Practical-14

Controlling Weeds in Gardens through Manual and Chemical Methods

Exercise 14.1: Use of herbicides and manual weeding methods to control weeds in vegetable crops

OBJECTIVE:

- To control weeds by using herbicides and manual weeding in vegetable crops.

Delivery schedule: 01 period.

Student's expectations/learning objective:

- Importance of weed control.
- Different methods of weed control in vegetable crops.

Pre-learning required: Different weeding operations and importance of weed management.

Handouts/material/equipment's & tools required: Paper sheet and pen to note down the instruction, hand hoe, herbicide, spray pump, stop watch, measuring tape *etc.*

Introduction:

Before we do some practical exercise on weed control practices in vegetable crops, you should know about the importance of weed control and different methods employed for controlling weeds.

What is weed and how it affects crop production?

Weeds are unwanted plants in crop field and its surrounding. They can easily establish and flourish under non-ideal conditions of growth and may affect human welfare adversely. They compete with the crop for water, soil nutrients, light and space and ultimately have direct impact on yield and quality of the crop. Weeds also act as host for insects, pathogens and nematodes.

Direct seeded crops like radish, carrot, peas, beans, palak, amaranth, okra and fenugreek are more vulnerable to weed competition before emergence and during establishment of young plants. Weed seeds easily germinate

under varied conditions and have long seed viability. They have prolonged seed dormancy in some cases where they do not germinate for years under unfavourable conditions.

Losses caused by weed

1. Reduction in crop yield: The weeds cause 70-80% losses in total yield of vegetable crops if weeds are not controlled well in time. Therefore, it is necessary to control weeds.
2. Loss in quality of the crop harvest: The leafy vegetables suffer much due to weed problem as the leafy weed mixture spoil the economic value.
3. Alternate host for diseases and pests: Because of their close association with the crop, they may serve as important reservoir or alternate host for many diseases and insect-pests.
4. Smother the growth of crop: They compete with crop for water, soil nutrients, light and space and thereby suppress the growth of the crop.
5. Interference in crop handling and performing agricultural operations *e.g.* heavy infestation of *Cynodon dactylon* (Doob grass) cause poor ploughing performance
6. Loss of human efficiency by causing allergies and poisoning *e.g.* Congress weed

Methods of Weed Control

- Preventive weed management
- Physical methods
- Cultural methods
- Chemical method
- Biological methods
- Integrated weed Management

Here, we will **focus on physical and chemical methods of weed control.**

Mechanical or Physical Methods: Removing the weeds physically with hands or by using tools/ implements is called mechanical method. Common mechanical methods of weed control are:

1. **Tillage:** Tillage is done with implements drawn by animals or mechanical engines (tractors, tillers *etc.*) rather than by man. Extensive tillage operations which include ploughing, discing, harrowing and levelling are undertaken to prepare the soil. These operations promote the germination of weeds through turning over the soil and then exposing the weed seeds to sun light which ultimately destroy the weeds. With the gradual industrialization, pre-planting or post planting tillage is practical and has been found as an economical method of controlling weeds.

2. **Hoeing** is widely used weeding tool for centuries. It is quite effective in row crop. It is useful for annual and biennial weeds. In case of perennials, it destroys aerial growth with little effect on underground plant parts resulting in regrowth.

3. **Hand weeding:** It is done by physical removal or pulling of weeds or removal with the help of *khurpi*/ hand hoe, spade, *etc.* but it is labour intensive, time consuming and costly.

4. **Digging** is practiced especially for the removal of shrubby and stumpy woody perennials. It is time consuming and costly. Thus, digging is restricted for the removal of very hard perennial woody stem.

5. **Sickling:** It is done to remove the top growth of weeds to prevent seed production and starve the underground part.

6. **Mowing** is cutting the weeds at ground level from weed infested area. It is practiced to keep the growth of weed under check. It has limited value as a mean of weed control but it effectively reduce the seed production of weeds. It is commonly practiced in meadows and pastures, along road side and in waste lands.

7. **Burning** is very powerful technique of weed control in uncultivated land. It destroys aerial portion of the weed directly through flame of the fire and underground portion through the heat effect.

8. **Flooding** kills the weeds by depriving plants of air, thus they die because of suffocation and inability to carry out photosynthesis. It is an effective method of weed control when roots and shoots of weeds are completely covered or surrounded by water for a long period of time. The perennial weed like *Convolvulus arvensis* can be effectively controlled by this method.

In vegetables, the common weed control practices followed are hoeing and hand weeding.

Chemical weed control:

- In this method, chemicals are used to control weeds. The chemicals used for weed control are called as weedicides or herbicides. Chemical weed control is less time consuming and less expensive than hand weeding. Selective and non-selective herbicides are used for weed control.
- Soil fumigants like carbon dioxide, methyl bromide, chloropicrin, cynamide *etc.* and soil sterilants like, simazine, atrazine, formaldehyde *etc.* are applied to soil to kill weeds.

Advantages of chemical weed control:

1) It eliminates early crop weed competition.

2) Herbicides give quick response in terms of checking the growth of weeds.

3) Hand weeding may lead to injuries to the root system of crop and thus damage the crop

4) This method is convenient and economical.

5) Tillage is minimized and thus farm power can be conserved.

6) This method conserves soil moisture and nutrients as weed emergence is prevented during initial crop growth.

7) Weeds similar in morphology to that of crop can effectively be controlled.

Critical period for crop-weed competition in different vegetable crops

S. No.	Crops	Critical period after sowing/planting (days)
1.	Potato	30-50
2.	Pea	30-40
3.	Cole crops	35-40
4.	Solanaceous vegetables	35-40
5.	Onion and garlic	20-30
6.	Okra	20-30
7.	Root vegetables	20-30

Table: Herbicides used for control of weeds in vegetable crop

Crop	Herbicide	Rate (kg/ha)	Time of application
Solanaceous crops	Fluchloralin (Basalin)	1.25	Pre plant incorporation
	Alachlor (Lasso)	1-3	Pre-plant incorporation and 8 days after transplanting
	Pendimethalin	1-1.5	4-5 days after transplanting
Potato	Simazine (Princep)	0.25	Post-emergence
	Alachlor (Lasso)/Nitrofen	2.0	Pre-emergence
	Pendimethalin (Stomp)	1.5	Pre-emergence
Root vegetables	Nitrofen (TOK-E-25)	2.0	Pre-emergence
	Oxadiazon (Ronstar)	1.5	Pre-emergence
Okra	Trifluralin (Treflan)	1.0-1.5	Pre-sowing incorporation
	Alachlor (Lasso)	1.25	Pre-emergence

Cauliflower	Fluchloralin (Basalin)	1.25	Pre-plant incorporation
	Alachlor (Lasso)	1.5-2.5	Pre-plant incorporation
	Pendimethalin (Stomp)	0.75-1.0	Pre-plant incorporation
Cabbage	Trifluralin (Treflan)	1-1.5	Pre-plant incorporation
Onion	Trifluralin (Treflan)	1-1.5	Pre-plant incorporation
	Fluchloralin (Basalin)	0.75	Pre-plant incorporation

Precautions to be taken using herbicides:

- Herbicides should be used within the permissible range.
- Application of pre-plant herbicides should be done one or two days before planting but not earlier, as the herbicidal efficiency may be lost due to volatilization, photo-decomposition or soil microflora *etc.*
- Only the recommended herbicide should be used at a appropriate time.
- Drift on other crop in vicinity should be avoided.

Problems associated in chemical weed control

- Pollution of the environment.
- Soil microbial population is affected.
- Herbicides may cause drift effect.
- It requires technical knowledge for calibration.
- Residual effects are there.
- Some herbicide are costlier and cause weed resistance.

How to handle spray pump?

In order to maintain spray efficiency and safe herbicide application, special attention should be given to clean the equipment after each use. It is recommended that one sprayer should be used for herbicide application only. However, if only one sprayer is used for all pesticide application, then it must be ensured that the spray pump is thoroughly washed.

Exercise 14.1: Identification of important herbicides

Herbicides are chemicals which are used to kill weeds in different cropped and non-cropped areas. These are originally manufactured as technical grades (a.i.) but in this form they are not suitable for direct use because

of their unsuitable physical characteristics. Therefore, different formulations are made by adding materials like inert carriers, emulsifiers, wetting agents, solvents *etc.*, which give them specific colour and structure. The students should be able to identify different formulated herbicides while handling them

Requirements: Different herbicides, petri dishes

Procedure: Students will be provided different herbicides and will be asked to record certain observations as per data sheet and will interpret the information

DATA SHEET

Exercise: Observe the given sample of herbicides and record your observations

Sample no.	Name	Form (liquid, powder, granular)	Type (pre-plant, pre-emergence, post-emergence)	colour	Active ingredient	Specific identification character

Exercise 14.2: Weed management in vegetable crops

Weeds cause considerable loss to the crop by competition and allelopathic effects and are therefore, required to be managed before the critical period of competition with the crop to obtain higher production. The efficacy of different weed management practices using hand tools and chemical methods can be shown to the students by conducting a visit to the experimental farm.

14.2.1: Chemical weed control

Requirements: Herbicide, measuring cylinder, spray pump, water, measuring tape and stop watch

Student will record information regarding the name of herbicide, a.i., dose and time of application for the control of weeds in different vegetable crops.

Procedure for pre-emergence application of weeds

- Demarcate plot in which sowing of any crop has been done.
- The plot should have proper moisture at the time of herbicide application. Therefore, pre-sown irrigation is essential.
- Prepare the solution by adding the herbicide in water in the spray pump *e.g.* for spraying in an area of 400 m^2, 120 ml of pendimethalin has to be dissolved in 30 litres of water that means 2 spray pumps of capacity 15 litres.
- It is essential to monitor the speed of spraying the herbicide solution so that the recommended dose should be sprayed in the specified area. Over spray leads to toxicity while spraying at lower concentration or amount results in un-effective/no control of weeds.
- For monitoring the speed, you can go for blank spray of water in a specified area.
- Record the time of staring application of herbicide and its completion and work out the efficacy of spraying herbicide in hours/ha.
- The efficacy will be calculated in terms of man hour per hectare as

$$\text{Efficacy (man hour per ha)} = \frac{\text{(Time taken to complete spray (hours)} \times 10000)}{\text{(Area covered)}}$$

14.2.2: Mechanical weed control

Requirements: Hand hoe, mechanical weeder, measuring tape and stop watch

Procedure:

- Demarcate weed infested plots each having specific cropping area.
- Remove the weeds from the plots with the help of hand tools like hoe and from the other plot with mechanical weeder.
- Note the time taken for completing the weeding operation.
- Work out the efficacy of hand tool in hours/ha.
- The efficacy of hand tools will be calculated in terms of man hour per hectare. If a student take 15 minutes to complete the weeding in 5 m^2 area with hand hoe then the efficacy will be calculated for an hectare as

$$\text{Efficacy (man hour per ha)} = \frac{(\text{Time taken to complete weeding (hours)} \times 10000)}{(\text{Area covered})}$$

$$= \frac{(15 \times 10000)}{(60 \times 5)} = 500 \text{ man hours/ha}$$

Exercise 14.3: Calculation of dose of herbicide in terms of active in gradient

$$\text{Quantity of commercial product of herbicide (kg per ha)} = \frac{(\text{Recommended dose of herbicide})}{(\text{a.i of herbicide formulation})} \times 100$$

Solved example

If, you buy pendimethalin with 40% a.i. Its recommended dose of application in tomato is 1.0 kg/ha. Then, the quantity of commercial product required will be

$$= \frac{1.0}{40} \times 100 = 2.5 \text{ kg/ha}$$

In this case, 2.5 kg of commercial product is added to the amount of water required for one hectare. Spraying herbicide with hand operated Knapsack Spray pump, water required to cover a hectare area varies from 750-800 litres.

Exercise 14.4: Calculation of quantity of water to be used

Quantity of water required per unit area (litre per unit area)

$$= \frac{(\text{water required for one ha} \times \text{area to be sprayed})}{10000}$$

Assignment

Students will be given different problems to calculate the doses of herbicides for different situations.

Exercise14.5: Participate in weed control operations in any of the vegetable crop and record observations on the data sheet

DATA SHEET

Operation conducted	Observations
Name of the crop	
Area covered	
Stage of the crop	
Weed population	
Weed species present	
Stage of weed growth	
Field condition	
Tool used for weeding operation	
Time taken to complete the weeding	
Man hours required for one hectare	
Problem faced, if any	
Any other observation	

Exercise 14.6: Conduct an experiment to know the comparative effect of chemical weed control and no weed control in garden pea/French bean and record observations on the data sheet.

DATA SHEET

Operation conducted	Plots spayed with chemical	No weed control	Integrated weed management (Chemical as pre emergence + one hand weeding after 30-45 days of sowing)
Name of the crop			
Area covered			
After one month			
Weed population			
Weed species present			
Stage of weed growth			
Crop condition			
After two months			
Weed population			
Weed species present			
Stage of weed growth			
Crop condition			
At harvest stage			
Crop condition			
Yield			
Any other observation			