

Integrated weed management in vegetable crops

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Vegetables provide the much needed vitamins and minerals besides the major nutrients required for human health. In India, more than 20 types of vegetables are grown in various seasons. Major among them are beans, bitter gourd, bottle gourd, brinjal, cabbage, cauliflower capsicum, carrot, cucumber, chillies, elephant foot yam, mushrooms, okra, onion, pointed gourd, peas, potato, radish, pumpkin, sweet potato, tapioca, tomato and others. In India, during 2016-17, vegetable crops were grown in an area of 10.29 million ha with production of 175 million tonne and productivity level of 17.01 tonne ha. At field level, although they are grown on small areas, they fetch higher returns to the farmer.

Key words: Crops, Management, Vegetable, Weed

Vegetables are grown under input intensive production systems. Frequent irrigations and application of farmyard manure and fertilizers induces heavy infestation of weeds. The losses caused by weeds in vegetable crops may be as high as 90 %. Thus, it becomes very important for the vegetable growers to adopt effective and economical strategies to manage weeds to levels at which they do not hamper their production and quality.

Weed flora associated with vegetable crops

Major weed flora associated with vegetable crops during *kharif* and *rabi* are:

Kharif: The weed grow in this season are *Amaranthus viridis* (jungali chaulai), *Alternanthera sessilis* (katvaiya), *Ageratum conyzoides* (mahakua), *Cyperus rotundus* (nagar motha), *Commelina benghalensis* (kankaua), *Celosia argentea* (safed murg), *Cynodon dactylon* (doob ghas), *Digitaria ciliaris* (ghod doob), *Dactyloctenium aegyptium* (makra), *Digera arvensis* (lahsua), *Echinochloa colona* (sawan), *Eleusine indica*



Heavy infestation of weeds in onion (*Allium cepa*) crop

(jungali ragi), *Physalis minima* (van makoy), *Phyllanthus niruri* (hazardana), *Trianthema portulacastrum* (patharchatta) etc.

Rabi: The weeds grown in rabi are: *Asphodelus tenuifolius* (van pyaji), *Anagallis arvensis* (krishna neel), *Chenopodium album* (bathua),

Convolvulus arvensis (hirankhuri), *Cynodon dactylon* (doob ghas), *Cyperus rotundus* (nagar motha), *Coronopus didymus* (pitpapra), *Euphorbia hirta* (dudhi), *Fumaria parviflora* (Papra), *Lathyrus aphaca* (van matari), *Melilotus indica* (senji), *Orobancha* spp. (bhuinphod), *Rumex dentatus*



Straw mulching in pumpkin

(jungali palak), *Spergula arvensis* (bandhanian), *Sonchus arvensis* (sow-thistle), *Vicia sativa* (ankari) etc.

Crop-weed competition and losses

In general first one-third crop duration is critical for crop-weed competition. Weeds if not kept under control can cause huge losses in the yield and quality of vegetable crops Table 1.

Weeds as alternate hosts of insect-pests and pathogens

Weeds associated with vegetable crops also serve as hosts for many pests and diseases which require additional inputs for their control. *Vicia sativa* provides shelter to *Helicoverpa armigera*. *Solanum nigrum* is a host for brinjal fruit and shoot borer (*Leucinodes orbonalis*), common lambsquarters (*Chenopodium album*) acts as a host for aphids. *Ageratum* spp. and *Lantana* spp. provide shelter to white fly which transmits yellow mosaic virus disease.

Table 1. Reduction in economic yield of vegetables depends upon the type of weed species, severity and duration of infestation, competing ability of crop plants and also climatic conditions which affect weed and crop growth.

Crops	Critical period (days after planting)	Reduction in yield (%)
Onion	30-70	50-70
Garlic	30-60	50-70
Cabbage	30-45	35-60
Cauliflower	25-30	50-60
Okra	15-30	40-50
Tomato	30-45	40-70
Chilli	30-45	60-70
Potato	20-40	6-82
Peas	30-45	25-35
Brinjal	20-60	70-80
Carrot	15-20	70-80

WEED MANAGEMENT

Preventive methods

The proverb 'prevention is better than control' also holds true in weed management in vegetable crops. The prevention of a weed problem is often the most practical, easier and less costly method than control or eradication. Prevention restricts the entry of weeds in newer areas. Prevention of weeds can be achieved by the followings:

- Do not select fields with known history of heavy weed infestation, especially of perennial weeds.
- Remove weeds before flowering and seed set to prevent reproduction of weeds.
- Organic manures particularly farm yard manure are a major source of weed seed addition in vegetable crop fields. Apply organic manures only after thorough decomposition for 4-5 months so that weed seeds are killed.
- Remove weeds that come up on field bunds, near irrigation channels, fence rows, and adjacent non-crop lands.
- Avoid transportation or use of soil from weed infested area

Cultural methods

The aim of cultural method is to provide favourable growth condition to the crop instead of weeds. They are not only eco-friendly but also reduce the use of herbicides. Cultural practices which can be followed for weed management in vegetable crops could be:

Land preparation: The number of tillage operations to prepare the field for sowing vegetable crop will



Black polyethylene mulch in cauliflower

depend upon the soil conditions and also the kind of weed species prevalent in the field. If annual weeds are dominant then shallow cultivation is enough while prevalence of perennial weeds requires ploughing by mould board or disc plough, to uproot, cut and destroy them. In general, 2-3 ploughings followed by 1-2 cross harrowing and planking are required to arrive at proper tilth and destruction of weeds.

Stale seedbed technique: It is a practice to remove 2-3 flushes of weeds from the field where vegetable crop is to be grown. The land is cultivated once and a light irrigation is given to germinate weed seeds. Once the seeds are germinated they are destroyed either by non-residual herbicides like paraquat or glyphosate, or by shallow cultivation. It is important not to cultivate below the top 1 to 2 cm soil otherwise a further flush of weeds may emerge.

Mulching: It is an effective weed management practice in cultivation of vegetable crops. Mulch is a protective covering of materials maintained or placed on soil surface. Materials used for mulch include crop residues, straw, leaves, and plastic mulch sheets. Mulching the soil surface can prevent weed seeds germination or physically suppress seedling emergence, but is not effective against established perennial weeds. Mostly, black polythelene mulch is used within the crop rows to block the solar radiation reaching the soil and weed seeds so that germination and growth of weeds is inhibited. Besides arresting weed



Soil solarization of nursery beds

germination, it also moderates soil temperature which results in reduced number of irrigations.

Soil solarization: By clear thin plastic films raises the soil temperature 55 to 60°C which kills most of the weed seeds and soil borne insects and pathogens present in the upper layer of soil. This is very effective technique for weed control in vegetable crops especially during nursery raising. To solarize a field, the land is finely prepared and leveled, a light irrigation is given to moisten the soil up to field capacity, then a clear thin plastic film is covered on the land which is tucked in from all sides so that heat generated is trapped inside the plastic film. The solarization is done for 5-6 weeks during peak summer.

Mechanical

Hand weeding is normally done to remove weeds from vegetable crop. However, due to scarcity and escalating costs of labour, hand weeding has become uneconomical. Hand weeding at 25 and 40 days after sowing vegetable crops gives the highest weed control efficiency. Alternative mechanical methods are also effective as well as economical. In India, several hand tools and implements are used for mechanical removal of weeds before and after sowing the crop. They include hand chisel (*khurpi*), hand hoe, wheel hoe, blade harrow, country plough (*bakhar*), inter-row cultivator, soil turning and disc plough. By using these weeding implements although weeds in inter-row are effectively controlled, the intra-row weeds was to be removed manually.

Table 2. The herbicide application should be integrated with other methods of weed control.

Herbicide	Dose (kg/ha ¹)	Treatment	Vegetable crops	Weeds controlled
Alachlor	1.0-1.5	Pre-emergence	Brinjal, chilli, tomato, okra, cumin, fenugreek	Grasses and some broadleaved
Butachlor	2.0	Pre-emergence	Tomatoes, cucurbits	Grasses
Fluchloralin	1.0-1.5	Pre Plant Incorporation	Tomato, pepper, okra, brassica crops, legumes, garlic, umbelliferous crops	Grasses and some broadleaved
Haloxypop-butyl	0.100	Early-post emergence	Onion, garlic	Grasses and some sedges
Metribuzin	0.200-0.350	Pre or early Post emergence	Tomato, potato, pumpkin, cucumber, gourds, carrot, peas	Grasses and broadleaved
Oxadiargyl	0.090	Pre-emergence	Onion, garlic	Grasses and broadleaved
Oxyfluorfen	0.200-0.300	Early post	Direct-seeded and transplanted onions, potato	Grasses and some broadleaved
Pendi-methalin	0.750-1.0	Pre-emergence	Brinjal, beans/peas, okra tomato, onion, garlic, spinach, carrot, radish legumes, potato	Grasses and some broadleaved
Quizalofop-p-ethyl	0.050	Post-emergence	Brinjal, beans/peas, okra tomato, onion, garlic, carrot, cauliflower/cabbage, potato	Grasses and some sedges

Chemical

The choice of highly selective herbicides in vegetables is limited. Some herbicide recommendations for vegetable crops are discussed in Table:

Integrated weed management

The conventional method of hand weeding has become an expensive input in the cultivation of vegetable crops. Combination of different methods should be followed in place of relying on any single method of weed control. Pre-emergence herbicides may be followed with hand weeding, earthing-up or mulching. In seed beds and tuber/bulb crops mechanical cultivation may damage the seedling and underground parts. Herbicides are not available for controlling parasitic weed *Orobanche* spp. in vegetable crops hence several cultural and manual methods need to be integrated. In such fields crop

rotation with non-host crops should be followed.

SUMMARY

Frequent irrigations and application of farmyard manure and fertilizers induces heavy infestation of weeds in vegetable crops and reduce the crop yields drastically. The critical period of crop-weed competition varies from 15 to 30 days in okra and between 30 and 70 days in onion. Cultural methods such as manual weeding, stale seed-bed technique, mulching, soil solarization in vegetable nurseries, drip irrigation etc. help in reducing weed problem. Integration of pre-emergence herbicides with intercultural operations (hoeing, earthing-up, mulching) has been found effective and economical.

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