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Birhanu Gebeyehu
Department of Plant Science, College of Agriculture, Mekdela Amba University, Ethiopia

Corresponding Author:
Birhanu Gebeyehu
Department of Plant Science, College of Agriculture, Mekdela Amba University, Ethiopia

Review paper on Soybean weed

Birhanu Gebeyehu

Abstract
The existing paper is review quite a number lookup findings on weeds and weed control in soybean. Soybean is the most important oil seeds and grain legume crop in the world, in terms of whole manufacturing and international trades. However, losses due to weeds have been one of the fundamental limiting factors in soybean production. So, successful weed manipulate is one of the most essential practices for low-priced soybean production. Weeds that germinated at the identical time as soybeans grow faster and hold a cover above and under the pinnacle of the soybean cover and resulted in decreased quality. The role of weeds as alternate hosts for soybean crop pests and ailment and their interference with cultivation operations ensuing greater costs of production. Weeds additionally have impact on the use of fertilizer due to the fact they compete with the crop for nutrients. Weed control chances consist of preventive, cultural, mechanical, and chemical methods. Continuous cultivation of a single crop or crops having similar administration practices permits certain weed species to come to be dominant in the gadget and, over time, these weed species come to be tough to control. The care taken that weeds do no longer need to go to seed, that harvesting equipment is no longer transporting weed seeds, and that clean seed is used for all crops in the rotation; is an essential part of a weed program. Combining weed control method can help maintain weed injury before financial threshold stages and shall be performed rather than a separate manage method.

Keywords: Soybean, weed, weed control

Introduction
The soybean (Glycine max L.) is the most important grain legume plants in the world in phrases of complete production and global trades. Soybean is an erect bush, leafy annual legume classification below household fabeacea and sub family papillonacea. It is short day plant additionally self-pollinated and definitely self-fertile with less than 1% cross pollinated. It has notably a vast adaptability to many geographically different regions and is productive per unit region as in contrast to those intently related crops. Soy bean is C3 plant life thatgrow properly in tropical, sub-tropical and temperate climates. Its germination nature is epigeal and the crop has faucet root system (Seyoum Assefa, 2010) [23].

Weeds are a primary detriment to soybean yield, even though they can be controlled at once with the aid of chemical or mechanical treatments or circuitously through agricultural practices, such as crop rotation and soil tillage (Oerke, 2006). Weed manage performs an vital position in elevating the productivity of crops. The presence of weeds is inflicting a shortage of the crop up to 40% (Soliman *et al*., 2015).

Successful weed manage is most important thing for fruitful soybean production, due to the fact losses due weeds have been one of the important limiting elements in soybean production. Weeds compete with crop for mild moisture and nutrients, with early-season opposition being the most critical. Being arainy season crop soybean faces severe weed competition throughout early ranges of crop growth, resulting in a loss of about 40-60 per cent of the viable yield, depending on the weed intensity, nature, environmental circumstance and period ofweed opposition (Kachroo *et al*., 2003). Adverse weather prerequisites limit the use of equipment and implements for clearing weeds in the field. On environmental grounds, emphasis has been given to really appropriate mixtures of cultural and chemical techniques of weed control. Therefore, built-in weed management machine is a desired exercise that targets at lowering the dosage of herbicide to be applied with mechanical weeding, which will help in managing weeds in a first-class way for realizing to maintain and improve the manufacturing of soybean. Similar work has been executed by way of Idapuganti (2003) and Singh (2007) [5].

Objective

1. To review on weeds and weed control methods in soybean

Literature Review

Competition between soybean and weeds for biotic factors

The biotic elements that determine the elevated competitiveness of positive species over othersare: plant dimension and architecture, increase rate, extension of root system, dry mass production,increased susceptibility to environmental factors (such as frost and dry spells), higher leafarea index and increased potential for production and release of chemicals with all elopathicproperties (Silva A *et al*. 2007) [29].

Morphophysiological qualities of flora influence the competitive relationship between cropand weeds. Plant peak and improvement cycle, for example, are features that have beenpositively related with competitive capacity in soybean; cultivars with higher cyclelength and peak decrease seeds manufacturing and measurement of weed species due to the enlarge incompetitiveness of the crop (Bennett, A. C, & Shaw, D. R.2007) [8]. Moreover, yield losses due to opposition have a tendency to be higher the greater comparable are the individuals, i.e. their morphophysiological traits, reaching most stress within the equal species, because in this case neighboring flora compete for the identical sources and occupy the same ecological area of interest (Radosevich, S, Holt, J, & Ghersa, C. 2007) [26].

Weed of soybean

The primary weeds in soybean are grouped in to two principal classes, wide leaved weeds and grasses and sedges.

Grasses and sedges

Generally, perennial grasses are the most frustrating weeds of soybeans. They cause large harm and difficult to control. Such weeds consist of common cocklebur (Xanthium pensylvanicum), large foxtail (Setariafaberii), sword grass (Imperator cylindrical), Johnson's grass (Sorghum halepense) and Couch grass (Cynodondactylon) (Daugovish *et al*., 2003) [8]. They shape enormous underground vegetative machine which makes them difficult to control. Sedges (Cyperusrotundus) and (C. esculentus) are also challenging to control, but purpose a lot of damage to soybeans. Apart from competition of moisture, carbon dioxide, light and nutrient; they have allelopathic results on soybeans (Drost and Doll, 1980; Jannink *et al*., 2000) [11, 15].

Perennial weeds usually have the potential for vegetative replica from underground parts. These are additionally organs for boom after slicing and they are storage organs for meals reserves. Therefore they require deep cultivation which brings the underground prop gules to the surface and expose them to desiccation through the solar and wind (Drost and Doll, 1980) [11].

Broad leafed weeds

Broad-leafed weeds are now not as dangerous as the grasses and sedge in soybean production. However, they purpose some harm and have to not be over looked. Some produce many seeds making then difficult to manage e.g. lamb squatters (Chenopodium album). Other serious broad-leafed weeds frequent in soybean fields encompass spiny Amaranth (Amaranthusspinosus) and morning glory (Convolvulus arvensis). Annual weeds can be dealt with by repeated shallow cultivation. Common weeds international have been given by means of (Joshi, 2001).

Effects of Weed on Soybean Production

Soybean (Glycine max) is an vital meals crop for human consumption whose yield is up to 80% is lost due to weed opposition in many parts of the world (Daugovish *et al*., 2003) [8]. (Jannink *et al*., 2000) [15] suggested that root and shoot interference is the predominant elements that motive soybean yield reduction. Weeds that germinated at the same time as soybeans develop quicker and keep a canopy above and beneath the top of the soybean canopy. Therefore they intercept photosynthetically active radiation (PAR) at the price of soybeans. This outcomes to elongation of soybean stems with a limit in diameter, inflicting lodging. Soybean are not robust competitors in the early phase of the season, consequently weeds out grow them. If the crop is now not stored weed free, light opposition takes location after 4 weeks when the weed develop taller than soy beans and intercept picture synthetically lively radiation PAR (Jannink *et al*., 2000) [15]. Sink strength (rate of change in weight of substance for a plant part) is profoundly affected by the shading effect of weeds in soybean (Bradley *et al*., 2002) [3].

Weed Control Methods in Soybeans

Preventive method

It is more difficult to manipulate weeds as soon as they set up themselves, so preventing foreign weeds from entering a new area is generally easier and expenses much less than controlling after they have spread.According to (Silva *et al*., 2007) [29] the preventive control of weeds is the use of practices aimed at stopping the introduction, establishment and, or, spread of sure complex species in areas not yet infested by way of them. These areas can be a country, a state, a municipality or a piece of land inside the farm. In federal and state levels, there are legal guidelines regulating the entry of seeds into the us of a or state and its interior commercialization. Under these laws are the tolerable limits of seeds of each weed species and also the listing of prohibited seeds per crop or crop group. Locally, it is the responsibility of person farmers or cooperatives, to prevent the entry and spread of one or more weed species that may additionally emerge as serious problems for the region. In summary, the human aspect is the key to preventive control. The environment friendly occupation of the agroecosystem area by using the crop reduces the availability of fabulous factors for increase an development of weeds, and can be viewed an integration between preventive and cultural method. Choosing the right cultivars is truly the first step in successfully setting up a crop. In the soybean case, there is a large range of cultivars adapted to extraordinary areas of the world. Some of the measures that can prevent the introduction of the species are: use of excessive purity seeds, easy absolutely machines, harrows and harvesters; carefully look into seedlings acquired with soil and additionally all the natural matter (manure and compost) from other areas; clean irrigation canals; quarantine of delivered animals, etc. (Radosevich *et al*., 2007) [26] and (Chauhan *et al*. 2012) [5]. Confirm that most crops have their seeds contaminated with weeds, especially when weed seeds resemble the measurement and shape of crop seeds. Contamination usually occurs at some point of the time of crop harvesting when weeds that have life cycles comparable to those of crops set seeds. When even a small quantity of weed seeds is present, it may additionally be ample for a serious infestation in the subsequent season. The notion have to be to limit the weed infestation place and minimize the dissemination of weed seeds from one location to some other or from one crop to another. Control of weed species is performed by using decreasing flora and propagules to the point at which their presence does now not critically

interfere with an vicinity of economic use. The planning of postinfested weed manage applications be carried out in such a way that the build-up of weed seeds is reduced substantially within a short period. Proper care should be taken to prevent the weed seed bank measurement in the place by way of the use of integrated methods of weed control. In undisturbed or no till systems, seeds of weeds and volunteer crops are deposited in the topsoil (Locke *et al*., 2002) [19]. Therefore, an splendid approach is wanted to keep away from excessive weed infestations and to prevent unacceptable opposition with the emerging crop (Locke *et al*., 2002) [19].

Cultural control

The aggressive ability of weeds mostly depends on the time of emergence in relation to the soybean, in such a way that, if the crop germinates faster, and additionally happens a lengthen on the emergence of weeds, competition will be decreased (Radosevich *et al*., 2007) [26]. According to (Silva *et al*., 2007) [29] cultural manipulate is the use of common practices for the proper management of water and soil as crop rotation, variation of crop row spacing, dwelling mulches, etc. Amending the soil, neutralizing the aluminum content and growing the pH, favors the crop and not sure weed species adapted to acid soils conditions and high contents of Al. Fertilization utilized at the planting furrow is a common practice, and also favors soybean, so the fertilizer do no longer stand so shut to the weeds in the inter-rows. These practices assist to minimize the seed bank of weeds. It consists, therefore, in the use of their very own ecological traits, both from crops and weeds, in order to gain the establishment and development of crops.

One of the main practices is crop rotation. Its advantages depend on the determination of vegetation and their sequence in the system. Continuous cultivation of a single crop or vegetation having similar administration practices approves certain weed species to come to be dominant in the machine and, over time, these weed species come to be challenging to manage (Chauhan *et al*., 2012) [5]. According to (Kelley *et al*., 2003) [19]. Soybean production is elevated by using the usage of crop rotation as a administration practice.

Numerous research have shown diminished yield when soybean used to be grown constantly in monoculture than when turned around with another crop (Crookston *et al*., 1991) [7], (Meese *et al*., 1991) [20], (West *et al*., 1996) [32]. In the short-term, gain of crop rotation was once elevated soybean yield, which would probably increase soybean profitability. In the long-term, rotations with high residue-producing crops, such as wheat and grain sorghum, appreciably increase complete soil C and N concentrations over time, which can also in addition enhance soil productivity (Kelley *et al*., 2003) [19]. Variation of the spacing or plant density in the row is another practice that can make contributions to the discount of weed interference on the crop, depending on the architecture of the cultivated flowers and weed species. The discount of spacing between rows regularly affords aggressive gain for most vegetation over shading sensitive weeds. In this case, by way of reducing the spacing between rows, supplied it does not exceed the minimal limit, there is extended mild interception with the aid of the cover of cultivated plants. This effect is established on elements like the kind of species to be cultivated, morphophysiological qualities of genotypes, weed species current in the vicinity and season and climate stipulations at the time of its emergence, as properly as environmental conditions (Herbert *et al*., 1984) [14], (Anaele *et al*., 1992), (Knezevic *et al*., 2003) [17].

The essential intention of using cover plants for weed manage is changing an unmanageable weed populace with a manageable cover crop. This is accomplished through deciding on the phenology of the cowl crop to preempt the area of interest occupied by weed populations Teasdale, J. R (1996) [30]. They have been used to control weeds in soybean (Ateh, C. M, & Doll, J. D. (1996) [11], (Liebl *et al*., (1992) [18], (Moore *et al*., 1994) [22], Samarajeewa KBDP Horiuchi T, Oba S. Finger millet (2006). According to (Silva *et al*., 2007) [29]. The spacing and sowing density are similarly equipment in cultural management and enable less weed interference in soybeans, essentially to plant life with low tolerance to shade. Usually, the density experiments for weed manipulate are performed in graminae: maize, rice and also wheat. However, even in soybean, research carried out in Brazil show that decreasing the spacing between rows of vegetation (e.g. 60 cm to 30 cm) interferes with the length of weed manipulate (Melo *et al*., 2001) [21]. The competitive capability of weeds mostly depends on the time of emergence in relation to the soybean, in such a way that, if the crop germinates faster, and additionally happens a prolong on the emergence of weeds, competition will be reduced (Radoservich *et al*., 2007).

According to (Silva *et al*., 2007) [29], cultural manipulate is the use of common practices for the applicable management of water and soil as crop rotation, variant of crop row spacing, living mulches, cowl plants etc. Amending the soil, neutralizing the aluminum content and increasing the pH, favors the crop and now not certain weed species tailored to acid soils prerequisites and high contents of Al. Fertilization utilized at the planting furrow is a common practice, and also favors soybean, so the fertilizer do no longer stand so shut to the weeds in the inter-rows. These practices help to reduce the seed bank of weeds. It consists, therefore, in the usage of their own ecological traits, both from plants and weeds, in order to gain the establishment and improvement of crops. One of the most important practices is crop rotation. Its advantages depend on the resolution of crops and their sequence in the system. Continuous cultivation of a single crop or vegetation having comparable management practices allows sure weed species to turn out to be dominant in the system and, over time, these weed species become challenging to manage (Chauhan *et al*., 2012) [5].

Mechanical control

According to Silva *et al*. (2007) [29] weed plucking, or weeding, is the oldest method of weed control. It is still used to control weeds in home gardens and in the removal of weeds between crop rows, when the main method of control is the use of a hoe. The manual weeding made with a hoe is very effective and still widely used in our agriculture, especially in mountainous regions, where there is subsistence agriculture, and for many families, this is the only source of work. However, in a more intensive agriculture in larger areas, the high cost of manpower and the difficulty of finding workers when necessary and in the desired quantity, make this method only complementary to others, and should be done when the weeds are still young and the soil is not too humid. It can assume great importance in seed production fields, being a good alternative for using isolated or as a complement for other control methods (Gazzeiero *et al*., 2003).

Mechanized cultivation, made by cultivators pulled by animals or tractors, is widely accepted in Brazilian agriculture, being one of the main methods of weed control on properties with smaller areas planted. The main limitations of this method are the difficulty of controlling weeds in the crop rows, low efficiency when performed in wet conditions (wet soil), and it is also

inefficient to control weeds that reproduce by vegetative parts. However, all the annual species, when young (2-4 pairs of leaves), are easily controlled in conditions of heat and dry soil. Cultivation breaks the intimate relationship between root and soil, suspending the absorption of water, and exposes the roots to unfavorable environmental conditions. Depending on the relative size of weeds and crops, the displacement of the soil on the row, using special hoe cultivators, can cause the burial of seedlings and there by promote weed control even in the rows of the crop (Silva *et al*., 2007) [29].

Biological control

Biological control is the use of natural enemies (fungi, bacteria, viruses, insects, birds, fish, etc.) Capable of reducing weed populations, reducing their ability to compete. This is maintained by the population balance between the natural enemy and the host plant. It should also be considered as biological control the allelopathic inhibition of weeds (Silva *et al.*, 2007) [29].

According to Charudattan & Dinoor (Charudattan, R, & Dinoor (2000) [6], bioherbicide is defined as a plant pathogen used as a weed-control agent through inundative and repeated applications of its inoculum. In the United States and many other countries, the prescriptive use of plant pathogens as weed control agents is regarded as a "pesticidal use" and therefore these pathogens must be registered or approved as biopesticides by appropriate governmental agencies.

Currently, one fungus species is registered as bioherbicide in the United States for use in soybeans. Collego®, based on *Colletotrichum gloeosporioides* f.sp. *aeschynomene*, is used to control *Aeschynomene virginica* (northern jointvetch), a leguminous weed, in soybean and rice crops in (Arkansas *et al*., 2000) and Charudattan & Dinoor (2000) [6] also state that, among the limitations of biocontrol of weeds by plant pathogens, the most important are the limited commercial interest in this approach to weed control due to the fact that markets for biocontrol agents are typically small, fragmented, highly specialized, and consequently the financial returns from biocontrol agents are too small to be of interest to big industries; and the complexities in production and assurance of efficacy and shelf-life of inoculum can further stifle bioherbicide development. For instance, the inability to mass-produce inoculum needed for large-scale use is a serious limitation that has led to the abandonment of several promising agents. The authors conclude that plant pathogens hold enormous potential as weed biocontrol agents.

In addition to the use of plant pathogens as biocontrol agents, it is likely that pathogen-derived genes, gene products, and genetic mechanisms (e.g., hypersensitive plant cell death and herbicidal biochemicals) will be exploited in the near future to provide novel weed management systems. 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(Arkansas *et al*., 2000) and Charudattan & Dinoor (2000) [6].

Chemical control

There are several advantages in using herbicides: pre-emergence control, eliminating the weeds precociously; hits targets that the hoe or cultivator does not reach, like the weeds in the crop row; reduces or eliminates the risk of damage to the roots and to young plants.

perennial weeds; reduces the need for labor; increases the speed and efficiency of the control operation per unit area, reducing the cost per treated area; controls the weeds for a longer period, when the use of a cultivator is impossible in view of the crop growth; and can be used in rainy periods, when the mechanical control is not efficient and when labor is required for other activities. However, it has the disadvantage of requiring skilled labor, because, if done improperly, can poison the crop, the environment and, especially, the applicator himself. Although herbicides are very effective in controlling weeds, they may promote the development of resistant biotypes, a fact that would further exacerbate the problem within an area Zimdahl, R. L. (2000) [35].

According to (Oliveira Jr. *et al*.,2006) [24] the most common strategies used in the management of both cover crops and weed vegetation in areas of no-tillage are reduced to three: desiccation immediately before sowing, between seven and ten days before sowing or anticipated drying. These authors undertook a study aimed to evaluate the interaction between tillage systems and weed control in post emergence in soybean with these three strategies. They concluded that, although desiccation in different management systems have been effective, the anticipation of desiccation in anticipated management favored the emergence and initial soybean development, providing greater productivity gains, given the infestation conditions. The management system also affected the flow of weed emergence after soybean emergence, with fewer reinfestations in the anticipated management system, due to the control of initial flows given by the second application of this management system. Management applied at planting and ten days before planting, hindered the development of soybean, resulting in lower productivity, while anticipated management provided the highest yield.

Procópio *et al*. (Procópio *et al*., 2006) [25]. Carried out a study in which they compared the effects of tillage systems on the control of the weeds *Digitaria insularis*, *Synedrellopsis grisebachii* and *Leptochloa filiformis* before soybean planted in no-till. The authors found satisfactory control and prevention of regrowth of *D. insularis* and *L. filiformis* when glyphosate was applied five days prior to soybean planting or when the sequential application of glyphosate and paraquat + diuron was done. Sequential applications of the mixture paraquat + diuron were not effective in controlling However, it has the disadvantage of requiring skilled labor, because, if done improperly, can poison the crop, the environment and, especially, the applicator himself. Although herbicides are very effective in controlling weeds, they may promote the development of resistant biotypes, a fact that would further exacerbate the problem within an area (Zimdahl *et al*., 2000) [35].

According to Arregui *et al*. (2006) [1], there are several soil-applied broadleaf herbicides that effectively control weeds like *Ipomoea spp*., *Commelinaspp* and Sidespins. Chlorimuron and sulfentra zone reduce Ipomoea spp. S. spinosadensity decreased with imazaquin, metribuzin and sulfentrazone applications and with cloransulam and diclosulam (Reddy *et al.*, 2000) [27].

Integrated weed management

The concept of Integrated Weed Management (IWM), a component of Integrated Pest Management, has been proposed (i) to decrease the density of weeds emerging in crops,(ii) to reduce their relative competitive ability (in order both to preserve crop yields andto limit the replenishment of weed seed bank), and (iii) to control emerged weeds usingnon chemical techniques, with the overall aim of reducing the need for herbicide applicationat the cropping system level (Deytieux *et*

al., 2012) [9]. IWM advocates the use of all available weed control options such as: plant breeding, fertilization, crop rotation, tillage practices, planting pattern, cover crops and mechanical, biological and chemical controls. To define the correct weed management strategies, it is necessary to know the ability of the weed species, in relation to the crop, to compete for water, light and nutrients, which are factors responsible for decreasing crop yield (Silva *et al.*, 2007) [29].Usually, it is not taken into consideration that a good program of weed management should allow for maximum production in the shortest time, the maximum sustainable production and minimal environmental and economic risk. (Wilson *et al*,. 2009) [33].

Plant height significantly affected by different weed control treatments as compared to weedy check. The highest plant height was observed in weed free which found at par with hand weeding at 15 and 35 DAS, imazethapyr @ 75 g a.iha-1andquizalofop-ethyl @ 40 g a.i ha-1in combination with hoeing at 35 DAS. This might be due to the increased availability of nutrients and lesser competition of weeds which could possibly result in better accumulation of photosynthates. Similar result has been reported by Thakur (2008) [31] and Dhane *et al.* (2010) [10]. The maximum number of branchesplant-1 was found in weed free which was statistically at par with hand weeding at 15 and 35 DAS. However, highest number of pods was recorded in weed free which was statistically at par with hand weeding at 15 and 35 DAS, imazethapyr @ 75 g a.iha-1 and quizalofop-ethyl @ 40 g a.i ha-1in combination with hoeing at 35 DAS. It might be due to reduction in dry matter production by weeds under herbicidal and cultural treatments (hoeing) that subsequently increased nutrient and moisture availability to the soybean crop. Similar results were reported by Gupta and Saxena (2008) and Dhane *et al.* (2009) [10]. Mechanical weeding improved the soil aeration and increased nutrient availability to the crop through active mineralization and decomposition. It was also accordance with Seema *et al*., 2014 [28], Prasad and Pandey, 2005. Seed and straw yields are significantly influenced by different weed control treatments as compared to weedy check (Table 2). The maximum seed and straw yield was obtained with weed free treatment followed by hand-weeding at 15 and 35 DAS. Among various herbicidal weed control treatments, imazethapyr @ 75 g a.i ha-1+ hoeing (35 DAS) recorded maximum seed and straw yield which was found to be at par with quizalofop-ethyl @ 40 g a.i ha-1+ hoeing (35 DAS). It might be due to the fact that both these herbicides when applied as post-emergence suppresses the weed growth efficiently which is supplemented by hoeing at the crucial stage of crop growth which checks the weed growth and resulted in higher seed and straw yield. Similar findings have been reported by Dhane *et al.* (2009) [10], Yadav and Shaikh (2009) [34] and Wadafale *et al.* (2011).

Summary and Conclusion

Soybean is among the most promising source of high quality, but low cost of protein in developing world at large. It has relatively a wide adaptability to many geography. This multipurpose crop is very popular industrially due to its oil and protein rich seeds from which various basic food items and other products are processed or synthesized for different uses basically different regions and is productive per unit area as compared to those closely related crops. Losses due to weeds have been one of the major limiting factors in soybean production, where, weeds compete with soybean for light, moisture and nutrients with early- season competition, being the most critical. Perennial grasses are the most problematic weeds of soybeans. They cause significant damage and are difficult to control. Broad-leafed weeds are not as detrimental as the grasses and sedge in soybean production.

Soybean are not strong competitors in the early part of the season, therefore weeds out grow them. Weeds in the field at harvest also result in reduced grades (quality).Weeds also have effect on the use of fertilizer because they compete with the crop for nutrients. Fertilizers encourage weeds growth therefore they should not be applied until the first weeding has been done. Weed management involves activities directed at the weeds (direct management) and, or, the system formed by soil and crop (indirect management).Weed control possibilities include preventive, cultural, mechanical and chemical methods.

However, to maintain the sustainability of agricultural systems, it is important to integrate these control measures by observing the characteristics of soil, climate and socioeconomic aspects of the producer.It is harder to control weeds once they establish themselves, so preventing foreign weeds from entering a new area is usually easier and costs less than controlling after they have spread. Choosing the right cultivars is actually the first step in successfully establishing a crop.

Continuous cultivation of a single crop or crops having similar management practices allows certain weed species to become dominant in the system and, over time, these weed species become hard to control.Soybean production is improved by using crop rotation as a management practice. Mechanical control is used to control weeds in home gardens and in the removal of weeds between crop rows, when the main method of control is the use of a hoe.

Although herbicides are very effective in controlling weeds, they may promote the development of resistant biotypes, a fact that would further exacerbate the problem within an area. The care taken that weeds do not need to go to seed, that harvesting equipment is not transporting weed seeds, and that clean seed is used for all crops in the rotation; is an integral part of a weed program. Therefore, combining weed control method can help to keep weed damage before economic threshold levels.

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