

# Cole Crops Disease Management Approaches Practiced by Farmers and its Impact on their Health: A Case Study of Nala, Kavre District of Nepal

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## ABSTRACT

A case study was conducted at Nala, Kavre district to assess the present cultivation and disease management status in cole crops in the year 2019 with use of semi-structured questionnaire among the local farmers. It was found that majority of respondent cultivated cole crops seasonally and faced five major disease problem in it namely: stalk root (*Sclerotinia sclerotiorum*), Alternaria leaf spot (*Alternaria brassicae* and *A. brassicicola*), damping off (*Pythium sp.*), root rot (*Rhizoctonia solani*) and club root (*Plasmodiophora brassicae*). For management of those diseases, 83% respondent used conventional method of disease management i.e. chemical fungicides and insecticides. But the methods of management of disease was found significant with IPM training and awareness on biological approaches they have heard or related program attained. Almost 40% respondent had practices IPM packages of pest control based on training they have received and 33% has practiced based on the awareness program they have received. Also female guided farming has more probability to adapt IPM tools to minimize effect of pesticides and cooperatives had also played major role in mass communicating benefits of IPM. With 83% conventional management practicing farmers, they reported to face piles of immediate and chronic health issues due to continuous pesticidal use. Eye irritation (16.9%), skin problems (21.4%), headache (10.7%), respiratory problems (7.1%), and vomiting (5.3%), and chronically cancer (27.7%) was reported in the area due to prolonged and hazardous use of pesticides in conventional practices as per the respondents.

**Keywords-** cole crops, conventional, health issue, IPM, Kavre.

## I. INTRODUCTION

Cole crops are the largest group of temperate vegetables that includes Cauliflower (*Brassica oleracea* var. *botrytis*), Cabbage (*Brassica oleracea* var. *capitata*), broccoli (*Brassica oleracea* var. *italica*), Brussels sprout (*Brassica oleracea* var. *gemmifera*), Kale (*Brassica oleracea* var. *acephala*), knol khol (*Brassica oleracea* var. *gongylodes*) and so on. Those crops are the rich source of vitamin C and minerals (Roy and Chakrabarti, 2003). Cole crops being an important vegetable grown in

Nepal, about 32% of total area shared by this commodity (79954.1ha) and 35.1% of total production (3,700,969 mt) of vegetables in the country. But recent 5 years of period (2011/12-2015/16) have shown that vegetables in this family has been increasing in term of production, area and yield (Ghimire *et al.*, 2018). The production of vegetables in year 2016/17 was about 3,859,492 mt where the area of cultivation was 284,135 hectares (AICC, 2018). Being winter season crop, due to success stories of farmers successfully adopted such crops as offseason vegetables cultivation. Crops under these categories may have different edible parts but climate, soil and cultural practices for cultivation are similar (Pandey, Raj *et al.*, 2017). Different crops of this commodities have high demand in the market which is easy to sell (Sharma, 2001). Infestation with various diseases are one of the limitations for successful cultivation and desired production. In the case of cole crops cultivation, some of the diseases are appearing as economically important, One of the most important disease of cole crops is Club root which has been mentioned to be caused 100% crop loss in 2007/2008 at Palung district of Nepal and about 25% loss at Bhaktapur district (Timila, Manandhar and Manandhar, 2015). According to (Bhattarai *et al.*, 2015), in the year 2012/13 downy mildew and Alternaria leaf spot caused significant yield loss on different varieties of cauliflower at Nala.

Farmers are adopting various types of disease management practices to reduce crop losses without knowing their effects on health and the environment.

This study highlights recent production of cole crops in Nala, Kavrepalanchowk district with pest management practices as adopted by the farmers. Also, it tries to reveal the impact of management practices in their health.

## II. MATERIALS AND METHODS

The location of study was Nala of Kavre District (Fig 1). It is administered under ward 2, 3 and 4 of Banepa Municipality expanding from north western part of Kavre district to the eastern part of Bhaktapur

district in province 3. Site selection was purposive as Kavre district is nearest hub of highest vegetable crops production (MoALD and ICIMOD, 2015) from Kathmandu and with maximum annual cole crops (especially cauliflower, cabbage and broccoli) production in Province 3 (MoALD, 2017). Structured questionnaire was prepared with close and open-ended questions. It was coded in Kobocollect app version 1.27.3 to collect data remotely. Interview was taken with

82 farmers and disease infestation in cole crops wereself-observed in the field. Study was conducted in June/July 2018. Collected data was exported into Microsoft excel for further cleaning. Descriptive analysis and Fisher’s exact test was performed at  $p < 0.05$  for comparing attributes of qualitative nature using R-studio version 1.3.1056. For the visualization of data Microsoft Power BI Desktop version 2.84.981.0 was employed.

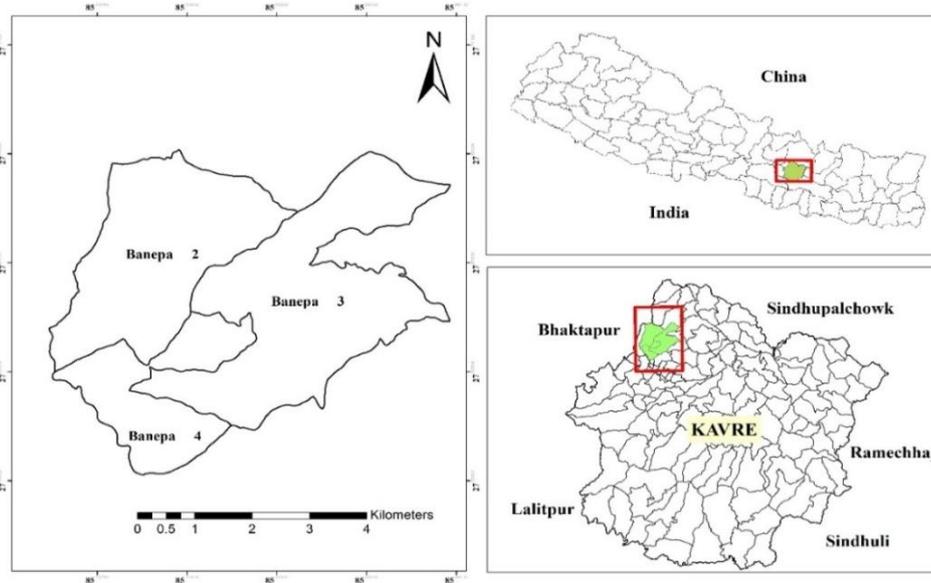


Figure 1: Map of study area

### III. RESULTS AND DISCUSSION

#### 1. Status of Colecrops cultivation and diseaseinfestation

Cole crops such as cabbage, cauliflower, broccoli and turnips were cultivated by the respondents in Nala. About 80.7% of the cultivable area was covered with cole crops commodity (Fig 2). Generally, people cultivated 2 ropani (0.1 ha) of land area with cole crops only. It is the maximum cultivated crops after potato harvest in the site.

According to MOALD (2017), cole crops alone accounted for 2367ha of land coverage with 39,499 mt production in Kavre district. In the year 2015/16 this group of vegetables shares 32% of total vegetable cultivation area (79,954.1 ha) with the total production of 35.1% (3,700,969 mt) of vegetable production in the country; in which cauliflower is cultivated in 3497 ha that covers 14% in area which is the highest among the cole crops. From the year 2011/12-2015/16, data have shown the increasing trend of these vegetables in term of area under cultivation, production and yield (Ghimire *et al.*, 2018).

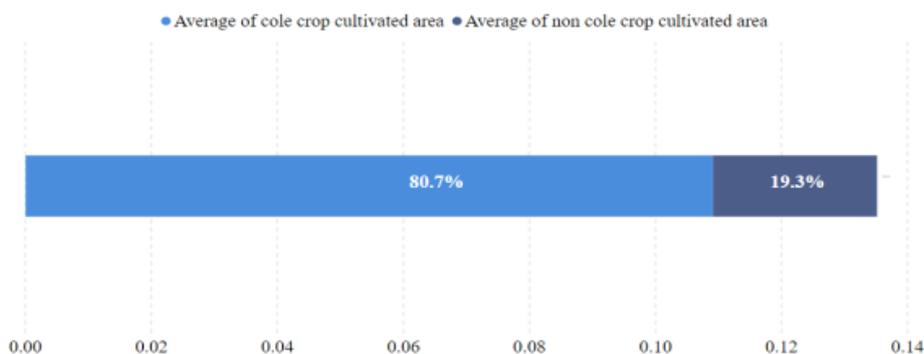


Figure 2: Percentage cultivation area occupied by cole crop at Nala, Kavre

Five different diseases namely stalk root (*Sclerotinia sclerotiorum*), Alternaria leaf spot (*Alternaria brassicae* and *A. brassicicola*), damping off (*Pythium sp.*), root rot (*Rhizoctonia solani*) and club root

(*Plasmodiophora brassicae*) of cole crops were evident in the site during study period. . Among the diseases highest prevalence was of club root (92.68%) followed by root rot (68.29%) and damping off (59.76%) (Fig 3).

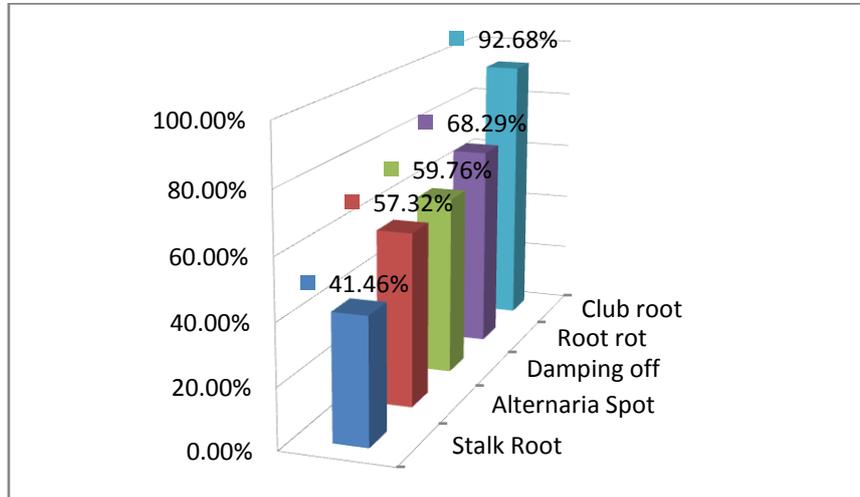


Figure 1: Disease infestation at the site

Similarly club root in combination with *Rhizoctonia* root rot disease was observed in Sera of Kavre district with severe yield loss on cole crops (PPD, 2013). Also Damping off, wirestem, foliar blight, bottom rot, head rot, crown rot ; the major yield reducing disease caused by *Rhizoctonia solani* were also reported in almost all cole crops cultivating locations of the hill and terai region of Nepal (Timila, Manandhar and Manandhar, 2015).

2. Management approaches adopted by farmers

For the management of above mention diseases, growers are found to adopt both conventional and IPM

practices. Under conventional approach, chemicals fungicides available in the nearby local market were applied. Fungicides such as Bavistin (Carbendazim), Dithane M-45 (Mancozeb), Dimethomorph were the mostly used ones.

While respondent adopting IPM tools were found to apply diluted cow urine, Trichoderma, local botanicals, soap water, crop rotation, garlic extract, and Jhol mal. Majority of the farmers followed conventional method i.e., application of chemicals fungicides for disease management in cole crops (Fig 4).

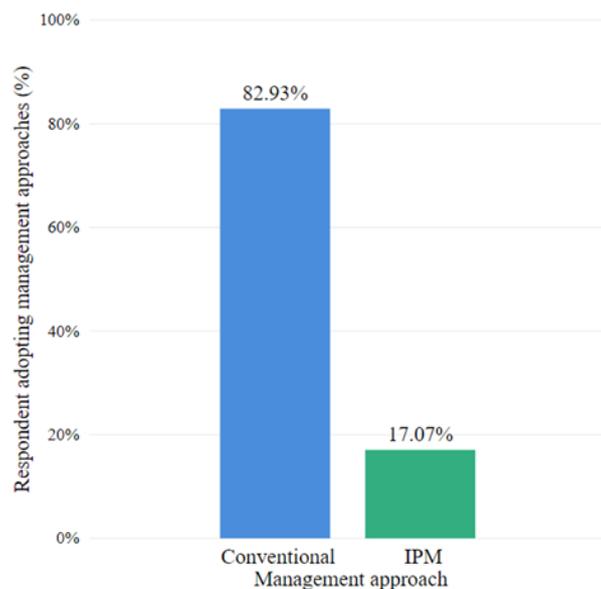


Figure 4: Management approach practiced at Nala, Kavre for management of diseases in cole crops

Table 1: Adoption of management practices by the farmers of Nala, Kavre

	Management Practices Adopted %			
	Total (N)	Conventional	IPM	
<b>Contribution</b>	Male	36	88.89	11.11
	Female	46	78.26	21.74
	<b>p-value</b>	<b>Ns</b>		
<b>Literacy</b>	Illiterate	30	86.67	13.33
	Literate	52	70.59	29.41
	<b>p-value</b>	<b>Ns</b>		
<b>IPM Training</b>	Yes	20	60	40
	No	62	90.32	9.68
	<b>p-value</b>	<b>0.004*</b>		
<b>Awareness on Bio-fungicides</b>	Aware	33	66.67	33.33
	Not Aware	49	93.88	6.12
	<b>p-value</b>	<b>0.002*</b>		
<b>Engagement with Cooperation</b>	Engaged	47	76.6	23.4
	Not Engaged	35	91.43	8.57
	<b>p-value</b>	<b>Ns</b>		

\* represents significant at  $p < 0.05$ ; ns represents non-significant

Adoption of disease management practices was found significant ( $p < 0.05$ ) with IPM Training and knowledge on bio fungicides. About 40% of respondent who have attained IPM training were more diverted to practice IPM packages in the field to control disease in cole crops. Application of chemicals pesticides in terms of active ingredients have been reduced from 2.85kg/ha to 1.82 kg/ha i.e., about 36% have been reduced by the positive effect of IPM-Farmer's Field School (FFS) training (Kafle *et al.*, 2014)

Meanwhile 33.3% of people who have idea on bio fungicide was found applying it on their disease management practices. For those who have not any training and awareness on bio fungicides, maximum percentage (>90%) was found to be applied conventional disease management practices (Table 1).

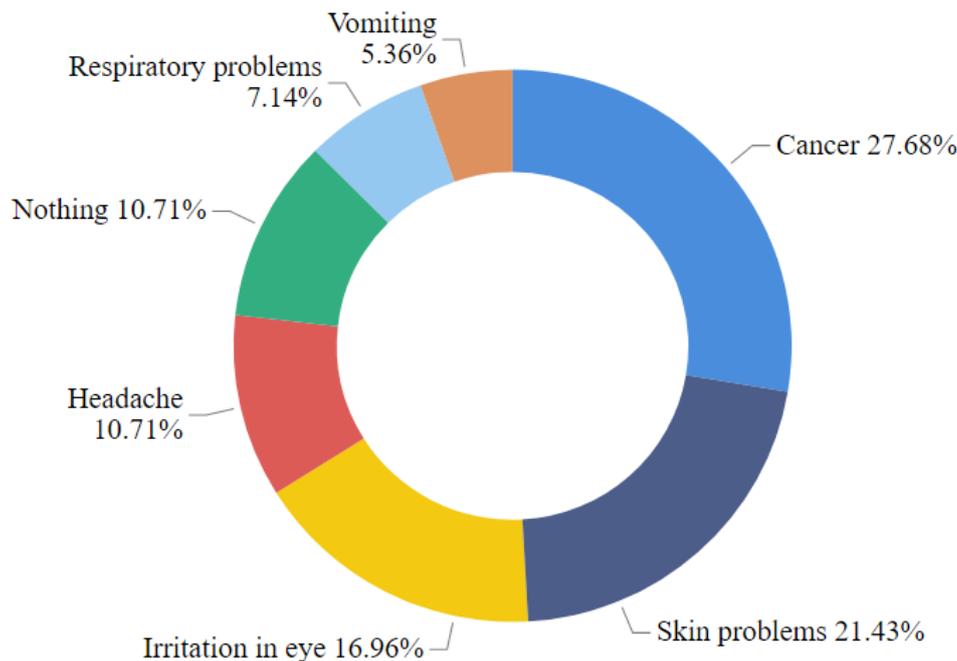
An interesting result was seen that female leaded farming was found to adopt IPM practices more frequently. In rural areas of Nepal, literacy classes and women's training had been conducted which indirectly contributed for women involvement in IPM at different level (FAO, 2000). Possible explanation to this might be due to effect of trainings and different awareness programs conducted by cooperatives where female enrollment was higher. Involvement in local farmer group and cooperatives in Bhaktapur and Kavre districts, specially rural women were actively participating in planning, implementation and management of local development program which have empowered them

more and increased their involvement in agricultural activities (Bhandari, 2012). Also in Nepalese context, female are more concerned to the health of family.

### 3. Observed health consequences due to conventional practices

With 75.6% of respondent (Table1) applying conventional method i.e. chemical fungicides several health effects are seen due to use of such chemicals. Not only fungicides they also had used insecticides simultaneously such as Dursban, Cypermethrin, Cholorpyrifos, etc. which combinedly had resulted in health issues. Respondent reported temporary and immediate effects such as eye irritation, headache, respiratory problems, vomiting, skin problems, etc. (Fig 5). Also, respondents claimed there is 27.8% cancer to be chronic health effect. Aryal *et al.* (2014) also explains that no judicious use of pesticides leads to abdominal cramps, vomiting, dizziness, anxiety, tremor, etc. While Gyawali (2018) suggest in developing country like Nepal this effect is caused due to inappropriate use, inappropriate handling and inadequate knowledge on pesticide use.

Farmers from different parts of the country who took part in FFS-IPM training program found hazardous effects of pesticides on human health along with environment (Kafle *et al.*, 2014). According to the local people, there is one cancer sufferer per every 4-5 households.



**Figure 5: Percentage of different health problems evident in the site due to practice of conventional management practices**

#### IV. CONCLUSIONS

Disease and pests associated with agricultural crops viz. cole crops being an important aspect for its optimal production. Diseases such as club root, root rot, damping off, alternaria leaf spot and stalk rot were found more prevalent in the study site. Though most of the farmers have knowledge about negative impact of pesticide use on their health. But management of disease were found more chemical oriented as a result of which they have faced health problem such as eye irritation, headache, respiratory problem, vomiting etc. Considering adoption to disease management practices, female led farms, farmers with knowledge about bio fungicides and trained in IPM tools were significantly more adaptive to IPM packages to control diseases in cole crops such as *Trichoderma* and locally made botanicals. Major cooperatives have actively worked to aware farmers regarding negative impact of conventional management practices.

However these study has limited to Kavre district but it reveals that it is not a quick process to convert conventional to eco friendly techniques to manage diseases in crops. But drivers like cooperatives must play important and active role in conducting trainings that addresses eco-friendly tools to combat with disease and pest problems in crops. Also, such group extension must encourage higher female participation for quick dissemination of such practices practically. Enforcing farmer to avoid chemicals could be quite chaotic but motivating to apply practices with judicious and safe use of chemical pesticides in integrated way might be resilient to commence healthy production.

#### CONFLICT OF INTEREST

The authors declare that there is no conflict of interest with present publication.

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