Report of the

The Integrated Pest Management in Rice Training of Trainers and Farmers' Field School

FTC, Dhanusa District, Nepal
June 27 – October 15, 1999

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The activity was funded by the Government of Norway
as part of FAO project GCP/RAS/172/NOR

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1. INTRODUCTION

Nepal's agricultural production is characterized by diversity in farming systems influenced by differences in agro-ecological topography. Farming systems and crops vary widely depending upon altitude and climatic conditions. The agricultural sector contributed 40.22% to the Gross Domestic Product (GDP) in 1995/96 (CBS, 1996). A large majority of households depend upon agriculture and allied activities such as livestock rearing and forest product collection. As the agriculture sector is the key sector of the economy, determining economic growth and employment, the standard of living of the population depend on its development. Despite investment in irrigation and agricultural development projects, agriculture production is still largely determined by favorable weather condition.

Rice is the most important cereal crops in Nepal. It grows from altitude of 75 meters to the height of 3050 meters. Of the total cultivated land, rice covers 59% of the area. Its contribution to the nation Gross Domestic Product (GDP) is 25%. Seventy-nine (79) percent of rice is grown in rainfed condition, of which 70% is in lowland and 9% in the mid-hills. According to season of cultivation, rice can be grouped in 3 types: Chaite rice, Bhadaiya rice and normal season rice.

Other than rice, wheat and maize are the major crops of Nepal. Farming systems and crop production in Nepal vary across the agro-ecological zones. Physically, the country is divided into four ecological strata: the southern *terai* plain; the southern mountain ranges; the central hill complex and the northern great Himalayas. Rice-based cropping systems, with wheat or maize as secondary crop, are predominant in the terai and mid-hills, whereas in the high mountain maize, millet, barley and buckwheat are cultivated.

2. DESCRIPTION OF THE TRAINING OF TRAINERS (TOT) COURSE

2.1 Overview

This second edition of season-long IPM TOT as part of His Majesty's' Government of Nepal thrust to develop a sustainable program for food security based on an ecological approach. As part of the Nepal component of GCP/RAS/172/NOR, the season-long IPM training once again brought together for the first time, extension officers, NGOs and INGOs as well as communities in conducting agriculture research and training.

2.2 Training Objectives

It was aimed at training 35 field workers from NGOs, INGOs and HMGs extension and crop protection officers from the regional and district level. The training was conducted over a period of one cropping season to be able to produce a second core of IPM trainers that will enable the Department of Agriculture to conduct farmers field schools throughout the rice growing areas of Nepal.

Besides training 35 field workers from NGOs, INGOs and HMGs extension and crop protection officers over a period of one cropping season, the TOT was specifically aimed at:

- improving the training capability and facilitating skills of the participants to become more able to facilitate IPM technology and process to the farmers;
- assisting farmers in developing the ability of making critical and informed decisions that render production system for rice and other crops more productive, profitable and sustainable;
- revitalization of existing farmers organization; and
- bringing together field staff from national/local government units, NGOs, INGOs and communities in a learning relationship which results in the development and application of IPM skills among farmers.

2.3 Venue of the TOT

For the second batch of season-long IPM-TOT, the National IPM Program of Nepal chose the Fisheries Training Center (FTC) in Janakpur, Dhanusa District. FTC was the logical choice because it offers all the facilities needed for a season-long training. The FTC is only one kilometer away from one of the religious Mecca of *terai*, the town of Janakpurdham.

2.4 Duration of the TOT

The TOT officially started on June 27 until October 15 1999. During the TOT most participants are up and about at 6:00 to take breakfast. The daily session formally starts from 7:00 o'clock in the morning with a one hour thirty minutes noon break and usually ended up to 5:00 o'clock in the afternoon.

2.5 The TOT Participants

The selection and arrangements with agencies related to participants was the responsibility of the Chief of the Plant Protection Division (PPD). List of participants is provided in ***Annexation 1.***

2.6 Organizational Affiliation of the TOT Participants

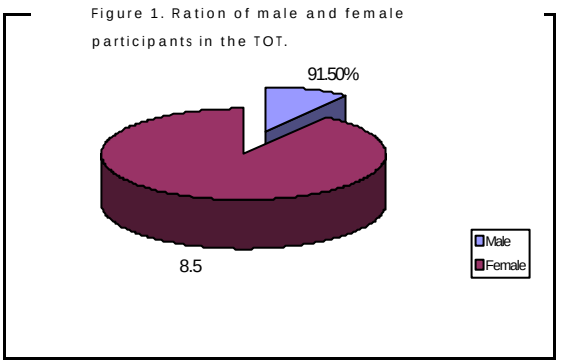
Table 1. Organizational Affiliation of the TOT Participants

Organizational Affiliation	No. of Participants
District Agriculture Development Office (DADO)	24
National Agriculture Research Center (NARC)	1
World Education (WE-Nepal)	6
CARE-Nepal	2
Total	35

2.7 Gender Composition of the TOT Participants

Table 2. Gender Composition of the TOT Participants

Participants	Number	Percentage
Male	32	91.5%
Female	3	8.5
Total	35	100%



2.8 TOT Facilitators and Organizational Structure

Also please see ***Annexation2*** for more details.

2.9 Core IPM TOT Facilitators

1. Bhanu Bakta Mainali- Assistant Plant Protection Officer/Master IPM Trainer
2. Shiva Rijal- Assistant Plant Protection Officer
3. Ratna Kumar Jha - Assistant Plant Protection Officer
4. Ram Chandra Yadav - Assistant Plant Protection Officer
5. Sharad Chandra Parasar - Assistant Plant Protection Officer
6. Homendra Gurumaita - Assistant Plant Protection Officer

2.10 International IPM Specialists

1. Soehardi - Rice IPM Specialists/Indonesia
2. Cesar Galvan – National IPM Expert/Philippines
3. Dr. Henk vanden Berg- IPM Officer for South Asia
4. Dr. Douglas Russel Dilts – Regional Program Coordinator/FAO Program for Community IPM in Asia

Except for Mr. Soehardi who stayed for one crop season to provide guidance and support, other experts provided technical assistance to the training in relation to developing capacity and capability of the TOT participants. Introduced new training approaches and enhances the understanding of the processes and techniques involve in non-formal education approach to training that can be used in the implementation of the program.

2.11 Management of TOT

Committees were formed to enhance Management of the Training. Also please see ***Annexation 11.***

Chief of which was to transfer management of IPM training to local trainers and to make sure of an effective monitoring and backstopping systems including trainees reporting and quick response to requests of trainers and trainees.

Among the management aspect of the training that was handled to the trainers were:

- Oversees day-to-day activities in consultation with the different sectoral/area or group coordinators;
- Presides over management meetings, including facilitation of problem-solving sessions and decision-making/planning activities;
- Ensures the conduct of or submission of process documentation on a regular and timely basis (e.g., trainers' training process and FFS sessions);
- Regularly updates office of National IPM Program regarding the on-going TOT activities; and
- Ensures that FFS selected had conform to proposed criteria;
- Design and suggest monitoring forms for the different field studies in the FFS;
- Lists materials needed for each session based on regular management meetings;
- Designs and provides suggestions on trials for TOT;
- Maintain a Field Trial Book with trials procedures, implementing dates, and field layouts;
- Maintain a calendar of activities for all trials and ensures that they are implemented strictly as planned; and
- Looks into training-related individual/personal needs of participants, including health concerns.

2.12 Activities in the TOT

2.11.1 Basic Field Studies conducted in the TOT and FFS

Importance:

These basic field studies are integral part of the IPM-TOT and FFS training designed to respond to pressing problems of farmers in their own localities. These studies form the basis for developing farmer's management capabilities and on greater scale, they also served as basis of recommendation for rice culture using IPM methods.

In this case the field studies follows the four basic IPM principles that includes:

- Growing a healthy crop;
- Understanding the agro-ecosystem and observation of natural enemies;
- Regular or weekly field observation; and
- Farmers becoming experts in their own fields.

These studies help to understand the meaning and origin of these principles and help understand what now must do to implement these principles. The field study topics includes:

1. Growing a healthy crop:
- Yield and pest response to nitrogen dosage.
- Varietal monitoring
- Different Weeding Methods
2. Understanding the agro-ecosystem and conserving natural enemies:
- Insect Zoo (Predation Study)
- Comparison of With Compost and Without Compost Rice Ecosystem
3. Regular or weekly field observation:
- Simulation of Defoliation Study (Leaf Cutting)
- Stemborer Simulation Study (Tiller Cutting)
- Pegging Trials
4. Farmers becoming experts in their own fields:
- Comparative Study of Farmers Practice and IPM Methods

2.11.2 Training Methods, Approaches and Management Concepts

To be able to provide quality IPM training, the following strategies and methods was employed by the IPM facilitators to ensure smooth and pleasant administration of the training.

2.11.3 Team/Group Processes Designed to Facilitate Team Building and Group Dynamics Activities Used in the Season-Long TOT.

- *Team Building Activities* among trainees was considered an important feature of the IPM training process. It encourages interactions that help develop leaders, promote co-operation, wholesome relationship, industry

and co-operative planning. Through all these, decision-making skills and value re-orientation are enhanced in the participants.

- *Brainstorming Activities* was commonly used to allow the participants to open -up their minds to a practical solution to problems. Its strength lies on the ability of the facilitator to gather ideas or reactions from the group with speed.
- *Small and Big Group Discussions* was a standard because it facilitates the exchanges of ideas and opinions on any given activity or topics to be discussed with the end view of arriving at a conclusion or a solution. It could be among the participants themselves during small group discussion or between facilitator and participants as in big group discussion.
- *Role-Plays* are being employed because it gives an opportunity for participants to put themselves on another person's shoes or imitate the insects in the order to show how they view things. Usually role-plays are structured where the facilitator selects both the situation and the roles to be enacted by the role players.

2.11.4 Conduct of Weekly Agro-ecosystem Analysis (AeSA)

The regular conduct of agro-ecosystem analysis (AeSA) was the core activity in the TOT and FFS site. The conduct of weekly AeSA generally facilitated the participants understanding of the inter-dependent relationship among the components of the ecosystem as well as in honing their skills in analyzing the condition of the field. This activity also accustomed the trainees to a key IPM principle: "monitor fields weekly". Field monitoring in small learning teams' result in the development and translation of an agro-ecosystem drawing that is used for analysis.

2.11.5 Sampling and monitoring of the result of other season-long field studies.

The introduction of season-long field studies on yield and pest response to different fertilizer rates, simulation of defoliation and stemborer damage, varietal performance monitoring. These studies sought to demonstrate to the farmers that they can conduct basic experiments to solve their immediate problems especially for those group of farmers who came from in-accessible communities and literally with-out access to this kind of activities.

2.11.6 Special topics and Field exercises

Special topics are prepared by the facilitators depending upon the needs of the participants and according to its importance. The same special topics maybe discuss during the FFS as the need arises. Special topics might concern on particular issues such as a set of damage or they maybe involve in field studies being carried out. In the field school, special topics may vary from schools to school as reflected by the individual FFS need. Some special topics a re planned ahead of the training while other are developed as the training progresses. For the list of special topics given to the participants, please see ***Annexation 4.***

2.11.7 Insect Zoo and Cup Studies

Rearing insect inside a makeshift rearing house, otherwise known in FFS as *insect zoo* or in plastic cups and empty bottle of mineral water enables the participants to verify what was discussed in the special topic. Insect zoo facilitate participant's understanding and help them to learn more about the life cycle of different insects as well as the dynamics between various pests and predators by direct observation and manipulation. TOT participants used them to demonstrate to FFS participants the feeding habit of most insect pests, their gradual development and predator's hunting abilities.

2.11.8 Group dynamics

Team Building and Group dynamics activities are considered important feature of the IPM training process. Specific exercises encourage interactions, which helps in developing leaders, promote cooperation and good relationship. Through team building and group dynamics activities, decision-making skills and value reorientation are enhanced and inculcated to the participants.

2.11.9 Case study and field visit

During the TOT, the participants managed to visit other areas for conducting case studies and orientation. Having problem with mineral deficiency in the TOT site, the TOT participants conducted field studies in the outskirts of Dhanusa District to learn about the effect of *zinc* deficiency and observe how farmers solved these problems. The participants are also able to learn about mealy bugs *(Brevenia rehi)* and observed damage caused by caseworms (*Nymphulla depunctalis*) both relatively minor pests that also causes minimal damage to rice plant. In one occasion, the TOT visited the Hetauda in Makawanpur District to conduct case study about gall midge (*Orseolia oryzae*). This pest which is becoming important pest in the terai was not observed in the TOT site. The group also went to Bhanauli, Mohattori District to conduct case study on bacterial leaf blight (*Xanthomonas sp.*). The objective of which was to learn to recognize symptoms of the disease. In Jhapa, the TOT visited the conduct of FFS field and graduation day. This enables the participants to learn about the conduct of field and graduation day that will be implemented in the TOT and FFS sites in Mahottari and Dhanusa Districts.

2.11.10 Field visit by FFS participants

During the course of the season-long TOT, more than 200 FFS participants from the different FFS sites in Dhanusa and Mahottari Districts visited the TOT site to learn about the activities being conducted by the TOT participants as well as exchanged views about the result of the field studies. FFS participants were also invited to witness classroom sessions of the TOT and once again in sharing of ideas and experiences. These activities enhanced the value of the training being received by the farmers and enhance their total awareness of the objective of the IPM program.

2.11.11 IPM Advocacy

As part of the advocacy and awareness campaign in the IPM training, the TOT through the initiative of the Plant Protection Division (PPD/DOA) invited both national and local government officials to observe the conduct of TOT and FFS. These activities enhanced the awareness to IPM among local government officials and improved relationship and understanding about the program by the national government officials.

One of the most important officials who visited the TOT was the Minister of Agriculture, Hon. Minister Chakra Bastola and his deputies: Secretary of Agriculture and Mr. Surat Babu Aryal, Deputy Director General of Department of Agriculture. Mr. Winston Rudder, FAO Representative for Nepal who was also very supportive of the program visited the site.

Since its opening program on June 24 until the closing on October 13, the TOT received the following visitor whom in one way or another lifted the spirits of the participants and helps create better understanding of the program. The following are the personalities who visited the TOT site: Mr. Shiva-nanda Yadav, Chief of Fisheries Trai-ning Center (FTC), Janakpur; Mr. Kausal Dev Joshi, Chief District Offi-cer of Dhanusa. Dr. Henk Van Den Berg, Deputy Co-ordinator for South Asia along with John Silverstone and Helen Sherpa of World Education-Nepal twice visited the site. Hiedi Evelyn Heggen and Anne Gro Syverstad, graduate students from Norway also visited the site to learn from the experiences of the TOT participants. Mr. Saroj Adhikari, Asst. Evaluation Officer/DOA; Mr. Dor Bajadur Rayamajhi, Asst. Planning Officer/DOA; Mr. Thapa, Regional Director for Central Development Region-Nepal; Dr. Douglas Russel Dilts, Regional Program Coordinator of the FAO Program for Community IPM in Asia. Some of the members of the pesticide dealers association of Dhanusa also visited the TOT site to know more about IPM.

2.11.12 Conduct of Field and Graduation Days

Field days are aimed at providing the IPM training participants an opportunity through which they could effectively showcase the gains from participating in the season-long training. It also provides trainees with another “hands-on” experience on community-based activity planning, preparation and actual execution of programs.

2.11.13 Management of Field and Graduation Day

The design, actual implementation and management of field day are left to the TOT participants with very minimum supervision of the facilitators. This was after input on how to run a field day was given and brainstorming has been conducted.

A typical field day and has three parts, these are tours of the field site, viewing and the exhibits and the program proper.

During the tour of the field site, training participants who were assigned at different trials answered question and discuss to the visitors the result of their studies as well as the newly acquired knowledge about new farming system that is IPM. After the field tour the visitors viewed the exhibits that includes among other things the props made by the FFS participants during their field and graduation days as well as TOT participant's outputs. Mr. Ratna Kumar Jha explained the outcome of the weekly agro-ecosystem analysis, participatory action research, result of insect zoo, posters designed to entertain as well as educated the expectator and many others.

On the other hand, the program proper was highlighted by the display of ability of the participants to spread IPM messages through the use of folk media (e.g. drama, song and dances) which is famous in the locality. The field and graduation day, which was held at the FTC grounds in Janakpur, was very lucky to have Minister Chakra Bastola, the Secretary of Agriculture, Deputy Director General of the Department of Agriculture and Hon. W. Rudder FAO Representative to the Kingdom of Nepal as guest of honors.

3. RESULTS OF THE TRAINING OF TRAINERS

Please see ***Annexation 4*** for details of the daily and weekly activities in the TOT.

3.1 General result

In this TOT, the National IPM Program-Nepal enable to correct some unintentional lapses of the first TOT by introducing additional field trials in weed management, pegging and comparison of with compost and without compost rice ecosystem. The management also introduces additional field exercises to better understand the function of natural enemies and decomposers. Habitat studies (berlise, seedbed, malaise and pitfall traps) were introduced to enhance discovery-based learning.

The TOT tried to improved facilitation skill of both IPM facilitators and participants by introducing more meaningful group dynamics activities exposing them to other places where they conducted case studies and field observation of pest that was not available in the TOT and FFS sites.

3.2 Result of Field Trials to Compare Farmers' Practice and IPM

Importance:

This study was designed to compare IPM methods with local farmers' practices or conventional methods. There are two (2) treatments, which was prepared on large plots (at 2 blocks of fields) and compared. In many FFS, farmers and trainers will change "Farmer Practice" during the season as they learn more about the ecosystem and realize much that less pesticide or fertilizer are necessary compared to that previously used. It is therefore very important to set "Farmer Practice" beforehand and to implement it based on the usual practices.

Methodology:

1. The rice variety that was used was Radha-32.
2. Aside from the amount of fertilizer and timing of application, each treatment used the same agronomic practices.
3. Samples were taken weekly at all ten pegged plants. The number of insects, disease or any other damage was record as well as deadhearts and whiteheads.
4. At the end of the season, yield was measured from a 2 X 5 block.

Result of the Study:

INFORMATION OF IPM v/s FP PLOT

IPM Methods	Farmers' Crop Protection Practice
Variety - Radha - 32.	Variety - Radha - 32.
Seeding date - May 31, 1999.	Seeding date - May 31, 1999.
Transplanting date - July 5, 1999.	Transplanting date - July 5, 1999.
Fertilizer (N, P, K) @ 100:30:30 *Basal:* Urea @ 62 kg/ha DAP @ 66 kg/ha Phosphorus @ 50kg/ha Top dressing: Urea @ 66 kg/ha 1) @ 21 DAT 2) @ 40 DAT	Fertilizer: Urea @ 150 kg/ha DAP @ 90 kg/ha 1) Urea @ 75 kg/ha (basal) 2) DAP @ 90 kg/ha (basal) 3) Urea @ 75 kg/ha (top dressing @ 50 DAT) Pesticide: Butachlor: 10 kg/ha (basal) Thimet: 15 kg/ha Malathion: 1) before flowering @ 15 kg/ha 2) After flowering @ 15 kg/ha
Weeding 1) at 21 DAT 2) at 40 DAT	Weeding: @ 50DAT

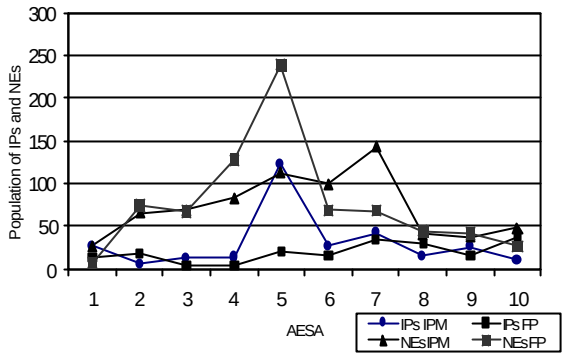
Table 3. Summary of the result of the weekly AeSA conducted in IPM and Farmers' Practice plots at the TOT site.

AeSA #	Pest		Natural Enemies		Decomposer		Total	
	IPM	FP	IPM	FP	IPM	FP	IPM	FP
1	26	13	27	7	83	45	136	65
2	5	17	65	74	14	5	84	98
3	12	3	69	67	0	0	81	70
4	13	3	83	128	1	3	97	134
5	123	20	112	239	4	9	150	265
6	26	15	99	69	1	15	126	100
7	42	34	143	68	91	36	276	135
8	15	29	41	44	27	42	83	115
9	25	15	37	41	18	10	80	66
10	10	37	47	26	38	9	95	72

Table 4. Plant height and number of tiller of IPM v/s Farmers' Practice plots in TOT site.

AeSA	Plant height (cm.)		Number of tillers/hill	
	IPM	FP	IPM	FP
1	41.32	44.98	3	3
2	42.9	45.35	5	4
3	46.26	49.85	12	10
4	52.26	53.54	16	14
5	56.88	58.71	19	18
6	67.53	70	22	19
7	82.34	82.53	21	18
8	95.58	97.28	20	18
9	100.11	100.83	15	14
10	100.66	101.08	15	14

Figure 2. Population densities of Ipests and natural enemies in IPM and Farmers' Practice plots in TOT site.



In terms of plant height, both IPM and Farmers Practice have almost identical height but since the plant spacing (20 X 20) is relatively wider in IPM plot, the number of tiller is higher than that of the farmers' practice. For other details please see ***Annexation 3.***

Figure 3. Average plant height in IPM vs Farmers' P ractice plots in TOT site.

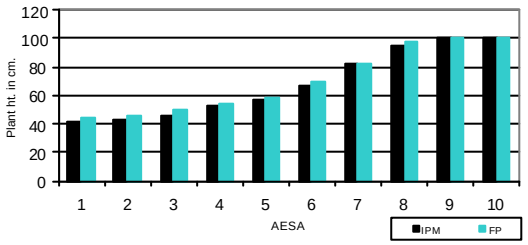
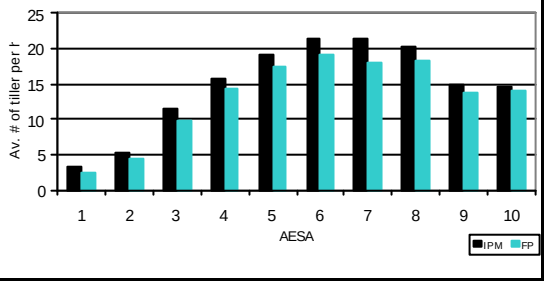


Figure 4. Average number of tiller per hill in IPM vs Farmers' Practice plots in TOT site.



3.3 Results of Other Field Trials

New field trials were introduced in the TOT site. These trials were conducted with the goal of further enhancing the understanding of participants of the dynamics of ecology. The following are the new studies that were introduced:

3.3.1 Weed Management Trial

Importance:

Growing a healthy crop requires that farmers use appropriate varieties with good seed quality, correctly establish and irrigate the crop, provide adequate nutrition through proper soil fertility and manage the weeds through locally appropriate combinations of cultural practices. However, weed problems cannot be solved by general crop management practices alone. There is a need for the development of integrated weed management systems

combining a variety of control measures, that are economically and sustainable. Rather than trying to eradicate weeds from the field, emphasis should be given on the management of weed populations. The development of integrated weed systems requires insight of the behavior of weeds in agro-ecosystems and understanding of the factors that control weed population sizes.

Methodology:

1. Treatments are as follows:
   T1 At 30 and 60 DAT conduct handweeding (two hands)
   T2 At 60 DAT - Conduct hand weeding (one hand)
   T3 Farmers Practice – 10 kilogram of butachlor /hectare
   T4 Use of recommended chemicals (butachlor @ 20 kg/ha)
   T5 Control (no weeding/spraying will be done)
2. Use IPM agronomic practices *except weeding*
3. Sampling for each treatment. Sample weekly for each treatment, count the number of tillers, record plant height, disease intensity, insect pest and natural enemy density. At the end of the season measure the yield.

Result

Information:
Variety: Radha-32
Date of seeding: May 31. 1999
Date of transplanting: July 4, 1999
Fertilizer applied: 100-30-30 NPK kg/ha

Table 5. Average plant height and number of tiller of weed management trial in TOT site.

Week	Plant Height (Average in cm.)					Number of Tillers (Average)				
	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
1	44.2	44.93	43.13	41	42.07	3.4	2.73	2.93	2.8	2.8
2	47.2	46.66	45.53	43.93	44.46	5.6	4.53	4.66	4.73	4.46
3	49.13	50.2	49.93	49.2	48.6	12.53	11.8	11.93	12.13	12.4
4	54.1	56.1	56.2	53.6	54	14.6	16	16.7	16.8	16.4
5	58.7	56.3	59.2	57.9	58.13	16	17	16.9	17.1	18.6
6	66.4	69.3	70	68.7	70.6	16	17.5	17.7	16.9	18.5
7	85.53	77.2	83.66	80.66	80.66	13.66	12.86	14.46	13.73	14.2
8	97.9	100.8	99	100.5	100.1	17.4	16.7	17.2	16.3	17.1
9	100.13	101.63	103.7	101.6	103.93	13.5	14.33	13.6	13.5	14.53
10	99.47	100.2	104.47	102.2	103.8	13.3	14.1	13.5	13.9	14.5

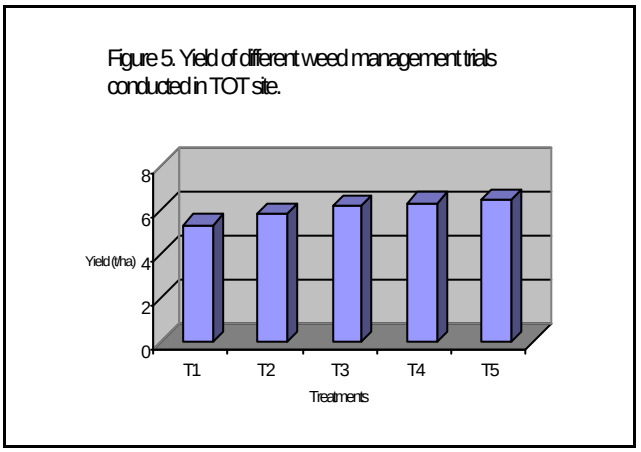
Table 6. Population density of pests and natural enemies of weed management trials at TOT site.

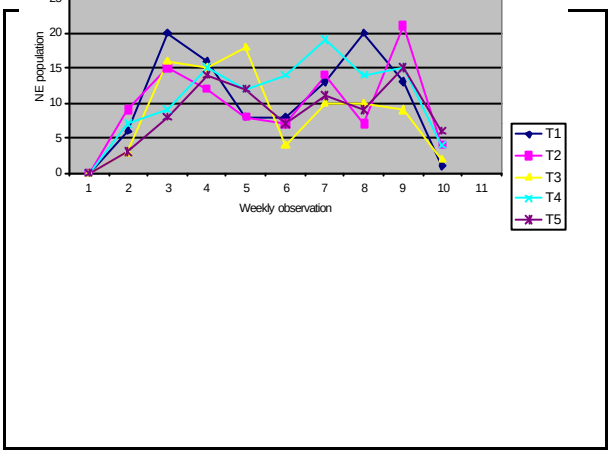
	Pest Population Density					Natural Enemy Population Density				
AeSA	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
1	3	1	1	1	1	6	9	3	7	3
2	1	4	4	2	6	20	15	16	9	8
3	4	4	3	2	3	16	12	15	15	14
4	4	5	2	0	2	8	8	18	12	12
5	2	1	0	5	3	8	7	4	14	7
6	8	2	10	9	5	13	14	10	19	11
7	2	4	3	6	2	20	7	10	14	9
8	9	5	5	4	6	13	21	9	15	15
9	11	5	4	41	7	1	4	2	4	6
Total	44	31	32	70	35	105	97	87	109	85

Discussion:

Apparently, treatments 3, 4 and 5 have the best management/method the farmers have the right benefit from an informed decision.

Figure 6. Population of natural enemies in weed management trials in TOT site.





3.3.2. Study of population dynamics of insects (pests, natural enemies and decomposers) in different sample detection methods

Justification of the study:

Pegging is by far the simplest and easiest way of detecting the samples, however the presence of many unknown insects and other species resting on the pegs, seemed to have influenced higher population of insects in pegged hills than others. So it was just practical to verify the sample detection method.

Methodology:

Treatments:

- Usual pegging
- Use of Aluminum tags
- Use of Ribbon tags
- Locating

Replication: 3

Plot size: 1 M^2 for each treatment.

Use the already transplanted plot near by basic field study trials.

Result and Discussion:

The observation table presents the number of insects observed in different treatments.

Table 7. Population density of insects found in the different sample detection methods.

Treatments	First Observation				Second Observation				Third Observation				Fourth Observation				Fifth Observation			
	R1	R2	R3	Ave.	R1	R2	R3	Ave.	R1	R2	R3	Avg.	R1	R2	R3	Avg.	R1	R2	R3	Avg.
1. Bamboo peg	14	16	10	13.33	11	14	19	14.67	8	11	3	7.33	23	13	8	14.67	4	1	2	2.33
2. Aluminum tag	3	2	2	2.333	16	5	7	9.33	4	5	9	6	13	9	5	9	5	1	2	2.66
3. Ribbon tag	2	6	4	4	6	9	4	6.33	5	7	10	7.33	7	6	7	6.66	4	4	2	3.33
4. Locating	7	4	4	5	2	4	3	3	7	9	8	8	11	11	9	10.33	5	4	2	3.66

Please see ***Annexation 14*** for other details of the study.

3.3.3. Study of population dynamics of insects and other natural enemies and decomposers with compost *and* without compost *environment.*

Justification of the study:

It has been reported that majority of the aquatic insects parasitising the eggs of other insect pest. This makes them very important natural enemies of the insect pest. If compost increases the number of water insects, it will be better to recommend the application of compost to manage the insect pest.

Methodology:

Variety: Masuli

Plot size: 2x2 M^2

Treatments:

- Composting @25 MT/ha.
- Non-composting.
- Fertilizers: 50:30:30 kg NPK/ha in both the treatments.

Result:

Table 8. Population dynamics of insects in Without Compost and With Compost trials conducted at TOT site.

Particulars	W/Out Compost				W/ Compost			
	No. of Observations			Total	No. of Observations			Total
	1	2	3		1	2	3	
Culicids	13	0	1	14	40	0	0	40
Maggot/Grub	1	0	0	1	1	3	15	19
Water boatman	0	2	0	2	0	7	0	7
May flies	0	3	0	3	0	0	0	0
Snail	0	2	6	8	0	3	3	6
Flies	0	0	2	2	0	1	0	1
Spider	0	0	0	0	0	0	1	1
Water beetle	0	0	0	0	0	0	1	1
Chironomids	0	0	0	0	0	0	2	2
Other decomposers	0	2	12	14	0	175	3	178
Total	14	9	21	44	41	189	25	255

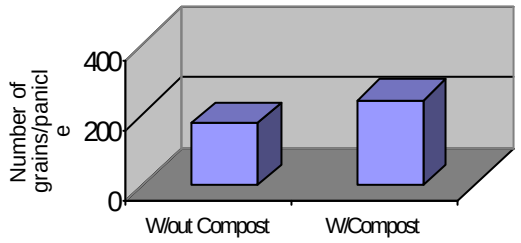
Table 9. Some important parameters observed:

Parameters used in data collection	W/out Compost	W/Compost
Average plant height in centimeters	93.0	110.8
Average No. of tillers/hill	11	13
Panicle length in centimeters	22	22.91
Average grains/panicle	175.7	240.5

Discussion:

The use of compost enhances the population of decom-posers. Good positive effect on survival of natural enemies. The population of decom-posers and neutrals was higher at early stage and while the population of predators (water beetle, spider, grubs and others) was higher at later stage. The presence of natural enemies in the aquarium resulted in lower population of water organism in composted sample in the third observation, so the role of natural enemies is very important. The plant height and number of tillers are higher in composted plot as compared to the non-composted plot. This is presented in Table 5. The last important is, no insect pest found in aquatic condition.

Figure 7. Average number of grains per panicle in w/compost and w/out compost plots



Conclusion:

Aquatic insects are important because they serve as decomposers and as food for the natural enemies. Some of these aquatic insects are also very important natural enemies of major pests in rice ecosystem. The use of compost increases the number of aquatic insects, it will be better to recommend the application of compost as it also increases the yield.

Please see ***Annexation 15*** for more details.

4. THE FFS IN DHANUSA AND MAHOTTARI DISTRICTS

4.1 Context of the Farmers' Field School

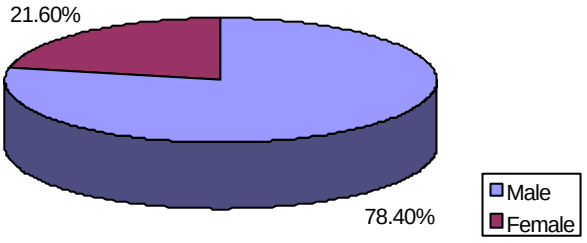
The weekly field school conducted in twelve areas by the TOT participants in parallel to the TOT. The participants conducted a total of 16 (including 2 weekly preparatory sessions) weekly FFS sessions. Please see ***Annexation 5*** *for* the name of individual FFS. As usual, the FFS followed a consistent design and structure. It started the session with recapitulation, of last weeks activities, field work (AeSA), processing, group dynamics, and a timely special topic that helped reinforce fieldwork observation results.

4.2 Farmers' Field School (FFS): A Brief Description

The primary objective of the farmers' field school is to train farmers to master and apply IPM field ecology management skill and ultimately become IPM expert in their own field. The farmer field school brings farmers together in carrying out extensive training on methods and issues over the growth stages of the rice plants.

In the FFS, the facilitator utilizes the experiential and discovery based learning process that means analyzing the problem in the field as they occur in the field. Each week, the farmers conduct their own "agro-ecosystem analysis" or AeSA which include observation of the over all plant health and development, the population density of pests and natural enemies (predators and parasites). In conducting AeSA, farmers also take into consideration the current weather condition, water and nutrient management, weed density and disease surveillance. This helped the farmers to make their own interpretation of the condition of the field and thus allow them to develop self confidence and a vision of balanced ecological processes which in turn helped them in making sound and informed management decisions.

Figure 8. Percentage of male and female participants among the 12 farmers' field schools in Dhanusa and Mahottari Districts.



4.3 Objective of FFS

The training was aimed at making farmer as experts in their own fields. Training methods invites discovery, comparison and analysis of field problem as they arises are being use. By the end of the season-long FFS, the farmer graduates are expected to carry out the following:

- describe the development of the crop;

- describe the compensation ability of the rice plant and give an example of the importance of plant compensation for either stemborer, defoliation or disease management;
- describe the ecological function, life cycle and give local name of major insect detritivours, insect pest and natural enemies seen in the rice field;
- identify local name and development factors of major disease found causing yield losses in the field; and
- describe the level of potential yield loss given a particular field condition and compare with the cost of controlling yield loss factors.

4.4 Principles of the FFS

The guiding principles in the field school learning process:

- The rice field is the focus of all activities and is the primary learning tool. All learning activities must take place in the field and this form the basis for discussion and further basic farmer driven participatory action research and experiments.
- All learning is based on the farmers' experience in the field. Every decision must be based on the experiential and discovery based learning process that means analyzing the problem as they occur in the field.
- Focused on the conduct of agro-ecosystem analysis (AeSA) which helps the farmers gain insight on the interaction of organism in the environment. Becoming aware of these interaction of organism combined with the basic principle of IPM that is growing a healthy crop gives farmers a solid foundation for better decision making.
- Also focused on the entire crop duration gives farmers an ample understanding of the relevant IPM management and decision making tools to be used at each stage of the crop.

4.5 The 12 FFS Sites in Dhanusa and Mahottari Districts

Name of FFS (Dhanusa District)	Name of FFS (Mahottari District)
1. Bidhyapati Krishak Patshala, Kurtha 8,Dhanusa	1. Shree Annapurna Krishak Pathshala, Khairawa, Ekarahiya 5, Mahottari
2. Shiva Krishak Patshala, Mahuwa 4, Dhanusa.	2. Shree Bidhya-Pati Gadh Krishak Pathshala, Bhanauli, Mahottari
3. Shree Tapasi Krishak Pathshala, Agilesawa 4, Sapahi, Dhanusha	3. Saraswoti Krishak Patshala, Pipara –2, Mahottari
4. Ram Janaki Krishak Pathshala, Kapileshor-14, Janakpur, Dhanusa	4. Saraswati Krishak Patshala, Sahorwa 6, Mahottari
5. Jaya Hanuman Krishak Pathshala, Basahiya 8&9, Sonapara, Dhanusa.	5. Shree Janajyoti Krishak Pathshala, Attarar, Ekraiha-7 Mahottari
6. Radha Krishna Krishak Pathshala, SinurjodaVDC 1, Sohani, Dhanusa	6. Jagriti Krishak Patshala, Kabirgama, Bramapura 7&8,Mahottari

4.6 The Farmers' Field School Curriculum

The agronomic and physiological issues related to the growth stages of the rice crop formed the foundation of the field school curricula. A typical day in farmers' field school is divided into three integral parts:

- conduct of agro-ecosystem analysis and its relation to the current growth stage of the crop;
- small and big group discussion and group dynamics activity; and
- presentation of a relevant and timely special topic.

4.7 Basic Training Activities in the FFS

The farmers' field schools are based upon a solid, field-tested curriculum and materials package that covers an entire crop production season and directly incorporates key IPM principles. The following is a field school schedule for any given day:

07:30 - 08:30	Field monitoring in small groups
08:30 - 09:45	Agro-ecosystem analysis and discussion in small groups
09:45 - 10:00	Large group discussion
10:00 - 10:15	Break
10:15 - 10:45	Group dynamics activity in small groups
10:45 - 12:00	Special topic: activity and discussion in small and large groups

5. EVALUATION OF TRAINEES PERFORMANCE

Evaluations are non threatening, it was used to the curriculum, and the learning processes. A pre-training test and post-training test using ballot box method form part of the standard evaluation tool was employed.

- The *Ballot-Box Evaluation* - enables the facilitator to measure the (TOT and FFS) participants' field skill in a way that is non-threatening. However, it was also treated as one of the structured field exercises for the TOT participants to become acquainted with process and approach. Ballot box can be use to evaluate training needs of the FFS participants.

  The participants were also given theoretical and practical examinations during the TOT. Please see ***Annexation 9 & 10*** for other details.

6. CONCLUSIONS

Although the objective of the TOT in Jhumka and Janakpur was the same, that is to train 35 field workers from NGOs, INGOs and HMGs extension and crop protection officers. One should not compare it to the first TOT, because the latter was primarily designed to build confidence, capability and capacity within the Department of Agriculture especially the Plant Protection Division. It was like constructing a house, the TOT in Jhumka made sure that the house stands in a very solid foundation so that even when the occupant started shaking the house it will not easily collapse. Now the national IPM Program has the experience, capacity and capability as proven by them in organizing, managing and implementing the second TOT with minimal supervision from the FAO IPM Programme. The second TOT is merely for strengthening the foundation laid by the TCP project and at the same time gaining more experience and confidence.

This TOT saw the National IPM Program-Nepal ironing-out some unintentional lapses of the first TOT by introducing additional field trials and other field exercises that enhances more discovery-based learning. It also tried to improve facilitation skill of both IPM facilitators and participants to become more able to facilitate IPM technology and processes to the farmers. It introduced more meaningful group dynamics activities and exposing the participants to other places to conduct case studies and field observation of pest that was not present in the TOT and FFS sites.

It brought together field staff from national/local government units, NGOs, INGOs and communities in a learning relationship, which results in more NGOs and INGOs supporting the effort of the National IPM Programme in bringing IPM to communities.

And most of all the training creates yet another group of farmers who can make critical and informed decisions that will render production system for rice and other crops more productive, profitable and sustainable.

7. PROBLEMS AND RECOMMENDATIONS

- Adequate time should be spent in locating and deciding for an ideal field site. The TOT site should serve as the laboratory during the training but it was far from the session hall. A lot of precious hours that should have been spend in the productive discussion of result of field activities have been missed because the participants are very tired from walking to and from the TOT site. Excessive flooding during the first few weeks of the TOT delayed and hampered some of the field activities. It is therefore being recommended that criterion for field site will be given the first and foremost attention in choosing site.

- The international IPM trainers would want to recommend the development or otherwise, the translation of field activity guides to Nepalese version that will enable IPM trainers, Junior Technical Assistants, other laymen and Farmer Trainers to use as training guides.

- The organizer of the TOT should have thought a long time ago that the maturity period of the variety to be planted in the FFS should coincide with the one that would be planted in the TOT site. What happened was an exact replay of the last TOT where in the participants were not able to get the yield result thus losing some of the value of the season-long training. The facilitators were not able to prove to the farmers the benefits of implementing IPM.

List of Annexations
(separate volume)

No.	Particulars
1	List of Participants
2	TOT Organizational Structure
3	Basic Field Studies Conducted in the TOT and FFS
4	Updated Version of the Training Curriculum
5	List of Farmers Field Schools
6	Gender Profile of FFS Participants
7	Result of Economic Analysis
8	Management System of the TOT
9	Result of Ballot Box Evaluation
10	Result of Theoretical and Practical Examinations
11	Ramjanaki Krishak Patshala
12	Result of insect Zoo and Cup Studies
13	Field Trials on Different Weed Management
14	Field Trials on Pegging
15	Field Trials on Compost v/s No-compost
16	IPM Workplan: Proposal from WE and Care-Nepal