Some important terms: -

1) **Prevention:-** Prevention, which means stopping a given weed species from contaminating an area, is often the most practical means of controlling weeds. Prevention in agriculture is perfectly accomplished by:
   a) Making sure that new weed seeds are not carried onto a farm in contaminated crop seeds, feed, or on machinery.
   b) Preventing the spread of perennial weeds that reproduce vegetative new plants. Prevention is a method of weed management that, if properly employed, could greatly reduce weed problems worldwide.

2) **Control: -** is the process of limiting weed infestations. In crops, the weeds are limited so that they have minimal effect on crop growth and yield. The degree of control is usually a matter of *economics*, a balance between the costs involved and the increase in profits due to the control of the weeds and the types of production systems and tools being used. Weeds are thus limited to a level that does not allow them to interfere with human activities. Most biological control programs using a highly specific insect or plant disease organism as a control agent are based on obtaining adequate economic management of a weed, but not eradication.

3) **Eradication: -** Eradication is the complete elimination of all living plants, including their vegetative propagules and seeds. Eradication is much more difficult than prevention or control. In general, it is justified only for the elimination of a serious weed in a limited area—for example, a perennial weed in a small area of a field, around fuel storage tanks, or in railroad yards.

4) **Economic Threshold**: - An economic threshold for weeds is the density of a weed population at which control is economically justified because of the potential for yield reduction, quality loss, harvesting difficulties, or other problems that weeds may cause.

5) **Invasive weed species**: - Are introduced plants that grow spread and take over a new habit beyond their natural range. They are usually introduced

inadvertently by human activity. These plants threaten the environment and the economy, and can be extremely damaging to native pasture grassland. Local districts spend considerable time and money in control programs. An example of a restricted plant is the spotted knapweed (*Centaurea maculosa*) in south alberta/ Canada. There are several categories of such weeds: restricted, noxious, and nuisance. All of these create various degrees of threat, and all of them are difficult to eradicate.

a) **Restricted:** Restricted weeds are usually found in small numbers, and are designated as restricted in order to prevent their establishment. Restricted weeds are non-native species that pose a serious threat because of their ability to spread rapidly and out-compete natural vegetation.

b) **Nuisance:** Nuisance weeds are common throughout the Province, and are often native species. Due to their abundance and biological suitability, it is difficult to eradicate nuisance weeds.

6) Noxious Weeds: - Plant defined by law as being especially undesirable, troublesome, and difficult to control.

Weed Biology and Ecology

The biology of weeds is concerned with their taxonomy, genetics, establishment, growth, and reproduction. The ecology of weeds is concerned with the development of a single species within a population of plants and the development of all populations within a community on a given site. The numerous factors of the environment have a pronounced influence on all of these processes and systems. The environment and the living community are considered as an ecosystem, and in an agricultural situation are considered an agroecosystem.

Genetic background and environment are the master factors governing life. The genes of a plant determine what it becomes by controlling life form, growth potential, method of reproduction, length of life, and so on. The environment largely determines the extent to which these life processes proceed by influencing the expression of the genes within the plant.

Knowledge of weed biology and environmental management practices makes it possible to shift plant populations and communities in desired directions. This is the principle behind crop production that theoretically optimizes the growth environment of the crop but minimizes the potential of unacceptable pest levels. For example, cultivation in a crop field makes the environment favorable to the crop plants by removing competing weeds.

Understanding the basic biology of a weedy plant, how it responds to its environment (ecosystem), its place of origin and similarity (crop mimics with parallel evolution) or dissimilarity (independent evolution) with crop plants can provide needed insight to weed managers on specific practices to reduce weed influences in given situations. At present, the weakest link in our weed management programs is the lack of basic biological and ecological information. This lack of information has necessitated that most effective weed management programs are designed to remove problem weeds by brute physical or chemical means. The recent emphasis in research on obtaining a better understanding of weed biology/ecology and the interactions within the agroecosystem will allow for the design of more balanced ecologically and environmentally based weed management systems. The purpose of such systems will be to provide consistent and acceptable weed control and ensure the sustainability agricultural systems.

WEED CHARACTERISTICS

Weeds have been defined as plants growing where they are not wanted or as undesirables. In most instances, weeds are plants that take advantage of disturbed sites, having characteristics that allow them to efficiently capture available resources and grow prolifically. Weeds are usually herbs with a characteristic short life span and high seed production. Such plants occupy the earliest stages of succession. For students to understand more clearly what constitutes a weed, we must clarify what undesirable means. In this regard, Navas (1991) defined a weed as “a plant that forms populations that are able to enter habitats cultivated, markedly disturbed or occupied by man, and potentially depress or displace the resident plant populations which are deliberately cultivated or are of ecological and/or aesthetic interest.”

Bridges (1995) suggests that Navas's definition provides a useful description of a weed that recognizes the ecology and biology of the plant as well as the impact on humans. Therefore, weeds are plants that are equally well adapted to environmental disturbances as our crops. Weeds can thrive under the conditions generated by the agriculture field practices of tillage, irrigation, fertilization, and row spacing that minimize normal growth-limiting stresses of drought, low fertility, limited light, and high pest levels.

Ideal Characteristics of Weeds

1. Germination requirements fulfilled in many environments.
2. Discontinuous germination (internally controlled) and great longevity of seed.
3. Rapid growth through vegetative phase to flowering.
4. Continuous seed production for as long as growing conditions permit.
5. Self-compatibility but not complete autogamy or apomixes.
6. Cross-pollination, when it occurs, by unspecialized visitors or wind.
7. Very high seed output in favorable environmental circumstances.
8. Production of some seed in wide range of environmental conditions; tolerance and plasticity.
9. Adaptations for short-distance and long-distance dispersal.
10. If a perennial, vigorous vegetative reproduction, and brittleness, so as not to be drawn from ground easily.
11. Ability to compete interspecifically by special means (rosette, choking growth, and allelochemicals).

WEED CLASSIFICATION

There are approximately 250,000 species of plants in the world, but only about 200 species are considered to be major weed problems. In addition to this small number of species there are relatively few plant families that contain major weeds. Of the 300 plant families, 75 families comprise 75% of all flowering plants, and of these only 12 families comprise 68% of the world's worst weeds. Within these 12 families, just 3 families comprise 43% of the world's worst weeds, with 37% being in the Poaceae (grass family) and Asteraceae (composite family). Most of the major

families of weeds also contain members that are major crops, such as grains in the Poaceae, beans/peas in the Leguminosae, and vegetables in the Solanaceae and Brassicaceae, to name a few. Other families have few crop representatives but many weeds, such as the Asteraceae.

The definition of a weed and the plant characteristics that contribute to its weediness are good to know. However, other factors such as habitat, growth form or seed type, and life cycle are important in identifying the most appropriate management practices for weeds in humans' various plant-related activities and useful in determining specifically what weed is present in any given situation. Life cycle refers to a plant's life span, season of growth, and method of reproduction and determines the methods needed for management or eradication.

FACTORS RELATING TO WEED ESTABLISHMENT AND SURVIVAL:-

1) Climatic factors include the following:

a. Light (intensity, quality, and duration including photoperiod).

b. Temperature (extremes, average, frost-free period)

c. Water (amount, percolation, runoff, and evaporation)

d. Wind (velocity, duration)

e. Atmosphere (CO_2, O_2, humidity, toxic substances)

2) Physiographic factors include the following:

a. Edaphic (soil related factors including pH, fertility, texture, structure, organic matter, CO_2, O_2, water drainage)

b. Topographic (altitude, slope, exposure to the sun)

3) Biotic factors include the following:

a. Plants (competition, released toxins or stimulants, diseases, parasitism, soil flora)

b. Animals (insects, grazing animals, soil fauna, humans)