

CROP PESTS IN BAGMATI ZONE

Introduction

Weeds, plant diseases, and insects adversely affect agricultural production by not only competing with crops for farm resources but also by releasing harmful substances. They increase expenditure on labour and equipment and also reduce the quality of agricultural produce. Weed seeds germinate earlier. Their seedlings grow faster; they flower earlier and mature ahead of the crop they infest. They have the remarkable capacity to germinate under varied conditions but are mostly season-bound. In non-irrigated areas the competition between weeds and crops is largely for water. On irrigated tracts, the competition is for nutrients. The successful application of weed control interventions (mainly chemicals) is determined by the knowledge one has regarding the biology of both the crops and the weeds. Plant diseases are structural abnormalities that are harmful to the plant or to any of its parts or products and reduce its economic value. It may be permanent or temporary, localised, or systemic. Plant diseases are caused by micro-organisms or may also be incited by physiological causes, including high and low temperatures, deficiency of plant nutrients, and soil acidity. In the case of seed-borne diseases, the pathogens are carried either on the surface of the seed or within it. When a pathogen is external or air-borne, it may be destroyed by treating the seed or the foliage with a chemical. For internally-borne diseases, hot water treatment and solar treatment are very efficacious. In the case of soil-borne diseases, the use of soil disinfectants is helpful. Insects are probably man's oldest enemy. In spite of the significant advances made in the war against insects, there has been little success in eradicating even one of the thousands of serious pests which damage food, agricultural products, and livestock.

Pests in Agriculture

Although maize covers the largest area in the Bagmati Zone, production-wise rice is the largest crop. The main cropping period for these two crops is during the summer monsoon when insect-related pest problems are the greatest. For crops, such as wheat and barley, grown under temperate conditions, the problem is considerably less. However, these crops do need seed treatment to prevent seed-borne diseases. Weed control is mostly manual. Table 2.1 provides a list of the key pests of cereal crops.

In the Bagmati Zone, paddy has been damaged by *Leptocoryza* sp. (1986); seed-bed beetle (1990); *Sogatella furcifera* (1982); and rice hispa (1988). Blast is an annual phenomenon in temperate rice and the effects are devastating, especially when the affected seedlings are transplanted. The existence of the tungro virus, especially in the Indrawati River Valley, has also been suspected.

Maize plants are seriously affected by white grubs and farmers resort to soil treatment. Maize borer, is a very serious problem and is managed by farmers by increasing the plant population per field and eventually replacing affected with non-affected plants. Army worms create havoc and are frequent especially in the Rasuwa and Nuwakot districts. People spray, even at night under petromax illumination, to control army worms.

Table 2.1: Key Pests of Cereal Crops in the Bagmati Zone

Crop	Pest	Estimated loss (%)	Area
Rice	1. <i>Cnaphalocrocis medinalis</i> (1989/90)	20-30	Extensive area in Lalitpur
		Total	4,000 ha in Nuwakot
	2. <i>Dicladispa armigera</i>	20%	10 ha in Thankot
	3. Leaf hopper and Plant hopper	70-80	Throughout Kathmandu Valley
	4. <i>Leptocoryza</i> sp		Kathmandu 1990
	5. <i>Piricularia oryzae</i>	80%	Extensive
	6. Sheath blight	10	Nuwakot
Bandicoots, field rats, and seed-bed beetles are ever present on rice with variable losses.			
Wheat	1. <i>Mythimna separata</i>	Severe in early stages No loss	5 ha Kathmandu and Lalitpur
	2. Smut	5-10	Extensive
	Rust and Smut are common, endemic, and subject to pre-treatendent in the form of seed treatment throughout this region.		
Maize	1. <i>Mythimna separata</i>	Nominal	Kathmandu
	White grub (<i>Phyllophaga rugosa</i>); Maize borer (<i>Chilo zonellus</i>); Leaf blight (<i>Helminthosporium maidis</i>); and Ear/Cob Rot (<i>Fusarium</i> sp and <i>Cladosporium</i> sp) are very destructive and widespread pests		

Source: Compiled by Author

Wheat pest management is strictly limited to the use of Vitavax for seed treatment. For most of the other cereal crops, no active pest control measures are undertaken.

Pest problems in **cash crops like oil seeds and sugarcane** are very serious. Although some studies have suggested (Sharma and Khatri 1979) losses of over sixty per cent because of insects on mustard, pesticidal control measures have not been reported. Sugarcane also has serious pest problems, but attempts to control them have not yet been recorded in this sub-region. Potatoes are an exception. Here farmers do their best to arrest pest problems. Non-pesticidal methods of controlling potato pest problems, such as selection of resistant varieties (for late blight), use of tissue culture methods -biotechnology (for virus diseases), and use of pheromones to trap egg-laying moths (for tubermoth in the field) have been reported.

Pulse crops are generally either relayed with lentils after rice on lowland or intercropped with soyabeans and maize, or other crops, or grown in poor soils (horse gram, phaseolus, etc). They have pest problems such as pod bores (*Heliothis armigera*, *Lampedes* sp), pod flies (*Melanagromyza suji*), aphids (*Aphis glycine*, *A. craccivora*, and *Acyrtosiphon pisi*), cutworms (*Eoxia segetum*,) and hairy caterpillars (*Spilartica cosignata* and *Amsacta* sp). Diseases such as

leaf spots and frog eye spots are worth mentioning. However, pesticides are seldom used. When the monoculture of crops such as soyabeans is affected extensively by pests like hairy caterpillars, use of pesticides has been recorded in the Kathmandu and Panchkhal valleys.

Pests in Horticulture

There are good potentials for expansion of vegetable and fruit cultivation in the Bagmati Zone. However, development so far has been limited, and it is only recently that promising signs are beginning to emerge. Many warm temperate fruits, such as peaches, pears, and plums, are grown in the Kathmandu Valley, but cultivation is still confined to household backyards. Although good varieties have been introduced recently by the Department of Horticulture, commercial orchards for these crops are seldom seen. Citrus plantations in the Dhading and Kabhre districts are increasing. Apple growing has also been started in the Sindhupalchowk and Rasuwa districts. Floriculture is also slowly developing in the Kathmandu Valley.

Vegetables should be a vital component of our daily diet. Traditionally, they are grown in the kitchen garden for family consumption. The fast-growing population of the Kathmandu Valley has provided a steady demand in the market. Vegetable growing is more and more being adjusted to suit the seasonal demands in the market. Vegetables that can be grown only in winter in the plains of the Kathmandu Valley (around 1,260masl) are grown in higher hill areas like Kakani (around 1,800masl) in summer. Crops that can only be grown in summer in Kathmandu are grown in the winter months in the low-lying valleys of the Trishuli and in Dhunibesi and Panchkhal.

Environmental diversity provides us with a unique opportunity to test and identify successful 'niche' for needed varieties. This has added to the varieties of vegetables already grown in this zone (Table 2.2).

Table 2.2: Vegetables Grown in the Bagmati Zone

<i>Cruciferae</i>	<i>Alliaceae</i>	<i>Cucurbitaceae</i>	<i>Leguminosae</i>	<i>Solanaceae</i>	<i>Miscellaneous</i>
1. Cauliflower	1. Onion	1. Bitter Gourd	1. Bean	1. Tomato	1. Parsnip
2. Cabbage	2. Garlic	2. Squash	2. Cow Pea	2. Egg Plant	2. <i>Methi</i>
3. Broccoli	3. <i>Chhyapi</i>	3. Sponge Gourd	3. Pea	3. Capsicum	(Fenugreek)
4. Knolkol		4. Luffa		4. Chilli	3. Lady Finger
5. Radish		5. <i>Sechium</i> sp.			(Okra)
6. Turnip		6. Cucumber			
7. Broad-leaved Mustard		7. <i>Chathel</i> gourd			
8. Cress					
1. Spinach					
2. Swiss Chard					
3. Lettuce					

Source: Compiled by Author

To list all the pests that affect these crops is beyond the scope of this paper. Only those considered serious by farmers are provided in Table 2.3. While listing the pests, weeds have not been included as they are mostly manually managed by farmers.

Table 2.3: List of Important Pests Found on Vegetable Crops

Host Type	Pests	
	Insects	Diseases
Cruciferous	<ol style="list-style-type: none"> 1. <i>Phyllotreta</i> spp 2. <i>Phyllophaga</i> 3. <i>Eoxia segetum</i> 4. <i>Lipaphis erysimi</i> 5. <i>Brevicoryne brassicae</i> 6. <i>Pieris brassicae</i> 7. <i>Plutelia maculipennis</i> 	<i>Xanthomonas campestris</i>
Leguminous	<ol style="list-style-type: none"> 1. <i>Aphis craccivora</i> 2. <i>Lampedes</i> 3. <i>Melanagromyza</i> 4. <i>Alcinodes</i> 	<i>Colletotrichum lindemuthisi</i>
Cucurbitous	<ol style="list-style-type: none"> 1. <i>Dacus cucurbitae</i> 2. <i>Epilachna 28-punctata</i> 3. <i>Aulacophora foveicollis</i> 4. <i>Aphis gossypii</i> 	
Solanaceous	<ol style="list-style-type: none"> 1. <i>Leucinodes orbonalis</i> 2. <i>Heliothis armigera</i> 3. <i>Aphis gossypii</i> 4. <i>Thrips</i> 	<i>Phytophthora infestans</i> <i>Alternaria solani</i>
Miscellaneous	<ol style="list-style-type: none"> 1. <i>Thrips tabaci</i> 	

Source: Compiled by Author

Fruit Pests

Orchard development has not expanded rapidly in the Bagmati Zone. Some old mango orchards in the Indrawati and Trishuli basins have been maintained. Deciduous fruit trees in Rasuwa, Nuwakot, and Sindhupalchowk have low yields. However, citrus orchards grow in Kabhre and Dhading. The fruit trees receiving maximum attention against pests are in the Kathmandu Valley. While the amount of pesticides used is small, it nevertheless affects the environment and is therefore important. Names of pests for which farmers have sought treatment advice from concerned agencies are listed in Table 2.4.

Table 2.4 Pests Commonly Reported on Fruit Crops in the Bagmati Zone

Crop Host	Pests	Location
Mango	<ol style="list-style-type: none"> 1. <i>Dacus</i> (Fruit fly) 2. <i>Rhyncophorus</i> (Nut weevil) 3. <i>Idio cercus</i> (Leaf hopper) 	Trishuli Khimehet Bagaicha Sipaghat Throughout Lower River Basin
Litchi	<i>Eriophyes</i> mite	Trishuli
Deciduous Fruit	<ol style="list-style-type: none"> 1. Peach leaf curl aphid 2. Fruit fly 3. Papery bark 4. Blossom beetles 	All over the region Hills Tankaghyang, Sermathang Kakani
Citrus	<ol style="list-style-type: none"> 1. Leaf miner 2. Scale insects 3. Aphids 4. Mealy bugs 	Everywhere All over the region All over the region All over the region

Source: Compiled from the Annual Reports of the Entomology and Plant Pathology Divisions

Crop Losses on Account of Pests

The main reason for taking effective control measures against pests is the damage they incur on food crops. While scarce resources are deployed to increase production, this makes little sense if the output of such efforts is destroyed or reduced by weeds, insects, and diseases. Table 2.5 shows the percentage of farmers reporting losses to foodgrains in the middle mountain and Kathmandu Valley areas of Bagmati Zone. For paddy, insects, rats, and diseases are the main destroyers of crops, although the percentage of farmers reporting such losses is lower for the Kathmandu Valley than for the outlying hilly areas. For maize, damage by insects is reported by the largest number, followed by birds, farm animals, and monkeys. What is quite unmistakable from Table 2.5 is that insects are the single, most important factor for crop damages for all major crops.

Table 2.5: Percentage of Farmers Reporting Losses to Foodgrains in the Middle Mountains of the Bagmati Zone and the Kathmandu Valley

	Paddy		Maize		Wheat		Finger Millet		Potato		Buck-wheat	Mustard	Pulses
	MM	KV	MM	KV	MM	KV	MM	KV	MM	KV	MM	MM	MM
Insects	39	17	34	7	21	8	19	2	36	16	20	25	13
Diseases	12	0	12	-	11	-	12	-	22	-	13	12	12
Rats	20	3	10	-	12	1	24	-	-	-	10	1	7
Birds, Farm	7	+	27	-	15	-	14	-	-	-	19	-	6
Animals, Monkeys	-	-	12	-	-	-	4	-	9	-	5	-	-
Others													

Source: His Majesty's Government of Nepal and the Government of Canada Land Resources' Mapping Project (1985), Kenting Earth Sciences

Key

MM = Middle Mountains

KV = Kathmandu Valley

Different surveys of crop losses (Cramer 1962 and FAO 1977) are more or less consistent with losses caused by various factors as reported by the farmers. Based upon my own experiences and some assessments carried out in Nepal by many entomologists, I feel that the average losses of foodgrains due to various factors are not different from what Cramer provides (Table 2.6).

Table 2.6: Crop Losses due to Different Factors

Crops	Percentage loss due to			Total percentage
	insects	diseases	weeds	
Paddy	26.7	8.9	NA	35.6
Wheat	5	9.1	9.8	23.9
Maize	12.4	9.4	13.0	34.8
Potatoes	6.5	21.8	4.2	31.5
Vegetables	NA	NA	NA	

Source: Cramer 1962

The overall percentages are very large indeed. Given the overall growth rate of agricultural production in the country, which has barely kept pace with the population growth, these losses are alarming by any criterion. Over 30 per cent of the gross agricultural output of major crops is lost to pests in this region.

Kathmandu Valley farming is noted for its tradition of intense cultivation and a high level of productivity. Spurts of pest epidemics are rare and occasional, and this has been due to farmers' sound farming practices which included maintenance of quality seeds; using many crop varieties which suited various land types with their specific demands; strict adherence to crop rotation; and maintaining plant vigour by providing organic manure and water. Crop genetic diversity was maintained, and this drastically reduced pests characteristic in the monocultural farming of today. In spite of all this, crops were still ravaged, albeit in limited areas. Assorted control measures were practised which are, even today, theoretically sound and restricted to the area of epidemics. Let us enlist some of their control practices.

1. Rice cultivation and duck farming were complementary. The duck suppressed borers and provided fertiliser for the crop.
2. Soil preparation methods included sun drying which exposed gestating and hibernating larvae, spores, and cysts to the vagaries of nature and predation by birds. Inundating the land with water for some days and puddling it later drastically reduced and suppressed weeds.
3. Inter cultivation of crops, such as maize and soyabeans or cow peas, often provided micro-environments where notorious pests could not establish themselves; a fact observed by many researchers.
4. Small flag-poles littered over rice fields (to be noticed in rice fields in Bhaktapur even today) frightened away the birds above, and their moving shadows the rats below.
5. Potato and chilli farmers manually collected cutworm larvae and slugs with the help of *tuki* (local wick) at night in earthen jars and fed their ducks with them.
6. Potato tubers were stocked in cool *chhidi* (basements) over dry sand; a practice which lengthened storage duration and kept potatoes free from tuber moth attack.
7. Ashes were spread on aphid-infested vegetables which stuck to plants because of honey dew secreted by aphids and choked the pest to death.
8. Cereal grains were thoroughly sun dried before storage, reducing pest infestation.
9. Local herbs such as *titepati* (*Artemisia* sp) and *asuro* (*Adhatoda vasica*) were spread on the fields and *bakaino* (*Melia indica*) was commonly planted around the fields. All these plants are noted for their antifeedant, deterrent, bactericidal, and even insecticidal properties.
10. Maize farmers seeded their fields densely, borer and white grub affected plants were selectively used as fodder.

All these methods are labourious but environmentally sound. In addition, revering snakes and petting of cats were accepted norm, in the farming society.

When such a balanced system is disturbed by the introduction of new technologies, disturbances do occur. The present spurt of ravaging pests is, in essence, a consequence of such activities. Let us cite the spread of *Eupatorium* as an example which hopefully will not be out of context.

The genus *Eupatorium* inhabits mainly tropical and subtropical regions of the world. The herbarium record of the Department of Botany suggests that six species are found in Nepal of which *E. adenophorum* and *E. odoratum* have acquired pest status; and they are commonly known as *banmara* (killer of the forest). The former is native to Jamaica and Mexico, whereas the latter is found in the West Indies and continental America around Florida (Bennet 1968). These exotic species entered Nepal from the east (Sharma and KC 1977) and have now spread wherever natural forests have been destroyed. On intensely cultivated farmlands, they are meticulously controlled but are a menace during early establishment of plantation crops such as tea and citrus. Efforts to establish *Cecidocharis utilis*, a gall forming fly, on *E. adenophorum* has been a success but, due to various sociocultural necessity of Nepali farmers, they have remained a problem, especially on pasturelands and creeks and they cover smaller streams and rivulets completely with adverse ecological consequences such as lowering of the water temperature and providing shelter for rodents. Farmers now-a-days use the plant as composting and bedding material.