Trends in Biosciences 8(18), Print : ISSN 0974-8431, 4779-4782, 2015

REVIEW PAPER

Weed Management in Vegetable Crops

RAVNEET KOUR[1*] AND R.K. SAMNOTRA[2]

Krishi Vigyan Kendra Doda[1] and Division of Vegetable Science and Floriculture[2], Sher-e-kashmir University of Agricultural Sciences and Technology-Jammu
**email: kourravneet24@yahoo.com*

ABSTRACT

Weeds are the most severe and widespread biological constraint to crop production and cause invisible damage till the crop is harvested. Weeds are responsible for reduction in crop yield , degrade quality of produce and raise cost of product.Since the vegetables are the cash crops ,the weed management becomes very important. Different methods of weed management have their own benefits and limitations. The level of phytotoxicity of chemical herbicides differs from crop to crop and has environmental hazards too. Therefore, an integrated approach of weed management is the recent trend.

Key words *weeds; herbicides; solarisation ; hand weeding*

Vegetables contribute to national food security. India is the 2nd largest producer after china. Yield is very less on farmer's field as weeds play a major role and the loss incurred is 10-90 percent. Critical period of crop weed competition is 15-60 days after sowing or transplanting. Weeds cause losses by; hiding fruits, discolouration of fruits, overripening of fruits, rotting of fruits and infestation of insects and diseases. Presence of weeds in general reduces crop yield by 31.5 per cent (22.7 percent in rabi season and 36.5 percent in kharif season). Considering the problem of weeds in crop field and the need for weed research in India, All India Coordinated Research Project on Weed Control was started by the ICAR in Collaboration with the United States Department of Agriculture (USDA) at 6 locations. At present, it is operating at 22 locations covering different agro ecological zones all over the country. Consequently, the National Research Centre for Weed Science was established in April, 1989, which was further upgraded to Directorate of Weed Science Research (DWSR)in January, 2009. The impact of weeds on the Indian economy estimated about two decades ago ranged from Rs. 20 to 28 billion. A recent study undertaken at DWSR suggests that proper weed management technologies, if adapted, can result in an additional income of Rs. 1,05,036 crores per annum (NRCWS, 2007).This figure would be greater if the direct and indirect impact of weeds on aquatic systems, forestry and industrial sites are also included. Besides, huge amount of money is spent on controlling the weeds. At a conservative estimate, an amount of Rs. 100 billion is spent on weed management annually in India, in arable agriculture alone. The potential yield losses due to weeds can be as high as about 65 per cent depending on the crop, degree of weed infestation, weed species and management practices. However, the importance of the weeds depends on the crop and the weeds. Another good reason to keep control of the weeds throughout the season is to avoid building up of the seed bank. If the weeds are allowed to disseminate seeds, it also means future problems with weeds in subsequent crops, confirming the English proverb "One year seeding means seven years weeding". Following methods can be used individually or in different combination to control weeds in vegetable crops:

Cultural methods

Cultural methods are also practiced in some situations which involve use of competitive and smother crops, use of allelopathic cover crops, and crop rotation. A popular cultural method for controlling weeds in vegetables is the stale seedbed technique. With the stale seedbed method, the soil is tilled approximately two weeks before the expected seeding date, and weeds are allowed to germinate and emerge under optimal soil moisture and temperature. The emerged weeds are then tilled into the soil or burned down with a non selective herbicide such as glyphosate prior to planting the crop.

Physical methods

Mechanical or physical weed control involves hand weeding, use of mulches, or simple machinery like hoes, cultivators, mowers, flamers, solarisation etc. Hand weeding is expensive but can be very effective in early-season weed control. Mulches used to control weeds include straw, newspaper, plastic, and grass clippings. When mulching with organic materials, it is important to mulch deep enough to conserve soil moisture as well as block weed emergence. Most organic mulches keep the soil cool, and thus will not result in early harvest of most vegetables. Plastic mulches are becoming popular for vegetable weed control in both home gardens and commercial fields. Mulches block light so weeds do not germinate. In addition, the plastic keeps the soil warmer (black mulch) or cooler (white mulch) and reduces evaporative loss of water.

Biological control

Bioherbicides are applied as sprays to kill or suppress the growth of weeds. These are usually microbial pathogens like bacteria, virus and fungi. Generally the pathogens considered for this strategy are fungi, hence commonly known as myco-herbicides. Recently reported myco-herbicides are CASST, BIOMALA,VELGO and ABG 5003 etc.

Chemical control

Use of chemicals for weed control offers great potential in crop production. Still, quite a few herbicides are made available for weeding vegetables, but unfortunately, no single herbicide controls all the weed species that may plague a vegetable field. Herbicides control weeds effectively up to 4-5 weeks period by the time majority of vegetables develop sufficient canopy and provide smothering effects on weeds.

Reviews on different methods of weed control

Mulching

In a field study on mulching (Ashrafuzzaman *et al*., 2013) with different type of plastic mulches, it was reported that different mulches generated higher soil temperature and soil moisture under mulch over the control. Transparent and blue plastic mulches encouraged weed population which were suppressed under black plastic. Plant height, number of primary branches, stem base diameter, number of leaves and yield were better for the plants on plastic. At the mature green stage, fruits had the highest vitamin-C content on the black plastic. Mulching produced the fruits with the highest chlorophyll-a, chlorophyll-b and total chlorophyll contents and also increased the number of fruits per plant and yield. However, mulching did not affect the length and diameter of the fruits and number of seeds per fruit. Plants on black plastic mulch had the maximum number of fruits and highest yield. Thus, mulching appears to be a viable tool to increase the chilli production under tropical conditions. Sathappan *et al*., 2012 reported that integrating both goat grazing and sugarcane trash mulching compared better than conventional practices of hand-weeding and herbicide treatments, in offering a sustainable weed control and favouring crop yields. A 21% enhancement in soil organic matter content was also achieved due to this integration in vegetable crop of eggplant (*Solanum melongena* L.) during June-September.

Hand-weeding

The hand-weeding is a commonly employed method to manage the weeds Abid *et.al*., 2011 reported that the hand weeding twice in growing season was the most effective treatment in terms of weed suppression & yield enhancement among six non - chemical methods used in chilli cv. Long green.

Solarization

The technique of soil solarization involves covering the soil with transparent, polyethylene film during the hottest part of the summer months, for 2-4 weeks.Thus temperature rise by 10-12^{0}C over the unfilmed fields, which is sufficient to kill weed seeds present on the surface of the soil. An experiment on evaluation of soil solarization on weed seed bank of soil was conducted with six non chemical agronomical weed management practices (Arora and Tomar 2012) *viz.*, solarized (45 days), non-solarized, stale seed bed, deep ploughing, green manuring and mulching by green biomass. The soil temperature recorded under solarized conditions were 43.9^{0}C and 43.8^{0}C at 10 and 15cm depth and it was 4.6^{0}C and 4.5^{0}C higher than non-solarized soil respectively. In solarized soil total number of broad grassy leaved and sedges weeds was lowest, while highest grasses were reported in non-solarised soil. Total number of weeds was highest in non solarized soil followed by green manuring, stale seed

bed, mulching, deep ploughing and non-solarised soil. Thus soil solarization was found to be the best non chemical agronomical practice for weed management methods used resulting to lowest weed seed bank.

Biological control

Rao, 1999 reported various bioagents in weed control. Among the insects, he found that weeds *cyperus rotundus* (motha) and *Parthenium hysterophorus* (congress grass) could be controlled by *Bactra vermosana* and *Zygogramma bicolorata* respectively. The nematode *Orrinia phyllobia* was effective against *Solanum elaegnifolium* (silverleaf nightshade). The bacteria deleterius rhizobacteria was used as bioagent against *Amaranthus retroflexus* (redroot pigweed) and *Poa annua* (bluegrass). Fungus *streptomyces spp*. was useful against *Echinochloa crusgalli* (barnyard grass) and *Pseudomonas syringae* pv. *tagetis* against *lactuca serriola* (prickly lettuce).

Chemical control

Efficacy of four herbicides, Trifluralin, Ethalfluralin, Sethoxidim and Bazagran were investigated and results showed Bazagran herbicide compared to other herbicides are more effective in weeds control in beans (Jafari *et al*., 2013). In Onion, it was found that pre-emergence application of oxyfluorfen (23.5% EC) at 400 g·ha”1 gave significantly lower total weed density, weed dry weight and higher weed control efficiency at all the intervals. Application of new formulation of oxyfluorfen (23.5% EC) at 200 g·ha”1 as pre-emergence herbicide can keep the weed density and dry weight below the economic threshold level and increase the bulb weight and yield in onion. Unweeded control accounted for lower bulb yield which in turn reflected through higher weed index due to heavy competition of weeds for nutrients, space and light (Ramalingam *et al.,* 2013). Kunti *et.al.,* 2011 reported that pendimethalin (Extra) (0.64 kg/ha) pre-transplanting+one hand weeding at 40 DAT + pendimethalin (Extra) (0.64 kg/ha) at 45 DAT as postemergence resulted in better performance followed by pendimethalin (1.0 kg/ha) pre-transplanting + one hand weeding at 45 DAT with respect to growth and yield parameters due to effective weed management in brinjal. Maximum benefit: cost ratio was found with pendimethalin (extra) (0.64 kg/ha) pretransplanting one hand weeding at 40 DAT + pendimethalin (Extra) (0.64 kg/ha) at 45 DAT.

In brinjal, the pendimethalin at 1.0 and 1.5 kg a.i. /ha was found non phytotoxic in comparison to other chemical herbicides and weed control efficiency (WCE) (%) was highest with the pendimethalin at 1.5 kg a.i. /ha. The yield parameters viz., number of fruits, fruit weight, and fruit yield decreased significantly in unweeded control while weed index was higher. The fruit yield was significantly higher with application of pendimethalin at 1.5 kg a.i. /ha.(Shivalingappa *et al.,* 2014) In chilli the butachlor 1.0 kg ha-1 gave good to excellent control, lower weed population, weed dry weight and higher weed control efficiency (WCE) at all the stages of crop growth followed by alachlor 2.0 kg ha-1. Application of diclosulam 22 g ha-1 caused severe injury of chilli crop and some stand loss during crop season, while pendimethalin 1.0 kg ha-1, oxyfluorfen 0.3 kg ha-1 and haloxyfop 75 g ha-1 gave slight toxic injury. Significantly higher net returns and benefit: cost ratio was recorded in butachlor. Weed free check and alachlor 2.0 kg ha-1 was next to butachlor (Singh *et al*., 2011).

In recent years, methods of **integrated weed management** that use herbicides with greater efficiency in order to reduce environmental pollution have gained the attention of weed research. This study was conducted to test the integrated weed management methods in tomato crop .The treatments consisted of two tillage systems (protective and conventional) and six treatments of weed control, viz; herbicide, reduced herbicide, weeding, cultivator, a combination of treatments 2 and 3, Integration of treatments 2 and 4. Results showed that the frequency of broad-leaf and narrow-leaf weeds were higher for the cultivator treatment than the other methods of weed control. Treatment by herbicides alone was not effective enough, not only on the efficiency of the tomato crop but the method also reduced biodiversity and caused environmental pollution (*Hesammi,* 2013)

It is concluded that the integrated approach is the best method to control weeds as it leads to better weed control, reduces the cost of production , increases the yield and less hazardous to the environment and human and animal life. Therefore this approach should be encouraged for efficient weed management.

LITERATURE CITED

Abid Khan, A., Sajid, M., Hussain, Z. and Khattak, A.M. 2012. Effect of different weed control methods on weeds and yield of chillies (*Capsicum annuum* L.). *Pak. J. Weed Sci. Res.* **18(1):** 71-78, 2012

Arora, A. and Tomar, S.S. 2012. Effect of soil solarization on weed seed bank in soil. Indian Journal of Weed Science **44(2):** 122–123, 2012

Ashrafuzzaman, M., Abdul Halim, M., Razi Ismail, M., Shahidullah, S.M. and Alamgir Hossain, M. 2011. Effect of Plastic Mulch on Growth and Yield of Chilli (*Capsicum annuum* L.) *Brazilian Archives of Biology and Technology* An international journal. **54 (2):** 321-330

Hesammi, E. 2013. Evaluation of Weed Control in Tomato. Middle-East Journal of Scientific Research **13 (6):** 737-739

Kunti, Sharma, G. and Singh, A.P. 2012. Weed management practices on growth and yield of winter season brinjal under Chhattisgarh plain conditions. *Indian Journal of Weed Science* **44(1):** 18–20.

Ramalingam, S.P., Chinnagounder, C., Perumal, M., Palanisamy, M.A. 2013.Evaluation of New Formulation of Oxyfluorfen (23.5% EC) for Weed Control Efficacy and Bulb Yield in Onion. *American Journal of Plant Sciences*, Published Online April 2013.

Rao, V.S. 1999. Biological approaches in weed management. Principles of weed science, pp 319-347.

Sathappan, C.I., Arivukarasu, K., Rameshkumar, S., Murugan, G. and Kathiresan, R. 2012. Sustainable management of weeds in rainfed eggplant in India. *Pak J. Weed Sci. Research* **18:** 557-564.

Shivalingappa, Bangi, S., Eugenia, P.L., Santosh, S.B., Umesh, T. Sattigeri, 2014. Effect of herbicides on weed control efficiency (WCE) and yield attributes in brinjal *(Solanum melongena* L.) *Journal of Agriculture and Veterinary Science* **7 (6) :** 59-65

Singh, U. Hiremath, S.M., Halikatti, S.I., Shashidhara, G.B. and Patil, P. 2011. Evaluation of herbicides for weed control in rainfed transplanted chilli (*Capsicum annuum* L.) *Karnataka J. Agric. Science* **24 (2) :** 125-128

Jafari, R., Rezai, S. and Shakarami, J. 2013. Evaluating effects of some herbicides on weeds in field bean (Phaseolus vulgaris). *International Research Journal of Applied and Basic Sciences* **6 (8):** 1150-1152.

Received on 20-08-2015 *Accepted on 25-08-2015*