

A survey report on application of pesticides on tomato (*Lycopersicon esculantum*) in Bishnupur district, a major commercial vegetable producing area in Manipur, India



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## Introduction

Off-season production of tomato is widely accepted by the farmers in Manipur, India for higher returns because of the ideal soil and climatic conditions for cultivation of vegetable. Like other states of India it is seriously affected by pest attack.

Various agrochemical pesticides are used to reduce damage and increase in yield by farmers or vegetable growers in Manipur.

## Objective of the present study

- To study attitudes and practices developed by vegetable growers on pesticide application.
- To identify the commonly used pesticide on tomatoes.
- To assess the possible impact of pesticide application on health of the environment.

## Methodology

- Questionnaires were prepared based on Miah et al., 2014; Adjrah et al., 2013; Krishna et al., 2011.
- Face to face interviewed with the vegetable growers.
- Informations were collected from agrochemical dealers, Krishi Vigyan Kendra (KVK) i.e Farm Science Centre and agriculture expert.

## Results and Observations

Majority of vegetable growers are male (36-70) years and literate (Table1).

Consult only with agrochemical dealers while 5 of them received professional training and 6 of them have recommendation from agriculture expert (Table 1).

None of them wear goggles and few of them wear gloves as well as nasal mask and maximum of them maintained separate clothes (Table 1 and Fig 1) .

Inappropriate materials were used to quantify pesticides (Table 1).

Figure 1. Social and professional characterization of vegetable growers in Bishnupur District

Name of respondent	Sex	Age (yrs)	Literate /illiterate	Professional training (pesticide use) (Yes/No)	Recomd. of agricultural experts (Yes/No)	Consulting dealers (Yes/No)	Experience in veg. production (years)	Protective measure used during handling and spraying (Yes/No)	Intoxication accident during spraying (Yes/No)	Use of material to quench pesticide (Appropriate /inappropriate)
Prabomcha Singh	Male	44	Literate	No	No	No	7	Gloves = Yes Oro-nasal mask = Yes Goggles = No Separate Clothes = Yes	Yes	Inappropriate
Pradawson	Male	36	Literate	No	No	Yes	5	Gloves = Yes Oro-nasal mask = Yes Goggles = No Separate Clothes = Yes	Yes	Inappropriate
Prabubam Singh	Male	43	Literate	No	Yes	Yes	7	Gloves = No Oro-nasal mask = Yes Goggles = No Separate Clothes = Yes	Yes	Inappropriate
Pradam Ibobi Singh	Male	50	Illiterate	No	No	Yes	6	Gloves = No Oro-nasal mask = Yes Goggles = No Separate Clothes = Yes	Yes	Inappropriate
Pradnaochoa Singh	Male	43	Literate	No	Yes	Yes	10	Gloves = No Oro-nasal mask = No Goggles = No Separate Clothes = Yes	Yes	Inappropriate
Pradmani Singh	Male	48	Literate	No	No	Yes	3	Gloves = No Oro-nasal mask = No Goggles = No Separate Clothes = Yes	Yes	Inappropriate
Pradam Chandra Singh	Male	37	Literate	Yes	Yes	Yes	9	Gloves = No Oro-nasal mask = Yes Goggles = No Separate Clothes = Yes	Yes	Appropriate

Detailed description of the incident										
Name of respondent	Sex	Age (yrs)	Literate /illiterate	Professional training (pesticide use) (Yes/No)	Recomd. of agricultural experts (Yes/No)	Consulting dealers (Yes/No)	Experience in veg. production (years)	Protective measure used during handling and spraying (Yes/No)	Intoxication accident during spraying (Yes/No)	Use of mask and quantify (Appropriate/Inappropriate)
Prabham Singh	Male	53	Literate	Yes	Yes	Yes	36	Gloves = No Oro-nasal mask = Yes Goggles = No Separate Clothes= Yes	Yes	Appropriate
Prabham Singh	Male	62	Literate	Yes	No	Yes	45	Gloves = Yes in Toxic Pesticides Oro-nasal mask = Yes Goggles = No Separate Clothes= Yes	Yes	Inappropriate
Prabham Singh	Male	70	Literate	Yes	Yes	Yes	40	Gloves = No Oro-nasal mask = Yes Goggles = No Separate Clothes= Yes	No	Appropriate
Prabham Singh	Male	47	Illiterate	Yes	No	Yes	20	Gloves = No Oro-nasal mask = No Goggles = No Separate Clothes = Yes	Yes	Inappropriate
Prabham Singh	Female	44	Literate	No	No	Yes	20	Gloves = Yes Oro-nasal mask = Yes Goggles = No Separate Clothes = Yes	Yes	Inappropriate
Prabham Singh	Male	44	Illiterate	No	No	Yes	15	Gloves = Yes Oro-nasal mask = Yes Goggles = No Separate Clothes = Yes	Yes	Inappropriate
Prabham Singh	Female	49	Literate	No	Yes	Yes	35	Gloves = No Oro-nasal mask = No Goggles = No Separate Clothes = Yes	Yes	Appropriate
Prabham Singh	Male	66	Literate	No	No	Yes	20	Gloves = No Oro-nasal mask = Yes Goggles = No Separate Clothes = Yes	No	Inappropriate



protective  
while handling  
of pesticides





Common target pest in tomato were found to be fruit borer (*Helicoverpa armigera*) and cutworm (*Peridroma saucia*) as well as diseases are early blight of leaves and stem by *Alternaria solani*, bacterial wilt of leaves and stems by *Pseudomonas solanacearum* . A blossom end rot of young fruit and leaf miner of tomato leaves were also observed during investigation at surveyed zone as highlighted in Table and in Fig 2 to Fig 4.

# Major target pest and diseases on tomatoes in Bishunupur district

Village	Variety of tomato used	Target pest		Disease					
		Common name	Scientific name	Fungal disease	Fungus	Symptoms	Bacterial disease	Bacteria	Symptom
Maning near Village	Chai tai, Amitabh	Fruit borer, Stem borer	<i>Helicoverpa armigera</i> , <i>Symmetrischema tangolias</i>	-	-	-	-	-	-
Leikai (Village)	Suraksha, Amitabh 004	Aphid	<i>Macrosiphum euphorbiae</i>	-	-	-	-	-	-
Ward 5	Amitabh	Diamond back moth	<i>Plutella xylostella</i>	-	-	-	-	-	-
Angam Leikai	Amitabh, Abhishek	Cutworm	<i>Peridroma saucia</i>	Early blight	<i>Alternaria solani</i>	Entire older leaf becomes yellow, infects stem, leaves and fruit becoming dark leathery sunken spots near the stem end	-	-	-
Leikai	Neeraj, Namdari 501, Amitabh	Fruit borer	<i>Helicoverpa armigera</i>	-	-	-	-	-	-
Leikai	Neeraj, Badshah, Sinjeta 017	Fruit borer, Stem borer	<i>Helicoverpa armigera</i> , <i>Symmetrischema tangolias</i>	-	-	-	-	-	-
Man no.4	Namdari 501	Fruit borer, Cutworm	<i>Helicoverpa armigera</i> , <i>Peridroma saucia</i>	-	-	-	Bacterial wilt	<i>Pseudomonas solanacearum</i>	Wilting of young during hot day then recovering and later a sudden permanent wilt
Leikai	Amitabh 004	Fruit borer, Cutworm, Aphid	<i>Helicoverpa armigera</i> , <i>Peridroma saucia</i> , <i>Macrosiphum euphorbiae</i>						

Stage	Variety of tomato used	Target pest		Disease					
		Common name	Scientific name	Fungal disease	Fungus	Symptoms	Bacterial disease	Bacteria	Symptoms
Suraksha	Suraksha	Cutworm, Stem borer, Fruit borer, Aphid	<i>Peridroma saucia</i> , <i>Symmetrischema tangolias</i> , <i>Helicoverpa armigera</i> , <i>Macrosiphum euphorbiae</i>						
Amitabh 004	Amitabh 004	Aphid, Fruit borer,	<i>Macrosiphum euphorbiae</i> , <i>Helicoverpa armigera</i> ,	Early Blight		Entire older leaf becomes yellow, infects stem, leaves and fruit becoming dark leathery sunken spots near the stem end			
Amitabh, Allround	Amitabh, Allround	Cutworm, Aphid	<i>Peridroma saucia</i> , <i>Macrosiphum euphorbiae</i>	-	-	-	-	-	-
Amitabh 501	Amitabh 501	Tomato fruitworm (green)	<i>Helicoverpa zea (boddie)</i>	-	-	-	-	-	-
Amitabh 004	Amitabh 004	Cutworm, Fruit borer, Flea beetle	<i>Peridroma saucia</i> , <i>Helicoverpa armigera</i> , <i>Epitrix hirtipennis</i>	Early blight	<i>Alternaria solani</i>	Entire older leaf becomes yellow, infects stem, leaves and fruit becoming dark leathery sunken spots near the stem end	-	-	-
Amitabh 004	Amitabh 004	Aphid, Cutworm, Diamond backmoth	<i>Macrosiphum euphorbiae</i> , <i>Peridroma saucia</i> , <i>Plutella xylostella</i>	Early blight	<i>Alternaria solani</i>	-do-			
Amitabh 004, Namdhari 815, Allround	Amitabh 004, Namdhari 815, Allround	Flea Beatle, leaf minor, Fruit borer	<i>Epitrix hirtipennis</i> , <i>Tuta absoluta</i> , <i>Helicoverpa armigera</i>	Early blight	<i>Alternaria solani</i>	-do-	Bacterial wilt	<i>Pseudomonas solanacearum</i>	Wilting of youngest at hot daytime and then at night and later a permanent wilt



Early blight at Balaram  
Village Maning Leikai



b.) Early blight at Kabowakching  
Maning Leikai



b.) Early blight at Kabowal  
Makha Leikai

Fig 2: Common fungal disease in tomato at surveyed zone



Fig 3: Bacterial wilt of tomato in Leimaram Awang Leikai Maning



a.) Spider mite at Kabowakching  
leikai



b.) Flea beetle at Leimaram awang  
leikai maning



c.) Blossom end rot at  
Kabowakching  
maning leikai

Fig 4: Other common pest and disease in tomato.

- From the investigation it was observed that a total of 31 different active ingredients of pesticides were reported by vegetable growers of which 11 are insecticides, 11 are fungicides, 2 are nematicides and 7 are herbicides. Among insecticides Flubendiamide and Cypermethrin are the most common insecticides used, mancozeb is most commonly used fungicides, Carbofuran and alphamethrin are the only nematicides used and Glyphosate is the most commonly used herbicide (Table 3).
- The frequency of pesticide application depends upon the type of pest concerned and insecticides and fungicides were mostly used 1 to 10 times ( Table 3).

### 3. Frequency of pesticide application and active ingredient used in tomatoes

Village	Growing season (months)	Insecticides		Fungicides		Nematicides		Herbicides
		Active ingredients used	No. of appl	Active ingredient used	No. of appl	Active ingredient used	No. of appl.	Active ingredient used
Maning Chothe	Jan-April	Flubendiamide 20% w/w (Takumi), Chlorantraniliprole (Coragen), Imidacloprid (Tatamida)	1	Mancozeb (DhanukaM45), Carbendazim (Bavistin), Hexaconazole (Turnus), Metaconazole (Sectin), Iprovalicarb + Propineb (Melody duo), Tebuconazole (Folicur)	4	Carbofuran (Furadan)	2	Paraquat dichloride (Gramoxone) , Ammonium salt of Glyphosate 71% SG (MERA 71), Glyphosate ( Glycel)
Wang Village	April-Sept.	Flubendiamide 480SC (FAME), Cypermethrin (Superkiller)	2	Mancozeb 63%+ Carbendazim 12% (Sixer), Tebuconazole (Folicur)	5	NA	NA	NA
Card no.5	Feb-April	Flubendiamide 20%w/w (Takumi), Dichlovos ( Nuvan), Flubendiamide 480SC (FAME)	3-4	Mancozeb 63%+ Carbendazim12% (Sixer), Difenconazole+Cyprodinil (Super)	2	NA	NA	Glyphosate (Glycel), diflufenican (Tiger)
Makha	Jan-Feb	Cypermethrin (Superkiller)	2-3	Mancozeb (Dhanuka M45)	2-3	NA	NA	NA
Meinouk	Aug-Sept	Flubendiamide480SC (FAME), Cypermethrin (Superkiller), Profenos (Profex), Cypermethrin 4%+Profenofos 40% (Rocket)	1	Hexaconazole (Turnus), Hexaconazole 5%EC (Contaf), Tebuconazole (Folicur), Carbendazim12%+ Mancozeb 63% (SAAF), Carbendazim 50%DF (Bavistin) Mancozeb 63%+ Carbendazim12% (Sixer),	1	NA	NA	Ammonium salt of Glyphosate 71% SG (Mera71), Glyphosate (Glycel)
Ngthak	Dec-Jan	Emamactin benzoate (Perfect), Profenophos 40% + Cypermethrin 4% (Kilcron)	1	Mancozeb 63%+ Carbendazim12% (Sixer), Tebuconazole (Folicur)	1	NA	NA	Ammonium salt of Glyphosate 71% SG (MERA 71), Glyphosate (Glyfos)



Vegetable area	Growing season (months)	Insecticides		Fungicides		Nematicides		Herbicides
		Active ingredients used	No. of appl	Active ingredient used	No. of appl	Active ingredient used	No. of appl.	Active ingredient used
Card no.4	June-July	Flubendiamide 480SC (FAME), Cypermethrin (Superkiller), Flubendiamide 20%w/w (Takumi)	2	Propineb (Antracol), Mancozeb 64% + Metalaxyl 8% (Master), Tebuconazole 50%+ Trifloxystrobin 25% (Nativo)	10	Alphamethrin (Alphashot)		Paraquat dichloride ( Gramoxone ), Glyphosate (Glycel) , Metribuzin (Sencor)
ching leikai	Feb-May	Flubendiamide 480SC (FAME)	3	Mancozeb 63%+ Carbendazim12% (Sixer), Tebuconazole (Folicur)	2-4	NA	NA	NA
ching leikai	May-June	Flubendiamide 480SC (FAME), Imidacloprid (Admire),	1-2	Mancozeb 63%+ Carbendazim12% (Sixer) with Paracetamol, Propineb (Antracol) with Paracetamol, Hexaconazole 5% EC ( Danzole)	1	NA	NA	Diclofop-methyl (Rhino)
g Makha i	Jan-March, April-May	Flubendiamide 480C (FAME), Dichlovos (Nuvan)	3	Ethylmarcaptan (Captan), Tebuconazole (Folicur), TUbeconazole 50% + Trifloxystrobin 25% w/w (Nativo), Propineb (Antracol), Iprovalicarb + Propineb (Melody duo)	3	NA	NA	NA
Awang i	Jan- March	Chlorpyrifos (Tricel), Flubendiamide 480C (FAME), Cypermethrin (Superkiller)	3	Mancozeb (Dhanuka M45), Carbendazim 12%+ Mancozeb 63% (SAAF)	3	NA	NA	Glyphosate 18% and diquat 0.73% (Roundup)

Vegetable area	Growing season (months)	Insecticides		Fungicides		Nematicides		Herbicides
		Active ingredients used	No. of appl	Active ingredient used	No. of appl	Active ingredient used	No. of appl.	Active ingredient used
Ang Leikai	Feb-April	Mancozeb 63% + Carbendazim 12% (Sixer), Fosetyl aluminium 80% (Signature)	4	Fosetyl aluminium 80% (Signature), Al tris (o-ethyl-phosphonate) (Aliette)	3	NA	NA	NA
Awang	Feb-April	Flubendiamide 480SC (FAME)	4	Mancozeb (Dhanuka M45), Carbendazim 12%+ Mancozeb 63% (SAAF)	4	NA	NA	NA
Khul Leikai	Nov-Dec, Jan-April	Flubendiamide 480SC (FAME), Imidacloprid (Admire)	4	Propineb (Antracol), Tebuconazole (Folicur),	2	NA	NA	Glyphosate 18% and diquat 0.73% (Roundup)
atching Leikai	March-April, Feb-April	Flubendiamide 480SC (FAME), Dichlovos (Nuvan)	2	TUbeconazole 50% + Trifloxystrobin 25% w/w (Nativo), Tebuconazole (Folicur)	2	NA	NA	NA

The waiting period for insecticides were found to be mostly 15 to 20 days and fungicides were 1 week to 15 days . Most of the farmers used pesticides according to the packet bottle label by company as highlighted in Table 4.

Mostly hand driven sprayer pump was used as an equipment to spray pesticides and empty container or packets were disposed off in open field near farm, burning off near the farm and throwing at riverside as well as in drain near farm ( Table 4 and Fig 5).

Major symptoms of pesticides in vegetable growers after application were found to be headache, vomiting, eye problem, skin problem and fatigue. One of the farmer has a problem of gastric ulcer and diarrhea ( Table 4).

Possible impact of pesticides on health of environment are highlighted in Table 5.

#### 4. Pesticide use pattern by vegetable growers in tomatoes in Bishnupur area

Table	Type of pesticide used	Waiting Period after using pesticide	Interval of pesticide spraying	Level of pesticide use	Method of pesticide application	Disposal of pesticide container	Symptoms due to exposure to pest
Chotho	Insecticide Fungicide	5 days 15 days	3 to 4 times /month -do- Once in a month 2 times	According to packet or bottle label	Hand driven sprayer machine (pump)	Disposed off in open field near farm	Diarrhoea, eye v problem, gastric t irritation
wang village)	Insecticide Fungicide	15 days -do-	2 to 5 times/ month -do-	According to packet or bottle label	Hand driven sprayer machine (pump)	Toilet septic tank and dumping in a pit	Not specific
ard	Insecticide Fungicide	20 days 1 and ½ months	3 to 4 times/ month 2 times/month	According to packet or bottle label	Hand driven sprayer machine (pump)	Burning off the container or packet in open field	Not specific
lakha	Insecticide Fungicide	8 days -do-	2 to 3 times / month	According to the packet or bottle label	Hand driven sprayer machine (pump)	Disposed off near the farm and near field drain	Headache, Skin I and vomitting
inou	Insecticide Fungicide	15 days -do-	Once in a month	According to the packet or bottle label	Hand driven sprayer machine (pump)	Dumping in a pit near the farm	Fatigue due to ex weakness
gthak	Insecticide Fungicide	30 days 6 days	Only once	According to the packet or bottle label	Hand driven sprayer machine (pump)	Open field and separate area at home by digging pit	Not specific
Vard	Insecticide Fungicide	1 week 5 days	4 times 10 times	According to the packet or bottle label	Hand driven sprayer machine (pump) as well as battery charging pump	Burning off in open field and dumping near riverside	Weakness, burnin sensation of eyes sensation on skin exhaustion of bod
ng ai	Insecticide Fungicide	20 days 15 days	3 times/ month -do-	According to the packet or bottle label	Hand driven sprayer machine (pump)	Burning off in open field near farm	Burning sensation
ng i	Insecticide Fungicide	15-20 days -do-	1-2 times/ month Only once	According to the packet or bottle label	Hand driven sprayer machine (pump)	Disposed in open field near the farm	Headache, Eye w

Table	Type of pesticide used	Waiting Period after using pesticide	Interval of pesticide spraying	Level of pesticide use	Method of pesticide application	Disposal of pesticide container	Symptoms due to exposure to pest
ng	Insecticide Fungicide	40 days 1 week – 25 days	2 times/ month -do-	According to the packet or bottle label	Hand driven sprayer machine (pump), Battery charging hand pump	Burning off in open field near farm	Vomitting, Skin i
wang	Insecticide Fungicide	15 days to 1 month 1 week	3 times /month -do-	According to the packet or bottle label sometimes increase the dose according to condition	Hand driven sprayer machine (pump)	Dumping and disposed off in open field near the farm	Eye irritation, we after 1 week of sp burning sensation headache
ng	Insecticide Fungicide	15 days 6 to 7 days	3 to 4 times/ month -do-	According to the packet or bottle label	Hand driven sprayer machine ( pump)	Burning off in open field near farm	Weakness and he
wang ng	Insecticide Fungicide	15 days -do-	3 to 4 times/ month -do-	According to the packet or bottle label, acc. To dealer's sugg.	Hand driven sprayer machine (pump)	Disposed off in open field near the farm	weakness
l i	Insecticide Fungicide	15-20 days 15 days	4 times/month	According to the packet or bottle label	Hand driven sprayer machine (pump)	Dumping in open field	Not yet
ng	Insecticide Fungicide	20 days -do-	2 times/ month -do-	According to the packet or bottle label as well as recommendation from dealers	Hand driven sprayer machine (pump)	Burning off in open field near farm	Skin allergy



a. Kwasiphai



b. Keinou Thongthak



c. Khuman Maning leik Chothe village



d. Kwasiphai



e. Bishnupur Ward no. 7

Fig 5 : a. Open dumping at Kwasiphai  
b. Keinou Thongthak  
c. Khuman Maning leik Chothe village  
d. Open dumping at Kwasiphai  
e. Disposed off openly near Bishnupur ward no. 7

Table 5. Possible impact of pesticides on the environment

Environment	Impact of pesticides
Target pests	May develop resistance and resurgence.
Plants	May damage due to phyto-toxicity, presence of residues and vegetation may change due to overuse of pesticides.
Animals	Mortality in birds and domestic animals after consuming pesticide affected insects and residue containing fresh vegetables.
Human	Presence of residue in body, poisoning due to occupational exposure.
Air	May contaminate air due to chemical disposal and bad smell emitting from dumping site as well as due to fumigating materials.
Water	May contaminate surface and ground water due to direct contact and leaking of disposal.
Soil	May contaminate soil due to misuse and spray pesticide ultimately returned soil which in turned may destroy soil micro-fauna.

## Conclusion

From the investigation it was concluded that chemical control of pest was the main approach used by farmers in survey area to protect tomatoes from insect damage and diseases.

They practiced uncontrolled use of pesticide during application without consideration of health of consumers and themselves.

They have little or have no knowledge about the safe use of chemical pesticides.

They are not aware of waiting period, environmental health hazards and all those accidents led by misapplication of these chemical pesticides.



THANK YOU

