CHEMICAL WEED CONTROL IN CHINA ASTER

(Callistephus chinensis [L.] Ness*)*

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DIVISION OF HORTICULTURE

UNIVERSITY OF AGRICULTURAL SCIENCES

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Affectionate dedication to my beloved parents

Smt. ERAMMA
Sri. CHICKANANJAIAH

AND

Sri. VEERABHADRAIAH
Smt. SAROJAMMA H.B

DEPARTMENT OF HORTICULTURE

UNIVERSITY OF AGRICULTURAL SCIENCES

BANGALORE

CERTIFICATE

This is to certify that the thesis entitled **"CHEMICAL WEED CONTROL IN CHINA ASTER (Callistephus chinensis (L.) Ness"** submitted by **Mr. C.BASAVARAJU,** for the **Degree of Master of Science** (Agriculture) in Horticulture of the University of Agricultural Sciences, Bangalore, is a record of research work done by him during the period of his study in this University under my guidance and supervision and the thesis has not previously formed the basis of the award of any degree, diploma, associateship, fellowship or other similar titles.

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INTRODUCTION

I INTRODUCTION

China aster (callistephus Chinensis (L)Ness) is one of the important Cut flower in Karnataka next to Chrysanthemum. It is gaining importance around cities. China aster are grown in an area of about 800 ha, for their cut flower of diverse forms and flowers used in making bouquets, Botton holes and garlands. Mainly grown in the districts of Bangalore, Tumkur, Kolar and Mysore. As with the other ornamental plants, perfection in the form of plants, excellence in the quality of cut flowers and increased flower production are important objectives to be reckoned in commercial flower production.

China aster flowers are grown for bedding as well as for cut flowers. Large compact flowers with straight stalks are considerd ideal for cut flower industry while for making garlands, the thickness of flower is of vital importance. However for better economic utilization of china aster flowers, further improvements in the number of flowers per plant as well as quality of individual bloom is of considerable importance.

Though the quality of cut flower is primarily a varietal trait. It is greatly influenced by climatic,

nutritional, crop composition weed flora and other factors, frequent irrigation and liberal use of manures and fertilizer in cultivation of china aster provides favourable conditions for luxurious growth of weeds. More often fields get so much infested with the weeds that crop production becomes uneconomical unless they are controlled. Thus weeds pose greatest hazards and they compete with china aster plants for water, light and nutrients. They increase cost of cultivation and reduce the quantity and quality of china aster.

Control of weeds in Indian farms is one of the most expensive items in production of china aster. Hand weeding is normally taken re-course to keep the crop free from weed competition. The process of weeding operation requires every nook and corner of land to be covered by labour, This is indeed very expensive and accounts for 20 to 25 per cent of the total cost of production (Sahu and Battacharya 1964). Weeding has to be carried out expediously within short period of time during which period the availability of labour will normally be inadequate, thus the use of herbicides appear to be a better substitute for this age old tiresome practice.

The science of weed control has advanced considerable during the past two decades. A number of herbicides have been advocated for control of weeds in flower crops. However detailed information on the these herbicides, their appropriate dosage, time of application, is not fully available to the farmer level, considering the economic importance of this crop, the present study was taken up with the following objectives.

1) To screen the different herbicides and efficiency on controlling weeds in china aster.
2) To know the effect of different herbicides on growth, yield and quality of china aster.
3) To study the effect of herbicides in combination with sucrose in post harvest life of cut flowers.

REVIEW OF LITERATURE

II REVIEW OF LITERATURE

Weeds are unwanted and undesirable plants which interfere with the utilization of land and water resource and thus adversely affect human welfare. Weeds compete with crop plant for nutrients, soil moisture and sunlight. Reduction in crop yield has a direct correlation with weed competition. In flower crops we may have to resort mainly to an integrated approach of weed control, involving cultural practices in combination with some herbicides. A sudden switch over from hand weeding to chemical weed control may not be the answer to alleviate the weed presence in china aster.

Commercial cultivation of china aster (Callistephus chinensis (L.) Ness) has recieved attention only in recent past and as such one its information available on chemical weed control is very meagre, Hence information on closely related flower crops have been included in this review in the following subheadings.

1) Screening of herbicide to control weeds.
2) Phytotoxicity
3) Herbicidal effect on growth and yield and
4) Herbicidal effect on vase life.

China aster even though hardy crop, it is greatly influence by climatic, nutritional, crop composition, weed flora and other factors, frequent irrigation and liberal use of manures and fertilizer in cultilvation of china aster provides favourable condition for the growth of weeds.

Use of herbicides has recieved much less attention and systamatic investigation to asses the effect of herbicides on growth and flower production in china aster have not been under the field condition.

2.1 Screening of herbicides to control weeds in flower crops

The potential use of herbicide will delay the weed growth during cropping season, because of the high wages and unfavourable weather conditions at weeding, herbicides are gaining importance in areas where they have not previously been used.

Overman (1973) reported that the application of Sodium Azide at 10-40 lb ai per acre and Carbofuron at 10 lb per acre, either alone or in combinatin to chrysanthemum beds are effective to control pig weeds but when applied at high dose of 20, or 40 lb/acre, caused phytotoxic to pig weeds (Amaranthus Spp).

Baranowski (1974) evaluated nine herbicides in china aster and recomended use of Nexoval (chloroprophan) spray at 4 kg /ha one day before transplanting to control weeds, however he observed phytotoxicity due to higher rate and Tenoran (Chloroxuron) herbicide application.

Billat (1976) reported that control of weeds in chrysanthemum with the application of Tenoran (Chloroxuron) at 6 to 9 kg/ha. Further observed that best control due to Tenoran at 5 kg/ha combined with either planavin 1.5 kg or kerb (propyzamide) at 2 kg ai per ha.

Moreau (1976) evaluated five herbicides on gladiolus on various soil types and noted that efficient weed control with metolachlor without phytotoxicity and also evaluated three herbicides on carnation and concluded that propachlor as the best weedicides, further conducted studies with seven more herbicides on some annuals grown for seed production where he observed that in general the best results were with Metabromuron and metribuzin and noted that the non effectiveness of trifluralin.

Wilfreet and burgis (1977) working on flower crops viz., Ageratum, gladiolus and petunia, in fine sandy soils that applicaion of herbicides three times at one month

interval with soil remaining fallow for four months after last application reported that EPTC, Napropamide at 6 lb and MBR-825-(perfluridon) at 4 lb per acre were the most effective in reducing weed population.

Nishimato et al (1979) conducted studies in chrysanthemum and carnation all were grown from rooted cuttings and when treated on same day or the day after transplanting observed that Trifluralin, EPTC, Nitrofen, DCPA and Diphenamid were the most effective herbicides for control of weeds in chrysanthemum and trifluralin and Nitrofen in carnation.

Rolewskez and saniewski (1978) working on gladiolus with eight different herbicides reported that Aresin (monolinuron) at 2.5 kg per ha or Afalon and Linuron at 3 kg per ha as most effective in control of annual weeds.

Chapugier (1979) reported that in roses the annual weed were effectively controlled in bare soils by Simazine at 2.5 and 3.5 kg/ha or Alachlor at 3.3 kg/ha. But noted that in mulched soil the herbicide activity was much reduced, perennial weeds were controlled only by glyphosate at 2 lb or 4.32 kg/ha. Further reported that under the glass house the most effective treatments were nitrofen at 2kg + either

Chlorothal dimethyl at 7.5 kg, propyzamide at 1.5 kg or propachlor at 7.5 kg per ha.

Newman and Binning (1980) studied on annual flowering crops with twenty four herbicides applying over a seven periods on twenty flower species on silt loam soils having 3.5 per cent organic matter, where liquid application were made before and dry formulations immediately after transplanting in irrigation water. Where they observed that control of broad leaves weeds over a period of 6 years was 93 per cent with diphenamid, for oxadiagon (97 per cent) and (77 Per cent) trifluralin (96 per cent) and control of annual grasses were 85, 48, 99 and 98 per cent respectively.

Ahrens (1981) reported that when twenty two herbicides were sprayed in newly planted perennials ornamental in the field observed that excellent control of annual weeds for 25 days and generally less good control for 65 days, further observed that two component mixture gave better weed control for 65 days than individual herbicides further noted that fine at 1 lb ai per acre was most effective to control weeds in perennial ornamentals.

Bing (1981) reported that when Alachlor at 4 lb, chloramben at 4 lb, oxidiazon at 4 lb per acre were very

effective in controlling weeds seedlings when applied after transplanting of annual flower viz., Begonia, Coleus, Dahlia, Impatients, Petunia, Salvia, Geranium and Marigold.

Bing (1981) observed that Diphenamid at 4 lb per acre and Napropamide at 4 lb per acre resulted in excellent selective weed control in newly planted annuals.

Haramaki and Kuhns (1981) observed that mixture of sprays Alachlor and Simazine, Metolachlor are effect to control weeds when sprayed of Alachlor + Simazin 1 lb, Oxyflurofen 0.5 - 4 lb and prodiamine 1 - 8 lb, per acre produced good weed control especially at the higher rates and mixtures of these herbicides gave excellent weed control.

Pitt et al (1981) found that application of Linuron at 1 kg per ha 24 days after planting of Gladiolus corms, resulted in fairly good weed control and did not appreciably affect most of the growth and flower attributes.

Deuber and Aguiar (1982) observed that on silty soil, application of 1 to 2 kg either of Granular or Oxadiazon was effective to control weeds in rose and with higher rates in a clay soil.

Koutepas (1982) working on the effect of weedicides on qulitative and quantitative character of gladiolus observed that Metoxuron was effective to increase plant height with flower weight and higher flowering per centage and further noted that perfluidone was phytotoxic.

Molnar (1982) listed the most important weeds in the glass house ornamentals as Amaranthus albus, Capsella bursapalforus, Chenopodium album, Ambrosca elatior, Galinsoga parviflora, and Digitaria sanguinalis, further noted that in carnation best weed control was obtained with Tenoran chloroxuron, at 300 g + Adol (Lenacil) at 200 g per 1000 m2, applied after the establishment of rooted cuttings. Addition of dual (metolachlor) at 300 ml per 1000 m2 to the mixture enhanced weed control in Chrysanthemum acceptable weed control was obtained with Tenoran at 300 g + Dachthal chlorthal dimethyl 900 g per 1000 ml applied 1 to 2 days before planting out the rooted cuttings.

Singh (1982) observed that maximum herb and oil yield in Mentha arvensis and Mentha Piperta were obtained by maintaining weed free condition for 105 days from planting using Terbacil at 1.5 kg. A mixture of Terbacil at 1.2 kg per ha and propanil at 1.5 kg per ha when applied as pre-emergent was most effective in Mentha pipertita.

Watkins and Heggers (1982) inferred that many weed species associated with nurseries can be kept control by using Oryzalin + Trifluralin at 0.3 and 0.5 kg/ha. Further noted that both broad leaved and grass weeds can be checked up to two months.

Bing (1983) observed that in Chrysanthemum grown in pots were free of weeds with application of 4 lb oxadiazon followed by the same rate of wettable powder formulations are effective to control weeds with 3 lb Metolachlor, 0.5 lb Oxyflurofen granules.

Hensley and Carpenter (1983) reported application of post emergent herbicides glyposate at 2.24 kg per ha or paraquat 4.48 kg per ha to control weeds in Juniper species plots.

Haramaki and Kuhns (1983) observed that the best control of weeds in china aster and Ageratum by application of chloramben, and Napropamide granuals.

Johnson (1983) reported that control of Bermuda grass in Juniper species by application of Glyposate dalopon and paraquat at 2.2, 4.2 or 0.6 kg per ha respectively.

Rozanski et al (1983) inferred that the effective control of weeds in gladiolus Viz Digitaria sanguianalis, Eleusina indica and Paspalum accuminatum were effectively controlled by sethoxydim.

Stewart et al (1983) reported that in green house and in field experiments of gladiolus that Alachlor and Metolachlor had potential for control of Cyperus esculantus at 2.2 or 4.4 kg/ha for six weeks further Bing and Macksel (1984) observed that 10 and 20 lb DCPA, 4 and 8 lb Napropamide 2.8 lb trifluralin and 2 - 8 lb diphenamid per acre were effective against grasses in flowering annuals.

Gilreath (1984) evaluated and recomended use of pre and post emergent application of 1.5 lb Alachlor + 2 lb CIPC 2 lb Napropamide, Oryzalin, Pronamide and 4 lb Thiobencarb per acre for control of Digitaria ciliaris and Amaranthus hybrida in Gladiolus.

Gilliam et al (1984) recommended that use of post emergent of 1.1 kg sethoxydim and 0.6 kg fluazifop-butyl per ha for 90 per cent control of Cyandon dactylon grown in ornamentals.

Brosh et al (1985) reported that best control of convolvulaceae weeds in gladiolus by pre emergent and post

emergent application of Oxadiazon and Oxyflurofen.

Brosh et al (1985) observed that eighty per cent reduction in Convolvulaceae species by applying oxyflurofen as soil drench with hand sprinkler at the base of rose bushes, prior to irrigation and further reported that control of all annual weeds by Oxyflurofen and Oxadiazon, application.

Bucsbaum et al (1985) working on Geranium reported that treating the soil with phloem translocation such as 2, 4-D and glyposate aplication two weeks before transplanting cuttings were able to prevent emergence of annual weeds during winter. Further noticed that the selective control of weeds with Neboron + Surfactant were on effective to control young grasses, while Simazine at low rate in early winter to control conyza species.

Johnson and Burns (1985) suggested that herbicide such as Chlorthal-dimethyl and Napropamide for control of Digitaria sanguinalis in Cynodan dactylon turf with soil pH 5-6.

Ahrens (1986) reported the use of oxyflurofen in irrigation water 5-6 times bi-weekly at 0.056-0.45 kg/ha for

container grown Azalea and Rhododendron. Oxyflurofen at 0.22 kg per ha gave 90 per cent control of Senecio vulgaris and Conyza canadensis weeds.

Gilreath (1986) conducted series of experiments and suggested that use of Oryzalin at 2.2 kg per ha in Gladiolus for control of Digitaria ciliaris, Eleusina indica and Amarathus hybridus.

Kuhns et al (1986) recommended the use of pre-emergence and post-emergence herbicides such as sethoxydim, B.A.S. 517-02-H (Cycloxydem) fluazifop-butyl and AXF 1294 for control of grasses in annual flower crops.

Lamont and Connell (1986) recommended that the use of 1.25 or 2.25 kg of Alachlor 1.2 or 4 kg Oxyflurofen and 2.25 or 2.5 kg Napropamide per ha to control the weeds in china aster and zinnia during summer.

Lamont (1986) evaluated hebicides suitable for the control of weeds in cut flower crops in sandy loam soil and recommended that herbicides viz., Alachlor,Chlorates, dimethyl, Napropomide, Oxadiazon and Oxyflurofen suitability during summer for Carnation, Chrysanthemum, Gypporphilla helichrysum and Zinnia to control more than 90 per cent of grasses and 67-100 per cent of broad leaved weeds.

Yadav and Bose (1987) in trials with Tuberose single and Gladiolus cv, vinks glory observed that the promotion of growth flowering and yield at 0.5 kg/ha of Oxyflurofen in Tuberose and Gladiolus apart from maximum control of weeds.

Hatterman et al (1987) observed that pre-emergent application of Chloroprophan, Napropamide, Oxadiazon, EPTC and Trifluralin were effective to control weeds in annual flower statice, further suggested that the use of Oxadiazon for control of broad leaved weeds.

2.2 Phytotixicity

The length of time that a herbicide remain active or persists in the soil is extremely important as it relates to the length of time of that weed control can be expected, also residual toxicity is important. As it relates to phytotoxic after effects that may prove injurious to succeeding crops of planting. Herbicides may disappear faster with large amounts of water that provide leaching and with repeated cultivation or mixing of the soil.

Overman (1973) working on chrysanthemum reported that the use of Sodium Azide at 10-40 lb/acre was phytotoxic to pig weeds and Amaranthus weeds.

Baranowski (1974) observed phytotoxicity due to the application of Tenoran (Chloroxuron) at 6 kg/ha in China aster.

Billat (1976) inferred that in Chrysanthemum application of Tenoron (Chloroxuron) at 6 or 8 kg/ha and planavin (Nitralin) at 3 kg/ha was phytotoxic.

Freeland et al (1981) conducted studies on selected herbicides in annual for crops viz., Snapdragon, Marigold, Geranium and petunia and observed that application of Trifuralin at 9 kg ai per hectare. Oryzalin at 2.2 kg ai per hectare and Alachlor at 4.5 kg ai per hectare were injurious to Snapdragon.

Pitt et al (1981) reported that the safe use of herbicides such as of Linuron at 1 kg per ha twenty four days after planting of Gladiolus corms.

Bing (1981) reported that in annual flowers viz., Begonia, Coleus, Dahlia, Impatients, Petunia, Salvia, Geranium and Marigold that tolerance to herbicides was variable with severe injury to Begonia from Nitrofen at 4-8 lb per acre and less injury due to Alachlor, Oxadiazon and Chloramben and Nitrofen at 4 lb/acre but Impatients and

Petunia injured severly due to these herbicides at 4 ib/acre.

Koutepas (1982) worked on effect of weed and herbicides on qualitative and quantitative charactaristic of Gladiolus with pre-emergence application of 3 kg ai Metoxuron or 2.5 kg ai perfluidone per hectare, and incorporation of EPTC granules at 3.5 kg ai/ha and reported that the perfluidane herbicide was phytotoxic.

Haramaki and Kuhns (1983) conducted chemical weed control experiments in bedding plants with Chloromben and Napropamide granules and a Diphenamid and observed that Ageratum, and China aster are tollerent but injurious to Impatients, Portulaca and sweet willium.

Johnson (1983) reported that the use of Glyphosate, Dalapon and paraquot at 2.2, 4.2 and 6.0 kg per hectare are not injurious to Junipers species when applied for control of edging grass.

Stewart et al (1983) showed that Alachlor and Metolachlor were not injurious to Gladiolus and potential for control of Cyperus esculantus weed .

Bing and Macksel (1984) working on control of weeds in

flowering annuals in the field trial at the dosage of 10 and 20 lg per acre DCPA 4 and 8 lb Napropamide 2.8 lb Trifuralin and 2.8 lb Diphenamid per acre were noticed some phytotoxicity. Particularly which were responsible for reduction in growth of Celosia and observed that Diphenamide at 8 lb per acre was toxic to Celosia and Antirrhinum.

Gilliam et al (1984) worked on bermuda grass control in woody ornamentals with post-emergent application of herbicides at 1.1 kg Sethoxydim and 0.6 kg fluazifopbutyl per hectare, they observed that when these applied directly over field grown ornamental. Only Azalea was damaged by application fluazifopbutyl to a degree of that the plants were unsalable.

Brosh et al (1985) reported that when Oxyflurofen at 0.5, 0.75 and 1 kg Oxadiazon and 1.6, 2.4 and 3.2 kg Metoxuron applied as pre and post emergence to Gladiolus main infesting weed species noticed were Amaranthus, Malvaceae, Heliotropium and Convolvulace species Oxyflurofen and oxadiazon were safe only at the lower rate, but Post-emergent sprays damaged the leaves and inhibited plant Growth and also reported that the hand aplication at lower rate as soil drench was non injury.

Ahrens (1986) observed that in trials with oxyflurofen when applied 5-6 times bi-weekly in irrigation water 5 to 6 times bi-weekly at 0.056 to 0.45 kg ai per hectare to container grown ornamentals viz., Syntheia, Azalea and Rhododendron all these rates of a oxyflurofen injured the ornamentals when applied during flushes of new growth but matured leaves were less affected.

Kuhns et al (1986) conducted experiment in field trials and found that sethoxydim BAS 517-02-H (Cycloxydim), fluazifop-butyl and AXF 1294 provided total control of grasses without any injury to begonia, petunia, salvia and statice.

Hatterman et al (1987) evaluated weedicides suitable for annual flower statice and suggested the use of pre-emergence weedicides such as Chloropropham, Napropamide, EPTC and Oxadiazon which cause no injury or reduce marketability.

2.3 Herbicidal effect on growth, yield and quality

There are various methods to control weeds in china aster, but none can be said as best because each has its own merits and de-merits. The final choice of any weed control method or herbicide will depend on effectiveness on the crop

growth and quality.

Baranowski (1974) working with nine herbicides noticed that the higher numbers of flowers obtained, however with Nexoval or Alipur each at 4 kg per hectare, however the treatment had no appreciable effect on flower diameter, seed number or seed germination.

Bing (1977) reported that pre-emergence application of Alachlor or Napropamide at 2 lb per acre in the cultivation of gladiolus was effective to control weeds but Alachlor at higher dosage of 8 lb per acre was markedly reduces Cormel yield.

Wilfreet and Burgis (1977) reported that when EPTC at 6 lb/acre, Napropamide at 6 lb and MBR-8251 (Perfluroden) at 4 lb recorded of higher flower yield in Petunia, Ageratum and Gladiolus herbicides applied to fine sandy soil three times at one month interval with soil remaining fallow four weeks after the last application. In Petunia, Ageratum and Gladiolus recorded higher flower yield.

Rolewska and Saniewski (1978) reported that higher flower production and corm yield in gladiolus with the application of Aresin at 2.5 kg ai per hectare or Afalan, Linuron at 3 kg per hectare.

Bing (1979) observed that herbicide Napropamide upto 16 lb, and Prodiamine at 2 to 4 lb per acre, Oxadiazon at 4 to 8 lb and Oxyflurofen 2 to 4 lb per acre were greatly reduced the production of Gladiolus cormels, further noted that Alachlor at 4 to 8 lb per hectare reduced corm production from cormels and cut flower yield.

Pitt et al (1981) reported that when linuron at 1 kg per hectare applied 24 days after planting corms on vertisol, during the Kharif did not appriciably increased the growth of flower attributes, however noted the increase in leaf length, bredth and girth of the stem.

Koutepus (1982) observed that in gladiolus the pre-emergent application of 3 kg/ha ai Metoxuron was responsible for increase in plant height, flowering percentage and cut flower weight and earlier flowering by 5 to 8 days compare to unweeded.

Bing and Macksel (1984) reported that use of herbicides at 10 and 20 lb DCPA 4 and 8 lb Napropamide, 2 to 8 lb Trifluralin and 2 to 8 lb diphenamid per acre were effective in flowering annuals. Application of DCPA reduce the growth of Celosia, Vinca, Impatients, Balsamina, Begonia and

Coleus. Further noted that the use of DCPA, Napropamide and Trifluralin delays flowering in Vinca and Balsmina species.

Gilreath (1984) evaluating the pre and post emergence application of 1.5 lb Alachlor + 2 lb C.I.P.C. 2 lb Napropamide, Oryzalin, Pronamide and 4 lb Thiobencorb per acre in gladiolus found that application of Napropamide and Thiobencorb were able to reduced the number weight of flower spikes, while yield from plants treated with Alachlor + CIPC Oryzlin and Pronamide were compareble to control.

Brosh et al (1985) repoted that safe use of 0.75 kg Oxyflurofen per hectare as soil drench without any undesirable effect on growth and flower yield of Gladiolus Cv peter pearce.

Bing et al (1986) reported that in gladiolus safe use of post-emergence use of herbicides Sethoxydim or fluazi-fop-butyl which compensated for corm yield increase resulting from weed control.

Gilreath (1984) observed that in multiple application of several pre-emergent herbicides such as Oryzalin at 2.2 kg per hectare, 2.2 kg Propazamide, 1.7 kg Alachlor and 1.7 kg Metolachlor per hectare with minimal effect on growth of Gladioulus but with reduced corm yield.

Gireath (1986) evaluated twelve herbicides on growth of Caladium tuber production and found that the safe, use of pre-emergent and post-emergent application of 3 to 6 lb per acre, Alachlor 2 or 4 lb per acre, Simazine, Oryzalin 1.5 or 3.0 lb per acre in Caladium. Further noted that plant Oryzalin vigour was greater with 1.5 lb Oryzalin than with 6 lb Alachlor or either rate of Simazine. However the higher tuber yield was obtained with 1.5 lb Oryzalin.

Yadav and Bose (1987) working on herbicidal effect on Tuberose and Gladioulus recorded highest Tuberose flower yield (10 to 20 tonnes per hectare). with good quality compare to unweeded (5 to 8 tonn per hectare) and recommended Oxyflurofen at 0.5 kg per hectare as preplant soil spray for promoting growth and flowering in Gladiolus with higher flower yield (221000 spikes/ha).

2.4 Herbicidal effect on vase life

The use of preservative solution to promote quality and prolong the life of cut flowers has been known for many years. Flower preservatives composed mainly of sugars and germicides and sometimes include other ingredients. The primary function of the sucrose was to supply a source of energy for metabolic processes.

Sucrosee is included in most preservative formulations but other metabolic sugars like Glucose and Fructose are similar effective. Lactose and Maltose were active only on low concentrations, while the non-metabolic sugars Mannitol and mannose were inactive or harmful (Aarts, 1975 a Halevy and Mayak 1979, Kofranek et al 1978 and Narayana Gowda 1986).

The optimum concentration of sugars varies with the treatment and the flowers, generally for a given flower the longer the exposure to the chemical solution the lower the concentration required, therefore high concentration are used for pulsing, intermediate for bud opening and low for holding solutions.

Excesively high sugar concentration can damage foliage and petals, one of the main reason for the variability in optimal sugar concentration for different flower is the sensitivity of the foliage of some plants. Green leaves are most sensitive to high sugar concentration than petals, probably because their ability for osmatic adjustment is less than that of petals (Halevy 1976).

Acock and Nichols (1979) and Narayana Gowda (1986)

confirmed that sugar improve the water balance and osmatic potential of flowers.

Water

The most important and the universal ingredient is water, the composition of 'tap water' varies greatly in various locations. This may influence the longivity of the flower in tap water, as well as the efficiency of chemical solutions used for holding, pulsing or bud opening(Rogers, 1973 and Staby and Erwin, 1978) the determental effect of tap water depends on several factors acidity, RH, total dissolved solids (TDS) and the presence of specific toxic ions, because of the complexity of the various factors and their interactions, it is difficult to predict the effect of certain tap water on longivity just from the mineral analysis of the water. In a few cases, tap water found to be better than deionised water for increasing the keeping quality of some flowers (Coorts and Gartner, 1963).

2.5 Economics of weed control

The final choice of any weed control method depends to a greater extent on the cost of the herbicides and their relative efficiency. Although chemical weed control seems to be cheaper and effective, the overall economics of this practice does not justify its general adoption by growers

except in areas where the labour is costly and scare during peak periods of farm operations. No reports are available on economics of flower crops.

Weed spectrum varies with location in the same crop and weeds cause severe reduction in yield, competing with the crop for nutrients moisture, light etc. The weeds pose a serious problem in china aster in the early four to six weeks period during which the crop is most succeptable to weed competition. Use of herbicides have several advantages on growth quality and yield of flower crops.

MATERIAL AND METHODS

III MATERIAL AND METHODS

The present experiments were conducted during the period of June to October 1988 (Monsoon) at the Horticultural Research Station Gandhi Krishi Vignana Kendra University of Agricultural Sciences, Bangalore. The material used and techniques adopted during the course of this investigations are given below.

3.1 Geographical location and climate

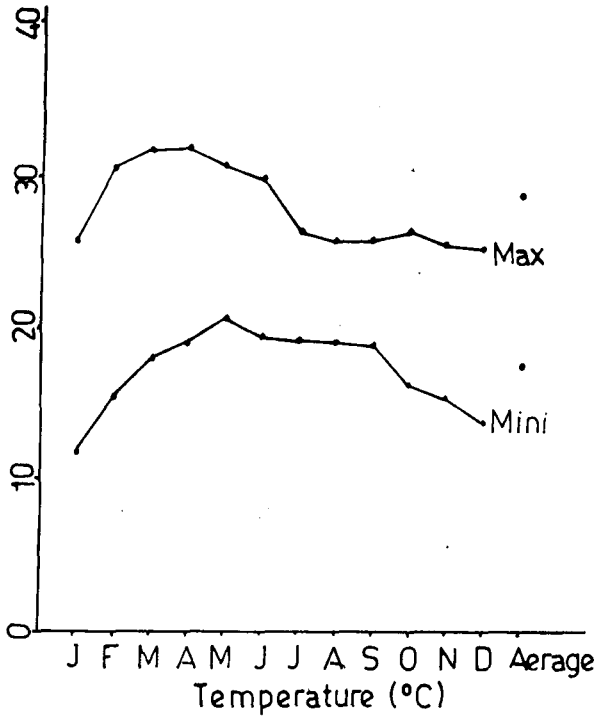
The experiment was conducted in red sandy loam soil with pH 5.9 which is located at an elevation of 930 M above the sea level. North and on a longitude of 77°-35' East. The meteorological data for the period from January 1988 to December 1988 is presented in Table-1 and depicted in Fig. 1 and 1.1.

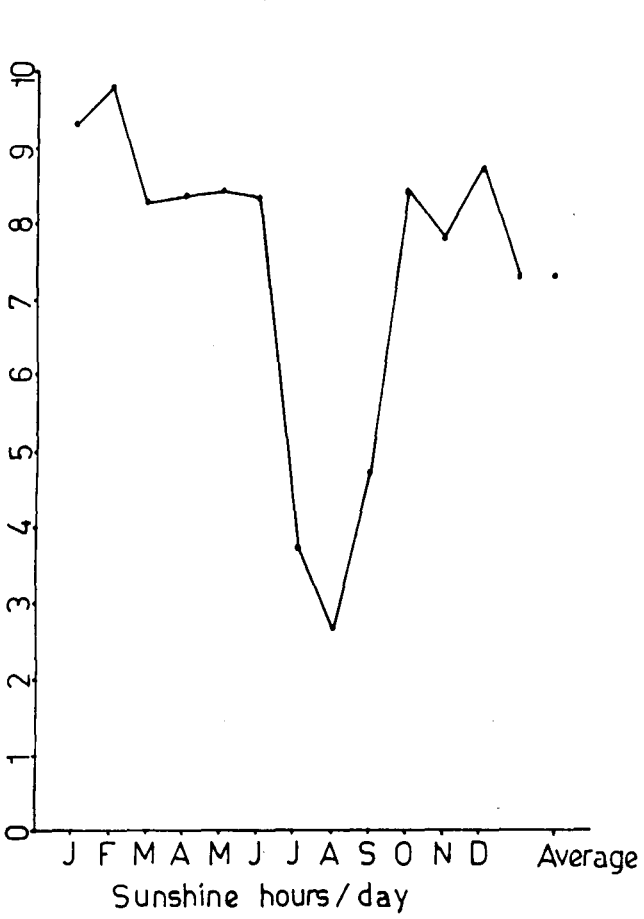
3.2 Varietal description

China aster (Callistephus chinesis (L) Ness), Cv ostrich plume belongs to the comet type belonging of pink erect annual with alternatively arranged broad ovale leaves with serration edges. It grows in a very open form with loose branching habit, flowers are bracteate and bracteolate with central disc visible due to reflexed florets.

Table-1 Mean monthly meterological data for the year 1988.

Months	Temperature (oC) Max.	Min.	Relative Humidity (%)	Sunshine Hours/day	Wind Speed KMPH	Rain fall (mm) Monthly	No. of Rainy days
January	26.4	13.3	69	9.4	8.0	0.0	0.0
February	30.7	15.9	53	10.0	7.5	0.8	0.0
March	33.3	18.9	57	8.3	7.3	7.6	2.0
April	33.3	19.6	58	8.4	8.3	75.8	4.0
May	32.3	20.4	62	8.5	10.4	163.4	5.0
June	30.5	19.8	63	8.4	13.5	7.7	1.0
July	27.5	19.6	72	3.8	13.6	272.0	14.0
August	26.7	19.2	75	2.7	11.5	167.7	16.0
September	27.0	18.9	75	4.8	7.7	388.5	12.0
October	28.2	16.9	68	8.5	4.7	123.9	4.0
November	26.7	15.1	63	7.9	7.0	18.9	2.0
December	25.7	14.0	64	8.8	8.4	59.8	2.0
Annual Temprature.	29.0	17.6	65	7.3	9.0	128.7	62.0





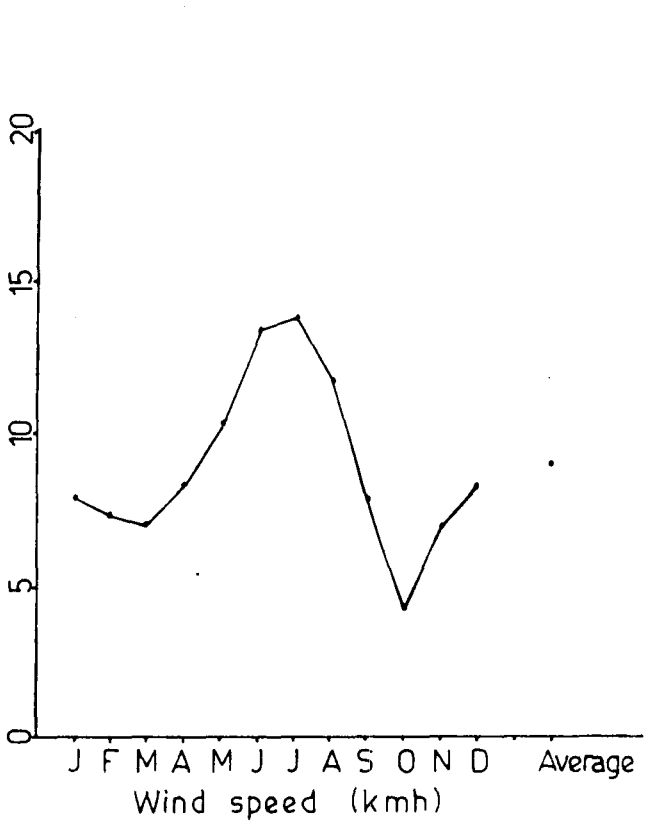


FIG.1.0 MEAN MONTHLY METEROLOGICAL DATA FOR THE YEAR 1988

3.3 Design and experimental details

The experiment was laid out by adopting the Randomization completely Block design. (R.C.B.D.).

3.4 Experiment - I

Experimental details:-

Net plot 2 m X 1.8 m = 3.6 m2

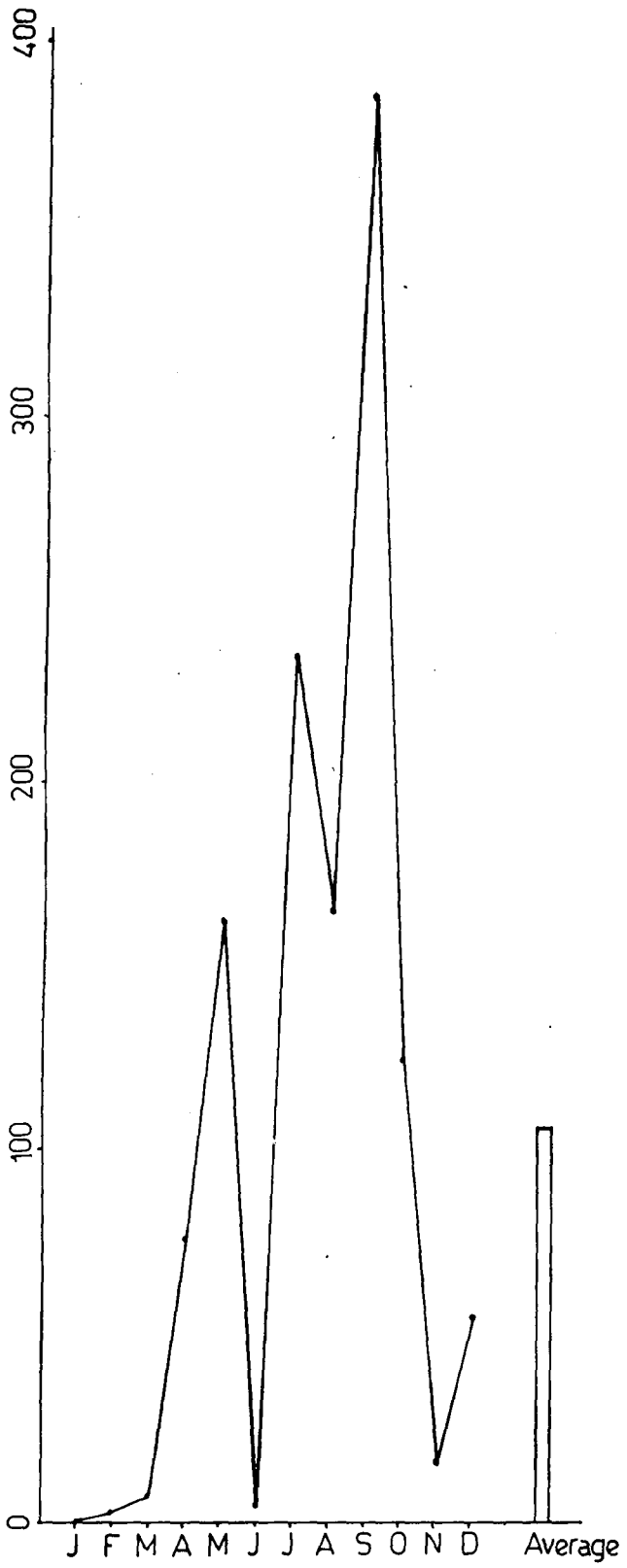
Total gross area/plot 2.15 X 1.9 m = 4.1925 m2

Replication : Three

Treatments : 17 as below

The details of treatments were as follows.

1.	Diuron	0.75 kg ai/ha as pre emergence application
2.	Diuron	1.00 kg ai/ha as pre emergence application
3.	Diuron	1.25 kg ai/ha as pre emergence application
4.	Simazine	1.00 kg ai/ha as pre-emergence application
5.	Simazine	1.25 kg ai/ha as pre-emergence application
6.	Simazine	1.50 kg ai/ha as pre-emergence application
7.	Metolachlor	1.00 kg ai/ha as pre-emergence application
8.	Metolachlor	1.25 kg ai/ha as pre-emergence application
9.	Metolachlor	1.50 kg ai/ha as pre-emergence application
10.	Alachlor	1.00 kg ai/ha as pre-emergence application
11.	Alachlor	1.25 kg ai/ha as pre-emergence application
12.	Alachlor	1.50 kg ai/ha as pre-emergence application



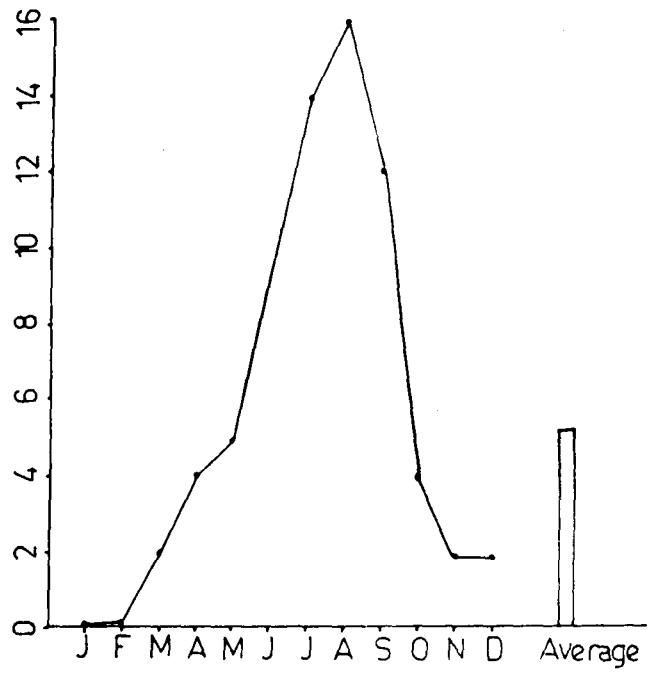


FIG.1.1 MEAN MONTHLY METEROLOGICAL DATA FOR THE YEAR 1988

13. Pendimethalin 1.00 kg ai/ha as pre-emergence application

14. Pendimethalin 1.25 kg ai/ha as pre-emergence application

15. P endimethalin 1.50 kg ai/ha as pre-emergence application

16. Unweeded control

17. Hand weeding thrice at 30, 60 and 90 DAT.

3.5 Pre-emergence spraying of herbicides

One day after the transplanting, the herbicides were sprayed with the help of hand operted knapsac sprayer. The spray volume was 1000 L/ha.

The hand weeding was followed to study or to compare with the efficiency of various herbicides for weed control.

3.6 Design and layout

The experiment was laid out in a Randomized completely block design with three replication, the plan of layout is given in fig.2.

Plot Size

Net plot 2 m X 1.8 m = 3.6 m2

Total area : 2.15 m X 1.95 m = 4.1925 m2

3.7 Nursery

Seeds were sown in raised seed beds on 15th May 1988.

T_8	T_{13}	T_4	T_{14}	T_{17}	T_{11}	T_9	T_1	T_{12}	T_3	T_{15}	T_6	T_{16}	T_7	T_2	T_{10}	T_5	R_I
T_2	T_{10}	T_5	T_3	T_6	T_{17}	T_{11}	T_{14}	T_7	T_4	T_{16}	T_{15}	T_{13}	T_9	T_1	T_{12}	T_8	R_{II}
T_9	T_{17}	T_8	T_{16}	T_{11}	T_1	T_{14}	T_3	T_6	T_{15}	T_{10}	T_7	T_{12}	T_4	T_{13}	T_5	T_2	R_{III}

LEGEND

T_1=Diuron 0.75 kg ai/ha.
T_2=Diuron 1.00 kg ai/ha.
T_3=Diuron 1.25 kg ai/ha.
T_4=Simazine 1.00 kg ai/ha.
T_5=Simazine 1.25 kg ai/ha.
T_6=Simazine 1.50 kg ai/ha.
T_7 =Metolachlor 1.00 kg ai/ha.
T_8 =Metolachlor 1.25 kg ai/ha.
T_9 =Metolachlor 1.50 kg ai/ha.
T_{10}=Alachlor 1.00 kg ai/ha.
T_{11}=Alachlor 1.25 kg ai/ha.
T_{12}=Alachlor 1.50 kg ai/ha.
T_{13}=Pendimethalin 0.75 kg ai/ha.
T_{14}=Pendimethalin 1.00 kg ai/ha.
T_{15}=Pendimethalin 1.25 kg ai/ha.
T_{16}=Unweeded control.
T_{17}=Hand weeding at 30, 60 and 90 DAT.

Fig = 2. PLAN OF LAYOUT OF EXPERIMENT.

Captan drenching was given along with regular watering to the beds. Seedlings were ready for transplanting in 30 days after sowing.

3.8 Transplanting

The experiment plot was ploughed to a depth of 15-20 cm and the plots of 2m X 1.8m were prepared and to each of the plots 10kgs of farm yard manure was added. Treatments were alloted randomly to each plot. Thirty days old seedlings were transplanted on 15th of June 1988.

3.9 Irrigation

The crop was irrigated once in four to six days depending upon soil moisture conditions.

3.10 Plant protection

The crop was sprayed at 25 days intervals with a 0.2 percent mancozeb and 0.2 per cent Dimethoate as prophylactic measures.

3.11 Application of fertilisers

Nutrients were supplied in the form of urea (46.4 percent N), Super phosphate (16.0 percent of P2O5) and muriet of potash (60 per cent of K2O) respectively. A fertilizer dose of 180:120:100 kg/ha was applied. Entire phosphorus and potash and half of Nitrogen doses were given

Plate-I

1. General view of experimental plot.

as basal dose, the remaining half of Nitrogen applied 30 days after the transplanting.

3.12 Herbicides

3.12.1 Diuron (80%)

It belongs to ureas group, the chemical name is 3-(3,4-dichlorophenyl)-1, 1-dimethyl urea. It is a pre emergence selective herbicide for controlling emerging grass.

3.12.2 Simazine (50%)

It belongs to triazine group, the chemical formula is 2-chloro-4, 6-bis (ethylamimo)-S-triazine. Simazine widely used as a selective pre-emergence herbicide for control of many annual broad leaf weed and some grasses in maize.

3.12.3 Metolachlor (50% EC)

It belongs to amide group, the chemical name is 2-chloro-N-(-2-ethyl-6-methylphenyl)acetamide. Metolachlor is applied at pre-emergence in crop like soybean, cotton sunflower, groundnut, maize etc., for control of annual grasses and perennial grasses including (echinochloa crusgalli and cyperus esculantus) etc.

3.12.4 Alachlor (50% EC)

This has a chemical formula 2-chloro-,6-diethyl-N-

Plate-II

2. Unweeded control.

(methoxymethyl) acetanilide. Belongs to amide group Alachlor is applied at pre-emergence or early post-emergence for control of the annual and certain broad leaf weed in corn and ground nut etc.

3.12.5 Pendimethalin (Stomp 30% EC)

It belongs to dinitroanilline group, the chemical formula is N-(1-ethylpropyl)-3, 4-dimethyl-2, 6-dinitro benzenamine. It is used mainly for the control of annual grasses and broad leaf weeds. It is used as pre-emergence and also appplied on a pre-plant soil incorporation treatment.

3.12.6 Observation on weed growth

The following are the observation recorded along with technique followed .

3.13 Weed control and crop toxicity rating

Visual ratings were made at 30, 45 and 60 days after transplanting at harvest to determine the extent of weed control and extent of toxicity caused by different herbicides on crop employing E.W.R.C. ratings.

The crop toxicity rating (E.W.R.C. System) made form 0 to 10 percent scale as follows

Score	Phytotoxicity Symptoms
1.	No symptoms/healthy plants.
2.	Very mild symptoms, Slight stunting.
3.	Mild but clearly recognisable.
4.	More sever sumptoms (e.g. chlorosis). not necessarily with negative effect on yield.
5.	Thinning out, heavy chlorosis or stunting reduction in the yield to be expected.
6. 7. 8. 9. 10.	Heavy damage to total kill.

The weed control rating were made from 0 to 10 points scale as follows :

Score	Percent activity	
1.	100	Complete control (excellent control)
2.	99.9 - 98.0	Good to excellent control
3.	97.9 - 95.0	Satisfactory control
4.	94.9 - 90.0	Moderate control
5.	89.9 - 82.0	Deficient to moderate control
6.	81.9 - 70.0	Deficient control
7.	69.5 - 55.0	Poor to deficient control
8.	54.9 - 30.0	Poor control

9.	29.0 - 00.0	Very poor control
10.	00.0	No control

3.14 Weed count :

The total number of weeds present per 0.5 sq. m. area in a permanetly marked spots were count in each plot before spraying of herbicides (30 days after transplanting at 60 DAT and at harvest they were further separated into monocot dicot and sedges.

3.15 Dry weight of weeds

The dry weight of weeds from an area of 0.5 sq.m. randomaly selected in the net plot area was recorded at three stages at 30 days, 60 and harvest days after transplanting, on maturity of weeds, they were cut upto ground level in 0.5 sq.m. area in the plot. The net plot was divided into two halves of the net plot was meant for dry matter sampling of weeds and crop and another half for crop yield. The weeds were oven dried at 80°C and dry weight were recorded.

3.16 Observation on plant growth and yields of China aster

3.16.1 Plant Height

The height of the growing tip of the plants from ground level was recorded in (cm) as height of plants. This was

recorded at an interval of 15 days after transplanting upto the harvest of the crop.

3.12.2 Number of branches per plant

The number of main branches arising from the main stem were counted in labelled plants and the average value was recorded as number of branches per plant it was recorded at 30, 45, 60 DAT.

3.16.3 Leaf area estimation

Leaves separated from the plants during partitioning were used for leaf area estimation. Leaf area was computed by using the punch borer method (Nuir, 1971). The diameter of the punch borer was 0.90cm and 25 leaf discs per plant were used.

3.16.4 Leaf area index

It is the ratio of the leaf area of the plant to the ground area occupied by the plant. It was computed by using the formula

$$LAI = \frac{\text{Leaf area of plant}}{\text{Area occupied by the plant (Spacing)}}$$

3.17 Flowering components:

i) Number of flowers per plant:

Randomly five labelled plants were selected from each experimental net plot and total number of flowers per plant were recorded.

ii) Numbers of days taken for 50 percent flowering:

Number of days taken for 50 percent flowering was counted commencing from the date of starting the experiment till 50 percent of plants in the plot flowered.

iii) Flower yield per hectare :

This was worked out on basis of fresh weight of harvested plants with flowers from each experimental plot.

3.18 Quality parameters:

Five labelled marketable flowers from each experimental plot were selected at random for recording the following observations.

i) Peduncle length:

The length of the stalk of flower was taken as peduncle length.

ii) Diameter of the flower:

Maximum breadth and length of the flower was taken as the diameter. This was measured by means of vernier calliperse.

iii) Dry weight ofthe flower:

Dry weight of fower was recorded after oven drying of the flower at 60°C till they recorded constant weight.

iv) Dry weight ofthe plant:

Five tagged plants in each plot were cut at the ground level and the above ground portions were first air dried and the later dried in hot air at 70°C till they recorded constant weight and average weight per plant was recorded.

3.19 CHEMICAL PLANT ANALYSIS

Five plants were cut at the base level from each plot and were dried at 70°C and chopped into small pieces about 20 grams of the plant material was sampled randomly and powdered and analysed for Nitrogen, Phosphorus and Potash content.

a) Total Nitorgen

The Nitrogen content of the plants was determined by kjeldahl's method (Piper 1950) distilling ammonia into boric acid and titrating against Ammonia collected into boric acid with standard sulphuric acid.

b) Phosphorus

One gram of plant sample was digested with triacid

mixture containing nitric acid per chloric acid and sulphuric acid and these were made upto 50 ml. with 4N HCl (10:4.1 v/v) on a suitable aliquot yellow cololur was developed by vandomolbdate method. Intensity of the colour was measured at 420 nanometer by using spectrophoto-meter (Jackson 1967).

c) Potassium

Wet digested samples were distilled and fed to the flame photometer to estimate potash content.

d) Reducing and non-reducing sugars.

Both reducing and non-reducing sugars were determined by Nelson somogyi micro copper method (Nelson, 1974) the underlying principle is that Blue cupric hydroxide suspended in an alkaline medium when heated is converted to insoluble black cupric hydroxide. In the presence of reducing sugar or agents, the cupric hydroxide is reduced to insoluble yellow red cuprous oxide. Thus cuprous oxide then reacts with arseno molybdate to give a blue colour complex, whose intensity is directly proportional to the amount of reduced copper.

Total sugar was calculated by adding the amount of reducing sugar present in the sample.

3.20 EXPERIMENT - II

Vase life studies :

Studies were carried out to improve the vase life of China aster Cv ostrich plume using chemical preservatives.

3.20.1 Experimental details

3.20.2 Design: Randomized completely blocks design

3.20.3 Variety: Ostrich plume

3.20.4 Treatments: 17 as below

3.20.5 Replication: Three

Details of treatment:

1.	Diuron	0.75 kg ai/ha + 2 per cent Sucrose
2.	Diuron	1.00 kg ai/ha + 2 per cent Sucrose
3.	Diuron	1.25 kg ai/ha + 2 per cent Sucrose
4.	Simazine	1.00 kg ai/ha + 2 per cent Sucrose
5.	Simazine	1.25 kg ai/ha + 2 per cent Sucrose
6.	Simazine	1.50 kg ai/ha + 2 per cent Sucrose
7.	Metolachlor	1.00 kg ai/ha + 2 per cent Sucrose
8.	Metolachlor	1.25 kg ai/ha + 2 per cent Sucrose
9.	Metolachlor	1.50 kg ai/ha + 2 per cent Sucrose
10.	Alachlor	1.00 kg ai/ha + 2 per cent Sucrose
11.	Alachlor	1.25 kg ai/ha + 2 per cent Sucrose

12. Alachlor 1.50 kg ai/ha + 2 per cent Sucrose
13. Pendimethalin 0.75 kg ai/ha + 2 per cent Sucrose
14. Pendimethalin 1.00 kg ai/ha + 2 per cent Sucrose
15. Pendimethalin 1.25 kg ai/ha + 2 per cent Sucrose
16. Unweeded control + 2 per cent Sucrose
17. Hand weeding at 30, 60 and 90 DAT + 2 per cent Sucrose.

Freshly prepared solutions with distilled water was used, for the vase life studies, Ostrich plume variety of flowers were cut and prepared in the same way as described earlier for vase life study. Individual flowers picked at random were placed in glass bottles containing 100 ml. of the above mentioned solution after determining the fresh weight of the flower.

3.21 Observations

i) Fresh weight: Daily changes in flower fresh weight were recorded by weighing each flower every day on a top pan balance. Fresh weight was expressed as percentage of original weight.

ii) Solution uptake: Amount of solution observed was found by substracting the solution remaining in each bottle from the original amount of solution.

iii) Vase life: The vase life was expressed as number of days from starting of the experiment until the flowers could no longer be retained as cut flower.

3.22 Economics of weed control treatment

To study the economics of different weed control treatments, observations on market price of herbicide time taken for spraying and hand weeding was recorded cost of labour was calculated taking into account the prevailing labour wages at the time of investigation at Rs.10.50 per woman, and Rs. 12.00 per men. Gross return from cutflower was calculated, Net returns was calculated by using the following formulae.

Net returns = Gross returns - cost of production

3.23 Statistical analysis and interpretation of data

Statistical interpretaion of data was done by following the fisher's analysis of variance technique as given by panse and Sukhtme (1967). The results were compared at 5 percent level of significance.

EXPERIMENTAL RESULTS

IV EXPERIMENTAL RESULTS

The result of the chemical weed control field experiment conducted during the year 1988-89 presented in this chapter.

4.1 Weeds observed in the experiment field

The important weed species observed on the experiment field were Panicum repens (L). Digitaria marginata link var fimbriata and Cynadon dactylon (L) pers, among the mono cots. Among sedges Cyperus rotundus(L.), and among dicots Aconthospermum hispidum DC., Achyranthus aspera (L.), Ageratum conyzoides (L.), Amaranthus spinosa (L.), Borreria articularis (L.), Commelina benghalensis (L.), Lagasa mollis (cav.), Phyllanthus fraternus webston, were the predominent weeds. These weeds are described below.

4.1.1 Panicum repens (L). Family : Poaceae

It is a aggresssive perennial creeping grass. Which propogated vegetatively through Rhizomes. The leaves are 15 to 25 cm long and 1.5 cm wide or less, linear, flat, or folded with a round base. the panicles are 6 to 8 cm long. Some what lease and open and errect or ascending. The spikelets are two flowered. pale green or pale yellow. It spreads very rapidly and becomes very persistant.

4.1.2 Digitaria marginata link var. Fimbriate Family : Poaceae

It is a annual, usually met within waste places cultivated field and pastures, recemes 2 many sub digitate, alternate. Sub whorled ; hairs of the mature spikelets spreads out farming a rapid fringe on both the sides, often mixed with thick-walled bristles. It is readily grazed by cattle.

4.1.3 Cynadon dactylon (L.) perse Family ; Poaceae

It is a perennial grass with long runners which strike root at the nodes, and extensive under ground Rhizomes. The leaves vary greatly in length from 3 to 20 cm. There is no membranous ligule where the leaf blade Joins the sheaths. The flowering stems normally 15 to 50 cm long. The inflorscence consists of 4 to 5 slender purplish, spikes of 10 cm long. It propogates vegetatively more than by seeds.

4.1.4 Cyperus rotundus (L.) Family : Cyperaceae

It is a very trouble some perennial weed, Stoloniferous, Stolens not bulbiferous, stem trigonus upto one meter high non tubers zones. Leave shorter or longer than stem, narrow, numerous, bracts usually 3, upto 6 cm long spikelets spreading, linear to lanceolate, upto 2.5 cm

long, glumes imbricate, plicate, pale brown or chest nut brown sometimes with a reddish tinge ; nut trigonoce broadly obovoid, greyish-black.

It is an obnoxious weed with a very high propogation potential. Tubers connected by Rhizomes go deep into soil even upto 60 cm and spread out widely. Tubers have a very high capacity for survival under adverse conditions. This is one of the world top ten worst weeds.

4.1.5 Acanthaspermum hispidum DC., Family : Asteraceae

It is a erect branched, hairy herb, upto 0.5 M high : leaves opposite simple ovate, entire or serrate acute, upto 4 x 2.2 cm ; heads in the forks of dichotomous branches, heterogamous, rayed ; corolla 3 lobed in female, 5 lobed in bisexual, lobes acute, ; Stamens 5, another base obtuse, not tailed fruit an achene, Spinous.

4.1.6 Achyranthus aspera (L.) Var, porphyristachya hook Family ; Amarathaceae

It is a erect herb about 90 cm high, Stem simple or branched ; leaves thicks, orbicular-obovate or elliptic, obtuse, pubescent, tomentose, or velvety, rarely glaborous, petiole short ; Spike long about 25 cm long in fruit ; bracts membranous, spinescent, persistant bracteoles spinescent ; perianth 4-5 ragid, lonceolate, 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 backianthers, 2 celled ; Ovary sub compressed, 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.

4.1.7 Ageratum conyzoides (L.) Ageratum Family : Asteraceae

It is a erect softly hairy, annual herb ; leaves opposite, homogamous, in densecorymbs involucre componulate, bracts 2-3 seriate, Striate, Sub-equal ; receptable flat, naked or with codueous scales : Corolla tubular, equal, limb 5-Cleft, regular ; blue or white : anthers : appen daged base obtuse : style arms elongate, obtuse : achenes 5-angled, glabrous or the angles slightly hispid : pappus paleaceous, scaly, 5-awned, Serrate below.

4.1.8 Amaranthus spinosa (L.) Family : Amarathaceae

It is a erect spinous herb, stem reddish : leaves long petioled, ovate or oblong, leaf axils with spines : flowers in dense or lese axillary panicles bracteate, bracts setaceous, bristle-tipped, unisexal perianth 5-lobed, acuminate in the male flowers obtuse in the female flower.

Stamens 5, ovary compressed styles short, filiform : utricle with a thickned top.

4.1.9 Borreria articularis (L.) F.N. will Family : Rubiaceae

It is a hispid procumbent annual herb with long inter nodes : leaves opposite almost sessile ovate Stipules connate with marginal bristles : flowers small, axillary or terminal fascicles with long narrow corolla tube, white or pink stamens 4 : gynoceium inferior, bicarpellory, syncarpus, biloculer with only one ovule in a locule on axile placenta : fruit two-seeded mericap seeds pale red, oblong with a ventral groove.

4.1.10 Commelina benghalensis (L.) Family : Commelinaceae

It is glabrous or pubscent herb : stem creeping and rooting below lower nodes sometimes develop naked under ground shoots which bear small white flowers ripening into seeds under ground. Leaves ovate, oblong or suborbicular, obtuse or acute, base contracted into a petiole, pubescent or villous sheaths pubseent or villous, oftenbearded, or ciliate diffuse, short or long : spathes funnel-shaped 1-3 together, aurided on one side, pubscent or hirsute, upper branch of cymes 2-3 flowered, lowered 1-2 flowered or suppressed : flowers blue, undergound flowers white : sepals

3, membranons inner two connate : petals 3, two long clawed, third sometimes wanting ; stamen 3, perfect, 2-3 unperfect, filaments filiform, spirally coiled ovary 3-celled free, two cells 2-ovuled, third cell one ovuled : capsule membranous, shining, dorsal, valve strariolate, 5-seeded seeds closely pitted.

4.1.11 Lagasca mollis (cov) Family : Asteraceae

It is a annual rigid, villous grey-pubescent herb : Stem and branches scabrid : leaves opposite or upper alternate : petioled ovate acuminate : sub crenate, silky, tomentose beneaths, entire or toothed : heads in leafy balls, Solitary terminal and pedeencled,, homogamous, supported by bract like leaves, all bisexual fertile, while, involucre tubular, bracts 4-5 connate : receptacle small : corolla regular tube, tube short, limb elongate, cylindric or dilated lobes 5 : anther bases sagitate, auricles obtuse, style arms long, curved, hairy, achenes cuniate, compressed or 3-angled, papus fimbriate obscure it is an introduced from central America.

4.1.12 Phyllanthus fraternus Webston Family : Euphorbiaceae

It is a small, annual, glaborous, branching herb leaves, simple, alternate, membranous, Subsessile glaucouse

beneath, broadly obtuse at apex, elliptic-obovate, prominently, distichous resembling pinnately compound leaves : flowers solitary, axillary, minute, shortly pedicelled monoecious : Sepals 5-6, of male, borlicular, of female narrowly obovate oblong with broad white margins, spreading : petals in both desk in male glandular, in female annular lobed : Stamens 3, on a short column, sessile overy, superior, tricarpellery, synacarpous styles 3, free 2-lobed, capsule globle smooth, thinly crustaceous, found below the small narrow leaves. It is very common weed flowering throughout the year.

4.2 Weed population counts

Observation on monocot, dicot, sedges and total weed population were recorded from 0.5 sq.m area at 30, 60 days and at harvest after transplanting and the same has been presented in the Table-2 and 3.

4.2.1 Monocot weed population

Observation on monocot weed count at different crop growth stages are presented in Table-2 at all the crop growth stages monocot weeds count differed significantly among herbicides treatments.

At 30 day after transplanting heribicides treatments

recorded lower weed counts (5.33 to 7.33 per 0.5 sq.m). The maximum number of weed counts were in unweeded (34.33 per 0.5 sq.m) control. Application of Diuron at 1.25 kg ai/ha recorded the lowest weed count (5.33 per 0.5 sq.m), while Diuron at 0.75 kg ai/ha recorded the highest weed count (7.33/0.5 sq.m).

At 60 days after transplanting all herbicides treatments recorded lower weed count as compare to unweeded control (37.00/0.5 sq.m) The treatments which recieved hand weeding during this period recorded low counts (4.33/0.5 sq.m). Among the different herbicides tried Diuron (1.25 kg ai/ha) alone recorded the lowest weed count (5.00/0.5 sq.m). While simazine 1 kg ai/ha and 1.25 kg ai/ha recorded the highest weed count (8.33/0.5 sq.m).

At harvesting stage in all the herbicidal treatments weed count differed significantly with maximum weed count in unweeded control (42.66/0.5 sq.m). Diuron at 1 kg ai/ha, and hand weeding recorded minimum weed count (3.33/0.5 sq.m). Simazine at 1.25 kg ai/ha (9.66/0.5 sq.m) Pendimethalin at 1.00 kg ai/ha (10.33/0.5 sq.m) and Metolachlor at 1.5 kg ai/ha (10.66/0.5 sq.m) recorded lowest weed count. Diuron 0.75 kg ai/ha, Metolachlor 1.25 kg ai/ha, Alachlor 1.50 kg

ai/ha, recorded high weed count (11.00/0.5 sq.m) of monocot weeds at harvesting. Diuron at 1.25 kg ai/ha, Simazine 1.25 kg ai/ha, Alachlor 1.25 kg ai/ha and Pendimethalin 0.75 kg ai/ha recorded the higher number (12.00/0.5 sq.m) of monocot weeds.

4.2.2 Dicot weed population

Observation on dicot weed count at different crop growth stages are presented in Table-2. At different crop growth stages dicot weed counts differed significantly due to herbicidal treatments.

At 30 days after transplanting in all treatments recorded the lowest dicot weed population than unweeded control, (16.66/0.5 sq.m). Simazine at 1.25 kg ai/ha, Metolachlor 1.00 kg ai/ha, Metolachlor 1.25 kg ai/ha, Metolachlor 1.50 kg ai/ha were on par in weed count (2.00/0.5 sq.m). Diuron at 1.25 kg ai/ha, Simazine 1.00 kg ai/ha, Simazine 1.50 kg ai/ha, Alachlor 1 kg ai/ha, Pendimethalin 1.25 kg ai/ha were also on par in weed count (2.66/0.5 sq.m), followed by Diuron at 0.75 kg ai/ha. Alachlor 1.5 kg ai/ha, Pendimethalin 0.75 kg ai/ha, Pendimethalin 1. kg ai/ha, recorded high weed count (3.00/0.5 sq.m), next to Alachlor at 1.25 kg ai/ha which recorded higher (3.33/0.5 sq.m) weed count.

Table 2. Effect of different wed control treatments on monocot and dicot weeds (in 0.5 sq.m area) at different growth stages in China aster.

Treatments	Days after transplanting					
	Monocot Weeds			Dicot Weeds		
	30	60	At harvest	30	60	At harvest
Diuron 0.75 kg ai/ha	7.33	7.00	11.00	3.00	4.00	5.66
Diuron 1.00 kg ai/ha	6.33	6.00	3.33	2.33	3.66	4.66
Diuron 1.25 kg ai/ha	5.33	5.00	12.00	2.66	3.33	4.33
Simazine 1.00 kg ai/ha	5.66	8.33	12.00	2.66	5.33	7.00
Simazine 1.25 kg ai/ha	5.66	8.33	9.66	2.00	4.66	8.00
Simazine 1.50 kg ai/ha	3.66	7.33	12.00	2.66	4.00	10.66
Metolachlor 1.00 kg ai/ha	6.33	7.66	11.66	2.00	5.33	10.33
Metolachlor 1.25 kg ai/ha	6.33	7.33	11.00	2.00	5.00	7.66
Metolachlor 1.50 kg ai/ha	6.33	7.33	10.66	2.00	5.33	8.33
Alachlor 1.00 kg ai/ha	6.33	7.33	14.00	2.66	3.66	9.00
Alachlor 1.25 kg ai/ha	6.00	7.33	12.00	3.33	4.00	9.00
Alachlor 1.50 kg ai/ha	6.00	6.00	11.00	3.00	6.00	10.00
Pendimethalin 0.75 kg ai/ha	6.66	7.33	12.00	3.00	5.00	10.33
Pendimethalin 1.00 kg ai/ha	5.66	7.33	10.33	3.00	6.00	9.66
Pendimethalin 1.25 kg ai/ha	6.33	7.60	11.33	2.66	5.00	10.00
Unweeded control	34.33	37.00	42.66	16.66	17.33	27.66
Hand weeding at 30, 60 and 90 DAT	2.06	4.33	3.33	2.33	4.00	3.00
F test	*	*	*	*	*	*
SEM ±	0.8402	0.6216	1.2374	0.952	0.5633	1.2878
C.D. at 5%	2.4239	1.7934	3.5698	1.942	1.1149	3.7154

At 60 days after transplanting in all herbicidal treatments significantly lower weed population (3.33 to 6.00/0.5 sq.m.) was recorded over unweeded control (17.33/0.5 sq.m), however in all the treatments weed counts were on par, except with Alachlor 1.5 kg ai/ha and Pendimethalin 1 kg ai/ha (6.00/0.5 sq.m).

At harvesting ain all the herbicidal treatments there were significantly minimum weed population (4.33 to 10.66/0.5 sq.m), than unweeded control (27.66/0.5 sq.m). Diuron at different level recorded lower weed count than unweeded control, however in hand weeding lowest weed population (3.00/0.5 sq.m) was recorded than unweeded control. Pendimethalin and Simazine at different levels tried were not effective in control of weeds at harvesting stage, in all the three levels higher weed population were recorded in both the herbicides.

4.2.3 Sedges weed population

Observation on sedges at different crops growth stages are presented in Table-3. At all growth stages Sedges weed count differed significantly due to the herbicides treatments.

At 30 days after transplanting all herbicides treatments had significantly lower weed count as compared to unweeded control (25.33/0.5 sq.m). Diuron at 0.75 kg ai/ha recorded the lowest weed count (5.00/0.5 sq,m), followed by hand weeding (4.66/0.5 sq.m) and pendimethalin at 1 kg ai/ha recorded the low weed count (5.66/0.5 sq.m), Diuron 1.25 and 1 kg ai/ha recorded 6.00 and 6.33 number of weeds per 0.5 sq.m respectively. Pendimethalin at 0.75 kg ai/ha (6.33/0.5 sq.m), Metolachlor 1.25 kg ai/ha, (6,66/0.5 sq.m) recorded the minimum weed count than control, however Alachlor 1.25 and 1.50 kg ai/ha (7.33/0.5 sq.m) recorded low sedge count. Similarly low weed count in pendimethalin 1.25 kg ai/ha was recorded (7.33/0.5 sq.m), which were on par. In Alachlor 1 kg ai/ha (8.00/0.5 sq.m) followed by Metolachlor 1 kg ai/ha (8.33/0.5 sq.m) Simazine at 1.50 kg ai/ha (8.66/0.5 sq.m) and Simazine at 1. kg ai/ha (9.66/0.5 sq.m) recorded the maximum sedge population.

Weed count at 60 days after transplanting shown a significant difference on reduced weed population (4.33 to 8.00/0.5 sq.m), over unweeded control (28.00/0.5 sq.m) Diuron at 0.75 kg ai/ha recorded the lowest weed control (4.33/0.5 sq.m) but Simazine at 1.25 kg ai/ha recorded the maximum weed population (8.00/0.5 sq.m), However Diuron at

Table 3. Effect of different weed control treatments on Sedges and total weeds (in 0.5 sq.m area) at different crop growth stages in China aster.

Treatments	Days after transplanting					
	Sedges			Total weeds		
	30	60	At harvest	30	60	At harvest
Diuron 0.75 kg ai/ha	5.00	4.33	9.00	15.00	15.00	25.67
Diuron 1.00 kg ai/ha	6.33	6.00	2.66	15.00	15.66	10.67
Diuron 1.25 kg ai/ha	6.00	5.00	6.00	14.00	13.33	22.33
Simazine 1.00 kg ai/ha	9.66	6.00	7.33	18.00	19.67	26.33
Simazine 1.25 kg ai/ha	7.66	8.00	7.00	14.66	21.00	24.67
Simazine 1.50 kg ai/ha	9.66	7.33	9.00	17.00	18.67	31.67
Metolachlor 1.00 kg ai/ha	8.33	7.33	9.00	16.67	20.33	31.00
Metolachlor 1.25 kg ai/ha	6.66	7.00	9.00	15.00	19.33	27.67
Metolachlor 1.50 kg ai/ha	7.66	5.66	11.00	16.00	18.33	30.67
Alachlor 1.00 kg ai/ha	8.00	6.66	9.66	17.00	17.67	32.67
Alachlor 1.25 kg ai/ha	7.33	7.66	12.00	16.67	19.00	33.00
Alachlor 1.50 kg ai/ha	7.33	7.33	10.00	16.33	19.33	31.00
Pendimethalin 0.75 kg ai/ha	6.33	6.66	10.00	16.00	19.00	32.33
Pendimethalin 1.00 kg ai/ha	5.66	7.66	10.33	14.33	21.00	30.33
Pendimethalin 1.25 kg ai/ha	7.33	7.33	7.66	16.33	19.00	29.00
Unweeded control	25.33	28.00	29.66	73.00	82.33	100.00
Hand weeding at 30, 60 and 90 DAT	4.66	4.00	2.66	7.66	12.33	17.00
F test	*	*	*	*	*	*
SEM ±	0.9704	0.7849	1.0108	1.8647	1.5169	1.7320
C.D. at 5%	2.7995	2.2643	2.9161	5.3797	4.3769	7.8817

1.25 kg ai/ha (5.00/0.5 sq.m), Metolachlor at 1.50 kg ai/ha (5.66/0.5 sq.m), were on par. Diuron 1 kg ai/ha and Simazine 1 kg ai/ha (6.00/0.5 sq.m) were on par, similarly Alachlor at 1 kg and Pendimethalin 0.75 kg ai/ha recorded weed population of (6.66/0.5 sq.m) Simazine 1.25 kg (8.00/0.5 sq.m) and 1.50 kg ai/ha (7.33/0.5 sq.m) shown similar effect however Metolachlor 1 kg ai/ha (7.33/0.5 sq.m) and Metolachlor 1.25 kg ai/ha (7.00/0.5 sq.m) and Alachlor 1.50 kg ai/ha, and Pendimethalin 1.25 kg ai/ha recorded (7.33/0.5 sq.m) weed count. Alachlor 1.25 kg ai/ha, Pendimethalin 1 kg ai/ha (7.66/0.5 sq.m) were recorded singnificantly higher weed count than unweeded control. Hand weeding recorded the lowest weed count (4.00/0.5 sq.m) than all the treatments tried.

At harvesting stage all the herbicidal treatments recorded lower weed population (2.66/0.5 sq.m) than unweeded control. The lowest weed population was recorded with Diuron at 1 kg ai/ha (2.66/0.5 sq.m) while the maximum weed count was with Alachlor 1.25 kg ai/ha (2.00/0.5 sq.m), than unweeded control. There were not much difference in weed counts among other treatments they were on par. But the lowest weed count (2.66/0.5 sq.m) was with hand weeding.

4.2.4 Total weed population

Observation on total weed count at different crop growth stages are presented in Table-3. At all growth stages total weed count differed significantly due to the herbicides.

All the herbicides treatments recorded less number of weeds at 30 days after transplanting as compared to unweeded control (73.33/0.5 sq.m) Diuron 1.25 kg ai/ha recorded less weed count (14.00/0.5 sq.m), while the maximum weed count was recorded with Simazine 1 kg ai/ha (18.00/0.5 sq.m).

At 60 days after transplanting herbicidal treatments recorded significantly lower weed counts (13.33 to 21.00/0.5 sq.m) than unweeded (82.33/0.5 sq.m) after 60 days after transplanting. Diuron at 1.25 kg ai/ha recorded the least weed count (13.33/0.5 sq.m) while Simazine at 1.25 kg ai/ha recorded the maximum weed counts (21.00/0.5 sq.m). Diuron at 0.75 kg ai/ha (15.00/0.5 sq.m) Diuron 1 kg ai/ha (15.66/0.5 sq.m) were on par. Alachlor 1 kg ai/ha recorded weed count of (17.67/0.5 sq.m) followed Metolachlor 1.5 kg ai/ha (18.33/0.5 sq.m), and Simazine 1.50 kg ai/ha (18.67/0.5 sq.m) were on par. Pendimethalin 1.25 kg ai/ha and 0.75 kg ai/ha recorded (19.00/0.5 sq.m) higher number of weeds, closely followed by Alachlor 1.25 kg ai/ha (19.00/0.5 sq.m)

and Metolachlor 1.25 kg ai/ha (19.33/0.5 sq.m) and Simazine kg ai/ha (19.67/0.5 sq.m) which were on par. Metolachlor 1.00 kg ai/ha recorded high weed population (20.33/0.5 sq.m). Simazine 1.25 kg ai/ha and Pendimethalin 1.00 kg ai/ha (21.00/0.5 sq.m) recorded the higher weed count, However in hand weeding lower weed count (12.33/0.5 sq.m) was observed than other treatments.

During harvesting in all the herbicidal treatment low weed count was (10.67 to 33.00/0.5 sq.m) as compare to unweeded control (100.00/0.5 sq.m) Diuron at 1 kg ai/ha recorded the maximum weed counts (10.67/0.5 sq.m) while Alachlor at 1.25 kg ai/ha recorded the highest weed count (33.00/0.5 sq.m). Diuron at 1.25 kg ai/ha (22.33/0.5 sq.m) and Simazine 1.25 kg ai/ha followed by Diuron 0.75 kg ai/ha (25.67/0.5 sq.m) and Metolachlor 1.25 kg ai/ha (27.67/0.5 sq.m) recorded low weed population than unweeded control. Pendimethalin 1.00 kg ai/ha (30.33/0.5 sq.m) Metolachlor 1.5 kg ai/ha (30.67/0.5 sq.m), Alachlor 1.50 kg ai/ha, Metolachlor 1.00 kg ai/ha (31.00/0.5 sq.m), Simazine 1.50 kg ai/ha (31.67/0.5 sq.m) and Pendimethalin 0.75 ai/ha recorded higher weed count (32.33/0.5sq.m) however Hand weeding (17.00/0.5 sq.m) recorded low weed counts than different herbicides and levels tried.

Table 4. Effect of different weed control treatments on weed control rating and crop toxicity at different crop growth stages in China aster.

Treatments	Days after transplanting					
	Weed control rating			Crop toxicity		
	30	60	At harvest	30	60	At harvest
Diuron 0.75 kg ai/ha	3.50	6.20	6.23	1.66	1.66	1.33
Diuron 1.00 kg ai/ha	3.77	6.80	7.20	1.66	1.33	1.33
Diuron 1.25 kg ai/ha	3.85	6.30	7.00	1.33	1.00	1.66
Simazine 1.00 kg ai/ha	5.66	9.00	6.85	1.66	1.66	1.66
Simazine 1.25 kg ai/ha	5.33	9.35	9.00	1.66	1.66	2.00
Simazine 1.50 kg ai/ha	6.20	8.95	9.20	1.33	1.00	1.66
Metolachlor 1.00 kg ai/ha	7.28	5.50	8.20	2.00	1.33	1.66
Metolachlor 1.25 kg ai/ha	6.80	6.20	7.50	1.33	1.66	1.33
Metolachlor 1.50 kg ai/ha	6.90	6.30	7.00	1.33	1.66	1.66
Alachlor 1.00 kg ai/ha	6.00	6.66	7.50	1.33	1.66	1.00
Alachlor 1.25 kg ai/ha	5.80	7.33	5.33	1.33	1.33	1.66
Alachlor 1.50 kg ai/ha	7.50	5.85	8.00	1.66	1.00	1.00
Pendimethalin 0.75 kg ai/ha	7.60	6.00	8.25	1.66	1.66	1.60
Pendimethalin 1.00 kg ai/ha	6.50	6.25	9.25	1.33	1.33	1.33
Pendimethalin 1.25 kg ai/ha	6.45	6.30	9.00	3.66	4.00	3.66
Unweeded control	10.00	10.00	10.00	1.00	1.00	1.00
Hand weeding at 30, 60 and 90 DAT	1.66	2.1	2.26	1.00	1.00	1.00

4.3 Weed control and Crop toxicity ratings

Visual observation recorded on weed control rating on 30, 45, and 60 days after transplanting are presented in Table-4, and crop toxicity ratings recorded on 30, 45 and 60 days after transplanting are also presented in Table-4.

4.3.1 Weed control ratings

a) At 30 days after transplanting

Marked differences in weed control rating were noticed among the weed control treatments. The application of Diuron at 0.75 kg 1.00 and 1.25 kg ai/ha gave good control of weeds, which was comparable to hand weeding (1.66), Simazine at 1.00 kg, and Simazine at 1.25 kg ai/ha and Alachlor at 1.50 kg ai/ha gave a dificient to moderate control of weeds.

b) At 45 days after transplanting

Hand weeding gave a good control of weeds in the field (2.1), closely followed by Metolachlor 1.00 kg ai/ha, (5.50), Alachlor 1.50 kg ai/ha gave moderate control of weeds (5.85), while all other treatments gave very poor control of weeds.

c) At 60 days after transplanting

None of the treatments recorded a good control of weeds

rating at 60 days after transplanting. Alachlor 1.25 kg ai/ha (7.33) shown a difficient to moderate control of weeds. While in all other treatments poor weed control rating was noted.

4.3.2 Crop toxicity ratings

a) At 30 days after transplanting

Marked differences in crop toxicity was noted among different treatments. Maximum toxicity (3.66) was noted in pendimethalin at 1.25 kg ai/ha, followed by slight stunting toxicity was noticed in metolachlor at 1.00 kg ai/ha (2.00).

b) At 45 days after transplanting

Maximum crop toxicity was noticed with pendimethalin at 1.25 kg ai/ha, after 45 days of transplanting, while there was not much toxicity was observed due to the other herbicides tried.

c) At 60 days after transplanting

Pendimethalin at 1.25 kg ai/ha caused a moderate toxicity to the crop (3.66) followed by slight toxicity (2.00) with Simazine 1.25 kg ai/ha at 60 days after transplanting of china aster in the main field.

4.4 Dry weight of weeds

Observation on dry weight of weeds sampled in 0.5sq.m. area at 30 and 60 days after transplanting and at harvest are presented in Table-5 and depicted in Fig-3.

a) At 30 days after transpalanting

Dry weight of weeds differed significantly among the herbicidal treatments. All herbicidal treatments recorded significantly lower weed dry weight (3.25 to 8.77 g/0.5 sq.m.) than unweeded control (9.12 g/0.5 sq.m.). The minimum dry weight (3.25 g/0.5 sq.m.) was recorded with Simazine 1.50 kg ai/ha, followed by Alachlor 1.25 kg ai/ha. (3.47 g/0.5 sq.m.), Diuron 1.00 kg ai/ha (3.50 g/0.5 sq.m.) and Metolachlor 1.00 kg ai/ha (3.73 g/0.5 sq.m.).

b) At 60 days after transplanting

Dry weight of weeds differed significantly among herbicidal treatments. All herbicidal treatments recorded significantly lower weed dry weight (5.65 to 16.55 g/ 0.5 sq.m.) than unweeded control (26.36 g/0.5 sq.m.). Application of Diuron at 1.00 kg ai/ha recorded the lowest by pendimethalin 1.25 kg ai/ha. (6.58 g/0.5 sq.m.), and Simazine 1.25 kg ai/ha (6.35 g/0.5 sq.m.). Alachlor 1.25 kg ai/ha and pendimethalin 0.75 kg ai/ha (6.74 g/0.5 sq.m.) were on par.

Table 5. Effect of different weed control treatments on dry weight of weeds (0.5 sq.m. area at different crop growth stages in China aster.

Treatments	Days after transplanting		
	30	60	At harvest
Diuron 0.75 kg ai/ha	4.43	6.98	33.96
Diuron 1.00 kg ai/ha	3.50	5.65	23.31
Diuron 1.25 kg ai/ha	8.77	14.62	45.45
Simazine 1.00 kg ai/ha	6.74	15.62	28.51
Simazine 1.25 kg ai/ha	4.70	6.35	34.33
Simazine 1.50 kg ai/ha	3.25	7.45	26.55
Metolachlor 1.00 kg ai/ha	3.73	8.12	19.40
Metolachlor 1.25 kg ai/ha	5.70	16.55	25.25
Metolachlor 1.50 kg ai/ha	4.30	7.33	28.51
Alachlor 1.00 kg ai/ha	8.60	15.33	30.33
Alachlor 1.25 kg ai/ha	3.47	6.74	19.68
Alachlor 1.50 kg ai/ha	6.12	7.50	17.06
Pendimethalin 0.75 kg ai/ha	7.88	6.76	14.56
Pendimethalin 1.00 kg ai/ha	6.72	15.77	36.51
Pendimethalin 1.25 kg ai/ha	5.63	6.58	18.93
Unweeded control	9.12	26.36	70.55
Hand weeding at 30, 60 and 90 DAT	4.18	6.79	22.18
F test	*	*	*
SEM ±	0.1840	0.3330	2.1848
C.D. at 5%	0.5307	0.9606	6.3031

INDEX

TREATMENTS

T_1 =Diuron 0.75 kg ai/ha.

T_2 =Diuron 1.00 kg ai/ha.

T_3 =Diuron 1.25 kg ai/ha.

T_4 =Simazine 1.00 kg ai/ha.

T_5 =Simazine 1.25 kg ai/ha.

T_6 =Simazine 1.50 kg ai/ha.

T_7 =Metolachlor 1.00 kg ai/ha.

T_8 =Metolachlor 1.25 kg ai/ha.

T_9 =Metolachlor 1.50 kg ai/ha.

T_{10} =Alachlor 1.00 kg ai/ha.

T_{11} =Alachlor 1.25 kg ai/ha.

T_{12} =Alachlor 1.50 kg ai/ha.

T_{13} =Pendimethalin 0.75 kg ai/ha.

T_{14} =Pendimethalin 1.00 kg ai/ha.

T_{15} =Pendimethalin 1.25 kg ai/ha.

T_{16} =Unweeded control.

T_{17} =Hand weeding at 30, 60 and 90 DAT.

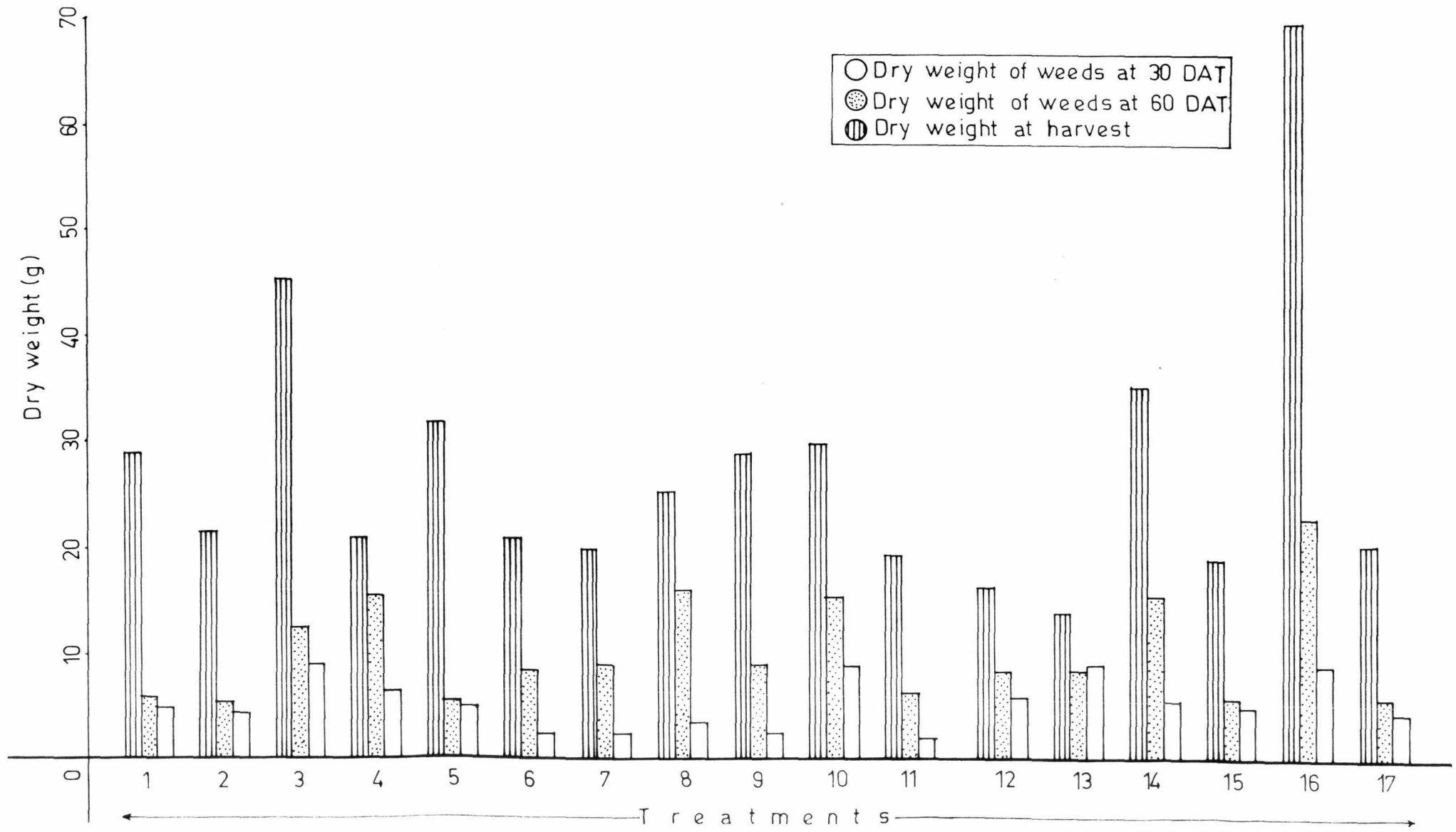


FIG. 3. EFFECT OF DIFFERENT WEED CONTROL TREATMENT ON DRY WEIGHT OF WEEDS AT DIFFERENT CROP GROWTH STAGES OF CHINA ASTER

c) At harvest

Weed dry weight differed significantly among the herbicidal treatments. All herbicide treatments recorded significantly lower weed dry weight (14.56 to 45.45 g/0.5 sq.m.) as compare to unweeded control (70.55 g/0.5 sq.m.). The lowest dry weight was recorded with metolachlor at 1.00 kg ai/ha (19.40 g/0.5 sq.m.), and highest dry weight among treatment tried recorded with Diuron at 1.25 kg ai/ha (45.45 g/0.5 sq.m.), Closely followed by Pendimethalin 1.00 (36.57 g/0.5 sq.m.), Simazine 1.25 kg, (34.33 g/0.5 sq.m.) and Diuron 0.75 kg ai/ha (33.96 g/0.5 sq.m.), hand weeding recorded (22.18 g/0.5 sq.m.) comparatively low dry weight.

4.5 Plant growth parameter

4.5.1 Plant height

The observation on plant height recorded on 15, 30, 45, 60 and 75 days after transplanting are presented in Table-6.

a) At 15 days after transplanting

The plant height differ significantly among the herbicides treatments. Diuron at 1.00 kg ai/ha recorded the taller plants (8.65 cm) follwed by Alachlor 1.50 kg ai/ha (8.63 cm) and the least plant height was with unweeded control (6.32).

Table 6. Effect of different weed control treatments on plant height (cm) and number of branches at different crop growth stages in China aster.

Treatments	Days after transplanting								
	Plant height					Number of branches			
	15	30	45	60	75	30	45	60	75
Diuron 0.25 kg ai/ha	7.53	18.52	36.23	45.22	47.01	2.66	8.73	10.60	13.06
Diuron 1.00 kg ai/ha	8.65	21.10	40.67	44.82	47.22	2.60	8.13	10.80	13.13
Diuron 1.25 kg ai/ha	7.56	17.85	36.80	44.97	43.94	2.33	8.13	10.26	13.76
Simazine 1.00 kg ai/ha	7.90	18.32	37.76	44.84	47.24	2.60	8.20	10.73	13.33
Simazine 1.25 kg ai/ha	7.66	18.63	39.04	43.83	46.99	2.46	7.80	10.86	12.90
Simazine 1.50 kg ai/ha	7.46	18.49	40.26	45.16	47.03	2.00	8.13	10.66	13.03
Metolachlor 1.00 kg ai/ha	7.43	18.50	39.52	44.73	46.34	2.13	7.73	10.46	13.33
Metolachlor 1.25 kg ai/ha	7.03	18.52	39.77	44.52	45.12	2.66	7.53	10.20	13.46
Metolachlor 1.50 kg ai/ha	7.53	17.61	38.73	43.83	46.85	2.46	7.96	10.73	13.30
Alachlor 1.00 kg ai/ha	7.51	18.19	39.60	44.52	46.46	2.53	7.86	10.80	13.33
Alachlor 1.25 kg ai/ha	8.63	22.44	40.05	44.86	46.95	2.60	7.66	10.73	13.26
Alachlor 1.50 kg ai/ha	8.05	19.97	39.79	45.31	47.38	2.33	7.73	10.53	13.36
Pendimethalin 0.75 kg ai/ha	7.08	18.19	38.30	44.89	46.74	2.40	7.60	10.33	13.20
Pendimethalin 1.00 kg ai/ha	7.21	18.00	38.72	44.41	46.88	2.66	7.40	10.53	13.40
Pendimethalin 1.25 kg ai/ha	7.66	18.64	38.82	44.78	46.84	1.80	7.73	10.60	13.26
Unweeded control	6.32	15.60	21.54	33.84	40.37	2.03	4.26	6.83	9.36
Hand weeding at 30, 60 and 90 DAT	6.93	18.13	37.44	44.78	44.06	3.96	9.36	10.60	13.63
F test	*	*	*	*	NS	*	*	*	*
SEM ±	0.3199	0.8261	1.3415	0.4234	3.5227	0.2038	0.2388	0.1904	0.1883
C.D. at 5%	0.9228	0.2834	3.8702	1.2216	10.1630	0.5880	0.6889	0.5492	0.5433

b) At 30 days after transplanting

There was significant differences due to herbicidal treatments with regard to plant height at 30 days after transplanting. Maximum plant height was recorded with Alachlor at 1.50 kg ai/ha (22.44 cm), and the least was with unweeded control (15.60 cm).

c) At 45 days after transplanting

There was significant difference among herbicide treatments. The lowest plant height was recorded in Diuron 0.75 kg ai/ha (3.623 cm), but Diuron at 1.00 kg ai/ha recorded maximum plant height (40.67 cm). However the least plant height was with unweeded control (21.54 cm).

d) At 60 days after transplanting

Plant height differ significantly among herbicide treatment at 60 days after transplanting. The lowest plants height was recorded with unweeded control (33.84 cm), and among herbicides tried Metolachlor at 1.50 kg ai/ha recorded the least plant height (43.83 cm). Maximum plant height was observed in Alachlor 1.50 kg ai/ha (45.31 cm) followed by Diuron 0.75 kg ai/ha (45.22 cm).

e) At 75 days after transplanting

Plant height at 75 days after transplanting donot differ owing to weedicidal treatment tried, howevcer the maximum plant height was rcorded with Alachlor 1.50 kg ai/ha (47.38 cm) and the least was with unweeded control (40.37 cm) Metolachlor 1.25 kg ai/ha recorded the lowest plant height (33.12 cm).

4.5.2 Number of branches

Data on the number of branches per plant influenced by different weed control treatments are presented in the table-6.

a) At 30 days after transplanting

All herbicides treatments recorded significantly more branches (1.80 to 2.66) as compared to unweeded control (2.03) at 30 days after transplanting.

b) At 45 days after transplanting

The number of branches differed significantly due to herbicide application at 45 days after transplanting. All herbicides treatment recorded significantly more branches (7.40 to 8.73) as compared to unweeded control (4.26).

c) At 60 days after transplanting

The number of branches recorded with application of Simazine at 1.25 kg ai/ha (10.86), but all other herbicidal

treatments were on par with each other.

d) At 75 days after transplanting

All herbicidal treatments recorded significantly higher number of branches ranging from 12.90 to 13.76 per plant. However the least was with unweeded control (9.36).

4.5.3 Leaf area and leaf area index

Data on Leaf area and leaf area index influenced by different herbicidal treatment are presented in the Table-7.

4.5.3.1 Leaf area

a) At 15 days after transplanting

Leaf area was significantly influenced by herbicidal treatments. Leaf area of (2.2 to 3.2 dsq.m.) was recorded due to herbicides, where unweeded control recorded low leaf area (1.8 dsq.m.) than other treatments but the maximum leaf area was recorded (3.2 dsq.m.) with Diuron 1.00kg ai/ha.

b) At 30 days after transplanting

All the herbicidal treatment differ significantly in leaf area ranging from 4.5 to 6.7 dm2). The maximum was recorded with Diuron 1.25 kg ai/ha (6.7 dm2), while the least area was recorded with unweeded control (2.8 dm2), however Simazine at 1.25 kg ai/ha, Metolachlor at 21.50 kg

Table 7. Effect of different weed control treatments on leaf area and leaf area index (dm2) at different crop growth stages in China aster.

Treatments	Days after transplanting							
	Leaf area				Leaf area index			
	15	30	45	60	15	30	45	60
Diuron 0.75 kg ai/ha	2.5	4.5	11.6	11.7	0.27	0.50	1.28	1.30
Diuron 1.00 kg ai/ha	3.2	5.2	11.0	11.2	0.35	0.57	1.22	1.24
Diuron 1.25 kg ai/ha	3.0	6.7	10.8	11.2	0.33	0.74	1.20	1.24
Simazine 1.00 kg ai/ha	2.2	5.3	9.8	11.0	0.24	0.58	1.08	1.22
Simazine 1.25 kg ai/ha	2.4	5.4	9.7	9.7	0.26	0.60	1.07	1.07
Simazine 1.50 kg ai/ha	2.9	5.8	8.7	9.8	0.32	0.64	0.96	1.08
Metolachlor 1.00 kg ai/ha	3.0	5.7	8.9	9.8	0.33	0.63	0.98	1.08
Metolachlor 1.25 kg ai/ha	2.2	5.2	9.7	9.5	0.24	0.57	1.07	1.05
Metolachlor 1.50 kg ai/ha	2.5	5.4	9.1	9.1	0.27	0.60	1.01	1.10
Alachlor 1.00 kg ai/ha	2.4	5.6	9.1	9.2	0.26	0.62	1.01	1.02
Alachlor 1.25 kg ai/ha	2.2	5.4	9.9	9.3	0.24	0.60	1.10	1.03
Alachlor 1.50 kg ai/ha	2.4	5.3	8.5	9.9	0.26	0.58	0.94	1.10
Pendimethalin 0.75 kg ai/ha	2.5	5.9	9.7	9.6	0.27	0.65	1.07	1.06
Pendimethalin 1.00 kg ai/ha	2.6	6.0	9.9	9.9	0.28	0.66	1.10	1.10
Pendimethalin 1.25 kg ai/ha	2.3	5.2	9.8	9.9	0.25	0.57	1.08	1.10
Unweeded control	1.8	2.8	3.7	4.2	0.20	0.31	0.41	0.46
Hand weeding at 30, 60 and 90 DAT	3.0	6.5	12.1	12.6	0.33	0.72	1.34	1.40
F test	*	*	*	*	NS	*	*	*
SEM ±	0.38	0.49	0.69	0.89	0.12	0.14	0.110	0.124
C.D. at 5%	0.68	0.96	1.012	1.680	0.352	0.379	0.232	0.342

ai/ha and Alachlor 1.25 kg ai/ha (5.4 dm2) were on par in leaf area at 30 days after transplanting.

c) At 45 days after transplanting

The leaf area differ significantly among the herbicidal treatments at 45 days after transplanting. All herbicidal treatment recorded significantly more leaf area (8.5 to 11.6 dm2) than unweeded control (3.7 dm2).

d) At 60 days after transplanting

The maximum leaf area was recorded with application of Diuron at 0.75 kg ai/ha (11.7 dm2) least leaf area was recorded with Alachlor at 1.00 kg ai/ha (9.2 dm2) as compared to unweeded control (4.2 dm2).

4.5.3.2 Leaf area index

a) At 15 days after transplanting

Leaf area index was significantly influenced by at 15th day after transplanting, all herbicidal treatments recorded significantly more Leaf area index (0.24 to 0.35 dm2) as compared to unweeded control (0.22 dm2).

b) At 30 days after transplanting

The Leaf area index differed significantly 30 days after transplanting. The lowest leaf area index was

obtained with application of Diuron at 0.75 kg ai/ha (0.5 dm2) and the maximum Leaf area index was recorded due to application of Diuron at 1.25 kg ai/ha (0.74 dm2).

c) At 45 days after transplanting.

The maximum leaf area index (1.28 dm2) was recorded was with Diuron at 0.75kg ai/ha while the lowest leaf area index with application of Simazine at 1.50 kg (0.96 dm2) hand weeding recorded maximum leaf area index (1.34 dm2) than the rest of the herbicides treatments tried.

d) At 60 days after transplanting

Leaf area index was significantly influenced at 60th day after transplanting due to herbicidal treatments, the maximum leaf area index was recorded with Diuron at 0.75 kg ai/ha (1.30 dm2) and the least was with unweeded control (0.46dm2).

4.5.4 Days taken for 50 percent flowering, number of flower per plant, peduncle length and diameter of flower

4.5.4.1 Days taken for 50 per cent flowering

Data on the Influence of different levels of herbicides on days taken for 50 percent flowering are presented in Table-8 and depicted in Fig-4.

Table 8. Effect of different weed control treatments on days taken for 50 per cent flowering, Number of flower per plant, peduncle length, and diameter of flower in China after.

	Days after transplanting			
	Number of days taken for 50% flowering	Number of flower per plant	Peduncle length (cm)	Diameter of flowers (cm)
Diuron 0.75 kg ai/ha	67.66	27.00	17.53	8.93
Diuron 1.00 kg ai/ha	69.33	23.00	17.75	8.33
Diuron 1.25 kg ai/ha	68.00	24.33	17.78	9.13
Simazine 1.00 kg ai/ha	71.33	26.33	17.20	7.16
Simazine 1.25 kg ai/ha	70.66	23.00	14.43	7.46
Simazine 1.50 kg ai/ha	73.66	25.00	18.20	7.70
Metolachlor 1.00 kg ai/ha	68.00	25.00	17.56	7.96
Metolachlor 1.25 kg ai/ha	64.66	25.00	16.46	7.50
Metolachlor 1.50 kg ai/ha	67.33	24.33	17.48	7.53
Alachlor 1.00 kg ai/ha	65.66	24.00	17.23	7.86
Alachlor 1.25 kg ai/ha	66.00	24.66	16.73	7.46
Alachlor 1.50 kg ai/ha	64.00	26.00	16.53	8.00
Pendimethalin 0.75 kg ai/ha	69.00	24.33	17.36	8.40
Pendimethalin 1.00 kg ai/ha	71.00	23.66	16.56	7.93
Pendimethalin 1.25 kg ai/ha	71.00	27.00	17.73	8.26
Unweeded control	81.00	18.00	14.64	4.93
Hand weeding at 30, 60 and 90 DAT	52.33	31.00	16.03	9.96
F test	*	*	*	*
SEM ±	2.1864	1.1401	0.7920	0.2835
C.D. at 5%	6.3077	3.2892	2.2850	0.8180

The least number of days required for 50 per cent flowering was with hand weeding (52.33 days) and the maximum number of days required for 50 per cent flowering was unweeded control (81 days). The herbicidal application was significantly influenced the flowering application of Alachlor at 1.50 kg ai/ha needed 64 days for flowering followed by Alachlor at 1.00 kg and 1.25 kg ai/ha of 65.66 and 66 days respectively.

4.5.4.2 Number of flower per plant

Number of flower per plant significantly influenced by different herbicidal treatment. Application of Pendimethalin at 1.25 kg and Diuron at 0.75 kg ai/ha recorded (27.00) flowers per plant. Maximum number of flowers (31.00) was with hand weeding at regular interval, however the lowest number of flowers per plant was recorded with number of flowers per plant was recorded with unweeded control (18.00).

4.5.4.3 Peduncle length

There was significant differences in peduncle length among the treatments. Among different herbicidal treatment, the application of Diuron at 1.00 kg and 1.25 kg ai/ha recorded highest peduncle length (17.75 to 17.78 cm), the

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T_1 =Diuron 0.75 kg ai/ha.

T_2 =Diuron 1.00 kg ai/ha.

T_3 =Diuron 1.25 kg ai/ha.

T_4 =Simazine 1.00 kg ai/ha.

T_5 =Simazine 1.25 kg ai/ha.

T_6 =Simazine 1.50 kg ai/ha.

T_7 =Metolachlor 1.00 kg ai/ha.

T_8 =Metolachlor 1.25 kg ai/ha.

T_9 =Metolachlor 1.50 kg ai/ha.

T_{10} =Alachlor 1.00 kg ai/ha.

T_{11} =Alachlor 1.25 kg ai/ha.

T_{12} =Alachlor 1.50 kg ai/ha.

T_{13} =Pendimethalin 0.75 kg ai/ha.

T_{14} =Pendimethalin 1.00 kg ai/ha.

T_{15} =Pendimethalin 1.25 kg ai/ha.

T_{16} =Unweeded control.

T_{17} =Hand weeding at 30, 60 and 90 DAT.

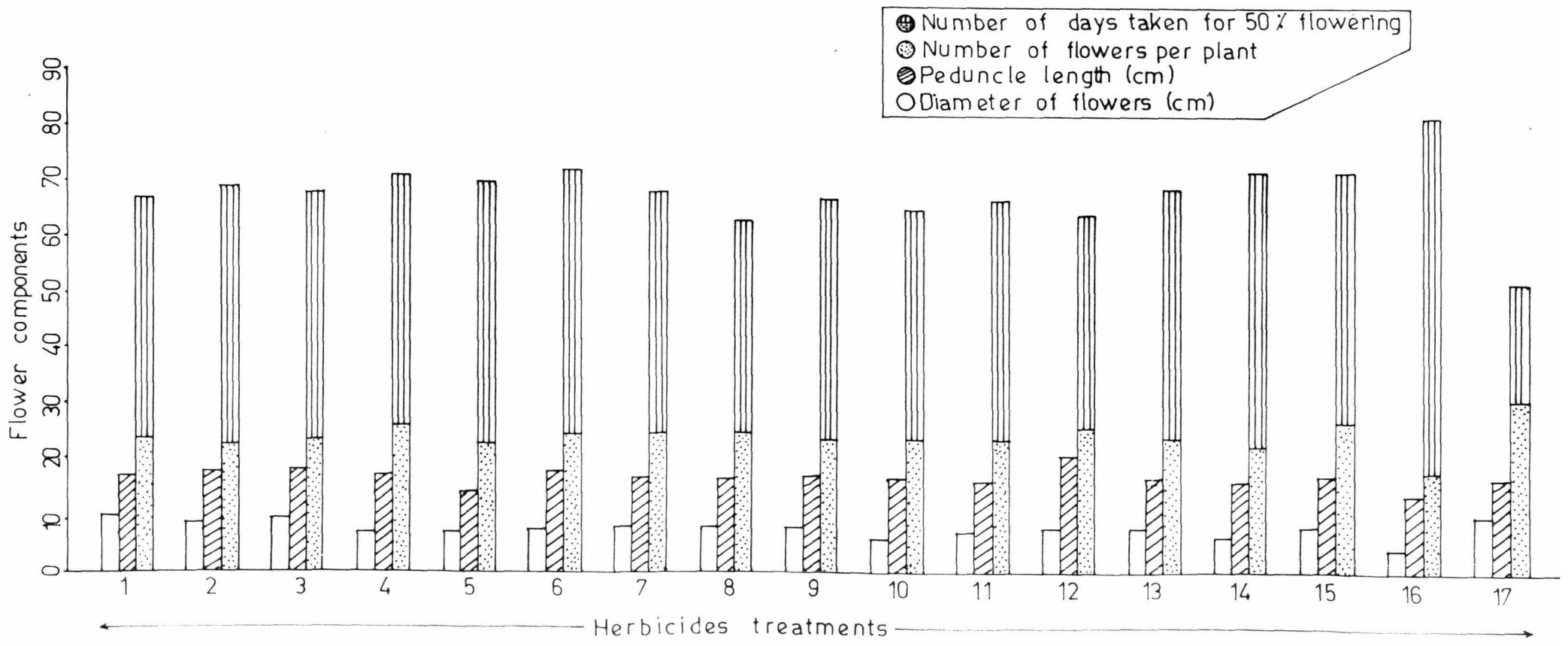

FIG.4. EFFECT OF DIFFERENT WEED CONTROL TREATMENTS ON DAYS TAKEN FOR 50 PER CENT FLOWERING, NUMBER OF FLOWER PER PLANT, PEDUNCLE LENGTH AND DIAMETER OF FLOWER IN CHINA ASTER

least peduncle length was recorded with application of Simazine at 1.25 kg ai/ha (14.43 cm). However the unweeded control recorded 14.64 cm peduncle length followed by hand weeding (16.03 cm).

4.5.4.4 Diameter of flower

Herbicides significantly influenced the diameter of flower. Application of Diuron at 1.25 kg ai/ha recorded highest diameter of flower (9.13 cm) and the least diameter of flower was (6.86 cm) with application of Alachlor 1.00 kg ai/ha, but in unweeded control (4.93 cm) the least diameter of flower was recorded.

4.5.5 Fresh weight of plant (g), Dry weight of plant (g), fresh weight of flower (g) and Dry weight of flowers (g)

The data showing the effect of different herbicidal treatments on fresh weight, dry weight of plant, fresh weight of flower and dry weight of flower are presented in Table-9.

4.5.5.1 Fresh weight of Plant

Higher fresh weight of plants was obtained due to application of Diuron at 1.00 kg ai/ha (65.65 g). While the least fresh weight was recorded with application of Simazine at 1.00 kg ai/ha (53.33 g). However there were much

Table 9. Effect of different weed control treatments on fresh weight of Plant, fresh weight of flower and dry weight of flower in China aster.

Treatments	Fresh weight of plant (g)	Dry weight of plant(g)	Fresh weight of flower(g)	Dry weight of flower (g)
Diuron 0.75 kg ai/ha	65.55	18.63	2.50	0.58
Diuron 1.00 kg ai/ha	65.65	17.59	2.70	0.47
Diuron 1.25 kg ai/ha	64.50	16.48	2.40	0.37
Simazine 1.00 kg ai/ha	53.33	17.57	1.90	0.31
Simazine 1.25 kg ai/ha	56.65	17.62	2.00	0.25
Simazine 1.50 k ai/ha	64.55	17.57	2.03	0.33
Metolachlor 1.00 kg ai/ha	60.55	16.52	2.06	0.39
Metolachlor 1.25 kg ai/ha	56.65	16.52	2.10	0.52
Metolachlor 1.50 kg ai/ha	55.55	16.54	2.03	0.56
Alachlor 1.00 kg ai/ha	64.50	17.62	2.40	0.51
Alachlor 1.25 kg ai/ha	60.55	17.59	2.26	0.48
Alachlor 1.50 kg ai/ha	63.30	17.59	2.16	0.51
Pendimethalin 0.75 kg ai/ha	65.30	16.55	2.03	0.44
Pendimethalin 1.00 kg ai/ha	65.35	16.58	2.43	0.36
Pendimethalin 1.25 kg ai/ha	60.30	16.55	2.13	0.30
Unweeded control	53.45	14.40	1.80	0.50
Hand weeding at 30, 60 and 90 DAT	65.40	16.90	1.98	0.63
F test	NS	*	*	*
SEM ±	6.08	4.627	0.2994	5.257
C.D. at 5%	12.24	1.21	0.5754	0.019

difference in fresh weight of plants due to herbicides and unweeded control (53.40 g). In hand weeding treatment (65.40 g) maximum fresh weight was recorded (Table-9).

4.5.5.2 Dry weight of plant

Significant difference was recorded in dry weight of plant due to weed control treatments. The maximum dry weight was recorded with the application of Diuron at 0.75 kg ai/ha (18.63 g)and the least dry weight (14.40 g) was with unweeded control, however hand weeding treatment recorded as high as 16.90 g of dry weight of plants.

4.5.5.3 Fresh weight of flower

There was significant difference among (Table-9) herbicidal treatments in fresh weight of flower. Higher fresh weight of flower (2.70 g) was obtained with the application of Diuron at 1.00 kg ai/ha, followed by Diuron at 0.75 kg ai/ha (2.50 g) and the least fresh weight was recorded with unweeded control (1.80 g) and Simazine at 1.00 kg ai/ha (1.90 g).

4.5.5.4 Dry weight of flower

There was significant differences in dry weight of flower among the different herbicides and levels tried. The highest dry weight of flower was obtained due to application

Table 10. Effect of different weed control treatments on flower yield per plant (g) and flower yield per hectare (kg).

Treatments	Yield of flowers per plant (g)	Flower yield per ha (kg)
Diuron 0.75 kg ai/ha	60.19	8260.66
Diuron 1.00 kg ai/ha	57.29	8805.54
Diuron 1.25 kg ai/ha	58.43	8100.43
Simazine 1.00 kg ai/ha	48.08	7940.43
Simazine 1.25 kg ai/ha	51.29	7690.18
Simazine 1.50 kg ai/ha	50.30	7435.62
Metolachlor 1.00 kg ai/ha	52.35	6879.18
Metolachlor 1.25 kg ai/ha	51.27	6685.84
Metolachlor 1.50 kg ai/ha	50.45	7101.14
Alachlor 1.00 kg ai/ha	50.33	7148.96
Alachlor 1.25 kg ai/ha	50.08	7212.03
Alachlor 1.50 kg ai/ha	56.38	6037.07
Pendimethalin 0.75 kg ai/ha	59.38	6534.92
Pendimethalin 1.00 kg ai/ha	53.11	7424.59
Pendimethalin 1.25 kg ai/ha	60.12	6092.70
Unweeded control	30.25	3601.07
Hand weeding at 30, 60 and 90 DAT	60.25	8260.85
F test	*	*
SEM ±	1.3286	148.72
C.D. at 5%	3.6538	427.1729

of Diuron at 0.75 kg ai/ha (0.589 g) which was closely followed by metolachlor 1.50 kg ai/ha (0.569). The lowest dry weight of flower (0.25 g) was recorded with Simazine 1.25 kg ai/ha.

4.5.6 Flowers yield per plant and flower yield per hectare

Data on flower yield per plant (g) and flower yield per hectare (kg) are presented in Table-10.

4.5.6.1 Flower yield per plant

Flower yield per plant was significantly influenced by different herbicides. The maximum flower yield per plant was recorded with application of Diuron at 0.75 kg ai/ha (60.19 g). The lowest flower yield per plant was recorded owing to the application of Simazine 1.00 kg ai/ha (48.08 g). However in hand weeding the flower yield of 60.25 g was recorded as compared to hand weeding at 30, 60 and 90 DAT (30.25).

4.5.6.2 Flower yield per hectare

There was significant difference among herbicidal treatments. The highest flower yield was recdorded with the application of Diuron at 1.00 kg ai/ha (8805.54 kg). The lowest yield was recorded with the application Metolachlor

at 1.00 kg ai/ha (5879.18 kg), as compare to unweeded control (3601.07 kg). However in hand weeding at 30, 60 and 90 DAT the flower yield of 8260.85 kg was recorded Table-10 and depicted in Fig-5.

4.5.7 Reducing non reducing, and Total sugars

Data on reducing, non reducing and total sugars content of China aster plants as influenced by diferent Herbicidal treatments are presented in Table-11.

4.5.7.1 Reducing sugars

There was significant difference on reducing sugars at different herbicidal treatments. The maximum reducing sugars was recorded in Metolachlor 1.25 kg ai/ha (0.77 per cent) and the least reducing sugars was recorded with the application of Simazine 1.25 kg ai/ha 0.58 per cent.

4.5.7.2 Non-reducing sugars

Non reducing sugar differed significantly among the treatments. Highest non-reducing sugars was recorded with the application of Diuron at 0.75 kg ai/ha (1.22 per cent). There was no marked differences in non reducing sugars among different herbicides tried.

4.5.7.3 Total Sugars

Treatments with herbicides were effective in

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T_1 =Diuron 0.75 kg ai/ha.

T_2 =Diuron 1.00 kg ai/ha.

T_3 =Diuron 1.25 kg ai/ha.

T_4 =Simazine 1.00 kg ai/ha.

T_5 =Simazine 1.25 kg ai/ha.

T_6 =Simazine 1.50 kg ai/ha.

T_7 =Metolachlor 1.00 kg ai/ha.

T_8 =Metolachlor 1.25 kg ai/ha.

T_9 =Metolachlor 1.50 kg ai/ha.

T_{10} =Alachlor 1.00 kg ai/ha.

T_{11} =Alachlor 1.25 kg ai/ha.

T_{12} =Alachlor 1.50 kg ai/ha.

T_{13} =Pendimethalin 0.75 kg ai/ha.

T_{14} =Pendimethalin 1.00 kg ai/ha.

T_{15} =Pendimethalin 1.25 kg ai/ha.

T_{16} =Unweeded control.

T_{17} =Hand weeding at 30, 60 and 90 DAT.

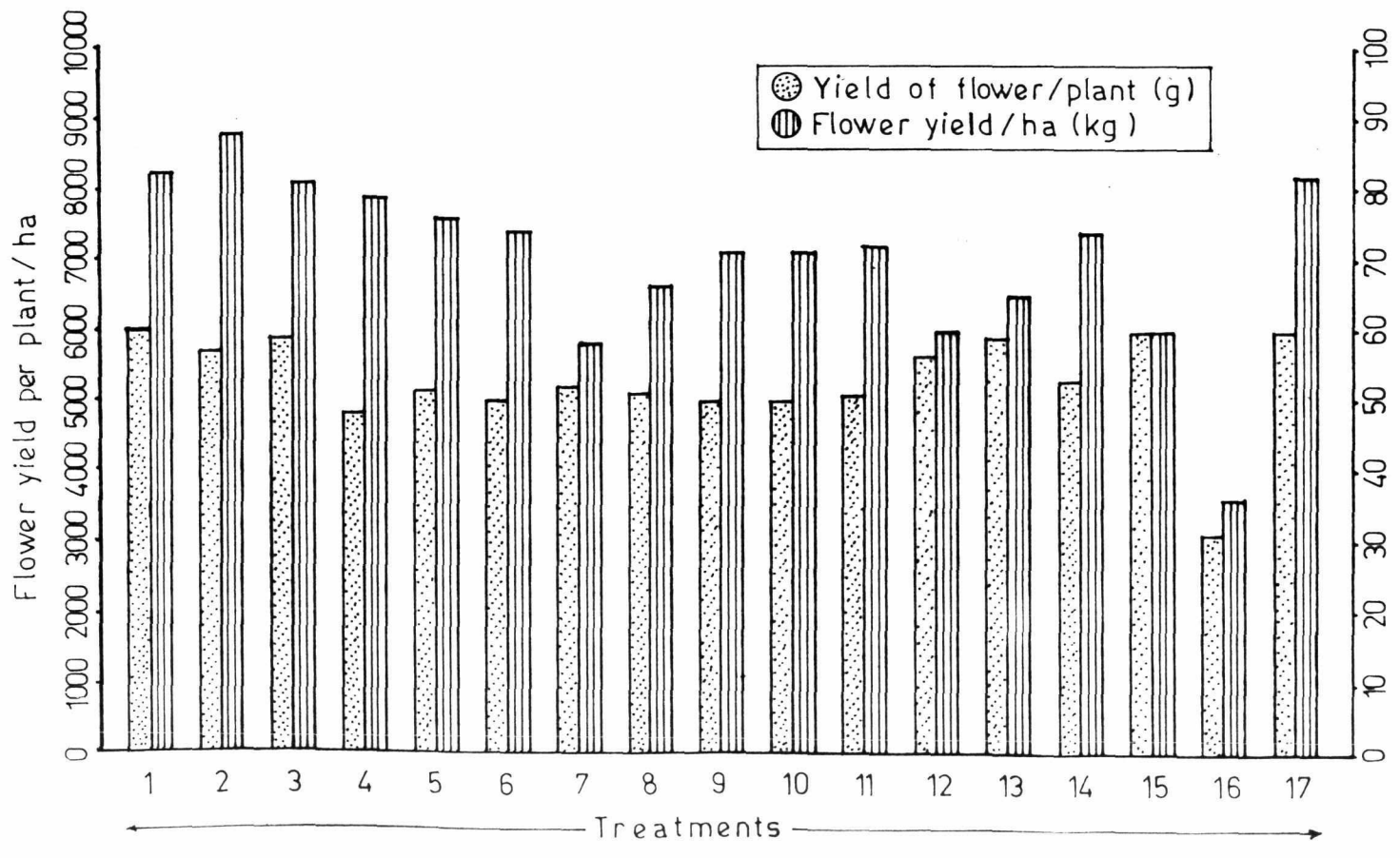

FIG. 5. EFFECT OF DIFFERENT WEED CONTROL TREATMENTS ON FLOWER YIELD PER PLANT (g) AND FLOWER YIELD PER HECTARE (kg)

Table-11 Effect of different weed control treatments on Reducing sugar. Non reducing sugars (per cent) in China aster.

Treatments	Reducing sugars	Non Reducing sugars	Total sugars
Diuron 0.75 kg ai/ha	0.72	1.22	1.94
Diuron 1.00 kg ai/ha	0.64	1.06	1.70
Diuron 1.25 kg ai/ha	0.74	1.09	1.83
Simazine 1.00 kg ai/ha	0.64	1.17	1.81
Simazine 1.25 kg ai/ha	0.58	1.20	1.78
Simazine 1.50 kg ai/ha	0.67	1.19	1.86
Metolachlor 1.00 kg ai/ha	0.73	1.07	1.80
Metolachlor 1.25 kg ai/ha	0.77	1.14	1.91
Metolachlor 1.50 kg ai/ha	0.66	1.17	1.83
Alachlor 1.00 kg ai/ha	0.68	1.17	1.85
Alachlor 1.25 kg ai/ha	0.72	1.09	1.81
Alachlor 1.50 kg ai/ha	0.67	1.05	1.72
Pendimethalin 0.75 kg ai/ha	0.70	1.16	1.86
Pendimethalin 1.00 kg ai/ha	0.72	1.20.	1.92
Pendimethalin 1.25 kg ai/ha	0.68	1.18	1.86
Unweeded control	0.65	1.00	1.65
Hand weeding at 30, 60 and 90 DAT	0.73	1.10	1.83
F test	*	*	*
SEM ±	0.0137	0.0318	0.0437
C.D. at 5%	0.0395	0.064	0.1259

influencing the total sugars content of plants. Highest total sugars content was recorded with the application of Diuron at 1.00 kg ai/ha (1.70 percent).

4.5.8 Total Nitrogen, Phosphorus and Potassium in plants

Data on total Nitrogen, Phosphorus and Potassium control in China aster on dry weight basis as influenced by different weed control treatments are presented in Table-12.

4.5.8.1 Total Nitrogen

There was significant in total nitrogen content of plants. The highest per cent of Nitorgen was recorded with Pendimethalin at 1.00 kg ai/ha (3.21 per cent), closely followed by Metolachlor 1.00 kg ai/ha (3.14 per cent) Diuron at 1.25 kg ai/ha and Simazine at 1.50 kg ai/ha recorded 3.13 per cent of Nitrogen which were on par. The least Nitrogen content in plant was recorded with unweeded control (1.30 per cent).

4.5.8.2 Phosphorus Content in plants

There was significant differences in phosphorus content of plants due to different levels and herbicides tried. Highest per cent of phosphorus was recorded with Metolachlor 1.50 kg ai/ha (0.37 per cent) and the least was with unweeded control (0.10 per cent). However there was no

Table 12. Effect of different weed control treatments on Nitrogen Phosphorus and Potassium content (per cent) in plant of China aster.

Treatments	Nitrogen	Phosphorus	Potassium
Diuron 0.75 kg ai/ha	2.14	0.28	0.213
Diuron 1.00 kg ai/ha	2.46	0.16	0.204
Diuron 1.25 kg ai/ha	3.13	0.20	0.201
Simazine 1.00 kg ai/ha	2.39	0.16	0.184
Simazine 1.25 kg ai/ha	2.18	0.13	0.155
Simazine 1.50 kg ai/ha	1.98	0.20	0.111
Metolachlor 1.00 kg ai/ha	2.34	0.19	0.129
Metolachlor 1.25 kg ai/ha	3.13	0.19	0.143
Metolachlor 1.50 kg ai/ha	3.14	0.37	0.160
Alachlor 1.00 kg ai/ha	1.80	0.16	0.212
Alachlor 1.25 kg ai/ha	1.90	0.17	0.210
Alachlor 1.50 kg ai/ha	2.65	0.15	0.197
Pendimethalin 0.75 kg ai/ha	2.71	0.13	0.209
Pendimethalin 1.00 kg ai/ha	2.94	0.12	0.210
Pendimethalin 1.25 kg ai/ha	3.21	0.14	0.208
Unweeded control	1.30	0.10	0.181
Hand weeding at 30, 60 and 90 DAT	2.29	0.14	0.210
F test	*	*	*
SEM ±	0.1144	0.0081	0.009
C.D. at 5%	0.3302	0.0165	0.0184

marked differences in phosphorus content of plant due to herbicides.

4.5.8.3 Potassium content in plant

There was significant difference in potassium content of plants. Highest potassium content was recorded with Diuron at 0.75 kg ai/ha (0.213 per cent), followed by Alachlor at 1.00 kg ai/ha (0.212 per cent). The least potassium content was recorded with Simazine at 1.5 kg ai/ha (0.11 per cent). However unweeded control recorded 0.181 percent potassium. Hand weeding and Pendimethalin at 1.00 ai/ha recorded the same content of potassium (0.210 per cent) which were on par.

4.5.9 Economic of different weed control treatment in China aster.

Economics of different weed control treatments in China aster is presented in Table-13.

The cost of weed control by weedicides was the maximum in Pendimethalin at 1.25 kg ai/ha (Rs.580.05/ha) followed by Pendimethalin at 1.00 kg ai/ha (Rs.474.30) and Metolachlor 1.50 kg ai/ha (Rs.425). Cost of hand weeding at 30, 60 and 90 DAT was maximum (Rs.840.00/ha) and the lower cost of weed control was with Diuron at 0.75 kg ai/ha (Rs.227.90/ha). The

Table-13 Economics of different weed control treatment in china aster.

Treatments	Cost of Cultivation Excluding Control(Rs)	Cost of Weed control (Rs)	Total cost of Cultivation (Rs)	Gross Returns (Rs)	Net Returns (Rs)
Diuron 0.75 kg ai/ha	9200.00	227.90	9427.90	24781.00	15354.08
Diuron 1.00 kg ai/ha	9200.00	275.00	9475.00	26416.62	16941.62
Diuron 1.25 kg ai/ha	9200.00	331.25	9531.25	24301.29	14770.04
Simazine 1.00 kg ai/ha	9200.00	290.00	9490.00	23821.29	14331.29
Simazine 1.25 kg ai/ha	9200.00	350.00	9550.00	23070.54	13520.54
Simazine 1.50 kg ai/ha	9200.00	410.00	9610.00	22306.86	12696.86
Metolachlor 1.00 kg ai/ha	9200.00	300.00	9500.00	17637.54	10137.54
Metolachlor 1.25 kg ai/ha	9200.00	362.50	9562.50	20056.62	10494.12
Metolachlor 1.50 kg ai/ha	9200.00	425.00	9625.00	21303.04	11678.04
Alachlor 1.00 kg ai/ha	9200.00	275.00	9475.00	21446.88	11971.88
Alachlor 1.25 kg ai/ha	9200.00	300.00	9500.00	21636.09	12136.09
Alachlor 1.50 k ai/ha	9200.00	325.00	9525.00	18111.21	8586.21
Pendimethalin 0.75 kg ai/ha	9200.00	367.50	9567.50	19604.74	10037.24
Pendimethalin 1.00 kg ai/ha	9200.00	474.30	9674.30	22276.77	12602.47
Pendimethalin 1.25 k ai/ha	9200.00	580.05	9780.05	18278.10	8498.05
Unweeded control	9200.00	---	9200.00	10803.21	1603.21
Hand weeding thrice at 30, 60 and 90 DAT	9200.00	840.00	10040.00	24782.55	14742.55

Labour cost : Man Rs. 12.00/day, Women 10.50/day.
Diuron (80% EC) 1 lit = Rs.180.00.
Simazine (50% EC) 1 lit = Rs.120.00.
Metolachlor (50% EC) 1 lit = Rs.125.00.
Alachlor (50% EC) 1 lit = Rs.100.00.
Pendimethalin 30% EC 1 lit = Rs.127.00.
China aster flower yield 6 to 8 thousand kgs. Spray cost Rs.50.
Market rate per kg Rs.3.00.

total cost of cultivation incurred was maximum with the usual method of weed control by hand weeding (Rs.10,040.00/ha).

Gross returns were higher in all the herbicides treatments as compared to hand weeding. The highest gross return was realized in the treatment Diuron at 1.00 kg ai/ha (Rs.26,416.62/ha) followed by Diuron at 0.75 kg ai/ha (Rs.24781.98/ha), However the unweeded control realized only Rs.10,803.21/ha as compared to hand weeding (Rs.24,782.55).

The maximum net return was realized in Diuron at 1.00 ai/ha (Rs.16,941.62/ha) closely followed by Diuron at 0.75 kg and 1.25 kg ai/ha (Rs.15,354.08 and 14,770.04/ha). The lowest net return was with unweeded control (Rs.1603.21/ha). however with hand weeding at 30, 60 and 90 DAT realized (Rs.14,742.55/ha).

4.5.10 Prolong the vase life of cut flowers of China aster

The data on vase life as influenced by different herbicides with two per cent sucrose solution are present in Table-14. In general the fresh weight of flower was found to be increased first two days and later on declining trend was observed reducing value below the initial fresh weight.

The different herbicides treatments did not differ significantly in vase life on fresh weight during Ist day, 2nd day, 3rd day, 4th day and 5th day. But there were significant difference among the treatments. The maximum fresh weight was recorded on 6th day with Diuron at 0.75 kg ai/ha (63.25 g). The lowest fresh weight was recorded with Simazine at 1.25 kg ai/ha (48.00 g).

On 7th day the maximum fresh weight was recorded with application of Diuron at 0.75 kg ai/ha (58.80 g). The lowest fresh weight was recorded due to Pendimethalin at 1.25 kg ai/ha (43.00 g) and closely followed by Simazine 1.00 kg ai/ha (43.25 g) and Alachlor 1.50 kg ai/ha (44.00 g).

On 8th day the maximum fresh weight was observed with pendimethalin 1.00 kg ai/ha, and Alachlor at 1.25 kg ai/ha (50.00 g). However hand weeding recorded a fresh weight of (50.25 g). The lowest fresh weight was recorded (40.00 g) due to the Pendimethalin 0.75 kg ai/ha. In general there was not much difference in fresh weight of flower owing to herbicides treatments. The little difference exhibited is mainly due to chemical preservatives used.

Uptake of solution

The different herbicidal treatment tried donot differ

Table 14. Effect of different herbicides and two per cent sucrose on fresh weight, up take of solution and vase life (days) in China aster.

Treatment	Fresh weight (g)								Uptake solution (ml)								Cumulative uptake (ml)	Vase life days
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8		
Diuron 0.75 kg ai/ha	63.25	65.50	67.50	68.75	66.50	63.25	58.80	46.85	6.50	6.00	5.50	3.15	3.00	2.25	0.25	0.00	26.65	7
Diuron 1.00 kg ai/ha	60.35	65.75	67.75	68.25	65.25	60.25	46.75	46.85	7.50	7.00	6.00	4.65	3.50	2.00	0.00	0.00	30.65	7
Diuron 1.25 kg ai/ha	64.65	66.25	66.50	67.25	65.25	60.25	51.65	45.00	7.50	7.00	7.00	4.20	3.00	2.50	0.00	0.00	31.20	7
Simazine 1.00 kg ai/ha	60.35	65.35	65.75	66.75	63.00	59.00	43.35	40.50	6.50	6.00	5.00	4.50	2.00	0.75	0.00	0.00	24.75	7
Simazine 1.25 kg ai/ha	59.65	63.25	64.50	65.00	60.00	48.00	55.25	45.00	5.50	5.25	5.00	4.25	3.00	2.25	0.25	0.00	25.50	7
Simazine 1.50 kg ai/ha	60.65	64.25	65.00	65.50	63.00	60.00	45.00	40.00	6.00	5.50	5.00	3.50	2.75	2.50	0.50	0.00	25.75	7
Metolachlor 1.00 kg ai/ha	63.65	65.50	66.25	66.75	64.00	62.25	50.00	45.00	7.50	7.00	6.00	4.00	3.25	0.00	0.00	0.00	28.00	6
Metolachlor 1.25 kg ai/ha	60.35	64.25	65.50	67.00	65.00	60.00	55.00	45.00	8.00	7.50	7.00	4.60	3.00	1.50	0.25	0.00	31.85	7
Metolachlor 1.50 kg ai/ha	59.50	60.25	62.00	62.75	60.00	48.25	53.00	49.00	7.50	7.00	6.50	4.00	4.75	2.50	0.70	0.00	32.95	7
Alachlor 1.00 kg ai/ha	60.50	65.25	65.75	66.25	65.25	50.75	50.25	48.50	6.50	6.25	6.00	4.50	2.50	2.00	0.00	0.00	27.75	7
Alachlor 1.25 kg ai/ha	58.75	60.25	62.50	62.75	60.75	58.75	44.00	40.50	6.50	5.75	5.00	4.00	3.50	2.25	0.50	0.00	27.50	7
Alachlor 1.50 kg ai/ha	60.65	63.50	63.75	64.00	60.75	48.25	55.00	50.00	7.50	7.25	6.25	4.50	3.00	2.00	0.00	0.00	31.00	7
Pendimethalin 0.75 kg ai/ha	63.65	65.50	66.50	67.00	65.00	63.25	48.00	40.00	8.00	7.50	7.00	3.50	3.00	2.00	0.00	0.00	31.00	7
Pendimethalin 1.00 kg ai/ha	58.50	60.75	62.25	63.00	60.25	58.75	55.00	50.00	7.50	7.25	7.00	4.50	4.00	1.00	0.50	0.00	31.75	7
Pendimethalin 1.25 kg ai/ha	60.65	62.50	63.00	63.50	60.75	49.25	43.00	40.25	7.50	7.00	6.75	4.50	3.00	1.25	0.00	0.00	30.00	7
Unweeded control	60.25	63.50	64.00	64.25	60.00	58.00	55.25	48.25	7.50	7.00	6.50	3.75	3.50	0.00	0.00	0.00	28.25	6
Hand weeding at 30, 60 and 90 DAT	63.25	65.50	65.75	66.25	64.50	60.50	55.75	50.25	8.00	7.00	6.75	5.50	3.00	2.00	1.00	0.00	33.25	7
F test	NS	NS	NS	NS	NS	*	*	*	NS	NS	NS	NS	NS	NS	-	-	-	-
SEM ±	4.86	6.725	7.018	7.296	5.92	3.724	2.45	1.95	0.667	0.542	2.440	0.290	0.254	0.120	-	-	-	-
C.D. at 5%	11.99	12.023	13.125	13.463	11.824	7.027	5.70	3.98	1.321	1.064	0.675	0.756	0.692	0.201	-	-	-	-

significantly in uptake of solution except 7th day .

On 7th day there was significant difference among the treatments. The maximum uptake of solution was recorded due to Metolachlor at 1.5 kg ai/ha (0.70 ml). China aster flower from hand weeding plot exhibited uptake of 1.00 ml solution.

Prolong the vase life of cut flowers of China aster

The different herbicidal treatments did not differ significantly on prolonging the vase life of cut flower of China aster. Even though there was little difference in cumulative uptake of solution but was no difference in vase life of China aster as influenced by difference herbicides.

DISCUSSION

V DISCUSSION

In recent years the approach in weed control is to adopt different effective herbicides are known to result in over all improvement in growth parameters, flower yield and flower quality in many of the flowering annuals. The manual hand weeding is of high cost and labour not available in time. In the present study the main emphasis was on chemical weed control in china aster with differnt pre-emergent herbicides. The major objective of this investigation was to study the efficiency of herbicides on control of weed population. The crop toxicity and the growth development and productivity in china aster.

The results obtained in this investigations on china aster (Callistephus chinensis (L) Ness) during 1988-89 are discussed in this chapter.

5.1 Effect of different herbicidal treatments on the weed population, and weed dry weight.

In the experimental plots the weed population was predominently due to monocot weed as compared to dicot weeds. The population of sedges were also considerable. Amongst the monocot weeds the most predominent were Cynodon dactylon (L) pers). Cyperus rotendus (L.), Digiteria morginata (link), and Panicum repens (L.) and Cyprus

rotundus (L.) among sedges. Among dicots prominent weeds were Acanthospermum hispidum (DC),Amaranthus spinosa (L.), Ageratum canyzoides (L.), Borreria articularis (L.), Lagasca molllis (Cav) and Phyllanthus fracternus (W). This clearly indicates that it is necessary to indentify suitable herbicides which are effective on monocots, dicots and sedges.

Monocot weed popultion was least in the first thirty days and later on increased. Dicot weeds also shown a less number count in the early stage of plant growth, this may be attributed to stagared germination of seeds shorter duration of weeds and crop inhibitary effect on weeds. Similar results were reported by Bing (1981) in bedding plants and Stewert et al (1983) in gladiolus (Rolewska and Saniewski, 1978) annual flowers (Newman and Binning, 1980) and in herbacious perennials (Ahrenus, 1981).

In all the herbicidal treatments minimum number of dicot weed count was observed. At 30 and 60 days and at harvest lower dicot weed count was noted. Herbicides were not effective in controlling sedges at later stages. However the weed population at 60th day declined when compare to 30th day. The results clearly indicated that

herbicides tried were effective in increasing plant growth, early flowering and yield (Yadav and Bose 1987). In general all the herbicides tried were effective in controlling monocot and dicot weeds, however their effectiveness on sedges was relatively less.

Simazine at 1.50 kg ai/ha was more effective among the weedicides tested, which was responsible for reduce 98 percent of dicot weeds, 77.66 percent of monocot weeds. But the sedge population reduced only by 9.66 percent at 30th day after transplanting. Among the different herbicides tested diuron at 1.00 kg ai/ha and Simazine at 1.25 kg ai/ha were effective to reduce the weed flora of both monocot and dicot. Similar results of effective control of monocot weeds were reported by Stewert et al (1983) in gladiolus and Hansely and Carpenter (1983) in woody ornamentals by application of Simazine, Hatterman et al (1987) observed the control of weeds by herbicides without reducing marketability in statice flower.

Mechanical weed control by hand weeding was found to be effective in reducing the weed count of monocot, dicot and sedges which clearly indicated that mechanical weed control treatments are effective in checking the weed number, however this method is costly and time consuming.

Diuron at 0.75 ai/ha was effective to control sedges, however pendimethalim at 0.75 kg ai/ha and Metolachlor at 1.25 kg ai/ha recorded the lowest weed count. Alachlor at 1.25 kg and 1.50 kg ai/ha recorded lowest sedges count. Hand weeding treatment recorded the lowest sedge count at 30, 60 daya after transplanting and at harvest, however the maximum sedge count was with unweeded control (29.66) the reason may be that as sedges are known to sprout from Rhizomes and tubers, the pre-emergence herbicides seems to have no specific effect in controlling the sprouting and growth of sedges.

At harvesting of the china aster crop in all the herbicidal treatments low weed count was noted (10.67 - 33.0/0.5m2) as compared to unweeded control (100.00/0.5m2), However in hand weeding lower total count of weeds (17.0/0.5 sq.m.) were recorded compare to different herbicidal and their levels tested. Similar observations were made by Haramaki and Kuhns (1983) in bedding plants due to chemical weedicides. Control of Conyza species by Simazine was reported by Bucsbaum et al (1985) in Geranium and reduced weed population also in petunia by E.P.T.C. and Napropamide at 6 lb/acre (Wilfreet and Burgis 1977).

The total dry weight of weeds recorded in different stages is a better reflection of the efficiency of herbicides tested. Though weed number showed decreasing trend at 30th day but weed dry weight was maximum at harvest, this was due to the dominance of some weeds like Acanthospermum hispidum not controlled by Alachlor which accumulated the biomass, suppressing the others. However the results indicated that the herbicides adpoted were effective in checking the weed growth.

Dry weight of weed differed significantly among the herbicides tried at 30, 60 days after transplanting and at harvest. Hand weeding seems to be more effective in checking the weed growth at all the growth stages, the reduction in weed dry weight was more pronounced in hand weeding at 30 and 60 DAT. Among the herbicides, Simazine at 1.50 kg ai/ha recorded lowest dry weight at 30th day (3.25 g) and Diuron at 1.00 kg ai/ha recorded lower dry weight (5.65 g) on 60th day.

5.2 The relative toxicity of different herbicides on china aster (Callistephus Chinensis (L.) Ness)

One of the objectives of the investigation was to identify an effective combination of herbicides with the hand weeding is to see the possibility of reducing the

herbicides effect on the main crop both in terms of seedling growth and crop growth. An attempt was made in this study to know the extent of crop toxicity caused by different herbicides.

Visual observation on crop toxicity rating at 30, 45 and 60 days after transplanting showed mild or no toxicity symptoms in all the herbicides except in Pendimethalin at 1.25 kg ai/ha showed chlorosis and stunting of crop at 30th 45th and 60th day after transplanting and Metolachlor at 1.00 kg ai/ha where as with Simazine at 1.25 kg ai/ha, the symptoms were noticed only on60th day after transplanting. Similarly Baranowski (1974) working on china aster with nine different herbicides observed the phytotoxicity due to the Tenoran (Chloroxuron) at 6 kg ai/ha applied ten days after transplanting and Bing and Macksel (1984) reported phytotoxicity due to the application of 4 and 8 lb of Napropamide and 10 and 20 lb of DCPA (Chlorteral - dimethyl) in flowering annuals of Celosia, Vinca, Begonia and Coleus. Moreau (1976) observed control of weeds without phytotoxicity in gladiolus.

5.3 Effect of different herbicidal treatments on crop and productivity.

5.3.1 Growth attributes:

Vegetative growth is best measured in terms of plant height, number of branches and plant height to a great extent is an indication of vegetative growth.

In the present study china aster Cv Ostrich plume responded positvely to herbicides. Plant height recorded at different crop yield stages, differ significantly except on 75th day after transplanting due to differnt herbicidal treatments. In china aster the maximum plant height China aster was recorded with application of Diuron at 0.75 kg (36.23 cm) and 1 kg ai/ha (40.67 cm) at 45 days after transplanting. Simazine at 1.00 kg, 1.50 kg and Alachlor at 1.50 kg ai/ha. Similar results were observed by Koutepus (1982) in gladiolus.

Plant height differed significantly at all the stages in growth. The least plant height was recorded with unweeded control, followed by Matolachlor at 1.25 kg ai/ha (33.12 cm) at 75 days after transplanting. Lowest plant height was recorded with unweeded control (21.54 cm).

The primary branches emerge in early stages of crop growth which influence the ultimate yield per unit. In the present study infestation of weed did not affect the number of branches in unweeded control. The number of branches per

plant recorded at different crop growth stages differ significantly owing to different herbicidal treatments. Higher number of branches ranged from 12.90 - 13.76 per plant, perhaps this may be due to more nutrient are available to the China aster however the least was with unweeded control.

Leaf area index has been considered as one of the physiological indices in determining the crop yield as it represents the size of photosynthetic system. Leaf area and leaf area index differed significantly at all the crop growth stages owing to different herbicidal treatment. Among different herbicides tried Diuron at 1.00 kg ai/ha resulted in significantly higher leaf area and leaf area index as compared to hand weeding, but it was on par with Diuron at 1.25 kg ai/ha, Metolachlor at 1.00 kg ai/ha were on par. Similar observation of increased leaf area and leaf area index was reported by Pitt et al (1981) in gladiolus.

The better leaf area and leaf area index in hand weeding plot at 60th day after transplanting was due to better weed control which facililated the plants in utilising the available resources more effciently to photosynthesis and translocate to plant parts resulting in

high dry matter production.

5.3.2 Flower components

Marked difference on days required for 50 percent flowering in china aster were obtained with different herbicidal treatments. More number of days were taken for 50 percent flowering by application of Simazine at 1.00 kg and 1.50 kg ai/ha and Pendimethalin 1.00 kg and 1.25 kg ai/ha. Application of Alachlor 1.00 kg, 1.25 kg ai/ha, and Metolachlor 1.25 kg ai/ha were resulted in early flowering. Similar observations was made by Koutepas (1982) in gladiolus.

The number of days required for flowering progressively increased with distraction of weed population, in the present study flowering was delayed slightly by 5 to 8 days due to the different herbicides and also weed population. Alachlor at 1.50 kg ai/ha induced early flowering due to control of weeds during early stage of growth.

Significant increase in number of flowers per plant was obtained with lower level of application of Diuron at 0.75 kg ai/ha, and with Pendimethalin at 1.25 kg ai/ha. Similar results reported by Baranowski (1974) in china aster the increase in number of flowers per plant due to herbicides.

But other levels also increased, the total number of flowers per plant substantially. Simazine at 1.00 kg ai/ha also significantly influence on number of flowers per plant. Maximum number of flowers per plants (31.00) was with hand weeding at regular intervals. Drastic reduction in flower yield per plant was recorded in the control (18.00).

Yadav and Bose (1987) observed the increase of flower yield in Tuberose and gladiolus due to herbicides applications. Rolewska and Saniewski (1978) reported similar results of weed control and flower production in gladiolus due to Aresin at 2.5 kg and Linuron at 3.00 kg ai/ha.

The peduncle length and flower diameter are important quality attributes determining suitability as a cut flower. Quite often the value of the cutflowers generally varies with the stalk length and flower diameter. Usually cut flower with longer stalk and larger size fetch high prices. This is obviously due to the usefulness of such flowers. In flower arrangements, for making bouquets and garlands and even for their preference in beds borders and in pot culture.

In the present herbicidal study improvement in the

quality attributes such as peduncle length and flower diameter due to treatment were evident. Increase in peduncle length flower diameter was noticed in all most all treatments. Highest peduncle length was due to the application of Diuron at 1.00 kg ai/ha (17.75 cm). Because of Diuron is in urea herbicidal group. The least peduncle length was obtained with application of Simazine at 1.25 kg ai/ha (14.43 cm).

There was significant increase in flower diameter with weed control treatments. The maximum diameter of flower was obtained with application of Diuron at 1.25 kg ai/ha (9.13 cm) and the least flower diameter (6.86 cm) was owing to the application of Alachlor at 1.00 kg ai/ha, however the unweeded control recorded the least flower diameter (4.93 cm). however Baranowski (1974) reported non effectiveness of herbicides on flower diameter in china aster.

The fresh weight of plant donot differ significantly owing to the herbicidal treatments in China aster. The dry weight of plant was significantly higher with application of Diuron at 0.75 kg ai/ha (18.63 g) the least dry weight was recorded with the application of Diuron. Fresh and dry weight of flower significantly differed among the herbicidal treatments. The higher fresh weight of flower (2.70 g) was

obtained with the application of Diuron at 1.00 kg ai/ha. The least fresh weight of flower was recorded due to application of Simazine at 1.00 kg ai/ha (1.909) and the lowest with unweeded control (1.80 g).

Higher dry weight of flower was recorded with the application of diuron at 0.75 kg ai/ha (0.58 g) and the least dry weight of flower was noted with the application of Simazins at 1.25 kg ai/ha. In the present study there was a remarkable increase in yield in different herbicidal treatments. There was marked increase in yield from 6037.07 kg at Alachlor at 1.50 ai/ha 8805.54 kg with application of Diuron 1.00 kg ai/ha. Similar results reported in gladiolus by Wilfreet and Burgis (1977) and Yadav and Bose (1987) in Tuberose and Gladiolus. The reduction in yield due to less effectivce control of weeds was reported in Rose and Chrysanthemum by Chapugier (1979) and in gladiolus by Bing (1979). Lowest flower yield was obtained in unweeded control (3601.07 kg) as compared to hand weeding thrice at 30, 60 and 90 days after transplanting (8260.85 kg), this is due to sever competition of weeds in unweeded control in supression of crop growth there by resulted in lower flower yield.

5.3.3 Composition of plants:

Plant analysis is one of the methods which reflects on the composition, which is sensitive and convenient method for understanding the herbicides effect on composition.

Highly significant differences were obtained in the total sugar content of China aster at harvest due to chemical weed control treatments. Highest sugar content (1.94 Percent) was recorded with application of Diuron at 0.75 kg ai/ha. There was significant difference in reducing and non reducing sugars. A relatively higher reducing sugar was recorded with application of Metolachlor at 1.25 kg ai/ha, higher non reducing sugar was noticed at lower rate of application of Diuron , this suggested higher stored carbohydrates. The extra amount of sugars apparently contributed towards increased yield and better flower quality. The vegetative and reproductive charactersitics of the herbaceous annuals and biennuils are generally influenced by different herbicides sprayed apart from season factors and the change in micro climatic condition on growth, composition, yield and quality of produce.

Significant increase in Nitrogen content of plant was observed, the highest Nitrogen content in plant (3.14 per cent) was recorded with application of metolachlor at 1.50

kg ai/ha and the least (1.80 per cent) with the application of Alachlor at 1.00 kg ai/ha. Phosphorus content of plant differed significantly among herbicidal treatments. The highest percent of phosphorus was recorded (0.37 percent) with Metolachlor at 1.50 kg ai/ha and the least with unweeded control (0.01 percent). High potassium content was obtained due to the application of Diuron at 0.75 kg ai/ha (0.213 percent). Least potassium content was recorded with Simazine at 1.5 kg ai/ha (0.181 per cent) potassium content. This may be due to the severe competition of weeds for nutrient resulting in supression of crop growth and quality. However in hand weeding and with pendimethalin at 1.00 kg ai/ha recorded 0.21 per cent of potassium.

5.3.4 Prolonging the vase life of cut flower of china aster

The use of preservative sulution to promote the quality and prolong the life of cut flowers has been known for many years. Flower preservative are composed mainly of sugars. Germicides and acidifiers. loss of turgor due to depletion of water in cutflower contributes to deterioation. Chemically fortified flower preservatives have been shown to maintain turgor and prolong the cut flower life. These chemical preservatives reduce microbial growth, prevent vascular blockage and allow greater flow of solution.

In the present investigation there were no significant difference in fresh weight of flower except on 6th, 7th and 8th days. Uptake of solution did not differ significantly owing to herbicidal treatments. Vase life (in days) was not enhanced by the herbicides tried to control weeds in China aster.

5.4 Economics of different herbicides in china aster

The highest net returns was obtained in Diuron at 1.00 kg ai/ha (Rs 16941.62/ha) closely followed by Diuron at 0.75 kg ai/ha (Rs 15354.08/ha). The lowest net returns was with unweeded control (Rs 1603.21/ha). This was due to poor weed control which resulted in low yield of crop. There is immediate need of work out the cost of cultivation of all commercial flower crops with the use of herbicides for the effective control of weeds as chemical weed control is cheaper and effective and gives highest net returns.

SUMMARY

VI SUMMARY

Studies on the "Chemical weed control in China aster (Callistephus chinesis (L) Ness) Cv Ostrich plume" was conducted during 1988-89 at Horticulture Reasearch Station , University of Agricultural Sciences, G.K.V.K. Bangalore. The following are the salient findings of this investigations.

The important weed species observed in the experimental plots were, Panicum repens, Digitaria marginata, Cynodon dactylon, Cyperus rotendus, Acanthospermum hispidum, Ageratum conyzoids, Achyranthus spinosa, Borreria articularis, Commelina benghalensis, Lagasca mollis and Phyllanthus fraternus.

Through out the crop growth period monocots weeds were dominated over dicots and sedges. Among different types of weed dicots were controlled than monocots and sedges. Dicot weed population declining during early stage of growth. Sedges weed population decreased at 60th day compare to 30th day, this results obtained in this experiment clearly indicates that at crop productive stage helps in plant growth and to flower early. Relative effectiveness of herbicides tested indicated that Diuron at 1.00 and 1.25 kg

ai/ha and Simazine at 1.25 kg ai/ha were effective in decreasing the weed flora of both monocot and dicot weeds, sedges count was maximum with Diuron at 1.00 kg ai/ha and in hand weeding.

The total dry weight of weeds differ significantly at all stages of growth, however un weeded control recorded maximum dry weight of weeds indicating the higher number and luxurious growth of weeds.

Very mild phytotoxic symptoms were observed in Pendimethalin treated plots. However the plants recovered in the later stages. Mild or non phytotoxic symptoms were seen in Simazine and metolachlor sprayed plots.

The number of branches differ signifiantly due to herbicidal treatment at 45, 60 and 75 days after transplanting. Hand weeding progressively recorded higher leaf area and leaf area index, than other herbicidal treatments. Leaf area and leaf area index increased with application of Diuron at 0.75, 1.00 and 1.25 kg ai/ha, where unweeded control resulted in lowest leaf area and leaf area index.

Days taken for 50 per cent flowering significantly increased due to herbicides. Number of flower per plant and

total yield per hectare were enhanced due to Diuron application.

Flower quality attributes such as penduncle length and flower diameter were significantly increased with herbicides application. Flower diameter and dry weight of flowers were maximum with Diuron application.

Plant Nitrogen, Phosphorus and Potssium content were significantly incressed with different herbicidal treatments. Metolachlor at 1.50 kg ai/ha recorded higher Nitrogen and phosphorus content in the plant. Diuron at 0.75 kg ai/ha recorded the highest potassium content in the plant.

Herbicides did not influence the vase life of cut china aster flowers.

Highest net returns were realised with Diuron at 1.00 kg ai/ha (Rs.16,941.62/ha) followed by Diuron at 0.75 kg ai/ha and 1.25 kg ai/ha (Rs.15,354.08 and 14,770.04/ha).

Based on the results obtained from the present study it could be concluded that use of pre-emergent herbicides such as Diuron to keep the crop free of weeds in all stages of growth, producing quality flowers, higher flower yield by

controlling weeds effectively resulting in higher net returns.

Future line of work

1) There is need to study the use of suitable herbicide mixture to broaden the spectrum of weed control needs to be studied.
2) The type of weed flora controlled by different herbicides needs to be studied to improve the effeciency of herbicides in controlling weeds.
3) Residual effect of herbicides on succeeding crop needs to be understand.
4) There is need to study the use of different herbicides in control of weeds in other commercial flower crops.

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