III. Major Soybean Pests of the World

A. Diseases

More than 100 pathogenic and nonpathogenic agents are known to affect soybeans, about 25 of which are important economically. The economic importance of any single disease may vary from one geographic area to another in any one season. During the 1994-95 growing season, a conservative estimate of about 15% of the world's production was lost to all soybean diseases. Losses in the USA were about 28 million metric tons in 1989, 21 million metric tons in 1990, and 22 million metric tons in 1991 (Doupnik, 1993; Wrather et al., 1995). Pathogens associated with soybean at various plant growth stages (Table 3) and a list of nutrient disturbances, mineral deficiencies and toxicities (Table 4) are presented.

B. Arthropods

The total arthropod community associated with soybean worldwide includes about 2,500 species in 1,670 genera (Kogan, 1988). Many are innocuous or beneficial since they are predators or parasitoids of other arthropods, decomposers of crop residues, or pollinators. In any given region, one may find between 200 and 400 species of plant—feeding insects. Despite this large and diverse fauna, no more than 15 species usually account for up to 99% of the arthropod-induced injury to soybean in most regions (Kogan, 1980). Iii each major region of the world, four or five species are considered serious, and another nine or ten are occasionally serious. Arthropods with potential economic impact generally do not occur simultaneously on the crop. Instead, species complexes that attack different plant parts appear at various stages of plant growth (Table 5).

The impact of arthropods on soybean yield varies from region to region, but, as a rule, arthropod problems are more severe in the tropics and subtropics than in the temperate zones. The major soybean arthropods of six regions with an index of their economic impact upon the crop is shown (Table 6). This index is based on ratings provided by local soybean specialists. The ratings take into account the frequency of insecticide applications required to keep arthropods below the EIL during crop development, as well as the hectareage treated in a given year.

Plant injury results from arthropod feeding or oviposition behavior. A single hole made in a leaf by a feeding adult beetle is innocuous, but an aggregate of holes made by hundreds of beetles may be detrimental to a crop. Depending on the type, extent, and intensity of the injury, the crop may suffer an economical yield loss. The damage or injury/economic loss relationship is complex and depends on the plant growth stage at the time of the injury, the level of any previous injury, the physiological condition of the plant resulting from other stress factors, and cultivar differences, as well as on the level of the arthropod pest population and its potential to cause injury. The following are some of the most important types of insect injury inflicted at different stages of plant growth.

1. Injury affecting stand establishment

Insects that feed on seedlings or on germinating seeds may destroy the whole plant or some of its vital parts, resulting in either a thinning of the stand or a delay in plant growth. Cutworms (Plates 46, 47) cut seedlings at ground level and open gaps in the stand. Rows with linear gaps of 25 to 100 cm may suffer yield reductions ranging from 5 to 19%. Bean flies bore into young stems and cause seedling death. Soybean, however, can compensate for minor stand reductions; thus, small gaps dispersed in a field normally are filled by adjacent plants and no yield reductions are detected. Fields should be surveyed shortly after emergence to detect injury by bean flies and cutworms,

Other early season arthropod pests, such as leaf beetles (Plate 2) and seed maggots (Plate 62), destroy cotyledons and the expanding unifoliolates resulting in yield loss (Table 7).

2. Injury during the vegetative growth

Injury during vegetative growth may affect both above- or below-ground parts. Insects with chewing mouth parts (Fig. 9), such as lepidopterous caterpillars, coleopterous adults and larvae, and grasshopper adults and nymphs (Plates 1, 3, 6, 8, 10, 15, 18, 37, 39, 41, 42, 45, 48, 57, 59—61) may destroy leaf tissue. Some species, e.g. Dectes texanus (Plate 13) in North America, Oberea brevis in India, and Zygrita diva (Plates 11, 12) in Australia and New Zealand, live inside stems during the larval stage and bore into the pith tissues. Plants thus infested are prone to break. Insects with sucking mouth parts (Fig. 9), such as aphids (Plate 32), whiteflies (Plate 35), planthoppers (Plate 33), and stink bugs (Plates 22 to 26, 28 to 30), may suck plant sap and interfere with photosynthate production and translocation. Many of these insects are potential vectors of plant pathogens. White flies

Table 3. Pathogens causing disease in soybean at various growth stages[1]

Growth stage(s)	Disease(s)	Casual agent(s)
V2—V3	Seed decay	Alternaricj cilternata and A. tenuissima associated with bean leaf beetle damage
	Phomopsis seed decay (Plate 91) Yeast spot	Phomopsis longicolla Nematospora coryli associated with stink bug damage
	Pre— and postemergence damping—off (Plate 88)	Pythium aphanidermatum, P debaryanum and P ultimum, Phytophthora sojae, Rhizoctonia solani
V5-V7	Bacterial blight (Plates 83, 98)	Pseudomonas syringae pv. glycineo
	Bacterial pustule	Xanthomonas cam pestris pv. glycines
	Fusarium root rot	Fusarium oxysporum
	Fusarium collar rot	Fusarium semitectum
	Red leaf blotch (Plate 86)	Dactuliochaeta glycines (syn. Pyrenochaeta glycines)
	Phytophthora root and stem rot	Phytophthora sojae
V8-R2	Frogeye leaf spot (Plates 84, 91)	Cercospora sojina
	Phomopsis stem canker (Plate 85)	Diaporthe phaseolorum var. caulivora and D. phaseolorum var. meridionales
	Rust (Plate 87)	Phakopsora pachyrhizi and P. meiboniae
	Septoria brown leaf spot	Septoria glycines
V10-R5	Anthracnose (Plate 89)	Colletotrichum truncatum
	Cercospora leaf spot (Plates 84, 91)	Cercospora kikuchii
	Downy mildew	Peronospora manchurica
	Pod and stem blight (Plate 85)	Diaporthe phaseolorum var. sojae (Phomopsis phaseoli)
	Soybean cyst nematode (Plate 95)	Heterodera glycines
	Yellow mosaic (Plate 94)	
	Green mosaic (Plate 92)	Bean yellow mosaic potyvirus
		Soybean mosaic potyvirus
R6-R8	Brown stem rot (Plate 90)	Phialophora gregata
	Charcoal rot	Macrophomina phaseolina
	Sclerotinia stem rot (white mold) (Plate 96)	Sclerotinia sclerotiorum
	Sudden death syndrome	
	Bud blight (Plate 93)	Fusarium solani
	Seed disease (Plates 91, 98)	Tobacco ringspot virus Cercospora kikuchii, C. sojina, Phomopsis Ion gicolla, Pseudomonas syringae pv. glycinea and the soybean mosaic potyvirus
	Smut (Plate 97)	Melanopsichum pennsylvanicum (contaminator)

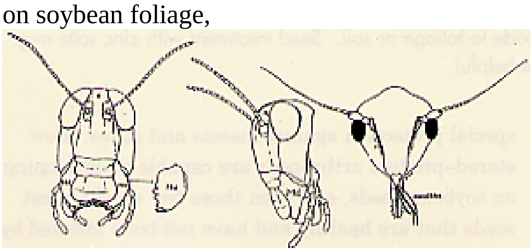
[1] The growth stage during which any one to season, location to location, and field to field depending on the environmental conditions. For example, Phytophthora diseases can occur anytime during a growing season.

(Plate 35) are vectors of soybean yellows in India, aphids are potential vectors of soybean masaic virus, and stink bugs (plates 21 to 29) have been implicated in the transmission of yeast sport organism into soybean seeds.

Soil-inhabiting arthropods may feed on roots and *Bradyrhizobium* nodules, thus reducing nutrient-fixation, and causing lodging. White grubs (Plate 19) can cause extensive root pruning, resulting in wilting. Other species e.g. larvae of the lesser corn stalk borer, *Elasmopalpus lignosellus* (Plate 55), girdle the base of seedlings causing them to break. The yield of effect of extensive nodule feeding by maggots of root flies, *Rivellia* spp., (Plate 63) and some species of agromyzids, and by karvae of chrysomelid beetles in the genera *Diabrotica* and *Cerotoma* (Plate 2) have been difficult to quantify, but nodule destruction affects the nitrogen balance with potential reduction in yields.

Different species consume different amounts of foliage to complete development. Thus knowledge of consumption rates of the major species is important for establishing criteria for treatment (Tables 2, 3). Although arthropods differ in feeding habits and rates, the reduction of leaf area by arthropods is similar for all species with chewing mouth parts (Fig. 9). Therefore, it is possible to estimate the effect of leaf area loss by the aggregate of all leaf chewing activity (defoliation) on yield reduction. This effect varies with the crop development stage at which defoliation occurred.

By comparing defoliation caused by insect feeding and defoliation induced by manually removing known portions of foliage, it is possible to compute the correlations between defoliation level and yield reduction. These computations show that the relationship between defoliation and yield reduction is curvilinear (Fig. 8A). Although these data were collected and calculations were made to describe yield effects of arthropod feeding on soybean foliage,



A B C

Figure 9. Examples of mouth parts of plant-feeding anthropods: A-B. Example of chewing mouth parts: head of grasshopper, frontal and lateral views; and C. Sucking mouth parts: head of planthopper (Md = mandibles) (modified after Essig, 1942; Ross *et al.*, 1982).

any type of foliage injury that results in a decrease in photosynthetic area will produce comparable relationships. Based on the same equations, it is possible to estimate yield losses due to foliar pathogens that cause necrosis or mechanical injury from wind or hail. Much of the early research on defoliation came from reports of hail injury used by insurance adjusters.

3. Injury affecting flowering and pods

Injury to the reproductive plant parts results in loss or shedding of blossoms and young pods, abortion of seeds, seed malformation, production of infertile seeds, changes in the oil/protein ratio in the seeds, and transmission or facilitation of the penetration by disease organisms. Soybean normally sheds 20% to 80% of all flowers produced. Consequently, some arthropod-induced flower shedding up to the beginning of pod set may have little effect on yield. Experimental results indicate that even if blossom loss results in fewer pods, those pods that develop produce large seeds and the effect on final yield is minimal.

The symptoms of injury to pods and seeds differ depending whether the injury is produced by insects with chewing or sucking mouth parts (Fig. 9A-C). Pod feeders with chewing mouth parts such as *Helicoverpa* (Plate 45), *Heliothis* (Plate 80), *Maruca testulalis* (Plate 49), *Matsumeraeses phaseoli* larvae, or *Cerotema* spp. adults (Plates 1 to 3), scrape or bore through pod walls into the developing seeds. Certain pod borers, such as *Leguminivora glycinivorella* (Plate 51), eat preferentially on the germ, thus reducing seed quality.

Stink bugs (Plates 21 to 29) with sucking mouth parts are among the most serious pests of soybean worldwide. Besides the destruction of seeds, extensive pod feeding by stink bugs may result in pod abortion. Severe pod abortion may induce such plants to remain in the vegetative stage, causing foliar retention which poses problems at harvest. Stink bugs transmit *Nematospora coryli* Peglion, the causal agent of the yeast spot disease. A single stink bug puncture is the radicle/hypocotyl axis may result in the loss of seed germination, whereas multiple punctures to the cotyledons may not. Therefore, it is difficult to correlate stink bug feeding rates with yield and seed quality.

Direct pod and seed injury may result in yield loss and decrease in seed quality due to microorganisms, even if plants compensate for considerable injury that occurs in the pod-set stage R3). Although not all injury to the pods results in total pod losses, the relationship between pod loss and yield is

Table 4. Nutrient disturbance, mineral deficiencies and toxicities in soybean

Deficiency/ toxicity/ pollution damage	Management
Boron deficiency	Rare on soybeans in the field. Boron is least available in strongly acid or alkaline soils. Adjust soil pH with sodium borate or boric acid for normal growth of soybeans.
Boron toxicity (Plate 99)	Adjust soil pH for maximum normal growth of soybeans.
Iron deficiency (Plate 100)	Iron deficiency is due to soil fixation and chelated iron should be used to correct the problem. Foliar sprays have been satisfactory in some areas. Cultivators vary in their tolerance to iron deficiency.
Magnesium deficiency (Plate 102)	Magnesium deficiency inhibits nitrogen fixation. Application of dolomitic limestone corrects the deficiency. If lime is not required, sulfate of potash magnesia can be used to supply magnesium, potassium and sulfur.
Magnesium toxicity (Plate 102)	Usually occurs under highly alkaline soil conditions. Adjust pH for maximum normal growth of soybeans.
Manganese deficiency (Plate 101)	Apply fertilizers that contain manganese either to the soil or by spraying with manganese sulfate when plants are 10 to 15 cm tall. Alkaline soils bind it in an unavailable form. Then a mixture of manganese salts with acid-forming fertilizers should be applied in bands beneath the rows.
Oxidant injury (Plate 104)	Ozone injury occurs in rural areas as a result of complex photochemical reactions involving hydrocarbon and nitrogen oxides pollution. Tracing the sources and reducing the pollutant will reduce damage.
Potassium deficiency (Plate 103)	Soybeans require large amounts of potassium, which should be provided by applying fertilizers that contain the element at a rate determined by soil analysis.
Sulfur dioxide injury (Plate 105)	Like ozone injury, the source is usually a pollutant, burning high-sulfur fuel or smelting high-sulfur ore. Tracing source and reducing the pollutant will reduce damage.
Zinc deficiency (Plate 106)	Zinc deficiency can be corrected by applying a zinc sulfate or zinc oxide to foliage or soil. Seed treatment with zinc salts may also be helpful.

the one most closely evaluated experimentally (Fig. 8B). If depodding occurs during early pod set (R3), soybean usually compensate with no apparent yield loss. If, however, pods are removed at the end of the seed- development stage (R7), the relationship to yield decrease is nearly linear, indicating that any pod destruction will result in yield loss.

4. Injury to seeds in storage

Soybean seeds in storage generally do not require special protection against insects and mites. Few stored-product arthropods are capable of developing on soybean seeds, and even those few rarely infest seeds that are healthy and have not been affected by injury from other arthropods, or have not been mechanically damaged (Sirisingh & Kogan, 1983). With the expansion of soybean production into subtropical regions, however, soybean seeds often are harvested and stored with a high moisture content and with serious damage to

Table 5. Arthropod species associated with soybean at avarious plant growth stages.

	Early-season (V2 to V3-V5)	Mid-season (V8-R2 to v10-R5)	Late-season (R7 to R8)
North America	Cerotoma trifurcate (Plates 1,2) Agrotis spp. (Plates 46-48) Delia platura (Plate 62) Sericothrips variabilis	Helicoverpa zea (Plates 44-45) Heliothis virescens Pseudoplusia includens (Plates 38-39) Anticarsia gemmatalis (Plates 36-37) Spodoptera spp. (Plates 42-43) Elasmopalpus lignosellus (Plates 54-55) Cerotoma trifurcate (Plated 1-2) Tetranychus urticae	Helicoverpa zea Nezara viridula (Plated 24-25) Acrosternum hilare (Plates 21-23) Cerotoma trifurcata
South America	Agrotis spp. (Plated 46-48) Elasmopalpus lignosellus (Plates 54, 55)	Pseudoplusia includens Spodoptera spp. Anticarsia aporema (Plate 52) Cerotoma spp. Bemisia tabaci	Etiella zinckenella Maruca testulalis Lespeyesia fabivora Nezara viridula Piezodorus guildinii (Plate 29) Euschistus spp. (Plate 28)
Orient	Delia platura (Plate 62) Melanagromyza spp. (Plate 60) Aphis glycines	Heliothis viriplaca Plusia agnatha Matsumuraeses phaseoli Agrotis ypsilon (Plates 46-47) Syllepete ruralis Melanagromyza spp. Anomala rufocuprea (Plate 18) Aphis glycines (Plate 32) Aulacorthum solani	Heliothis viriplaca Etiella zinkenella Leguminivoria glysinivorella (Plates 50-51) Hedylepta indicate (Plate 53) Nezara viridula Piezodorus hybneri Dolycoris baccarum (Plates 26-27) Riptortus clavatus (Plate 30) Asphondylia spp.

the seed coat by stink bug feeding or seed pathogens. Under those circumstances, soybeans are valuable to further injury by arthropods is the almond moth, *Cadra cautella* (Walker). The larvae of this moth cut small circular holes and consume parts of the grain. In the process, the larvae web grains and broken grain pieces together to use as shelter in which to live and pupate. As a result, the quality of the soybean seed is lowered by the presence of frass, chewed grains, and webbing materials mixed with the grain (Sirisingh & Kogan, 1983).

C. Weeds

Plants are considered weeds when they become established in cultivated plant- or crop-production areas and compete with such plants for light, nutrients, space, water, and other essentials for the productive plant growth.

Weeds increase production costs for several reasons, including: (i) the need for control whether by chemicals, hand, or mechanically; (ii) provide habitat for soybean arthropods and pathogens; (iii) interface with water management in irrigated soybeans; (iv) increased processing costs because of cleaning and other operations; and (vii) presence of weed seeds, making them more susceptible to storage fungi colonization. They can serve as infection loci for arthropods and pathogens.

The variety of weed species found in soybean production areas varies between countries and between locales within a country, as well as within political units within a country (Tables 8 to 10).

Table 6. Pest0impact for principle arthropods associated with soybean in major agroecological regions.[1]

Plant parts or stage of growth	North America	PIR[2]	Central and South America	PIR	China, Korea, Japan	PIR
Pods and seeds on plants	Helicoverpa zea	1	-		Helicoverpa viriplaca	3
	-		Etiella zinckenella	3	Etiella zinckenella	1
	-		Maruca testulalis	2	Leguminivora glysinivorella	1
	Nezara viridula	1	Nezara viridula	1	Nezara viridula	1
	-		Piezodorous guildinii	1	Nezara antennata	
	Euschistus servus	3	Euschistrus spp.	3	Piezodorus hybneri	1
	Acrosternum hilare	2	Acrosternum sp.		Dolycoris baccarum	2
	-		-		Riptortus clavatus	1
	Cerotoma trifurcata (A)[3]	2	-		-	
	-		-		Asphondylia sp.	1
Blossoms	-		Laspeyresia fabivora		-	
	Frankliniella tritici	4	-		-	
Stalks and upper stems	-		Epinotia aporema	2	Mastsumuraeses phaseoli	1
	-		Hedylepta indicata	3	Hedylepta indicata	2
	-		Maruca testulalis		Syllepte ruralis	
	-		-		Melanagromyza sojae	2
	-		Sternechus subsignatus		Melanagromyza shibatsuji	3
Leaf blades	Helicoverpa zea	1	-		Helicoverpa viriplaca	3
	Heliothis virescens		-		-	
	Pseudoplusia includens	1	Pseudoplusia includens	2	Plusia agnate	3
	Trichopolusia ni		-		-	
	Anticarsia gemmatalis	1	Anticarsia gemmatalis	1	-	
	Spodopetra exigua	3	Spodoptera latifascia	2	Spodoptera litura	3
	Spodoperta eridania	3	Spodoptera erldania	2	-	
	Plathypena scabra	3	-		-	
	Spilosoma virginica	4	-		-	
	Vanessa cardui	4	Urbanus proteus	4	Ascotis selenaria	3
	Certoma trifurcata(A)	2	Cerotoma arcuata (A)	3	Paraluperodes nigrobilineatus	3
	-		Cerotoma ruficornis (A)	3	-	
	Colaspis brunnea (A)	4	Maecolaspis aeruginosa	4	-	
	Diabrotica balteata (A)	3	(A)	3	-	
	Epicauta vittata	4	Diabrotica speciosa (A)	4	Epicauta gorhami	3
	Epilachna varivestis	2	Epicauta atomaria		-	
	Popilia japonica	4	-		Popilia japonica	3
	-		-		Anomala rufocuprea (A)	2
	Melanoplus spp.	3	-		-	
	Sericothrips variabilis	4	-		Attractomorpha bedeli	
	-		Caliothrips sp.		-	
	Empoasca fabae		-		Aphis glycines	1
	-		-		Aphis craccivora	2
	-		-	3	Aulocorthum solani	2
	-		Bemisia tabaci		-	
	Tetranychus urticae	3	-		Chauliops fallax	3
			-			
Lower stems	Elasmopalpus	2	Elasmopalpus	3	-	
	lignosellus		lignosellus		-	
	Spissistilus festinus	2	-		-	
	Dectes texanus	4	-		-	
Roots and nodules	Cerotoma trifurcate (L)[4]		Cerotoma arcuata (L)		-	
	Rivellia quadrifasciata		-		Melanagromyza	2
Seedlings and seed in soil	Delia platura	3	-		Delia platura	2
	Agrotis ypsilon	3	-		-	

[1] From Kogan & Turnipseed, 1987
[2] PIR=Pest Impact Rating
[3] (A)=adult
[4] (L)=larva

Plant parts or stage of growth	India	PIR	Australia and New Zealand	PIR	Africa	PIR
Pods and seeds on plants	Heliothis armigera - - Nezara viridula - - - - - -	3 2	Heliothis armigera Heliothis punctigera Etiella herbrii Nezara viridula Piezodorus hybneri - Riptorus serripes - Melanagromyza pseudograta	1 1 1	Heliothis armigera Cydia ptychora Maruca testulais Nezara viridula - Piezodorus punctiventris Aspavai dentipes Riptorus serripes - -	 1 2 1 1
Blossoms	- - -		- - -		Taeniothrips sjostedti Caliothrips imopurtus Sericothrips occiptalis	
Stalks and upper stems	- Hedylepta indicate - - Melanagromyza sojae - Oberea brevis	 3 1 2	- - - - Ophimyia phaseoli - Zygrita diva		- Hedylepta indicate - - Ophimyia phaseoli - -	
Leaf blades	Heliothis armigera - Plusia orchalcea - - Spodoptera litura Spodoptera exigua - Diacrisia obliqua - Monolepta sp. - - - Epicauta mannerheimi - Popilia gemma - Attractomorpha crenulata - - - - Bemisia tabaci Chauliops fallax	3 3 3 3 1 4 4 4 4 1 2	Heliothis armigera Heliothis punctigera Plusia orchalcea Chrysodeixis eriosoma - Spodoptera litura - - Utetheisa pulchelloides - Monolepta australis Aulacopjora abdominalis - - - - - - Attractomorpha similis - - - - - - -	1 1	- - Plusia orchalcea - - Spodoptera littoralis - - Spilosoma auroantica - Gonocephalus simplex Aulacophora Africana - - Lagria villosa - - - Zonocerus variegates - - - Aphis craccivora Aphis gossypii Bemisia tabaci -	
Lower stems	Melanagromyza sojae Oberea brevis -	 2 2	- - -		- - -	
Roots and nodules	- -		- Rivellia nr. basilaris		- -	
Seedlings and seed in soil	Delia platura Melanagromyza sojae Agrotis ypsilon	2 2 2	- - -		Barombiella humeralis - -	

Table 7. Effect of early season injury to cotyledons and unifoliolate leaves in soybean yield.[5]

Extent of Injury	Yield reduction
One cotyledon removed after seedling emergence	0.0
Two cotyledon removed after seedling emergence	1.0
Two cotyledons removed with first unifoliolate expanded	0.0
Two unifoliolates removed after expansion	2.8
Two unifoliolates and two cotyledons removed after unifoliolate expansion	7.3
Seedling cut below unifoliolates after expansion	16.1

Table 8. Major weed species of soybean in Argentina[6]

WSSA[7]	Scientific name	Common name (USA)
	Monocotyledonous: annual and perenial	
CYNDA	Cynodon dactylon (L.) Pers.	bermuda grass
CYPRO	Cyperus rotundus L.	nutsedge, purple
DIGSA	Digitaria sanguinalis (L.) Scop.	crabgrass, large
ECHO	Echinochlosa colona (L.) Link	junglerice
ELEIN	Eleusine indica (L.) Gaertn.	goosegrass
SORHA	Sorghum halepense (L.) Pers.	johnsongrass
	Dicotyledonous: annual and perennial	
AMACH	Amaranthus hybridus L. (Plates 114, 115)	pigweed, smooth
ANVCR	Anoda cristata (L.)	anoda, spurred
BIDsp[8]	Bidens subalternans DC	beggarticks
BRSRA	Brassica rapa L.	mustard, birdrape
CHEAL	Chenopodium album L. (Plates 112, 113)	lambsquarters, common
CONAR	Convolvulus arnevsis L.	bindweed, field
DATsp[4]	Datura ferox L. (Plates 121, 122)	thornapple, large
EPHHL	Euphorbia heterophylla L.	poinsetta, wild
NICPH	Nicandra physaliodes (L.) Gaertn.	apple -of Peru
POROL	Poartulaca oleracea L.	purslane, common
TAGMI	Tagetes minuta L.	marigold, wild
XANsp[4]	Xanthium cavanillessii Schouw	cocklebur, large
XANST	Xanthium strumarium (Plates 28, 129)	cocklebur, common

[5] After: Webber & Caldwell, 1966.
[6] After: Mitidieri, 1992.
[7] Bayer Code used in *Weed Science Society of America*, 1989.
[8] Genus but not species found in the *Composite List of Weeds*, 1989

Table 9. Major weed species of soybean in Brazil.[1]

WSSA[2]	Scientific name	Common name (USA)
	Monocotyledonous: annual and perenial	
BRAPL	Brachiaria plantaginea (Link) A. S. Hitchc.	alezandergrass
BRAsp[3]	Brachiaria decumbens	signalgrass "decumbent"
CCHEC	Cenchrus echinatus L.	spiderwort, tropical
DIGsp[3]	Digitaria hortizontalis Willd.	crabgrass "tropical"
ECHCG	Echinochloa crus-galli (L.) Beauv.	barnyardgrass
ELEIN	Eleusine indica (L.) Gaertn.	goosegrass
PESsp[3]	Pennisetum setosum (swartz) L. Rich.	pennisetum, "silky"
SORHA	Sorghum halepense (L.) Pers.	johnsongrass
	Dicotyledonous: annual and perennial	
ACNAU	Acanthospermum australe (loefl.) Ktze.	starbur, Paraguay
ACHNI	Acanthospermum hispidum DC.	starbur, bristly
AGECO	Ageratum conyzoides L.	ageratum, tropic
ALRsp[3]	Alernanthera tenella	"alligatorweed"
AMACH	Amaranthus hybridus L. (Plates 114, 115)	pigweed, smooth
AMAVI	Amarnthus viridus L. (Plates 114, 114)	amaranth, slender
BIDPI	Bidens pilosa L.	beggartricks, hairy
CASOB	Cassia obtusifolia L.	sicklepod
DEDsp[3]	Desmodium purpureum	beggarweed, "purple"
EMISO	Emilia sonchifolia (L.) DC. ex Wight	tasselflower, red
EUPsp[3]	Eupatorium pauciflorum	"jopyeweed"
EPHHL	Euphorbia heterophylla L.	poinsetta, wild
GASPA	Galinsoga parviflora Cav.	galinsoga, smallflower
HYPsp[3]	Hyptis lophanta	"mint" (Labiatae)
HYPsp[3]	Hyptis suaveolens	"mint" (Labiatae)
IPOsp[3]	Ipomoea aristolochiafolia (Plates 118, 119)	"morningglory"
MITsp[3]	Mitracarpus hirtus	(Rubiaceae)
NICPH	Nicandra pyssalodes (L.) Gaertn.	apple-of-Peru
POROL	Poartulaca oleracea L.	purslane, common
RAPRA	Raphanus raphanistrum L.	radish, wild
RCHBR	Richardia brasiliensins (Moq.) Gomez	pusley, Brazil
SIDRH	Sida rhombifolia L.	sida, arrowleaf
SOLAM	Solanum americanum Mill. (Plates 123, 124)	nightshade, American black
SOLSI	Solanum sisymbriifolium Lam.	nightshade, sticky
TRQPR	Tridax procumbens L.	buttons, coat
VIGSI	Vigna unguiculata (L.) Walpers	cowpea

[9] After: Gazziero, 1992.

[2] Bayer Code used in *Weed Science Society of America*, 1989.

[3] Genus but not species found in the *Composite List of Weeds*, 1989

Table 10. Major weed species of soybean in the United States.[1]

WSSA[2]	Scientific name	Common name (USA)
	Annual monocotyledonous (grass)	
BRAPP	Brachiaria platyphylla (Griseb.) Nash	signalgrass, broadleaf
DIGSA	Digitaria sanguinalis (L.) Scop.	crabgrass, large
ECHCG	Echinochloa crus-galli (L.) Beauv.	barnyardgrass
ELEIN	Eleusine indica (L.) Gaertn.	goosegrass
PANDI	Panicum dichotomiflorum Michx.	panicum, fall
PANTE	Panicum texanum Buckl.	panicum, Texas
SETFA	Setaria faberi Herrm. (Plates 107, 108)	foxtail, giant
SETLU[3]	Setaria glauca (L.) Besuv.	foxtail, yellow
SORVU[4]	Sorghum bicolor (L.) Moench	shattercane
	Perennial monocotyledonous (grass or sedge)	
AGRRE[5]	Elytrigia repens (L.) Nevski	quackgrass
CYPES	Cyperus esculentus L. (Plates 109, 110)	nutsedge, yellow
CYPRO	Cyperus rotundus L.	nutsedge, purple
SORHA	Sorghum halepense (L.) Pers.	johnsongrass
	Annual dicotyledonous (broadleaf)	
ABUTH	Abutilon theropharasti Medicus (Plates 116, 117)	velvetleaf
AMA??	Amaranthus spp. (species vary by area) (Plates 114, 115)	pigweed, etc
AMBEL	Ambrosia artemisiifolia L.	ragweed, common
AMBTR	Ambrosia trifidia L.	ragweed, giant
CASOB	Cassia obtusifolia L.	sickelpod
CHEAL	Chenopodium album L. (Plates 112, 113)	lambsquarters, common
DATST	Datura stramonium L. (Plates 121, 122)	jimsonweed
DEDTO	Desmodium tortuosum (Sw.) DC.	beggarweed, Florida
IPO??	Ipomoea spp. (species varies by area) (Plates 118,119)	morningglory, etc
POLPY	Polygonum pensylvanicum (Plate 111)	smartweed, Penn.
SEBEX	Sesbania exaltata (Raf.) Rydb. ex A.W. Hill	sesbania, hemp
SIDSP	Sida spinosa L.	sida, prickly
SOLPT	Solanum ptycanthum Dun.	nightshade, eastern black
	Perennial dicotyledonous (broadleaf)	
APCCA	Apocynum cannabinum L.	dogbane, hemp
ASCSY	Asclepias syriaca L.	milkweed, common
CIRAR	Cirsium arvense (L.) Scop.	thistle, Canada

[10] After: Bridges & Bauman, 1992.
[2] Bayer Code used in *Weed Science Society of America*, 1989.
[3] SETLU formerly Setaria lutescens (Weigel) F.T. Hubb
[4] SORVU formerly Sorghum vulgare Pers.
[5] AGRRE formerly Agronpyron repens (L.) Beauv