Chapter I

Introduction

Review of Literature
INTRODUCTION

Weeds are unwanted and undesirable plants, which interfere with the main crop in the utilization of land and water resources, and thus adversely affect human welfare. In croplands weeds compete with the beneficial and desired investigation and cause reduction in yield and quality of production. These are the important factors in the management of all lands and water resources, but their effect is greatest on agriculture. There is no reliable study of world wide damage due to weeds, however it is widely known that losses caused by weeds are maximum as compared to losses from any other categories of agricultural pests like insects, nematodes, diseases rodents etc. Out of total annual loss of agricultural products from various pests in India, was account for 45%, insects 30%, diseases 20% and other pests 5% Rao (1981).

It is well known that there is a correlation between crop and weed because agriculture is the man's oldest profession of income and weed is their oldest agricultural problem. Weeds compete with crop plants for nutrients soil moisture and sun light. The revolution has produced man managed vegetation in the form of crop fields, which are very suitable habitats offering special opportunities for weed
invasion. There is a regular war with weeds in our country, but still it is practically difficult to find a field without weeds.

With unprecedented increase in human population in recent years all over the world specially in developing countries like ours, the agricultural services and crop lands have been pressed to extract maximum possible returns. To supplement the supply, man has also domesticated a large number of bovine populations for the purpose of milk and meat. Cattles are also used in plough and bullock-carts are a type of power to be used in different agricultural operations specially in our country. The crop lands produce a variety of agricultural crops.

The ultimate solution of feeding problem is agriculture and it is the main source of income for majority of the population. According to chisla of 1977, 69.9% of population was engaged with removal of some notorious species which interfere with agricultural operations.

To meet this disturbed economy man has moved to the principle of economics and in terms of ecology the histories of weeds may often "improve the chances of designing efficient control" (Harper 1958). Thus in order to determine the best way of eradicating weeds, it becomes necessary to grow them experimentally (Borton, 1962).
Weeds have been a very serious problem in horticulture also. Man has been mostly indifferent towards weeds and has allowed them to create havoc by growing, spreading and dissemination their seeds at will. Even in woodlands weeds like Lantana & Hyptis cause several problems in seedling establishment, regeneration and tree growth. Weeds like Nymphaea etc. in aquatic ecosystem too create water pollution problems. The majority of weeds are products of the survival of the fittest. As is well known, that weeds are mainly propagated and distributed through seed grains and by live stock, birds and wild animals. Many noxious weeds spread by self reproduction by means of vegetative reproduction by stolon, rhizomes, tubers, roots and bulbs. Fortunately a large majority of the weeds are not very harmful. A large majority of the weeds found in the country can be kept in check by good cultivation that is necessary to grow economic crops. But others require specific treatment, if attempt to exterminate them are to be successful.

A large amount of work has already been done on crop weed relationship, periodic following, manuring and crop rotation on the composition of weed flora and relative prevalence of viable weed seeds in the soil (Brechley, 1940; Brechley and Warington, 1933, 45 & 58; Robert, 1962, 1962b and Caussan, 1966). The important modification of cropland habitat that directly affect the weed density and weeding.
The spread of weed seeds in the arable land through the use of contaminated manure and seed stock, while making an ecological study of weed infested wheat and gram fields at Varansi. Tripathi (1965) observed that the weeds were more abundant in crop fields at an early stage of crop growth compared to later stages. It was suspected that the crop seeds sown by farmers are often mixed with a good number of weed seeds and this was confirmed through the analysis of crop seed stock. Thus the crop seeds sown by farmers are often mixed with a good number of weed seeds. Such contaminated crop seeds help in disseminating the weed to different places, through marketing inadvertently, which is one of the chief sources of weed seed dissemination. Wellington (1980) has aptly remarked that there are many biological adaptations to ensure the dispersal of seeds by natural agencies.

Reduction in crop yield has a correlation with weed competition. Generally an increase in one kilogram of seed growth corresponds to reduction in one kilogram of crop growth, Rao (1981). Weeds remove plant nutrients more efficiently than crop plants. In drought situation they thrive better than crop plants when left uncontrolled, some weeds can grow taller than crop plants and inhibit tillering and branching. They can take sunlight easily and adversely affect photosynthesis and plant productivity.

Depending on the degree of competition, weeds reduce
the crop yield by 10-15%. In other words if weed competition is completely eliminated from the entire cropland, farm production can be increased by 10-15%. Taking a conservative figure of 10%, the annual gross agricultural income of India for 1980-81 would have been higher by Rs. 3000 crores (Rs. 30 billion) had all the effective weed control measures been adopted on the entire crop land. This figure would keep rising with an increase in cropped area under high yielding varieties, irrigation and multiple cropping. Losses of food by weeds in the world in 1985 was estimated at 287, 500,000 metric tons per annum or 11.5% of total food production (Parker and Fryer, 1975).

Heavy infestation by annual and perennial weeds could make agriculture as well as land unsuitable for cultivation resulting in loss in its economic value. A lot of part of cultivable area in the rice growing regions of India have been abandoned or are not being regularly cultivated due to severe infestation by Cyperus rotundus, (Rao, 1981), Paspalum species (Shukla, 1972) and other annual and perennial grasses and weeds.

There are over 250,000 plant species in the world, out of these about 250 have become prominent weeds in agricultural and non agricultural systems. In India there are about 700 poisonous weed species which reduce human efficiency through physical discomfort caused by allergy and poisoning. A large number of which are weeds in cultivated fields. They cause
enormous loss and suffering to the human beings by way of reduction in crop quality and quantity, wastage of human energy and resources and increased expenditure to alleviate the problem of them.

The factors controlling spatial distribution and growth behaviour of weeds include the general climate of the area, the microclimate of the crop fields, soil condition and biotic influence while considering the biotic set of environmental factors in a cropland ecosystem. First thought is generally given to various agronomic operations such as ploughing, manuring, irrigation practices, weeding harvesting etc. and one trend to overlook that the crop plants may also exercise a strong influence over the associated weeds and therefore serve as a significant biotic factors. The crop land environment is generally manipulated in favour of crop plants, but weeds do enjoy the benefits except for the fact that a deliberate attempt is made to remove them from the fields employing different techniques. The nature and magnitude of weed infestation is largely determined by human being.

Among the anthropogenic factors some external and internal factors affect the growth and physiological process of associated communities, which are associated with the plant species which may be weeds, light, moisture, temperature and soil. The growth and survival of seedlings of crop and their behaviour and scientific basis at early stages of the plant
life are some important aspects of agricultural management. The assessment of favourable environmental conditions for the development and growth of seedlings may be affected by associated weeds. Such type of works have been done by Pathak (1981) and Verma (1981) on Commelina benghalensis and Alysicarpus longifolius, respectively.

In India from an ecological point of view some aspects of a few weeds were attempted by the workers engaged in different research centres. (Mall and Arzare, 1956; Kaul, 1959; Rama-Krishan, 1959; Misra et al., 1968; Trivedi, 1976; Gupta, 1976; Pathak, 1981; Bell et al., 1981; Kimme et al., 1981; Pandya et al., 1982; Thind and Sandhu, 1982; Sharma, 1983; 84 and Camarda, 1985).

India is facing a serious weed problem, unfortunately it did not receive adequate attention because of the availability of agricultural labour at comparatively cheaper rate. In spite of this there are losses in our country of about 4,200 million rupees annually. The losses caused to crop yield through the weeds is not only single effect of association but it also combines its effect in changing internal and external characters of crop plants i.e., its phenology flowering, allelopathy and competition.

Losses caused to crops by weeds are mainly through competition. The two plants even grow closely will never compete with each other so long as water, nutrient material,
light and heat are in excess of the need of both. When the immediate supply of a single necessary factor falls below the combined demand of these plants competition begins.

Association or phytosociological aspects of weeds, in crop fields have been studied by numerous workers (Pandeya and Shah, 1966; Tripathi and Misra, 1971; Shukla, 1972; Rao et al., 1977; Kodnop et al., 1977; Singh, 1978; Sharma, 1981; Shivnath and Gupta, 1982 and Sharma, 1984).

Shukla reported some quantitative, qualitative and synthetic characters of the weed crop association of different crop in Denmark. There was a close relationship between the growth period of crop and their weed floras. Singh (1978) revealed that majority of weeds are annual therophytes of 'Rabi' and are usually not represented during 'Kharif' season though a few were recorded in both. He also studied habit, phenology, frequency and abundance of weed species associated with different crops. Such type of works have not been done in northern bundelkhand region.

In India from eco-physiological point of view some aspects of a few weeds including seed germination have been dealt with by Misra and Siva Rao (1948), Bakai (1952), Vandana and Mathur (1929), Jain (1971), Jain and Misra (1972), Dakwale (1975), Misra and Dakwale (1975), Pathak (1981), Yadav (1982), Tripathi (1984) and Babeley (1985). Most species of weeds may affect in percentage reduction of seed germination and
resulting growth of associated crops. It is well known that seed germination is the most important critical and prime event in the life cycle of a plant.

Some important contributions reporting the detrimental effect of chemical substances released by plant populations in their environment affecting seed germination as well as seedling growth of neighbouring plants are those of Pickering (1903), Evenari (1949), Whittaker and Feena (1971), Chouet at (1976), Bokhari (1978), Pathak (1981), Sharma (1984) and Harrison and Peterson (1986).

Plants release those substances into substratum via root exudation, volatilisation, rain wash from their aerial parts and also by leaching and decomposition of litter (Kanchan, 1978). Dubey and Mall (1976) while studying the phenomenon of allelopathy in M. grandis reported that this species has not only a strong allelopathic effect on crop and other associated species, but its own population gets affected.

Though weed may look harmless when they are small but, weed control should be in a well planned and scientific manner right from the early growth. Chemical weed control progressed much in the last thirty years. The main object of the herbicidal control of weed was to minimize labour and replace the time consuming method.

From 1948 to 1972 about 30 sophisticated herbicides
belonging to different groups were reported in India. A number of research papers (Asana, 1951; Gupta, 1952; Arakeri, 1951; 1952, 1953; Arakeri and Adnate, 1957; Verma and Bhardwaj, 1957; Krishnamurti and Bhandari, 1957; Mani et al., 1960, 61, 1977; Gill and Brar, 1977; Prasad, 1977; Dubey and Mall 1973, 1976 and Jai Prakash et al., 1978) about herbicidal control of various weeds were published.

In U.S.A. (National agricultural chemical association 1970) a study conducted revealed that the total number of compound screened per year increased by about 4% from (60,000 to 62,000) between 1967 to 1970, while the number of compounds which needed to be examined to produce a successful product increased.

The cost of research development required as percentage of sales within the industry crop area with 2.6% for all other manufacturing industries.

In relation to control measures it is necessary to pay attention on the effect of herbicides on association crop whether herbicides causing loss or not. These chemical effects on weeds or with the associated crops keeping this idea in mind present attempt have been made to study the herbicidal control as well as some ecological aspect of weed. *M. emarginata* has been selected which was associated with 'Rabi' and 'Kharif' crops. The study confirms the very obligatory importance of weed ecology and great necessity of weed eradication.
The present work was undertaken to cover the following aspects in detail:

(1) Phytosociology - To study the qualitative and quantitative characters of weed in relation to its associates.

(2) Ecophysiology - To study the various phenological events and physiology of germination etc.

(3) Study of allelopathic effect of *Merremia emarginata* on germination, seedling and plant growth of main crop.

(4) Control - To study physical and chemical control of the weed in relation to the main crop 'Rabi' and 'Kharif'.

The present investigation are made to understand the nature of weed and its cheapest control measures. So that the methods may be applied country-wise in a essay way.
Tansley and Chip (1926) described the aims and methods of the study of vegetation. Work of Singh and his collaborators (1937, 1938) at Varanasi covered such aspects as changes in density of weed flora during the course of 'Rabi' season. Quantitative analysis of weed flora and distribution pattern of weeds on arable land. They recommended use of one metre square quadrats for quantitative studies of weed flora in general and have also used such quadrats for determining changes in density and distribution pattern of weed flora on arable lands during 'Rabi' season.

Earlier publications on the weed flora are mostly in the form of manuals and hand books (Kenoyer, 1924; Thandulingam and Nargan, 1932; Luthra, 1938; Singh and Mittal, 1941 and Thakur, 1954). However they are to be upgraded by incorporating precise description of weeds and latest nomenclature.

Cottam and Curtis (1948) used the punched cord method in phytosociological studies. The concept of interspecific association or correlation has long been used as a tool for understanding the biological relationships among different species of a community (Cole, 1949; Goodall, 1952; Smith and Cottam, 1967 and Singh, 1969). The biological association is composed of species which are more frequently associated
with each other in comparison to other species. The interspecific association is generally evaluated through Chi square test. Statistically association may be considered as the amount of co-occurrence in excess or otherwise of the two species are independently distributed. Cottam and Curtis (1948) used Chi square test for testing the association between plant species. Later on it was advocated by Cole (1949) and Goodall (1952) used positive interspecific correlation for the classification of vegetation based on quadrat study. The correlation between the presence or quantity of different species recorded in quadrats implies heterogeneity of different species recorded in quadrats were placed of the quadrat data can be so divided that within each sub-division no interspecific correlation occurs, three subdivisions represent elementary classification units of vegetation. An objective classification may be arrived at if some method can be found of satisfying this requirement.

It is accepted that shape size and number of quadrat varies with the nature & density of community. Van Dyne et al., (1963) and Naik (1973) employed circular quadrat, Christidis (1931), Green (1951) and Pearson (1965) used rectangular shaped quadrats in their studies. Square shape of the quadrat has been considered suitable by Bliss (1956), Odum (1960), Iwaki et al., (1964), Singh (1969), Pearsall and Newbould (1957), Godley (1965), Shanker (1965), Choudhary (1967), Dakwale (1975), Gupta (1976), Trivedi (1976)

Cole (1949) has emphasized that the positive association between two species can be attributed to their overlapping habitat requirement. Pielore (1969) pointed out that in case of positive association a species may have beneficial effect. He further stated that the two species showing positive association may have identical overlapping ecological association the habitat requirement of the two species are distinct or one species tends to exclude the other.

Mac Arthur (1968) observed that a greater species diversity in a community leads to the formation of many niches in a microhabitat. Richard (1963) surveyed the arable land of Trinidad to find out easily weeds succession by quadrats sampling method.

Gupta and Yadav (1977) studied interspecific association among highly abundant species in a mixed grassland. They concluded that all species combinations can be classified into three categories i.e., species pairs significant, positive association and significant negative association and non-significant negative or positive association.

Phytosociological aspect of weeds in crop fields and their ecological characters have been studied by numerous workers (Pandeya and Shah, 1966; Tripathi and Misra, 1971; Shukla, 1972; Rao et al., 1977; Kudnappa et al., 1977; Singh,
1978; Sharma, 1981; Shivnath and Gupta, 1982; Sharma, 1984; and Lyshele, 1985).

Shukla (1972) reported some quantitative and synthetic analytical characters of weed crop association of different crop fields in Denmark. The data were subjected to cluster and factor analysis in an effort to relate crop types and their weed flora. There was a close relationship between growth period of crop and their weed flora Singh (1978). He revealed that majority of weeds specially annual therophytes weeds of 'Rabi' are usually not represented during 'kharif' through a few were recorded in both. He also studied habit, phenology, frequency and abundance of weed species associated with different crops. Similar studies were carried out by Sudhir Kumar (1979) in a wheat field and five dominant weeds with 100% frequency were recorded.

Sharma (1981) and Shivnath and Gupta (1982) carried out a phytosociological study at Ajmer in the semiarid zone and in subtropical conditions at Kotdwara Garhwal Himalaya during the 'rabi' and 'kharif' season. The importance value index (IVI) of each species associated within crop was calculated for frequency, density and cover values.

Kodnoop et al., (1977) and Kumar et al., (1980) carried out phenological observations of weeds. Kodnoop et al., (1977) stated that the weeds germinate within a week and complete their life cycle in about 10–12 weeks, they suggested that weed
control method must be adopted before sixth week otherwise seed setting starts making it difficult to eradicate them. They studied 8 common weeds of Hyderabad and reported that only one weed showed seed dormancy.

Kumar et al., (1980) while studying the phenological variation in herbaceous vegetation state that climatic conditions have strong impact on vegetation. Lyskede (1985) studied morphological and anatomical features of *Cuscuta pedicellata* and *Cuscuta compesta* at different life cycle stages.

Fisher (1985) studied contribution to the study of the arrhenatherion Alliance in West Germany.

Bajpai and Verma (1964) surveyed the weed flora of Jodhpur. Tomar and Mathur (1965) surveyed the common weeds of Ganga canal area and work on classification of weeds. Their salient features and association with crop season and place of occurrence were also carried out by these workers Mehta and Singh (1969) surveyed weed flora of command area of Chambal at Kota and reported that about 50% of the weeds belong to 5 families (*Leguminosae, Compositae, Gramineae, Euphorbiaceae* and *Amarantaceae*) while the rest of the weeds belong to 35 families of angiosperms.

Patel et al., (1949) surveyed the weed flora of Kodona project command area of Khariya district of Gujrat and reported 175 species belonging to 49 families. Joshi and
Singh (1965) reported 250 species of agricultural importance from all parts of India with notes on infested crops and economic distribution and recommended control measures. They categorised these weeds into 'kharif' and 'rabi' crop weeds.

Gupta (1966) surveyed the weed flora of Tarai region in Uttar Pradesh and reported 140 weed species belonging to 34 families, a majority of which belonged monocotyledons. Chauhan (1966) studied the flora of Vallabh Vidhya Nagar giving emphasis on grasses.

Saikie et al. (1967) gave a check list of important weeds in Asian pacific region presenting weeds of 17 countries or major areas. They included weeds of three major ecological areas for their survey. (a) waste land range pasture and orchard weeds (b) upland crop weeds (c) low land and aquatic weeds.

and cultivated fields at Jhansi.


Granström (1974) studied the cropping techniques and weeds in Sweden. The weed flora in a variety of crops is outlined and the competitive ability and mode of growth of the crop are discussed. Crop rotation, seedling rate, plant density and mode and time of harvesting with reference to their effect on weed flora are also discussed.

Carnegie (1974) surveyed the dicot weeds in spring sown cereals in North West Scotland. The survey area was split into 6 districts and the weed seedlings were counted just before spraying of herbicides, out of the total weed flora 6 weed species alone could account for more than 80% of the weed population. He further recorded considerable differences in the proportions of weed species in the various districts which showed specific relationship with the soil conditions and frequency system.

Ingram (1978) studied the distribution of perennial
weed grasses in the arable region of the United Kingdom, 24% of grasses alone were reported to cover arable land the proportion of grass species and soil type.

Ito (1977) surveyed the weed flora in Takachi district Hokkaido (Japan). He reported 416 weed species belonging to 67 families including the poisonous and naturalized weeds, growing in the upland and lowland habitats. 119 species of naturalized weeds were found in the arable non-arable lands.

Gupta et al., (1977) studied the weed problem at Rampur (Nepal). They conducted the weed survey in major crop area and in non-crop situation; 63 major weeds were found. Out of these 15 belonged to Gramineae and 15 to Cyperaceae.

Chancellor (1977) carried out a preliminary survey of arable weeds in Britain. He concluded that weeds of arable land are in a constant state of flux. Each change in agricultural practice has resulted in decline or increase in the occurrence of individual species. There is a wide spread belief that in recent years change in weed flora have been accelerated by the use of herbicides. Mittnacht et al., (1979) reported the change in the weed flora of cereal crop since 1948 weed survey conducted in 1948–49 reported 124 weed species out of these 60 were detected in a subsequent survey in 1975–78. Takematsu et al., (1980) studied agricultural weeds of cropland in Brazil.
Chaudhary et al., (1981) surveyed the weeds of eastern Arabian peninsula. They have calculated the intensities of infestation and listed the plants which caused severe infestation.

Ball (1981) carried out identification of grass weeds in cereals. Keys were prepared based on vegetative characteristics for identification of the major perennial and annual grass weeds of cereals in U.K.

Various workers carried out ecological survey of weeds in paddy fields. Many such reports are available from several parts of this country (Hay, 1955; Misra and Mohanty, 1962; Dutta and Majhi, 1963; Pandey and Shah, 1964; Vinod Shanker, 1965; Bir and Sidhu, 1974; Shetty et al., 1975; Sugha and Shukla, 1977; Dutta and Banerjee, 1978; Singh, 1979; Pathak, 1981; Vinod shankar, 1982 and Sharma, 1983).

Reports on survey of weed infesting paddy fields are also available from other countries. Their control measures have also been suggested. Barrett and Seaman (1980) studied weed flora of Californian rice fields and discussed the origin and present composition of this flora. They have reported 62 species of aquatic angiosperm, out of which two third are native. Teerawatsakul (1981) surveyed the weeds of paddy fields in Thailand.

Sundra (1981) surveyed the weed flora of paddy fields
in Indonesia. Kim (1981) surveyed the weeds in Chiang and Lew (1981) surveyed the weeds in Thaivan. Efimora and Kryshko (1982) reported the nature of weed infestation of rice yields in Kuban river area, which are mainly infested with 32 weeds belonging to 16 families some of them are the most dominant.

Marceno et al., (1985, 86) described flora of sicilian mountains in west central Sicily.

Fischer (1985) studied sociology, ecology, syndynamics and distribution of 'ruderal meadows' within the city of Giessen (West Germany) comparison with corresponding relieve material from their cities of central Europe.

Autecological and eco-physiological works have been done by many workers in our country like Bakai (1952), the autecology of Anisochilus erioccephalus; Mall (1957), autecology of M. punyak C. tora; Dubey (1968), autecology of M. gangetica; Pathak (1981) ecophysiology of Commelina benghalensis; Tripathi (1984), ecophysiology of Anogeissus pendula. Rai and Agrawal (1985) seed polymorphism and germination behaviour of Ipomoea muricata growing in cultivated India tropic deserts.

The earliest cultivation has been familiar with the competition among plants and the adverse effect of weed on the growth of crop. Although their knowledge was purely in
empirical terms. Element et al., (1929) extensively reviewed the earlier work on competition.

It is not necessary that the association of two or more plant species should always result in competition. A prime example exists in the symbiotic association of legumes and grasses. Mathur (1961) and Dubey (1971) discussed such as aspect of plant relationship. Similarly a comparative study of cereals and legumes has been carried out by Mirchandani and Misra (1957), Schreiber (1967), Hall (1974), Kapoor and Ramakrishnan (1975) and Willey (1979). All these authors suggest that such a relationship results in increase of the yield.

The detrimental effect of chemical substances released by plant population in their environment affecting seed germination as well as seedling growth of neighbouring plants were reported by Pickering (1903), Eveneri (1949), Whittaker and Feena (1971), Chou et al., (1976), Bokhari (1978), Pathak and Misra (1981) and Sharma (1984).

Plants release those substances via root exudation, volatization, rainwash from their aerial parts and also by leaching and decomposition of litter (Kanchan, 1978). The inhibitory action of these substances is usually related to the quantity of weed plant material and soil moisture content present within the field to dilute exudate.
Decandolle (1832) has emphasized the importance of root exudation by plants, which inhibit growth of plants. Some workers like Gray and Bonner (1948), Hamilton and Bucehots (1955), Martin et al. (1964), Ohman et al. (1960), Bellet et al. (1972), Rizivi et al. (1980) and Parker (1985) have examined successional sequences mainly from competition point of view in terms of allelopathy.

Dubey (1976) studying the phenomenon of allelopathy in M. gangetica reported that this species has not only a strong allelopathic effect on crop and other associates species but its own population gets supressed.

Rydrach and Muzik (1968) studied the competition between Pormus tectorem and wheat. Their studies show that it causes the premier weed problem in winter wheat areas receiving 15 to 55 cms of rainfall under the higher rainfall regime because of the greater weed population.

Smith and Levik (1974) examined the effect of Lolium rigidum on the grain yield of wheat and related it to a yield analysis equation. The presence of rye grass at quite a low density (450 plants/m²) reduced the capacity of wheat plants to produce fillers. Neither the later removal of rye grass nor the addition of nitrogen overcome the set back. This results in a further loss in yield and that this would increase with increasing density of rye grass.
Sharma and Lavania (1981) studied the interference between *Vicia* species and *Triticum aestivum*. They have concluded that severe infestation of these species causes considerable loss to the growth and yield of crops. The deleterious effect of increasing weed crop ratio from 2:1 to 10:1 resulted in the reduction of all the growth parameters in *T. aestivum*.

Kadian *et al.*, (1982) studied the effect of intra and interspecific competition on various growth parameters of wheat variety. 'Sonalika' in pure and mixed stand with *Chenopodium album*.

Pandeya and Vyas (1982) carried out investigations on interspecific competition between *Celosia argentea* L. and pearl millet. They introduced weeds into the crop plant simultaneously earlier and later than crop sowing. The effect of root exudates from the weed plants of different ages on seedlings of the crop plants were also studied. The biomass and yield of the crop plants introduced simultaneously and the weed plants that were introduced early sowed depressing effect on the crop growth while the late introduced weed plants were suppressed by crop plants.

Cacissan *et al.*, (1982) studied the effect of the duration of co-existence of *Chenopodium album* on the field of a maize crop. Weeds developed rapidly, competition was strong even at low densities. At a density of 7 weeds/m for 10 weeks
the grain yield of maize was reduced by 18% and reduction in yield was significantly greater when weeds persisted for more than 10 weeks.

Successful use of various chemicals have been suggested by a number of workers (Asana et al., 1955; Singh et al., 1960; Dubey, 1968; Shopov, 1972; Singh and Choudhary, 1970; Singh, 1973; Naik et al., 1977; Reddi et al., 1977; Seshadrinath et al., 1980; Sharma, 1981; Pathak, 1981; Vantzaramjeam et al., 1984; Petvadzhieva et al., 1985 and Rao et al., 1985).

Smith (1971) reported that different herbicides have different mode of action.

Matlib and Kirwood (1976) reported that 2,4-D and 2,4,5-T inhibit phosphate uptake in bean roots by uncoupling or inhibiting oxidative phosphorylation. After spraying treatment with 2,4-D and 2,4,5-T some morphological changes observed in weeds as earlier reported by Khoela (1967), Bakal, (1972), Musiyaka and Kalini (1975).

Pathak (1981) reported that small amount of herbicide gave stimulatory effect on associated weed and much amount gave harmful effect on weed.

Petvadzhieva et al., (1985, 86) reported effect of herbicides on hedge wind weed Calystegia sepium. They reported that Glyphosate fluroxypir sulphoxat herbicide can reduce the number of dormant radicle buds within 40 cm of the surface.