IWM (Integrated Weed Management)

Integrated weed management (IWM) includes the application of many types of technology and supportive knowledge in the deliberate selection, integration, and implementation of effective weed control strategies, with consideration of the economic, ecological, and sociological consequences. IWM is a component of integrated pest management (IPM).

Most descriptions of IPM mention three elements:

1. Multiple tactics of pest management used in a compatible manner.
2. Pest populations maintained below levels that cause economic damage.
3. Conservation of environmental quality.

A successful IWM system is effective, economically and ecologically sound, stresses integration of control tactics with all other practices that influence the ecosystem, and links weed control to the larger picture of ecosystem management. The basic principles related to weeds and IWM must be understood and considered in designing and implementing an effective IWM system. These principles include: What is a weed, the basic resources that weeds and crops compete for, factors affecting weed seed emergence, weed growth and reproduction, length of interaction, and the general ecology and population biology of weedy plants. The six main areas of weed control tactics are (1) survey, (2) prevention, (3) mechanical practices, (4) cultural practices, (5) biological control, and (6) chemical control.

I. Survey: - involves knowing specifically what weeds are present in a given field, an estimation of their number (density), their location, and, over time, whether shifts in location or weed types are occurring.

II. Prevention: - means stopping a new weed from invading an area or limiting weed buildup in a field. Prevention is practiced by (a) not planting crop seed contaminated with weed seed, (b) not carrying weed seeds or vegetative propagules into an area with machinery, contaminated manure, irrigation water, transplants or nursery stock, or growth media or soil, (c) not allowing weeds to go to seed and recharge the soil seedbank, (d) eliminating weeds from fencerows and other areas adjacent to fields, and (e) stopping the spread of vegetatively reproducing perennial weeds.

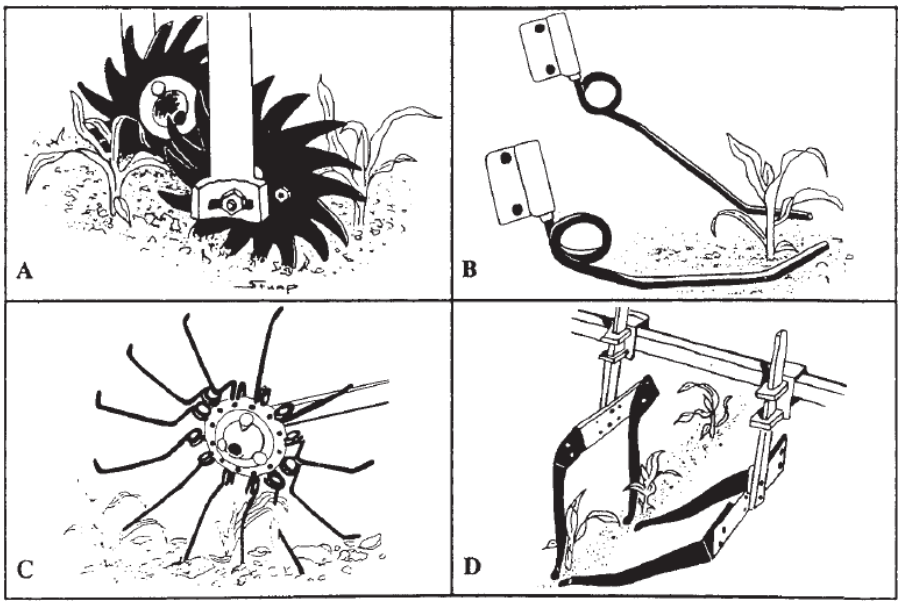
III. **Mechanical Practices**: - Tillage, hand weeding, mowing, mulching burning, and flooding are considered mechanical weed control methods.

1) Tillage is the mechanical disturbance of the soil involving soil preparation, followed by planting, cropping, harvest, and post-harvest soil management. Primary tillage is the initial ground breaking in preparation for crop production, and secondary tillage is additional soil movement to smooth and level the ground prior to planting.

	Weeds per Acre		
Tillage Treatment	Hemp Dogbane	Common Milkweed	Canada Thistle
Moldboard plow	880	0	0
Chisel plow	925	3	3
No-till	1850	34	5

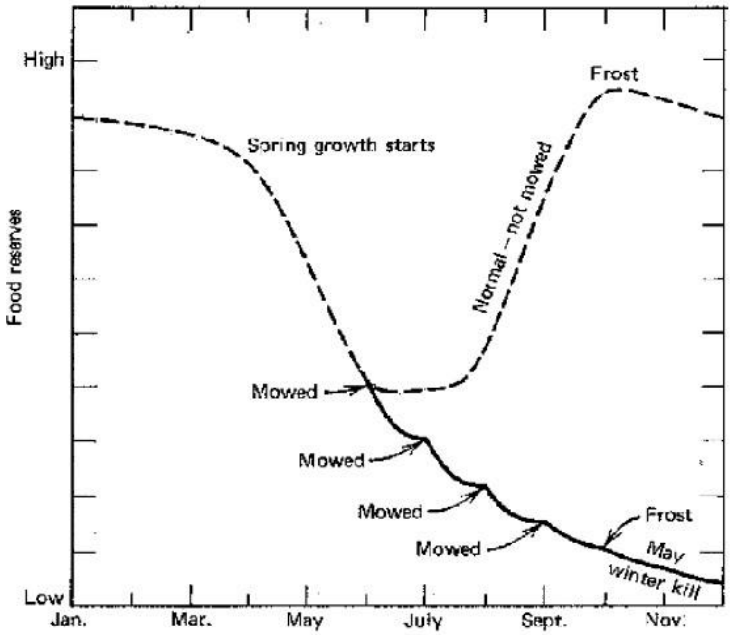
[a]Population counts taken after 4 years of treatment with the tillages. The counts are the average of those from continuous corn and corn-soybean rotation patterns.

2) Row Crop Cultivation: - The primary objective of cultivation is to control weeds, and primary and secondary tillage are aimed at preparing a suitable crop seedbed. The main purpose of growing crops such as corn and soybeans in rows is to allow mechanical weed control between the rows, and the original row widths were designed to allow the passage of draft animals without damaging the crop. Herbicides and machine cultivation has allowed a decrease in row widths.



3) Hand Weeding: - Pulling out unwanted weeds by hand or by hoeing is the oldest method of selective weed control; it remains a very safe and effective method against most weeds in most crops. The major disadvantages are the expense and increased potential for crop injury if such methods are performed carelessly.

4) Mowing: - Mowing can effectively prevent seed formation on tall annual and perennial weeds, deplete food reserves of the vegetative reproductive organs of perennial weeds, and favor competitive crops adapted to mowing. Unfortunately, mowing can also favor weeds that grow and reproduce below the cutting height. Repeated mowing can cause a shift in the dominant biotype of a weed species, from an upright growing form to a more prostrate form.



Food reserves of a perennial unmowed plant as compared with reserves of a repeatedly mowed plant.

5) Mulching: - Mulches stop weed growth by restricting the penetration of sunlight to the soil surface, and in the case of surface mulches of cover crops have the potential to release inhibitory (allelopathic) chemicals into the soil environment that inhibit weed seedling growth. Many weed seeds require light to stimulate germination, so mulches reduce the germination of such seeds. Seedlings that do not require light can germinate, but if light is restricted the seedlings emerging from the soil are killed through starvation by lack of photosynthesis or, if allelopathic mulches are present, may die because of chemical inhibition of growth. Perennial weeds are not well controlled by most types of mulches as they have sufficient plant reserves to begin growth and to emerge through the mulch in the absence of light and in the presence of

most allelochemicals. Mulches can be either nonliving or living material of enough density to restrict light penetration.

Yield and Production Costs for Different Cropping Systems in Southwest Nebraska (Klein, 1988).

Crop	Tillage	Average yield (bu/A)	Production cost ($/bu)
Wheat	clean fallow	37	3.88
Wheat	stubble mulch	43	3.44
Wheat	ecofallow-reduced tillage	45	3.30
Sorghum	conventional	40	3.09
Sorghum	ecofallow-reduced tillage	65	2.42
Corn	conventional tillage with center-pivot irrigation	140	2.59
Corn	ecofallow-reduced tillage	65	2.52

6) Burning: - Fire can be used to remove undesirable plants from ditch banks, roadsides, and other waste areas, to remove undesirable underbrush and broadleaf species in conifer forests, and for annual weed control in some row crops. Burning must be repeated at frequent intervals if it is to control most perennial weeds. In alfalfa and western mint, burning can control weeds, diseases, and some insects. Environmental air quality laws may restrict burning as a weed control tactic in the future.

Flaming has been used most successfully for selective weed control in cotton. Special propane burners are used to direct a flame at the base of the cotton plants. The hard woody cotton stem escapes injury, but young weed seedlings are killed. Proper adjustment and speed of operation are essential to avoid crop injury.

Technique is important, and flaming the weeds early, while they are small, is most efficient. Efficient flaming conserves fuel and does not toast the weeds but results in a drooping and wilting of the weeds within a few hours. Many systems now incorporate a water shield, which sprays a thin layer of water over the crop plants with a flat fan nozzle to protect them from the flame heat. However, as fuel costs continue to increase, flaming is less economical as a technique for weed control.

7) Flooding: - it is used to control weeds in rice fields, as water-saturated soil limits oxygen availability, which prevents many seeds from germinating but does not

inhibit rice seed germination. Aquatic plants can tolerate the flooded conditions and are not controlled by this technique. Flooding for perennial control requires a good water source and is expensive because it requires creating dikes and maintaining the water level for prolonged periods.