INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 8 | ISSUE 2 | OCTOBER, 2015 | 279-287

● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/8.2/279-287

Agro-chemicals use pattern of cucumber growers in controlling insect-pests and diseases

■ HIRALAL JANA

Department of Agricultural Extension, College of Agriculture, Bidhan Chandra Krishi Vishwavidyalaya, BURDWAN (W.B.) INDIA

ARITCLE INFO

Received : 30.05.2015
Revised : 08.08.2015
Accepted : 23.08.2015

KEY WORDS :
Cucumber growers, Agro-chemicals, Use pattern, Insect-pests, Diseases, Sustainable agriculture

ABSTRACT

Sustainability in agricultural production, and to maintain environmental balance are the two major concerns in recent time. Keeping it in consideration, the present study was undertaken with the following objective- to portray the agro-chemicals use pattern of cucumber growers in controlling insect-pests and diseases. The study was conducted in Murshidabad district of West Bengal. For the selection of area and respondents of the present study, multi-stage random sampling technique and universe method were adopted. The study reveals that (1) more than half of respondents (52%) in the study area were illiterate (2) at the most 42 per cent of respondents had upto 1 bigha of own cultivable land (3) at the most 39 per cent respondents had upto 10 kathas of vegetable cultivable land (4) at the most 42 per cent of respondents had 11-20 years of experience in vegetable cultivation (5) at the most 40 per cent of respondents had 11-20 years of experience in agro-chemicals application on vegetable crops (6) main source of personal information on agro-chemicals use was agricultural input retailers (95%) (7) main source of impersonal information was radio (38%) (8) their interval of spraying of chemicals was mainly 4-7 days (73%) (9) spraying was most popular method of application of agro-chemicals (100%) (10) infestation of insect-pests and diseases was mainly seen on mature stage of the crop (11) the cucumber growers used 40-60 litres of water per bigha at seedling stage and 100-130 litres of water per bigha of land for spraying the agro-chemicals at mature stage of the crop (12) the most harmful insect-pest of cucumber crop was red pumpkin beetle (100%) (13) fruit rot disease was the most damaging disease (72%) (14) cucumber growers were using various brands of various technical grades of agro-chemicals for controlling insect-pests and diseases with several doses. Therefore, on the basis of the present investigation, the various extension agencies those are working in the study area should reorient their extension strategies accordingly.

How to view point the article : Jana, Hiralal (2015). Agro-chemicals use pattern of cucumber growers in controlling insect-pests and diseases. *Internat. J. Plant Protec.*, **8**(2) : 279-287.

Author for Correspondence :
Email: janahiralal@yahoo.in

INTRODUCTION

Agriculture is the backbone of the Indian economy" –said Mahatma Gandhi five decades ago. Even today, as we enter the new millennium, the situation is still the

same, with almost the entire economy being sustained by agriculture, which is the mainstay of the villages, but also every one of us looks up to agriculture for our sustenance too (Moses, 2014). The agricultural research though made considerable progress in addressing food security, adopted policies to grow more and more food to support the growing population, ignoring the issues of health and environment, which lead to disastrous situations. The adequate food and environment security would remain the key issues confronting mankind in the third millennium. The use of chemical pesticides in agriculture has seen a sharp increase in recent years. In current scenario plant protection was mainly oriented towards the chemical control. Though chemicals gained lot of importance and proved their positive effects in targeting the food security but their continuous and injudicious use has resulted in several implications like development of insecticidal resistance, residue in food chain, degradation in quality of ecosystem, human health and adverse effect on beneficial micro-biota. Moreover, with increase in cost of cultivation, the net income per unit area has gone down sharply. Maintaining the productivity in a sustainable manner with sound sources of management would be key issue in the coming decades (Aswal and Sha, 2011). The production and consumption of vegetables are most important to human diet for better health, because they possess high nutritive value and are rich source of carbohydrates, proteins, vitamins and minerals. In spite of this, the vegetable production is low, because improved vegetable production technologies are not fully adopted by the farmers at their own fields (Mohan and Helen, 2014). The lower yields are attributed to infestation of the crops by the insect-pests and diseases and non adoption of plant protection measures for control of insect-pests and diseases by farmers (Bhalekar *et al*., 2013). Among the crops, vegetables are the one of the major users of plant protection chemicals as observed. Farmers' use behaviour of agro-chemicals in vegetables is dynamic in nature which requires regular research. Keeping these points in view, an attempt was made to portray the agro-chemicals use pattern of cucumber growers in controlling insect-pests and diseases.

MATERIAL AND METHODS

The study was undertaken in the State of West Bengal. Multi-stage random sampling technique and universe method were adopted for the selection of area and respondents of the present study. At the first stage of sampling, Murshidabad district was selected among the 19 agricultural districts of the State purposely based on its' comparatively higher area coverage in vegetable cultivation. Out of 26 blocks of the district, one block (*i.e.* Baharampur) was randomly selected at the second stage of sampling. In the selected block (Baharampur) a relatively homogenous field cultivated with vegetable crops was chosen on the basis of the opinion of the local agricultural input retailers. The farmers who were growing cucumber in the field were selected as respondents of the present study through total enumeration. Thus total 100 cucumber growers ultimately considered as respondents of the study. A well-structured interview schedule was prepared. Personal interview method was followed to collect data in local language for expecting exact responses. For analysis of the data statistically, simple percentage method was used to reach at meaningful results and conclusion.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Level of education :

It is clear from the Table 1 that more than half of respondents (52%) in study area were illiterate. At the most 9 per cent of cucumber growers had higher secondary and above level of education which indicates a positive sign of agriculture, which beckons more scientific cultivation in near future because they are the good adopter of agricultural technologies. Vegetable cultivation needs proper time management, following crop rotation, more scientific application of fertilizers, pesticides, irrigation water, weeding in proper time, thinning, harvesting in proper time etc. so, it is easy to

Table1 : Level of education **(n=100)**

Level of education	Number of respondents possessed	Percentage of respondents possessed
Illiterate	52	52
Primary level	25	25
Secondary level	14	14
Higher secondary level and above	9	9

say that educated persons in the field will be comparatively more suitable in dealing these activities properly. Exactly one-fourth per cent of respondents (25%) had primary level of education and remaining 14 per cent of respondents had secondary level of education.

Own cultivable land and vegetable cultivable land :

The Table 2 indicates that most of the respondents in study area were marginal farmers. At the most 42 per cent of respondents had upto 1 bigha of cultivable land, 22 per cent of respondents had 1.1 -2.0 bigha of cultivable land, 24 per cent of respondents had 2.1-4.0 bighas of cultivable land whereas 7 per cent of respondents had 4.1-6.0 bighas and remaining 5 per cent had above 6 bighas of cultivable land. Above one third per cent of respondents (39%) had upto10 kathas of vegetable cultivable land, 28 per cent of respondents had 10.1-20 kathas of vegetable cultivable land, 17 per cent of respondents had 1.1-2.0 bighas of this land, 10 per cent of respondents had 2.1-4.0 bighas of vegetable cultivable land whereas remaining 6 per cent of respondents had above 4.0 bighas of vegetable cultivable land.

Experience in vegetable cultivation and experience in application of agro-chemicals :

It is clear from the Table 3 that at the most 42 per cent of respondents had 11-20 years of experience on vegetable cultivation, in this respect other categories were-upto 10 years (31%), 21-30 years (15%), 31-40 years (7%) and remaining 5 per cent of respondents had above 40 years of experience on vegetable cultivation. In case of application of agro-chemicals, at the most 40 per cent of respondents had 11-20 years of experience on application of agro-chemicals in controlling insect-pests, diseases, etc. 30 per cent of respondents had upto 10 years of experience in this respect, 22 per cent of respondents had 21-30 years of experience and remaining 5 per cent of cucumber growers had above 30 years of experience in application of agro-chemicals. The respondents also reported that recently the farmers are using plant protection chemicals in massive scale and now-a- days cultivation is pesticide dependent along with other factors of production because the infestation of insect-pests, diseases, etc. are more due to intensive cultivation, vagaries of weather etc. and above-all highly profit mindedness of vegetable growers.

Personal sources of information regarding use of agro-chemicals :

Almost all the respondents (95%) reported that (Table 4) they mainly got information in using agro-chemicals from agricultural input retailers at the time of purchasing and 41 per cent of respondents collected it from progressive farmers (opinion leaders) Nearly one-third of respondents (32%) collected information from fellow farmers and it was a very traditional way of getting

Table 2 : Own cultivable land and vegetable cultivable land **(n=100)**

Own cultivable land (Bigha)	Number of respondents possessed	Percentage of respondents possessed	Vegetable cultivable land	Number of respondents possessed	Percentage of respondents possessed
Upto 1.0	42	42	Upto 10 Kathas	39	39
1.1-2.0	22	22	10.1-20 kathas	28	28
2.1-4.0	24	24	1.1-2.0 bighas	17	17
4.1-6.0	7	7	2.1-4.0 bighas	10	10
Above 6	5	5	Above 4.0 bighas	6	6

20 katha=1 bigha, 3 bigha=1 acre and 2.5 acre=1 ha

Table 3 : Experience in vegetable cultivation and experience in application of agro-chemicals **(n=100)**

Number of years engaged in vegetable cultivation	Number of respondents possessed	Percentage of respondents possessed	Number of years engaged in application of agro-chemicals	Number of respondents possessed	Percentage of respondents possessed
Upto 10	31	31	Upto 10	30	30
11-20	42	42	11-20	40	40
21-30	15	15	21-30	22	22
31-40	7	7	Above 30	5	5
Above 40	5	5			

information. In the study area, nearly one-fifth per cent of respondents (22%) collected information from neighbours (farming community). Only 11 per cent of respondents' source of information was relatives whereas 48 per cent of respondents collected that information from other information sources these were Agricultural Development Officers (ADOs), Krishi Prayukti Sahayaks (KPSs), experts of agricultural university, company personnel or other agricultural field functionaries. After collecting the information from various sources, each respondent evaluated it in their level best and finally applied the appropriate one. Singh *et al*. (2014) reported that about one-third of the respondents (33.75%) and nearly one-fourth of the respondents (23.75%) had medium and high overall information seeking behaviour respectively. Private dealers, friends, kisanmela and PAU scientists were emerged as the main sources of seeking information. The weed control, plant protection, recommended varieties and fertilizer applications were the major areas for seeking information regarding vegetable cultivation. Most of the respondents shared information with neighbours, friends, relatives and mode of sharing was verbal as stated by 100 per cent of the respondents.

Impersonal sources of information :

It is clear from the Table 4 that at the most 38 per cent of respondents collected information regarding agro-chemicals use from Radio. Radio is a low cost basic mass media. The different programmes are broadcasted by radio; these are *Chasi- bhaider -balchi, Krishi-kathar- asar, Buno-jamir-duno-fasal* etc. They mainly listened radio at night time when they were freed from day's work. Only one per cent of respondent collected information from agricultural magazine (*i.e*. Sar Samacher). Other impersonal sources were – T.V. (21%), Newspaper (5%), internet (2%), book (3%) and others (8%; mainly leaflet, booklet, folder and literature supplied by the company personnel or govt. officials).

Interval of applying agro-chemicals :

Respondents in the study area (Table 5) preferred to apply pesticides in the following days' interval-1-3 days (11%), 4-7 days (73%), 8-15 days (10%) and more than 15 days (6%). The cucumber growers who applied chemicals 1-3 days interval generally they were highly commercial minded and they did not want any kind of risk. The cucumber growers who applied chemicals above 15 days of interval, they cultivated the crop mainly for home consumption and excess they sold in market. Hence, they were not so much commercial minded.

Methods of applying agro-chemicals :

All the respondents in the study area (100%) applied agro-chemicals (Table 5) mainly through spraying whereas 27 per cent of cucumber growers followed

Table 4 : Personal and impersonal sources of information regarding use of agro-chemicals (n=100)

Personal sources	Number of respondents collected information	Percentage of respondents collected information	Impersonal sources	Number of respondents collected information	Percent of respondents collected information
Retailers	95	95	Radio	38	38
Progressive farmers	41	41	T.V.	21	21
Fellow farmers	32	32	Newspaper	5	5
Neighbours	22	22	Internet	2	2
Relatives	11	11	Book	3	3
Others	48	48	Magazines	1	1
			Others	8	8

Table 5 : Interval of applying agro-chemicals and methods of application (n=100)

Interval of applying agro-chemicals (days)	Number of respondents followed	Percentage of respondents followed	Methods of application of agro-chemicals	No. of respondents adopted	Percentage of respondents adopted
1-3	11	11	Spraying	100	100
4-7	73	73	Dibbling	27	27
8-15	10	10	Dusting	14	14
Above 15	6	6			

dibbling method (digged the soil and the pesticides were inserted and filled the hole by soil again especially application of granular pesticides) and only 14 per cent of selected farmers also applied the chemicals by following dusting method.

Insect-pests and diseases, their attacking stage and amount of water used for spraying :

Insect-pests and diseases mainly (Table 6) infested at mature stage of the crop. At seedling stage, the amount of water applied by the respondents for spraying chemicals was 40-60 litre/bigha of land and at mature stage of the crop, the amount of water applied by the respondents for spraying chemicals was 100-130 litre/ bigha of land.

Insect-pests of cucumber (*Cacumis sativus*) :

All the respondents in the study area (100%) reported about the presence of red pumpkin beetle. Majority of respondents (80%) reported about the pumpkin caterpillar, 42 per cent of respondents replied about the presence of Mite and at the lowest 16 per cent of respondent told about the harmful effect of aphid (Table 7). Choudhury (1996) reported that most important insect-pests of cucumber are red pumpkin beetle, aphid, cut worms, fruit fly and root knot nematodes whereas the major diseases are bacterial wilt, anthracnose, downy mildew, powdery mildew, angular leaf spot and mosaic disease. Jotwani (2003) reported that major insect-pests of cucurbits are pumpkin beetles, leaf eating beetles, melon fruit fly, pumpkin caterpillar, snake-gourd semi-looper, bottle gourd plume moth, pumpkin borer, banded blister beetle, stink bugs, cotton aphid, flea beetle, gall fly and mites.

Insect-pests :

Red pumpkin beetle (*Aulacophora foveicollis*) :

The grubs damage the plants by boring into the roots, underground stems and sometimes fruits touching the soil. The adult beetles feed on the foliage, buds and flowers. They make holes in the leaves of young seedlings. The early sown cucurbits suffer most from this pest. The grubs are creamy white with a slightly darker oval shield at the back. They are 12 mm in length. The beetles are oblong with brilliant orange red colour. The ventral surface is black and covered with short soft

Table 6 : Stage of crop infestation of insect-pests and diseases and amount of water used (n=100)

Insect-pests	Crop stage	Diseases	Crop stage	Water used for spraying at seedling stage	Water used for spraying at mature stage
Red pumpkin beetle	All the stages	Fruit rot	Fruiting stage and onwards	40-60litre/bigha	100-130 litre/bigha
Pumpkin caterpillar	All the stage	Downy mildew	Mainly mature stage		
Mite	Mature stage	Mosaic	Mature stage		
Aphid	Flowering to onwards	Leaf spot	All the stage		

Table 7 : Various insect-pests of cucumber (n=100)

Insect-pests	Number of respondents reported	Percentage of respondents reported
Red pumpkin beetle	100	100
Pumpkin caterpillar	80	80
Mite	42	42
Aphid	16	16

Table 8 : Agro-chemicals used to control Red pumpkin beetle (n=100)

Brand name	Agro-chemicals	Number of respondents adopted	Percentage of respondents adopted	Dose (per litre of water)
Malathion	Malathion	13	13	1.0-3.0 ml
Sevin	Carbaryl	19	19	2.0-5.0 g
Metacid	Methyl Parathion 50%	22	22	1.0-3.0 ml
Rogor	Dimethoate	25	25	2.0-4.0 ml
Sumidon	Phosphamidon	21	21	2.0-4.0 ml

white hair. The pesticides used, their doses and the percentage of respondents reported were the following (Table 8)- Malathion @ 1.0-3.0 ml/litre of water (13%), Sevin @ 2-5 gm/litre of water (19%), Metacid @ 1.0-3.0 ml/litre of water (22%), Rogor @ 2.0-4.0 ml/litre of water (25%), Sumidon @ 2.0-4.0 ml/litre of water (21%). The amount of water used for spraying the chemicals at mature stage of the crop was 80-130 litres/bigha.

Pumpkin caterpillar (*Palpita indica*):

It was seen all stages of the crop. The larvae feed on the lower surface of the leaves and they bind them together with the help of silken threads exuding from the mouth of larvae. They also attack the ovaries of flowers and bore the young developing fruits which become unfit for human consumption. The moths have white wings with dark brown marginal patches. Caterpillars are bright green. The pesticides used, their doses and the percentage of respondents reported were the following (Table 9)- Thiodon @ 1.5-3.0 ml/litre of water (35%), Sevin @ 2.0-5.0 gm/litre of water (10%), Malathion @ 1.0-3.0 ml/litre of water (12%), Rogor @ 2.0-4.0 ml/litre of water (25%), Metacid @ 1.0-3.0 ml/litre of water (18%). The amount of water used for spraying the chemicals at mature stage of the crop was 80-130 litres/bigha.

Mite *(Tetranychus cucurbitae):*

It was seen mainly in mature stage of the crop. These are small insects and appear in large colonies. They feed on the under surface of the leaves by sucking cell sap. They remain protected by fine shinning webs. The affected leaves develop greyish patches and finally curl and dry up. The chemicals used for controlling the pest, their doses and per cent of respondents reported are the following (Table 10)- Rogor @ 2.0 ml /litre of water (17%), Metasystox @ 2.0-4.0 gm/litre of water (13%), Sulfex @ 2.0-4.0 gm/litre of water (12%) and Dicofol @ 2.0-4.0 ml/litre of water (58%). The amount of water used for spraying the chemicals at mature stage was 80-130 litres per bigha of land.

Aphids *(Aphis gossypii)* :

Nymphs and adults appear in colonies and suck the plant sap from the leaves and tender shoots. The leaves curl and dry up. In young stages the cotyledonary leaves crinkle and in severe cases the plants wither. They transmit the viral diseases also. The agro-chemicals used, their doses and the percentage of respondents reported were the following (Table 11)- Malathion @ 1.0-3.0 ml/litre of water (27%), Metasystox @ 2.0-4.0 ml/litre of water (31%), Rogor @ 2.0 ml/litre of water (19%), Nuvan @ 1.0-2.0 ml/litre of water (15%), Phoskill @ 1.5 ml/litre of water (11%), The amount of water used for spraying the chemicals at mature stage of the crop was 80-130 litres/bigha.

Diseases :

It is clear from the Table 12 that majority of the respondents (72%) reported that fruit rot disease was most damaging. Other diseases were -downy mildew (51%), mosaic (46%) and leaf spot (38%). Raychaudhury (2003) reported that major diseases of cucurbits are powdery mildew, downy mildew, stem rot, root rot and

Table 9 : Agro-chemicals used to control Pumpkin caterpillar **(n=100)**

Brand name	Agro-chemicals	Number of respondents adopted	Percentage of respondents adopted	Dose (per litre of water)
Thiodon	Endosulfan	35	35	1.5-3.0 ml
Sevin	Carbaryl	10	10	2.0-5.0 g
Malathion	Malathion	12	12	1.0-3.0 ml
Rogor	Dimethoate	25	25	2.0-4.0 ml
Metacid	Methyl Parathion 50%	18	18	1.0-3.0 ml

Table 10 : Agro-chemicals used to control Mite **(n=100)**

Brand name	Agro-chemicals	Number of respondents adopted	Percentage of respondents adopted	Dose (per litre of water)
Rogor	Dimethoate	17	17	2.0 ml
Metasystox	Methyl Demiton 25%	13	13	2.0-4.0 ml
Sulfex	Sulphur	12	12	2.0-4.0 gm
Colonel-S	Dicofol	58	58	2.0-4.0 ml

mosaic.

Fruit Rot (*Pythium aphanidermatum*):

The fruits in contact with the soil suffer from the disease. The skin of the fruit shows soft, dark green, water soaked lesions which develop into a watery soft rot. On this rotting portion the cottony mycelia growth develops abundantly during humid atmosphere. The affected fruits look as if wrapped in absorbent cotton. On the margin of the cottony growth the skin of the fruit looks dark green and water soaked. The fungi are present in the soil living in a saprophytic manner on dead organic matter. It was observed in fruiting stage to whole mature stage of the crop. The fungicides used, their doses and the percentage of respondents reported were the following (Table 13)- Dithane M-45 @ 2.5-3.0 g/litre of water (49%), Indofil-M-45@ 2.5-3.0 g/litre of water (31%), Bavistin @ 2.0-4.0 g/litre of water (12%) and Fytolan @ 2.0-4.0 g/litre of water (8%). The amount of water used for spraying the chemicals at mature stage was 80-130 litres/bigha.

Downy mildew of cucumber (*Pseudoperenospora cubensis*) :

The spots are yellow, angular, and often restricted by the veins on the upper surface of the leaves. On the lower surface of these spots, the purplish downy growth appears during periods of high humidity. Sometimes the purplish colour is lacking and the lower side of the spots looks white to almost black. The entire leaf dies quickly. The fruits are few and smaller than the healthy ones with poor tests. The fungus survives as mycelium and spores on some hosts. It was mainly visible in mature stage of the crop. The agro-chemicals used, their doses and the percentage of respondents reported were the following (Table 14)- Dithane M-45 @ 2.5-3.0 g/litre of water (37%), Fytolan @ 2.0-4.0 g/litre of water (26%), Pinnacle @ 0.75ml /litre of water (9%), Emisan @ 2.5 gm/kg of seed (13%), Derosal @ 1.0 g/litre of water (17%). The amount of water used for spraying the chemicals at mature stage was 80-130 litres/bigha.

Mosaic disease (Cucumoviruses group) :

The symptoms differ according to different hosts and the virus strains attacking the host. The disease is characterized by the formation of streaks in the inter-veinal regions of the leaves, which enlarge to form characteristic green-vein banding. Young leaves are usually mottled, deformed, small and sometimes curled downwards. Internodes of stems are shortened resulting in dwarfing. Young fruits are rough, mottled and deformed. Systematically affected lines produce only few

Table 11: Agro-chemicals used to control Aphid **(n=100)**

Brand name	Agro-chemicals	Number of respondents adopted	Percentage of respondents adopted	Dose (per litre of water)
Malathion	Malathion	27	27	1.0-3.0 ml
Metasystox	Methyl Demiton 25%	31	31	2.0-4.0 ml
Rogor	Dimethoate	19	19	2.0 ml
Nuvan	Dichlorvos	15	15	1.0-2.0 ml
Phoskill	Monocrotophos	11	11	1.5 ml

Table 12 : Various diseases of cucumber **(n=100)**

Diseases	Number of respondents reported	Percentage of respondents reported
Fruit rot	72	72
Downy mildew	51	51
Mosaic	46	46
Leaf spot	38	38

Table 13 : Agro-chemicals used to control Fruit Rot **(n=100)**

Brand name	Agro-chemicals	Number of respondents adopted	Percentage of respondents adopted	Dose (per litre of water)
Dithane M-45	Mancozeb	49	49	2.5-3.0 g
Indofil-M-45	Mancozeb	31	31	2.5-3.0 g
Bavistin	Carbendazim	12	12	2.0-4.0 g
Fytolan	Copper oxychloride	8	8	2.0-4.0 g

fruits. Sometimes the leaves are much deformed and they become filiform. The veins and veinlets often produce beyond the leaf margin and the leaves become spindle shaped. The virus persists on different weed hosts and they serve as the source of primary inoculum. The agro-chemicals used, their doses and the percentage of respondents reported were the following (Table 15)- Metasystox @ 2.0-4.0 ml /litre of water (18%), Thiodon @ 1.5-3.0 ml/litre of water (52%), Rogor @ 2ml /litre of water (17%), Sumidon @ 2.0-4.0 ml/litre of water (13%). The amount of water used for spraying the agro-chemicals at mature stage of the crop was 80-130 litres/ bigha. Farmers applied various insecticides to control the insect vectors of the disease.

Leaf spot : (*Xanthomonas campestris* pv. cucurbitae):

Water soaked lesions appear on the underside of the leaves. The areas opposite to these lesions on the upper surface look yellow. The spots are interveinal. The spots enlarge and become angular and brown in colour. There is a chlorotic zone around the spots. Several spots may coalesce and form larger spots. The lesions may develop on the stem and petioles in the form of brown lines or streaks. The bacterium is seed borne and also persists on the diseased crop debris. The agro-chemicals used, their doses and the percentage of respondents reported were the following (Table 16)- Blue copper @ 2.0-4.0 g/litre of water (17%), Dithane M-45@ 2.5-3.0 g/litre of water (63%), Cyvistin @ 2.0-4.0 g/litre of water (11%), Captaf @ 1.0-3.0 gm/litre of water (9%). The amount of water used for spraying the chemicals at mature stage of the crop was 80-130 litres/bigha.

Agriculture is not only the backbone of country's economy, but also the backbone of our livelihood and culture. To feed the ever-increasing population of our country-to produce more food was main concern. In this way, high yielding varieties programme was introduced in 1966-67 which brought green revolution in country. Cultivation of high yielding varieties is an input intensive technology. Therefore, more fertilizers, pesticides, weedicides, irrigation water etc. were applied to field. Initial years of green revolution, it was not a problem, but gradually, it had become a great problem. Indiscriminate use of chemicals in agriculture during post green revolution period had brought adverse effect on soil health and environment has created an alarming situation. A situation has resulted which urgently demands

Table 14 : Agro-chemicals used to control Downy mildew **(n=100)**

Brand name	Agro-chemicals	Number of respondents adopted	Percentage of respondents adopted	Dose (per litre of water)
Dithane M-45	Mancozeb	37	37	2.5-3.0 g
Fytolan	Copper oxychloride	26	26	2.0-4.0 g
Pinnacle	Propiconazole	9	9	0.75 ml
Emisan	Methoxy Ethyl Mercuric Chloride	13	13	2.5 gm/kg of seed
Derosal	Carbendazim	17	17	1.0 g

Table 15 : Agro-chemicals used to control Mosaic disease **(n=100)**

Brand name	Agro-chemicals	Number of respondents adopted	Percentage of respondents adopted	Dose (per litre of water)
Metasystox	Methyl Demiton 25%	18	18	2.0-4.0 ml
Thiodon	Endosulfan	52	52	1.5-3.0 ml
Rogor	Dimethoate	17	17	2.0 ml
Sumidon	Phosphamidon	13	13	2.0-4.0 ml

Table 16 : Agro-chemicals used to control Leaf spot **(n=100)**

Brand name	Agro-chemicals	Number of respondents adopted	Percentage of respondents adopted	Dose (per litre of water)
Blue copper	Copper oxychloride	17	17	2.0-4.0 g
Dithane M-45	Mancozeb	63	63	2.5-3.0 g
Cyvistin	Carbendazim	11	11	2.0-4.0 g
Captaf	Captan	9	9	1.0-3.0 g

an environmentally safe, sustainable and simultaneously, economically viable production system. This indeed is essential for optimizing production and at the same time to minimize threat to environment. Therefore, the time has come to follow the following considerations those have emerged from the present investigation: - (1) Short-term training on plant protection aspects of cucumber cultivation should be conducted. (2) Due to pressure of population, fragmentation of land is happening day by day, therefore, farmers should choose suitable cropping pattern according to their situations. (3) Farmers have better experience in cucumber cultivation practices, but they need more exposure on plant protection aspects. (4) Farmers are mainly collecting information on agro-chemicals use from retailers. Therefore the Govt. extension agencies should have a special attention on this section of society and should consider retailers as one of stakeholders of agricultural development. (5) Farmers should have more exposure on mass media. (6) Majority of respondents (73%) applied chemicals following the 4-7 days interval as a routine work. Farmers should refrain from this use behaviour and agro-chemicals only be applied to the crop when insect-pests infestation crosses the economic threshold level (ETL). (7) In the study area, spraying was the mostly followed method of application of agro-chemicals compare to dibbling method and dusting method, therefore pesticides manufacturers should have more emphasis on liquid chemicals production. (8) Insect-pests and diseases infestation was mainly in mature stage of the crop; therefore, farmers should have more care on crop during this stage of crop. (9) Farmers should follow various precautions properly in using agro-chemicals. (10) Farmers should apply recommended dose of chemicals. (11) Farmers should have sound knowledge on various brands of chemicals. Otherwise, they will consider any new brand as new chemical. (12) Cucumber growers should give more emphasis on controlling insect-pest of red pumpkin beetle. (13) Growers should give more emphasis on controlling disease of fruit rot. Therefore, on the basis of the findings of the present investigation, the govt. extension agencies, agro-chemicals companies and private extension agencies should reorient their extension programmes accordingly. Similarly work related to the present investigation was also done by Kate *et al*. (2006); Mandeel and Baker (1991) and Paulitz *et al*. (1987).

REFERENCES

Aswal, J.S. and Sha, Binita (2011). Bio-pesticides are Eco-friendly Alternatives: *Indian Fmg.,* **60** (10) : 20-22.

Bhalekar, M.D., Sidam, V.N., Bondarwad, S.P. and Lad, A.S. (2013). Constraints in adoption of biological pest management practices in cotton in Vidarbha region. *Agri. Update*, **8** (1&2) : 70-72.

Choudhury, B. (1996). *Vegetables*: National Book Trust, India, New Delhi, p-146-150.

Jotwani, M.G. (2003). *Insect-pests of crops* (Ed); Handbook of Agriculture; ICAR; New Delhi, p-417-450.

Kate, R.O., Bharodia, R.K., Joshi, M.D., Pardeshi, A.M. and Makadia, R.R. (2006). Seasonal incidence of fruit fly, *Bactrocera cucurbitae* (Coquillet) on cucumber. *Asian Sci.*, **4** (1&2) : 83-84.

Mandeel, Q. and Baker, R. (1991). Mechanisms involved in biological control of Fusarium wilt of cucumber with strains of nonpathogenic *Fusarium oxysporum*. *Phytopath.*, **81**: 462-469.

Mohan, D.J. and Helen, S. (2014). Attitude of farmers towards organic vegetable cultivation: *Agric. Update*, **9**(3): 364-367.

Moses, V.J.R.E. (2014). Challenges and Opportunities for Agricultural Development in India, *Kisan World*, **41**(4):33-39.

Paulitz, T. C., Park, C. S. and Baker, R. (1987). Biological control of Fusarium wilt of cucumber with nonpathogenic isolates of *Fusarium oxysporum*. *Canadian J. Microbiol.*, **33** : 349-353.

Raychaudhury, S.P. (2003). *Diseases of crops* (Ed); Handbook of Agriculture; ICAR; New Delhi, p. 296-416.

Singh, J., Kalra, R.K., Sharma, A. and Sanatombi, K.H. (2014). Information seeking and information sharing behaviour of the vegetable growers of Ludhiana district: *Agric. Update*, **9** (3): 377-382.