Weeds; Identification & Control with Special Reference to Cotton (*Gossypium Hirsutum L*.) in Pakistan

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Abstract-- Present study was conducted to review various weed plants in the world with special reference to Cotton (*Gossypium hirsutum* L.) crop in Pakistan. Even, concentrated information on Rabi season v/s Kharif season, Annuals v/s biennials and broad leaved v/s narrow leaved weeds is provided in current manuscript. A maximum of 22 weed species are recorded in the family *Poaceae*. Information on effect of weeds on crop plant and various methods to dilute their impact is also included in present article text.

Index terms: *Gossypium Hirsutum*, Rabi v/s Kharif, Identification, Biological control, Eradication, Annuals, perennials.

INTRODUCTION-

An unwanted/undesirable plant growing out of its place that obstructs the cultural practices of man and causes economic damage is called weed.

Weeds are out of sight enemies who mutilate crop plants without making growers aware of the real losses.

Direct effects of Weeds:

1. They result in an often underestimated consequence on yield and quality of agricultural products as they compete for resource like; light, space, nutrients, water and carbon dioxide (CO_2).
2. Weeds provoke direct and mechanical injury (thorns) to human and livestock.

Associated effects of Weeds:

1. They are alternate host for several insect-pests and diseases.
2. Weeds cause allergic reactions in humans and disturb animal health too as they contain toxic alkaloids, oxalates, nitrates etc.
3. Weeds significantly hold back the cultural practices e.g. irrigation, hoeing, cultivation, spraying and crop harvesting.
4. Increases cultivation costs (machinery, oil, manpower) to control weed.
5. Deteriorate seed quality and increase cost associated to grain cleaning.
6. They affect the efficiency of irrigation systems by clogging into irrigation channels and contaminate water bodies.
7. Increase evapotranspiration, provide environs for mosquito breeding and affect flavor and color of drinking water
8. Toxic chemicals released by weeds check the growth and development of crop plants.
9. Yield losses by weeds range from 20 to 30 percent in various crops (Hussain *et al* 2013) and reduction in crop production was reported upto 36 million tons (Saeed *et al* 2010).

Sr. #	Crop	Losses (million tons)	Losses (Billion Rupees)
1	Wheat	7.48	112.0
2	Rice	2.86	71.0
3	Cotton	1.00	42.0
4	Sugarcane	19.14	29.0
5	Maize	1.40	18.0

6	4 pulses crops	0.46	19.0
7	Oilseed crops	-	3.0
8	Barley, Millet, Sorgum	-	3.4
9	Vegetables	2.64	26.0
10	Fruits	5.0%	9.0

Table 1. Losses in major crops (Weeding out huge crop losses, By M. Naeem Mushtaq and Dr Z. A. Cheema).

LITERATURE-

Weeds Types & their Identification

Weeds can be categorized in following three ways;

1) Broadleaf weeds v/s Narrow leaf weeds.
2) Rabi season weed v/s Kharif season weeds v/s Perennial weeds.
3) Annual v/s Biennial v/s Perennial weeds.
4) Crop wise prevailing weeds.

BROAD LEAF WEEDS V/S NARROW LEAF WEEDS

It is prerequisite to distinguish between Broadleaf and Narrow leaf weeds to have wider understanding of the subject.

1) Petty spurge – لال دودھک
2) Fumitory –شہاترا
3) Field bindweed - لہلی
4) Horse Purslane - اٹ سٹ
5) Sun spurge – چھتری دودھک
6) Wild jute - جنگلی پٹسن
7) False maranth – تندلہ
8) Puncture Vine – بھکڑا
9) Wild Carrot-جنگلی گاجر
10) Common Goosefoot-باتھو
11) Swine cress-ھالوں
12) Stellaria Media-پھولن بوٹی
13) Green Amaranth - جنگلی چولائی
14) Blue Pimpernel-بلی بوٹی
15) Common Vetch-ریواری
16) Wild Mustard-جنگلی سرسوں
17) Milk Thistle-کنڈیالی دودھک
18) Canada Thistle -لھ
19) Broad Leaved Dock-جنگلی پالک
20) Sweet Clover-سینجی
21) Black Night Shade-مکو/پیلک
22) Blue Daisy-کاسنی
23) Fat Hen-کرونڈ
24) Wild Safflower-پہولی
25) Crow Pea-جنگلی مٹر
26) Heliotrope-اونٹ چرا

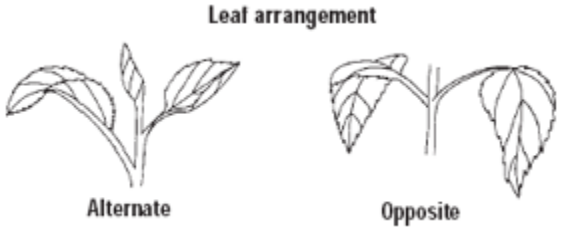
i) Broadleaf weeds

Broadleaf weeds have wider leaf blade having a netlike pattern of veins with leaf divided into half by main vein. Broadleaf weeds can be identified by their leaves arrangement. Leave are arranged either in opposite, alternative or rosette (circular pattern) from central growing point present above or beneath the soil surface (stolons and rhizomes respectively). They have large fleshy, taproot or fibrous root system. Moreover, they often possess colorful flowers with various shapes and sizes that can be very useful identification aid.

Following are major broad leaf weeds found abundantly in Pakistan;

ii) Narrow leaf weeds/Grass weeds:

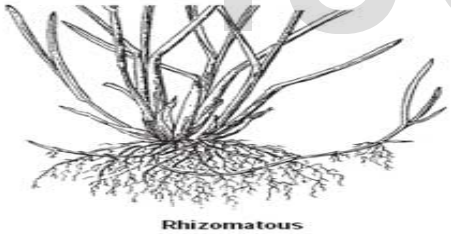
They contain long, parallel veined, narrow leaves with similar leaves shape among species and lack any kind of colorful flowering. Their growth habit, vegetative structures and seedheads play important role for their identification.



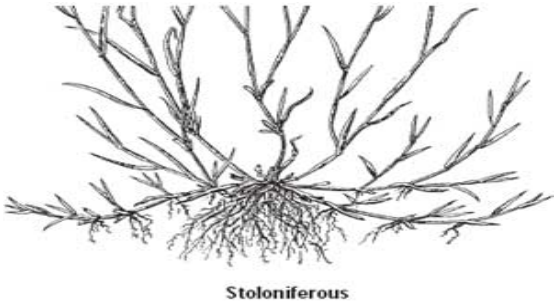
Growth habit of narrow leaf weeds:

a) Bunch type; Grass weeds that spread solely by tillering (new stems form through tillers).

b) Rhizomatous; Horizontal creeping rhizomes (below ground) produce nodes that form new tillers.

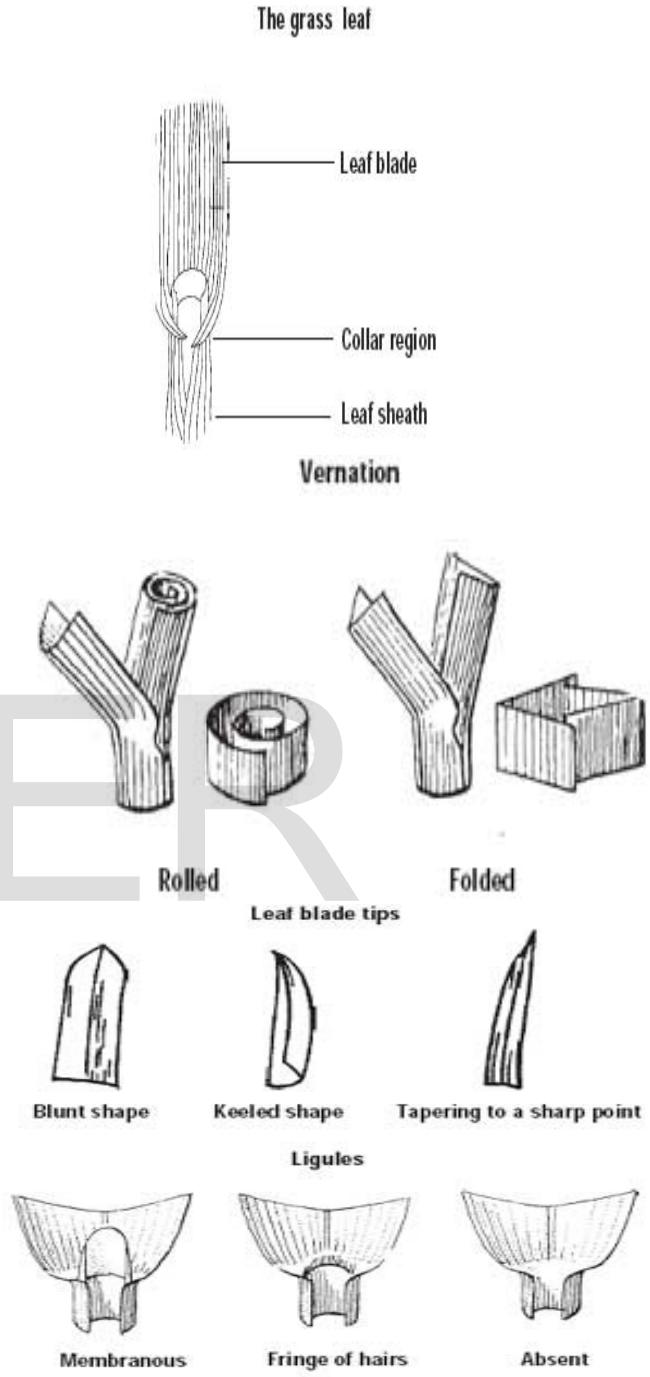


c) Stoloniferous; Horizontal creeping stolons (above ground) produce nodes that form new tillers.



Vegetative structures in narrow leaf weeds:

Most important of these are leaf blade and collar characters.



Seedheads of narrow leaf weeds:

The seedhead appears as compact, divided or open-panicle spike.

Following are major narrow leaf/grass weeds found in Pakistan;

1) Green foxtail - لومڑ گھاس
2) Wild Oat-جنگلی جئ
3) Jhonson Grass – بارو
4) Jungle Rice - سوانکی گھاس
5) Nut Grass -ڈیلا گھاس
6) Wild Onion– پیازی
7) Egyptian Grass -گھاس مدھانہ
8) Canary Grass-دومبی سٹی
9) Water Grass-نرو گھاس
10) Rye Grass-رائ گھاس
11) Cynodon dactylon-کھبل گھاس
12) Large Crab Grass-موٹی کھبل

RABI SEASON WEEDS V/S KHARIF SEASON WEEDS

Rabi season weeds:

1) *Anagallis arvensis* (Billi Booti)
2) *Asphodilus tenuifolius* (Piazi) Jungle onion
3) *Avena fatua*Javi (Urdu) Wild Oats
4) *Bromus japonicus* (Silai Ghass) Cheat grass
5) *Carthamus oxyacantha*, Wild safflower/ Wooly distaff thistle
6) *Chenopodium* album (Bathoo) Common goosefoot
7) *Chenopodium murale* Bathu (Urdu)
8) *Cirsium arvense*(Lahia , Bhur Bhur)
9) *Convolvulus arvensis*, Ilri , Laihai (Urdu)
10) *Coronopus didymus*(Jangli Haloon)
11) *Euphorbia prostrata* (Lall Dhodhak)
12) *Euphorbia helioscopia*, Chattri (Urdu)
13) *Fumaria indica* (Urdu)
14) *Galium aparine* (Wari booti, Lappetee booti)
15) *Lathyrus aphaca* (Jangli mattar)
16) *Lathyrus sativus* (Rewari kalan)
17) *Medicago polymorpha* (Maina)
18) *Melilotus albus* (Sanji Safeed)
19) *Melilotus indicud* (Sanji Zarad)
20) *Phalaris minor* (Sutti booti or Dumbi sutti)
21) *Polopogon monspelliensis* (Dumb Ghass or Ghooian) White grass
22) *Polygonum plebeium* (warank)
23) *Rumex dentatus* (Jangli palak)
24) *Sisymbrium viridis* (Jangli sarsoon)
25) *Sonchus arvensis* (Dahami Dhodhak)
26) *Spergula arvensis* (Kalri booti)
27) *Trigonella monantha* (Meeni)
28) *Veronica agrestis* (Chandani booti)
29) *Vicia sativa* (Rewari)

Kharif season weeds:

1) *Cyperus rotundus*, Lavala Purple nutsedge
2) *Echinochloa colonum*, Jangle rice, pakhad, Wild rice, Barnyard grass
3) Swanki or Jungle Rice
4) Chibber of White melons

5) *Saccharum spontaneum*, Wild Sugarcane or Kans, Tiger Grass (It sit)
6) *Xanthium strumariu*, Gokharu, Burweed

RABI WEEDS IDENTIFICATION

Figure 1. Anagallis arvensis L (Billi Booti)

Figure 2. Asphodilus tenuifolius(Piazi) Jungle onion

Figure 3,4. Avena fatua, Javi (Urdu), Wild Oats

Figure 5. Bromus japonicus (Silai Ghass) Cheat grass Figure 6. Carthamus oxyacantha Wild safflower/ Wooly distaff thistle

Figure 7. Chenopodium (Bathoo) Common goosefoot

Figure 8. Chenopodium murale Bathu (Urdu)

Figure 9. Cirsium arvense(Lahia , Bhur Bhur)

Figure 10. Convolvulus arvensis Ilri , Laihai (Urdu)

Figure 11. Coronopus didymus(Jangli Haloon)

Figure 12. Euphorbia prostrata (Lall Dhodhak)

Figure 13. Euphorbia helioscopia, Chattri (Urdu)

Figure 14. Fumaria indica, Shahtra (Urdu)

Figure 15. Galium aparine (Wari booti, Lappetee booti)

Figure 16. Lathyrus aphaca (Jangli mattar)

Figure 17. Lathyrus sativus (Rewari kalan)

Figure 18. Medicago polymorpha (Maina)

Figure 19. Melilotus albus (Sanji Safeed)

Figure 20. Melilotus indicud (Sanji Zarad)

Figure 21, 22. Phalaris minor (Sutti booti or Dumbi sutti)

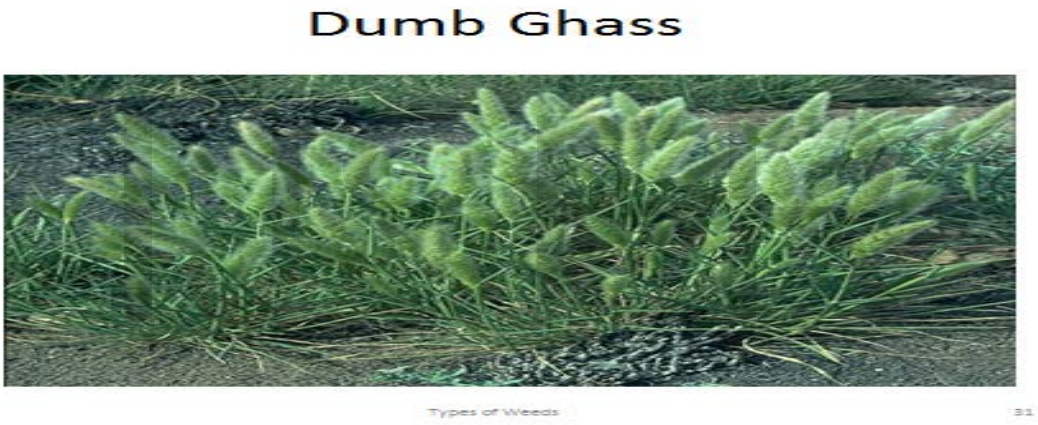


Figure 23. Polopogon monspelliensis (Dumb Ghass or Ghooian) White grass

Figure 24. Polygonum plebeium (warank)

Figure 25. Rumex dentatus (Jangli palak)

Figure 26. Sisymbrium viridis (Jangli sarsoon)

Figure 27. Sonchus arvensis (Dahami Dhodhak)

Figure 28. Spergula arvensis (Kalri booti)

Figure 29. Trigonella monantha (Meeni)

Figure 30. Veronica agrestis (Chandani booti)

Figure 31. Vicia sativa (Rewari)

KHARIF SEASON WEEDS

Figure1. Cyperus rotundus (Lavala) Purple nutsedge

Figure 2. Echinochloa colonum, Jangle rice, pakhad, Wild rice, Barnyard grass

Figure 3. Swanki or Jungle Rice

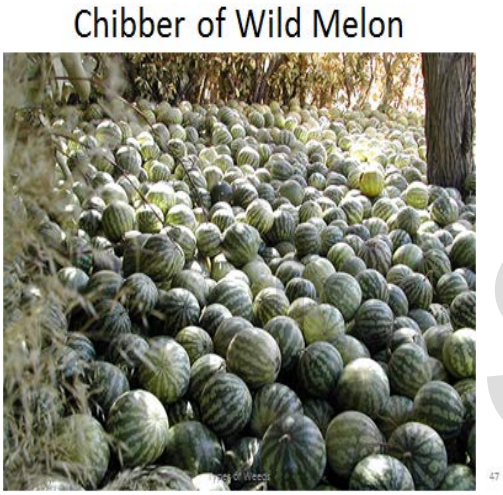


Figure 4. Chibber of White melons

Figure 6. Saccharum spontaneum, Wild Sugarcane or Kans, Tiger Grass (It sit)

Figure 7. Xanthium strumariu, Gokharu, Burweed

Perennial weeds:

1) *Opuntia dellenii*, (Nagphani) Prickly pear
2) Aak/ Milkweed
3) Laran
4) *Typha angustifolia*, Pankanis, Cat tail
5) *Cynodon dactylon*, Harali, Bermuda Grass, Doobgrass
6) *Sonchus arvensis,*Mhatari, Sowthistle

Aak or Milkweed

Laran

Figure 3. *Opuntia dellenii*, Nivdung, Nagphani (Prickly pear)

Figure 4. *Typha angustifolia*, Cat tail

Figure 5. *Cynodon dactylon*, Harali, Bermuda Grass, Doobgrass

Figure 6. *Sonchus arvensis*, Mhatari, Sowthistle

WEEDS OF COTTON CROP

In cotton following weeds are major interest and are found most frequent, images and their names are given under;

Figure1.Petty spurge - دودھک (Euphorbia prostrata)

Figure 2. Field bindweed - لہلی (Convolvulus arvensis)

Figur 3. Bermuda grass – کھبیل گھاس (Cynodon dactylon)

Figure 4. Purple nutsedge - ڈیلا (Cyperus rotundus)

Figure 5. Common purslane - قلفہ (Portulaca oleracea)

Figure 6. Jhonson grass - بارو (Sorghum halepense)

Figure 7. Horse purslane – اٹ سٹ (Trianthema portulacastrum)

Figure 8. Green amaranth - جنگلی (Amaranthus viridis)

Figure 9. Jungle rice - سوانک ی گھاس (Echinochloa colonum)

Figure 10. Green foxtail - گھاس لومڑ (Setaria viridis)

Figure 11. Sun spurge - دودھک (Euphorbia heliscopia)

Figure 12. Wild jute – یجنگل پٹسن (Corchorus tridens)

Figure 13. False amaranth - تندلہ (Digera muricata)

Figure 14. Puncture vine – بھا کھرا (Tribulus terrestris

S.#	Scientific name	English name	Vernacular name	Habit

1.	*Amaranthus viridis* L.	Pigweed	Jangli cholai	Annual
2.	*Anagallis arvensis* L.	Blue Pimpernel	Billi booti	Annual
3.	*Asphodelus tenuifolius* Cav.	Wild onion	Piazi, bhokat	Annual
4.	*Avena fetua* L.	Wild oat	Jangli jai, Javdri	Annual
5.	*Carthamus oxycantha* (L.) G. Don	Wild safflower	Pohli, kandiari	Annual
6.	*Chenopodium album* L.	Goose foot	Bathu,bathwa	Annual
7.	*Chenopodium murale* L.	Fat hen	Karund	Annual
8.	*Cichorium intybus* L.	Blue daisy	Kasni	Annual
9.	*Cirsium arvense* (L.) Scop	Creeping thistle	Kandyari, Leh	Perennial
10.	*Convolvulus arvensis* L.	Field binweed	Lehli, Hirankhuri	Annual/perenial
11.	*Coronopus didymus* (L.)Smith.	Swine cress	Jangli halon	Annual/Bienial
12.	*Cynodon dactylon* (L.)	Bermuda Grass	Dub, Khabbal	Perenial
13.	*Euphorbia helioscopia* L.	Sun spurge	Dudhi	Annual
14.	*Fumaria indica* (Hausskn) Pugsley	Fumitory	Shahtra, pitpapra	Annual
15.	*Galium aparine* L.	Bedstraw	Warribooti	Annual
16.	*Lathyrus aphaca* L.	Crow pea	Dokanni	Annual
17.	*Lathyrus sativus* L.	Grass pea	Chraal, kasseri	Annual
18.	*Lepidium sativum* L.	Garden cress	Halon	Annual
19.	*Malva parviflora* L.	Dwarf mallow	Sonchal	Annual
20.	*Medicago polymorpha* L.	Bur clover	Maina	Annual
21.	*Melilotus alba* Desr.	White sweet clover	Sufaid senji	Annual
22.	*Melilotus indica* (L.) All.	Yellow sweet clover	Zard senji	Annual
23.	*Phalaris minor* Retz.	Bird's seed grass	Dumbi sittee	Annual
24.	*Polygonum plebejum* R. Br.	Prostrate knotweed	Dranak, hazardani	Annual
25.	*Polypogon monspeliensis* (L.) Desf.	Rabbit foot grass	Lomar ghas	Annual
26.	*Rumex dentatus* L.	Broadleaf dock	Jangli palak	Annual
27.	*Saponaria vaccaria* L.	Soapwort	Takla	Annual
28.	*Sisymbrio irio* L.	London rocket	Khoob kalan	Annual
29.	*Sonchus asper* (L.) Hill	Spiny sowthisle	Kandiali, dodhak	Annual
30.	*Spergula arvensis* L.	Corn spurry	Kalri booti	Annual
31.	*Stelleria media* (L.) Vill.	Common chickweed	*Stel* Phullan booti,	Annual
32.	*Vicia sativa* L.	Common vetch	Revari, Choti phali	Annual

WEED MANAGEMENT

After Identification, understanding the weeds biology and visual threshold study next step is to choose appropriate control, its Implementation, documentation and record keeping (Field History).

Approach towards Weed Management:

1) **Avoidance/prevention:** Planting non-contaminated crop seed and cleaning of farming implements.

2) **Control:** minimize weed effects on crop plants to achieve economic and production goals.

3) **Exclusion or Eradication:** complete elimination of weed plants and seed from the soil.

Prevention: (Prevention is better than control)

Stopping weed species from contaminating an area and making sure new weed seeds are not carried onto a farm and crop seeds, machinery etc not contaminated

Following actions are recommended to ensure prevention from weed infestation:

1. Use weed free, non-contaminated crop seeds for sowing.
2. Ensure cleanliness of farm machinery, shoes, gloves, irrigation channels, fences and threshing floor.
3. Do not feed farm Animals with material having weed seeds
4. Strict Quarantine: Inspect nursery stock for the presence of weed and avoid use of sand and soil from weed-infested area.
5. Integrated Weed Control Strategies

Role of weed flowering/fruiting time:

Study of flowering & fruiting time in weeds is very important to provide their better control. To avoid multiplication of weed's seed it is recommended to control them and even eradicate before the flower or form fruit.

Flowering/fruiting period of some weeds is given in table below;

Sr. #	Local or Vernacular Name	Habit	Flowering/Fruiting period
1	Waho	**AH**	Nov.-Dec.
2	Mariro	**AH**	July-Sept.
3	Lular	**AH**	Aug.-Oct.
4	Aak	**PS**	July-Sept.
5	Khip	**PS**	Nov.-Dec.
6	Gidewar	**AH**	July-Sept.
7	Bhattar, Bathal	**AH**	Feb.-Sept.
8	Pili Dodak	**AH**	Feb.-Sept.
9	Mohabbat botti, Cocklebar	**AH**	Aug.-Nov.
10	Chawar, Kasondi	**PS**	April-Oct.
11	Dhanar, Khathoori, Ponwar	**AH**	April-Aug.
12	Chibbar	**AH**	July-Nov.
13	Dodak	**AH**	May-July
14	Sinjh	**AH**	April-Sept.
15	Patir, Peeli buti	**AH**	March-April
Sr. #	**Local or Vernacular Name**	**Habit**	**Flowering/Fruiting period**
16	Jhangli bhindi	**AH**	Aug.-Oct.
17	Lunak	**AH**	Aug.-Dec.
18	Ras Bhari	**AH**	July-Oct.
19	Lai	**PS**	May-Nov.
20	Mandheri,Bahu phalli	**AH**	Feb.-Nov.
21	Piazi, Basri	**AH**	Jan.-March.
22	Ganni, Jargigh	**PG**	June-Oct.

23	Chhaber	**AH**	Round the year.
24	Dubh	**PG**	July-Oct.
25	Denoi, Palwan	**PG**	Round the year.
26	Sawari, Sanwak	**AG**	Aug-Nov
27	Drabhuri. Siru.	**PG**	Round the year.
28	Kana, Sarkanada.	**PS**	Oct.-Nov.
29	Kilk, Kahu, Kans.	**PS**	Aug.-Sept.

Timely detection followed by immediate and effective weed control measures is prerequisite.

1) Cultural control
2) Mechanical control
3) Chemical control
4) Biological control

CULTURAL CONTROL

(Help the crop compete against weeds)

Establishment of more favorable condition for crop to compete with weeds by;

i. **Crop Rotation:** Crop rotation can result in natural suppression of weeds, when rotation of legumes and fallow is included as it increases soil fertility. If a single crop is planted continuously for many years then

population of weed would mount. Therefore, crop rotation would help to check weeds growth by disturbing their breeding cycle.

ii. **Weed free field preparation:** Destroyed weeds before planting.

iii. **Intercropping:** Intercrop with legumes and fallow would suppress weeds growth.

iv. **Mulching:** Helps to stop light for photosynthesis to weeds.

v. **Grazing**

vi. **Canopy coverage:** Shading suppresses weeds.

MECHANICAL/ PHYSICAL CONTROL

Hoeing, tillage, hand weeding, sickling, digging, mowing, burning, etc. are main mechanical weed control measures.

i. **Tillage:**

Before sowing the crop weeds present in the field are uprooted and buried deep in the soil by primary tillage operation and in wider-row crops later ones are controlled by inter tillage.

ii. **Dab method:**

Plough and plank the field with Sohaga, for 8-10 days after Rauni (pre-sowing irrigation). Then allow the weeds to germinate and destroy them while land preparation for sowing.

iii. **Hoeing, hand pulling and weeding** (Time consuming, Limited and costly)**:**

Weeding and hoeing is a method to eradicate weeds during seedling stage in botanical gardens but becomes laborious when practiced in crop plants. Mechanical hoeing and weeding is not a good practice at later stages of crop development as it may uproot crop plants. Weed seedlings may regenerate more vigorously if survived the mechanical injury. It also becomes difficult to differentiate between some weeds and actual crop seedlings such as *Phalaris minor, Avena fatua* and wheat crop at early vegetative stage.

iv. **Bar harrowing:**

After the application of first or second irrigation Bar harrowing eradicates various growing weeds and is easy to perform when the crop is cultivated in rows.

v. **Mowing and sickling:** (Broad leaf and annual weeds)

vi. **Fire/burning:** (steam boxes, flame throwers etc.)

vii. **Weeds burial:**

Burial works best for small weeds especially in crop row, when crop is larger than the weed

viii. **Uprooting:** to eliminate soil-root contact.

CHEMICAL CONTROL

The practice of killing the unwanted plants (weeds) with herbicides is called **chemical weed control**. H**erbicides** are chemical substances that are used to kill or suppress the growth of weeds. They affect weeds by drying out their leaves, stems, or by making it drop its leaves. It is the most effective, time saving and economical way of weed control.

It becomes difficult to differentiate some weeds from crop plants at seedling stage (*Avena fatua* & *phalaris minor* resemble with the wheat seedlings). So, it becomes difficult to manage such weeds mechanically/physically at early stages of development. Hence, eradication of weeds through chemicals is considered suitable and has wider application for more area during short period of time without considerably damaging the main crop.

Herbicides are classified based on their

Selectiveness:

Based on their effect on specific categories of weeds and are reported as

i. **Selective herbicides:** Their affect is specific to some weeds.

ii. **Non-selective Herbicides:** They are not specific to a single class of weeds.

iii. **Broad-range herbicides:** They affect broad range of weeds.

Emergence:

i. Pre-emergemce
ii. Post-emergence

Popularity of Chemical weed control over manual and mechanical weeding:

1. In physical methods weeds grow back sooner than chemical method. Herbicides suppress the weeds for considerable duration after their application.

2. Pre-emergence application provides weed free environment to protect crops from early competition with weeds at seedling stage which is not easy to do with other methods of weed control.

3. Effective for broadcast and narrow spaced sown crops because chemical reaches to maximum number of weed population.

4. Herbicides can penetrate to wider spaces and control both inter-row and intra-row weeds. Whereas, other methods control weeds between the crop rows only.

5. Herbicides are now available which can suppress the weeds of similar morphology to crop without damaging the crop itself.

6. Translocated herbicides can control vegetatively propagated, deep-rooted weeds. While, methods like hoeing or weeding are not so effective for their control.

BIOLOGICAL CONTROL

Use of living organisms that attack weed plants is termed as biological weed control. Biological weed control is self-perpetuating, cost effective and environmentally safe. Organisms that are used in biological control are called as Bio-agents.

In biological control we use;

1. **Insects**
2. **Mites**
3. **Nematodes**
4. **Pathogens**
5. **Grazing Animals**

Features of Bio-agents:

i. **Host specific;** they do not damage the main crop and suppress the growth of their host only.

ii. **Adaptability & hardiness;** Survive better in food shortage and changing environment

iii. **Feeding habit;** prevent seed production in targeted weeds and even Kill them, heavy feeders

iv. **Reproduce;** at higher rate with luxury of natural reproduction

Examples of Biological control

Sr. #	Name	Bio-agent	Country
1	Lantana camara (Ghaneri)	Crosedosema lantana (moth)	Hawaii
2	=	Lantana bug & Hispine beetle	Australia
3	Prickly pear /cactus	Cochineal scale insect	South India
4	=	Cactoblastis cactorum	Australia
5	Alligator weed	Flee beetle	USA
6	Fern	Beetle (Cytrobagous saviniae)	India
7	Nut sedge	Shoot borer moth	USA
8	Prickly pear /cactus	Spider Mite	Australia
9	Acacia glauca	Spores of cephalosporium	Hawaii
10	Water hyacinth	Rhizoctonia blight	Hawaii

11	Aquatic weeds	Grass carp and snaila	Water bodies

Use of Mycoherbicides /bioherbicides:

Sr. #	Name of weed	Product	Content
1	Strangle vine	De Vine	Liq. suspension of fungal spores P. palmivora
2	Joint ventch	Collego	Wettable powder of spores Colletotrichum spp.
3	Johnson grass	Biolaris	Suspension of spores of Bipolaris sorghicola
4	Non selective	Biolophos	Microbial toxin of Streptomyces hygroscopicus

Summary of weed management:

1. Proper seedbed preparation
2. Germinate weeds before beginning tillage
3. Plough as deeply as possible to break compaction
4. Tillage just before planting
5. Good field sanitation is better for weed control.
6. Clean planting, harvesting, and tillage implements.
7. Keep field perimeters weed free
8. Rotate crops/ species with a different life cycle
9. Seeding at the proper depth
10. Seeding at the appropriate rate and time
11. Selecting the correct amount, timing, and placement of fertilizers
12. Using adapted and vigorously growing cultivars.
13. Use certified seed which is free from weed seeds

Integrated Weed management:

- Integrated weed management (IWM) involves different methods of weed prevention and control in right proportion and at appropriate time against the target weeds with minimum damage to the environment.

  Utilization of a combination of preventive measures, mechanical/physical, cultural, biological & chemical methods of weed control in a planned sequence, to keep weeds "off balance" without affecting the ecosystem.

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