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Weed management strategies in Soybean (*Glycine max*) — A review

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ABSTRACT

Soybean (*Glycine max* L.) being a rainy season crop, faces severe infestation of *kharif* weeds. Since the crop suppresses weeds due to its dense canopy at later stages of growth, the control of weeds has received very little attention. Weeds offer severe competition to crops during the early stage of growth. The critical crop weed competition period in soybean varies from 15–45 days after sowing (DAS) depending upon location and prevailing environmental conditions. Weeds cause a 26–84% reduction in the yield depending upon the types and intensity of weeds, besides impairing the quality of the produce. Different methods of weed management in field crops include preventive, cultural, mechanical, chemical, biological, and biotechnological means. Weed control through a physical approach achieved by hand weeding at 20 and 40 DAS (twice) is ineffective due to the continuous rainfall and high labour wages. The use of herbicides for the control of weeds has gathered momentum in recent years. Weed control through the integration of herbicides with cultural weeding is a paying proposition. Double knock application of one pre-emergence herbicide followed by application of post-emergence herbicides, solves the problem of labour scarcity encountered by the farmers. However, the timely application of different weed management tactics has a crucial role in achieving the desired target. Killing one or two flushes before seeding a crop and immediate cultivation of field after harvest to destroy survivors has an added advantage. An effort has been made in this article to review the work done on weed management in soybean.

Keywords: Herbicides application, Oilseed crop, Soybean, Weed management

In India, soybean (*Glycine max* L.) was introduced from China probably through the Himalayan route or through Myanmar. The cultivation of black seeded soybean started as early as 1882 at Nagpur (Vinaygam *et al.* 2006). Soybean is a member of the family Fabaceae and sub-family Faboideae. It contains about 20% oil and 40–42% high-quality protein as compared to 20–25% in other legumes (Agarwal *et al.* 2013). Therefore, this crop has rightly been named as a miracle crop of the 20th century. According to the USDA report, soybean as vegetable oil is the second largest consumable oil commodity after palm oil. Its oil is consumed as a salad oil, vegetable shortening, and margarine. Industrial uses include its use in soaps, paints, resin, and dry oil. Several protein-rich products such as soy milk, soy cheese (paneer), soy sauce, and soy flour are also produced from its seeds (Thakur and Dhiman 2016). Soybean leaves residual nitrogen equivalent to 35–40 kg/ha for the succeeding crop, with which it helps in improving soil fertility.

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Soybean is a day-neutral plant but in India, it is mostly grown in *kharif*. During this season, weeds have a higher initial growth rate and higher diversity due to unprecedented rainfall which as a result removes more nutrients from the soil and reduces the seed yield. Weeds are one of the major threats in sustaining higher crop productivity owing to competition for nutrients, moisture, solar radiation, and space with crop plants. Problems due to weeds vary from crop to crop, agro-ecological conditions, growing seasons, and management practices. Weeds also act as an alternate host for different types of insect pests and disease-causing organisms. Weeds are the major biological constraints causing almost 34% of yield loss worldwide as compared to 18% and 16% by insect pests and pathogens, respectively, in major field crops like rice, wheat, maize, soybean, and cotton. When improved smart agricultural techniques are adopted, efficient weed management becomes even more important for obtaining maximum productivity and benefits. Losses of soybean production due to weed intensity, and duration of weed competition have been the major limiting factors. The early presence of the weeds causes soybean canopy coverage which reduces the quality of the grains (Tehulie *et al.* 2021). Wider row spacing and the slow initial growth rate of soybean provide a congenial atmosphere for the profuse growth of weeds. Due to increased area of soybean, scarcity of labour for weeding operation and the rainy season allows weeds to come in several flushes. The conventional methods of weed control are time-consuming, expensive, and laborious. Also, weeding during critical growth stages is sometimes not possible due to continuous heavy downpours. Moreover, the crop is grown during the summer season favouring the luxurious growth of a large number of weeds.

Major weed flora

Because of slow initial growth, warm and humid climate, the soybean crop permits the weeds to grow without any competition, especially at the initial stages of its growth. Region-wise weed flora invading the soybean crop have been summarized in Table 1.

Crop weed competition

Crop-weed competition refers to the rivalry between the crop and weeds for a common demand which eventually runs short of supply and becomes a limiting factor. The weeds compete with crop plants for space, moisture, light, carbon dioxide and take away a major share of native and applied plant nutrients that otherwise should have been utilized by the crop plants. Type of irrigation methods, amount of irrigation, cropping system, weed control measures adopted, and environmental factors have a significant influence on the intensity, diversity and infestation of weeds. Water is the most limiting factor essential for plant growth and production. Generally, C_3 species have predominate metabolism in temperate regions, while C_4 have in tropical and subtropical regions. *Amaranthus hybridus* with C_4 metabolism shows higher water use efficiency (WUE) compared to soybean. Light interception by the plant canopy depends on plant density and distribution, plant height, branching rate, leaf area and distribution of leaves, leaf angle, angle of leaf blades, and dry matter accumulation. The quick emergence of weeds than crop emergence has increased grain yield losses of soybean. Crops with fast root growth maximize the use of water and nutrients so an accelerated growth of the root system constitutes a desirable feature for better nutrient use. Unlike insect pests and disease outbreaks, losses due to weeds do not show any clear visual symptom, especially at the early stages of growth. Therefore, farmers pay little attention to weed control practices.

Critical period of crop-weed competition

The critical period of weed control (CPWC) is the period of crop growth when the crop must be kept weed-free to prevent qualitative and quantitative yield loss due to weed interference. The competition of weeds with the crop at critical growth stages leads to a severe reduction in crop yield.

The critical period is the maximum period for which weeds can be tolerated without affecting final crop yields, or the point after which, weed growth does not affect final yield. Thus, under the light of the literature reviewed above, it can be concluded that a crop requires a maximum initial period during its growth, where interference due to weeds should be the least. Critical crop-weed competition period for North Hill zone, Northern Plain zone and Central zone

Table 1 Region wise distribution of major weed flora in soybean

Zone	States	Weeds flora	References
North Hill Zone	Himachal Pradesh, Uttar Pradesh and Hill region of Uttarakhand	Broadleaf: *Galinsoga parviflora*, *Commelina benghalensis*, *Ageratum conyzoides*, *Polygonum alatum* Grasses: *Echinochloa colona*, *Cynodon dactylon*, *Digitaria sanguinalis*, *Panicum dicotomiflorum* Sedges: *Cyperus rotundus*	(Kumar *et al.* 2008, Chander *et al.* 2014, Kumar *et al.* 2018a)
Northern Plain Zone	Punjab, Haryana, Delhi, Eastern plains of Uttar Pradesh, Plain of Uttarakhand and Eastern Bihar	Broadleaf: *Commelina benghalensis*, *Digera muricata*, *Eclipta alba* Grasses: *Dactyloctenium aegyptium*, *Digitaria sanguinalis*, *Dinebra retroflexa*, *Leptocloa chinensis* Sedges: *Cyperus rotundus*	(Yadav *et al.* 2017, Dass *et al.* 2019)
Central Zone	Bundelkhand region of Uttar Pradesh, Rajasthan, Gujarat, North-West region of Maharashtra and Orissa	Broadleaf: *Convolvulus arvensis* L., *Commelina benghalensis*, *Eclipta alba*, *Phyllanthus niruri* Hook F., *Portulaca oleraceae* (L.), *Lindernia ciliate* Grasses: *Echinochloa colonum* (L.) Link, *Echinochloa crusgalli*, *Dinebra retroflexa*, *Digitaria adscendens, Trianthema partulacastrum*, *Digera arvensis* Forsk., *Cynodon dactylon* (L.) Sedges: *Cyperus iria*, *Cyperus rotundus* L.	(Meena *et al.* 2017, Patel *et al.* 2019)
Southern Zone	Karnataka, Tamil Nadu, Telangana, Southern part of Kerala and Maharashtra	Broadleaf: *Phyllanthus maderaspetansis*, *Phyllanthus niruri*, *Digera muricata*, *Commelina benghalensis*, *Lagasca mollis* Grasses: *Dactyloctenium aegyptium*, *Panicum repens*, *Echinochloa colonum*, *Cynodon dactylon*, *Acalypha ciliate*, *Parthenium hysterophorus* Sedges: *Cyperus rotundus*, *Cyperus difformis*	(Prachand *et al.* 2014)

was 0–40 DAS, 0–45 DAS and 15–45 DAS, respectively (Kumar *et al.* 2018a, Mishra *et al.* 2013). This critical period for soybean is the first 60 days and control of weeds during this period may result in a considerable increase in grain yield.

Losses caused by weeds

The ultimate effect of weed infestation in the crop field is the reduction in yield and quality of the produce. The magnitude of the effect depends on weed emergence time, type of species, density, stages of the critical competencies, and other management factors. Weeds cost Indian agricultural production over USD 11 billion every year with a 31% estimated yield reduction in soybean (Gharde *et al.* 2018). The presence of major weeds reduces the yield of soybean crops such as *Sorghum bicolor* (25%), *Ipomoea* sp. and *Xanthium strumarium* (64%), *Amaranthus* sp. and *Echinochloa crusgalli* (32–99%) and *Euphorbia geniculata* (12–30%) (Mishra and Singh 2005). The rapid growth of weed species caused severe crop-weed competition and reduction in crop yield ranging from 25–80% depending upon the type of weed flora and weed density (Sandil *et al.* 2015).

Methods of weed management

Weed control is a practice of great importance for obtaining higher yields of soybean because of its poor competitive ability due to inherent characteristics such as short stature, shallow root system, and very slow growth rate in the initial stages. Moreover, high temperature coupled with high humidity as a sequel of frequent rain showers provides favourable conditions for weed growth during summer. Weeds can be controlled manually by pulling, mechanically, and chemically by application of herbicides or by a combination of these methods.

Preventive methods

Weed prevention includes all measures to retract the entry and establishment of new weeds in an area not infested with it yet. This can be achieved by the use of weed-free crop seeds, seed certification, weed laws, and quarantine laws. In general, the spread of weeds within-country can be reduced by clean seed laws; cleaning farm equipment; harrows and harvesters; cleaning irrigation water; cleaning sand and gravel, and reducing the number of weed seeds returned to the soil. Introduction of weed in crop fields can be prevented by using weed-free seed, not using fresh or partially decomposed farmyard manure (FYM) or compost, proper cleaning of farm machinery before sowing, and keeping farm bund and irrigation/drainage channel free from weeds. Contamination of crop seeds due to the resemblance of weed seeds usually happens during the time of crop harvesting when weeds that have life cycles similar to those of crop set seeds. Control of weed species is achieved by reducing the weed infestation area and reducing the dispersal of weed seeds from one area to another or from one crop to another (Chauhan *et al.* 2012).

Cultural methods

The cultural methods of weed control such as irrigation, intercropping, crop rotation, stale seedbed, tillage, sowing, and fertilizer application timing, etc. may be considered as one of the best and oldest worldwide accepted methods. The cultural weed control methods manage water and soil as the rotation of crops, row spacing, application of living mulches and cover crops etc. In soybean, the competitive ability of weeds largely depends on the time of emergence of the crop. Continuous growing of the same crop as a monoculture decreased its yield as compared to the rotation with other crops. Crop rotations with high residue producing crops significantly increase total soil C and N concentrations over time, which may further improve soil productivity and microbial population. Stale seedbed is very well applicable to eliminate weeds or to reduce crop weed competition. In this irrigation is given after preparing the field and then the field is left unsown for some time such that the first flush of the weeds can germinate. Those weeds can be removed by spraying herbicide or by doing tillage operations. The supply of N fertilizer favours more weed species not belonging to the legume family than soybean; therefore, ineffective management of N in these crops may increase the problem of weed interference. Hence, the yield of the soybean crops is reduced under N-fertilizer application due to an increase in weed biomass (Song *et al.* 2021). Application of 75% recommended dose of fertilizer reduces the weed population and biomass. Although, the time of application of fertilizers is found to affect weed population, as weeds absorb nutrients early and more rapidly than crops and it is further suggested that delayed fertilizer application can manage weeds like *Amaranthus palmeri* which are otherwise more competitive to crop (Liebman and Davis 2000).

The most potential benefits of incorporating a cover crop are to suppress and reduce the density and biomass of weeds. Cover crops namely ryegrass, oats, rye, pigeon pea, velvet bean and vetch are used in soybean to reduce the weed population, weed biomass, weed seed bank and improve soil physical, chemical and biological status. The mulch has physical (intrusion on germination and seedling survival rate), chemical (allelopathic effect), and biological (diverse microbial population in the topsoil) effects on weeds. Fadhli *et al.* (2021) reported that an increased amount of organic mulch inhibits weed germination and emergence which reduces the competition for nutrients, light, water and space between soybean plants and weeds. The type of crop cultivars with different morpho-physiological traits has differential competitive abilities compared to weeds. Soybean cultivars with an increase in seeding density/plant population having more height suppress weed growth and size by early canopy closure and seed production due to more competitiveness (Datta *et al.* 2016). With the adoption of fast-growing cultivars, the growth of crop plants accelerates and has more competitive success with the weeds. The selection of late-maturing cultivars may reduce losses caused by weeds in view of more competitive ability and flexibility. However, Owen *et al.* (2010) reported that genetically modified (GM) glyphosate-resistant soybean cultivars have higher yield potential and weed competition abilities compared to non-GM cultivars.

Mechanical methods

In mechanical or physical methods of weed control either some tool or machine is used to reduce the competition by weeds or the weed plants are removed simply by hand pulling. Mechanical methods are intensively used in areas where labour is cheaper and easily available. For inter-row weeding with a hoe in soybean, automatic machine guidance systems have slightly higher efficiency as compared to conventional mechanical weed control methods (Kunz *et al.* 2015). Higher yield contributing characters of soybean were obtained with one hoeing at 20 DAS along with hand weeding twice at 30 and 60 DAS as compared to other chemical treatments (Shete *et al.* 2008). Application of hoeing and hand weeding twice significantly reduced the weed count and weed dry weight as compared to the weedy checks (Dhaker *et al.* 2015).

Biological methods

In a biological method of weed control, natural enemies (fungi, bacteria, viruses, insects, birds, fish, etc.) are used as bio-agents having the capacity to reduce weed populations, their dissemination and reduce their ability to compete with crop plants. The use of pathogens such as bacteria and fungi (Li *et al.* 2003) and viruses (Diaz *et al.* 2014) in the biological control of exotic weeds have been used in many parts of the world. Bio-herbicide may be defined as the inundative and repeated applications of the plant pathogen and its inoculum as a weed-control agent. Currently, Collego is a fungus-based bioherbicide, *Colletotrichum gloeosporioides* f.sp. *aeschynomene* is used in soybean and rice to control a leguminous weed, *Aeschynomene virginica* (northern joint vetch). Among the limitations of biological control of weeds by plant pathogens, the fact that markets for bio-control agents are typically fragmented, small, and consequently the financial returns from bio-control agents are too small to be of interest to big industries. Also, the non-ability to mass-produce inoculums needed for large scale use is a serious limitation. On the other hand, the present over-reliance on chemical herbicides and the tendency to base weed-management decisions purely on economic considerations, at expense of the exclusion of ecological and societal benefits, is a serious limitation that could stifle biological control.

Chemical methods

Soybean is both a legume and an oilseed crop. The conventional methods of weed control are hand weeding but, it is time-consuming and labour-intensive. The present-day agriculture is more input-intensive, can't depend on such a practice that requires a large number of man-days for a single operation and that too at very high rate of wages. Thus, it is more favourable to use chemicals due to the scarcity of human labour during peak season. Therefore efforts have been made in the recent past to evaluate the chemical methods against hand weeding in terms of weed control efficiency and economics (Meseldzija *et al.* 2020). Moreover, the chemicals provide an early stage of weed control. The important herbicides in soybean are listed in Table 2.

For broad-spectrum weed control, it is necessary either to use herbicide mixtures or their sequential application (Oliveira *et al.* 2017). Post-emergence herbicides can be used as a sequence with all pre-planting or pre-emergence herbicides depending upon the nature of weed flora (Table 2).

Integrated weed management

An integrated weed management approach involving a combination of both chemical and agronomic manipulations

Table 2 Chemical application in soybean crop

Chemical	TOA	Effective on weeds	References
Sole Herbicides			
Imazethapyr (75 – 100 g/ha)	Pre or Early post	BLW's (*Commelina benghalensis*, *Polygonum alatum*, *Ageratum conyzoides*, *Portulaca oleraceae*) and NLW's (*Echinochloa colonum*, *Eleusine indica*) etc.	(Rana *et al.* 2013, Dass *et al.* 2019)
Acetachlor (900 g a.i./ha)	Pre	BLW's (*Digera muricata*, *Convolvulus arvensis*, *Commelina benghalensis*, *Amaranthus tricolor*) and Grassy weeds (*Echinochloa colonum*, *Digitaria sanguinalis*) etc.	(Kumar *et al.* 2008, Song *et al.* 2020)
Pyroxasulfone 85% WG (127.5 g ai/ha)	PPI	Annual Grassy weeds (*Panicum repens*, *Setaria glauca*, *Digitaria adscendens*) and BLW's (*Convolvulus arvensis*, *Commelina benghalensis*, *Polygonum alatum*) etc.	(Meena *et al.* 2018)
Trifluralin (1500 g/ha)	PPI	Annual Grassy weeds (*Echinochloa colonum*, *Digitaria sanguinalis*, *Panicum dicotomiflorum*) and BLW's (*Amaranthus palmeri*, *Chenopodium album*) etc.	(Malik *et al.* 2006)
Chlorimuron-ethyl (10 g/ha)	Post	BLW's (*Xanthium strumarium*, *Conyza Canadensis*, *Chenopodium album*) etc.	(Bhimwal *et al.* 2018)

Cond.

Table 2 (*Concluded*)

Chemical	TOA	Effective on weeds	References
Quizalofop-p-ethyl (50 g/ha)	Post	Annual Grassy weeds (*Echinochloa colonum*, *Digitaria sanguinalis*, *Dactyloctenium aegyptium*) etc.	(Singh *et al.* 2013, Kaur *et al.* 2019)
Propaquizafop (75 g/ha)	Post	Annual Grassy weeds (*Echinochloa colonum*, *Panicum dicotomiflorum*) etc.	(Panda *et al.* 2015, Kumar *et al.* 2018b)
Fenoxaprop-ethyl (100 g/ha)	Post	Annual Grassy weeds (*Echinochloa colonum*, *Digitaria sanguinalis*, *Echinochloa crusgalli*, *Panicum dicotomiflorum*) etc.	(Singh *et al.* 2013)
Pendimethalin (1.5 kg/ha)	Pre	Annual Grassy weeds (*Digitaria sanguinalis*, *Eleusine indica*, *Panicum dicotomiflorum*) and BLW's (*Chenopodium album*, *Amaranthus palmeri*, *Polygonum persicaria*) etc.	(Nayak *et al.* 2000, Kumar *et al.* 2018b)
Haloxyfop (100 g a.i./ha)	Post	Annual Grassy weeds (*Echinochloa colonum*, *Digitaria sanguinalis*, *Panicum dicotomiflorum*, *Digitaria adscendens*)	(Kumar *et al.* 2008)
Herbicide mixture and sequential application			
Quizalofop-p-ethyl + chlorimuron-ethyl	Post	Annual Grassy weeds (*Echinochloa colonum*, *Digitaria sanguinalis*, *Dactyloctenium aegyptium*) and BLW's (*Xanthium strumarium*, *Conyza Canadensis*, *Chenopodium album*) etc.	(Jadav 2013, Singh *et al.* 2013)
Propaquizafop + imazethapyr	Post	BLW's (*Commelina benghalensis*, *Polygonum alatum*, *Ageratum conyzoides*, *Portulaca oleraceae*), NLW's (*Echinochloa colonum*, *Eleusine indica*) and annual grassy weeds (*Echinochloa colonum*, *Panicum dicotomiflorum*) etc.	(Sandil *et al.* 2015, Kumar *et al.* 2018b, Kumar *et al.* 2018c, Patel *et al.* 2019)
Imazethapyr + Bentazone (75 + 75 g/ha)	Post	BLW's (*Commelina benghalensis*, *Polygonum alatum*, *Ageratum conyzoides*, *Portulaca oleraceae*) and NLW's (*Echinochloa colonum*, *Eleusine indica*) etc.	(Patel *et al.* 2019)
Metribuzin *fb* propaquizafop	Post	BLW's (*Digera muricata*, *Convolvulus arvensis*, *Commelina benghalensis*, *Amaranthus tricolor*) and grassy weeds (*Echinochloa colonum*, *Digitaria sanguinalis*) etc.	(Renjith *et al.* 2014)
Lactofen + propaquizafop	Post	BLW's (*Digera muricata*, *Convolvulus arvensis*, *Commelina benghalensis*, *Portulaca oleraceae, Amaranthus tricolor*) and grassy weeds (*Echinochloa colonum*, *Panicum repens*, *Setaria glauca*, *Digitaria sanguinalis*) etc.	(Pardhan *et al.* 2010)
Imazethapyr + quizalofop-p-ethyl	Post	BLW's (*Commelina benghalensis*, *Polygonum alatum*, *Ageratum conyzoides*, *Portulaca oleraceae*), NLW's (*Echinochloa colonum*, *Eleusine indica*) etc. and annual grassy weeds (*Echinochloa colonum*, *Digitaria sanguinalis*, *Dactyloctenium aegyptium*) etc.	(Prachand *et al.* 2014, Thakare *et al.* 2015, Yadav *et al.* 2017)
Imazethapyr *fb* quizalofop-p-ethyl	Post	BLW's (*Commelina benghalensis*, *Ageratum conyzoides*, *Portulaca oleraceae*) and NLW's (*Echinochloa colonum*, *Eleusine indica*) and annual grassy weeds (*Echinochloa colonum*, *Digitaria sanguinalis*, *Dactyloctenium aegyptium*) etc.	(Thakare *et al.* 2015)
Pendimethalin *fb* imazethapyr	Post	Annual Grassy weeds (*Digitaria sanguinalis*, *Eleusine indica*, *Panicum dicotomiflorum*) and BLW's (*Commelina benghalensis*, *Chenopodium album*, *Polygonum persicaria*) and NLW's (*Echinochloa colonum*, *Eleusine indica*) etc.	(Jha and Soni 2013)
Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g a.i./ha	Post	Annual Grassy weeds (*Digitaria sanguinalis*, *Panicum dicotomiflorum*) and BLW's (*Commelina benghalensis*, *Chenopodium album*, *Amaranthus palmeri*, *Polygonum persicaria*) and NLW's (*Echinochloa colonum*, *Eleusine indica*) etc.	(Meena *et al.* 2018)
Imazethapyr *fb* Imazethapyr	Post	BLW's (*Commelina benghalensis*, *Digera muricata*, *Convolvulus arvensis*, *Polygonum alatum*, *Ageratum conyzoides*, *Portulaca oleraceae*) and NLW's (*Echinochloa colonum*, *Eleusine indica*) etc.	(Chander *et al.* 2013)

Pre, Pre-emergence; Post, Post-emergenc; PPI, Pre-plant incorporation; *fb*, followed by; BLW, Broad Leaves weed; NLW, Narrow leaves weed; TOA, Type of Application.

Table 3 Integration of different weed control methods (IWM) in soybean crop

Integration of weed management practices	TOA	Agro-climatic zone	Location	References
Pendimethalin 1000 g/ha *fb* hoeing *fb* weeding at 30 DAS	Pre	Western dry region	Udaipur, Rajasthan	(Meena *et al.* 2017)
Trifluralin 1000 g/ha *fb* hand hoeing at 20 DAS		Trans Gangetic plain region	Hisar, Haryana	(Malik *et al.* 2006)
Pendimethalin (750 g a.i./ha) + one hand weeding at 20 DAS	Pre	Central plateau and hills region	Gwalior, Madya Pradesh	(Rajput and Kasana 2020)
Pendimethalin (1000 g/ha) *fb* hand hoeing at 20 DAS	Pre	Eastern plateau and hills region	Chattisgarh	(Chandraker and Paikra 2015)
Quizalofop-ethyl + chlorimuron-ethyl @(0.05 + 0.009) kg/ha + HW at 30 DAS	Post	Western plateau and hills region	Maharashtra	(Jadhav and Kashid 2019)

TOA, Time of herbicide application; PPI, Pre Plant Incorporation; Pre, Pre emergence; Post, Post-emergence; DAS, Days after sowing; *fb*: Followed by.

resulted in improved crop geometry and density which resulted in a better crop competitive ability against weeds. The concept of integrated weed management (IWM) decrease the density of weeds emerging in crops, reduce their relative competitive ability (in order both to preserve crop yields and to limit the replenishment of weed seed bank), and control emerged weeds using non-chemical techniques, with the overall aim of reducing the need for herbicide application at the cropping system level (Table 3).

Conclusion

Weed interference in soybean and other oilseed crops cause significant yield reduction. Weeds in the field cause thresholds damage and affect yield as well as the quality of the produce. To avoid economic losses, weed control measures should be adopted early in the growth period, especially in the first two to four weeks which is the critical period of competition in soybean. Weed management is a key issue, as herbicides are the most followed weed control method, which as result are found to contaminate surface as well as below-ground water resources. Therefore, it is the demand of hour to adopt appropriate weed management strategies through proper knowledge about the weed biology and phenology, weed dynamics, and shift of that area and competition for water, light, and nutrients and space, etc. responsible for decreasing crop yield. Weed management is a system approach, where prevention measures along with a selection of the correct cultivar, adopting best tillage practices, using cover crops and mulch, crop rotation, effective fertilizer management, and biological weed control methods are responsible for minimizing the use of chemical herbicides which consequently contribute for environmental conservation and sustainability.

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