Research Article

KNOWLEDGE AND PRACTICES OF VEGETABLES INSECT PEST MANAGEMENTS IN BANGANGA MUNICIPALITY OF KAPILVASTU DISTRICT

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ABSTRACT

A study was carried out in Banganga Municipality of Kapilvastu district to know the farmer's knowledge, practices, and management method used in insect pests of vegetables. The survey involved 160 randomly selected farmers who were interviewed using semi-structured questionnaires and also evaluated based on direct field observation. The data were analyzed using SPSS and Microsoft-Excel. Tomato, potato, chili, cauliflower, cabbage, garlic, and onion were major vegetables grown by the farmers during the winter season and cucumber, bottle gourd, bitter gourd, sponge gourd, tomato, chili, brinjal during the summer season. Aphids, cabbage butterfly, pumpkin beetle, tomato leaf miner, cutworm, and tomato fruit borer were the major pests in vegetable field. Knowledge of vegetable farmers regarding insect pest identification was also observed i.e., 86% of respondents identified insect pest by the help of Junior Technical Assistance and agro-vets, and 10% of respondents identified insects by their own knowledge. About 60% of respondents were found using chemical pesticides such as; chlorpyrifos, cypermethrin, imidacloprid, alphamethrin etc. to control pests, 4% of respondents were using botanical plant extract i.e., jholmal, neem extract, cow urine and 24% were using cultural methods such as crop rotation, mulching, tillage operation. Only a few farmers' groups were found to know about IPM, biological pest management practices, and conservation of natural enemies.

Keywords: *Vegetable crop, insect pest, disease, IPM, management*

INTRODUCTION

Nepal is being commercialized in agriculture gradually. The total cultivated area of vegetables in Nepal is 2,81,132 ha with the production of 39,62,383 mt and the productivity of 15.09 mt/ha (MoAD, 2019/20). Vegetables especially tomato, potato, cauliflower, chili, cabbage, sweet pepper, onion, garlic, radish, carrot, coriander etc. are produced commercially (Chaudhary, 2018). With this increase in vegetable production, there is also

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an increase in the use of production inputs such as chemical fertilizers and other plant nutrients, crop seeds, and pesticides (Malla, 2008).

Commercial vegetable production in Nepal heavily relies on chemical pesticides for pest control (Rijal *et al*., 2018). The excessive use of insecticides has led to the modification of its physiological and genetic organization, resulting in the development of resistance. It is found that the resistance of diamondback moth (DBM) *Plutella xylostella*, against *Bacillus thuringiensis* is due to the change in the midgut receptor. The tendency of pesticide use is increasing by 10-20% every year and 90% of which is used in vegetables (Ghimire and Lamsal, 2018). Aphids *Brevicoryne brassicae*, cabbage butterfly *Pieris rapae* diamondback moth *Plutella xylostella*, tobacco caterpillar *Spodoptera litura*, white grub, cutworms, red ants, red pumpkin beetle and fruit fly are the major insect pests of vegetable crops in Nepal (AICC, 2012). Similarly, whitefly and leaf miner in tomato, white grub and red ants on cereals and vegetables crops were the gist of researchable entomological issues in Nepal (Limbu, 2009). Pest management is one of the major aspects of vegetable production in Nepal. Farmers are not much aware of the pest management methods (Gyawali, 2014). Vegetables are one of the main products consumed fresh or raw (PPD, 2014). However, these crops receive a higher number of pesticides than the optimal economic dose due to a lack of knowledge among farmers. According to Mahmood *et al.* (2010) vegetable growers used the second-highest number of pesticides after rice producers in the country. The recent increase in the use of pesticides in vegetables is due to an increase in seasonal and off-season vegetable production (Atreya *et al*., 2012). It is estimated that Nepal losses 35% of production due to pest attacks in the field at the storage conditions (PPD, 2012). In 1996, brown plant hopper *Nilaparvata lugens* outbreak occurred and caused an estimated loss US$ 212201 in Rice. Then government of Nepal emphasized integrated pest management (IPM) in 1997 strategy for the management of such pest by educating the farmers through farmer field school in 1999 (Adhikari, 2017).

Majorities of people in Banganga Municipality depend on agricultural sector such as growing of different vegetables crops and livestock production in commercial and in small scale. People of this area have also shifted their farming pattern in commercialized way and producing vegetables in large scale to meet market demands. Agricultural division of Banganga Municipality encourages small scale farmers to expand their farming in commercial scale by providing them technical supports and different farm inputs such as seed, fertilizers, instruments, etc. which are used in agriculture sectors. They also provide different training related to seasonal and off-seasonal vegetable production, IPM, farmer field school, pesticides and insecticides use pattern etc. which are helpful to farmers as they can learn new methods and techniques regarding farming practices.

Very limited study has been carried out regarding insect pests of vegetable crop in Banganga Municipality. Studies on management methods followed by farmers are still

lacking. Farmers have less knowledge about identification of insect pests and choosing the best management method for controlling insect pest infestation in the field. They depend upon chemical pesticides as prescribed by agro-vets. Hence, this study provides representative data on major practice and knowledge of farmers in management of insect pest of vegetables at Banganga Municipality of Kapilvastu district.

MATERIALS AND METHODS

Selection of study site

Banganga Municipality which is located in Kapilvastu district was selected as a site of survey. It is most popular archeological site of Lord Buddha. Banganga municipality has a total area of 233.6 sq km of land area, lies in between 27° 35'' to 27° 48'' in North and 83° 03'' to 83° 14'' in East. According to the 2021 census report, the total population of the municipality is 97,114 with population density of 415.6 per sq.km. It consists of all together 11 wards. Kapilvastu district is one of the pocket zones for vegetable production. As many people are involved in vegetable farming as their major source of occupation there is a scope to evaluate their knowledge and practice regarding insect pest management methods used. This was the significant justification for choosing the site for the examination.

Sampling methodology and sample size

The field survey was carried out in the Banganga Municipality of Kapilvastu district. Altogether 160 farmers were selected randomly representing 15-20 farmers from each ward. Semi-structured questionnaires were administered to collect data. Individual farmers involved in agriculture were interviewed and data was collected based on questionnaires. Secondary information was collected from various published resources such as books, articles, research papers, journals and from different websites through internet surfing. The preliminary field visit was conducted to obtain the general information as well as the background of the study area. The survey was carried out during 15 January to 18 March 2021.

Data analysis

The collected data were coded, entered, managed and analysis by using MS Excel and Statistical Packages for Social Science version 25. In order to study whether two variables were associated with each other, chi-square test was done. Age group, education and occupation were compared with farmers practices and knowledge to see their association. Chi-square test was performed at 5% level of significance to measure the association among variables.

RESULTS

Socio- economics of the respondents

Majority of the vegetable growers were female (64%) and of the middle age class (55%). About 28% were illiterate, 47% had attained a primary level of education, 12% attained the secondary level of education and 13% attained a higher level of education. Banganga municipality was highly dominated by Tharu caste i.e., 48%. Out of the total farmer's surveyed, 44% depended on agriculture as their source of income, 20% in business, 23% in civil service and 13% in labor work, foreign employment, etc.

Table 1. Socio- economic condition of the respondents

Variables	Frequency
Gender of Respondents	
Male	58 (36)
Female	102 (64)
Age-group	
Young	53 (33)
Middle-age	86 (55)
Senior	21 (13)
Caste	
Tharu	75 (48)
Brahmin	31 (20)
Dalit	25 (14)
Chhetri	28 (18)
Education	
Primary	74 (47)
Secondary	20 (12)
Higher	20 (13)
Illiterate	46 (28)
Source of Income	
Agriculture	70 (44)
Business	32 (20)
Service	21 (23)
Others	37 (13)

Note: Figures in parentheses resemble percentage

Major vegetables grown in Banganga municipality

Majority of respondents were cultivating vegetables like cauliflower, cabbage, tomato, chili, potato, garlic, onion, etc. It showed that farmers were found to prefer hybrid seeds as compared to local seeds mainly due to their higher production, attractive fruits and get more profits. Farmers were also found to be using their own saved seed for fresh vegetable production in potato, garlic, and onion.

Table 2. Major vegetables grown in Banganga municipality

S.N.	Vegetable Crops	Varieties	Response (%)
1.	Cauliflower	Snow Crown	43
		Kathmandu Local	19
2.	Cabbage	White King	15
		White Diamond	22
3.	Tomato	Him Sona	33
		Heemshikhar	25
		Srijana	10
		Manisha	20
		Makis-F1	12
4.	Chili	NS-1701	18
		NCH-1901	29
		Pusa Jwala	22
		Super Tara	31
5.	Potato	TPS	20
		Cardinal	46
		Local	34
6.	Garlic	Local	100
7.	Onion	Nasik-53	50
		Gawran	15
		Local	35
8.	Bitter gourd	Pali	58
		Prachi	41
9.	Cucumber	Dynasty	17
		Bhaktapur Local	47
		Majesty	35

Major insect pests

Most of the farmers in the study area were not found to be aware about pests of vegetable crops. They were also unknown about beneficial and harmful insects. Cabbage butterfly, aphids, brinjal fruit and shoot borer, whitefly and potato tuber moth were observed as major pests in the survey area.

Table 3. Major insect pests of vegetables at Banganga Municipality

Crops name	Major pests	Incidence (%)
Cabbage/	Cabbage butterfly (*Pieris rapae)*	46
Cauliflower	Cutworm (*Agrotis ipsilon*)	25
	Aphids (*Brevicoryne brassica*)	29
Brinjal	Brinjal fruit and shoot borer (*Leucinodes orbonalis*)	67
	Aphids (*Myzus persicae*)	33
Tomato	Tomato fruit borer (*Helicoverpa armigera*)	58
	Tomato leaf miner (*Tuta absoluta*)	42
Chilli	White fly (*Bemisia tabaci*)	50
	Fruit and shoot borer (*Helicoverpa armigera*)	19
	Aphids (*Aphis gossypii*)	31
Potato	Potato tuber moth (*Phthorimaea operculella*)	59
Beans	Cutworm (*Agrotis ipsilon*)	35
	Aphids (*Aphis fabae*)	65
Cucumber	Red Pumpkin beetle (*Aulacophora foveicollis*)	66
	Cutworm (*Agrotis ipsilon*)	34

Source: Field Survey (2021)

Farmer's source of knowledge on identification of vegetables insect pest

Farmers identified various insect pests of vegetables by their common name some of them were aphids, mealy bug, butterfly, grasshopper, stem borer, beetles and 86% identified insect pests by the help of agro-vets and JTAs while 10% identified insect pests by their own experience.

Majority of farmers used to identify insect pest when agricultural officer visited their farms and by taking their samples to agro-vets or by simply explaining their damage symptoms directly to agro-vets and government officers.

Table 4. Farmers source of knowledge on identification of insect pest

Farmers category	**Farmers source of knowledge on identification of insect pest**			
Age-group	Self	JTAs	Agro-vets	Can't identify
20-30	4(1.9)	4(4.5)	5(5.6)	0(1.3)
30-40	3(5.8)	17(13.8)	15(17.3)	5(3.3)
40-50	10(12.4)	27(29.6)	41(37.1)	8(7.0)
50-60	6(3.0)	7(7.2)	8(9.1)	0(1.7)
Chi-Square value = 12.934		p- Value = 0.166*		
Farmers category	**Farmers source of knowledge on identification of Insect pest**			
Education status	Self	JTAs	Agro-vets	Can't identify
Illiterate	10(6.6)	20(15.8)	15(19.8)	1(3.7)
Primary	7(10.6)	13(25.4)	47(31.9)	7(6.0)
Secondary	4(2.9)	11(6.9)	2(8.6)	3(1.6)
Higher	2(2.9)	11(6.9)	5(8.6)	2(1.7)
Chi-Square value = 34.168		p- Value = 0.00813*		

Notes: Figures in parentheses resemble percentage. * Indicates level of significance at 5 percent

Farmer's practices of insect pest management

Table 5. Farmer's practices of insect pest management

SN	**Practices**	**Response (%)**
1	Grow seedling inside nylon net	5
2	Check seedling before transplanting	10
3	Use of botanical plant extract to control insect pest	10
4	Use of plastic mulch to control insect pest	10
5	Do not grow host crop and remove host weeds	3
6	Mass trapping with pheromone, yellow sticky trap or light trap	12
7	Use of chemical insecticides to control insect pest	50

Source: Field Survey (2021)

Farmer's knowledge and practices of insect pest management methods

A variety of insect pest management practices such as cultural, chemical, botanical, mechanical, and mixed methods were being practiced among the different levels of farming communities in the survey area. The study showed that about 60% used chemical methods for controlling the insect pests with alternation of mechanical and botanical methods, 16% of respondents used only botanical methods such as Jholmal, neem extract, cow urine, ash and 14% of respondents used only cultural methods, while 10% of respondents followed only mechanical methods.

It was found that the majority of farmers preferred to use chemical pesticides which were available at local Agro-vets. Different types of pesticides were found to be used by farmers in the survey area, of which the use of cypermethrin was the highest followed by cypermethrin + chlorpyrifos and imidacloprid.

The results clearly indicate that the use of chemical pesticide by farmers was more than other methods. Majority of farmers was interested in commercial production and to increase productivity farmers adopted chemical measures more rapidly than others measures. They believed chemical insecticide control pest more rapidly than biological method and availability of chemical insecticide in market was also high as a result farmers were directed more towards the use of chemicals than any other methods. Lack of knowledge about pesticides use pattern and its health hazards on human health farmers were using pesticides which directly affects the health of farmers and consumers. Majority of farmers are still unaware of the use of biological methods and mechanical methods to control insect pests. As farmers depend upon Agro-vets and JTA`s advice to control insect pests, farmers have less technical knowledge about insect pest management methods. The Agro-vets and JTA experts directly recommend pesticides to control insect pests. The availability of traps, pheromones lure, biological control agents like trichoderma, etc.were not found easily in nearby agro-vets which results in increasing use of chemical pesticides on vegetable production.

As agro-vets and local market were still selling the banned pesticides like dichlorvos, respondents were found commonly using in survey area. The Majority of farmers were unaware of the use of banned pesticides. Lack of awareness among farmers was found to be a major reason for using banned pesticides.

Table 6. Major pesticide used by farmers

Trade name	Common name	WHO group	Formulation	Group
Alfa gold, Double FARSHA	Alphamethrin	II	10% EC	SP
Anchor	Imidacloprid	II	17.8%	Neonicotinoid
Anumite	Cypermethrin	II	10% EC	SP
Nuvan	Dichlorvos	Ib	77.5% EC	OP
G - Attack, Loyal-505, Commando-505, Surya, Star-909	Chlorpyrifos + Cypermethrin	II	(50% + 5%)	SP + OP
Kobra	Emamectin Benzoate	II	5% WP	Avermectin
Uthane M- 45	Mancozeb		75% WP	Fungicide
Ridoxyl	Metalaxyl		35%	Systemic fungicide

Source: Field Survey (2021)

Note: SP: Synthetic pyrethroids, OP: Organophosphates

Methods of insect pest managements

Education status showed significant relationship between management methods used by farmers whereas training received and management methods used by farmers differed significantly. About 60% of respondents were found using chemicals, 24% cultural, 4% botanical, 3% chemical and botanical together and 9% mechanical methods of insect pest management, respectively.

Table 7. Methods of insect pest managements

Farmers category	**Methods of insect pest management**			
Training received	Cultural	Mechanical	Botanical	Chemical
Yes	3(6.9)	4(4.9)	7(8.6)	37(36)
No	19(15)	12(10.8)	19(17.7)	59(65.3)
Chi-Square value = 5.977		P- Value = 0.11266*		
Farmers category	**Methods of insect pest management**			
Education status	Cultural	Mechanical	Botanical	Chemical
Illiterate	13(6.3)	7(4.6)	15(7.5)	11(27.7)
Primary	6(10.2)	6(7.4)	6(12)	57(44)
Secondary	2(2.9)	1(2.0)	3(3.3)	12(16)
Higher	1(2.9)	1(2.0)	2(3.6)	16(12)
Chi-Square value = 37.168		P- Value = 0.0000020*		

Notes: Figures in parentheses resemble percentage. *Indicates level of significance at 5 percent.

DISCUSSION

Table 1 reveals that majority of vegetable growers were dominated by females (64%) and tharu community (48%). From Table 2 we can observe that, major vegetables cultivated by respondents were cabbage, cauliflower, tomato, brinjal, chili, potato, onion, garlic and cucumber. The seeds used in vegetable cultivation are mostly hybrids. Due to high availability of hybrid seeds in local markets and agro-vet's farmers was found to be relying more on hybrids seed as compared to local seeds. This result is in line with findings of Horowitz *et al*. (1998).

Table 3 shows that, cabbage butterfly, aphids, cutworms, fruit and shoot borer, leaf miner and whitefly were major destructive pest as reported by farmers during field survey. Farmers were unknown about the benefits of beneficial insect pest. Similarly, only 10% farmers identified insect pest as destructive by their own knowledge and remaining 90% identified insect pest with the help of agro-vet's, JTA's and agricultural officer. From Table 3, it was observed that education status shows significant association on identification of insect pests at 5% level of significance.

Table 4 shows that major source of knowledge for insect identification was agro-vets and JTA's. Regarding practices followed by farmers, in Table 5 maximum i.e., 50% use of chemical insecticides was observed and only 3% of respondents were found to be following the removal of host weeds and crops. Tang *et al.* (2002) has also reported that same results. About one-third of farmers (66%) in study area were applying pesticide at the initial stage and 34% of respondents were found to be use pesticide at the severity stage. 44% of farmer were use recommended dose of pesticides. Table 6 shows that, due to lack of awareness program about pesticide, many farmers used banded pesticide like dichlorvos. From Table 7, we can observe that, about 60% of respondents were found using chemical pesticides mainly systemic and organophosphate group such as; chlorpyrifos, cypermethrin, imidacloprid, alphamethrin etc. to control pests, 4% of respondents were using botanical plant extract i.e., jholmal, neem extract, cow urine and 24% were using cultural methods such as crop rotation, mulching, tillage operation. Gautam *et al*. (2020) reported the same result in Parbat district.

Farmers use pesticides mainly on the crops like potato, tomato, cauliflower, brinjal, chili, bean, bitter guard, etc. for controlling various insect pests (Neupane, 2003) and diseases (Shrestha, 1996). More than 150 chemical pesticides are used in Nepal. Nepal loses 35% of production due to pest attacks in the field and at the storage conditions (PPD, 2012). Due to inappropriate use of synthetic insecticide, insect develop resistant to insecticides, which results outbreak of secondary pests and undesirable effects on non-target organism (Hagen and Franz, 1973) as well as serious environmental pollution (Devi *et al*., 1986)) are causing serious hazards to human health. Sharma (2016) reported that in Kaski district around 80% of the vegetable growers were using pesticides for more than 10 years. The vegetables growers were using highly hazardous (lb) pesticides. Almost 80% of the vegetable's growers spray pesticides more than 6 times in a year. Less than half (44.3%) of the vegetable growers known the adverse effect of pesticides and more than half (62%) of the vegetable's grower experienced symptoms of health hazard.

CONCLUSION

Fruit fly, tomato leaf miner, aphids, cutworms, potato tuber moth and whitefly are reported to be destructive pest of study area. The study revealed that farmers are more concerned with insect pest damage in their crop but they had little knowledge about the specific insect that cause harm to the crop. Due to lack of technical knowledge about insect pest identification and management methods farmers are suffering from more insect pest problems. Effective control method was limited to chemical as prescribed by agro-vets. Few respondents were found to be using alternative management methods besides insecticides such as use of traps, lure, biological pest management and IPM. It was noted that none of the farmers had an awareness of alternative host plant and also unknown about the use and importance of beneficial and harmful insects. In order to improve the farming practice, the

farmers of Banganga Municipality should be encouraged more on adopting the use of lure, traps etc. and availability of such tools in the local market is necessary.

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