

A Ready Reckoner for Rice Weeds

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Foreword

Conservative estimates indicate that by 2050, we need to increase rice production by almost another 50 million tons, to current production levels of about 100 million tonnes, to meet the dietary requirements of ever growing Indian population. It would be a herculean task to meet the rice requirements of the future, in the backdrop of declining land and water, scarcity of labour and the environmental concerns. Combined strategies of developing high yielding, resource use efficient varieties with inbuilt resistance to biotic stresses and adoption of efficient and scientific crop management practices would take the way to achieve the targeted rice production in the coming years. Scientific crop husbandry, which involves cultural management and crop protection practices aimed at curtailing the losses due to weeds, insect pests and diseases is the need of hour to ensure sustainable and profitable rice production.

Weeds are one of the major constraints affecting the rice crop and the best way to mitigate the weed competition and reduce losses due to weeds in different eco-systems, is by eradication of problematic weeds. However this is seldom practiced under field conditions. Alternatively, the weed growth can be controlled by traditional, cultural and mechanical practices or by crop rotation and seedbed methods to a level where, weeds do not pose a senior problem to rice crop, However, it is also necessary to incorporate the chemical methods, in integrated weed management practices, in view of the current climatic changes which are conducive for proliferation and development of various weeds.

This publication may serve as a simple, illustrative and handy reckoner to identify common weeds in rice fields based on description of weed species. The authors have also provided methods of weed control in an integrated manner to enhance and sustain rice productivity. I hope, readers will find this publication informative and useful guide for eco-friendly weed management; for sustainable rice production, without unduly hampering the habitat and ecology of rice and associated agricultural crops.

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Introduction

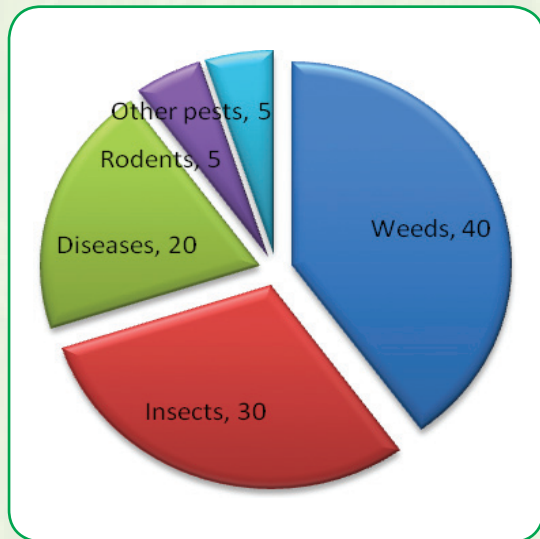
Rice (*Oryza sativa*) is the staple food of Southeast Asian population. Rice is the source of livelihood for hundreds of millions of house holds around the Globe. Several Asian and African countries are highly dependent on rice as a source of food and foreign exchange and government revenue (www.fao.org). Global rice production must increase by 36% by 2025 to feed an estimated 4 billion rice consumers (Pinstrup Anderson *et al.*, 1997). Water scarcity prevails in rice growing areas (Tuong *et al.*, 2005) and societal demands for water from the urban and commercial sectors will continue to increase. In response to rising production costs; especially for labor and water resources, farmers are shifting the methods of crop establishment from traditional transplanting to direct seeding. But direct seeding of rice faces severe challenges from weeds which are a major deterrent in increasing the rice production and productivity. Integrating preventive and interventional methods are essential to manage the weed communities. (Rao *et. al.*, 2007) and improved weed management will be quite crucial.

Over 1800 plant species have been reported as weeds of rice in South and South east Asia (Moody 1989) and there is an enormous diversity of taxa considered to be weeds of rice (Soerjani *et. al.*, 1987) Since rice is grown over a wide range of agro ecosystems, such as flooded fully or partially (irrigated) uplands which are highly prove for weed Infestation. In many developing countries, rice farming relies on manual labour and weed control is inefficient leading to their persistence. Weeds compete with the rice plants for nutrients, moisture, sunlight and space, causing a quantitative reduction in the potential yield of rice. In addition, the poor tillage practices, inadequate crop stand, delay in inter-cultural operations and poor water management aggravate the weed problem. The losses due to weeds in Rice are many

- (i) Direct yield loss due to competition
- (ii) Indirect loss due to crop quality
- (iii) Increased cost of cultivation
- (iv) Harbors insect pests, nematodes and diseases
- (v) Weeds cause environmental damage and threaten the diversity of natural resources.

Very often the yield loss due to weeds exceed those of the diseases and insect pests. However, damage to the rice crop due to weed competition is not of visible nature, and it does not attract attention of many people. Consequently, the weed control is often ignored in modern rice production technology. The present status of rice production indicates that weed control is one of the costly operations and it varies with the type of weed flora coexisting with particular types of rice eco-system, methods of field preparation, and in diverse agro-climatic conditions, which may warrant an integrated approach including chemical weed control through herbicides. Of the total annual loss of agricultural produce from various pests in India, weeds account for 40%, insects 30%, diseases 20%, rodents 5% and other pests 5%. Weeds alone account for annual loss of produce worth Rs. 1,800 crores. (Rajversharma and Shivashar 2008).

Losses of agricultural produce due to pests in India (%)



Losses due to weeds (%) in different systems of rice cultivation in India. (DRR- AICRIP 1978-2010)

SYSTEM OF RICE	LOSS (%)
a) transplanted	15 – 35
b) direct seeded	30 – 65
c) uplands	45 – 90

Categories of weeds by ecosystem

Common weeds associated with Transplanted rice

Scientific Name	Life form	Family
<i>Echinochloa Colona</i>	Annual	Poaceae
<i>Echinochloa Crus-galli</i>	Annual	Poaceae
<i>Digitaria sanguinalis</i>	Annual	Poaceae
<i>Cyperus iria</i>	Annual	Cyperaceae
<i>Scirpus spp.</i>	Perennial	Cyperaceae
<i>Marsilea quadrifolia</i>	Annual	Marseliaceae
<i>Sphenoclea zeylanica</i>	Annual	Sphenocleaceae
<i>Ludwigia perennis</i>	Perennial	Onagraceae
<i>Commelina benghalensis</i>	Annual/ Perennial	Commalinaceae

Common weeds associated with water seeded rice (puddled Direct Sown Rice)

Scientific Name	Life form	Family
<i>Echinochloa oryzoides</i>	Annual	Poaceae
<i>Echinochloa crus-galli</i>	Annual	Poaceae
<i>Echinochloa glabrescens</i>	Annual	Poaceae
<i>Ischaemum rugosum</i>	Annual	Poaceae
<i>Leersia hexandra</i>	Perennial	Poaceae
<i>Leptochloa chinensis</i>	Annual/ Perennial	Poaceae
<i>Paspalum distichum</i>	Perennial	Poaceae
<i>Cyperus difformis</i>	Annual	Cyperaceae
<i>Cyperus iria</i>	Annual	Cyperaceae
<i>Fimbristylis miliacea</i>	Annual	Cyperaceae
<i>Scirpus maritimus</i>	Perennial	Cyperaceae
<i>Eclipta prostrata</i>	Annual	Asteraceae
<i>Sagittaria pygmae</i>	Perennial	Alismataceae
<i>Ammania</i> spp.	Annual	Lathraceae
<i>Marsilea minuta</i>	Annual	Marsileaceae
<i>Ludwigia octovalis</i>	Annual	Onagraceae
<i>Monochoria vaginalis</i>	Perennial	Pontederiaceae
<i>Sphenoclea zeylanica</i>	Annual	Sphenocleaceae

Weeds associated with weeds (Rainfed lowland)

Botanical Name	Life style	Family
<i>Echinochloa colona</i>	Annual	Poaceae
<i>Eleusine indica</i>	Annual	Poaceae
<i>Cynodon dactylon</i>	Perennial	Poaceae
<i>Echinochloa crus-galli</i>	Annual	Poaceae
<i>Dactyloctenium aegyptium</i>	Annual	Poaceae
<i>Rottboellia exaltata</i>	Annual	Poaceae
<i>Panicum repens</i>	Annual	Poaceae
<i>Paspalum distichum</i>	Perennial	Poaceae
<i>Cyperus rotundus</i>	Perennial	Cyperaceae
<i>Fimbristylis miliacea</i>	Annual	Cyperaceae
<i>Commelina benghalensis</i>	Annual	Commelinaceae
<i>Phyllanthus niruri</i>	Annual	Euphorbiaceae
<i>Euphorbia hirta</i>	Annual	Euphorbiaceae
<i>Eclipta prostrata</i>	Annual / Perennial	<i>Asteraceae</i>

Weeds associated with Rainfed Upland Rice

Botanical Name	Life style	Family
<i>Bracliaria ramosa</i>	Annua	Poaceae
<i>Corchorus aestuans</i>	Annual	Poaceae
<i>Echinochloa colona</i>	Annual	Poaceae
<i>Eleusine indica</i>	Annual	Poaceae
<i>Cynodon dactylon</i>	Perennial	Poaceae
<i>Echinochloa crus-galli</i>	Annual	Poaceae
<i>Dactyloctenium aegyptium</i>	Annual	Poaceae
<i>Leptochloa chinensis</i>	Annual	Poaceae
<i>Rottboellia exaltata</i>	Annual	Poaceae
<i>Digitaria sanguinalis</i>	Annual	Poaceae
<i>Digitaria ciliaris</i>	Annual	Poaceae
<i>Eragrostis reptans</i>	Perennial	<i>Poaceae</i>
<i>Panicum repens</i>	Annual	Poaceae
<i>Paspalum distichum</i>	Perennial	Poaceae
<i>Cyperus rotundus</i>	Perennial	Cyperaceae
<i>Cyperus compressus</i>	Annual	Cyperaceae
<i>Fimbristylis miliacea</i>	Annual	Cyperaceae
<i>Cyperus iria</i>	Annual	Cyperaceae

Botanical Name	Life style	Family
<i>Scirpus spp.</i>	Perennial	Cyperaceae
<i>Caesulia axillaris</i>	Annual	Asteraceae
<i>Ageratum conyzoides</i>	Annual	Asteraceae
<i>Eclita alba</i>	Annual	Asteraceae
<i>Phyllanthus fraternus</i>	Perennial	Asteraceae
<i>Convolvulus arvensis</i>	Perennial	<i>Convolvulaceae</i>
<i>Ipomoea triloba</i>	Annual	Convolvulaceae
<i>Digera arvensis</i>	Annual	<i>Amaranthaceae</i>
<i>Amaranthus spinosus</i>	Annual	Amaranthaceae
<i>Amaranthus viridis</i>	Annual	Amaranthaceae
<i>Celosia argentea</i>	Annual	Amaranthaceae
<i>Portulaca oleracea</i>	Annual	Portulacaceae
<i>Portulaca oleracea</i>	Annual	Portulacaceae
<i>Commelina benghalensis</i>	Annual	Commelinaceae
<i>Commelina diffusa</i>	Annual	Commelinaceae
<i>Phyllanthus niruri</i>	Annual	Euphorbiaceae
<i>Euphorbia hirta</i>	Annual	Euphorbiaceae
<i>Eclipta prostrata</i>	Annual/ Perennial	<i>Asteraceae</i>
<i>Phyla nodiflora</i>	Annual	Verbenaceae

Weeds associated with Deep water and floating rices

Before flooding		
Scientific Name	Life form	Family
<i>Echinochloa colona</i>	Annual	Poaceae
<i>Eleusine indica</i>	Annual	Poaceae
<i>Cyperus iria</i>	Annual	Cyperaceae
<i>Cyperus rotundus</i>	Perennial	Cyperaceae
<i>Cyperus difformis</i>	Perennial	Poaceae
After flooding		
<i>Eichhoruia crassipes</i>	Free floating weed	Pontederiaceae
<i>Ipomaea aquatica</i>	Annual emergent	Convolvulaceae
<i>Monochoria vaginalis</i>	Perennial	Pontederiaceae
<i>Pistia stratiotes</i>	Free floating weed	Araceae
Anphibious weeds		
Wild rice <i>oryza bartnii</i>	Annual/ Perennial	Poaceae
Wild rice <i>oryza longistaminata</i>	Annual/ Perennial	Poaceae
<i>Scirpus</i> spp.	Perennial	Cyperaceae
<i>Sesbania</i> spp.	Annual	Leguminaceae
<i>Leersia hexadra</i>	Perennial	Poaceae

Categories of weeds by morphology

1. Grasses
2. Sedges
3. Broad leaved weeds

Grasses:-

- Culms, halo with nodes (solid) and internodes (hollow)
- Leaves arise alternately from nodes
- Leaf sheaths wrapped around culm
- Leaf blades – narrow with parallel veins
- Flowers – enclosed by lemma and palea
- Spikelets – arranged on a panicle, raceme or spike.

Sedges:-

- Culms, solid triangular without nodes
- Leaves 3 ranked
- Leaf sheaths basal portion of leaves fused to form tube around stem
- Leaf blades – no distinct division between leaf blade and sheath
- Flowers – not enclosed by pair of bracts
- Inflorescence variable.

Broad leaf weeds:-

- This group can be distinguished from the grasses, sedges by the presence of expanded leaf blades. The venation of the leaves may be parallel as in monocots or netted as in dicots.

Grasses are usually the dominant and competitive during early season while sedges and broad leaf weeds dominate later in the season.

Grass Weeds by Family

Sl. No.	Scientific name	Family	Sl. No.	Scientific name	Family
1	<i>Brachiaria ramosa</i>	Gramineae (Poaceae)	15	<i>Eragrostis tenella</i> var. <i>insularis</i>	Gramineae (Poaceae)
2	<i>Chloris inflata</i> (Syn. <i>Chloris barbata</i>)	Gramineae (Poaceae)	16	<i>Eragrostis lehmanniana</i> Nees	Gramineae (Poaceae)
3	<i>Cynodon dactylon</i>	Gramineae (Poaceae)	17	<i>Heteropogon contortus</i> .	Gramineae (Poaceae)
4	<i>Dactyloctenium aegyptium</i>	Gramineae (Poaceae)	18	<i>Ischaemum rugosum</i>	Gramineae (Poaceae)
5	<i>Digitaria sanguinalis</i>	Gramineae (Poaceae)	19	<i>Iseilema laxum</i>	Gramineae (Poaceae)
6	<i>Digitaria longiflora</i>	Gramineae (Poaceae)	20	<i>Leersia oryzoides</i>	Gramineae (Poaceae)
7	<i>Dinebra arabica</i>	Gramineae (Poaceae)	21	<i>Panicum flavidum</i>	Gramineae (Poaceae)
8	<i>Dinebra retroflexa</i>	Gramineae (Poaceae)	22	<i>Panicum repens</i>	Gramineae (Poaceae)
9	<i>Echinochloa colona</i>	Gramineae (Poaceae)	23	<i>Paspalum dilatatum</i>	Gramineae (Poaceae)
10	<i>Echinochloa crus-galli</i>	Gramineae (Poaceae)	24	<i>Pennisetum cenchroides</i>	Gramineae (Poaceae)
11	<i>Echinochloa glabrescense</i>	Gramineae (Poaceae)	25	<i>Perotis indica</i>	Gramineae (Poaceae)
12	<i>Echinochloa oryzoides</i>	Gramineae (Poaceae)	26	<i>Tragus roxburghii</i> Syn. <i>T. biflorous</i>	Gramineae (Poaceae)
13	<i>Echinochloa stagnina</i>	Gramineae (Poaceae)	27	<i>Weedy Rice</i>	Gramineae (Poaceae)
14	<i>Eleusine indica</i>	Gramineae (Poaceae)			

Brachiaria ramosa



- Family*** : Poaceae
- Common name*** : Brown top millet
- Habit*** : Annual herb
- Stem*** : Semi-prostrate, 10-70 cm high.
- Leaf*** : Flat lanceolate leaf-blades 2-25 cm long and 4-25 mm wide.
- Flower*** : Spikelets elliptic 2.5-3.5 mm long acute to cuspidate; lower glume up to 1/2 as long as the spikelet, upper lemma rugulose, subacute to mucronulate.
- Field spread*** : Through seeds
- Habitat*** : Dry and moist places.

Chloris inflate (Syn. Chloris barbata)



- Family** : Poaceae
- Common name** : Peacock plume grass
- Habit** : A tufted perennial, commonly found as a weed in dry cultivated fields and waste places.
- Stem** : Culms upto 60 cm high.
- Leaf** : Leaves 7.5 to 12.5 cm long.
- Flower** : Inflorescence with 6 to 15 digitately arranged spikes; spikelets usually purplish in colour.
- Fruit** : Caryopsis
- Field spread** : Seeds
- Habitat** : This is a good fodder grass, also known to serve as alternate host for many insects.

Cynodon dactylon



- Family*** : Graminae (Poaceae)
- Common name*** : Bahama Grass
- Habit*** : A perennial grass extensively creeping by means of scaly rhizomes or by strong flat stolons, culms 7.5 to 30 cm high, slender.
- Stem*** : The underground stems are hard, brittle, thick, pale white in colour, covered with short scale-leaves and occur at varying depth in soil.
- Leaf*** : Leaves linear, finely acute, 7.5 to 12.5 cm long;
- Flower*** : spikes 3 to 6, more or less erect, spikelets light green or purplish, sessile, laterally compressed, imbricate and 1-flowered.
- Fruit*** : Grain is minute, oblong/somewhat flattened, rounded on back.
- Field spread*** : Seeds and underground stolons
- Habitat*** : highly nutritious fodder grass, lawn grass. In black soils and in dry land areas, one of the ten worst weeds in the world.

Dactyloctenium aegyptium



- Family*** : Poaceae
Common name : Crow foot grass
Habit : An annual, grass growing in waste places and dry cultivated lands.
Leaf : Leaves flat, 5 to 20 cm long, glabrous
Stem : Culms 10-62.5 cm high.
Flower : Inflorescence of 2 to 5 spikes in terminal umbel, dark olive-grey, digitately radiating; the rachis projecting in a point beyond the spikelets.
Fruit : Caryopsis.
Field spread : Seeds
Habitat : Dry and moist places.

Digitaria sanguinalis



- Family*** : Gramineae (Poaceae)
- Common name*** : Common crab grass
- Plant*** : Several branching culms at the base, lower branches sprawl across the ground and upper branches erect, often forms colonies.
- Culms*** : Light green, glabrous, covered by sheaths
- Leaf*** : Dull light green, entire or slightly curly along the margins, often hairy towards the base
- Inflorescence*** : Receme, 2-8 recemes spread outward from a short stalk, narrow and straight. Rachis of each receme is light green, flattened many pairs of one-flowered spikelets along length of each receme, occur along one side of the flattened stalk.
- Grain*** : Ovoid and flattened like the lemmas. The lemmas enclose a single developing grain
- Habitat*** : Degraded wet lands

Digitaria longiflora



- Family** : Poaceae
Common name : Hairy crab grass
Habit : Ascending herb
Stem : Culms ascending from creeping and rooted stolons; nodes not beared.
Leaf : Blades ovate-lanceolate, to 5.5 x 0.6 cm.
Flower : Spikelets ternate, 1.5 mm, ovoid, homomorphous, pubescent 3- 5 nerved, lower lemma as long as spikelet, with 5-7 nerves in equidistant; upper lemma nerved
Fruit : Caryopsis
Field spread : Seeds and Stolons
Habitat : Field bunds and drylands.

Dinebra arabica



- Family*** : Poaceae
- Habit*** : A coarse tufted annual.
- Flower*** : Spikes are many, very *rough* when old and arranged in terminal, narrow, raceme-like panicles. Spikelets are closely imbricate and awned.
- Fruit*** : Caryopsis
- Field spread*** : Seeds
- Habitat*** : A field bunds and dry lands.

Dinebra retroflexa



- Family** : Poaceae
Common name : Viper grass
Habit : A tufted annual found as a weed in cultivated crops, in moist places
Stem : Culms 25 to 62.5 cm high
Leaf : Leaves 5 to 12.5 cm long; inflorescence 10 to 20 cm long
Flower : Spikes up to 5 cm long; spikelets crowded, 2 to 3 flowered, **pinkish**
Fruit : Caryopsis ellipsoid-oblong
Field spread : Seeds
Habitat : A Field bunds and dry lands

Echinochloa colona



- Family*** : Gramineae (Poaceae)
- Common name*** : Jungle grass
- Habit*** : A slender annual, growing up to 60 cm, common in water logged situations, in rice fields and in irrigated lands
- Stem*** : Culms
- Leaf*** : Leaf-blade 7.5 to 15 cm long, often blotched with purple or almost black cross bands; **ligule 0, auricle 0.**
- **Ligule and auricle are important characteristic present in rice plant for differentiation**
- Flower*** : Inflorescence linear upto 10 cm; racemes \pm 4-rowed, upto 2 cm, appressed to rachis, to half their length. Spikelets ovoid-ellipsoid, to 2mm, Glumes 5-nerved, unequal; lower lemma acute to cuspidate; upper lemma crustaceous
- Fruit*** : Caryopsis
- Field spread*** : Seeds
- Habitat*** : Common in cultivated fields, an excellent fodder.

Echinochloa crus-galli



- Family** : Gramineae (Poaceae)
Common name : Barnyard Grass
Habit : A tufted annual usually met with in rice fields and other wet places.
Stem : Culms up to 60 cms high
Leaf : Leaves 7.5 to 37.5 cms long; **ligule 0; junction of blade and sheath marked by a brown zone**
Flower : Inflorescence an erect panicle, branches up to 12; spikelets crowded, cuspidate or awned
Fruit : Fruit ovate or elliptic grain
Field spread : Seeds
Habitat : Common in rice fields.

Echinochloa glabrescens



- Family*** : Gramineae (Poaceae)
- Stem*** : Tufted in wet lands, spreading in dry situations
- Leaf*** : Tightly stem-clasping sheaths, blades are strap like, with a long thin apex
- Inflorescence*** : Closely branched panicle, pseudo spikes and spikelets numerous, with or without awns which are 1-3 mm long, Caryopsis held tightly within each spikelet and shed as a unit.
- Field spread*** : Seeds, vegetative fragments
- Habitat*** : Inundated paddy fields

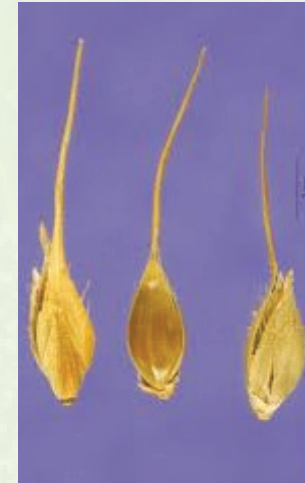




Echinochloa oryzoides

- Family*** : Gramineae (Poaceae)
- Habit*** : A tufted annual usually met with in rice fields and other wet places
- Stem*** : Stem 50-150 cm in height, straight, branchy from base, naked, with pubescent lower nodes
- Leaf*** : First leaf is normal leaf, linear-lanceolate, flat, with dense hairs at base of blade; sheaths naked or covered with hairs; **ligule absent**
- Inflorescence*** : 8-15 cm in length, with rough twigs Flowering in August and September
- Fruit*** : Fruiting in September and October, caryopsides
- Field spread*** : seed
- Habitat*** : Persistent, specialized weed of rice

Echinochloa stagnina



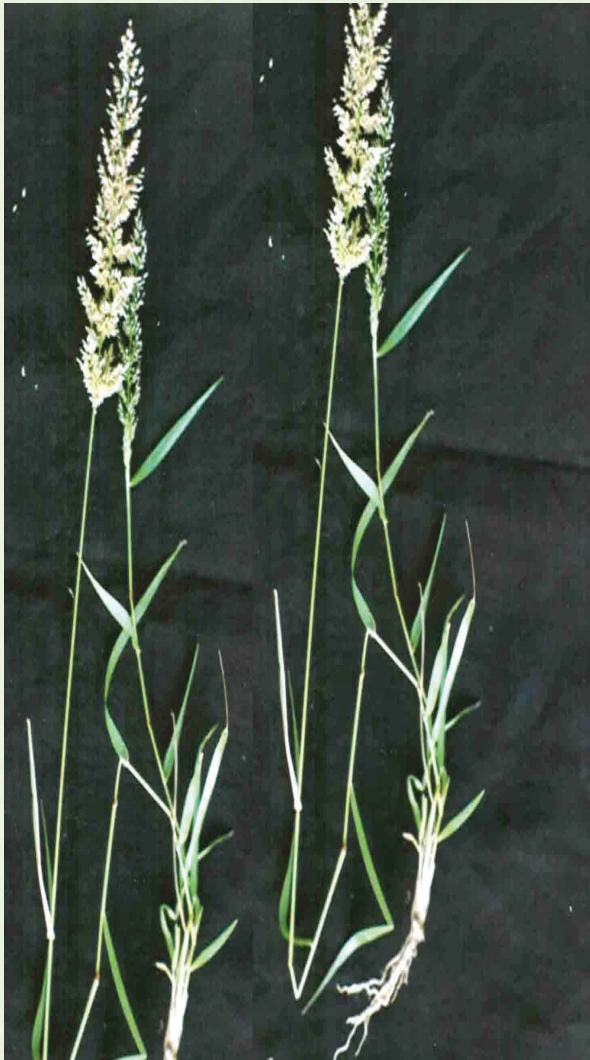
- Family*** : Gramineae (Poaceae)
- Common name*** : Hippo grass, Burgu millet
- Stem*** : The long, trailing leafy stems, which **float on the water surface**, have a high sugar content. When the water recedes, the stems root at the nodes and produce excellent regrowth.
- Habitat*** : Tropical aquatic perennial growing along rivers, in lakes and lagoons with water level upto 3metres, it tolerates floods well and controls erosion
- Seed** : used as food and hay for animals.



Eleusine indica

- Family*** : Poaceae
- Common name*** : Goose grass
- Habit*** : Annual
- Stem*** : 30-50 cm long with laterally flattened shoots
- Leaf*** : Leaf blades are flat and folded at the base
- Flower*** : Inflorescence consists of 4-8 narrow finger-like spikes, 5-15 cm long arising from the top of the stem to form a spreading umbel
- Seed*** : Ovate, reddish-brown in colour
- Field spread*** : Through seeds

Eragrostis tenella* var. *insularis



- Family*** : Gramineae (Poaceae)
- Common name*** : Love grass
- Habit*** : Annual
- Stem*** : Culms up to 60 cm
- Leaf*** : Blades lanceolate, 8 x 0.5 cm, flat.
- Flower*** : Panicles oblong-pyramidal, to 8 x 1.5 cm, pilose or not at axils, glands not sticky Spikelets oblong, 2-4.5 mm, 8-fls, pale yellow, breaking up from apex; florets slightly overlapping
- Fruit*** : Caryopsis globose
- Field spread*** : Seeds
- Habitat*** : Field bunds and drylands.



Eragrostis lehmanniana

- Family*** : Poaceae
- Common name*** : Love grass
- Habit*** : Annuals or perennials
- Leaf*** : Leaf-blades linear; ligule usually reduced to a ciliate rim, rarely membranous
- Flower*** : Inflorescence an open, contracted or spike-like panicle, the branches sometimes racemose but longer with short side branchlets.
- Fruit*** : Caryopsis usually globose to ellipsoid, smooth
- Field spread*** : Through seeds

Heteropogon contortus



- Family** : Gramineae (Poaceae)
- Common name** : Spear Grass
- Habit** : A very variable perennial hardy grass, growing well in shallow soils; grows in areas with low rainfall; stems erect. 30-90 cm high.
- Stem** : Culms to 60cm; nodes glabrous
- Leaf** : Leaves linear, tapering to a point
- Flower** : Inflorescence consists of a solitary spike with closely imbricating spikelets all on one side, **fertile spikelets awned**; callus long, acute, bearded with reddish-brown hairs; all the awns of a receme often twisted about each other
- Fruit** : Caryopsis
- Field spread** : Seeds

Ischaemum rugosum



- Family*** : Graminae
- Common name*** : Saramolla grass
- Habit*** : Perennial grass
- Stem*** : Culms upto 50 cm; nodes bearded.
- Leaf*** : Blades to 25 x 1 cm
- Flower*** : Racemes 2(3), upto 5 cm, divergent/close. Sessile spikelet: callus densely villous, Spikelet oblong to 4 mm. Lower glume broadly ovate, 7-9-nerved, 2-cuspidate, 2-winged, bristly; upper glume 5-nerved, 2-dentate, slightly winged; lower lemma upto 4 mm, 3-nerved; upper lemma hyaline, awn upto 1.5 cm. Pedicelled spikelet
- Fruit*** : Caryopsis
- Field spread*** : Seeds
- Habitat*** : Common on slopes, arable lands, etc.

Iseilema laxum



- Family*** : Graminae(Poaceae)
Habit : A perennial grass with a stout, short creeping root-stock
Stem : Culms to 30 cm, tufted; nodes glabrous
Leaf : Blades lanceolate, flat, upto 10 x 0.5 cm, abruptly obtuse.
Flower : Panicle terminal, upto 12 cm, interrupted; spatheoles 8 x 2 mm, glabrous. Homogamous spikelet to 4 mm. Sessile spikelet: lower glume lanceolate, beak elongate, 2-fid, awn upto 1.2 cm, paleate
Fruit : Caryopsis ellipsoid. Pedicelled spikelet
Field spread : Seeds
Habitat : Common on field bunds, dry lands.

Leersia oryzoides



- Family** : Graminae(Poaceae)
- Common name:** : rice cut grass
- Root system** : Rhizomatous and fibrous
- Plant** : More or less erect unbranched or sparingly so.
- Clum** : Light to yellowish, green hollow and sparingly covered with short stiff hairs
- Leaf** : Linear, dull green, somewhat rough, **Margins are very rough and sharp from fine saw teeth.** The short ligules lack significant hair and papery membranes. The nodes along each column are pubescent.
- Inflorescence** : Panicle with spikelets broader at the base and branch lets spread outward. Spikelets are light green having single lemma and an enclosed palea and no glumes. 3 steamers and stigmas are present
- Habitat** : Marshes, Swamps, low lying areas, wet lands. Clings to clothing, flesh, fur, can slice through human flesh.



Panicum flavidum

- Family** : Gramineae (Poaceae)
- Habit** : Tufted annual.
- Stem** : Branches freely from the base, tufted, decumbent at first but soon becoming erect, slender, glabrous, compressed and leafy.
- Leaf** : Distichous, leaf sheath compressed, glabrous, sometimes with a tinge of purple. **The ligule is a fringe of hairs.** Nodes are glabrous. Leaf blade is flat, linear, lanceolate and acuminate or ligulate with a rounded tip.
- Flower** : Inflorescence raceme of spikes, erect or inclined on short or long glabrous, strongly channelled peduncle. Spikelets are white in two rows on a flattened rachis. 4-glumes.
- Fruit** : Lodicules are small but conspicuous.
- Field spread** : By seeds.
- Habitat** : Grows in bunds of paddy fields and in wet situation.

Panicum repens



- Family** : Gramineae (Poaceae)
- Common name** : Ginger Grass
- Habit** : A very common perennial species, thrives in moist places
- Stem** : Culms creeping at the base, rhizomatous, 60 to 150 cm long. Underground stems are thick and hard, **very much resembling ginger**. Aerial branches are covered with pointed scale leaves at the base.
- Leaf** : Leaves distichous, rigid, glaucous, up to 25 cm long. Leaf sheath is triate and smooth with ciliate margins. Ligule consists of a short thin membrane hairy at the top
- Flower** : Inflorescence is much branched terminal panicle, 3-5 inches long. Spikelets are ovoid and pointed on a short stalk and has four glumes
- Fruit** : Grain is slightly enclosed by the fourth glume and palea
- Field spread** : By underground stems and grains
- Habitat** : A very common weed of garden and wet lands especially on bunds of paddy fields.

Paspalum dilatatum



- Family*** : Gramineae (Poaceae)
- Common name*** : Scruot grass
- Habit*** : Moist to wet soils
- Description*** : Tall, erect grass upto 2m height
- Leaver*** : Lower sheaths are hairy, long nor, bright green blades are hairless with an asymmetric ligule, angled along the midrib, sparsely long-hair around where it meets the stem.
- Inflorescence*** : Has 3-7 spike – like racemes but could be up to 11. Each raceme is at almost right-angles from the stem
- Seed*** : Seed heads have paired seeds lined up in 4 rows mature seed brown, fringed and may feel sticky.
- Important pasture grass.
- Field spread*** : Creeping stolons, seeds very competitive in rice, **tolerant to many herbicides**
- Habitat*** : Perennial grass grows as tall as 30-60 cm.

Pennisetum cenchroides



- Family** : Gramineae (Poaceae).
- Habit** : Tufted perennial
- Stem** : aerial branches and under-ground rhizomiferous stems, bearing thick fibrous roots and numerous buds covered by scarios sheaths. The aerial branches are tufted, erect or decumbent and geniculately ascending
- Leaf** : sheath is slightly compressed; keeled, with scattered long hairs outside, shorter than the internodes. **The ligule is a short thin membrane fringed with hairs.** Leaf blade is linear, tapering to a very fine point.
- Flower** : Inflorescence is a raceme of spikes, with spikes mostly densely arranged, though occasionally distant and not close-set, on a long, slender, puberulous or scaberulous peduncle; rachis is flexuous, flattened, grooved and scaberulous. The spikes have involucels, consisting of two series of bristles. Spikelets oblong-lanceolate, one to three in a spike and sessile. 4-glumes. Anthers are three, yellow, stigmas white, feathery and the styles shortly united at the base.
- Fruit** : Lodicules are not present.
- Field spread** : Seeds and stem bits
- Habitat** : Grown in all kind of soil and grows even when the soil is dry.

Perotis indica



- Family*** : Gramineae (Poaceae).
- Habit*** : A tufted wiry annual or sub-perennial grass
- Stem*** : Culms tufted, upto 40 cm
- Leaf*** : Leaves closely imbricate below
- Flower*** : Racemes slender, feathery; spikelets solitary; glumes hispid, awn purplish.
- Fruit*** : Caryopsis linear, terete
- Field spread*** : By seed
- Habitat*** : Common on field bunds and dry cultivated lands.

Tragus roxburghii* Syn. *T. biflorous



- Family*** : Gramineae (Poaceae)
- Habit*** : A low spreading, xerophytic species, commonly met within dry fields and waste places
- Stem*** : Culms short, rigid, 7.5 to 12 cm high
- Leaf*** : Leaves up to 2.5 cm long
- Flower*** : Racemes solitary, terminal, consisting of a central axis on which the sessile spikelets are packed; glumes awnless, upper glume bear hooked spines
- Fruit*** : Caryopsis ellipsoid
- Field spread*** : Seed
- Habitat*** : Common on field bunds and dry cultivated lands.

Weedy rice



- Family** : Gramineae (Poaceae)
- Description** : hybrid populations of cultivated rice *Oryza sativa* and other *Oryza sp.* *perennis*, *nivara*, *rufipogon*, *longistaminata*, *barthi*, and *glaberrima*
- Characteristics** : ratooning ability, excellent adaptation to any agronomic practices and ecological conditions suited for rice crop, a life cycle that is closely synchronized with the crop, high out crossing rate, abundant production of seeds that develop a capacity for germination relatively early, pre-harvest easy and heavy shattering, rapid emergence-vigorous and fast vegetative growth and reproductive development, prolonged and intense dormancies that maintains the germinability of shattered seed on or in soil seed bank for many years, paddy seed contamination
- Developments** : through the pollen flow from the wild species such as *O.rufipogon*, *O. nivara* and *O. spontanea* naturally occurring near the rice field, drainage, in the roads side, unplanted paddy field etc.
- Spread**

Chemical control of grassy weeds

Chemical Name	Dosage (g a.i./ha)	Time of application	Effective on
Acetochlor 90 EC	0.075	3-5 DAT	Grasses
Cinmethalin 10 EC	0.050 - 0.075	7 DAT	Grasses
Fentrazamide 50 WP	0.12 - 0.15	4-7 DAT	Grasses
Flufanacet 60 WP	0.12	3-5 DAT	Grasses
Butachlor + 2,4 -DEE 50 EC + 36 EC	1.0+0.4	5-7 DAT	Grasses and BLW
Anilophos + Triclopyr-BGE 30+30 EC	1.25	3-5 DAT	Grasses and BLW
Anilophos+Ethoxysulfuron 21+1 SC	0.375 + 0.015	10 DAT	Grasses and BLW
Cinmethalin+2,4-DEE (50 EC)	0.375 - 0.500	7 DAT	Grasses and BLW
Bensulfuronmethyl 60 DF + Pretilachlor 50 EC (6.6 G)	0.06 + 0.60	0 -5 DAT	Grasses and BLW
Almix + butachlor 20WP + 50EC	0.004+ 0.938	3-5 DAT	Grasses and BLW
Triasulfuron + Pretilachlor 20WG+50EC	0.006 + 0.500	5-7 DAT	Grasses and BLW
Chlorimuron + Metsulfuron-methyl 20 WP (Almix)	0.004	20-25 DAT	Grasses, sedges and annual BLW
Bispyribacsodium 10% 10SC	25 ml/ha	15 DAT	Grasses and annual BLW
Penoxsulam 24SC	25gm/ha	7-10 DAT	Grasses, aquatic weeds
Butachlor 50 EC	1.50	5-7 DAT	Annual grasses and some sedges
Benthiocarb 50 EC	1.50	5-7 DAT	Annual grasses
Pretilachlor 30 EC	0.50 - 0.75	3-7 DAT	<i>Ischaemum</i> , annual grasses and some BLW
Anilophos 30 EC	0.30 - 0.40	5-7 DAT	Annual grasses and some BLW
Oxyfluorfen 25 WP	0.10	5-7 DAT	Annual grasses, some BLW
Oxadiargyl 6 EC / 80 WP	0.15	5-7 DAT	Annual grasses, some Sedges
Pyrazosulfuron-ethyl 5 WP / 10WP	0.005 - 0.020	5-7 DAT	Sedges and BLW
Fenoxaprop – p-ethyl 7.5EC	0.056	15-20 DAT	Annual grasses

Sedges Weeds by Family

Sl. No.	Scientific Name	Family
1	<i>Cyperus difformis</i>	Cyperaceae
2	<i>Cyperus esculentus</i>	Cyperaceae
3	<i>Cyperus iria</i>	Cyperaceae
4	<i>Cyperus nutans</i>	Cyperaceae
5	<i>Cyperus pangorei</i>	Cyperaceae
6	<i>Cyperus rotundus</i>	Cyperaceae
7	<i>Cyperus tenuiculmis (Syn. C. Zollingeri)</i>	Cyperaceae
8	<i>Fimbristylis aestivalis</i>	Cyperaceae
9	<i>Fimbristylis argentea</i>	Cyperaceae
10	<i>Fimbristylis complanate</i>	Cyperaceae
11	<i>Fimbristylis milliacea</i>	Cyperaceae
12	<i>Fimbristylis woodrowii</i>	Cyperaceae
13	<i>Kyllinga brevifolia</i>	Cyperaceae
14	<i>Kyllinga nemoralis Syn. K. monocephala</i>	Cyperaceae
15	<i>Pycerus polystachyos Syn. P. odoratus</i>	Cyperaceae
16	<i>Scirpus maritius</i>	Cyperaceae



Cyperus difformis

- Family** : Cyperaceae
- Common name** : Umbrella sedge
- Habit** : A very common slender, weak plant found in marshes and in shallow ponds; stems tufted, 12.5 to 37.5 cm long.
- Leaf** : Leaves flaccid, as long as the stem; bracts 2 to 20 cm long.
- Stem** : Stem 8-40 cm.
- Flower** : Spikelets many, densely grouped into congested globose heads; glumes obovate, apex rounded.
- Fruit** : Nut subequally trigonous, yellow or pale-brown
- Field spread** : Seeds
- Habitat** : A common weed in paddy fields

Cyperus esculentus



- Family*** : Cyperaceae
- Common name*** : Yellow nut sedge
- Habit*** : A very common plant in swamps and in rice fields
- Root system*** : Fibrous, rhizomatous and tuberous.
- Stem*** : Stems tufted, 2.5 to 10 cm high.
- Inflorescence*** : Central stem terminates in an umbel or compound umbel of floral spikes. Each umbel has 1-3 sessile spikes and 6-10 non-sessile spikes on straight branches of varying length.
- Field spread*** : Tubers, and rhizomes
- Habitat*** : Weeds in moist areas, swamps, rice fields

Cyperus iria



- Family** : *Cyperaceae*
- Common name** : Sedge Weed
- Habit** : An erect glabrous annual
- Stem** : Stems 15 to 50 cm high, trigonous
- Leaf** : Leaves up to 42.5 cm long; bracts 3-5, 5 to 25 cm long
- Flower** : Spike consists of 5-15 spikelets; spikelets linear, oblong, yellow or pale-brown; glumes plicate
- Fruit** : Nut trigonous, obovoid, black
- Field spread** : Seeds
- Habitat** : A widely distributed species in all marshy situations and also occurs as a very common weed in paddy fields and in shallow ponds.

Cyperus nutans



- Family*** : Cyperaceae
- Habit*** : Erect annual
- Stem*** : Stem tufted.
- Leaf*** : Leaves prominently nerved sheaths purplish.
- Flower*** : Inflorescence decomound; involucre bracts (3)5-7. Spikes oblong, digitate rachilla persistent, winged. Glumes cupidate, apex retuse- emarginate; keel distinct or not. Stamens with smooth connectives
- Fruit*** : Nut obovoid-oblong.
- Field spread*** : Seeds
- Habitat*** : In moist places

Cyperus pangorei



- Family** : Cyperaceae
- Habit** : Erect upto 2.0 m height
- Stem** : sparsely tufted
- Leaf** : Leaves flat, sheaths purplish/ grey
- Flower** : Inflorescence compound, Spikes corymbose. Spikelets 2-10, spicate, 1-2.5 x 0.1-0.15 cm, purplish-brown, acute, compressed; rachilla flexuous, wing to 1.5 mm, hyaline. Glumes closely imbricate, ovate, mucronulate, sides 4-6- nerved. Stamens 3.
- Fruit** : Nut obovoid / ellipsoid.
- Field spread** : Seeds and nutlets.
- Habitat** : Marshy places and river banks.

Cyperus rotundus



- Family** : Cyperaceae
- Common name** : Nut Grass, Nutsedge
- Habit** : Stoloniferous, stolons not bulbiferous; stems trigonous, up to 1 m high; tubers not zoned, perennial
- Stem** : Stem sparsely tufted
- Leaf** : Leaves shorter or longer than stem, narrow, numerous
- Flower** : spikelets spreading, linear to lanceolate, up to 2.5 cm long; glumes imbricate, plicate, pale-brown or chestnut-brown, sometimes with a reddish tinge; **nut trigonous, broadly obovoid, grayish-black. Tubers connected by rhizomes go deep into soil even up to 90 cm and spread out widely. Tubers have a very high capacity for survival under adverse conditions.**
- Fruit** : Fruit is a broadly obovoid, trigonous, seed-like nut, grayish black in colour
- Field spread** : Seeds and nutlets
- Habitat** : Perennial weed, occurring in dry cultivated lands, gardens and in semi irrigated land. One of the worlds top ten worst weeds.

Cyperus tenuculmis (Syn. C. zollingeri)



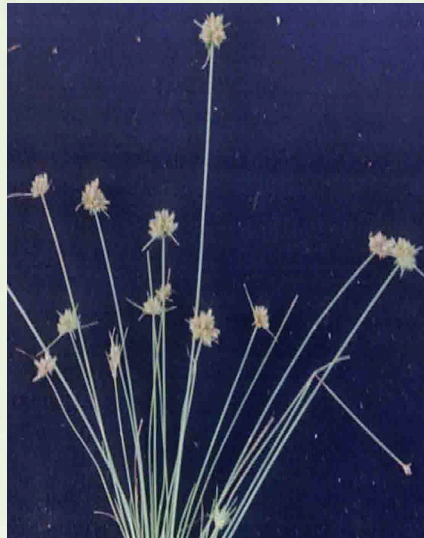
- Family** : Cyperaceae
- Habit** : Erect
- Stem** : Stem solitary, 20-45 cm, base incrassate
- Leaf** : Leaves shorter
- Flower** : **Inflorescence compound**, open, 4-6 cm; spikes 2, 10-spikeletted, spicate/racemose, at right angles to rachis. Spikelets yellow, compressed, rachilla straight. Glumes thick, apiculate/muticose; keel 3-5 nerved. stamens 3
- Fruit** : Nut ellipsoid/obovoid
- Habitat** : Gregarious in marshy lands.

Fimbristylis aestivalis



- Family*** : Cyperaceae
- Habit*** : Erect annual
- Stem*** : Stem tufted
- Leaf*** : Leaves filiform, densely pubescent
- Flower*** : Inflorescence compound, 2 x 4 cm; involucre bracts overtopping, longest to 4 cm. Spikelets acute, many rachilla narrowly winged. Glumes ovate, purplish-green, short, hyaline, apex acute; keel puberulous without, strongly 3-nerved. Stamen 1. Style-base papillose; stigmas ciliate.
- Fruit*** : Nut obovoid, biconvex.
- Field spread*** : Seeds
- Habitat*** : Moist places in irrigation channel, bunds

Fimbristylis argentea

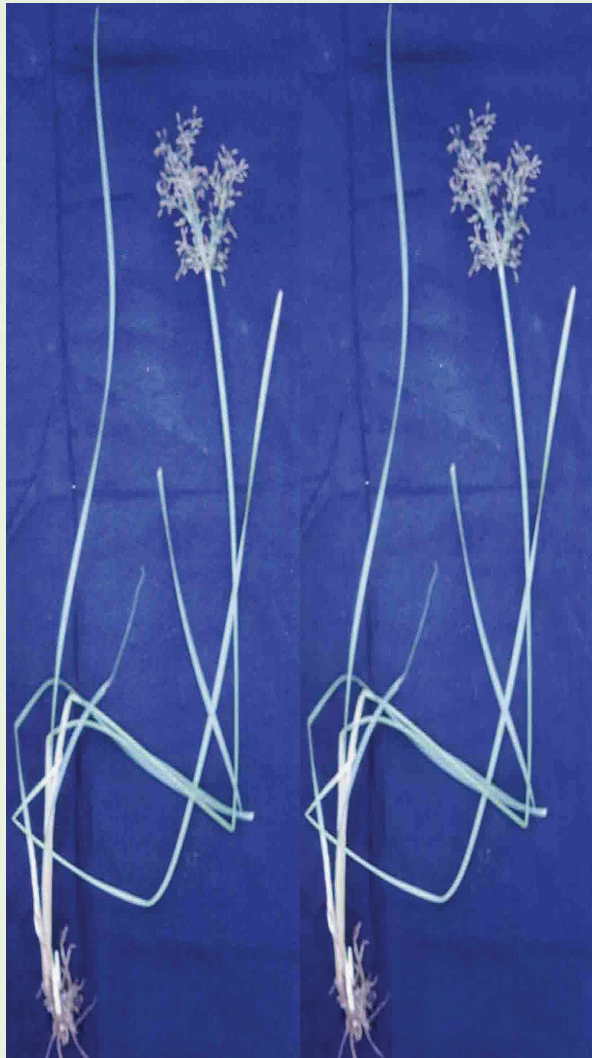


- Family*** : Cyperaceae
Habit : Erect annual
Stem : Stem tufted
Leaf : Leaves filiform, to 5 x 0.7 cm, sparsely scabrid; ligule 0.
Flower : Inflorescence capitate, 5-12 in a cluster Spikelets 3.5-8 x 1-1.5 mm, obtuse, many-fold; rachilla narrowly winged. Glumes spiral, ovate to mucronulate; keel 3-nerved. Stamens 1
Fruit : Nut obovoid, biconvex.
Field spread : Seeds
Habitat : Moist places and in canal bunds

Fimbristylis complanata



- Family*** : Cyperaceae
- Habit*** : Erect annual
- Stem*** : Stem dense and tufted
- Leaf*** : Leaves rigid, 15 x 0.4 cm glaucous; sheaths compressed, keeled
- Flower*** : Inflorescence decomound, 4-7 x 6-9 cm; slender. Spikelet 1, acute, c. 12-fold; rachilla winged. Glumes ovate, grey-purplish, mucronulate; keel strong, 3-nerved. Stamens 3. Style 3-fid
- Fruit*** : Nut obovoid, trigonous
- Field spread*** : Seeds
- Habitat*** : Moist places and in wetland.



Fimbristylis milliacea

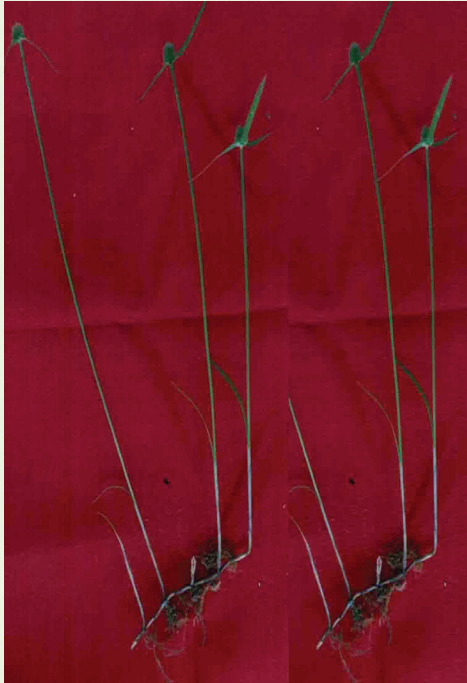
- Family*** : Cyperaceae
- Common name*** : Hoorah grass
- Habit*** : Erect annual
- Flower*** : Inflorescence (de)compound, to 2.5 cm; primary and secondary ray(s) 1-3, spikelet 1, globose, to 4 mm; rachilla winged. Glumes orbicular; keel 1-3 nerved. Stamen 1. Style 3-fid.
- Fruit*** : Nut obovoid.
- Field spread*** : Seeds
- Habitat*** : **Wet land weed**

Fimbristylis woodrowii



- Family*** : Cyperaceae
- Habit*** : Erect annual
- Stem*** : Stem sparsely tufted
- Leaf*** : Leaves flaccid, prominently nerved; ligule 0
- Flower*** : **Inflorescence a cluster of 3 spikelets.** Spikelets oblong. Rachilla winged. Glumes ovate, plicate; keel strongly 3-5-nerved. Stamens 2. Style 3-fid
- Fruit*** : Nut obovoid.
- Field spread*** : Seeds
- Habitat*** : Wet land weed

Kyllinga brevifolia



- Family*** : Cyperaceae
- Habit*** : Distributed in shady places and in gardens; rhizomatous, rhizome covered with light-pink to brown scales, up to 30 cm long,
- Stem*** : Stems up to 75 cm high.
- Leaf*** : Leaves few, up to 25 cm long; bracts 3-4, up to 12.5 cm long.
- Flower*** : Heads usually solitary, subglobose or ovoid, up to 0.8 cm long.
- Fruit*** : Nut elongate, yellowish-brown.
- Field spread*** : Seeds and rhizomes
- Habitat*** : **Paddy weed in tropical and subtropical region.**

Kyllinga nemoralis* Syn. *K. monocephala



- Family*** : Cyperaceae
- Common name*** : White kyllinga
- Stem*** : Up to 40 cm
- Leaf*** : Leaves several, up to 15 cm, flaccid
- Flower*** : Spikes 4 x 8 mm. Spikelets ovate/ elliptic; rachilla wingless. Glumes 4. Stamens 3
- Fruit*** : Nut obovoid
- Field spread*** : Seeds and by runners
- Habitat*** : **Very common in rice field bunds.**



Pycerus polystachyos* Syn. *P. odoratus

- Family*** : Cyperaceae
- Habit*** : Erect annual
- Stem*** : Stem tufted, 8-40 cm.
- Leaf*** : Leaves several, flat/canaliculate.
- Flower*** : Inflorescence simple/subcompound, up to 2.5 cm, densely clustered; primary rays 3-5, subsessile. Spikes up to 1.5 cm, suberect, spicate/fascicular. Spikelets 15, oblong, 4-8 x 1-1.5 mm, stramineous, 15-20-fold; rachilla persistent, narrowly winged. Glumes ovate/oblong. Stamen(s) 1(2).
- Fruit*** : Nut oblong, (ob) ovoid, biconvex.
- Field spread*** : Seeds and nuts
- Habitat*** : **Cosmopolitan**

Scirpus maritius



- Family* : Cyperaceae
- Common name* : Seactubrush
- Stem* : Sharply 3 sided, sometimes winged
- Leaf* : Long leaves grooved above and keeled below
- Inflorescence* : **Spikelets egg shaped**, spikelets stalked, clusters of spikelets. They have an upright leaf like bract which appears like a continuation of the stem beyond the inflorescence and 2 & 3 smaller bracts at an angle to the stem.
- Habitat* : Wet and marshy lands

Chemical weed control of sedges

Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
Glyphosate 41 SL	0.75-1.50	15 DBT	Sedges & All vegetation
Carfentrazone ethyl	25 ga.i/ha	40 DF	3-4 leaf stages of sedges and BLW
Chlorimuron + Metsulfuron-methyl 20 WP (Almix)	0.004	20-25 DAT	Grasses, Sedges and annual BLW

Broad Leaves Weeds by Family

Sl. No.	Scientific Name	Family
1	<i>Acalypha indica</i>	Euphorbiaceae
2	<i>Achyranthes aspera</i>	Amaranthaceae
3	<i>Aerva lanata</i>	Amaranthaceae
4	<i>Aerva tomentosa</i>	Amaranthaceae
5	<i>Aeschynomene indica</i>	Papilionoideae(Faboideae)
6	<i>Ageratum conyzoides</i>	Compositae(Asteraceae)
7	<i>Allmania nodiflora</i>	Amaranthaceae
8	<i>Alternanthera paronychioides</i>	Amaranthaceae
9	<i>Ammania baccifera</i>	Lythraceae
10	<i>Alternanthera sessilis</i>	Amaranthaceae
11	<i>Andrographis serpyllifolia</i>	Acanthaceae
12	<i>Bergia ammanioides</i>	Elatinaceae.
13	<i>Bidens pilosa</i>	Compositae (Asteraceae)

Sl. No.	Scientific Name	Family
14	<i>Caesulia axillaris</i>	Compositae (Asteraceae)
15	<i>Celosia argentea</i>	Amaranthaceae
16	<i>Commelina benghalensis</i>	Commelinaceae
17	<i>Commelina diffusa</i>	Commelinaceae
18	<i>Convolvulus arvensis</i>	Convolvulaceae
19	<i>Corchorus olitorius</i>	Tiliaceae
20	<i>Cyanotis axillaris</i> ,	Commelinaceae
21	<i>Digera muricata</i> (Syn. <i>D. arvensis</i>)	Amaranthaceae
22	<i>Eclipta alba</i>	Asteraceae
23	<i>Eclipta prostrata</i> (Syn. <i>Eclipta alba</i>)	Asteraceae
24	<i>Euphorbia hirta</i>	Euphorbiaceae
25	<i>Ipomea alba</i> Syn. <i>Calonyction bona-nox</i>	Convolvulaceae
26	<i>Ipomea carnea</i> .ssp.fistulosa	Convolvulaceae
27	<i>Ipomea pestigridis</i>	Convolvulaceae
28	<i>Ipomea sepiaria</i>	Convolvulaceae
29	<i>Merremia emarginata</i>	Convolvulaceae
30	<i>Oldenlandia umbellate</i>	Rubiaceae
31	<i>Oxalis corniculata</i>	Oxalidaceae
32	<i>Phyla nodiflora</i> (Syn. <i>Lippia nodiflora</i>)	Verbenaceae
33	<i>Portulaca oleracea</i>	Portulacaceae
34	<i>Rotala densiflora</i>	Lythraceae
35	<i>Rungia repens</i>	Acanthaceae

Acalypha indica



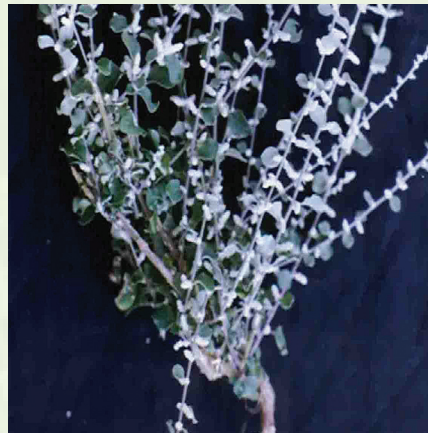
- Family** : Euphorbiaceae
- Common name** : Indian Acalypha
- Habit** : Erect, annual, pubescent herb growing to a height of 20 to 60cm
- Stem** : Round or angular and densely shortly pubescent.
- Leaf** : Long-petioled, petiole longer than the blade, ovate or rhombic-ovate, crenate, serrate, acute or obtuse, base cuneate entire.
- Flower** : Minute, green, unisexual, monoecious, axillary erect spikes; bracteate, many nerved, dentate, folded, alternate; male flowers few and terminal; calyx lobes 4, membranous, valvate; petals; ostamens many on a convex receptacle; female flowers basal: calyx 3-4 lobed, lobes imbricate, petals 0; ovary superior, hispid, syncarpous, 3-celled, ovules solitary in each cell, style filiform, often very long.
- Fruit** : Capsules covered by the bract, often 1-seeded, hispid; seeds ovoid, acute, smooth
- Field spread** : Seeds
- Habitat** : Aerobic and upland rice, waste lands and pastures.

Achyranthes aspera



- Family* : Amaranthaceae
- Common name* : Prickly Chaff Flower
- Habit* : Erect herb about 90 cm high; sparingly branched, biennial or perennial.
- Leaf* : Leaves thick, orbicular-obovate or elliptic, obtuse, pubescent tomentose or velvety, rarely glabrous, petiole short.
- Stem* : Round, striate and hairy.
- Flower* : Spike long, about 25 cm long bracts membranous, **spinescent**, persistent: **bracteoles spinescent**; rigid, lanceolate, aristate strongly ribbed, shining and hard; stamens 2-5, filaments connate at the base and alternate with staminodes which are toothed lacerate or with a toothed scale at the back; anthers 2-celled; ovary subcompressed, oblong, 1-celled; ovule solitary, pendulous, style filiform, stigma cap-like.
- Fruit* : An utricle, oblong or ovoid, indehiscent, rounded or areolate at apex; seed inverse, oblong.
- Field spread* : Seeds
- Habitat* : Common in waste lands and on bunds in dry land paddy

Aerva lanata



- Family** : Amaranthaceae
- Habit** : Branched under shrub, erect or prostrate, hairy tomentose, perennial growing to a height of 30-60 cm
- Leaf** : Small, woolly or glabrate, petiolate, elliptic, orbicular-obovate or orbicular-obtuse or acute.
- Stem** : Striate, round and softly woody tomentose
- Flower** : **Small in solitary or paniced spikes**; bracts and bracteoles small; perianth calycine, membranous 4-5 lobed, all or the inner woolly; stamens 4-5, filaments subulate, connate below with interposed linear staminodes into a cup, anthers 2-celled; ovary ovoid or subglobose, style long or short, stigma cap-like or bifid, ovule one, pendulous.
- Fruit** : Indehiscent utricle or circumsessile capsule; seeds inverse
- Field spread** : Seeds
- Habitat** : A perennial, common dry land paddy

Aerva tomentosa



- Family** : Amaranthaceae
- Common name** : Javanese Woolplant
- Habit** : White, tomentose, conspicuous, erect, herb, growing upto a height of 1.0m.
- Leaf** : Leaves alternate, linear oblong or spatulate, obtuse or acute, densely tomentose
- Stem** : Round, striate and thickly white tomentose.
- Flower** : **Flowers dioecious in densely white woolly spikes forming terminal panicles; perianth** calycine 5-lobed, membranous, woolly; stamens 5, alternating with staminodes, connate at the base; ovary superior, 1-celled, 1-ovuled, style as long as the stigma, stigmas 2.
- Fruit** : An utricle, membranous; seeds coriaceous.
- Field spread** : Seeds
- Habitat** : Common dry land weed in dry land paddy

Aeschynomene indica



- Family** : Papilionoideae (Faboideae)
- Habit** : Slender, much branched, annual under shrub
- Leaf** : Leaves imparipinnate, leaflets numerous, linear, close sensitive, obtuse, 1-nerved; stipules membranous, lanceolate, deciduous.
- Stem** : Stem not spongy.
- Flower** : **Flowers yellow**, small in axillary, viscid, peduncled racement; bracts small, lanceolate, rigid, gland-ciliated; calyx membranous, glabrous deeply, two-lipped, upper lobe entire or slightly toothed; corolla fugacious, papilionaceous; stamens diadelphous, five in each bundle; ovary superior, one-celled, many ovuled; style filiform, stigma terminal
- Fruit** : Pod long, straight, lower suture more or less indented, smooth or papillose on the face.
- Field spread** : Seeds
- Habitat** : A common weed in pastures, **wet lands**, margins of small pools and hilly regions up to 1000 meters above MSL.

Ageratum conyzoides



- Family** : Compositae (Asteraceae)
- Common name** : Chick weed / goat weed
- Habit** : Erect softly hairy, annual herb, growing to a height of 70 cm
- Stem** : Branched, terete
- Leaf** : Leaves opposite, petiolate, ovate, crenate, serrate
- Flower** : Heads small, homogamous, in dense corymbose; involucre companulate, bracts 2-3 seriate, striate, sub-equal; receptacle flat, naked or with caducous scales; corolla tubular, equal limb 5-cleft, regular; blue or white; anthers; appendaged, base obtuse; style arms elongate, obtuse
- Fruit** : Achenes 5-angled; glabrous or the angles slightly hispid; pappus paleaceous, scaly, 5-awned, serrate below
- Field spread** : Seeds
- Habitat** : A common weed in garden lands, pastures and other damp and shady places.

Allmania nodiflora



- Family** : Amaranthaceae
- Habit** : Annual, well branched herb with a root-stock, growing to a height of 10-50 cm.
- Leaf** : Leaves alternate, obovate, spatulate, apiculate; inflorescence brown, sessile, axillary and terminal, globose or ovoid
- Stem** : Stem slender.
- Flower** : Flowers hypogynous, bisexual; bracts and bracteoles narrow, scarious, hispid within, filiform tips; perianth 5-lobed, calycine, free, oblong lanceolate, lobes scarious; stamens 5, united below into a cup; anthers 2-celled; ovary superior, ovoid, style slender, stigma capitate or 2-lobed, ovule 1, erect.
- Fruit** : Fruit a circumcisedly dehiscent utricle; seed shining crustaceous black.
- Field spread** : Seeds
- Habitat** : Widely distributed in coastal areas on sandy soils.

Alternanthera paronychioides



- Family** : Amaranthaceae
- Common name** : Alligator weed
- Habit** : Much branched, prostrate, mat-forming herb.
- Stem** : Stem reddish; nodes pilose.
- Leaf** : Clustered, obovate-rhomboid, 0.6-1 x 0.4-0.7 cm.
- Flower** : **Spikes whitish, globose to oblong, paired, often clustered.** Sepals unequal; outer 3 larger, inner 2 narrower; Stamens 5; staminodes subulate.
- Fruit** : Utricle orbicular. Seed faintly reticulate.
- Field spread** : Seed
- Habitat** : Occasional in plains

Alternanthera sessilis



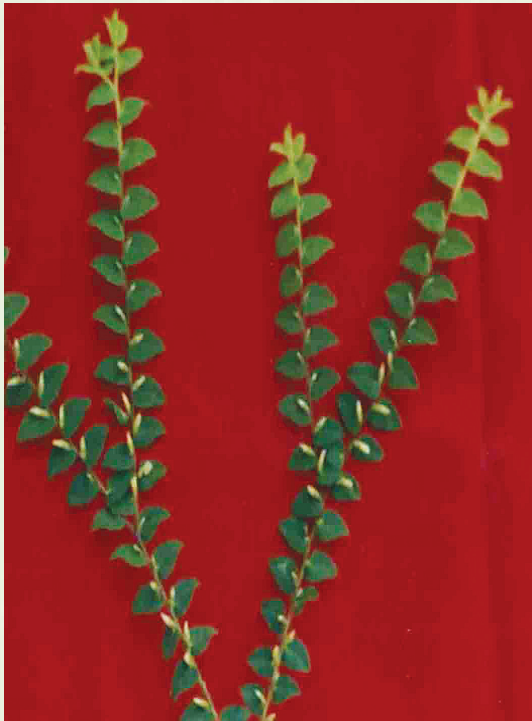
- Family** : Amaranthaceae
Common name : **Alligator weed**
Habit : Annual/perennial herb
Stem : 1 m tall, erect, ascending or creeping, often widely branched, with robust taproot
Leaf : Leaves opposite, simple; petiole up to 5 mm long; blade linear-lanceolate, oblong to ovate
Flower : Inflorescence an axillary
Fruit : Utricle
Seed : Small, lenticular, ovate and orange to dark brown in colour
Field spread : Through seed



Ammania baccifera

- Family* : Lythraceae
- Common name* : Blistering Ammania
- Habit* : An erect annual herb growing up to 30 cm.
- Stem* : Tetragonous, branches at the base are long becoming shorter towards the top.
- Leaf* : Small lanceolate, sessile, opposite, decussate narrowly oblong and tapering at base; stipules are very minute and deciduous.
- Flower* : **Flowers small in axillary clusters**; calyx tubular; corolla absent; stamens 4 attached to the calyx; gynoecium superior, bicarpellary, syncarpus.
- Fruit* : Fruit a capsule longer than the calyx tube; seeds minute, red.
- Field spread* : Seeds
- Habitat* : A common wet land weed.

Andrographis serpyllifolia



- Family** : Acanthaceae
- Habit** : **Trailing procumbent herb.**
- Stem** : Rootstock woody; stem villous.
- Leaf** : Sessile, orbicular, obtuse, more or less hairy, up to 2.5 cm diameter.
- Flower** : Racemes few-flowered in upper axils, one to two flowered in the lower axils; calyx-lobes slender, linear; corolla pale with purple blotches on the lower lip; stamens two, anthers bearded; ovary two celled, stigma minutely bifid
- Fruit** : Capsule glabrous, acute at both ends; seeds deeply rugose, retinacula spoon-shaped
- Field spread** : Seeds
- Habitat** : Common dryland weed and in dryland paddy.

Bergia ammanioides



- Family** : Elatinaceae.
- Common name** : Water Firewort.
- Habit** : Erect, gregarious, stout, terrestrial branching herb, branches decumbent, smooth or thinly pubescent, hairs glandular capitate, growing to a height of 15-45 cm.
- Stem** : Round, glandular and hairy
- Leaf** : Sessile, linear-lanceolate, or oblong, tapering below, sharply serrate, acute.
- Flower** : **Flowers red**, axillary, in dense clusters; sepals 5, acute, membranous, lanceolate, denticulate; petals 5, free, imbricate; stamens 3-5; ovary oblong, deeply grooved, 2-5 celled, styles 2-5.
- Fruit** : Capsule septisidal, 3-6 celled, valves with incurving edges
- Field spread** : Seeds
- Habitat** : A wet land weed, commonly found in marshy places also.

Bidens pilosa



- Family** : Compositae (Asteraceae)
- Common name** : Spanish Needle, Hairy Beggarticks
- Habit** : Erect, glabrous or pilose or pubescent, annual herb.
- Leaf** : Opposite, variable, 3-fid, 3-foliate, or 1-2 pinnatifid.
- Flower** : Heads on long stout peduncles, variable in length, with or without rays, in **corymbose panicles flowers bisexual, yellow**, fertile; involucre campanulate; bracts broad with scarios margins; receptacle flat or convex, subtending the bisexual flowers; corolla of ray flowers ligulate, of disk flowers tubular, limb 5-lobed; anther base obtuse; style arms hairy at the tip.
- Fruit** : Achenes black, slender, exceeding the involucre; pappus with 2-4 short, stout, spinescent awns covered with recurved hooks
- Field spread** : Achenes
- Habitat** : Common weed of cultivated and waste places, in plains and hills.

Caesulia axillaris



- Family** : Asteraceae (Compositae)
- Common name** : *Caesulia*
- Habit** : Annual herb.
- Stem** : Erect or diffuse, glabrous, sub-succulent
- Leaf** : Sessile, linear-lanceolate to oblanceolate, 3-15 x 0.5-2 cm, narrowed at base then suddenly expanded in to membranous, semi-amplexicaulous leaf base, distantly serrulate, acute or sub acute
- Flower** : **Heads compound**, axillary, sessile, containing several unflowered simple heads subtended by two leafy bracts broadly ovate-semiorbicular, winged on the back, produced into scale like appendages at apex. Pappus absent
- Fruit** : Achenes obovoides 2-3 mm long, flat, broadly winged due to persistent involucre bracts
- Seed** : 2.5-3.0 x 1.5-2.0 mm, oblong to obovate, flattened, with 2 awn like appendages at the apex
- Field spread** : Through seeds

Celosia argentea



- Family** : Amaranthaceae
- Common name** : Cock's comb
- Habit** : Annual/ semi-perrenial herb
- Stem** : Glabrous, erect herbs (with strongly ridged), up to 1.0 to 1.5 m high
- Leaf** : Alternate, simple and petiolate
- Flower** : Inflorescence is **pinkish-white**. Flowers are in spikes predominantly pink, regular and sessile
- Fruit** : Dehiscent (circumscissile), a capsule (pyriform, ovoid or globular)
- Seed** : Very small, disk shaped and glossy black in colour
- Field spread** : Through seeds

Commelina benghalensis



- Family** : Commelinaceae
- Common name** : Tropical spiderwort, Benghal dayflower
- Habit** : Annual/perennial
- Stem** : Succulent, creeping which assume an ascending position, 15 – 40 cm long, branched and rooting at the nodes
- Leaf** : **Simple, alternate, parallel-veined and ovate or elliptical**, acuminate, 3 – 7 cm long, 1 – 2.5 cm wide with a base narrowed into a petiole
- Flower** : Subtended by bracts with their edges fused to a length of about 10 mm to form a flattened funnel-shaped spathe, 1.5 cm long and wide. Flowers have three lilac blue petals 3 – 4 mm long, the lower rather smaller than the two laterals and occasionally white
- Fruit** : Pear-shaped capsule with five seeds and the capsule open when mature (dehiscent)
- Seed** : Subterranean, 2-3.5 mm long, ribbed-rough (rugose) and rayish brown in colour, sometimes appear sugar-coated
- Field spread** : Through seeds and the broken pieces of stem

Commelina diffusa



- Family** : Commelinaceae
- Common name** : Asiatic dayflower
- Habit** : Annual/perennial
- Stem** : Erect or rising (15-40 cm), branchy, glabrous
- Leaf** : **Egg-shaped**, lanceolate (2-8 cm), pointed, with wide membranous sheath, covered by thin short hairs, mainly on the lower side
- Flower** : Inflorescences on thin peduncles located in the upper leaf axils. Sepals greenish, membranous, egg-shaped (2 spliced at the base). Corolla is composed of 3 different petals: two are large, dark blue, obovate egg-shaped, uninoculated in root, third is smaller, obovate-lanceolate, pallid; stamens 3, staminodes 3, pistil with 3-ridus ovary
- Fruit** : Capsules, elliptic, 5–7 mm, and two-valved
- Seed** : Two seeds in each valve are brown-yellow, 2–3 mm long, irregularly pitted, flat-sided, and truncate at one end
- Field spread** : Through seeds and the broken pieces of stem

Convolvulus arvensis



- Family*** : Convolvulaceae
- Common name*** : Field bindweed
- Habit*** : Perennial herb
- Stem*** : **Prostrate or twining**, climbing, hardy
- Leaf*** : Arrow-shaped, simple, petiolate, alternate, 3-5 cm long and 2-3 cm wide
- Flower*** : **Funnel-shaped, solitary, white or pinkish** and 2.5-3.0 cm long
- Fruit*** : Globose, 2 celled capsule 0.60 cm long
- Seed*** : 3-angled grey brown, usually smooth or minutely tuberculate
- Field spread*** : Through underground roots and seeds

Corchorus olitorius



- Family** : Tiliaceae
- Common name** : Jew's Mallow
- Habit** : An erect annual fibrous herb.
- Leaf** : Leaves oblong, lanceolate/elliptic, 3-5.5 x 0.8-1.8 cm, basal serrature not appendaged.
- Flower** : Flowers 4 mm across. Stamens numerous, ovary 4-6 loculed.
- Fruit** : Capsule terete, to 6 cm with an entire beak, 10 ribbed, septate between seeds; seeds trigonous.
- Seed** : Seeds
- Field spread** : Gregarious weed of cultivated fields.

Cyanotis axillaris



- Family** : Commelinaceae
- Common name** : Cyanotis
- Habit** : Annual herb
- Stem** : Branched prostrate or sub-erect, fleshy annual rooting at the nodes, round, pinkish, growing to a length of 1.5 feet or more
- Leaf** : **Simple, up to 3 inches long, narrowly oblong, acute, alternate and sheathing at their base;** sheaths are dilated, clasping the stem, and ciliate with long hairs on margins and sides
- Flower** : **Blue, in axillary cymose clusters, partly hidden by the leaf sheaths**
- Fruit** : Loculicidal capsule, beaked at the top
- Seed** : Two in each cell; they are grayish, truncate at base with small conical point at the top and pitted
- Field spread** : Through seeds and the broken pieces of stem

Digera muricata



- Family** : Amaranthaceae
- Common name** : Digera
- Habit** : Erect or prostrate, annual herb becoming perennial with wide spreading branches, prostrate below.
- Leaf** : Leaves variable, ovate elliptic or rounded, acute, base rounded or cuneate.
- Stem** : Slender, glabrous.
- Flower** : **Flowers pink or greenish, in axillary peduncled spikes**; bracteate, bracts subulate, persistent; central flowers of the spike fertile, lateral ones sterile; perianth calycine, membranous, 4-5 lobed, lobes oblong, erect, the two outer larger, 5-9 nerved; stamens 5, free; ovary superior, 1-celled, 1-ovuled, compressed, truncate, style short, filiform, stigma recurved.
- Fruit** : Nut subglobose, enclosed by the perianth.
- Field spread** : Seeds
- Habitat** : Common weed of dry lands, dry land paddy

Eclipta alba



- Family*** : Asteraceae
- Common name*** : False daisy
- Habit*** : Annual herb
- Leaf*** : Simple, opposite with remotely toothed margins
- Stem*** : 25-100 cm long, erect or prostrate, well branched, slightly purple in colour, scabrous with appressed stiff hairs
- Flower*** : Inflorescence head is axillary with long peduncle, ligulate **flowers white**, tubular
- Fruit*** : Achene, brownish black in colour
- Seed*** : Wedge shaped with brownish-black in colour
- Field spread*** : Through seeds



Eclipta prostrata

- Family*** : Asteraceae
- Common name*** : False daisy
- Habit*** : Diffusely branched hirsutely strigose, annual herb.
- Stem*** : The stem is round, somewhat fleshy with strigose hairs
- Leaf*** : Leaves opposite, sessile, linear or oblong-lanceolate, subentire, narrowed at both ends, strigose.
- Flower*** : **Heads small**, axillary or terminal, peduncles slender, heterogamous, rayed; involucre ovate-obtuse or acute, broadly campanulate; bracts herbaceous, biseriate, receptacle flat; outer flowers female, fertile or sterile; corolla linear, 2-fid, ligulate, **white or yellow**; inner bisexual flowers tubular, fertile, limb 4-5 fid; anther bases obtuse; style arms short, flattened, appendages triangular, obtuse.
- Fruit*** : Achenes of female flowers triquetrous, warty, of bisexual Flowers compressed; pappus minute, toothed.
- Field spread*** : Seeds
- Habitat*** : The weed is present at all elevations in wet and garden lands particularly in dried up paddy fields.



Euphorbia hirta

- Family*** : Euphorbiaceae
- Common name*** : Garden spurge
- Habit*** : Prostrate annual herb
- Stem*** : Creeping along the ground at first and becoming erect later, 15-30 cm tall and reddish in colour with brownish crisp hairs. Stem contains milky sap and sometimes purple blotched leaves with toothed margins
- Leaf*** : Simple, opposite, 3-4 cm long and up to 1 cm wide
- Flower*** : Minute and form dense, rounded clusters in leaf axils
- Fruit*** : Small capsules, sharply trigonous, smooth, adpressed-pubescent
- Seed*** : 0.8 x 0.5 mm, ovoid-quadrangular, with a few shallow transverse ridges on each face, grey when mature, otherwise pinkish, ecarunculate
- Field spread*** : Through seeds



Ipomea alba* Syn. *Calonyction bona-nox

- Family*** : Convolvulaceae
- Habit*** : Massive twine spreading wide on trees.
- Leaf*** : Leaves cordiform, 10-15 x 10-15 cm, pustulate.
- Flower*** : Flower(s) solitary or cones; peduncle up to 15(20) cm. calyx-lobes subequal, broadly ovate. Corolla white, 15cm across, salverform. Stamens subequal, exerted. Ovary 2-locular, each 2-ovulate; style exerted. Flower opening at night and closing by 11 a.m.
- Fruit*** : Capsule 4-lobed, 3 x 2 cm; seeds 1 x 0.8 cm, densely white-pubescent.
- Field spread*** : Seeds
- Habitat*** : Garden land conditions and dry land paddy

Ipomea carnea ssp. fistulosa



- Family*** : Convolvulaceae
- Habit*** : Erect shrub to 2(3) m.
- Stem*** : Branchlet hollow. Leafy, stem with milky latex.
- Leaf*** : Leaves broadly ovate, deltoid, to hastate, 8-15(20) x 4-7(10) cm.
- Flower*** : Panicles to 10 cm. Calyx-lobes subequal. Corolla pink to rose, 7(10) cm across, funnel-form. Stamens hairy below. Flower slowly fading by noon.
- Fruit*** : Capsule 1.5 cm across; seeds hairy; hairs long, brownish, woolly.
- Field spread*** : Seeds
- Habitat*** : Marshy canals and bunds

Ipomea pestigridis



- Family** : Convolvulaceae
- Habit** : Twiner
- Stem** : Branchlets hispid.
- Leaf** : Leaves palmately 5-9-lobed, lobes obovate, 3-5 x 1.5-2.5 cm, sericeous; petiole to 8 cm
- Flower** : Flowers subsessile, in capitate clusters; peduncle to 8 cm. calyx-lobes unequal. Corolla white/pink, 4 cm across, funnel-form
- Fruit** : Capsule globose, 0.8 cm across; seeds pubescent; hairs in small tufts
- Field spread** : Seeds
- Habitat** : Often grown in arable lands.

Ipomea sepiaria



- Family*** : Convolvulaceae
- Habit*** : Slender vine
- Stem*** : Branchlet hirsute
- Leaf*** : Leaves triangular-cordiform, 2-4 x 2-3 cm
- Flower*** : Flowers in subumbellate cymes; peduncle to 10 cm. calyx-lobes subequal. Corolla cream, with a purple throat, 4 cm across, salver-form. Flower opening by 9 a.m.
- Fruit*** : Capsule globose, 0.8 cm across; seeds white-velvety
- Field spread*** : Seeds
- Habitat*** : Growing in arable lands, common in fields of canal irrigated area.

Merremia emarginata



- Family** : Convolvulaceae
- Habit** : A much branched, creeping, annual or a biennial herb.
- Stem** : Branches are prostrate, slender and hairy; densely cover the ground and root at nodes. Young shoots grow erect a few inches and are pinkish in colour.
- Leaf** : Leaves are small, or ovate-cordate and broader than long on petioles 1-1½ inches across, simple, alternate, usually kidney-shaped or ovate-cordate and broader than long on petioles 1-1½ inches long which are often bent at base and longer than the blade.
- Flower** : Flowers are small, yellow, 6-8 mm long, axillary, solitary or in clusters of 2-3, usually on short and rarely on a long peduncle. Bracts are small, ovate acute and hairy. Calyx consists of five sepals, the outer two being shorter than the three oblong inner ones. Corolla is yellow and glabrous, the limb being five-lobed. Stamens are five, sub-equal, attached to the base of the corolla and filaments are flat. Ovary is superior with four ovules; style is erect and stigma is bi-globose.
- Fruit** : Small somewhat globose, smooth capsule surrounded by the persistent calyx. Seeds are two, one in each cell, glabrous, round on the back and flat on the inner face and dark grey in colour.
- Field spread** : By seeds and bits of branches
- Habitat** : Black cotton soils and also in damp places

Oldenlandia umbellata



- Family*** : Rubiaceae
- Common name*** : Indian Madder, Chay Root.
- Habit*** : Dichotomously branched herb. Biennial or perennial herb.
- Stem*** : Branches are either prostrate or ascending and woody at the base
- Leaf*** : Leaves narrow opposite, stipulate; stipules interpetiolar.
- Flower*** : Flowers epigynous; white, occurring in umbels; calyx 4-5, persistent, teeth short, subulate; corolla tube short, 4-5, valvate; stamens 4-5, epipetalous; ovary inferior, bicarpellary, syncarpous, bilocular; ovules many attached to axile placenta.
- Fruit*** : Fruit a rounded capsule.
- Field spread*** : Seeds and root bits
- Habitat*** : A very common dry land weed particularly in red soils and rainfed

Oxalis corniculata



- Family** : Oxalidaceae
- Common name** : Indian Sorrel
- Habit** : A creeping herbaceous perennial weed with long-stalked trifoliate
- Stem** : Stem creeping.
- Leaf** : Leaves radicular cauline, usually digitate, leaflets obcordate
- Flower** : Flowers yellow, umbellate on slender long peduncles; sepals 5, fused, imbricate; petals 5, free; stamens 10 in two whorls of 5 each; ovary superior, pentacarpellary, syncarpous; ovules many attached to axile placenta
- Fruit** : Fruit a loculicidal capsule
- Field spread** : Seed
- Habitat** : Common weed occurring in moist situations and garden land and rainfed rice

***Phyla nodiflora* (Syn. *Lippia nodiflora*)**



- Family** : Verbenaceae.
- Common name** : Frog fruit
- Habit** : Prostrate herb widely creeping and rooting, minutely hairy.
- Stem** : Ascending stem, rooting at nodes.
- Leaf** : Leaves cuneate spathulate serrate towards apex.
- Flower** : Often aromatic influence a dense spike, globose at first, afterwards elongating, peduncles usually single; bracts broadly obovate, apiculate; calyx membranous 2 to 4 lobed 2-valved; corolla small salver shaped 2-tiped upper lip, bifid lower 3-lobed; stamens 4, didynamous; ovary bilocular, single ovule in each locule.
- Fruit** : Fruit small, seed exalbuminous.
- Field spread** : Seeds, stem bits
- Habitat** : A weed of wet ground and grassy pastures.

Portulaca oleracea



- Family*** : Portulacaceae
- Common name*** : Indian Purslane
- Habit*** : Herbs, usually succulent
- Stem*** : The main stem is short and erect bearing a number of lateral branches which lie prostrate on the ground; they grow to a length of 4-20 inches and are green or reddish in colour
- Leaf*** : The leaves are alternate at the base, sub-opposite or opposite at the ends of branches and crowded round the flowers. A well developed leaf is 1 inch by ½ inch; tip is rounded; the base is tapering and the margins are red or green. The lower surface of the leaf is pale and is covered with glistening dots. The leaf-stalk is short
- Flower*** : Flowers are without stalks, from 2-6 in number and are collected together in clusters at the ends of branches. Sepals are 2 and fleshy; they are united at the base and are free above. Petals are 5 and are yellow in colour. Stamens vary in number from 8-20 and surround the ovary. The ovary is 1-celled, many ovuled and is half inferior; styler branches are from 3-6
- Fruit*** : Fruit is dry, dehiscent transversely by the upper part enclosed by the sepals, coming off as a lid leaving the lower part in the plant. Seeds are minute, blackish brown in colour and are covered with concentric lines of tubercles
- Field spread*** : By seed
- Habitat*** : Moist areas in dry lands

Rotala densiflora



- Family*** : Lythraceae.
- Habit*** : An annual herb with many divaricating, floriferous branches.
- Stem*** : Stem quadrangular rooting at the base.
- Leaf*** : Leaves small, sessile, opposite, elliptic.
- Flower*** : Flowers in axillary clusters; calyx 3-6, tube campanulate; corolla 3-6, pink and persistent; stamens 1-6; ovary superior, bicarpellary, 2-4 celled.
- Fruit*** : Fruit is small, red, globose capsule partly enclosed by the persistent calyx and dehiscing late by three valves. Seeds are straw coloured, somewhat round or broadly ellipsoid and concave on the inner faces.
- Field spread*** : By seed.
- Habitat*** : A common wet land weed.

Rungia repens



- Family** : Acanthaceae
- Stem** : The stem is round or four-sided and sparsely hairy. Branches are spreading and they vary in length from 10-16 inches. Roots are produced at each of the basal nodes that touch the ground. The root system is shallow and consists of a tap-root with numerous lateral roots.
- Leaf** : Leaves simple, linear – oblong to lanceolate, acute or subobtuse, nearly glabrous, sessile.
- Flower** : Flowers white, blue or pink, hypogynous, bracteate inconspicuous, broad peduncled spikes with 2 rows of bracts; bracts orbicular, 4-ranked, scariously margined, regularly imbricating, ciliate and apiculate; bracteoles small, linear lanceolate, minutely pubescent; calyx 5-partite, segments linear – lanceolate, pubescent; corolla white with rose or purple spots, 2-lipped, lower lip 3-lobed, upper lip broad, emarginate, 2-lobed; stamens 2; ovary glabrous, superior, 2-celled, syncarpous, ovules 2 in each cell, style filiform, thinly hairy at the base, stigma bifid.
- Fruit** : Capsule thinly hairy; seeds concentrically rugose, ovoid, compressed.
- Field spread** : Seed
- Habitat** : A wet land weed common on bunds along water channels and other moist places; rarely in cultivated fields; flowering and fruiting from June - February.

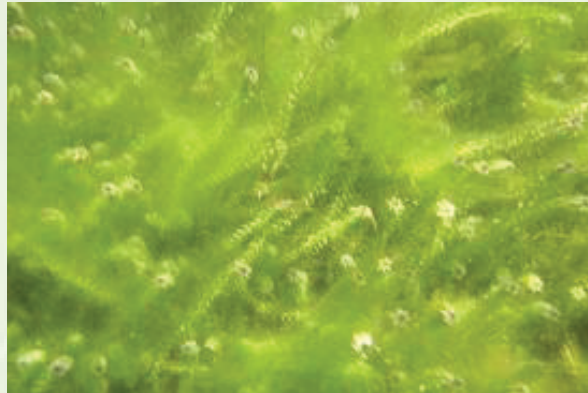
Chemical control of Broad Leaved Weeds

Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
2,4-D Na 80 WP	0.80	20-25 DAT	BLW
2,4-D EE	2.5-3.75	25-30 DAS / DAT	BLW
Bensulfuron-methyl 60 DF	0.060	20-25 DAT	BLW
Almix 20 WP + Surfactant (0.2%)	0.004	20-25 DAS	BLW
Bispyribacsodium	1-1.25	25-30 DAS	BLW
Ethoxysulfuron 15 WSG	0.015	15 DAS	BLW
Triasulfuron 20 WP	0.006 -0.009	7-12 DAT	BLW
Butachlor + Safener 50 EC	1.50	0-3 DAS	Annual grasses, some BLW
Pretilachlor + Safener 50 EC	0.60	0-3 DAS	Annual grasses, some BLW
Pendimethalin 30 EC	1.50	3-5 DAS	Grasses and some BLW

Aquatic weeds

Sl.No.	Scientific Name	Family
1	<i>Algae</i>	
2	<i>Azolla</i>	Salviniaceae/Azollaceae
3	<i>Chara zeylanica</i>	Characeae
4	<i>Eichornia crassipes</i>	Pontederiaceae
5	<i>Hydrilla verticillata</i>	Hydrocharitaceae
6	<i>Ipomea aquatica</i>	Convolvulaceae
7	<i>Leptochloa chinensis</i>	Poaceae
8	<i>Ludwigia perennis</i>	Onagraceae
9	<i>Marsilea quadrifolia</i>	Marsileaceae
10	<i>Monochoria vaginalis</i>	Pontederiaceae
11	<i>Pistia stratiotes</i>	Araceae
12	<i>Potamogeton distinctus</i>	Potamogetonaceae

Algae



Habit : Aquatic or semiaquatic

Stem : Not differentiated

Leaf : Not differentiated

Habitat : Heavy growth may give the color to the water body green/yellow/red/black and form water blooms/ scum. Source of food for many aquatic fish.

Azolla



- Family** : Salviniaceae/Azollaceae
- Common name** : Water velvet
- Habit** : Free floating aquatic fern
- Root** : Emanating from growing branches remained suspended in water.
- Plant** : Dichotomously branched, shape of Indian spp. is typically triangular. **The dorsal lobe remains exposed to air is having a specific cavity containing symbiotic bacteria Blue Green Algae(BGA)called Anabaena azolae.**
- **The fern is capable of fixing atmospheric nitrogen in the soil.** Mostly seen in rabi season
- Habitat** : Moist soils, ditches marshy ponds of topical belt.

Chara zeylanica



- Family*** : Characeae
- Common name*** : Filamentous Algae, musk grass
- Morphology*** : Single celled, joined end forming a single tread.
- Habit*** : Aquatic or semiaquatic
- Leaf*** : Branched filaments, nets or forked leaf like forms.
- Habitat*** : Capable of changing odious and quality of water.

Eichornia crassipes



- Family** : Pontederiaceae
- Common name** : Water hyacinth
- Habit** : Free floating aquatic weed
- Leaf** : Whorled The petioles are smooth and hollow, allowing oxygen flow up the petiole and buoyancy. The leaf blade is smooth and leathery. It is round but appears a bit spade-shaped
- Average Height** : Ranges from a few inches to over a meter
- Inflorescence** : Raceme, with 6-7 flowers, pedicels attaching to a single axis
- Flower** : Actinomorphic or radially symmetric The flowers have both male and female parts. Corollas are made up of six petals arranged in a circular rotating position. Every corolla features a “beacon” petal. The top petal has a dark purple-blue spot in the center of it. Within this area is a bright yellow spot. This spot could be a beacon to attract insects that would help pollinate the flower. Three long stamens that are easily visible and three more shorter stamens are found deeper within the corolla. The green, ovary unicarpellate is positioned inferiorly, at the bottom of the corolla. Running from the ovary up to the stigma. At the end of the style is the stigma. The tiny white stigma is funnel shaped and resembles a brush turned upside-down.
- Field spread** : Vegetative
- Habitat** : Freshwater marshes, ponds and waterways of Temperate to tropical regions. Hyacinths cover the entire surface they grow on, blocking out sunlight and oxygen to anything trying to live beneath

Hydrilla verticillata



- Family*** : Hydrocharitaceae
- Common name*** : Hydrilla
- Root*** : Perennial plant **forming dense colonies**. Branches profusely after reaching the surface extends across forming **thick mats**.
- Leaf*** : Leaves blade like with small tooth margins and spines on the underside of the midrib which make them feel rough
- Field spread*** : by fragmentation, from seeds, from turions (axillary buds), tubers.



Ipomea aquatica

- Family*** : Convolvulaceae
- Common name*** : Floating morning glory
- Habit*** : Trailing twine with milky sap.
- Stem*** : Hollow upto 2m long or more, rooting at the node, floating in aquatic situation.
- Leaf*** : Oblong- lanceolate (**arrow head shaped**)
- Flower*** : Showy, funnel form like morning glory blooms, solitary or few flowered clustery at leaf axils, petals white to pink-lilac.
- Fruit*** : Oval or spherical capsule with 1-4 grayish seed often short – hairy.
- Habitat*** : Wet lands, water courses.

Leptochloa chinensis



- Family*** : Poaceae
- Common name*** : Chinese sprangle top
- Habit*** : Annual/perennial grows up to 120 cm.
- Description*** : Ligule is membranous/hairy.
- Field spread*** : Seed, cuttings of culm or root stocks
- Habitat*** : Marshy fields and uplands

Ludwigia perennis



- Family** : Onagraceae
- Habit** : An erect annual aquatic herb growing up to 60 cm.
- Stem** : Stem is smooth, pinkish and angular.
- Leaf** : Leaves linear or linear-lanceolate, simple, alternate.
- Flower** : Flowers are axillary, solitary, or in cluster of 2-3, subsessile with 2, leaf-like bracteoles at base. Calyx lobes are 4-5, lanceolate and acute; petals are 4-5, yellow, elliptic and inserted below an epigynous disk. Stamens are 4-5, opposite the calyx lobes. Ovary is inferior, four-celled, with numerous ovules in many rows; style is erect and stigma is rounded.
- Fruit** : Fruit is 8 mm long, somewhat four-sided, pinkish or green with the calyx persisting at the top. It first opens by means of a hole at the apex and then by the walls breaking irregularly. Seeds are numerous, minute, ellipsoid, pink in colour and each with a small yellow raphe.
- Field spread** : By seeds
- Habitat** : A common weed in rice fields and other wet places.

Marsilea quadrifolia



- Family*** : Marsileaceae
- Common name*** : The Water Fern.
- Habit*** : Amphibious herb with procumbent rhizomes
- Stem*** : The stem is a long creeping stolon, rooting at the nodes.
- Leaf*** : Leaves are erect on long petioles. Leaflets are 4, rather large, obovate and entire on the margin. Veins are many and forking.
- Flower*** : Though it very much resembles a flowering plant is only a fern ally.
- Fruit*** : There are a few, small, shortly stalked, hard, oblong fruiting bodies called the sporocarps at the base of the petiole and attached to it.
- Field spread*** : Stolons and spores
- Habitat*** : Occurs in marshy areas, also in rice fields and floating in running water.

Monochoria vaginalis



- Family*** : Pontederiaceae
- Habit*** : A shallow rooted aquatic herb, commonly growing in fresh water and marshy areas.
- Stem*** : Root-stock short and suberect.
- Leaf*** : Leaves linear or narrowly ovate with cordate base, 5 to 15 cm long, pedicel long.
- Flower*** : Flowers in racemes, usually blue spotted with red; petaloid; perianth; 1-6 stamens, inserted at the base of the perianth; ovary superior, tricarpeled, 3 celled with many ovules in each cell.
- Fruit*** : Fruit a capsule.
- Field spread*** : By seed and also by root-stock.
- Habitat*** : A common wet land weed.

Pistia stratiotes



- Family*** : Araceae
- Common name*** : Water lettuce
- Root*** : White fibres, can hang up to 30cm below the water surface.
- Leaf*** : Thick green leaves arrayed in a circle and stems and looks like a rosette. Leaf surface covered with fine hairs that give texture like velvet, thick spongy and trailing. Young leaves are rounded in appearance and older leaves are more spatulate.
- Plant*** : Looks like a floating lettuce
- Habitat*** : Floating nuisance, clogging water ways, tropical fresh water bodies, irrigation canals

Potamogeton distinctus



- Family*** : Potamogetonaceae
- Common name*** : Pond weed
- Description*** : Turions (yellow banana shaped over wintering structures) produce a thin rhizome with one or more stems when water temp begins to rise in the spring, it grows rapidly and produce maximum vegetative growth. The stem elongation is maximal in absence of oxygen.
- Leaf*** : The leaves are alternate, typically thin, translucent, submerged and some floating leaves become more leathery. Presence of delicate membranous sheathing scale at leaf axil is imp diagnostic part.
- Flower*** : Spike with 4 rounded segments.
- Field spread*** : Turions, seed
- Habitat*** : Quiet or slow flowing fresh water aquatic habitats

Chemical control of aquatic weeds

Herbicides effective only before flooding			
Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
Pendimethalin 30 EC	1.50	3-5 DAS	Grasses and some BLW
Herbicides effective after flooding / in deep waters			
2,4-D Ester	0.5-1	3-4 leaf stage on foliage	Scirpus spp, Sagittaria, Eichhornia, Ceratophyllum
2,4-D Amine	0.5-1	3-4 leaf stage on foliage	Scirpus spp, Sagittaria, Eichhornia, Ceratophyllum
2,4-D sodium	0.5-1	3-4 leaf stage on foliage	Scirpus spp, Sagittaria, Eichhornia, Ceratophyllum
Copper sulfate	1ppm	Post-emergent applicant	Chara, Algae
Simazine	0.5 ppm	Apply to total water volume	Pistia, Algae, Potamogeton, Lemna, Wolffia
Paraquat	0.5 kg	3-4 leaf stage on foliage	Scirpus spp, Sagittaria, Typha, Eichhornia
Diquat	1 ppm	Below water surface	Potamegeton, Najas, Lemna, Ranunculus, Pistia, Ceratophyllum
Glyphosate	1.5 – 2 + surfactant 1%	Active growing plants at bloom stage	Typha, Phragmites

WEED MANAGEMENT

Critical period of crop weed competition: The period during which crop weed competition causes highest economic losses, has been identified for different ecosystems.

- 1) Transplanted irrigated rice - 4-6 weeks after planting
- 2) Direct sown rice puddled - 10-45 days after sowing
- 3) Upland direct sown rice - upto 6 weeks after sowing

Weed control: Reducing weed density or damage to an acceptable level by different preventive methods.

- Using clean seed
- Keeping the farm clean
- Using certified seed

Eradication:

- Removing weed completely from the field.
- Exterminating the seeds in soil by applying soil sterilants or by burning

Cultural practices:- to increase the competitive ability of rice and enable it to suppress weed growth.

Tillage practice:- Premonsoon dry tillage, deep ploughing, puddling etc.

Crop husbandry practices

1. **Stale seed bed method:-** Summer ploughing followed by rain or irrigation to germinate weeds. The weeds germinated are controlled by using contact herbicides like Glyphosate, @ 8 – 10 ml / 1 lt of water. One or two flushes of weeds are destroyed and seed sown in clean weed free seed beds.

2. Selection of varieties

- Using seed with higher germination and vigour
- Maintaining optimum plant population
- Adopting proper planting time and method
- Seed treatment with pesticides, dormancy breaking chemicals and germination boosters

3. Selective crop simulation:- Crop growth can be simulated in favour of crop by application of soil amendments e.g: lime, gypsum, Farm yard manure etc. Inoculation of crop seed with N or P solubilizing bacteria. Foliar application of nutrients to crop plants.

4. Following Good Crop Rotations:- Cereal–cowpea, Cereal–luncern n crop rotation helps in reducing persistence of weeds

5. Smoother crop growing:- Capable of germinating very quickly, develop large canopy and possess excellent root system and smother the ground within no time e.g: cowpea, luncern, berseem, millets.

6. Intercropping:- In this the intercrop is fast growing and effective in suppressing weeds. The crops themselves act as tools of weed management.

7. Lowering area under bunds:- Bunds are housing many weeds and reducing no of bunds and width of bunds and maintain clean and weed free bunds by applying contact herbicides in fallow period.

8. Flooding:- It is known to be effective in controlling all terrestrial weeds and is accepted worldwide crop husbandry practice. Submerging yields for 2 weeks or more excludes oxygen from micro environment and control the weeds.

Mechanical practices

1. Hand weeding
2. Rotary weeder
3. Hand hoeing
4. Spudding
5. Sickling

Biological methods

Biological agents such as insects, mites and fungi are successful in controlling weeds. But they are highly selective, work slowly and hence not popular among rice farmers. Community action is needed to make this practice feasible on large scale.

Chemical weed control methods

Herbicides are one of the most labor-saving innovations in rice farming. Herbicide application avoids much of the drudgery of weeding and makes farming more attractive. Herbicides can be applied over large areas in a short time, making the timely application possible provided the dosage should be taken care of.

Herbicide selectivity: Some herbicides are selective and ability to kill some plants without damaging crop plants. Care should be taken or avoiding high doses of non selective herbicides as they kill all plants. e.g. Grass weed killer kills grass weed effectively and not the broad leaved weeds.

Timing of herbicide application:

Pre-emergence incorporated (soil applied)

Advantages:

- Early control of weeds, minimizing competition.
- Where wet or windy weather after emergence can delay spraying.
- Planting and herbicide application may be done in one operation.

Disadvantages:

- Less effective under dry or cold soil conditions.
- Perennial weeds are generally not controlled.
- On sandy soils, heavy rains may leach the herbicide down to the germinating crop and cause injury.

- Wet or windy conditions after seeding can delay application until crop emergence and prevent herbicide application.
- Planting may be slowed down by combining planting and herbicide application.
- Residue may restrict crop competition the following year.
- Soil erosion may be a problem, as additional tillage for incorporation is required.

Pre-plant incorporated (soil applied)

Advantages:

- Early control of weeds, minimizing competition.
- Where wet or windy weather after emergence can delay spraying.
- Work load is distributed.

Disadvantages:

- Perennial weeds are generally not controlled.
- Less effective under dry or cold soil conditions.
- Residue may restrict crop rotation the following year.
- Soil erosion may be a problem, as additional tillage for incorporation is required.

Pre-emergence incorporated (soil applied)

Advantages:

- Early control of weeds, minimizing competition.
- Where wet or windy weather after emergence can delay spraying.
- Planting and herbicide application may be done in one operation.

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Disadvantages:

- Less effective under dry or cold soil conditions.
- Perennial weeds are generally not controlled.
- On sandy soils, heavy rains may leach the herbicide down to the germinating crop and cause injury.
- Wet or windy conditions after seeding can delay application until crop emergence and prevent herbicide application.
- Planting may be slowed down by combining planting and herbicide application.
- Residue may restrict crop competition the following year.
- Soil erosion may be a problem, as additional tillage for incorporation is required.

Post-emergence (Foliar applied)

Advantages:

- Type and density of weed can be seen before herbicide application.
- Soil texture does not directly affect herbicide choice or performance.
- Soil moisture has little influence on level of control.
- Few post emergent herbicides leave a soil residue which will restrict subsequent cropping rotation.
- Incorporation tillage is not required.
- Top growth control of several perennial weeds is possible.

Disadvantages:

- Specific stage of crop and weed are required
- Different times of emergence may be a problem.

- Flush of weeds after spraying generally not controlled.
- Wet or windy weather can delay application.

Computations for field use

➤ The quantity of water required for spraying a given area =
$$\frac{\text{area to be sprayed in m}^2 \times \text{sprayer output in lit/ha}}{10,000}$$

➤ Area to be sprayed on the basis of sprayer capacity =
$$\frac{\text{sprayer capacity (lit)} \times 10,000}{\text{sprayer output (lit/ha)}}$$

➤ Calculation of herbicides for a given area =
$$\frac{\text{recommended dose of a.i. (kg/ha)} \times 100 \times \text{area}}{\% \text{ concentration in formulated product}}$$

Table: Recommended chemical herbicides for different rice eco-systems

Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
Pre-planting herbicides for complete killing of all weeds and vegetation before planting			
Glyphosate 41 SL	0.75-1.50	15 DBT	All vegetation (Specially wild and weedy rices, some sedges)

Table: Recommended chemical herbicides for nursery

Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
Butachlor 50 EC	25 ml/250 m ²	8-10 DAS	Annual grasses and some sedges
Pretilachlor	60 ml/250 m ²	8-10 DAS	<i>Ischaemum</i> , annual grasses and some BLW

Table: Recommended chemical herbicides for irrigated rice

Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
2,4-D Na 80 WP	0.80	20-25 DAT	BLW
Butachlor 50 EC	1.50	5-7 DAT	Annual grasses and some sedges
Benthiocarb 50 EC	1.50	5-7 DAT	Annual grasses
Butachlor + 2,4 - DEE 50 EC + 36 EC	1.0+0.4	5-7 DAT	Grasses and BLW
Pretilachlor 30 EC	0.50-0.75	3-7 DAT	<i>Ischaemum</i> , annual grasses and some BLW

Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
Anilophos 30 EC	0.30-0.40	5-7 DAT	Annual grasses and some BLW
Anilophos + Triclopyr -BGE 30+30 EC	1.25	3-5 DAT	Grasses and BLW
Anilophos+ Ethoxysulfuron 21+1 SC	0.375 + 0.015	10 DAT	Grasses and BLW
Acetochlor 90 EC	0.075	3-5 DAT	Grasses
Cinmethalin 10 EC	0.050-0.075	7 DAT	Grasses
Cinmethalin+ 2,4-DEE (50 EC)	0.375-0.500	7 DAT	Grasses and BLW
Oxyfluorfen 25 WP	0.10	5-7 DAT	Annual grasses, some BLW
Oxadiargyl 6 EC / 80 WP	0.15	5-7 DAT	Annual grasses, some Sedges
Pyrazosulfuron-ethyl 5 WP / 10WP	0.005-0.020	5-7 DAT	Echinochloa sp.
Penoxulam 24 SC W/V	0.020	8-12 DAT	Annual grasses, some BLW
Bensulfuron-methyl 60 DF	0.060	20-25 DAT	BLW
Bensulfuronmethyl 60 DF + Pretilachlor 50 EC (6.6 G)	0.06 + 0.60	0 -5 DAT	Grasses and BLW
Fenoxaprop – p-ethyl 7.5EC	0.056	15-20 DAT	Annual grasses

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Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
Fentrazamide 50 WP	0.12 - 0.15	4-7 DAT	Grasses
Flufanacet 60 WP	0.12	3-5 DAT	Grasses
Chlorimuron + Metsulfuron-methyl 20 WP (Almix)	0.004	20-25 DAT	Grasses and annual BLW
Bispyribacsodium 10% 10SC	25 ml/ha	15DAT	Grasses and annual BLW
Almix + butachlor 20WP + 50EC	0.004+ 0.938	3-5 DAT	Grasses and BLW
Penoxsulam 24SC	25gm/ha	7-10 DAT	Grasses, aquatic weeds
Triasulfuron 20 WP	0.006 -0.009	7-12 DAT	BLW
Triasulfuron + Pretilachlor 20WG+50EC	0.006 + 0.500	5-7 DAT	Grasses and BLW
Copper sulphate	15 – 20 kg	As and when appear	Algae and Scum

Table: Recommended chemical herbicides for irrigated rice direct sown rice

Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
Butachlor + Safener 50 EC	1.50	0-3 DAS	Annual grasses, some BLW
Pretilachlor + Safener 50 EC	0.60	0-3 DAS	Annual grasses, some BLW
Ethoxysulfuron 15 WSG	0.015	15 DAS	BLW
Anilophos + Ethoxysulfuron 21+1 SC	0.375 + 0.015	5-7 DAS	Grasses, and BLW
Cyhalofop-butyl 10 EC	0.06	10 DAS	Grasses
Almix 20 WP + Surfactant (0.2%)	0.004	20-25 DAS	BLW
Bispyribacsodium 10% 10SC	25 ml/ha	15DAT	Grasses and annual BLW

Table: Recommended chemical herbicides

Chemical Name	Dosage (kg a.i./ha)	Time of application	Effective on
Pendimethalin 30 EC	1.50	3-5 DAS	Grasses and some BLW

(Source: DRR – AICRIP - Progress Reports 1978-2010)

DBT: Days before transplanting

EC: Emulsifiable concentrate

SC: Soluble concentrate

DAT : Days after transplanting

WSG : Water Soluble Granules

DF : Dry formulation

DAS : Days after sowing

WP: Wet table powder

Interaction of herbicides with other Agro-chemicals

Fertilizer herbicide interactions

Mixed for convenience of application, energy saving or to increase the efficiency of herbicides.

N fertilizers increase the efficiency of absorption translocation of herbicides.

e.g., Phytotoxicity of glyphosate increased by adding 0.5% $(\text{NH}_4)_2\text{SO}_4$ on Imperata, Agropyron. Tank mixing $(\text{NH}_4)_2\text{SO}_4$ increases 2, 4 D, activity $(\text{NH}_4)_2\text{NO}_3$ @ 10 kg/ha along with 2,4-D reduced weed population.

- Phosphorus fertilizers increase the phytotoxicity of herbicides.
- Mixed fertilizers + herbicides increase susceptibility of weeds to herbicides.
- Herbicides are physically and chemically compatible with suspension fertilizers.
- Solid, dry fertilizers can be mixed with powder form herbicides
- **Nutrient absorption:-** 2, 4 D., Dicamba decreased N uptake.

Herbicide Insecticide Interactions

- Herbicides and insecticides are often applied together or sequentially in a short time period. These are not harmful when applied at recommended dosages. Sometimes the activity of herbicide may be altered in the presence of insecticide.

Soil applied insecticides

- The selectivity of soil applied herbicides depend on the location of actively absorbing root system. Generally the crop roots are in deeper and lower layers than weed's roots and therefore weeds absorb higher amounts of herbicide.
- Some soil applied insecticides (organophosphates like phorate promote growth of crop root system in surface layers, resulting in higher uptake of herbicides (Triazines / urea group) and injury to crops.
- To reduce crop injury by atrazine, insecticides are applied post emergence instead of pre-emergence.
- If herbicides and insecticides are compatible - it is more economical to apply herbicides and insecticides.

Seed treated insecticides

When pre-emergence herbicides are applied, Carbamate insecticides (carbofuron) used for seed treatment against soil borne and early stage insect pests; increases the crop uptake of herbicides resulting in reduced crop growth. e.g: barley, maize.

Foliar applied insecticides

When carbamates, organophosphate insecticides and herbicides are tank mixed / sprayed separately in a day interval, increase the absorption of herbicide into the crop plants and reduce their break down resulting in toxicity.

Herbicide-pathogens, herbicide-fungicide interactions

Herbicides interact with fungicides as well as disease causing organisms. Some herbicides decrease the severity of diseases due to their toxic effect on pathogen or by their effect on morphology of plants.

- Some herbicides interact with pathogens and cause more injury.
- Some herbicides weaken the plants and make them susceptible to diseases.
- Some fungicides reduce the uptake of other herbicides and reduce phytotoxicity.

General guidelines

Precautions in herbicide use:

- Correct concentration is essential.
- Correct dosage and application at the proper stage of weed growth is a “MUST”
- Incorrect dosage and untimely application would lead to phytotoxicity. This is more in the case of direct seeded rice.
- Effectiveness of a herbicide is related to proper water management practices.
- Untimely fertilizer application adds to the weed problem.
- No herbicide is completely free from phytotoxicity particularly on direct sown rice.
- Proper water management practices.

A Ready Reckoner for Rice Weeds

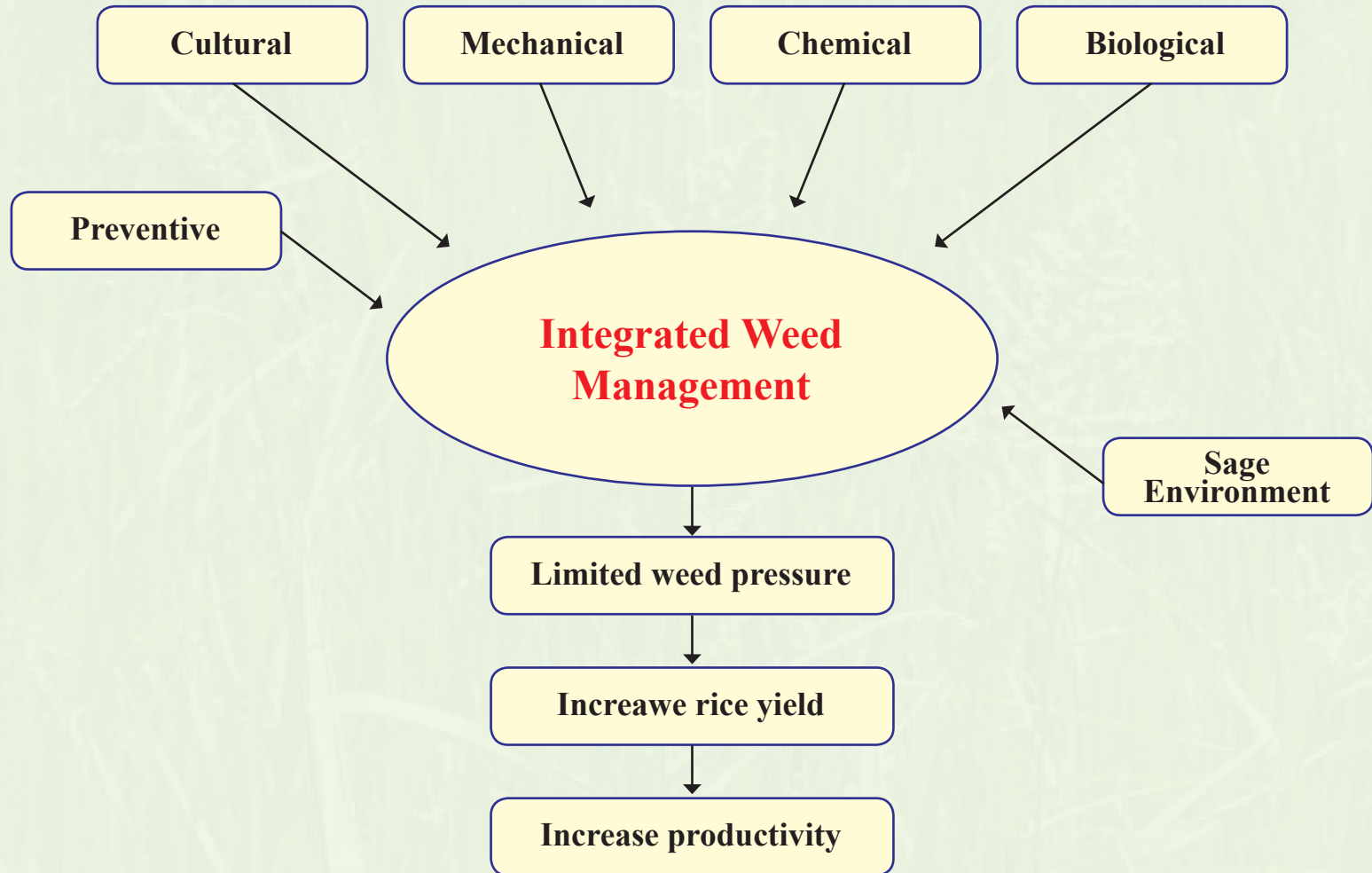
Steps to Reduce Herbicide Use

- Use herbicides only when weeds are in the susceptible stage
- Use herbicides only when weather and soil conditions are appropriate for effective control
- Use Wipe-on technology where appropriate for weeds growing above the crop
- Use band treatments over the row and cultivation between rows
- Selective flaming or steam treatment may be appropriate in some situations (more research needed)
- Use winter cover crops to reduce winter annual weed seed production
- Use rotary hoe and precision cultivators when possible
- Properly maintain application equipment and accurately calibrate
- Maximize competition from beneficial plants
- Think weed PREVENTION
- Read the herbicide label before use

Intergrated weed management

Intergrated weed management (IWM) is to use a combination of different practices to maintain weed densities at manageable levels by

1. Suppression of weed growth
2. Prevention or suppression of weed seed production
3. Reduction of weed seed reserves in the soil
4. Prevention or reduction of weed spread



GLOSSARY

Abaxial	Facing away from the axis
Accrescent	Increasing in size with age
Acuminate	Tapering gradually to a sharp point, as the tips of certain leaves.
Achene	A small, hard, 1-seeded, dry indehiscent fruit.
Acute	Sharp or pointed
Alternate	Describes leaves that are not opposite to each other on the axis, but arranged singly at different heights
Anthocarp	A pseudocarp consisting of the true fruit and the base of the perianth
Apex	The top or tip of a seed.
Apiculate	Ending abruptly with a sharp, flexible tip.
Appendage	An attachment or extension to the main body of the seed.
Attenuate	Tapered, narrowed.
Annual	A plant whose life cycle is of only one year's duration
Auricle	An ear shape appendage (lobe).
Awns	A bristle like appendage at the tip
Axillary	Situated in the axil.
Biennial	A plant with a life cycle that is completed in 2 years, with second year usually devoted to flowering and fruiting

Bristle	A hair like prickle.
Bulb	A modified underground bud with scale.
Bulblet	Bearing bulbs
Bur	A rough prickly husk covering fruit or seeds.
Capsule	A dry dehiscent fruit.
Calyx	The outer ring of floral parts or all the sepals considered together.
Caryopsis	A dry, indehiscent, one-seeded fruit in which the seed coat is fused to the pericarp in the hilar region, mostly in grasses.
Composite flower-	A dense cluster of sessile or nearly sessile flowers on a very short axis; heart-shaped
Compound	composed of several similar parts.
Concave	Surface curved downward.
Convex	Surface curved upward.
Corolla	Interior series of perianth
Crenate	Toothed with rounded teeth
Crescent	Shaped like the curve shape of moon
Culm	Hollow stem of inter internodes
Cuneate	Wedge-shaped
Cymose	A centrifugal inflorescence in which the secondary or lateral branches continued to grow and may extend beyond the main axis.

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Cypsela	An achene fruit derived from an inferior ovary.
Deciduous	Falling off, not persistent.
Decurrent	Prolonged downwards from the base.
Dehiscent	Splitting open at maturity to release contents.
Dentate	Sharply toothed.
Dicot	a plant with 2 cotyledons or seed leaves, netted leaf venation, and branched tap roots. Floral parts occur in groups of 4 or 5.
Decompounded	divided several times.
Diffuse	widely spread.
Digitate	a compound structure whose members arise and diverge from the same point; like the fingers of the hand.
Echinate	Beset with prickles or spines.
Ellipsoid	An elliptical solid body.
Elliptic	Narrow at the ends and broad near the centre
Elongate	Much longer than wide.
Erect	Vertical or upright.
Floret	A small flower.
Flower	the reproductive part of the angiosperms
Geniculate	Bent abruptly like a knee

Glabrescent	Becoming glabrous in age.
Glabrous	Without any kind of hairs
Globose	Globe-shaped
Glomerules	A small compact cluster.
Glume	Outer empty floral bracts of grasses.
Hermaphrodite	With bisexual flowers.
Inflorescence	The deposition of flowers on the floral axis
Involucre	A circle or collection of bracts surrounding a flower cluster or head, or a single flower.
Lanceolate	Shaped like a lance-head.
Lax	loose, distant.
Leaf sheath	the lowest part of the leaf enclosing the stem.
Lemma	The lower of the two bracts enclosing the flower in the grasses.
Ligule	A strap-shaped organ at the base of the leaf within.
Linear	Several times longer than wide.
Linear	long and narrow with nearly parallel edges.
Loculicidal	Longitudinally dehiscent between the partitions of the locul.
Lodicule	One of a pair of tiny scales at the base of a grasses florate believed to be reduced perianth segments. Monoecious With the male and female parts in different flowers but on the same individual plant

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Monocot	a plant with one cotyledon or seed leaf, parallel leaf venation, and fibrous roots. Floral parts occur in groups of 3.
Node	the joint of a stem from which the leaves or branches arise.
Obconic	Inverted cone shaped.
Oblanceolate	Spherical but flattened at the poles and shaped like a lance-head.
Obovoid	Having the form of an inverted egg.
Obtuse	Blunt or rounded at the end.
Orbicular	Resembling or having the form of an orb; spherical; circular; orbiculate.
Orbiculate	Circular in outline.
Ovate	Egg-shaped.
Ovoid	Egg-shaped in three diamensions.
Palea	Chaffy or gyaline scale present in the inflorescence of some plants.
Palmate	Diverging like the widely spreading fingers of the hand.
Panicle	A repeatedly branched inflorescence.
Paniculate	Growing or arranged in a panicle.
Pappus	Tufts of hairs on fruits.
Pedicellate	Stalked flowers.
Perennial	A plant whose life cycle lasts for three or more years.

Perianth	Flower envelops consisting of calyx and corolla.
Pericarp	A wall of a fertilized ovary.
Petiole	The stalk of a leaf.
Phyllary	One of the bract under the flower head of a plant, especially in Asteraceae.
Pilose	Hairy with rather long, soft, distinct hairs.
Pinnate	Organs or leaflets arranged on each side of a common axis as in a feather.
Pistillate	The complete female part of a flower.
Puberulent	Slightly hairy with short hairs.
Pubescent	Clothed with soft hairs.
Punctate	Dotted with depressions.
Raceme	A centripetal inflorescence with lengthened axis and equally pedicellate. flowers.
Racemiform	Receme inflorescence.
Receptacle	Part of the axis that bears one or more organs or flowers
Reniform	Kidney-shaped
Reticulate	In the form of network; netted.
Retuse	A shallow notch in a rounded apex.
Rhizome	A horizontal or elongated underground stem.

A Ready Reckoner for Rice Weeds

Rhombic	Diamond-shaped, with the base and tip having acute angles and the sides having obtuse angles.
Rosette	A cluster of leaves which grows in a circular overlapping pattern.
Rugose	Wrinkled.
Scabrous	Very scabrid.
Serrate	Sharp marginal teeth with forward-pointing
Sessile	Without stalk.
Slender	Thin.
Solitary	Borne singly or alone; not in cluster
Spatulate	Narrowly oblong with the end expanded and broader, more or less like a spatula.
Spikelets	A cluster of one or more flowers each in the axil of one or a pair.
Spikes	An inflorescence with sessile flowers on a usually elongate axis.
Staminate	Floral organ bearing anther and pollen
Stellate	With its parts radiating like the points of a conventional star.
Stolon	A horizontal stem at the ground surface, forming adventitious roots at the nodes or the apex, and forming new plants.
Stramineous	With staman.
Subsessile	With a slight stalk.
Subtended	situated beneath or at the base of.

Succulent	Soft and juicy.
Tomentose	Densely matted with wooly hairs.
Trigonous	Three sided
Tripartite	Divided into three parts.
Truncate	Terminating abruptly, as if cut straight across.
Tubercle	- A small tuber or tuber-like body.
Tuberculates	Bearing small, warty, swelling, rounded or variously shaped projection
Tufted	having many short, crowded branches all arising from about the same point.
Tubular	With the petals partly united to form a tube.
Umbel	an inflorescence in which a number of divergent flowers arises from the same point.
Utricle	A dry, thin-walled fruit with a free single seed.
Winged	A thin, membranous extension along the margins of the seed.

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