yielding compared to others.

Recommendation: Silver cup – 60 was recommended as the best off-season, short duration and high yielding variety for this locality.

Evaluation of Participants

The evaluation on the changes in the know-how of the participants was done through conductance of Pre & Post– Ballot Box Test (BBT). The results of both the tests are presented below in the table.

Table 3 Results of Ballot Box Tests

Details \ Activities	Pre test	Pre test	Remarks
No. of Participant	27	25	Full Marks-20
Minimum marks obtained	10	11	
Maximum marks obtained	19	20	

Post FFS Activities recommended by the farmers

- à Follow-up and participatory planning.
- à Farmer's group empowerment and their strengthening.
- à Facilitate the groups for fund raising and its better utilization.
- à Organization of IPM tours for interaction with other IPM groups.
- à Expansion of Farmer-to-Farmer Field School.

Achievements of FFS

- à Knowledge disseminated on IPM and on safe and judicious use of pesticide.
- à Knowledge enhanced on identification and conservation of natural enemies.
- à Knowledge created on that the early damage by defoliators can be compensated by the plant.
- à Know how on proper spacing (45 x 45 cm) and use of recommended dose of fertilizers enhanced.
- à Potential variety of cauliflower (Silver cup – 60) suitable for growing during off-season period identified by the farmers.
- à Farmers' know how enhanced about Learning by doing approach.
- à Farmers were:
  - Empowered in right decision making.
  - Habituated to conserve natural enemies and observe the field regularly.

Taikabu IPM FFS, Tathali-9, Bhaktpur District

Taikabu village is located near to the North East of Bhaktapur Municipality, which is under Tathali – 9 of Bhaktapur. There are 40 households having 2-20 Ropani of land holding.

The area was considered to be focused through FFS because of the following reasons:

- à The farmers' high demand for vegetable crop production technology with IPM approaches.
- à Virgin area for agricultural intervention.
- à Potential area for off-season vegetable production.
- à Subsistence level of farming with low income

Taking into account of the above, cauliflower and tomato crops were selected for off-season vegetable production.

Farming System

- à This area was completely virgin for the new agricultural innovation as farmers were practicing subsistence-farming system and producing only cereals.
- à There was high potential for vegetable production commercially.
- à The pesticide use under the crops was low.
- à Knowledge about the insect pest and disease management was Low.
- à Most farmers use inadequate quantity of FYM. Lack of skill for making good compost from the organic bio-products was observed.
- à No extension workers so far have reached this place.

FFS Regular Activities

- à Preparatory meetings
- à The first and second meetings were already completed before starting of FFS. Regular FFS gathering was organized on each Friday.
- à Introduction of participants and facilitators
- à Orientation of IPM programme, its objectives and programme procedures.
- à Selection of participants for FFS- 30 persons, Male - 11 & Female- 19
- à Naming of FFS -Taikabu IPM Framers Field School.
- à Nomination of Chairman (Group Leader) & Secretary of FFS.
- à Venue for regular gathering, discussion and special classes.
- à Formation of Sub groups and nomination of sub group leader
- à Collection of soil sample for the lababoratory analysis.

Trials and Studies Conducted in the FFS

A. Comparative Study on IPM Vs Farmer's Practices of Cauliflower

A comparative trial was conducted to study the performance of IPM Vs. Farmer Practice of cauliflower by the farmers and to introduce the improved technologies of cauliflower growing in the FFS area.

Methods: Ramie variety of cauliflower was grown both in IPM and farmer practice plot. The componenets of IPM technologies in the plots were adopted as per the recoomendations, whereas the elements of farmer practice were choosen based on the findings of PRA done with the farmers. AESA was done at the regular weekly interval. The participants of all five sub-groups carried out altogether 9 observations on every Friday of the week. Data was collected and analyzed especially on the condition of plants and existing factors and recommendation to be applied. Farmers themselves had to make recommendations on further actions to be taken on the basis of prevailing crop condition. Correction and support by the big group was done where ever felt necessary. The decisions taken by the big group used to be put into action immediately and completed then and there on the very day.

Findings: General findings of comparative trial are as following:

- à Plant height of the variety Ramie was continued even after the closing of FFS
- à Leaves increments were stopped after reaching 20 in numbers.
- à Canopy area decreased from eleventh week of transplanting.

- à Steam girth remained constant from 11th week of transplantations.
- à NE's population was very high during 6th week of transplanting.
- à No. of IP's were very high in the 3rd week of transplanting.
- à Wire stem and subsequently severity of soft and black rot disease was high after 3rd and 4th week
- à Weed population was slightly high in IPM plot than FP plot.
- à In Ramie variety, plants were still in curd initiation stage.
- à Ramie variety of cauliflower was newly tested at Budol and in some other FFS condition. Vegetative growth pattern was found very encouraging but yield factors yet need to be observed.

Major IP's and NE's population observed during the AESA are given in the below table.

Table 4 Major IPs and NEs in the cauliflower at Taikabu condition

Insects/Pests (IP's)	Natural Enemies (NE's)
Flea beetle, Red ant, Grasshopper & White grub, Hairy caterpillar, White aphids, Monolepta, Spodoptera, White grub, Red ant grub. Field DBM, larvae cricket spodoptera, Syrphid fly,	Spider, LB beetle, Dragon fly, Spider black ant, ants, Syrphid fly

Recommendation: For off-season production, Ramie variety was found not suitable. It was recommended to select some other variety like Silver cup-60 or 65 for off-season production.

B. Other Trials and Studies

Varietal Trial of Cauliflower: Performance of different vareities was compared in the FFS area. The treatments included: Ramie, Silver cup-60, NS-60 and Control.

As more than 79% plants were completely damaged due to heavy attack of wire stem after 3rd week of transplanting, therefore, no comparison could be made in the performance of tested varieties.

Simulation Study*:* A study on simulation of the defoliators' damage was conducted in the FFS with 80 plants of cauliflower using variety Ramie. The trial failed to meet the objective as the plants were heavily infested with wire-stem disease and completely damaged before the observation was completed.

Cup and Zoo Study: There was not any zoo study conducted and the farmers couldn't observe remarkable result on cup studies.

Ballot Box Test (BBT)

BBT results were in the range of 46% in pre BBT and 54% in post BBT

Team Building Exercises

- à Water Bridging
- à Rubber band passing (with pencil in mouth)
- à Rope knotting and de-knotting game.

Group dynamics

- à Verification of goods – carried out before starting of special topics.
- à Baby care – conducted after transplanting the plants.
- à Agro eco-system game – conducted before starting AESA for the knowledge of environment.
- à Knowing friend behind the wall – carried out in the middle of FFS for closeness and estimation.
- à Direction with hand – conducted for quick action as direction.
- à Focal point finding (Teeka on photo) –unknowing effort with blind eye.
- à 7-up – carefulness.

Special topics covered in the FFS

- à Damping off and wire stem diseases: Introduction, symptoms, causes and causal organisms and control measures.
- à Properties of quality seed with practical procedure.

- à Seed germination test in different media.
  - Simple Soil
  - Soil with organic matter
  - Wet cloth (cotton)
  - Sand and Banana Sheath.
- à Introduction on different fertilizers and their need.
  - Nitrogen fertilizer - Urea.
  - Phosphoric with N2 fertilizer - DAP
  - Potassic fertilizer - MOP
  - Soil nutrients 16 elements (NPK+13 Micronutrients)
- à Setting of cup study in plastic bottles.
- à Identification of insect pests and methods of insect drawing.
- à Nitrogen test, organic matter and phosphorus test of soil by strip method.
- à Effect of pesticide residue in plant with color dye.
- à Life cycle of Flea beetle, nature of damage, control, measures.
- à Nursery: Method of bed preparation, seed sowing, plastic doom house and watering.
- à Life cycle of White grub and Cutworm.
- à Alternaria leaf spot, Soft rot and Black rot: Symptoms and control measures.

Netra Prakash IPM FFS, Panauti-8, Kavreplanchok district

Netra Prakash IPM FFS was conducted at Panauti municipality-8 in Kharibot and it was l ocated at the distance approximately 11 k.m from the headquarters of Kavre district.

Farming System

Both commercial and subsitence farming systems were found in the area. Under the commercial farming, vegetable & potato are grown as principal crop. Rice occupies third position in area coverage. Livestock for milk production and mandarin orange cultivation are other major source of income for the majority of farmers in this area.

Under the subsistence farming, vegetable is grown in kitchen garden and in small scale fruit cultivation, poultry farming and goat farming are practiced. This area lacks irrigation facility as a result farmers have to solely depend on rainwater for irrigation.

It is a potential potato pocket area and vegetable farming is coming up. Farmers were found interested towards IPM activities.

FFS Regular Activities

There were 31 participants having 23 female and 8 male farmers in this FFS. Among the participants, 19 participants were from Brahmin-Kshetri and 12 from Newar ethnic groups.

The major activities carried out were selection of FFS, naming of FFS by the participants, formation of 5 sub-groups, selection of sub- group leaders, and FFS chairperson. The name Netra Prakash IPM FFS, Kharibot was based on the name of a primary school located at Kharibot.

During the preparatory meetings, introduction and importance of FFS and IPM was highlighted. Likewise selection of bari land (200 m^2) for study plot, selection of day and time for the FFS gathering, norms setting was also done. Apart from these, gender analysis matrix (GAM) was conducted. The role of female in agricultural operation was 56 %. The decisions were taken through participatory discussion having general consensus.

The FFS rules fixed were:

- à FFS day on Friday from 7:00 AM – 12:30 PM.
- à Continuous 3 times absentee was to be expelled out.
- à For the late comer dancing & singing was decided as punishment.

At the start up of each session daily attendance of participants followed by recapitulation of previous day's activities were conducted. After recap, participants did climate-setting activities. The minimum percentage of attendance was 83.8% and the maximum was 100% during FFS period.

Trials and Studies Conducted in the FFS

A. Comparative Study on IPM Vs. Farmers' Practices of Cauliflower

This trial was mandatory for IPM FFS and the objectives were to compare components of IPM Vs. farmer practice and based on take decision for better crop management

Methods: Cauliflower was selected for the study. Variety of Cauliflower used was Ramie. In IPM practice, plot size was 80 Sq.m. FYM was applied @ 2 mt/500 Sq.m. Chemical fertilizer was used @10:8:4 kg NPK/500Sq.m. Seedling planting distance was maintained at 45 x 45 cm. Plants were sprayed with Multiplex @ 2 gm/lit of water and Pensibao @ 5ml/16 lit.of water.

In the farmers' Practices plot size was 70 Sq.m. FYM was applied @ 20 dokos/500 Sq.m. 1st top dress done with 2-3 gm of Urea/plant after 15 DAT, whereas in the 2nd top dress chicken manures were incorporated. Seedling planting distance was maintained at 45 x 30 cm. The components of the farmers' practice was based on the report of PRA.

Agro-Ecosystem Analysis was done for taking decision for crop management. Sub-groups of farmer practice and IPM practice collected data from each plot at regular interval. The population of IPs and NEs was recorded. The data obtained from observations were processed, presented and discussed in big group (plenary) after each AESA. During FFS period, in total eight AESA were conducted. On the basis of AESA special topics for discussion were selected and as per AESA recommendations action to be taken in the field were done.

Findings: From the results obtained from comparative study trial, it was concluded that on the basis of the plants' growth in relation to height, number of leaves, canopy and the stem girth, IPM practice is some what better than farmer practice. However there was not significant difference in the presence of both IPs and NEs in both the cases. Similarly the plant height, and canopy girth was more in FP and the number of leaves were more in IPM. It was difficult to differentiate effects of the treatments and find the causes.

By practicing AESA Farmers become capable to analyze the growth rate of the plants by regular observation and monitoring of the fields.

B. Varietal Trial of Tomato

Tomato being one of the major off-season vegetable crops of this area was mainly affected by the late blight disease and was identified as main problem in the tomato cultivation. Farmers were willing to get a variety that is relatively late blight resistant.

Methods: Tomato varieties such as NCL-1, CL-cross, Suraksha, Bhim were taken for the study. Basal fertilization was done @ 2:1.5:4 kg NPK/500m2. First top dressing was done with 1 kg of N/500Sq.m and during 2nd top dressing another 1 kg N / 500m2 was applied. Planting spacing was kept at 75 cm X 60 cm (RR X PP) and single staking per plant was done.

Findings: Tomato variety Suraksha was identified relatively resistance to late blight compared to others.

C. Varietal Trial of Cauliflower

The objective of this trial was to identify the short duration (early) variety of Cauliflower for off-season cultivation.

Methods: Four varieties of cauliflower (hybrid) were used for the purpose that was Ramie, White flash, Silver cup-65, Silver cup-60. Basal fertilization was done with FYM and chemical fertilizer @ 2 ton of FYM /500m2 and 8:10:5 Kg NPK/500m2 respectively. Two top dressings were carried out. The dose of fertizer applied during each top dressing was 2:0:0 kg NPK/ 500m2. Transplanting of seedling was done in single row at the spacing of 4 5 cm X 45 cm (RR X PP).

Findings: Farmer's preference was for Silver cup-60 followed by Silver cup-65. These varieties were identified as early maturing variety of cauliflower compared to others tested in the trial.

D. Simulation Study of Defoliators' damage on Cauliflower

Flea beetle, Butterfly, Tobacco caterpillar, Mustard saw fly and Red ants were reported feeding and damaging leaves roots, and other parts at different growth stages in Cauliflower. The loss incurred in cauliflower curd is based on the population of these insects pest. However, these insect pests when occurred at certain

population density and crop stage may not need insecticides application to control. Majority of the cauliflower growers use insecticides which ever is available and use it to control these insects even when the damage is below economic threshe hold level.

This study was carried out with the objectives to appraise the compensation ability of cauliflower against defoliator's damage and based on make decisions on when to apply insecticides if it at all needed.

Findings: The results of the trial revealed that cauliflower plants have compensation ability in terms of plant growth and production to certain level of injury so if any defoliator damages the leaves in early stage of crop growth it is not necessary to use insecticides immediately.

E. Cup and Zoo Studies

The farmers conducted cup and Zoo study. The objective of these studies was to identify the unknown insects through their rearing and to learn the behavior of insects, their feeding habit and habitat as well as their lifecycle and growth stages. Findings of the study are given below in the table.

Table.5 Bhaviour of insects identified through rearing under Cup and Zoo studies

S.N.	Study Conducted	Methodology	Results
1	Identification of unknown egg mass of an insect.	Egg mass from cauliflower field was collected and reared in the cup.	Spodoptera larvae hatched out
2	Identification of unknown pupa collected from cauliflower field	Collected & reared in the cup	Syrphid fly appeared
3	Identification of unknown egg mass	Egg mass from cauliflower field was collected & reared in the cup	Larvae of cabbage butterfly hatched out
4	Identification of unknown larvae	Collection from cauliflower field & reared in the cup	Soyabean hairy caterpillar emerged out

Special Topics Covered in the FFS

Some of the topics dealt during the FFS are as follows:

- à Physical purity of the seed
- à Red ant management
- à Blindness of cauliflower
- à Management of potato tuber moth
- à General information and precaution to be taken in pesticide handling
- à Root and plant vessel (exercise)
- à Damping off and nursery management
- à Manures and fertilizer
- à Management of spodoptera
- à Physiological disorder of cauliflower
- à Soil sampling, importance & techniques
- à Soil PH, Organic Matter(OM) and Nitrogen determination by colour strip (An exercise)

Team Building Exercises

The following group dynamics/team building exercises were carried out:

- à My treasurer bag
- à Water Bridging,
- à Piling carrom men
- à 7-up
- à IPM Reflection Game
- à Human Eco-system Game
- à Hatkadi
- à Evaluation Game
- à Resource Game

Evaluation of FFS Participants

A pre-ballot box test was conducted at the third week of FFS. Similarly Post test was taken at the last day of FFS. The result of the tests conducted are presented in the table 6.

Table 6 Results of Pre- and Post Ballot Box Tests

Description	Pre-test	Post test	Remarks
No. of participants	26	29	
Minimum marks obtained	5	9	F. Mark: 20
Maximum ,, ,,	16	20	
Average ,, ,,	11.5	16.2	

Post FFS Activities as recommended by the farmers

- à Launch commodity based (Potato) Programme.
- à Register the FFS group at DADO, Kavre.
- à Planning for future programme/activities.

Achievements of FFS

- à Farmers were technically prepared for Cole crops especially cauliflower production in an ecological balance manner.
- à Social Empowerment of the farmers well expressed.
- à Farmers became capable to differentiate insect-pest and natural enemies.
- à Farmers became aware on how the misuse of pesticides takes place.
- à Farmers learnt about the process of IPM and become capable to apply in their own field.

Problem encountered during FFS and Suggestions

Table 7 Major problems encountered and suggestion provided during implementation of FFS

S.No.	Technical Problems	Suggestion
1	Wire stem problem	à Proper nursery management for raising seedlings. à Dipping seedling in 0.2% solution of carbendazim.
2	Red ant & White grub in cauliflower.	à Application of well decomposed compost. à Drenching of chloropyriphos @ 2 ml/lit of water.
3	Alternaria leaf spot	à Removing and destroying of infected leaves and plants. à Seed treatments with carbendazim @ 2.9 gm/kg of seed.
4	Black rot in cauliflower	à Uprooting and destroying of infected plants. à Transplanting of normal seedlings.
5	Blindness of cauliflower	à Uprooting the blind plants. à Protecting the plant from leaf defoliaters.

Chatapukhu IPM FFS, Sipadol-9, Bhaktapur District

This FFS was established at Shipadol-9, of Bhaktapur district. This place is located at East-southern part of the Bhaktapur. "Newars" are the main ethnic group inhabitating in the area.

Farming System

The usual cropping pattern of the area that farmers were practicing is rice-vegetable- vegetable. Mix cropping in vegetable with maize, soybeans was reported by the farmers. The farmers were not found cultivating off-season cauliflower and the tomato production was nil.

Major problems identified were the insect-pests like Cabbage butterfly, Spodoptera, Flea beetle etc in growing the crops. Farmers were found using more pesticides than needed for their control. They didn't know the residual effect & waiting period after the pesticide use.

FFS Regular Activities

Plant Protection Officer (PPO) of Bhaktapur had already conducted the two preparatory meetings. TOF participants were assigned to conduct the third meeting. In this meeting, 30 farmer participants to participate in the FFS on a regular basis and a FFS group leader were selected. The FFS and sub-groups naming was done. The sub-groups were named as Silver cup-60, Aphids, Manisha, Spider and Ramie.

Pre- FFS Activities that were carried out included preparation of rules and regulation for the FFS. The participants decided to conduct FFS once in a week on each Friday. The time for regular FFS session was fixed from 7.00 A.M. to 12:30 P.M. The regular attendance of the participants was carried out in each FFS session. Prior to the start of the FFS the facilitators explained to the participants regarding the support to be provided by them during the FFS and provision for the various agricultural inputs and stationeries to be made available by the programme. In the pre-FFS activities, discussion on various trials studies to be carried out by the participants and agreement on allocation of land for the field studies be provided by the farmers was also achieved. While preparing the cropping calendar of cauliflower, gender analysis was also carried out as per GA Matrix. In the analysis, the role of female and male farmers in cauliflower cultivation was identified as 55.35% and 44.6 % respectively.

During the FFS various technical exercises such as Seed purity test, Seed germination test, Borer management in Brinjal, Disorders of cauliflower, Methods of top-dressing, Late blight management in tomato, Root & Plant vessels exercise, Participatory Discussion (P.D.) on Late blight of tomato, P.D. on club root, Wire stem, Damping of management, Compost making technique, Vermiculture and Insect drawing were carried out.

Agro-ecosystem analysis was carried out in FFS with an objective to know the prevalence of insects' pest, natural enemies, and crop condition. Side by side farmers also learnt about natural eco-system and developed skill on decision making on their observation in the field. All together eight AESA were conducted

Trials and Studies conducted in the FFS

After the rigorous discussion among the farmers, varietal & simulation of defoliators damage trials were selected to be conducted on cauliflower. Participant farmers had also decided to conduct a varietal trial on tomato. The main purpose of this trial was to select appropriate variety that can be grown in the area and to learn about agronomic package of tomato cultivation.

A. Comparative study on IPM Vs Farmers' practices of Cauliflower

Methods: In Chhatapukhu the available land for comparative study & other small trials was not sufficient. However, adjustments were made to manage it. In IPM practice plot, all the agronomic practices of cauliflower were followed as recommended by NARC and DOA and necessary adjustment in management practices were done from AESA recommendation. In case of farmers' practice, crop management activities were conducted as per the PRA & cropping calendar report. Variety Silvercup-60 of cauliflower was included in the trial for the comparative study.

The detail components of IPM and Famer Practice compared are given below in the table 8.

Table 8 Major components of IPM and Farmers' Practice included in the comparative trial

Particulars	IPM plot	FP plot
Total area	125 Sq. m	125 Sq. m
Date of sowing	May 31, 2004	May 31, 2004
Date of Transplanting	June 25, 2004	June 25, 2004
Spacing	45 X 45 cm	40 X 30 cm
FYM	2 mt/Ropani	30 doko (750 kg)/R
Fertilizer application		
a) Basal	4:8:5 kg NPK/Ropani	2.5 g DAP + 2.5 g Urea per pit
b) Top-dress	3:0:0 kg NPK/Ropani 3:0:0 kg NPK/Ropani	DAP 5g/pit, 8-10 DAT Urea 5g/pit, 25-35 DAT

Micro-nutrient (Borex)-basal	750g/Ropani	750g/Ropani
Gap filling	70 %seedling	30% seedling
Gap filling (July 9,2004)	70 seedling	50 seedling
Spray of Pensibao (July 16,2004)	✓✓	✓✓
Divide the plot to 5-sub group (7/16)		
AESA start July 16,2004 (First AESA)		
Gap filling (August 4,2004)	50 plants	60 plants (590 plants in boarder area)
Nuvan spray (August 7,2004)	**X**	✓✓
Multiplex spray (August 11,2004)	✓✓	✓✓

Findings: From the AESA observation, it was revealed that around 90% of sample plants were off type in farmers practice, whereas in the IPM practice the percentage of off-type plants were 40%. Number of IPs and NE's were observed more in AESA 2, 3 and 4 which also coincided with the high population of aphid. In AESA 2, population of Flea beetle was found increased. In regards to the NEs number, the Ground beetle population was found more in 3 and 4 AESA. Having conducted the AESA 4, farmers recommended application of insecticide for the management of insects. Thus the plants in the farmers' practice were sprayed with Nuvan @ 2 ml/lit. of water. This resulted in decreasing the number of both IPs and NEs in the next AESA i.e. in AESA no. 5. In the observation, it was found that use of urea spray @ 2 gm/lit. of water reduced the aphid population.

B. Simulation of defoliators' damage on Cauliflower

The specific objectives of this trial were to make aware the farmers about the insects' damage on leaf and to make them understand the compensation ability of the plant.

Methods: Different treatments involving various levels of leaf cuttings included in the simulation study. The details of treatments compared are as follows:

Treatment 1 (T1) = 10% leaf cutting, Treatment 2 (T2) = 20% leaf cutting, Treatment 3 (T3) = 30% leaf cutting, Treatment 4 (T4) = 40% leaf cutting and Treatment 5 (T5) = Control - no leaf cutting

Findings: It was difficult to interpretet the result, as all the production data was not ready till the end of the FFS. However, the available data indicated no significant differences in vegetative growth of the plants among the treatments.

C. Varietal Trial of Cauliflower

Farmers were not aware about the availability of off-season cauliflower varieties that could be grown economically profitable variety. Taking into account of this, different varieties of cauliflower were tested by the farmers in the trial mainly with the objective to judge the performance of various varieties that could be suitable for growing during off-season (Ashad-Shrawan) in the area.

Methods: Performance of four different varieties was compared in the trial. Each variety consisted of 15 plants. The space engaged by each plant was 0.20m^2 & occupied the area of 3.00m^2/plot. The design was simple. Plant to plant & row to row distance was maintained at 45 X 45 cm. The varieties compared in the trial were: Treatment one (T1) = Ramie, Treatment two (T2) = White flash, Treatment three (T3) = NS-60 and Treatment four (T4) = Silver cup-60

Findings: Silvercup-60 & NS-60 were the early maturing varieties compared to the other two i.e. White flash & Ramie varieties. Silver cup-60 was found mixed with unknown variety or possibly mutation occurred. Owing to that growth of plants continued up to end of TOF. Therefore, it became difficult to interpretate the results because crop harvesting could not be done till the end of the TOF.

D. Varietal Trial of Tomato

The specific objective of this study was to identify the best variety of tomato for off-season production (Asadh-Shrawan) in the area.

Methods: 8 varieties i.e. Lapsegede, C.L- cross, Manisha, Bhim, N-S 815, Surakcha, & N-162 were planted in single replication. One variety (i.e one treatment) included 5 to 10 plants. Planting spacing was maintained at 75 X 30 cm.

Findings: Full harvest of the crop could not be done till the end of TOF. The local Lapsigede variety could resist the wet condition. The variety N-162 was more productive than the other varieties.

Team building exercises conducted in the FFS

- à Paper tearing
- à 7 UP game
- à Psedo jumping
- à Hypo game
- à Matching of figure
- à Human ecology game
- à Hathgadhi game
- à Passing rubber band
- à Making the Photo frame

Evaluation of Participants through Ballot box test

Two BBTs were conducted in the farmers' field. In the beginning of FFS session, initial BBT was carried out on the basis of farmer field problem, insect pests, natural enemies, fertilizer and diseases etc. There were twenty different questions. Similarly, final BBT was done in the same manner. In pre-BBT, twenty-two participants participated and they secured marks ranges from 8 to 19 with average marks of 13.5, where as in post BBT, twenty four out of twenty five participants participated and they secured marks ranges from 12 to 20.

Problem encountered in the FFS and Suggestion.

Table 9 Major problems encountered and suggestions made in the implementation of FFS

S.N.	Problem encountered	Control measure and Suggestion
1	Language·	à It remained unsolved problem so time to time support from interpreter was taken to translate Nepali into Newari and activities carried out.
2	Loss of transplanted seedling	à Gap filling à Do not transplant the over aged seedling à Care at the transplanting
3	Stunted growth of the plant	à Spray of micronutrient (pensibao, multiplex etc.) à Spray of growth stimulant
4	Late blight in tomato	à Drainage management à Avoid water logged condition à Use fungicide like Krinokxyl Gold 2 gm/lit à Hand picking of infected leaf and branch à Selection of resistance variety à Field sanitation
5	Whiptail in cauliflower	à Spray of micro-nutrient (Molybdenum)
6	Club root	à Seedling from reliable source à Maintain crop rotation à Use agri-lime for reduction of acidity in soil
7	Wire stem	à Seedling from reliable source à Avoid water logged condition à Intensive care at transplanting à Spray fungicide
8	Insect problem	
	Flea Beetle	à Damage will be insignificant after 9 week of age. à Heavy attack at initial stage. Spray of Nuvan @ 2 ml/lit. of water
	Spodoptera	à Use pheromone trap à Destroy egg mass à Picking larvae & kill à Use botanical pesticide à In case of heavy attack chemical pesticide should spray
	Aphid	à Spray Urea 2 gm/lit of water à Spray Nuvan 2ml/lit. of water
	White grub	à Picking & killing the larvae from the soil. à In sever case drenching of chlorophyphus @ of 2 ml/lit. of water.

Achievements of Farmer Field School

- à Farmers become able in identifying & conserving the natural enemies.
- à Awareness created among the farmers to observe the field regularly to determine management action necessary to produce profitable crop.
- à Farmers realized on the need for minimizing the pesticide usage to economical & safe levels for the sake of human health & protection of the environment.
- à Farmers were trained and learned to carry out field observations, analyze the information, and make appropriate decisions on suitable crop and field management.

Uddamshil Namuna IPM FFS, Tathali -9, Bhaktapur District

The FFS site was located at Tathali VDC of Bhaktapur district. The participants of the FFS were from Ward No.1 & 2 (Chap and Chitapol village) of this VDC.

Farming System

Most of the farmers of this locality practice integrated farming system. In 1998/99 two farmers of this area initiated cauliflower cultivation. Now farmers have started growing cauliflower for the commercial purpose. Though, farming has been based on integrated approach, but use of compost and potash was found minimum. Farmers use various types of pesticides, micronutrients, hormones and other growth stimulants in growing the vegetables especially cauliflower.

The total cultivated land in this area was estimated to be about 4000 Ropani and land under cauliflower (both seasonal and off season) was estimated about 400 to 500 Ropani.The source of irrigation was managed through drinking water pipe and through collection of rainwater by making trench or pit. The total household in Chitapol has been 54 and 250 in Chap. The literacy rate among the population was about 58 %. The ethinic strurcture comprises Brahmin (35%), Kshetri (60%), Dalit (1-2%), Newar and some others (4-5 %)

The major problem in growing the cauliflower was identified the threat of Club root and Black rot disease and Wilting disease in Solanaceous crops. In order to control these diseases farmers were using various pesticides by mixing insecticide, fungicide, growth regulators and micronutrients altogether.

This area was selected for the FFS on the basis of following criteria:

1. Cultivation of off-season vegetables was in growing trend.
2. Availability of good road facility and transport network.
3. Potential for introduction of IPM approach as misuse of chemical pesticides were heavy.
4. Imbalance use of fertilizers by the farmers.
5. For technical support Farmers mostly relied on Agrovet centers, which supplied seeds, fertilizers and pesticides.

FFS Regular Activities

The activities carried out after the selection of the FFS site were: participants' selection, establishment of procedure for FFS, crop & venue selection and establishment of FFS study plot. After these tasks, naming of FFS, group leader selection, formation of sub groups, norms setting and fixing the date and time of FFS were also done.

Trials and Studies Conducted in the FFS

A. Comparative study on IPM Vs. Farmers' Practices of Cauliflower

Cauliflower has been grown as main as well as off-season crop in the area and therefore the comparative study was decided to be conducted on this crop.

Methods: Silver cup – 60 variety of cauliflower was selected for the comparative studies on IPM and Farmer's practice. The components of IPM practices were taken based on the recommendation, wheras the elements of the farmer's practice was based on the findings of PRA and results obtained from the cropping calendar analysis. AESA was the measure tool for various observations and data collection. At the regular intervals, AESA was conducted by the farmers organizing in various sub-groups.

Findings: The findings made on the comparative studies between IPM Vs. Farmers' practices of cauliflower and results of various observations/measurements are reflected in the Fig 11, 12, 13 & 14.

Fig. 11 Population dynamics of insect in IPM practice at Tathali

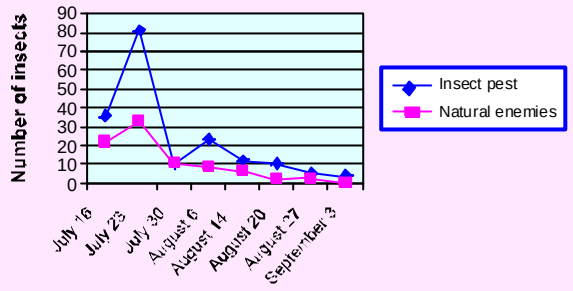


Fig. 12 Population dynamics of insects in Farmers' Practice at Tathali

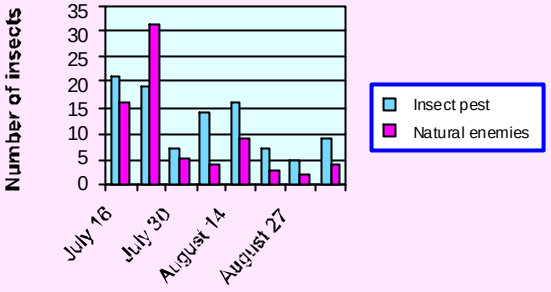


Fig. 13 Average plant height of cauliflower of Comparative trial at Tathali

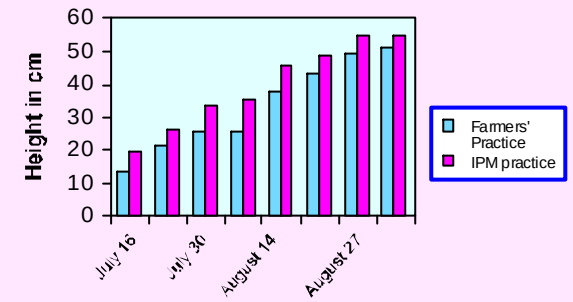
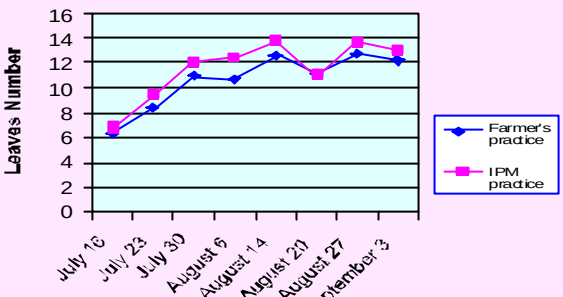


Fig. 14 Average number of leaves in comrative trial at Tathali



B. Simulation of defoliators' damage on Cauliflower

Farmers do not easily believe that the plants can compensate the damage of insects in the active growing stage, while a mature plant can tolerate a certain level of damage as it becomes hardy enough. Cutting plant leaves can simulate the damage of defoliators. For conveying the right message in this regard to the farming community, this trial was conducted.

Methods: The methodology of conducting the trial was same as mentioned above in case of other FFS. Cauliflower variety Silver cup-60 was used for the simulation study. The details of treatments compared were: Treatment 1 (T1) = 10% leaf cutting, Treatment 2 (T2) = 20% leaf cutting, Treatment 3 (T3) = 30% leaf cutting, Treatment 4 (T4) = 40% leaf cutting and Treatment 5 (T5) = Control - no leaf cutting. Five plants were pegged for data recording. The leaf cuttings were done at 14 days after transplanting. Data recording started right from the date of initiation of leaf cuttings.

Findings: The curd weight was taken as a basis for comparison. There was no significant difference among the treatments. The results indicated that up to 40% defoliation in the active growing phase, the cauliflower plant can compensate the damage easily. This trial helped the farmers to understand to what extent of damage is tolerable and after what extent they need to go for using the pesticides.

Recommendations: Damage by defoliators in cauliflower crop up to 40% foliage in the vegetative phase, the plants can compensate the damage without compromising the yield. Farmers decided to go for remedial measures at this level of damage on the foliage during active growing period of cauliflower.

C. Varietal Trial of Cauliflower

The objective of this study was to identify the best variety of cauliflower suitable to the local condition.

Methods: All together five varieties of cauliflower were selected by the farmers to study their performance in the local condition. The varieties were grown using the practices as adopted in the IPM practices.

The varieties of cauliflower included in the study were: Treatment 1 -Silver cup-60, Treatment 2- Silver cup-65, Treatment 3- White Flash, Treatment 4 –Ramie and Treatment 5- NS-60

Findings: Silver cup – 60, Silver cup – 65 and NS – 60 were harvested within the TOF period. However, harvesting of White flash and Ramie varities were some what delayed and in total only three curds from each variety could be harvested at the end of the training period.

Recommendation: Silver cup-60 was found to be best one among five varieties tested. Based on the results of this trial, farmers together with the facilitators recommended for cultivating Silver cup-60 variety of cauliflower in the rainy season.

D. Other Trials and Studies

Cup Study of Spodoptera: Collected egg mass of Spodoptera hatched for 2 days in room condition. The total count of newly hatched larvae was 203.

The Spodoptera larvae collected from cauliflower plant having size of 31 mm long was kept in plastic bottle. The bottle was filled by one-third with loose soil in room condition and feeded on cauliflower leaf. It was observed that the larvae entered into the soil after 3 days for pupation and a moth emerged after ten days of pupation.

Cup Study of Diamond Black Moth (DBM): Five pupae of DBM collected from the field and kept in plastic jar. Three moths emerged in four days of collection, while the other two changed into blackish color. On the seventh day two wasps were emerged.

Cup Study of Spider and Flea beetle: One spider collected from field kept into a plastic jar and supplied with five Flea beetles. The jar was observed after six hours and found that there were only three Flea beetles. The jar was again observed after six hours and there was not a single Flea beetle found in the jar.

Foot rot Management: One kilogram of fresh cow dung was collected and mixed with five liters of fresh water. The mixture was mixed well by continuous stirring. The solution was freshly used against foot rot disease.

Composite Botanical Pesticide: The composite botanical pesticide was prepared by mixing following herbs and other ingredients:

- à Ash (wood) – 2 mana (Around 1 litre)
- à Ground marigold leaf – 500 gm.
- à Onion – 200 gm
- à Kerosene oil – 10 ml
- à Defatted mustard cake (ground) – 1 litre
- à Garlic – 200 gm
- à Hot pepper – 100 gm (2 mutthi)
- à Water – 7 litre

Plant nutrients, their uses and deficiency symptom: There are different sixteen elements required for plants to grow and bear crops (fruits). NPK are the macronutrients. Calcium, sulphur and magnesium are considered to be the secondary nutrients, while boron copper, iron manganese, molybdenum, zinc and chlorine are considered to be the micronutrients. These secondary and micronutrients are required in small quantities and are generally applied only after soil test.

Effect of Chemical Pesticides: Majority of the farmers were not aware about different types of pesticides, formulation, and their mode of action. Hence, they were created awareness on the toxicity and hazards of pesticides and about that the pesticides are harmful on the natural enemies too. The knowledge were also createded on that the residual effect of pesticides on the crops, resistance build up in insect pests, resurgence and outbreak of secondary pests are other consequences of using the pesticides.

Management of Club root in Cauliflower: As club root was severe problem reported by the farmers in cauliflower and therefore, to manage it various short and long term strategies were discussed with the farmers.

Short term strategy:

- à Safe disposal of diseased plant and plant parts.
- à Use of disease free seedlings debris from the field.
- à Not to transfer the seedlings from diseased area.
- à Not to use infected/contaminated compost.
- à Not to feed infected plants to livestock.
- à Use of clean tools and equipment.
- à Improvement in drainage and healthy crop management.

Long-term management strategy:

- à Crop rotation with non- cruciferous crops for at least 5 years.
- à Internal quarantine enforcement.
- à PH improvement to neutrality.
- à Research on club root management tactics.

Management of Wilt diseases in Solanaceous crop: Bacterial wilt is serious soil born diseases that can cause total loss of plants in large parts of the field. Management practices such as crop rotation, use of resistant varieties, sanitation of field and clean cultivation help to prevent and reduce disease. Addition of compost also helps to reduce the disease. This may be due to stimulation of antagonistic fungi in the soil and better nutrition for the plants. Chemical control of bacterial wilt is not effective. Biological control agents like non-pathogenic *Pseudomonas* sp. can be effective but the commercial production is not available in the market.

Management of Helulla: Burning of crop stubble and removal of weeds help to lower the pest population. The critical period for Hellula attack begins when the first true leaves are forming. It is important to inspect the nursery every few days for presence of these caterpillars, especially during or shortly after the rainy season. Hand picking of eggs or caterpillars and removal of infested leaves may be the best solution for low level of population. In case of larger population, spot application of Bt (Basillus thuringiensis) or systemic insecticide may control the Hellula population.

Management of Spodoptera: The Removal of weeds, clean cultivation and burning of crop stubbles lower Spodoptera population. Before the preparation of land, the infested field may be flooded. Plowing of the field will bring the larvae and pupae to the soil surface for exposure to sunlight or predator like birds. The pest can be attracted and controlled by planting trap crops like sunflower or groundnut around the main field. In case of small plots, hand picking and destruction of egg masses and young caterpillars is recommended. When heavy population occurs, effective biocontrol agent like NPV can be sprayed.

Management of Cabbage butterfly: Removal of crop residues from the field after harvest as they contain eggs and young larvae. The crop residues can be buried into the soil or fed to animals or added deep into the compost pit or dried slightly and burnt. In case of small plots, hand picking of eggs and young larvae is recommended. Monitoring of field may help to find the signs of natural control by parasitoids. Natural control percentages can be very high and no additional control measure is necessary in that case. In case of high population, spraying of Bt may be effective for cabbage butterfly control.

Root and vessel experiment: Root and vessel exercise is an important and easy to understand by the farmers in the field school. This exercise is helpful in convincing that the chemical fertilizers and insecticides used in the soil are pumped by the crop plants making themselves more toxic. The systemic pesticides come out from the plant surface by the process of gestation. The natural enemies may consume the water droplets and they may die. For this exercise red dye was kept in two glasses and seedlings of different crop plants dipped into the solution. One glass kept under sun and the another one kept under shade. The experiment was observed after four hours. There was clear indication that the red dye well distributed in all parts of the seedlings. The rate of intake of water was found to be slow in glass that was kept under shade.

Management of Diamond Black Moth: Monitoring with pheromone traps may reduce the DBM population. Pheromone impregnated strips attract male moths thereby disrupt the DBM mating. Planting the cole crops during rainy season or irrigating the cole crop field with sprinkler irrigation may also wash out the larvae and disrupt mating behavior of DBM. Cabbage intercropping with tomato may help in reducing DBM population by making them problematic in finding cabbage plants as these are camouflaged between other crops. Planting trap crops like mustard around the main cole crop field may also attract DBM. Removing of all crop debris after harvest helps to reduce populations. The cabbage leaves can be used to feed animals or used for compost making in the pit.

Summary of the findings: There exists an equilibrium among insect pests and natural enemies in the crop field. Removal of crop residues and weeds from the field, hand picking and destruction of egg masses and young larvae proved to be better. Silver cup – 60 is the best variety for that locality in the rainy season. Damage of defoliators in cauliflower crop up to 40% foliage in the vegetative phase can compensate and do not affect in the yield at all.

Team building exercises conducted in the FFS

As part of the team building exercises, water bridging game, human ecosystem game, rubber band transfer, know your friend and non lifting pens were carried out by involving the participants.

Brief procedures of each of the above games are mentioned below as reference:

Water bridging game: Make line of each sub-group member. The length of each line should be the same. A big bucket with full of water is placed in front of each sub-group. An empty bucket is kept at the last of line. They have to transfer water with their anjuli (joining both hands) from one to another and the last member of their respective group pour into their respective empty bucket. They are given with five minutes of time. After five minutes, they are stopped and the amount of water gathered is measured. The group that transfers highest quantity of water wins the game.

Human ecosystem game: Insect pests, natural enemies, sun, crops, weeds and farmer are written on Meta cards. The Meta cards are glued on the back of participants. There will be only one sun and farmer. Sun stands in the center. Plants and weeds encircle the sun. Insect pests stand in circle after the crops and weeds. The natural enemies stand in circle out to the insect pests. The decomposers form the outer layer. The facilitators ask the participants to follow the indication i.e. to indicate that something disappears, they should sit down, and to indicate that something is growing they should stretch out. The relationship is simulated with the agro-ecosystem by using the following questions:

- à What gives energy to plants and animals (participant representing the sun stands up)?
- à Where goes energy from the sun to produce biomass (participants representing the plants and weeds will stand up)?
- à Which feed on the dead plants and animals (the decomposers stand up)?
- à What happens when the farmer spray (make sure that every one is standing, and act out a farmer spraying. When the farmer sprays the natural enemies, the crop, the weeds, the insect pests and the decomposers sit down)?
- à Which groups are likely to increase if you use a lot of organic manures (decomposers stand up)?

The facilitator should correct if they do not show the interaction correctly by asking them guiding questions.

Rubber band transfer: Make line of each sub-group member. The length of each line should be the same. Make sure that each sub-group are equal in number. Each member is provided with a pencil to put in his/ her mouth. A rubber band is given to keep in the tip of the first member's pencil. They are then called to transfer the rubber band through the pencil. The sub-group that can return the rubber band fast to the first member becomes first.

Know your friend: The total participants are divided into two groups and asked to stand opposite of each other. Between these groups, there appears a big and thick curtain. One chair is made available for each group. The facilitator announces to sit one member from each group. The assignment of member has to be quickly decided by the respective groups to sit on the chair. The facilitator spell 1, 2, 3 and the curtain falls. The sitting members say the name of opposite sitting member. Member that can say the name of opposite member as quickly as possible will earn the number. This can be done for ten times. Scoring is done side by side. Group having higher score wins the game.

Non-lifting pen: Sub-groups of farmers are kept separate in groups. They are given with a sheet of paper. They are said to imagine a figure of an insect. A member of a sub-group sketches a part. From the end point, the next member of that same sub-group adds the another part of the sketch, the other members add next part of the sketch and last member completes the figure without lifting the pen from first to the last member. Every member is bounded by time.

Problems encountered in the FFS and Measures undertaken

Problems

- à Strong acidic soil
- à Poor drainage system
- à Experimentation site surrounded by rice field
- à Heterogenity observed in seeds of cauliflower variety
- à Heavy drought during the crop establishment period
- à Seedlings were of old age at the time of transplanting
- à Heavy attack of cutworm in the initial days of transplanting
- à Owner farmer of experimentation plot demanded compensation, as the seeds of cauliflower was found heterogeneous.

Measures taken to solve the problems

- à Soil PH testing and recommendation made for liming
- à Baiting for the control of cutworms
- à Exploration of botanical pesticides
- à Case study done by the TOF participants for the appropriate suggestion against the black rot disease
- à Special topics delivered on the burning field problems (managerial)
- à Cup study of problematic pests

Suggestions and recommendations

Following suggestions and recommendations were made in the FFS:

- à Improve soil PH by liming
- à Improve drainage system
- à Follow crop rotation to minimize black rot disease
- à Increase the use of compost or farmyard manure
- à Not to bring the contaminated or infected seedlings from outside
- à Purchase seeds from reliable source

Chamunda IPM FFS, Ugrachandi Nala-6, Kavreplanchok district

Ugrachandi Nala VDC is situated approximately at 5 km north of Banepa town of Kavreplanchowk district. The village is linked with Banepa with gravel road. Population of the VDC (population census 2000) is approximately 13,000. Brahmin, Chhetri and Newar constitute major ethnic groups of the VDC.

Farming System

The VDC is one of the major potato as well as cereals production pockets of the district. Maize, potato, mustard and vegetables are major crops grown in upland (Bari), while paddy, potato and mustard are the major crops of low land (Khet).

The most common vegetables produced in the area are cauliflower, tomato, french bean, cowpea, bitter gourd, cucumber and brinjal. It was estimated that about 15 thousand metric ton of vegetables are supplied from this area to nearby Banepa and Dhulikhel town and to Kathmandu.

Ugrachandi Nala is characterized with commercial farming system and vegetables farming has emerged as one of the main source of income of the local people. With increasing trend of vegetable production especially the off-season vegetables, indiscriminate use of chemical pesticides has been increasing every year. The estimated consumption of chemical pesticides used in the area was (solid/dust form) about 5 - 6 kg/ropani. The use of such amount of chemical pesticides poses threat not only to the health of producers but also to the consumers of vegetables. Indications of suffering from various respiratory, nervous, and digestive system related illness were reported by the farmers.

Taking into account of the above, it was felt urgent to introduce IPM approaches of crop production as a means to arrest the further degradation of environment and farmer's/consumers's health from the adverse effect of pesticides.

Regular FFS Activities

During the very first preparatory meetings, participants were oriented on the objectives of IPM and ecological approach of crop production. In the meeting, selection of FFS participants, tentative activities to be performed during FFS, identification of location for FFS regular gathering, and selection of study and trial plots were carried out as well as cropping calendar of cauliflower and tomato was also prepared. Based on the outcome of cropping calendar exercise, design of comparative studies on IPM vs. farmers' practices of both the crops were developed. Similarly, Gender Analysis Matrix (GAM) was also prepared to identify the participation of male and female farmers in different activities of crop production. GAM exercise revealed 50 % male and 50 % female participation in crop production activities.

On first day of the FFS, norms setting and final selection of study and trial plots were done. FFS was conduted every Friday in the morning that started at 7:30 AM and lasted for about 5 hours. In the initial days of FFS, farmers were familiarized with principle and practices of IPM and techniques of Agro-Ecosystem Analysis (AESA). During these days, designing and setting of various studies and trials were also carried out.

From the fifth day of the FFS, agro-ecosystem analysis was started in comparative study (i.e. IPM vs Farmer's practice) of cauliflower and Tomato. Altogether eight AESA were carried out until 11th Day of FFS.

Besides above, other several activities were performed during FFS. Based on AESA, special topics on problems encountered were dealt through participatory discussion. Similarly, zoo and cup studies of important insect pests found in the study plots were carried out to observe their life cycle, nature of damage and feeding habit. To make every session lively and to energize the farmers in the learning process, group dynamics and team building exercises were conducted in every FFS session. These exercises were also meant for promoting group integration and team spirit among the participants.

Trials and Studies conducted in the FFS

A. Comparative study on IPM vs Farmers' practices of Cauliflower

Based on the decisions made in the preparatory meeting, a comparative study on IPM Vs. Farmer practice of cauliflower cultivation was conducted.

Methods: The details of the components of IPM and Farmer practices compared in the study are elaborated in the below table.

Table 10 Major components of IPM and Farmers' Practice included in the comparative study

S.N.	Particular	IPM	Farmer practice
1	Area	50 m^2	50 m^2
2	Date of transplanting	2061/3/8	2061/3/8
3	Spacing	45 x 45 cm	30 x 60 cm
4	Fertilizer application: Compost Chemical: NPK Basal Ist. top dress IInd top dress	 40 mt/ha 200:200:100 kg/ha 80:200:100 kg/ha 60:0:0 (5 gm/plant) 60:0:0 (5 gm/plant)	 11.5 mt/ha 108:110:60 kg/ha 5 gm urea/plant 5 gm urea/plant
5	Micronutrients Application: Borax Boron foliar spray Calcium nitrate foliar spray Multiplex foliar spray Biozymes	 15 kg/ha 2 gm/lit of water 3 gm/lit. of water 2.5 gm/lit of water	 20 kg/ha 3.5 gm/lit of water 2.5 gm/lit of water 20 kg/ha.
6	Insecticide use: Cypermethrin	 - -	 20 kg/ha Single spray 2 ml/lit of water
7	Fungicide	-	5 spray of Mancozeb and metalaxyl solution @ 2 gm/lit of water
8	Weeding	4 times	4 times

During the course of conducting the study, farmer participants of the FFS observed the crops on weekly interval using the AESA technique and recorded various agronomic parameters, no. of insect pests, natural enemies and disease severity in the sample plants. They also made general observation on field. After the AESA, farmers processed the data and reached to the conclusion and recommendation by discussing in the respective sub-groups. The outcomes were then discussed in the plenary to finalize the action to be taken in the field.

Findings: Though, Silver cup -60 variety of cauliflower was included for comparative study, but there was varietal mixture observed in the field. After four - five weeks of transplanting of seedlings in the farmer practice (FP) plot, the occurrence of varietal mixture was identified. In IPM plot, only the gap filled seedlings

were identified as variety Silver cup-60. The ininitial transplanted seedlings were turned to be another variety. Plant stand was better in FP plot, but unfortunately there was no sign of curding observed till the end of TOF in both the practices except in re-transplanted plants (gap filled plants) in IPM plot. 8 AESA were conducted in the study plots, but yield results could not be drawn. The major out come of this study has been that the farmers learned about AESA, its analysis technique and process of making crop management decision.

After two months from the TOF, farmers had reported that curding took place and the yield was satisfactory.

B. Comparative Study of IPM vs Farmer's practices of Tomato

Besides Cauliflower, Tomato was also found as an important vegetable crop grown commercially in Nala area and therefore in addition to comparing the performance of IPM technologies in cauliflower, the farmers also decided to study the componenets of tomato cultivation in the comparative study.

Methods: The elements of IPM and Farmers practices compared in the study are reflected in the below table.

Table 11. Major components of IPM and Farmers' Practice included in the comparative study

S.N.	Particular	IPM	Farmer practice
1	Area	75 m^2	75 m^2
2	Date of transplanting	2061/3/8	2061/3/8
3	Spacing	60 x 75 cm	50 x 50 cm
4	Fertilizer application: Compost Chemical NPK Basal Ist. top dress IInd top dress	 40 mt/ha 80:30:80 kg/ha 40:30:80 kg/ha 20:0:0 (5 gm/plant) 20:0:0 (5 gm/plant)	 8.7 mt/ha 30:28:12 kg/ha 5 gm urea/plant 5 gm urea/plant
5	Micronutrients Application: Calcium nitrate foliar spray	 2.5 gm/lit of water	 3 gm/lit of water
6	Insecticide use: Cypermethrin	 -	 2 spray @ 2 ml/lit of water
7	Fungicide	4 spray of Mancozeb and metalaxyl @ 2 gm/lit of water	18 spray of Mancozeb and metalaxyl @ 2 gm/lit of water
8	Weeding	4 times	4 times

Findings: Crop growth and development was satisfactory in the farmer practice. Observations made on the vegetative and reproductive parameters during the AESA were comparatively better in this practice. Late blight and bacterial wilt infestation on the plants grown under farmer practice was less compared to the IPM practice. Up to fifth harvesting, IPM plot yielded 23 kg of fruit, while farmers' practice gave 82 kg of fruit. The reason behind such differences in yield was because of the chemical plant protection measures adopted in the farmers' practice plot.

Recommendation: Plant stand in IPM plot was poor due to heavy late blight infestation. Four sprays of Mancozeb and Metalaxyl were used for late blight management in IPM practice plot against 18 sprays of same fungicide in farmers' practice. 18 Sprays in FP plot also helped to reduce bacterial wilt infestation. Wilt infestation was also more in IPM plot. It was hence recommended by the farmers that while growing tomato during the rainy season using IPM practice adequate measures should be taken to control the infestation of late blight.

C. Varietal Trial of Tomato

Tomato varieties such as CL-cross, and Lapsi gede (local) and NCL-1 varieties have been grown by the farmers as off season varieties in this area. However, the local farmers had reported that yield of

these varieties are in decreasing trend and are more susceptible to late blight and bacterial wilt diseases. Farmers had no idea about alternate varieties that could replace the above. Thus, it was felt needed to test some of the promising varieties in the local condition of Nala in order to identify suitable variety(s) that can replace the existing one.

The trial was conducted with the objectives to identify appropriate high yielding and comparatively tolerant variety to late blight and bacterial wilt suitable to the local condition.

Methods: All together 8 varieties were included in the trial to study their performance in the local condition. The varieties were grown using the cultivation practices as adopted in the IPM practice in the comparative study trial.

The details of treatments included in the study are as follows:

T1=Bishes	T2=Suraksha	T3=Bhim	T4=Manisha
T5=CL- cross	T6=NS-815	T7=NCL-1	T8=N-162

Findings: Based on the record of three harvesting, variety N-162 gave highest fruit weight followed by variety Suraksha. N-162 was identified as early maturing variety that allows the farmers to grow more crops a year by vacating the field early. This and Suraksha varieties were found to be determinate type that had helped the farmers in easy handling and staking of the plants.

The study also revealed Manisha, Bhim and Bishes varieties to be more tolerant to late blight disease. Similarly, Bhim, Suraksha, Bishes, N-162 and Manisha were found as bacterial wilt tolerant varieties. On the other hand, CL-cross, NS-815 and NCL-1 were found more susceptible to bacterial wilt.

Recommendation: N-162 variety has been found appropriate variety from yield point of view followed by Suraksha and Bishes. Since the trial was conducted in rainy season, it became difficult to restrict the farmers from using fungicide against late blight. Hence the results obtained may need further verification with sufficient scientific basis before going for general recommendation in favor of the varieties that out performed in the trial. The varities such as CL-cross, NS-815 and NCL-1 should not be further recommended for use in the plots having history of bacterial wilt disease.

D. Varietal Trial of Cauliflower

Farmers were using various hybrid varieties without knowing much about the characteristics of that particular variety. Sometimes, there has been poor harvest of the crop basically due to mismatching of varietal character with that of planting time.

Farmers were particularly lacking appropriate variety for off-season production. Hence this trial was designed to make the farmers able to choose the appropriate cauliflower variety suitable for rainy season in the Nala area.

Methods: A total of 4 varieties of cauliflower were compared in the trial. The growing technology for the varieties was same as adopted in the IPM practice of comparative trial. The treatments included in the trial were: T1=Ramie, T2=White flash, T3=Silvercup-60 and T4= NS-60.

Findings: The variety Ramie produced highest yield with an average curd weight of 294.4gm followed by White flash (240 gm) and Silver cup-60 (211 gm). Of the four varieties, NS-60 had produced the lowest curd weight (206 gm).

Recommendation: Though, Ramie variety gave highest curd weight. But because of the pinkish color of the curd with minute hairs on it reduced its market value. It was observed good market for Silver cup varities due to its short maturing nature and satisfactory taste. Hence, the farmers had choosen to grow Silver cup variety in the Nala condition.

E. Simulation of defoliator's damage on Cauliflower

Often Semiloopers, Tobacco cater pillar, Cabbage butterfly, Diamond black moth and Flea beetle defoliates leaves of cauliflower causing severe damage in the area. Farmers have been using different types of insecticides as soon as these defoliators are seen in the field even without causing any serious damage.

This has been resulting in economic loss to the farmers and increasing the risk to human and animal health. Therefore, it was necessary to convince the farmers on that the plant has its own compensation

ability of recovering defoliators' damage to a certain level with the view to help the farmers in reducing the use of pesticides to some extent.

The specific objective of the study was to estimate curd yield of cauliflower at different percentages of leaf damage by artificial defoliation.

Methods: The study was conducted through various level of leaf cuttings at the vegetative growth of the cauliflower.The treatment design of the trial was: T1=0 % leaf cutting, T2=10 % leaf cutting, T3=20 % leaf cutting, T4=30 % leaf cutting and T5=40 % leaf cutting. Curds were harvested at marketable size and curd weight for each treatment was recorded.

Findings: The results of the study showed that there was highest curd weight in 10 % leaf cutting with average curd weight of 234 gm followed by 30 % leaf cutting (211 gm). Interestingly, average curd weight in control plot (no leaf cutting) was lowest (150 gm) of all treatments.

Recommendation: It can be concluded from the results that no significant difference in curd weight will be observed even up to 40 % leaf damage by defoliators. The results also indicated that satisfactory yield can be harvested even if there is defoliator's damage to certain level. However, it is recommended that this trial need further verification.

F. Cup Study conducted at FFS

During the AESA several insect pests and natural enemies were found. It was important to identify them and to study about their characteristics, feeding behaviour, host and habitats through rearing and proper management.

Findings: The results of the study obtained from cup studies conducted are reflected in the below table.

Table 12 Results of cup studies achieved by the farmers

S.N.	Study title	Setting date	Observation date	Findings
1	Identification of unknown insect	2061/4/6 (Egg mass)	2061/4/10	Larvae (uncountable) of spodoptera.
2	Feeding behaviour of Spodoptera	2061/4/10	2061/4/13	Spodo eating cauliflower leaves and new growing tip
3	Identification of unknown larva	2061/4/14 (Larvae)	2061/4/26	Adult of cabbage butterfly found
4	Identification of Unknown insect	2061/4/22 (Pupa)	2061/4/26	Adult of DBM
5	Identification of unknown pupa	2061/4/20	2061/4/25	Adult of hover fly found

Special topics dealt in the FFS

- à Seedling management and Transplanting
- à Late blight management in tomato
- à Management of blindness in cauliflower
- à Slug management
- à Types of pesticide and their uses
- à Red ant and cutworm management
- à Management of black rot in cole crops
- à Soil testing and soil sampling techniques
- à Bacterial wilt management in tomato
- à Management of Blossom end rot in tomato
- à Management of tobacco caterpillar
- à Methods of pesticide spray (monologue)
- à Management of fruit fly in cucumber

Group dynamics and team building exercises

- à 7- up
- à Know your friend behind the curtain
- à Untying the knot
- à Inside my bag
- à Identify true or false statement (mid-term evaluation)
- à Water bridging game
- à Piling of carrom coins
- à Musical chair
- à Human ecosystem game
- à Shrinking boat

Post FFS activities recommended

- à Farmers of the group were suggested to continue the regular meeting once in two weeks in any issues related to community needs that keep the group in track and to strengthen them.
- à In every short term or seasonal type of farmer level trainings conducted by Agriculture Service Center, District Agriculture Development Offices, Regional Agriculture Training Center and any other institution, the agriculture related trainings must be included and provide to the farmers of the FFS group with the view to update them with different agriculture technology.
- à Provison of agricultural inputs available from DADO (Seeds of improved variety, demonstration and minikits, materials, technical equipments and the subsidized materials) should be there for the FFS group so that continuity of the IPM could be maintained.
- à Provison should be made for regular back stopping by agriculture extension workers from the DADO.
- à A small irrigation infrastructure is strongly recommended to establish in the FFS area.
- à The FFS group must be registered at DADO as soon as possible for the sustainability.
- à Social and Community development programmes should be carried out through NGO/INGOS and government efforts.
- à Awareness raising for income generation should be started with commercial crop cultivation.

2.2.5 Farmers' Field Day

Farmers' field day (FFD) is an important activity of FFS, which takes place at the end of training period. It is an occasion where the farmers and facilitators share their experiences with other people of the community through art of poems, folk songs, dances, dramas, drawings, posters relating the principles, methods, & results of IPM that they have observed and learnt throughout the crop season. It gives the final honor to the participant as a graduates of IPM and therefore it is also called as graduation day. In concrete terms FFD is designed to advocate IPM, share the experience among each other, motivate the non-participants farmers, show the final results of the FFS to local leaders, and community based organizations for their cooperation and commitment in favor of IPM.

Farmers' field day is a ceremonial occasion in which participants of the FFS are rewarded with the certificates and prizes for their outstanding performance shown in implementing the IPM FFS throught entire crop season.

A common ceremony of all six FFSs was arranged at TOF venue on 13th Sep 2004. The TOF participants organized themselves in various committees viz. stall management, transport management, food management, hosting**,** reporting, secretarial and stage management committees to run the FFD smoothly.

For the celebration of FFS day, stall decorations and stage programs were arranged. The group's stall display consisted of props, graphs, results of ballot box tests, best AESA reports, banners, posters, IPM slogans, social maps, live artistic specimens as well as cup study results. Farmers and their respective facilitators (Participants of the TOF) demonstrated with very high inspiration of honesty. Materials presented by FFS farmers were excellent and the presentation was highly impressive.

Stall decoration

Following materials were displayed at the stalls:

- à Social maps indicating participants' village map, location of FFS venue, FFS field and other infrastructure.
- à Props-Spider, Lady Bird Beetle, Red ant, Dragon fly, Moth, Larvae, Cauliflower plant, Spider web, woolen weaving in bamboo sieve etc.
- à Graph- Plant height, Plant canopy, Leaf number, Stem girth, no of IPs, no of NEs with synopsis obtained from AESA.
- à Ballot box tests- samples of Ballot box, questions and results (both pre and post-test)
- à Best AESA reports
- à Posters- IPs, NEs, predation, life cycle of different insects, agro-ecosystem, cultivation practice etc.
- à Banners- Related to IPs and NEs.
- à Slogans- Related to IPM, Pesticide use, Crop cultivation practices etc.
- à Live specimens of vegetables and insects and Cup study of different insects.

Farmers' Field Days' Proceeding

After the arrival of participants and other invitees at the training venue at 11:00 AM, FFD ceremony was started. Mr. Guru Raj Banjara, anchor of the program announced the program.

Mr. Krishna Bahadur Thapa, the oldest farmer participants chaired the FFD ceremony. Mr. Surath Babu Aryal, Regional Director of Regional Agriculture Directorate for central region chaired as the chief guest of the program.

Following dignitaries were also requested to chair their respective seats:

- à Mr. Ganesh Kumar K.C.- Coordinator of IPM Programme and Program Director of Plant Protection Directorate, DOA
- à Mr. Diwakar Poudel – Program Director, Marketing Division, DOA
- à Mr. Krishna Chandra Sharma- Program Director, Directorate of Agricultural Extension, DOA
- à Mr. Bhakta Raj Palikhe – Training Coordinator (for the period 11th-13th weeks) and Pesticide Registrar of PPD
- à Ms. Nailini Singh Upadhyaya –Training Coordinator (for the period 1st- 4th weeks)and Chief of RPPL, CR
- à Ms. Nabin Chand Tara Devi Shrestha- Training Coordinator (for the period 5th-10thweeks and last 2 weeks of the training) and Chief of National Plant Quarantine Programme, DOA
- à Mr. Danda Pani Khanal – Chief of DADO, Kavreplanchok district
- à Mr. Ram Ayodhya Mahato- Chief of DADO, Bhaktapur district
- à Mr. Airley Bajir Singh – Chief , Sericulture Section, DOA
- à Ms. Shashi Adhikari – Chief, Post Harvest & Loss Reduction Division, DOA

- ❖ After the above formalities, Harita Shrestha and Rameshwari Shrestha distributed batches.
- ❖ The participants of Uddyamshil IPM FFS -Kopila Thapa, Kalyani Thapa, Sajan Thapa, Angira Thapa, Shriram Thapa, Nirmala Thapa, Maiya Thapa and Bhagawan thapa, presented welcome song to the participants of FFD ceremony.
  The song conveyed the message on:
  We learned IPM
  We welcome all in this FFD
  Make successful this FFD
  The purpose of IPM is nice
  Use botanicals
  Avoid chemical pesticides
  Lets be expert and
  Identify disease and insects
- ❖ Second welcome song was presented by the participants of Minal Chautari IPM FFS - Menaka Dhital, Ganga Badal, Sunita Dhital, Kabita Dhital, Samjhana Dhital and Uma Dhaital
  The song conveyed message on:
  We all present here U are welcome
  Let's welcome IPM
  Welcome to facilitator and those who reached the village
  Lets IPM knowledge be diffused in the village
  Lets IPM bring new knowledge
- ❖ Similarly 3rd IPM welcome song was presented by Taikabu IPM FFS participants- Pratima Shakhakarmi and Santosh Giri.
  Song conveyed the message on:
  Both IPs and NEs live together in the field as members of the ecosystem
  Do not use pesticide haphazardly since IPM knowledge is indispensable for farmers.
  We would like to thank for those who conveyed this knowledge.
  IPM brought significant difference as compared to farmers practice giving higher yield.
- ❖ Mr. Upendra Dahal in his speech thanked all on behalf of the framer participants of all the six FFSs of Bhaktapur and Kavre districts. He was of the view that for the last few years they have been growing off-season vegetables but due to the lack of knowledge they were indiscriminately using pesticides. IPM program helped them to identify IPs and NEs and motivated towards proper use of pesticides. The

training also helped in their personal development. The message of IPM should be disseminated to every village of the country. After the training, they developed practice of regular field monitoring, observation on growth stages of crop and population dynamics of IPs and NEs. At the end, he expressed his gratefulness towards facilitators & management team for providing the opportunity to take part in IPM training.

❖ Mr. Bhakta Raj Palikhe, Training Coordinator, highlighted on the training report and further explained that in 1997 FAO helped HMG/N in launching the IPM through Technical Cooperation Programme. With this assistance, Plant Protection Directorate organized officer's level training of trainers on Integrated Pest Management in rice crop. By the year 2002, 104 officer facilitators, 415-farmer facilitators in 54 districts were prepared. Out of 700 FFS conducted, 20,000 farmers were benefitted so far. He further elaborated that Nepal's commitment in the national and international forum concerned with environmental perspective, programs like IPM have special priority. In the context of WTO membership, Nepalese agriculture sector has special challenge to be competitive enterprise having qualitative and pesticide free products for export. Visualizing the effectiveness of this program, Plant Protection Directorate has been conducting 105 days season long IPM based officer level Training of Facilitators in Vegetable with the technical assistance of FAO and financial support from Royal Norwegian Government under support to National IPM program in Nepal.

Mr. Palikhe elaborating about the training activities explained that there were 64.46% female and 35.54% male farmers in the FFSs. Three FFSs were conducting trial on cauliflower, while other three were engaged in conducting various studies on cauliflower and tomato.

The activities and exercises conducted in the FFSs as reported by Mr. Plaikhe were as followings:

- à Conduction of season long trial for location specific technology, their evaluation, selection and expansion.
- à Capacity development of farmers in crop management decision and on agro-ecosystem analysis.
- à Conduction of activities like capacity development on group organization, decision-making, development of partnership and cooperativeness, leadership development, communication skill, team building exercises.
- à Conduction of problem oriented special topics based on participatory discussion.
- à Study on the life cycle of IPs and NEs, food habit, habitat and detail study of the crop that help the farmers for better crop management. The focal point of learning process has been discovery based.

❖ After the above program, the guests of the ceremony observed the stall of all FFSs.

❖ Further on the presentation on individual FFS reports were done by the participant of the respective FFS groups.

- à Mrs. Pratima Shakhkamai member of Taikabu IPM FFS presented the FFS report. She said IPM training helped her to identify the harmful & useful insects. Farmers became aware of the negative effect of pesticides. Farmers learned the life cycle of insects.
- à Chairman of Uddyamshil IPM FFS in his report said that Farmers became knowledgeable on the principles of IPM. Cauliflower varieties Silver cup 60, Silver cup 65, Ramie, NS-60 and White flash were tested. Silver cup-60, silver cup-65 and NS-60 were found to be early maturing varieties. Ramie and White flash were found to be late maturing varieties. Variety Silver cup-60 performed better in many aspects. In defoliation trial there was no reduction in the yield of cauliflower up to 40% leaf defoliation. In the comparative trial IPM practice was found to be better than farmers practice in all FFS.
- à Chairman of Chamunda IPM FFS Mr. Binod Dahal in his report said trials were conducted in cauliflower, tomato and cucumber. In comparative trial of tomato, farmers practice has performed better than IPM practice mainly because of use of more fungicide spray. In tomato comparative trial variety N-162 performed better. Similarly in cauliflower varietal trial Ramie variety was reported to be the best. In cabbage variety Green coronet was said to be the best from the perspective of yield and pest Management.
- à Chairman of Netra Prakash IPM FFS Mr. Pradip K.C. reported that in the comparative trial of cauliflower, IPM practice has been found better than farmers practice (FP). In cauliflower varietal trial Ramie variety gave better yield. White flash variety did not perform better. In defoliation trial of cauliflower there was no reduction in the yield of cauliflower up to 40% defoliation. Tobacco caterpillar pheromone trap was installed & monitored weekly. After the FFS, farmers became aware

of major diseases of cauliflower and their management. Farmers developed the habit of decision-making based on agro-ecosystem analysis. Farmers became aware of the need for safe and minimum use of pesticides.

- à Menaka Dhital of Milan Chautari IPM FFS presenting the FFS report said that there were 30 participants (29 female and 1 male). Variety Silver cup-60, Silver cup-65 & NS-60 were found to be early maturing varieties. The comparative yield of IPM plot produced better yield than farmer practice in terms of curd weight.

	IPM Plot	**F P Plot**
Minimum curd weight	235 gm	178 gm
Average curd weight	477.5 gm	394 gm
Total production	128.5 kgs	58.5 kgs

- à Ram Prasad Lage of Chhatapukhu IPM FFS in his presentation said Farmers were exposed on the technique of growing vegetable in rainy season. After the FFS, farmers learned about decision-making process based on agro-ecosystem analysis and also the need for protecting natural enemies as well as promoting the group cohesiveness. No significant reduction in yield was found upto 40% defoliation. Cauliflower variety Silver cup-60 and Silver cup-65 was found to be early maturing variety. Similarly, in varietal trial of tomato, NCL-162 and Suraksha were found to be blight tolerant. In cup and zoo studies, life cycle and nature of damage of Cabbage butterfly and Tobacco caterpillar were observed. Pheromone trap for Spodoptera has been set to trap male Tobacco caterpillar moths.

❖ The stage program included various performances made by the FFS groups.

- à Taikabu IPM FFS presented a play disseminating IPM message. The play was performed by Pratima, Bishnu, Manoj, Santosh, Bishal & Gautam. Some actors acted as insect pest & others as natural enemies, Prakash Giri sang a song disseminating IPM message. Then, Malati, Padma, Kanchhi, and Sharmila presented IPM song.
- à Similarly Uddyamshil IPM FFS presented a play about the participation in IPM FFS. Song and dance was presented by Diwakar & Renuka.
- à Netra Prakash IPM FFS presented a drama disseminating the message about the toxicity of pesticide and health hazard. Santa Banjara and Rameshwori Shrestha sang an IPM song. Jamuna Shrestha presented IPM news.
- à Chamunda IPM FFS presented their stage program. Harita, Bhawana, Sarita and Kamala presented a song. Upendra Dahal presented IPM news. Yog Raj Dahal disseminating the message about IPM presented a lecture. The message mainly focussed on safe use of pesticide. Upendra, Harita, Pawan, Sarita and Harigopal presented IPM drama.
- à Milan Chautari IPM FFS presented their stage program. Sunita Dhital presented first IPM news. IPM song was presented by Menuka, Saraswati, Usha & Ganga. Menuka, Kalika & Ganga Badal presented another IPM song.
- à Chhatapukhu IPM FFS presented their stage drama and Ram Prasad Bakhunche, Sumitra Khyaju, Maya Keshari, Machamasi, Sarita Khyaju & Shyam Bala presented IPM song. Puneshwari Machamasi performed a dance. The chairman of the FFS Mr. Shivaram Sukupayo recited a poem.

❖ After the stage program of farmers, Mr. Ganesh Kumar K.C., Coordinator of National IPM Program in his remarks said that the IPM techniques that farmers have learned need to be disseminated extensively. He thanked all who made this program success on behalf of Plant Protection Directorate, FAO & Royal Norwegian Government.

❖ Chief Guest Mr. Surath Babu Aryal distributed certificates to the participants. In his speech after the certificate distribution, he said that farmers are aware of the advantage of Integrated Pest Management. He was of the view that the knowledge gained will be put on practice and disseminated in the village.

❖ Shiva Ram Sukupayo gave the vote of thanks and said IPM training has discouraged farmers to use pesticide. This training helped farmers to recognize insect pests and natural enemies. It will help in improving the traditional way of farming. He thanked all those who made farmers field day success.

At the end of the FFD ceremony, prizes were distributed to those FFS, which performed better in stall and stage presentation.

In stall presentation Uddyamshil IPM FFS, Chhatapukhu IPM FFS and Netraprakash IPM FFS stood first, second and third respectively. Similarly, Taikabu IPM FFS, Chamunda IPM FFS and Milan Chautari IPM FFS received consolation prizes.

Afetr the prize distribution, Chairman of the FFD closed the program saying that in a season long vegetable IPM FFS farmers learned that insect pests and natural enemies co-exist together. The training also helped personality development of participants. Farmers learned that indiscriminate use of pesticides not only kills insect pests but also natural enemies and the balance is disturbed.

2.2.6 Visit and Interaction Program

Observation of TOF Activities by Various Dignitaries

Following guests and dignitaries visited TOF venue and observed the TOF activities undertaken at Boodle of Banepa in Kavre district.

- à Mr. Hakon Hyene, First Secretary of Royal Norwegian Embassy and Mr. Laxman Gautam, Assistant FAO/R visited on 2061/4/17 the TOF.
- à Visit of journalist from the various press media was made on 2061/4/26 and interaction with FFS farmers & TOF participants was organized.
- à Ms. Marit Strand, Economist of Royal Norwegian Embassy and her husband visited the TOF.
- à Care Bangladesh team also visited and observed different IPM activities conducted at TOF site.
- à Mr. Bharat Pd. Upahyaya, Regional Director, Regional Agriculture Directorate of Western Development Region, visited TOF venue and had interaction with the participants.
- à A visit and interaction program at TOF venue was organized for the participants of all 6 FFSs.

Cross Visit of FFS by TOF Participants

A cross visits for the TOF participants was organized to the FFS conducted in Kavre and Bhaktapur districts on 31 July 2004. It provided an opportunity to share the experiences and visualize strengths and weaknesses of the participants of the respective FFSs.

In addition to the above, other recreational activities that refreshed and energized the participants were also organized at different stages of the TOF, which are as follows:

- à Various refreshing excursion program organized during the TOF period on the own initiation of participants without hampering the training program.
- à Farewell and welcome of Coordinators
- à Farewell and welcome of Facilitators
- à Birthday celebrations
- à Games, tournaments and competitions (Badminton, Carom board, Table tennis etc)
- à Picnics
- à Excursion tour
- à Quiz contest
- à Expression on personal feelings and turning point of life.
- à Poem contest
- à Cultural program
- à Special refreshment programs
- à Film show
- à Provisions of Televisions and DVD

2.2.7 Training Evaluation

Pre-Mid-term and Post Tests

Various tests were carried out during the training period, mainly to create and maintain the learning behavior as well as to measure the improvements occurred in participant's level of knowledge on IPM and their performance during the training. These tests were mainly related to the technical aspects and on FFS areas. Tests on disease ecology, insect's habitat & behavior, predators, parasitoids and damage nature, their lifecycles, plant growth, varieties, process of farmers' field schools, facilitation skills, and discovery based

learning and field-based exercises carried out through written and spotting test. Similarly, pre-& post Ballot Box Tests (BBT) were also carried out.

The marks secured by the participants in mid term and post-tests were very encouraging in terms of what the participants achieved and learnt from the course.

The results clearly showed that the level of knowledge and skills of the participants has improved and the training has achieved objective of preparing IPM facilitators of better quality.

Mid-Term Evaluation of Participants

Mid term, evaluation of the participants was conducted on 30 Shrawan, 2061. In this evaluation, both spotting and written tests were conducted. It was observed that the average score obtained by the participants increased from 45.44% (in the pre-test) to 68.02%, with an increment of 49.69% over the pre-test.

Evaluation of the Group

During the training period participant's evaluation was done by the facilitators and training coordinators and were accordingly rewarded with prizes.

The award received by the various sub-groups of the TOF based on the evaluation is as following:

- à Ladybird group was awarded for "Best reporting".
- à Tiger beetle- for " Best hosting and team work",
- à Spider group -for "Best performance on extra curricular activities",
- à Neem group -for" Best performance in zoo and cup study",
- à Trichogramma group-for "Best FFS field performance" and finally,
- à Moth group-for "Best group cohesiveness and teamwork".

Evaluations were also carried out on the field Day for advocacy of IPM & Graduation day and accordingly prizes were distributed to the FFS for best performance at stage and for stall decoration. Similarly, prizes were awarded for group evaluation +certification.

Following criteria were adopted for evaluating the above activities.

- à Quality of sense and feelings on IPM
- à Selection of words
- à Melody
- à Creativity
- à Response from audience

2.2.8 Views about the TOF

Mr. Ganesh Kumar K.C., Chief Training Coordinator, Programme Director of PPD and National Coordinator of IPM Programme, expressed that all the 35 participants were provided with a blank diary and asked to express their views on the training being free, frank and honest, but to surprise not all were found to be frank. Some of the participants acted like diplomats rather than a true IPM technician. Firstly, all of them did not respond to the request, and who ever responded they were too polite, where as a few were too rough, careless and ungrateful to what the management team did to make the program a success and to provide the maximum facilities to the participants so that they could learn more in the given condition & situation, with given resources, dedication, and understanding.

Participants' Views based on Individual Training Evaluation

A total of 23 participants responded on the queries. Following are the views expressed by the participants on various aspects of the Training :

Course content and Duration: 35% participants responded that course content was good but rest of the 65% expressed that the sessions on viral disease, post harvest, botanical pesticides and case studies were insufficient. Likewise, insufficient number of special topics, exclusion of field based exercises on nursery management & the initial preparatory activities from the TOF were other aspect of the dissatisfaction

All 23 participants expressed sufficient time and duration for TOF.

Facilitation: Out of 23 respondents, 15 participants' expressed excellent learning facilitation, 7 good and one satisfactory.

Management: Out of total respondents 60% expressed that training management was good, but 40% reported that vehicles management was poor. As expressed by the participants, proper selection of effective experts to deliver special topics, timely delivery of handouts and study materials were the lacking found in the training management.

Weaknesses: All the 23 respondents had responded that poor experts on some of the special topics, insufficient teaching aids, lack of long excursion tour, trend of FFD evaluation, mixed seeds of cauliflower varietes made available for the field trials, inadequate number of case studies, lack of color book for identification of insects and disease were some of the weak areas of the training.

Improvements to be made: Participants' suggested that some improvements need to be done in the similar type of training in future. The suggestions were: Provision of vacation in training period should be made. Similarly, training should be started from PRA and experienced resource persons for special topic should be arranged. Likewise, the participants also suggested that computer facility for the participants be made available, sufficient number of case studies should be carried out, well conditioned multimedia projectors should be managed, simple meteorological instruments should be kept in TOF site and sufficient sessions on bio-pesticides should be conducted.

Views of Chief facilitator

Mr. Madhusudan Poudel, the chief facilitator of the training expressed following views on the training:

- à Participants were from various faculties and from various geographic locations.
- à New Master IPM facilitators prepared from this TOF.
- à New training coordinators prepared from this TOF.
- à New concept about science by farmers was practically adopted.
- à Special topics were conducted not only on the technical topics rather it also included the topics related to social aspects, M&E, and sustainability of the IPM programme, WTO, SPS/IPPC etc
- à Various new predators and parasitoids were identified and reared.
- à Commercially available and naturally occurring microbial and biological tools were identified, used and practiced.
- à The trials on tomato and cauliflower became more or less successful even during a peak rainy and off-season period.
- à Number of facilitators were high i.e. 14 as compared to previous TOFs.
- à About 50% participants possessed unique interests, perceptions and were equipped with long field experiences.
- à The inputs and stationaries made available were sufficient. Similarly, the study materials were also supplied adequately.
- à The project coordinator and his new management group was found very enthusiastic and supported on every steps of TOF with a clear vision.
- à Special and careful attention need to be given during the PRA, so that reliable information as near as possible to the adopted farmers' practice could be obtained and accordingly used while designing the studies. In future TOF, while conducting the PRA, attention should be made on that the information about the farmers practice could be collected in time so that necessary preparation could also be made timely.
- à Assurance and arrangement of quality seed management should be important aspect.
- à In the TOF, provisions of master facilitators should be adequatetly made so that changes of facilitators every month could be minimized. Similarly, changing of training coordinators should not be done in similar type of TOF in future.
- à Some of the facilitators' behavior was of argumentative nature that always tried to prove them as very talent and made critics of other team members. Therefore, attention need to be given by the concerned training coordinator to discourage such behavior.
- à As a permanent facilitator, I prepared the weekly plan and discussed with the facilitators team members, assigned them job to be completed on that week.

3. Overall Training Achievements, Shortcomings and Recommendations

3.1 Achievements

- à Thirty-five Officers from various faculties of DOA NARC and NGOs prepared as Master IPM Facilitators to undertake the responsibility of promoting the IPM and facilitating the farmers on ecological based crop production.
- à With the efforts of TOF, additional 166 (59 male, 107 female) farmers were graduated from season long IPM training through six FFSs conducted in Kavre and Bhaktapur districts.
- à Six additional FFSs were established as village level organizations for the cause of farmers' welfare.
- à Experiences and skill of the new and existing Master facilitators enriched through TOF to facilitate similar trainings in future.
- à A pool of Training Coordinators created through TOF to plan and implement various TOFs in future.

3.2 Shortcomings

- à Low soil PH in the selected sites and infestation of Red ants in cauliflower constrained in better outcome from the IPM trials and studies. As a last resort, application of various micronutrients and chemical pesticide had to be applied.
- à Some problems were aroused due to mixing and probably mutation in the cauliflower variety in two FFS and therefore the expected results from the trials and studies could not be achieved.
- à In some of the Farmers Field Schools crop was heavily affected by wire stem caused mainly due to root damage by white grub followed by poor drainage system. This also affected in achieving better results from the IPM trials and studies.
- à Difficulties were faced in smooth implementation of the training due to the lack of conditioned computer facility and disruption in regular supply of power.
- à Vehicles were not sufficient and easily available to carry out the field activities.
- à The selection of resource person's and their deliberations on "special topics" was not very fruitful, and effective.

3.3 Recommendations

- à In the TOFs to be conducted in future, special care and attention should be paid in conducting the PRA, so that true and real information about the farmers' practice could be gathered.
- à Use of best practices developed and adopted by the farmers from long time could not be adopted as IPM practice, therefore this must be included as part of the experiential learning cycle.
- à Arrangement of quality seed from the reliable source should be given priority in future TOFs.
- à Proper attention should be given while selecting the resource persons for Special Topics in the TOFs.
- à In the TOFs, provisions of master facilitators should be adequatetly made so that changes of facilitators every month could be minimized. Similarly, changing of training coordinators should be avoided to the possible extent in similar type of TOF in future.
- à For the daily reporting, provision of adequate computers along with support staff should be made compulsorily so that the documentation could be done timely and properly. While preparing the initial, mid term and final reports, involvement of IPM facilitators is desirable.