INTERFACE BETWEEN INTEGRATED PEST MANAGEMENT (IPM) AND ORGANIC PEST MANAGEMENT (OPM) IN NEPAL

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ABSTRACT

In an attempt to document the status on Organic Pest Management (OPM) and Integrated Pest Management (IPM) in Nepal, a study was conducted by gleaning the available literatures and contacts with the people and organizations involved in these areas. The study showed that there are considerable numbers of individuals and households, who are demanding either organic products or products used with less chemical pesticides. The fraction for demanding Organic Pest Management is more than 29% where about 2% farmers are using organic products indicating the large gaps between the demand and supply. In Nepal, IPM was evolved in 90s with an aim to combat the negative effects of chemical pesticides, which could also be an entry point to the OPM although most of the past activities were concentrated with much emphasis on capacity building to the farmers and technicians. Negligible fraction (about 2-3 %) of farming communities, are found adopting this approach, however, the demand for this is overwhelmingly large exceeding more than 60%. Despite of the interest showed by the large number of producers and consumers, the sluggish paces in adopting these novel approaches are due to inadequate polices for appropriate support, alternatives to chemical pesticides, support activities such as inputs, irrigation and marketing facilities, premium prices to agricultural products, appropriate technology compatible to the farming etc. At the same time, there is growing awareness among the producers and consumers for safer and healthier produce; however, the present agricultural production system has given its thrust for meeting the food requirement for ever accelerating population. Ever since of the introduction of chemical pesticides as vector control tools in Nepal, they remained one of the dominant means of crop pest control and still there is a long hangover among the producers that they are highly regarded as magic solutions to cure pest and disease problem. However, at the same time, there are large proportions of the growers and consumers for their preference for having chemical free or less pesticide used agricultural products. The associated hazards due to chemical compounds were also documented and most of them are related to lack of awareness, ignorant among the producers as well as consumers, lack of alternative tools to IPM and OPM, price discrimination system between organic and pesticide used products are found as dominant factors. Current status of organic pest control as well as IPM with respect to their interfaces in Nepal is documented.

BACKGROUND

Nepal is sandwiched between two largest South Asian countries, China in North and India in rest parts of the country. Geographically, it is divided into three major zones, high hill, mid hill and low hill. Agriculture is the major sources of livelihood for majority of the people and nearly 65.5% population are directly and indirectly involved in this sector. It contributes more than 45% gross domestic product (GDP) of the country (Anonymous, 1995) however, it is struggling to feed its ever increasing population. The country's ever accelerating population most of whom make their living from farming, have nearly run out of land to cultivate, while their numbers continue to grow with an annual growth rate of 2.3%. The agricultural density in 1981 was 6.1 persons per hectare (or almost 0.2 hectare per person), which represents a very high density, especially given that the country's production technology remains in a backward state. Nepal's ability to reclaim more land in order to accommodate a rapidly growing population already had reached a maximum threshold. According to the census, 86 percent of this growing population lives in rural areas where the poverty and internal conflict is draining already scarce resources and our ability to adequately feed people will face growing challenges. Despite of the increasing reality for giving increasing thrusts for higher food

production, emphasis for producing quality foods are also realised at many levels. For this, Organic Agriculture (OA) and Integrated Pest Management (IPM) would be very vitals in the sustainable farming (Cisneros, 1912).

These approaches are based on integrated system of farming following most of the ecological principles". Both of them are concerned not only with simply replacing the chemical fertilizers and pesticides with aids permitted in organic farming systems. Organic farmers cycle nutrients on the farm and work with the soil to produce fertility, rather than use synthetic inputs. Organic farmers promote biodiversity on their farms. If we consider this definition with traditional Nepalese agriculture we can claim that it has a long history of organic agriculture. It is because traditional agriculture was based without using external inputs such as chemical fertilizers, pesticides and synthetic modern varieties. At that time, the crops used to suffer very less with the attack of insect pests, diseases and weeds because of the low cropping intensity. In case of their attack, farmers used to adopt some options such as crop rotation, mechanical means and by supporting diverse populations of plants, insects and other organisms. The synthetic chemicals were neither available nor attempted by the farmers in the traditional farming systems. Hand weeding was the only common options for removing weeds as the herbicides were not available at that time. Similarly, soil fertility was maintained using either cattle dung or plant remnants which were the leftover of animal feed. This situation clearly proves Nepal had been practicing Organic Pest Management before the influence of so called green revolution before 1960s.

With the negative consequences of green revolution especially after 1960s, the developed nations adopted alternative measures such as Integrated Pest Management (IPM) followed by Organic Pest Management (OPM). Realizing the fate of chemical pesticides, some industrialized nations curtailed the production and application of synthetic chemicals into their soils; however at the same time, they continued producing and promoting chemical pesticide to the least developed countries like Nepal. In developed nations, the first synthetic chemical compounds "organochlorine" groups were phased out about 10 years of their manufacturing from 1940-1950. Roughly the so-called second and revised versions of "organophosphates" pesticides were stopped for producing since 1950s and "carbamates" as third generation pesticides in 1960s (Anonymous, 2001). The basic reasons of cessations of these environmental pollutants was after the wider scale of public outcry as created by the books written by "Rachel Carson". She was the first lady scientist who publicly brought the fate effect of chemicals on the human health, non-target organisms and as environmental pollutants; however, in Nepal the story is different. Since the era of traditional agriculture to until this time, the organized movement of neither OPM nor IPM has taken momentum, rather there is very mixed type of situation which is evident depending on the place and crops. In fact, the sale and use of banned group of chemical pesticides is also common in some area whereas in other areas, novel types of compounds such as botanicals and biopesticides are also in use in minimal extent. At the same time, some area has come up commercial scale and some are still in traditional situation. The novel ideas of Organic Pest Management and IPM can be seen in patchy distribution in Nepal but the satisfactory point is that there is growing awareness in both of these approaches. In majority of the cases, IPM has been taken as entry points of OPM in Nepal which in the long run can go hand in hand.

INTRODUCTION

With increasing population pressure, Nepalese farmers have intensified their land use over the past decades with high value cash crops into their farmland. As a result of this intervention especially after so called green revolution, infestation of insect pests and diseases, declining soil fertility have realised as potential threats. Among them, many insect pests and diseases have become increasingly difficult pests in Nepal for the last few years. Their infestation has been reported throughout the country and magnitude of the problem has been widespread over the past years. Majority of the farmer depends primarily on the use of highly poisonous and poor graded chemical pesticides. The sole dependence of the use of chemical pesticides has aggravated the pest problem resulting in wider reluctances for the cultivation of major cereals as well as cash

crops in a commercial scale. In the same way, the haphazard uses of chemical fertilisers have degraded soil properties resulting into wider level of acidic soils. In Nepal, quantification of the damages due to many insect pests for degrading the soil quality has not been assessed at wider level (G.C. and Keller, 2002, STSS, 2002). Insect pests are basically managed either using synthetic chemicals or simply left in uncontrolled because of the lack of effective control measures. Several reports suggest farmers in commercial area try to control pest insects and diseases in crops with highly persistent and ecologically destructive pesticides (Neupane, 1993). In some cases, the banned group of chemical pesticides by WHO and date expired chemical compounds are also been use in Nepalese farming, however, they are largely ineffective to bring down the pest population (Dahal, 1995, G.C., 2006). The open and porous geographical border with India has accelerated this situation many folds. Among many reasons of mis-use of chemical pesticides, farmers are largely ignorant about the proper selection of the chemical pesticides, diagnosis of crop health and problem, application method, time, dosages and frequency etc. These practices have created several levels of hazardous effects to the human beings, non-target organisms, air and water pollutions, however, their fate effects are poorly documented in Nepalese situation. The use of toxic chemicals (mainly chemical fertiliser, pesticides and herbicides), which may lead to the depletion of soil nutrients and increasing salinity (ADB, 1987). Farmers have little access to the benefits of research and innovation, organic inputs especially for controlling pests, diseases and weeds. The increasing emphasis for judicious use of chemical compounds in IPM program has not been able to offer them alternative means of controlling biotic problems resulting into continuous use of chemical pesticide and chemical fertilisers becoming major choices in Nepal.

At the same time, there is a greater void of alternative control measures towards pest control and awareness on the producers and consumers for developing Organic Pest Management (OPM) and Integrated Pest Management (IPM) despite of their earlier necessity (Pandey *et al.* 1993). In Nepal, there is great potentiality of OPM as majority of its cultivated land has not been degraded much due to excessive uses of external inputs such as chemical pesticides and fertilizers excepts few of the commercial areas. In fact, the pesticide uses is very high in some of the countries like Korea, India, Japan, Indonesia etc. It is also because the infrastructure of Nepal does not support for the manufacturing of the chemical industry, where a huge amount of money is invested for purchasing the pesticides and fertilizer. Most of the agricultural inputs are imported from India and some from China, Korea and Indonesia. In most parts of India and Nepal there are open and porous borders where date expired and poor graded chemical pesticides are being traded. Pesticide regulations in practical terms are almost ineffective because of this situation. This is also one reason that, Nepalese farmers are largely misleading from the effective pest management and poor attention on the biorational pest control. Several insect pests and diseases have gained resistance with several groups of chemical compounds resulting into more difficulty for their control (Joshi, 1994). At the same time, it has resulted into adverse effects on the human health and environmental pollution. In this sense, Organic Pest Management and IPM may be best solutions to minimize the injudicious use of chemical pesticides and sustaining the crop yields, safeguarding human health and environment (Terry, 1987).

STUDY METHODOLOGY

In order to find the status of Organic Pest Management and IPM in Nepal, relevant and available literatures were reviewed from different organizations as well as from occasional papers.

1. Information collection from different institutions, individuals involved in agriculture and pest control.
2. Secondary information related to pesticide use, IPM and OPM was collected through available literatures. Information and data were collected by different methods such as direct interviews, telephone contact and literature review. Direct phone contact was made with some farmers, co-operatives and personnel.
3. In order to depict the current status of OPM in Nepal, literatures were cited available in the Department of Agriculture, NARC, Khumaltar, HASERA farm, NGOs, INGOs and with individual contacts. The history dates back nearly 45 year i. e. around 2020 BS (1960s), during that period of

traditional agricultural was very common in Nepal. Until this period, it is still rudimentary stage where not much work has been done in this regard.

FINDINGS

Existing policies on pesticide

The Nepalese parliament passed the Pesticides Act in 1991 (Nepal *Rajpatra*, 1991. The cabinet gave an approval to Pesticides Rules in 1994. Pesticide Act 1991 was promulgated to have a provision with regard to import, export, production, marketing and use of pesticides meant for killing the harmful pests that appear in various seeds, trees, animals, and fowls. The Act has a provision for a 15 member Pesticide Committee chaired by Secretary Ministry of Agriculture and Co-operatives (MoAC) consisting of members from various government Ministries, Departments, distinguished scientists, pesticide entrepreneurs, users, farmers and other members nominated by the Government of Nepal.

The Act has provision for publishing the names of pesticides registered in Nepal in *Rajpatra* (Gazette) by Government of Nepal on the recommendation of the committee. The Act can restrict the import, export, production, use, purchase or sale of any pesticide(s) other than those listed in the Gazette by the Government of Nepal. To obtain a license from the committee for formulation, sales and distribution a payment of the prescribed fee is required. Similarly, to register the roster of the professional dealing with specific pesticides similar processes needs to be fulfilled.

Pesticides use in Nepal

Pesticides classified as being extremely or highly hazardous to health by FAO and WHO are still found using in some crops and locations as a means to control of insect pests in agriculture and the public health sector and will continue to be used for some time (WHO, 1999). The most important threats from the pesticides are health hazards due to their indiscriminate and improper use. Since, 1997 there has been dramatic rise in gross pesticide import and consumption in Nepal (PRMD, 2009). Loss of crops in the field as well as in post-harvest storage has been reported to be as high as 35% in Nepal. PPD (2010) attributes these losses to various types of insects, pests, diseases, weeds, birds and rats. To reduce these losses farmers have been using chemical pesticides without much consideration of human and animal health, biodiversity and overall environmental protection. The misuse of modern inputs, chemical fertilizer and pesticides is a threat not only to the human beings and the environment but also to the sustainability of agriculture (PPD, 2010, Manandhar, 2006).

Import, distribution and use of pesticides

The earlier development plans promoted the use of pesticides as a means of increasing agricultural production. The government served as the main procurer and supplier of pesticides through the Agricultural Inputs Corporation (AIC) that was created in 1966. In addition, well-known international manufacturers such as Bayer, Hoechst, Ciba Geigy, Cynamid, Shell, BASF and Sumitomo also promoted pesticides through their sales agents. To date, about 650 types of pesticides have been registered for use (Box 1) under the Pesticides Act and Rules of Nepal of which 391 are insecticides, 170 fungicides, 63 herbicides, 15 bio-pesticides, 7 rodenticides, and 4 bactericides (PPD, 2010).

The involvement of the private sector began in 1995 when AIC stopped bulk purchasing of pesticides and private pesticide dealerships took its place. Nepal currently imports pesticides from six countries: India, China, Malaysia, Singapore, Italy and Japan. These are distributed through 67 national and foreign companies some of which also produce pesticides. A total of 97 pesticide suppliers have been registered with PPD by 2010 and these are the agencies now dealing with the import of pesticides in the country. Only four Nepalese Companies have been registered in Nepal to manufacture and formulate pesticides. Most of the supplies come from Indian companies including sole distributors for the main international manufacturers.

Box 1: Statistics on pesticides in Nepal	**Number**
Total pesticides registered in Nepal	650
Number of pesticides banned in Nepal	14
Registered pesticide dealers	6660
People trained on safe handling of pesticide	7028

Source: PPD, 2010

Direct purchase of pesticides is also done in the public sector and by parastatals i.e., by National Seed Company Limited (NSCL), the Cotton Development Board, the Nepal Food Corporation as well as the Epidemiology and Disease Control Division of the Ministry of Health and Population.

The involvement of the private sector paved the way for the formation of a network of private wholesalers and retailers in most districts of the country with the exception of remote districts and where agriculture was less profitable. Retail outlets for pesticides, mainly Agrovets, have greatly increased in the main agricultural areas of the Terai, in important areas for vegetable and fruit production including Kathmandu and other valleys, and in the more accessible areas of the hills. Currently there are 6,660 registered pesticide dealers in the country but it is also not uncommon for pesticides to be sold by unregistered vendors in the villages.

Status and trend of import of pesticides: Past records of pesticide imports reveal that insecticides comprised the majority of imports (60%) followed by fungicides (30%) and other pesticides (10%) (Manandhar, 2006). However, more recently, fungicides dominated the import volume (48%) particularly phosphamidon and organomercury fungicides (EMC, PMA, PMC, MEMC) followed by insecticides (44%), and herbicides. Currently organophosphates and synthetic pyrethroids are more commonly used pesticides in agriculture and public health (PRMD, 2009).

Table 1. Trends and value of import active ingredients pesticide of the in Nepal in different years.

Year	Quantity (kg. a. i.)	Rupees (NRs, 000)
1997	56,172.56	5,13,87.94
1998	77,856.87 (+)	6,60,59.84
1999	1,08,427.82 (+)	8,45,17.61
2000	1,96,064.58 (+)	14,74,38.80
2001	1,46,152.48 (-)	14,86,20.34
2002	1,77,591.10 (+)	18,35,35.85
2003	1,76,372.81 (-)	12,31,58.14
2004	1,54,082.05 (-)	13,10,22.8
2005	1,31,270.43 (-)	13,00,25.6
2006	1,31,284.55 (+)	13,31,28.45
2007	3,47,494.50 (+)	27,26,81.3
2008	3,12,740.50 (-)	23,33,10.75 (-)
2009	2, 11, 079.34 (-)	20,76,88.05 (-)

Source: PRMS, 2010

The present trend of pesticide formulation shows, there are few pesticide formulators in Nepal, where they import active ingredients from abroad. Until last year, about twenty one Corer Nepali Rupees has been investing for purchasing of the active ingredients but non-of the biopesticides formulators are in existence in the country. Very negligible quantity of biopesticides has been trading in the country either importing from India or other country. Small scale production of *Metarhizium anisopliae* in the talcum powder and *Trichoderma viridae* (and effort of Plant Protection Directorate and Agricare, Nepal) has been initiated only in the year of 2011 (PPD, 2010). Such products has been seen accidently and occasionally been using in the research scale because of their limited production. The initiation of PPD for the production of some of the novel compounds in its Regional Plant Protection Laboratories (RPPL) may have greater contribution

towards Organic and IPM production, which however, the Government effort has to forge with private agencies for their production.

Total pesticide import and consumption is steadily increasing, but there is a lack of systematic data recording system for the procurement and consumption of pesticides. It is somehow difficult to mention that the government statistics in Nepal only refer to the data which are provided by government line departments or parastatal companies, e.g. AICL, although, currently most of the procurement and distribution of these chemicals takes place through private-sector agencies. Official data for pesticides use are less in reliable format as the liquid pesticides are always presented together with agricultural lime without a clear break down of what proportion of the data was made up of which of its component (PPD, 2010). Even such data are missing for after 1999 when AIC was divided into two companies. However, following the establishment of Plant Protection Directorate in 2000 within DoA the process of compiling data has been initiated and 2009 data for the same have been reported in Table 1and Figure 1.

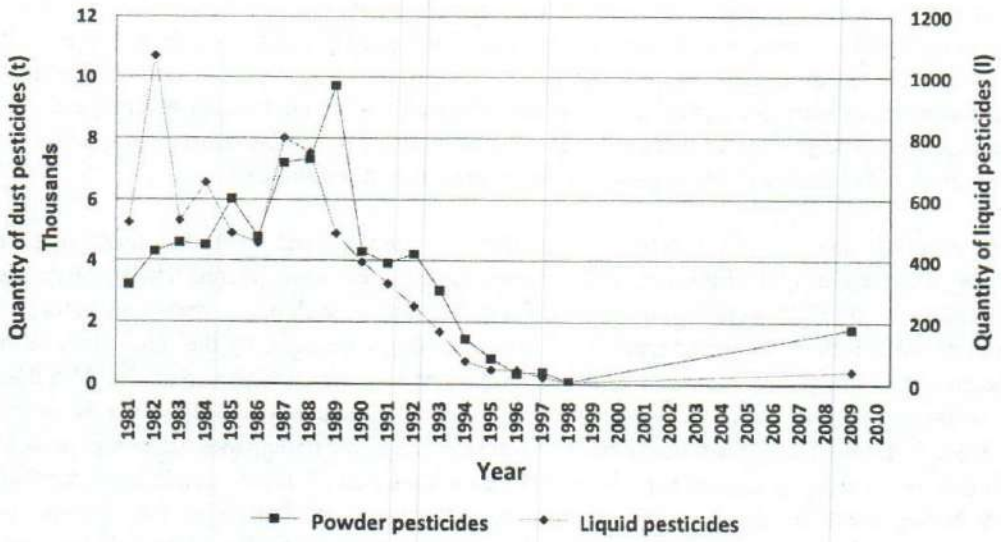

Figure 1. Pesticide use in Nepal from 1981 to 1998 and 2009. Source: Agricultural Inputs Corporation for the data 1981 to 1998 and PPD for 2009. Data from 2000 to 2008 are missing.

The highest amount of pesticide that was recorded as sold through AIC was 971 t of powder pesticides in 1989 and 10,699 litres of liquid pesticides in 1982, most of which would have been agricultural lime according to the Ministry of Finance (Sharma, 1994). The lowest recorded figure for pesticide sold was 7 t of powdery pesticide and 55 l of liquid pesticide in 1998 (Fig. 1).

Level of pesticide use in Nepal: Nepal does not use as much pesticide as many other countries in south Asia. The average pesticide consumption on agriculture in Nepal is only 142 g ha^{-1} (Thapa, 1991; Arms and Pandey, 1995), whereas in most of the South East Asian countries average use is 3.6 kg ha^{-1}(Manadhar, 2006). Nevertheless, the use of pesticide per unit area is exceptionally high in some of the commercial crops such as cotton (2.6 kg ha-1), tea (2.1 kg ha^{-1}) and vegetables 1.5 kg ha^{-1} as compared to the national average. In terms of volume of pesticides used on rice ranges from 40 to 50% which is because of its highest area coverage followed by grain legumes (14 to 20%), fibre crops (13 to %15) while only 10-15% of pesticides are used on vegetables and fruits (Thapa, 1991).

Although information on bulk import is available – but in an incomplete form - there is lack of data on the distribution and use of pesticides by crops and regions. There is no data recording system for supply by Agrovets and concerned government agencies. Manandhar (2006) points out that a weak regulatory framework and very poor monitoring system results in highly toxic, banned, or date-expired pesticides being

sold to poorly informed farmers (Manandhar, 2005). Some of the prior informed consent (PIC) related pesticides, such as methyl parathion and monocrotophos, that are classified as highly hazardous in nature by the WHO are officially banned for importing and uses, however, they are illegally been seen in some pesticide traders in Nepal. Recent monitoring in Kathmandu valley and reports from some DADO confirmed this. The illegal import of banned pesticides such as DDT and BHC from India is difficult to regulate and the quantities can only be estimated. Moreover, the retail pesticide market deals with many products and multiple brands of single products, which creates confusion among the users and farmers (Baker and Gyawali, 1994). This situation has created greater difficulties in initiating biorational pest control such as organized form of Organic Agricultural Pest Management and Integrated Pest Management in Nepal.

Organic Pest Management (OPM): an effort in Nepal and interface with IPM

In the past, a single control measures i. e. pesticide application dominated pest control in agricultural crops. After 40 years of manufacturing and indiscriminate use of such compounds, they were phased out and other alternative control measures were sought. As a result Integrated Pest Management (IPM) and Organic Pest Management (OPM), and other measures were initiated to combat the fate effects of chemical pesticides. At community level the OPM in Nepal, it was begun around 1963 but moved to a very slow pace. It was limited in unorganized manner. The awareness was very low among the producers and consumers. At that time, the government priority was to boost the agricultural production by maximizing inputs such as fertilizers, seeds, chemical pesticides etc. The priority at that time was on quantitative production rather than quality. As a result, different grades of chemical pesticides and fertilizers were introduced in Nepal.

DDT was first chemical, that entered in Nepal as a medicine to cure Malaria since then many persistent pollutants (PoPs) such as aldrin, dialdrine, heptachlor, mirex, toxaphae etc were entered. The Pradhanpanch, the then VDC chief and JT/ JTAs were also many thankful in distributing such magic chemicals in the name of agricultural kits. At that time, they used praised and overwhelmingly welcome by the community people. It was not uncommon of using such chemicals in fishing in the small streams, canals and ponds. Also thanks to Nepalese technicians who successfully understood their negative effects around 1990s after 30 years of their band in USA in 1960s. Until this time, Nepal enjoyed with ranges of trademarked chemical pesticides and fertilizers into its agricultural land. This period remained as "dark period" for the continuous adoption of Organic Pest Management in this country. Otherwise, the organized movement for Organic Pest Management would not have been necessitated to initiate around 25 years back in Nepal. It has almost passed more than two decades; however, it has not been able to do much except creating wider level of dissatisfaction over chemical pesticides rather internationalization about OPM. Most of its period passed in counseling in the name of the trainings in air conditioned hotels and lodges where greater level of emphasis has been laid on nature conservation, agricultural sustainability and ensuring quality food supply. The reality however remained too far in initiating the environment for OPM in the country from producers to consumers and policy makers. In general, it can be said, OPM in Nepal is almost at rudimentary stage as merely training people does not carry much sense without bringing it into practices. The major difficulties about its adoption lie with its agricultural priorities to feed its ever increasing population rather than feeding handful of choosy people. In addition to this, the land ownership pattern as well as available alternatives is few of the drawbacks which has been setting back it behind. If we see the reality, there is lack of OPM tools such as organic fertilizers, biopesticides, marketing infrastructures, premium prices, informed and organized marketing systems etc. Despite of all, there are good prospects of OPM in Nepal while comparing the fertilizer and pesticide use pattern with developed nations. It can supply organic products within the country where there is great demand for marketing of the organic products to the tourists. There are greater prospects of producing organic products in some locations and crops with ample scope of making foreign currencies. The organized movement of OPM started after the establishment of some of the organizations working in this area. Much emphasis has been given on the awareness, nature conservation; maintain agricultural sustainability and quality food supply. Handful organizations have involved in research, training, publication, awareness, production, processing, and marketing. In fact the production size is very low which is not copping the current demand as it is far higher than the production. The important drawbacks realized

are lack of wider awareness among the producers, consumers and involvement of the products costs for organic produce. Because of this most of the activities either conducted by Government or by non-governmental organizations are directed towards increasing quantity of the produce.

Organization involved in organic agriculture

The organized movement of Organic Pest Management in Nepal can be viewed after the establishment of Institute for Sustainable Agriculture in Nepal (INSAN) in 1986. Over the time, other organizations were also emerged taking with similar approach. These include Nepal Community Support Group (NECOS) in 1989, Jajarkot Permaculture Program in 1991, Lotus Land Agriculture Farm in 1991, Community Welfare and Development Society (CWDS) in 1992, HASERA Agriculture Farm in 1992, Nepal Permaculture Group (NPG) in 1992, Ecological Services Centre (ECOSCENTRE) in 1994. Since recent past, curriculum and teaching on organic agriculture has been initiated at IAAS, Rampur, HICAST and few of other teaching institutes in Nepal. Similarly, this concept has been well emphasized in the Government system resulting into the formulation of Organic Agricultural Policies. Similarly, many organizations including NGos and INGOs have been started their programs at different levels and crops. The OPM as one of the important steps was reaslised especially when Nepal entered as a member country into World Trade Organisation (WTO) in 2004. Nepal also expressed its commitment towards OPM since its participation in different international conventions, such as London, Basel, Rotterdam, Stockholm. It has also reviewed and included in the Pesticide Act 1991 and Pesticide Regulation in 1994. It accorded emphasis on OPM since 10th five year plan (NPC, 2003) and long term agriculture prospective plan. In these days, OPM has been a subject of discussion among the researchers, teachers, development workers, farmers, traders and even among the policy makers. Its importance increasingly realized when Nepal expressed its commitment for sanitary and phytosanitary (SPS) measures in the international conventions. These days, approximately 80 different national and international organizations are directly involving in this area.

Present situation of Organic Pest Management (OPM) in Nepal

Until now the situation of OPM in Nepal is almost at embryonic stage but there is increasing desire for its availability. Presently about 2% of urban households are consuming organic products but more than 29% showing their desire (Sharma, 2005). There are very few people only about 4% farmers are producing organic agricultural products which shows clear gap between the demand and supply. The major reasons are lack of adequate research and alternatives to produce such produce which may to support the demand and supply situation. Still the chemical based agricultural production dominates the country. It is very interesting to note that the average rate of chemical fertiliser and pesticide use in Nepal is very low (32 kg and 162 gm/ha/year respectively) but their associated hazards are unacceptably high in some locations. This is because the dosage the farmer use in particular crops in particular localities are higher resulting into fatal effects accordingly. Sharama (2005), have mentioned that, if we compare the certified area of OPM in Nepal with that of the world, it would be 0.0091%. Similarly, if we compare the certified area of OPM in Nepal with that of the pesticide and with other control measures, it would be 0.00097%. This clearly states that very meager works have been done so far in Nepal.

Policy support to Organic Pest Management (OPM) in Nepal

This area has been getting very less support and commitments from the government despite of the enhanced awareness created by some of the NGOs and with the joint efforts of young people. In fact the government initiatives were very late than that of NGOs and on the individual basis. From government level, we can see some initiatives expressed through pesticide act (1991), pesticide regulation (1994), Environment Protection Act and Environmental Protection Regulation (1997), Emphasis on national planning commission (NPC) and long term policies only after 1996. Few of the initiatives taken by the Government include,

1. Increase in the present dose of chemical fertilizer from 20 kg/ha to 120 kg/ha by which it would result annual increment of agricultural productivity from 3.5-5%.
2. Accord highest priority of producing and using organic fertilizer by providing susidy for establishing manufacturing equipments. At the same time, there are encouragements for the production of

biopesticides, balanced use of organic and in-organic chemical fertilisers and adopt IPM to curtail the sole dependence of chemical pesticides.

3. Promote organic farming and export the goods with international standard.
4. Ministry of Agriculture and Co-operatives has been supporting for the certification of organic produce to encourage the producers.
5. Promote increasing use of hybrid seeds, animals and regulate using GMOs, however, do not promote GMOs
6. Human resource development towards organic production is also good evidences of the Government support in this area.

Production, certification and marketing

Except handful producers, the production has been prevalent in an un-organised way and similar is the situation for certification and marketing. Very few of the producers are certifying their producing involving trained organic inspector. Production and certification entirely depends on community trust rather than residue analysis in the accredited laboratories. In general, this aspect goes mainly on trust starting from producers to the marketing intermediaries. At present, some of the organizations like NEC CERT, NASSAA, Gulmi Organic Coffee Certification agencies and couple of other organizations are being involved in certification of organic produce. Similarly, few of the groceries are being involved in selling organic tea, coffee, honey and vegetables.

Integrated Pest Management

Agricultural Prospective Plant (APP) and other government policies, strategies and plans give high priority to integrated Pest Management (IPM). The year 1997 was the first kick-start of IPM in Nepal as a national community IPM programme. Similar to other countries, the basic philosophy of initiating this approach was to enhanced the environment and biodiversity and contribute environmental friendly agriculture by enhancing judicious use of chemical pesticides and other biorational compounds while maintaining biotic problems in the agriculture. By 2003, a critical mass of human resources was developed in Nepal covering 104 graduate level and 415 farmer facilitators. 700 Farmers' Field Schools (FFSs) were established in the country training 20,000 farmers. Currently, the programme is being extended to parts of 62 districts conducting 853 FFSs with focus on women, small and disadvantaged farmers (PPD, 2010). Until now, IPM program has been financially supported by Norwegian Government and implemented by Plant Protection Directorate (PPD), where there is a technical support from FAO-Nepal directly in twelve Districts. PPD has been conducting this program directly in five Districts as Intensive IPM Program and other sixty two Districts as regular program.

This program has been one of the popular program of the Department of Agriculture mainly for the contribution for the production trained human resources, using it as an important vehicle for transmitting the technology, contribution in reducing hazardous groups of pesticides thereby reducing biotic problems so as to increase the agricultural production. In its program focused Districts, there have been reports of reducing un-necessary use of chemical compounds and promotion of botanical and local methods. Despite of its increasing recognition in the farming communities, technicians and policy makers, there has been criticism about its sluggish movement due to negligible extent of coverage, lack of IPM policy, certified IPM products. In the long run, IPM would be an entry point to the OPM, however, many of the infrastructural supports and tools are apparently feeling for its poor coverage.

Ever since its establishment, the IPM program in Nepal has been viewed and understood in a project mode and there is a long hangover among a considerable number of stakeholders that "IPM is a project". Similarly, most of the practitioners feel it as "a method rather than an approach"(PPD, 2009) resulting in low internalization and industrialization.

Another reason for the sluggish impact of the IPM program could be the lack of alternative measures to chemical pesticides. Success of the IPM program relies on the availability of the alternatives tools to chemical pesticides to control pest insects. In fact, the low rate of success of IPM in general and particularly in Nepal is lack of IPM tools and packages. In Nepal, none of the private organizations and individuals has been reported to be involved in manufacturing such tools and technology. There has been a lack of a clear-cut policy and vision, such as the involvement of public-private-partnership (PPP) concepts. Production of *Trichodrema, Metarhizium,* Nuclear Polyhederosis virus (NPV) for example could be produced in Nepal without much delay. This aspect had to put into higher priority by the Department of Agriculture. It is the only year 2010, such activities has been initiated by PPD in its Laboratories and been producing with the involvement of private organizations. High priority will be placed in the second phase of the IPM program for producing and promoting viable alternatives to the chemical pesticides. This will include the production of bio-rational alternatives compounds such as botanicals and indigenous plant materials, and microbial based bio-pesticides.

The organizations for promoting IPM in Nepal are mainly Plant Protection Directorate (PPD) of the Department of Agriculture, Nepal Agriculture Research Council (NARC), Institute of Agriculture and Animal Sciences (IAAS), Himalayan College of Agricultural Sciences and Technology (HICAST), Centre for Technical Education and Vocation Training (CTEVT), some INGOs and NGOs like the then, EUFF, RRN, MADE-Nepal, CARITAS, LI-BIRD, FOREWARD, ECOCENTRE, SSMP, IWRMP (pers. comm.) etc. As a major actor for the IPM program in Nepal, PPD has overall responsibility for regulating IPM policies, norms; conducting basic IPM ToF trainings suitable to the farmers, medium and officer level technicians. Over the span of one and half decade history of IPM program in Nepal, PPD in conjunction with FAO supported program has given training to the more than thousands of farmers, hundreds of technicians. It has also conducted IPM Farmers Field School (IPM FFS) in number of farming societies but still its coverage to the whole country is still within a figure of 1%. In fact, this is a very bitter fact with a underlying causes of its support programs such as input support, market support, policy support, technical support. At the same time, the IPM components have to be easily adoptable in the farmers' circumstances in terms of financial aspect, technical aspect, socio-cultural aspects as well as to support their livelihood aspects. These facts, has to be taken into greater contribution while gearing up further activities. In fact, achieving four buzz principles of IPM through slogan is very easy but in practical sense, it has to satisfy many requisites. In majority of the cases, emphasis has been found lay on the training to the farmers, technicians, however, regulatory mechanisms to the incessantly introduction of banned and date expired chemical compounds are largely lacking. At the same time, none of organizations involved in this approach have found giving priorities for producing IPM tools, botanicals and biorational compounds except some of the populist activities. This situation always laid emphasis on cosmetic things rather than addressing of the real needs of the program. In many cases, this program has been blamed as one of the program for singing and dancing. In fact this is not true as the IPM is discovery based learning and in majority of the cases the learning goes in a participatory better environment. In order to justify the apparent need of the program, this program has to answer many of the questions with related to reduction or cessation of the continuous use of highly hazardous groups of chemical pesticides, tangible contribution in increasing the crops yields, improvements in the environment and human health. In fact, these may be achieved with joint efforts for the wider scale dissemination of the messages for judicious use of chemical pesticides, promoting bio and botanical pesticides, intensifying regulatory mechanisms and development of alternative compounds. In addition, attraction towards larger community in this approach may largely be assisted with the imposition of the premium prices by the Government. For this, organized IPM production, certification, marketing would be vital aspects among many of the reminder of the programs (G. C. and Keller (2005). The success of IPM program would be a vital gateway for the OPM in Nepal and these programs may go hands in hand in many aspects as both of them operate with similar principles. In conclusion, it can be said that, the efforts both financial and technical aspects has to be concentrated putting into a single funnel for these programs and operated to the wider community. The resultant efforts of these programs is to produce healthy, hygienic and

nutritious foods which may contribute to for earning foreign currencies while improving the health of the human beings in many ways.

The study clearly demonstrates a clear and common understanding among farmers, researcher, and policy maker that there is a great need of OPM and IPM in Nepal. The key constraints include lack of alternative tools and technologies for promoting these approaches. Furthermore, both of them are complimentary to each other, where IPM being an entry point of OPM especially in pest insect and disease control and managing soil fertility. Both approaches operate on similar principles of sustainable agriculture, which is also the priority of the Government. At the same time, the ground reality is that, much of the works are related to the awareness related, in adequate of research and policy support, clear cut guidance as much of their programs are focused on blaming the chemical pesticides rather than developing alternatives. There is lack of inspection and standardization of the products integrated cropping system resulting into the use low organic manure. Despite of the popularity of the programs, greater emphasis for higher amount of production is apparent to meet the requirement of increasing population. At the same time, there is lack of mass awareness about the both of these components. Moreover, the land ownership pattern in Nepal has also impacted greatly for the effective implementation of OPM and IPM. Residue present on the agricultural crops has not been able to analyzed, so that the price discrimination between high pesticide used and no used could not been differentiated resulting into continuous discouragement for the producers.

FUTURE RECOMMENDATIONS

This review has showed that, before going into OPM, initiation of IPM program would be vital, so that the producers, consumers as well as up-stream beneficiaries may be accustomed to the less pesticide used produce. For this both human resource development as well as infrastructure development has to go hand in hand. This requires the building of the concepts in all institutions including research, teaching and extensions. Both of the components should be well back up and supported by research. Awareness, regulatory as well as support programs has to be promoted for the wider coverage of the program. The area and volume of production of the OPM and IPM has to expand without delay to meet the need of consumers. In order to promote the export of the organic production and substitute the import, the present volume can be increased with the wider adoption and implementation of the programs by various programs of the Government. Single efforts of Plant Protection Directorate will not be enough so that, it has to be adopted by other programs with their increasing supports such as from seeds to the markets. At the same time, policy has pivotal role for the success and wider scale coverage of the programs.

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