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*Corresponding author

Yubak Dhoj GC, Food and Agriculture Organization, Regional Office, Bangkok

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Review Article

Use of chemical pesticides in Nepal - The prospects for organic agriculture

Yubak Dhoj GC*

Food and Agriculture Organization, Regional Office, Bangkok

Abstract

With an aim to explore the possible phasing out of the chemical pesticides from the usages of agricultural purpose in Nepal, a desk review was carried out gleaning through the available literatures. The major studies covers the status and usages of chemical pesticides whether it has been an alarming state or it can be used as a least options along with other ecological pest control means. At the same time, the study also tried to accumulate the information on the existing policies on pesticides imports and registration along with the existing pest control measures with the use of chemical pesticides so as to determine judicious or injudicious usages. At the same time the insight was made on the alternative control measures using botanicals and bio pesticides as an alternative to chemical pesticides. Some of the initiatives towards the organic production were also reviewed. The study revealed that, Nepal is not a country using high amount of chemical pesticides while producing agricultural crops. It is very interesting to note that, there are no any chemical pesticide manufacturing industry existing in the country as there are only four pesticides. Formulations Company import active ingredients mainly from India. It has robust chemical pesticides registration system through its own established system. Very interestingly the national average of chemical pesticide is found as low as 396 a.i./ha which is very insignificant compared to other country. This further indicates that, the soil and environment of the country has not deteriorated yet and still large area of the country do not rely on chemical pesticides. However the use of chemical pesticide is the foremost choices to the farmers in some commercial crops and pockets. The judicious use of chemical pesticides considering the health of the farmers, users and environment are at the often considered indicating ample awareness on the safe use of chemical pesticides. Production and usages of botanicals and bio pesticides are in place. Some dozens of such compounds are being registered and in use. The study also explored the possibilities of using agricultural commodities without using chemical pesticides. It was found that, one of the provinces among seven in the country, the Karnali Province declared the organic state. Based on the geophysical situation of the country, the use of chemical pesticides has been limited to only in some commercial pockets less than 25% of the country, which is mostly at the flat area leaving mid-hills and high hills. In such area, agricultural produces in Nepal is by default organic in nature since time immortal as there is less access of chemical pesticides coupled with low infestation of insect pests and diseases. There is ample scopes of producing crops, vegetables, fruits and several niche products. For this enhanced coordination along of the governmental and non-governmental agencies is must. Food and Agriculture Organization (FAO) of the United Nations has been involving in capacity building of the national system, which would be crucial to work in this endeavour as a hand in hand initiatives in the Organic State, Karnali province in Nepal.

Abbreviations: OPM: Organic Pest Management; OA: Organic Agricultural; IPM: Integrated Pest Management; AIC: Agriculture Input Corporation; AICL: Agricultural Inputs Corporation Limited

Introduction

Nepal is predominantly an agrarian country and its agriculture production system is dominantly based in traditional basis. Over the recent years, commercialisation has initiated in some crops and areas where the use of external inputs such as chemical pesticides are prevalent however, still larger area is grown without the use of chemical pesticides and fertilisers. In order to meet the demand of food requirements to its population, Nepalese farmers have intensified their land use to cope the food demands of increasing population. As a result of this intervention especially after so called green revolution, infestation of insect pests and diseases, declining soil fertility have realised as a 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 [1]. 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 however, the recent study shows there has not been greater deterioration of its soils for agricultural production [2]. Insect pests are 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 [3]. In some cases, the banned group of chemical pesticides by WHO and date expired chemical compounds are also were in use until recent past in Nepalese farming, however, they are largely ineffective to bring down the pest population [4]. The open and porous geographical border 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 etc. These practices have created several levels of hazardous effects to the human beings, non-target organisms, and 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 [5]. Farmers have little access to the benefits of research and innovation; organic inputs especially bio pesticides and botanical pesticides 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. In this background a review was carried out whether Nepal can produces its agricultural crops with gradual phasing out of chemical pesticides. 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) within organic agricultural (OA) system [6]. The Nepal government's efforts to promote safe and minimal use of pesticides in the country includes an effective Integrated Pest Management (IPM) training program for vendors and others who deal with farmers. The training curricula covers capacity development for secure sales, distribution, storage and usage of pesticides (PPD, 2014) [7].

Along with these capacity development activities in place, there is great potentiality of organic agriculture as majority of its cultivated land has not been degraded much due to excessive uses of external inputs such as chemical pesticides and fertilizers. In fact, the pesticide uses is very high in some of the countries like Korea, India, Japan, Indonesia etc. however, Nepal consume only 396 gm a.i./ha. It is also because there is no chemical fertilizer manufacturing industry in Nepal. According to Plant QAMC (2018) 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 from which the entry of poor graded chemical pesticides are very likely. Pesticide regulations are revised as per the present context however, they are practically becoming cumbersome. This is also one reason that, Nepalese farmers are largely misleading from the effective pest management and poor attention on the bio rational pest control. Several insect pests and diseases have gained resistance with several groups of chemical compounds resulting into more difficulty for their control [8]. At the same time, it has resulted into adverse effects on the human health and environmental pollution. In this sense, organic pest management may be best solutions to minimize the injudicious use of chemical pesticides and sustaining the crop yields, safeguarding human health and environment [9]. The solution to promote organic agriculture in large scale is the promotion of bio rational compounds hence there seems a very logical interface between them.

Materials and Methods

The study was carried out gleaning through the literatures in the Ministry of Agriculture and Livestock Development of the Government of Nepal (MoAD, 2018). General agricultural system along with the production system was reviewed. At the same time, the policy related issues on the imports, registration and use of chemical pesticides was studied. Also, the possibilities of growing agricultural crops with the less or no use of chemical pesticides was also reviewed. In order to find the status of organic pest management and possibilities of introducing bio pesticides into the system of organic agriculture in Nepal, available literatures were reviewed through primary and secondary sources. Information were collected from different institutions, individuals involved in agriculture from production to policy level. Similarly, secondary information related to bio pesticides, IPM and OPM was collected through available literatures. In order to depict the status of organic pest management and organic agriculture in Nepal, literatures were cited available in the Department of Agriculture, NARC, Khumaltar, NGOs, and INGOs and with individual contact.

Results

Existing policies on chemical pesticide

The Nepalese parliament had approved the Pesticides Act in 1991 [9]. As a first ever bill in the country. Thereby the Pesticides Rule was formulated in 16 July 1994. These bills were 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 Livestock Development consisting of members from various government Ministries, Departments, scientists, pesticide entrepreneurs, users, farmers and other members nominated by the Government of Nepal. The Act had provision for publishing the names of pesticides registered in Nepal in Gazette by Government of Nepal as per the recommendation of the committee. The Act had a provision to deregister the pesticide and may restrict on 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 was required. Similarly, to register the roster of the professional dealing with specific pesticides similar processes were mandatory. These bills had limited windows for registering and promoting bio pesticides in Nepal. Looking into the need of revision of the past act, recently in 2019, Pesticide Act has been promulgated and has amended various articles in the changing context.

Pesticides use in Nepal

Pesticides are an enormous group of chemicals designed to kill unwanted insects (insecticides), weeds (herbicides), rodents (rodenticides), fungi (fungicides), and other so-called pests. Pesticides classified as being extremely or highly hazardous to health by FAO and WHO are not found in use in Nepal [10, 11]. The most important threats from the pesticides are health hazards due to their indiscriminate and improper use. Loss of crops in the field as well as in post-harvest storage has reported to be as high as 35% in Nepal. Since, 1997 there has been dramatic rise in pesticide imports and consumption in Nepal [12, 13]. 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. Although Nepal does not use higher amount of active ingredients of pesticides compared to other nations, which is only 396 gm a.i./ha [12]. Whereas in most of the South East Asian countries average use is 3.6 kg ha-1. Nevertheless, the use of pesticide per unit area is exceptionally high in some of the commercial crops such as cotton. (Table 1) shows the pesticide use in different crops in Nepal. Vegetable crops receive higher dose and frequency of chemical pesticides followed by cash crops where the cereals are less used. 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 [14]. Realising the harmful effects of chemical pesticides, search on the alternative compounds at the level of users, consumers and policy makers has been at high alert, which is very good.

Table 1: Pesticide use in different crops in Nepal.

Crops	Quantity (ai kg/ha)
Cereals	0.046125
Vegetables	1.604693
Cash Crops	0.186542
Pulses	0.05075
Fruits	0.029187

Pesticide registration

Looking into the summary of pesticides registered in Nepal (Table 2) to-date, about 3035 pesticides and bio pesticides with 1635 trade name and 59 common name of insecticides, followed by 746 trade name and 42 common name of fungicides are registered. Similarly small number of acaricide, bactericide, herbicide, rodenticide, molluscicide and nematicides are also registered for crop pest control (Table 2) shows the interesting figures that the role of bio pesticides and herbal compounds in Nepal is still at a rudimentary stage [15] based on their availability. There is a great scope of promoting non-chemical measures in Nepal through the formulation and imports of bio and botanical pesticides.

Table 2: Summary of Registered Pesticides in Nepal until December, 2018.

SN	Pesticides	Trade Name	Common Name
1	Insecticide	1635c	59
2	Acaricide	28	6
3	Fungicide	746	42
4	Bactericide	17	1
5	Herbicide	436	30
6	Rodenticide	38	2
7	Molluscicide	2	1
8	Biopesticide	113	14
9	Nematicide	1	1
10	Herbal	19	13
	Total	3035	169

Banned pesticides in Nepal

The problem is, many of the chemicals used to kill pests also endanger human health.

Some of the highly toxic group of chemicals, for example, have been linked to cancers, birth defects, and learning disabilities. Because of the hazardous nature of the chemical compounds, some of them are phased out and some are deregistered for the imports and uses in several countries. Nepal is also a signatory country for WHO and follows the rules, regulations as committed in different treaties and convention. Recently it has phased out 1a and 1b type of extremely and highly hazardous chemicals as categorized by WHO [16]. Based on these criteria, it has imposed ban more than 21 different chemical pesticides which are enlisted in below (Table 3). The Pesticide Inspector performs Monitoring and regulation of these compounds. The regulations for the import, sale and usages are further made stringent in the recently approved Pesticide Act in 2019. If a person is found in trading and using unregistered and ban group of chemicals the act has made provision for punishment of even the jail term and fine with the high amount of money. Thrusts on this act is towards the promotion of safer groups of chemical pesticides and bio pesticides while making the provision contextual. Source: Panjikrit Bisasdi ko Suchi tatha Bisadi Khapat Tathyank, 2076. Plant Quarantine and Pesticide Management Center, Ministry of Agriculture and Livestock Development, Nepal, 2019.

Table 3: Banned pesticides in Nepal.

SN	Pesticide	Date of ban	Remarks
1	Chlordane	April 9, 2001	POPs
2	DDT	April 9, 2001	POPs
3	Dieldrin	April 9, 2001	POPs
4	Endrin	April 9, 2001	POPs
5	Aldrin	April 9, 2001	POPs
6	Heptachlor	April 9, 2001	POPs
7	Mirex	April 9, 2001	POPs
8	Toxaphene	April 9, 2001	POPs
9	Lindane	April 9, 2001	POPs
10	BHC	April 9, 2001	POPs
11	Phosphamidon	April 9, 2001	PIC (Annex III)
12	Organo-Mercuric Fungicide (EMC, MEMC, PMA,PMC)	April 9, 2001	PIC (Annex III)
13	Methyl Parathion	December 31, 2007	PIC (Annex III)
14	Monocrotophos	December 31, 2007	PIC (Annex III)
15	Endosulfan	November 5, 2012	POPs
16	Phorate	Banned by Pesticide Committee on July 5, 2015, need to publish in Gazette.	PIC (Annex III)
17	Carbofuran	Banned by Pesticide Committee on December 31, 2018 and published in Gazette on January 27, 2020.	PIC (Annex III)
18	Carbaryl		II
19	Dichlorvos		Ib
20	Triazophos		Ib
21	Benomyl		
22	Dicofol	Banned by Pesticide Committee on August 4, 2019 and published in Gazette on January 27, 2020.	New POPs
23	Carbosulfan		II
24	Aluminium Phosphide 56% Formulation of 3g tab)		NC

Import, distribution and use of pesticides and bio pesticides

Nepal Government started procuring and supplying chemical pesticides since 1996 through Agricultural Inputs Corporation (AIC). Later on it was renamed as Agricultural Inputs Corporation Limited (AICL). In addition, well-known international manufacturers such as Bayer, Hoechst, Ciba Geigy, Cynamid, Shell, BASF and Sumitomo also promoted pesticides through their sales agents in different countries and Nepal was not an excuse. Nepal imports pesticides primarily from six countries: India, China, Malaysia, Singapore, Italy and Japan. These are distributed through 67 national and foreign companies. Ninety-seven pesticide suppliers have been registered in PQPMC. Currently, these agencies are dealing with the import of pesticides in the country. Most of the supplies come from Indian companies including sole distributors for the main international manufacturers. For some years, direct purchase of pesticides was also done in the public sector and by parastatals i.e., by the then National Seed Company Limited (NSCL), the Cotton Development Board, the then 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 in terai, in some commercial pockets of vegetables, cash crops and fruit production including Kathmandu and other valleys. Currently there are 6,660 registered pesticide dealers in the country. They are primarily concentrated in more commercial agricultural areas however; it is still good to note that their penetration has not been such a voracious in the mid and high hills. This signifies that, still the soil of such area has not been degraded to the level, which is undesirable. It would be very wise to introduce botanicals and bio pesticides in the semi-commercial to commercial scale in that area. (Table 4) shows that significantly higher amount of money has been investing in the imports of insecticides (more than 43 corer NRs) followed by fungicides which is (more than 22 corer NRs). It is very interesting to note the imports of bio pesticides and herbal compounds is almost in negligible extent. Furthermore, it is very regretting to see the zero figures of indigenous formulation of bio pesticides and herbal compounds in the country. Very insignificant quantity of bio pesticides has been trading in either the country imported from India or other country. Production of indigenous bio pesticides with Metarhizium anisopliae in the talcum powder and Trichoderma viridae was initiated with the public private efforts by the then Plant Protection Directorate and Agricare Pvt, Chitwan Nepal in 2011 [10]. It was the positive aspect in the field of producing novel means of pest control in Nepal. Since then, similar kinds of products are seen accidently and occasionally produced in home scale.

Pesticide imports reveal that insecticides comprised the majority (60%) followed by fungicides (30%) and other pesticides (10%) [14]. However, more recently, fungicides dominated the import volume (48%) particularly phosphamidon and organo mercury 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 [15]. Total pesticide import and consumption is steadily increasing, but there is a lack of systematic data for the procurement and consumption of pesticides. According to the record, the highest amount of pesticide that was recorded as sold through AIC was 971 t of powder pesticides in 1989 and 10,699 liter of liquid pesticides in 1982, most of which would have been agricultural lime according to the Ministry of Finance [17]. The lowest recorded figure for pesticide sold was 7 t of powdery pesticide and 55 l of liquid pesticide in 1998. Statistics on pesticides use are missing for after 1999 when Agriculture Input Corporation (AIC) was divided into two companies such as Agriculture Input Corporation Limited (AICL) and National Seed Company Limited (NSCL). However, following the establishment of Plant Protection Directorate in 2000 within DoA (now the PQPMC) the process has resumed.

Pesticide formulation in Nepal

Only four Nepalese Companies have been registered and has been involved in manufacturing and formulating pesticides. The present trend of pesticide formulation shows, there are few pesticide formulators in Nepal (Table 5) where they import active ingredients from abroad.

Table 4: Pesticide imported & Formulated in Nepal in 2017/18.

Pesticide	Import (A) in quantity			Formulation (B) in quantity			Total (A+B)		
	(Kg)	(Kg)	(Kg)	(Kg)	(Kg)	(Kg)	(Kg)	(Kg)	Rupees (NRs)
Insecticide	1455498	194873	3.92E+08	45054	21018	39776557	1500552	215891	4.32E+08
Fungicide	350433	242145	2.11E+08	34980	24889	12379941	385413	267034	2.24E+08
Bactericide	376	37	1297585	0	0	0	376	37	1297585
Herbicide	312868	126351	1.5E+08	31650	15791	12594829	344518	142142	1.63E+08
Rodenticide	23950	6171	11467197	0	0	0	23950	6171	11467197
Molluscicide	4000	240	1100452	0	0	0	4000	240	1100452
Bio pesticide	11865	866.56	2260388	0	0	0	11865	866	2260388
Herbal	1057	34.35	1357300	0	0	0	1057	34	1357300
Total	2160049	570720	7.71E+08	111684	61699	64751327	2271734	632419	8.36E+08

Table 5: Pesticide formulator in Nepal.

SN	Name of Company/Firm	Address	Contact Person
1	Amit Pesticide Udhyog	Birgung, Parsa	Surendra Kdiya
2	Nepal Agro Industries	Parsauni-2, Bara	Kamal Agrawal
3	Kissan Agro chemicals	Birgunj, Parsa	Shyam Tlsyan
4	Nepal Krishi Rasayan	Birgunj, Parsa	Anil Tulsyan

Thoughts on organic agriculture in Nepal

Historically and by default, Nepalese agriculture was organic in nature however; it was contaminated especially after the introduction of external inputs such as chemical pesticides and fertilizers. In the course of the time, a single control measures i. e. pesticide application after 90s dominated the pest control in agricultural crops in Nepal. However, after 40 years of manufacturing and indiscriminate use in developed agriculture, 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 especially in 60s in developed nations. In Nepal, the first ever-recorded community level organic pest management 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. 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 introduced. These compounds along with dozen others, found their fertile grounds in Nepal even after their ban in 30 years before in USA. Because of quick effects and ease of application, their usage was alarming and the movement of organic agriculture overshadowed. Hence, organized movement of organic agriculture remained almost at rudimentary stage. Despite of all hindrances, there are good prospects of organic agriculture in Nepal. By default, Nepal's agriculture is organic in nature and by the fact that it uses almost negligible quantity of active ingredients of chemical pesticides. Utilizing its untapped natural resources and geography, it has tremendous potentiality of using botanical and bio pesticides. Trading organic products to its giant neighbours, the China in the north and India in the south opens the vast scope. Considerable quantity of quality products can be made available to growing number of tourists and domestic consumers. The niche produce in some specific locations has the geographical advantages. Handful organizations have involved in research, training, communication, production, processing, and marketing. In fact, the production size is very small which is not copping the current demand, as it is far higher than the production. The important drawbacks associated are land, organic inputs and passions on the producers. Some producers are seeking the support for declaring organic zones and for certification and trading. Future efforts are indeed needed to these aspects.

Non-chemical herbs and bio pesticides in Nepal

Nepal is rich in botanical diversity and has huge prospects of using botanical herbs in pest management. The plant materials possessing pungency, bitterness, sourness and properties of repellence and anti feedant, which makes insect unhappy or causes death due to toxicity. Domestic use of some of the compounds like Artemisia vulgaris, Adhatoda viscia, Azarachtina, Melia etc. in different forms of local preparation are common. However, exotic formulations of herbs and bio pesticides in different trade name are also available in Nepal (Table 5). Despite of the greater potentiality in formulation and usage only two indigenous products such as Metarhizium anisopliae and Trichoderma viridae are formulated from the Nepalese isolates [18]. In the recent Pesticide Act, Nepal Government has provisioned the registration process easier for organic pesticides than the chemical pesticides. There are growing concerns and interests for registering compounds that are more organic. It is hoped that more of them will come into the registration in future.

Organization involved in organic agriculture in Nepal

The organized movement of Organic Agriculture in Nepal can be thought with 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, number of other institutions like LiBIRD, Jumla Farm and sales outlets are working in different level. Teaching institutes are involved in developing curriculum on organic agriculture at Tribhuvan University (IAAS) and Agriculture and Forest University (AFU) in 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. Ministry of Agriculture and Livestock Development has accorded highest priority in this endeavor and has recently working through high level Organic Agriculture Task Force. Karnali Province has declared organic state since last two years. Similarly, many organizations including NGos and INGOs have been started their programs at different levels. As a result some outlets are appearing mainly in Kathmandu, Pokhara and other parts. The organic agriculture as one of the important steps was realized especially when Nepal entered as a member country into World Trade Organisation (WTO) in 2004. Nepal also expressed its commitment in international conventions, such as Basel, Rotterdam, and Stockholm. It has also reviewed and included many provision in the recently promulgated Pesticide Act of 2019 over the previous Pesticide Act 1991 and Pesticide Regulation in 1994. It accorded emphasis on organic agriculture since 10th five year plan [19]. Agriculture Prospective Plan and Agriculture Development Strategy (ADS). In these days, organic products has been a subject of discussion among the researchers, teachers, development workers, farmers, traders, consumers and even among the policy makers. Its importance increasingly realized when Nepal expressed its commitment for sanitary and Phyto sanitary (SPS) measures in the international conventions. These days, more than 150 different national and international organizations, institutions, individuals are directly and indirectly involving in this area. Despite of the greater enthusiasms, systematic works in organic agriculture is still in primary phase.

Initiatives in Organic Agriculture in Nepal

Gradually, this area has been getting momentum despite of the enhanced awareness created by some of the NGOs initially. In fact the government initiatives emerged relatively late than that of private sectors and NGOs. Some of the initiatives taken by the Governments are notably through Pesticide Act (1991), Pesticide Regulation (1994), [20]. 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.

a. Use balance dose of fertilisers from organic and inorganic sources. Increase in the present dose of chemical fertilizer from 20 kg/ha to 120 kg/ha adding organic sources by which it would result annual increment of agricultural productivity from 3.5-5%.

b. Accord highest priority of producing and using organic fertilizer by providing subsidy for establishing manufacturing equipment. At the same time, there are encouragements for the production of bio pesticides, balanced use of organic and in-organic chemical fertilizers and adopt IPM to curtail the sole dependence of chemical pesticides.

c. Promote organic farming and export the goods with international standard.

d. Ministry of Agriculture and Livestock Development has been supporting for the certification of organic produce to encourage the producers.

e. Promote increasing use of hybrid seeds, animals and regulate using GMOs, however, Government does not favor using GMOs, LMOs and similar modified organisms.

f. Human resource development towards organic production is also good evidences of the Government support in this area.

g. Initiation of Nepal Good Agriculture Practices (Nepal GAP).

h. Formation of High Level Task Force for Organic Agriculture

i. Declaration of Organic Province in Karnali and gradual supports to other states.

j. Pesticide Residue Analysis and stringent criteria for pesticides imports and provision of punishments.

k. Subsidy on organic vegetable and other commodities through provincial government programs.

l. Subsidy on the production and trading of organic products within the program of Prime Minister Agriculture Modernization Program

m. Subsidy on the establishment of manufacturing level to the formulation of indigenous biopesticides.

Discussion

Despite of the greater potentiality of organic agriculture in Nepal, still the production system mainly in cereal crops is largely dominated by chemical pesticides and fertilizer. It will remain continue until the foundations for organic agriculture are not developed. This is probably not due to the desire of the producers but due to inadequate availability of the alternate compounds to chemical pesticides. Availability of land as organic production zones and organic inputs along with policy supports are key to this endeavour. Predominantly, Nepalese produce are organic in nature however, there is lack of organized production and certification system. There is lack of surplus produce as major bulk of production goes to homestead consumption except few of the export-oriented commodities such as tea, coffee, zinger, herbal products etc. It demands increasing the volume of production by quantity and value addition. It can be achieved by settling the issues related to policy, lands, subsidy, inputs and technology. It is largely determined by the complex cropping system influenced by land ownership and biotic factors. Nearly half of the problem for producing organic agriculture is linked with no use of external inputs such as chemical pesticides and fertilizers. Perfect organic or quasi-organic products depends on the commodities and locations. However, it would be vital to support this move by developing alternative compounds such as organic nutrients and bio rational compounds. Declaration of organic state, Karnali Province is a positive aspect in these initiatives however, lot has to be done in this regard. For this, organic inputs like bio pesticides and bio fertilisers needs widely available at the accessible and affordable means to the farmer. Augmented and inundated approach are needed at a time when the natural control over biotic problems are insufficient or unsuccessful. Principally, the role of nature and natural enemies can be cited however, their activity are insufficient as a result farmers are compelled to use pesticides. Similarly, varieties of options for enhancing soil carbon can be lectured but addition of inorganic source of fertilizers are inevitable. Organic agriculture in a small may be easier than the large-scale production. It is apparent when improved and hybrid crops are grown in a semi-commercial to commercial scale of production. Therefore, availability of organic tools and techniques with enhanced coordination are needed when the volume of production has to be increased [21-23].

Conclusion

Nepal is endowed with diverse range of flora and fauna, hence their exploitation seems vital. Most of them are considered highly useful in the managing biotic problem while producing agricultural crops. Smallholder farmers are using varieties of homebased products however, their production to the commercial level has not been exploited yet. There is the greater needs of coordination and production of the novel compounds at the commercial level. Nepalese agriculture offers the perfect environment for the exploitation of botanical pesticides as it is rich in floral diversity. In the no pesticide use area, there is ambulance of the natural enemies which offers potential solutions to control crop enemies. As they regulate the pest and diseases complex. However, their presence without artificial rearing and release are insufficient. For this, the research and development organization can work hand in hand. Furthermore, Nepal does not have a chemical pesticide manufacturing industry, meaning that its soil has not contaminated yet to the level which may be considered as an ill soils. This also offers good scope for organic production. Ranges of insect pests are controlled with toxic chemicals however, their needs can be avoided using bio pesticides. Some bio rational compounds are already in place. Various studies in Nepal has indicated ample scope of using such novel compounds but their commercial production are not available. These all are needed added supports to enhance the role of natural enemies otherwise they would require using chemical pesticides and fertilizer. At present, we are standing not at the fork where two roads diverge but standing at the meeting points where two road converge. We have the choices to go both organic as well as inorganic production system by specifying the production zones and commodities. It is also true in a sense, when the country is struggling for quantity and quality production. This needs wider collaboration, cooperation and interventions from lab to the land, farm to the fork and policy to the action.

In the coordinated venture, along with many other institutes, Food and Agriculture Organization (FAO) of the United Nations could be a potential institute for supporting capacity building. It has dedicated to defeat the hunger and malnutrition of the people. It considers food security, health of the people and environment from being deteriorating. Hence, judicious use of chemical pesticides while considering the human health and environments are its priority. Since long time, FAO Country office Nepal has been working in various capacity with the national government. Mainly its role is to support in strengthening of the national system in food production, alleviation of the poverty, environmental conservation. In the context of inadequate capacities of the technical staff and farmers backstopping role would be vital. The gradual phasing out of the chemical pesticides, FAO can play a pivotal role in capacity building of the working staff, farmers and various stakeholders. Preparation of master trainers in facilitating the ecological agriculture would be crucial. Collaborative efforts with research, extension, and development agencies in hand in hand initiatives are imperative.

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