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Research Article

Cost Effective Strategy to Disseminate IPM Technology: A Case of Banke and Surkhet District of Nepal

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Abstract

Integrated Pest Management (IPM) is a holistic approach in reducing damage caused by pests without harming the environment. A study on cost effectiveness strategy to disseminate IPM technology was conducted in the Banke and Surkhet districts of Nepal. For assessing the spread of information, farmers were asked a series of questions during the survey to determine knowledge of IPM and degree of IPM adoption. Using descriptive statistics and differences in means, analysis was done on relationships among access to information, IPM knowledge and adoption, and word-of-mouth diffusion of IPM techniques to neighboring farmers. For the evaluation of dissemination methods efficiency and to examine the cost for using the different dissemination methods of IPM technology followed by IPM IL project in Banke and Surkhet district, the cost measurements was focused only on the dissemination methods of IPM technology with a public cost such as mass media, agricultural officers, MPC, collection centre, FFS, CBFs, cooperatives, neighboring farmers, agro-vets and field days. When the number of farmers needing to receive training for one farmer to adopt IPM practices is known, and then that value can be multiplied by the cost per farmer trained which allows in providing the cost per farmer adopting the technology by transfer method. Capacity building in IPM technology development and dissemination in the study area was I/NGOs working in that area. Market Planning Committee of Banke and Surkhet district has played a vital role in disseminating IPM technology in cost effective and efficiently.

Keywords: IPM Technology; cost effective; adoption and dissemination.

Introduction

Agriculture is an important part of the economy in most developing countries and people depend on it as their primary source of income. Agriculture is also crucial to economic growth, in 2014, it accounted for one-third of global gross-domestic product (GDP). Agriculture development is essential for improved well-being in rural

Nepal. In Nepal approximately 66% of the population relies on agriculture as its primary source of income. It has undertaken a vegetable promotion strategy for small holders to capture the comparative advantage of vegetable production and marketing in economic growth and development, with the hope of reducing poverty. Vegetable production is associated with heavy use of chemical inputs--pesticides and fertilizers--to manage pests and optimize profits. Most pesticides are applied in liquid form using backpack sprayers and not all farmers utilize protective equipment while spraying (Crissman *et al*., 1998). Besides negative health and environmental impacts, pesticide use incurs a significant economic cost for producers. Pesticide expenditures typically comprise between 12% and 20% of production cost (Barrera *et al*., 2003). Various approaches had been practiced to disseminate IPM technologies in Nepal, including farmer field school, group dissemination through market planning committee; demonstrations, training, field days, written media (pamphlets), etc. through FAO, the Integrated Pest Management Collaborative Research Program (IPM CRSP) (now Integrated Pest Management Innovation Lab or IPM IL), KISAN, and Caritas Nepal among others. Given only limited involvement of the public sector in technology transfer, decision makers need information on the relative cost effectiveness of IPM dissemination methods. This understanding can help promote better technology transfer and help sustain vegetable production through IPM in Nepal.

Methodology

Selection of the Study Area

The study was conducted in Banke and Surkhet districts, Lumbini and Karnali Province of Nepal. These districts are prone area for vegetable growing in Nepal and IPM IL program funded by USAID was promoted in that area for the vegetable production through IPM technology. Altogether, 500 households were taken as the samples comprising of 42 farmers from each of six VDCs of each district selected randomly, which included farmers and marginalized people.

Cost of IPM Technology Disseminating Methods

For the evaluation of dissemination methods efficiency and to examine the cost for using the different dissemination methods of IPM technology followed by IPM IL project in Banke and Surkhet district, the cost measurements was focused only on the dissemination methods of IPM technology with a public cost such as mass media, agricultural officers, MPC, collection centre, FFS, CBFs, cooperatives, neighboring farmers, agro-vets and field days. The transfer method costs previously used by Ricker-Gilbert (2005) and Harris (2011) for Bangladesh IPM IL projects are shown in Table 1. Ricker-Gilbert (2005) used cost information from BARI and IPM IL to analyze costs, and Harris used DAE cost information for cost analysis. Since, no any study has been done in Nepal for the cost analysis in disseminating IPM technology. So, Harris's cost study seems more accurate with the cost of IPM technology transfers, the results from Harris's study has been taken as a reference and the cost used here are taken from the secondary source, such as IPM IL Nepal and Agriculture Knowledge Center, Banke.

Cost Effectiveness of Technology Transfer Methods

Finally, once adoption rates and costs are known for all of the public cost technology transfer methods, the probability of a farmer adopting for each transfer method can be converted to the number of farmers needing to be trained in IPM practices for one farmer to adopt IPM practices by dividing the probability of a farmer adopting out of one for each transfer method. When the number of farmers needing to receive training for one farmer to adopt IPM practices is known, and then that value can be multiplied by the cost per farmer trained which allows in providing the cost per farmer adopting the technology by transfer method. Once the cost per farmer adopting is known for each transfer method, those values can be compared to find the transfer methods with the lowest transfer cost per adopting farmer (Mccarthy, 2015).

Table 1: Cost of Dissemination Methods of IPM Technology per Farmer

Dissemination Method	Ricker-Gilbert (2005) US $	Ricker-Gilbert (2005) NPR	Harrris (2011) US $	Harrris (2011) NRS	Cost (NRS)*
Mass Media (Radio/Television, Newspaper)			0.06	7.03	50
Farmers' Group			0.21	24.61	80
Field day	5.12	599.91	0.21	24.61	80
Market Planning Committee					60
Farmer Field School	10.00	1171.7	6.59	772.15	200
Collection Centre					60
Agricultural Officers	0.50	58.59	1.07	125.37	200
CBFs					180
Agro-vets/Cooperatives					60

*cost used is taken from the IPM IL project and Agriculture Knowledge Centre, Banke

Indexing

Various farming problems, learned about IPM, spreading IPM knowledge and information quickly and willingness to adopt IPM were ranked with the use of index. Scaling techniques, which provides the direction and extremity attitude of the respondent towards any proposition (Miah, 1993) was used to construct index. The farming problem faced by the farmers, learned about IPM, spreading IPM knowledge and information quickly and willingness to adopt IPM were identified by using ten-point scaling technique comparing most important to least important using scores of 1.00, 0.90, 0.80, 0.70, 0.60, 0.50, 0.40, 0.30, 0.20 and 0.10 respectively. The formula given below was used to find the index for intensity various problem/reasons.

$$I=\sum \frac{S_i f_i}{N}$$

Where,

I = Index value

$\sum$ = Summation

Si = Scale value of i^{th} intensity

fi = Frequency of i^{th} response

N = Total number of respondents

Results and Discussion

Dissemination of IPM Technology

For the determination of the rate at which different methods of IPM technology are disseminated to farmers was judged on the basis of respondents view in the study area. If any innovation technology has reached to the farmers quickly that may allow the farmers to receive the benefit of that innovation for a longer period of time. If farmers do not receive information in a timely manner, the technology may lose its usefulness by the time it reaches them. The methods used for spreading information quickly are ranked in terms of their effectiveness at quickly spreading information in Table 2 on the basis of judgment of respondent's view. The methods are ranked from one to ten, with one being the fastest and ten being the slowest.

In the study area, it has been affirmed that market planning committee (MPC) has the greatest potential than other sources to disseminate the IPM technology to farmers, as MPCs allow farmers to aggregate smallholders' produce to meet market demand. Several farmer organizations join together and elect representatives to serve on the board of the MPC and have regular monthly meeting so that they can discuss on IPM technology and marketing strategy of the products. Mccarthy (2015) in his research found that newspapers play a vital role in disseminating the IPM technology quickly. Similarly, Gilbert (2005) has found that mass media have the greatest potential than other methods to disseminate the technology to farmers quickly.

Mass Media may be the other option to diffuse IPM technology as newspaper/leaflet, radio and television broadcasts can spread information over a great distance in a very short time. Collection centers are also other ways to disseminate IPM technology as vegetable collection is done on weekly basis but they do not function as quickly as MPCs, because they do not have time to discuss about the IPM technology. Field days are also another way of disseminating information to a large number of farmers, however, they do not function as quickly as MPC, because it takes time to organize and inform farmers about the occurrence of a field day. Farmer field schools are also another method of spreading information. FFS require time to establish and administer making them a less than desirable method for bringing information quickly. If information needs to be dispersed among a population in an emergency situation, the FFS model would be the wrong method to accomplish this task. Neighboring farmers, followed by agriculture officer, CBFs, agro-vets and cooperatives also play a vital role in disseminating IPM technology, but they do not function as quickly as MPC.

Table 2: Speed Rankings for IPM Diffusion Methods

SN	Spreading IPM information quickly	Index value	Rank
1	Market planning committee	0.9	I
2	Mass media	0.89	II
3	Collection centre	0.86	III
4	Field Day	0.76	IV
5	FFS	0.72	V
6	Neighboring farmer	0.7	VI
7	Agriculture officer (DADO)/NGOs)	0.68	VII
8	CBFs	0.64	VIII
9	Agrovets	0.6	IX
10	Cooperatives	0.58	X

Table 3: Cost per Farmer Adopting IPM Technology.

SN	Agricultural Information Source	Likelihood of IPM Use	Farmers trained per 1 adoption	Cost (NPR) per 1 farmer trained	cost (NPR) per 1 farmer adopting
1	MPC	44.32	2.26	80.00	180.51
2	Field day	42.33	2.36	90.00	212.62
3	Collection Centre	34.54	2.90	80.00	231.62
4	Agro-vets	35.64	2.81	90.00	252.53
5	Neighboring farmer	35.43	2.82	90.00	254.02
6	Mass Media	15.55	6.43	50.00	321.54
7	CBFs	45.66	2.19	180.00	394.22
8	Agriculture officer	48.32	2.07	200.00	413.91
9	Cooperatives	18.32	5.46	80.00	436.68
10	Farmer field school	43.52	2.30	200.00	459.56

Cost Effective Source for Disseminating IPM Technology

In this study for the identification of cost-effective strategy to disseminate the IPM technology to the farmers, the percentage of farmers using IPM technology for each information source was first divided out of 100%, to find out the number of farmers needing to receive IPM training before one farmer will adopt IPM practices. The number of farmers needed for one IPM adoption was then multiplied by the cost per farmer trained to get the cost per farmer adopting IPM practices as done by Mccarthy (2015) for his findings. It has been affirmed that Market Planning Committee (MPC) had the lowest cost per farmer in adopting IPM technology at NPR. 180.51 per farmer, followed by field day at a cost of NPR 212,62 per farmer, Collection centre at a cost of NRs. 231.62, Agro-vets at a cost of NPR 252.53 per farmer, Neighboring farmer at a cost of NPR 254.02 per farmer, Mass media (Radio, Television, Newspaper) at a cost of NPR 321.54 per farmer, Community Business Facilitator (CBF) at a cost of 394.21 per farmer, Agriculture officer at a cost of NPR 413.90 per farmer, Cooperatives at a cost of NPR 436.68 per farmer and Farmer Field School (FFS) at a cost of NPR 459.55 per farmer (Table 3). Market Planning Committee information sources have been found the most efficient and Farmer field school were the least efficient information source for disseminating IPM technology in the study area as compared to other sources. Similarly, Mccarthy (2015) in his study found that mass media information sources were most efficient source and farmer field school was the least efficient source for IPM technology transfer.

Summary

Integrated Pest Management (IPM) is a holistic approach in reducing damage caused by pests without harming the environment. A study on cost effectiveness strategy to disseminate IPM technology was conducted in the Banke and Surkhet districts of Nepal. For assessing the spread of information, farmers were asked a series of questions during the survey to determine knowledge of IPM and degree of IPM adoption. Using descriptive statistics and differences in means, analysis was done on relationships among access to information, IPM knowledge and adoption, and word-of-mouth diffusion of IPM techniques to neighboring farmers. For the evaluation of dissemination methods efficiency and to examine the cost for using the different dissemination methods of IPM technology followed by IPM IL project in Banke and Surkhet district, the cost measurements was focused only on the dissemination methods of IPM technology with a public cost such as mass media, agricultural officers, MPC, collection centre, FFS, CBFs, cooperatives, neighboring farmers, agro-vets and field days. When the number of farmers needing to receive training for one farmer to adopt IPM practices is known, and then that value can be multiplied by the cost per farmer trained which allows in providing the cost per farmer adopting the technology by transfer method. There is limited funding for the extension of agricultural technology in Nepal. So, finding the cost-effective strategy to disseminate IPM technology may promote for the adoption of IPM technologies. In this study, Market Planning Committee information sources have been found the most cost efficient and Farmer field school were the least cost-efficient information source for disseminating IPM technology. Thus, identified cost effective IPM dissemination information could be a source for Agriculture Knowledge Centers, policy makers, researchers and other extension agents to disseminate the IPM technology.

Authors' Contribution

Arjun Khanal designed the work plan, performed research work, analyzed data & prepared manuscript. Punya Prasad Regmi, Gopal Bahadur KC, Dilli Bahadur KC & Kishor Chandra Dahal analyzed data & critically revised the manuscript. All authors approved the final form of the manuscript.

Conflict of Interest

Authors declare no conflict of interest with the present research work.

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