

**Studies on integrated weed management practices in groundnut based  
intercropping system.**

Thesis submitted in part fulfilment of the  
requirements for the degree of  
**Doctor of Philosophy** (Agriculture) in Agronomy  
to the Tamil Nadu Agricultural University Coimbatore

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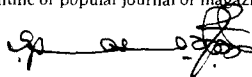
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## CERTIFICATE

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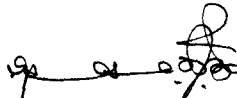


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(G.MANICKAM)

## ABSTRACT

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## **ABSTRACT**

### **STUDIES ON INTEGRATED WEED MANAGEMENT**

#### **PRACTICES IN GROUNDNUT BASED INTERCROPPING SYSTEM**

**By**

**G.MANICKAM**

**Degree** : Doctor of Philosophy (Agriculture) in Agronomy

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Field investigations were conducted during rabi seasons of 1992, 1994, 1995 and kharif 1994 at Regional Research Station, Vridhachalam, with the objectives of studying the nature of weed problem and the effect of various herbicides on the control of weeds in order to formulate an effective integrated weed management practice for groundnut based intercropping system.

The experiments were laidout in split plot design in three replications. The treatments in main plot comprised of pre-sowing application of glyphosate 1.0 per cent + ammonium sulphate 1.0 per cent ( sprayed on the weeds, 15 days prior to land preparation ) in comparison with unsprayed control. Intercropping of greengram and redgram in 4:1 ratio with groundnut under replacement series, were compared with sole

groundnut. In sub-plot, the pre-emergence herbicides viz. fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup>, pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup>, metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> and oxyfluorfen @ 1.0 kg a.i. ha<sup>-1</sup>, respectively with one hand weeding on 30 DAS in comparison with recommended practice of hand weeding on 25 and 45 DAS and the unweeded control, were studied.

The results revealed that the sedge, *Cyperus rotundus* dominated the weed flora. The highest weed control efficiency (WCE), weed control index (WCI) with least weed NPK uptake were obtained under pre-sowing application of glyphosate.

Among the intercrops, greengram in groundnut combination had an edge over other systems in respect to WCE, WCI and reduction in NPK uptake by weeds. The maximum values of WCE, WCI and the lowest weed NPK uptake were accounted under pre-emergence application of metalochlor @ 1.0 kg a.i. ha<sup>-1</sup> + one hand weeding H.W. on 30 DAS followed by pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS. Consequently, the higher values of WCE, WCI and minimum NPK uptake by weeds were achieved through the combination of these management practices.

There was appreciable improvement in growth and yield components of both groundnut and intercrops under pre-sowing glyphosate application. However, the practice of groundnut + greengram intercropping have shown only a slight improvement on growth and yield parameters. The pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS had registered a distinct improvement in growth and yield deciding characters of groundnut and intercrops, compared to rest of the weed control treatments.

The haulm and pod yield of groundnut and the grain yield of intercrops were higher under glyphosate application. Since, the intercrops with groundnut were raised in replacement series, reduction in haulm and pod yield of groundnut were noticed under intercropped situations. The increment in haulm and pod yield of groundnut and grain yield of intercrops were considerably higher with pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS and it was followed by pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS.

The different practices of intercropping and integrated weed management measures do not alter the oil accumulation in groundnut.

The highest groundnut pod equivalent and land equivalent ratio (LER) were recorded under glyphosate application. Regarding intercroppings, groundnut + greengram system accounted for the maximum groundnut pod equivalent and LER. Appreciable increment in pod equivalent and LER were registered under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS. It was followed by pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS. The overall productivity of the cropping systems under different weed management practices in terms of pod equivalent and LER, indicated that the pre-sowing application of glyphosate 15 days prior to land preparation followed by pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS for groundnut + greengram intercropping was the most beneficial.

The total NPK uptake by both groundnut and intercrops were higher with the application of glyphosate. Similar increment in total NPK uptake were obtained under groundnut + greengram intercropping system and also under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS.

Hence, it can be concluded that in view of favourable increase in WCE and WCI, growth and yield components of both the crops, groundnut pod equivalent, together with high monetary income, the pre-sowing application of glyphosate, 15 days prior to land preparation followed by pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> along with one hand weeding on 30 DAS is recommended for groundnut + greengram intercropping system. Alternatively, the practice of pre-sowing glyphosate application in conjunction with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one hand weeding on 30 DAS for groundnut + greengram intercropping system can be considered.

## CONTENTS

Chapter No.		Page No.
I	Introduction	1
II	Review of literature	4
III	Materials and methods	30
IV	Results	47
V	Discussion	127
VI	Summary and conclusion	155
	References	161
	Appendix	188
	Plate	191

## LIST OF TABLES

S.No.	TITLE	PAGE No.
1	Soil characteristics of the experimental site	33
2	Weed flora of the experimental site	48
3	Number of sedges on 30 DAS (No.m <sup>2</sup> )	50
3a	Number of sedges on 60 DAS (No.m <sup>2</sup> )	51
3b	Number of sedges on 105 DAS (No.m <sup>2</sup> )	52
4	Number of grasses on 30 DAS (No.m <sup>2</sup> )	54
4a	Number of grasses on 60 DAS (No.m <sup>2</sup> )	55
4b	Number of grasses on 105 DAS (No.m <sup>2</sup> )	56
5	Number of dicots on 30 DAS (No.m <sup>2</sup> )	58
5a	Number of dicots on 105 DAS (No.m <sup>2</sup> )	59
5b	Number of dicots on 105 DAS (No.m <sup>2</sup> )	60
6	Total number of weeds on 30 DAS (No.m <sup>2</sup> )	63
6a	Total number of Weeds on 60 DAS (No.m <sup>2</sup> )	64
6b	Total number of Weeds on 105 DAS (No.m <sup>2</sup> )	65
7	Weed control efficiency on 105 DAS (per centage)	67
8	Weed drymatter production on 30 DAS (g.m <sup>2</sup> )	70
8a	Weed drymatter production on 60 DAS (g.m <sup>2</sup> )	71
8b	Weed drymatter production on 105 DAS (g.m <sup>2</sup> )	72
9	Weed control index on 105 DAS (per centage)	74
10	Mean NPK uptake by weeds on 105 DAS (kg ha <sup>-1</sup> )	76
11	Mean plant height at different growth stages (cm) - groundnut	78

S.No.	TITLE	PAGE No.
12	Mean Leaf Area Index at different growth stages - groundnut	80
13	Mean drymatter production at different growth stages (g plant <sup>-1</sup> ) - groundnut	82
14	Number of nodules plant <sup>-1</sup> - groundnut	84
15	Mean growth components of intercrops at harvest	86
16	Number of matured pods plant <sup>-1</sup> - groundnut	88
17	Number of immature pods plant <sup>-1</sup> - groundnut	90
18	100 kernel weight (g) - groundnut	92
19	Shelling per centage - groundnut	94
20	Sound matured kernels (per centage) - groundnut	95
21	Pod yield (kg ha <sup>-1</sup> )	97
22	Haulm yield (kg ha <sup>-1</sup> )	100
23	Oil content (per centage)	102
24	Mean yield components and yield of intercrops at harvest	103
25	Groundnut pod equivalent (kg ha <sup>-1</sup> )	106
26	Land equivalent ratio	108
27	Total nitrogen uptake of groundnut and intercrops on 30 DAS (kg ha <sup>-1</sup> )	110
27 a	Total nitrogen uptake of groundnut and intercrops on 60 DAS (kg ha <sup>-1</sup> )	111
27 b	Total nitrogen uptake of groundnut and intercrops on 105 DAS (kg ha <sup>-1</sup> )	112
28	Total phosphorus uptake of groundnut and intercrops on 30 DAS (kg ha <sup>-1</sup> )	115

<b>S.No.</b>	<b>TITLE</b>	<b>PAGE No.</b>
28 a	Total phosphorus uptake of groundnut and intercrops on 60 DAS (kg ha <sup>-1</sup> )	116
28 b	Total phosphorus uptake of groundnut and intercrops on 105 DAS (kg ha <sup>-1</sup> )	117
29	Total potassium uptake of groundnut and intercrops on 30 DAS (kg ha <sup>-1</sup> )	119
29 a	Total potassium uptake of groundnut and intercrops on 60 DAS (kg ha <sup>-1</sup> )	120
29 b	Total potassium uptake of groundnut and intercrops on 105 DAS (kg ha <sup>-1</sup> )	121
30	Mean post harvest available soil NPK (kg ha <sup>-1</sup> )	124
31	Economics	126

## LIST OF FIGURES

Figure No.		Page No.
1.	Weather parameters during the cropping period (R'92 & R'94)	31
1a.	Weather parameters during the cropping period (R'95 & K'94)	32
2.	Field layout	36
3.	Total Number of weeds ( m <sup>2</sup> ) at harvest	169
4.	Weed Control Efficiency at harvest	131
5.	Weed drymatter production ( g m <sup>-2</sup> ) at harvest	133
6.	Weed control index at harvest	134
7.	Number of matured pods plant <sup>-1</sup>	139
8.	Pod yield ( kg ha <sup>-1</sup> )	142
9.	Haulm yield ( kg ha <sup>-1</sup> )	145
10.	Pod equivalent ( kg ha <sup>-1</sup> )	148

## LIST OF APPENDIX

Serial No.		Page No.
I	Meteorological data during the cropping seasons	188
II	Particulars of herbicides used	189
III	Economics	190

## ABBREVIATIONS USED

%	- Per cent
g	- gram
kg	- kilogram
ha <sup>-1</sup>	- per hectare
t	- tonne
cm	- centimeter
N	- nitrogen
P	- phosphorus
K	- potassium
PPM	- parts per million
a.i.	- active ingredient
LAI	- Leaf area index
DMP	- Drymatter production
DAS	- Days after sowing
H.W.	- Hand weeding
@	- at the rate of
LER	- Land equivalent ratio
WCE	- weed control efficiency
WCI	- weed control index
°C	- Degree in centigrade
MSL	- mean sea level
RM	- Rabi mean
SMK	- Sound matured kernels
Fig	- Figure
N.S.	- Not significant
SE d	- standard error deviation
CD	- critical difference
FYM	- Farm yard manure

## INTRODUCTIC

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## CHAPTER I

### INTRODUCTION

Groundnut is the major oilseed crop extensively cultivated in an area of 83 lakh hectares in India. Compared to other oil seeds, its contribution to the national edible oil production is high to the tune of 34 per cent. In Tamilnadu groundnut is cultivated in an area of 10 lakh hectares with an average production of 1480 kg ha<sup>-1</sup>. Though, the yield was 60 and 28 per cent increase over national and global averages, the scope for further improvement in yield are promising, since the genetic potential of the presently available cultivars are of two to four times higher than the current national and state average yields as reported by Rai (1995). The low productivity of groundnut in India is due to its cultivation even under sub-marginal lands and non-adoption of improved production technologies.

The practice of monocropping of groundnut in the traditional areas without intercropping or crop rotation resulted in buliding up of similar type of pest and diseases along with enormous depletion of soil nutrients by the weed flora that are well accustomed to the groundnut ecosystem. Since, high monetary income oriented cropping programmes have been emphasised, intercropping in groundnut gaining importance in recent times. The practice of intercropping besides offering an assured crop productivity against crop failures due to the natural hazards like drought, frost and pest and disease etc., enables the cultivator to obtain a variety of crop harvest from same piece of land with increased monetary returns from an unit area. In addition, through selection of suitable pulse as intercrops in groundnut the fertility and the productivity of marginal and submarginal lands could be improved through addition of crop residues. Further, the intercropping system through containing the weed population, restricts the nutrient depletion from the soil.

Weed infestation is one of the major constraint in productivity of any crop. Of the estimated losses due to all pests, amounting to about Rs. 6,000 crores annually in our country, more than 32 percent losses are caused due to weeds alone ( Sankaran **et al.**, 1993 ). The slow growth habit of groundnut at intial stages, and the copious application of fertilizer nutrients together concides with critcal period of weed competition i.e from 0 to 45 DAS (Kalaiselvan **et al.**, 1991b), favours weed infestation and results in poor crop yields. Unlike other crops, groundnut seems to have poor competitive ability against weeds and hence, the consequential yield losses would be upto 88 per cent. The losses, however depends upon the intensity of weed population, the type of weed flora and the stages of infestation (Dharam Singh **et al.**, 1992).

Keeping the groundnut fields under weed free conditions exclusively by hand weeding may not always be a feasible practice, due to labour shortage, high cost of labour and the time involved. Though an effective and timely weed control could be obtained through pre-emergence herbicides at intial stage, emergence of weeds was noticed after sometime. Inaddition the contineous application of similar type pre-emergence herbicides for a particular locality results in reduction of the herbicides efficacy and imparts resistance in existing weed flora. Moreover, the pre-emergence herbicides like fluchloralin, alachlor and nitrofen used for weed control in groundnut were effective only on annual broad leaved weeds and grasses, leaving the sedges and perennial weeds unchecked since they were deep rooted and mostly propagated through underground rhizomes. Subsequently it resulted in their ultimate dominance. Under such situations, use of broad spectrum, pre-sowing, translocative herbicides like glyphosate might be of reliable measure.

Hence, a complete weed control can not be achieved by using any one of the weed management methods, as the weed flora comprises of different species. A judicious combination of chemical and manual methods might be the answer for effective weed management in groundnut and groundnut based intercropping systems.

With the above needs in view, the present study on weed management in groundnut based intercropping situation was undertaken with the following specific objectives.

1. To identify the most accomodative and remunerative intercrop for groundnut ecosystem.
2. To compare the efficacy of pre-sowing and pre-emergence herbicides on control of annual and perennial weed species.
3. To evolve an effective integrated method of weed management for groundnut based intercropping systems.
4. To study the effect of integrated weed management practices on growth, yield attributes and yield of groundnut and intercrops.
5. To workout an economical intercropping and integrated weed management practice for groundnut.

REVIEW OF LITERATURE

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## CHAPTER II

### REVIEW OF LITERATURE

Weeds cause severe loss among field crops by competing for biotic and abiotic factors. Due to weed infestation the loss of yield in groundnut either as monocrop or intercrop is estimated to be between 17 and 96 percent. Through reviewing the various attempts made under weed control in groundnut will help to evolve an efficient weed management strategy could be formulated for groundnut based intercropping systems.

In recent times intensive cropping systems with diversified crops have been emphasised for higher monetary returns. Hence, the approaches in intercropping situations may be the most appropriate and remunerative. Though the intercropping system in groundnut offer sustainable yields under varied agroclimatic conditions, the attempts made on evaluation of suitable intercrop combination is very limited.

Hence, in this chapter the work done on different aspects of weed management in groundnut and groundnut based intercropping systems in groundnut are reviewed.

#### 2.1. Associated Weed Flora

The detailed information regarding the existence and dynamics of the associated weed flora of the crop ecosystem is helpful in formulation of appropriate weed management programme.

##### 2. 1. 1. Groundnut

In Tamilnadu, at Coimbatore the dominance of *Cyperus rotundus* and *Trianthema portulacastrum* under red sandy loam soil was documented by Selvamani and Sankaran

(1989). At Aliyarnagar, Kavimani and Muruganandam (1990) observed **Acalypha indica** L., **Chenopodium album** L., **Corchorus fuscularis**, **Euphorbia hirta**, **Trianthema portulacastrum** L., **Cynodon dactylon** (L.) and **Cyperus rotundus** as major weeds under sandy loam soil conditions.

The weed species viz. **Echinochloa colona**, **Panicum repens** L., **D.aegyptium**, **C.dactylon**, **C.rotundus**, **Boerhaavia diffusa** L., and **Phyllanthus niruri** were predominant at Bhavanisagar (Mohammed Ali and Sudhakar Rao, 1990)

Under sandyloam soil type, **Dactyloctenium aegyptium**, **Gynondropsis pentaphylla**, **D.sanguinalis** L., and **E . colonum** were observed to be the major weeds during 1990 at Vridhachalam (Kalaiselvan et al., 1991a).However, survey done by Venkatakrishnan et al. (1995) at Vridhachalam revealed the dominance of **Cyperus rotundus** and **D.aegyptium** and **Boerhaavia diffusa** under irrigated conditions.

In Andra Pradesh, while Sivanarayana and Bhanumathy (1990) recorded **C.rotundus**, **Tragus biflorus**, **D.sanguinalis**, **Cleome viscosa**, **Trichodesma indicum** as the predominant weeds, Kumar (1992) documented **Digeria arvensis**, **Justica prostrata**, **Panicum sp.** as major weeds.

In Karnataka, Sudhakar and Muniyappa (1992) observed **Digitaria marginata**, **C.dactylon**, **Eragrostis gangetica**, **Acanthospermum hispidum** and **Amarathus viridis** as the major weeds. Whereas Suresh and Nanjappa (1994) summarised **C.rotundus** **D.aegyptium**, **E.hirta** and **D. marginata** as the dominant weeds.

### 2. 1. 2. Greengram

In Karnataka, Prasad et al. (1990) recorded *Ergrostis riparia* and *E.pilosa* as the dominant weeds. Balyan (1993) reported *Trianthema portulacastrum*, *E.colonum*, *C.rotundus*, *D.arvensis* and *D. aegyptium* as major weeds at Haryana.

In West Bengal, during kharif the weeds *D.sanguinalis*, *E.colona*, *C.dactylon*, *D.aegyptium*, *C.rotundus*, *T.portulacastrum* and *Polygonum sp.* were dominant and during rabi, *Setaria glauca*, *P.repens*, *E.alba*, *E.colona* were predominant (AICRPWC, 1993)

### 2. 1. 3. Redgram

According to Bhalla et al. (1988) *Ageratum conyzoides*, *Cichorium intybus*, *Eclipta alba*, *Striga sp.* *E.hirta* in broad leaved weeds, *E.tenella*, *E.minor*, *C.dactylon* and *E.colonum* in grasses and *C.rotundus* and *C.iria* in sedges were the dominant weed flora in Uttar Pradesh.

The major weed flora in Punjab were *E.aegyptica*, *E.tenella*, *D.arvensis*, *Celosia argentea* and *Tribulus terrestris* (Brar et al., 1990). Phogat et al. (1991) observed *T.portulacastrum*, *E.crusgalli*, *C.dactylon* and *C.rotundus* as predominant weeds in the state.

### 2.1.4. Intercropped Situations

In groundnut + redgram intercropped situations under sandyloam soil at Uttar Pradesh, Tewari et al. (1989) observed *E.colonum*, *E.indica*, *D.aegyptium*, *D.sangunalis*, *Trianthema monogyna*, *Solanum nigrum* and *E.hirta* as major weeds. While the weed

species, *Lagasca mollis*, *Parthenium* sp., *Flavaria australasica*, *C.argentina*, *C.dactylon* and *C.rotundus* were predominant in Andhra (AICRPWC, 1990), the AICRPWC (1994) report summarises *D.arvensis*, *P.niruri*, *E.colona*, *D.aegyptium* and *C.rotundus* as predominant weeds. Subbiah et al.,(1995a) reported *D.aegyptium*, *C.dactylon*, *Acanthospermum hispidum* and *P. niruri* as problematic weeds under red sandy loam soil type in Karnataka.

According to Sawhney et al. (1989), *Arachene racemosa*, *C.dactylon*, *C.rotundus*, *S.halapensi*, *E.hirta* were dominant weeds in redgram + groundnut intercropped fields at Ludhiana. In Delhi, Singh et al. (1991) observed *A. viridis*, *P.niruri*, *C.dactylon*, *C.rotundus*, *E.colonum* and *E.indica* as major weeds in redgram + greengram intercropping system.

## 2. 2. Weed Dynamics

It denotes the change of weed species in proportion or in types due to several factors viz. seed contamination, tillage or cultural practices, moisture levels, soil pH, crops and cropping systems and type of weed management, in particular the herbicides. Changes in weed flora are the result of selection pressure imposed by innovations and modifications in the existing agricultural operations that alter their habitat (Sen, 1988 ; Ramakrishna, 1988).

### 2.2.1. Seed Contamination

In India, with the introduction of high yielding dwarf cultivars, weeds like *Avena fatua* and *Poa annua* gain dominance in wheat (Gautam, 1981). Similarly, increased population of *Echinochloa* sp. in rice was noticed by Krishnamurthy et al. (1988).

### 2.2.2. Tillage Practices

Tillage exerts a considerable influence in the evaluation of arable weed flora. Due to minimum tillage operations, decreased population of **Polygonum ariculare**, **Anagallis arvensis** and **Viola arvensis** in temperate cereals were documented by Froud-Williams *et al.* (1981) and Pollard *et al.* (1982).

### 2.2.3. Cropping Pattern

Monocropping with similar cultivation practices year after year imposed selection pressure on weeds and aided in weed shift. Accordingly, Moody and De Datta (1977) noticed the increased existence of **Scirpus maritimus** under monocropping of rice, compared to the rotation with maize or mungbean. Singh and Kaushik (1989) observed that none of the weeds dominated under maize + soyabean intercroppings due to changes in ecological conditions, tillage systems and nature of crops. Similar findings under the sequential cropping system of rice - maize - cowpea were documented by Srinivasan and Pothiraj (1989) and Elliot and Moody (1991).

### 2.2.4. Herbicidal Usage

Application of similar type of herbicide in a particular area for long time will impose new factors of selection through radical change in mutual competition or by increasing tolerance or by acquiring resistance in the susceptible species (Chancellor and Froud-Williams, 1986 ; Froud-Williams, 1988).

The increased dominance of **Veronica persica**, **Stellaria media** and **Gallium aparine** due to use of MCPA (or) 2,4-D over 12 years was earlier reported by Rademacher *et al.*

(1970). Rangaiah (1981) noticed the increased population of *Cyperus rotundus* with continuous use of selective pre-emergence herbicides on annual weeds.

Similarly, at Vridhachalam, during 1989-90 the annuals like *Gynodropsis pentaphylla* and *A. viridis* were noticed as the major weeds (Kalaiselvan and Ramdoss, 1990). Subsequently, the *Cyperus rotundus* became dominant (Venkatakrisnan et al., 1995).

### 2.3. Severity of Nutsedge

The purple nutsedge was listed as one of the world's worst weed (Holm et al., 1977). It occurs both in cultivated and uncultivated lands in tropical, sub tropical and mediteranian climate between 35° N and 35° S latitude (Bhowmik, 1993).

Ranade and Burn (1975) estimated that nutsedge could reduce crop yields by 25 to 35 per cent. A drastic reduction in yield of upland rice due to nutsedge infestation was documented by Okafo and De Datta (1976). Similar findings in cassava, sugarcane and in taro were noticed by Villamayor and Reoma (1987); Sathyavelu et al. (1992) and Srinivasan (1995).

Thus the literature reviewed under existence of weed flora and their dynamics in groundnut based cropping systems clearly indicated the dominance of nutsedge population in Tamilnadu.

### 2.4. Weed Competition on Crop Yields

Maintaining weed-free environment resulted in maximum yields in groundnut (Selvamani and Sankaran, 1963; Singh et al., 1991; Suresh and Nanjappa, 1994 ; Devidayal et al., 1994). However, assessing the critical stages of weed competition and containing the weeds during these periods was proved to be effective and economical.

### **2.4.1. Critical Stages**

Weed problem in groundnut crop is severe in early stage because of slow seedling emergence and its growth. The critical period of competition ranges from 4 to 9 weeks (Yuduraju et al., 1980; Gautam, 1981). The most critical period ranges from 0-45 DAS and the weeds emerge after this period may not have significant impact (Singh et al., 1985; Kalaiselvan et al., 1991). However, Everaarts (1992) suggested an initial weed free period of 15 days from sowing and subsequently the competition should be avoided during 35 to 60 DAS for profitable crop yields.

### **2.4.2. Yield Reduction**

In groundnut, the yield reduction is more due to weeds than any other yield limiting factors and it ranges from 17 to 88 per cent (Raghawani et al., 1984; Kulandaivelu and Sankaran, 1985; Rao et al., 1987; Prusty et al., 1990; Dharam Singh et al., 1992; Ghosh, 1995). Similarly in redgram yield reduction due to weeds ranged from 33 to 70 per cent (Itnal et al., 1993; Tripathi et al., 1995).

## **2. 5. Approaches in Weed Management**

### **2. 5. 1. Non-Chemical**

Amir and Lifshitz (1976) claimed that mechanical weeding alone could not eradicate weed menace in groundnut. Hence herbicidal application, followed by mechanical tillage was necessary (Hegde et al., 1977; Khattar et al., 1984; Suresh, 1984).

The problem of weeds could also be minimised by growing of compatible intercrops. Inclusion of cowpea and other pulses in redgram based intercropping reduced the weed population most significantly (Ali, 1987; Tewari et al., 1989; Mahapatra, 1991).

Malvia and Patel (1989) obtained better weed control in groundnut with hand weeding on 20 and 40 DAS and the intercultivation on 20, 40 and 60 DAS. Two hoeings on 15 and 35 DAS along with one hand weeding on 25 DAS was found to give higher weed control index in groundnut (Kathikar and Khan, 1990 ; Patel et al., 1991).

Kavimani and Murugananthan (1990) stated that hand weeding on 25 and 45 DAS was sufficient for groundnut. Itnal et al. (1993) opined that hand weeding on 60 DAS in addition to 20 and 40 DAS was necessary for redgram .

In redgram + groundnut intercropping system, hand weeding twice along with one intercultivation on 42 DAS, resulted in better weed control (Vijayakumar, 1991).

In contrast, the inferior effect of hand weedings and hoeings compared to integrated weed management in groundnut and groundnut based intercropping systems were reported by Maruthi et al. (1990) ;Nimje (1992) and Subbiah et al. (1995b.)

## **2. 5. 2. chemical**

Due to scarcity of labour at peak times of agricultural operations, different herbicides based weed control technologies have been developed and test verified. Effect of these management practices on yield components and yield of groundnut and intercrops are reviewed hereunder.

### **2. 5. 2. 1. Pre-Sowing**

In non-cropped situations post-emergence application of 2,4-D @ 2-4 kg a.i.ha<sup>-1</sup> gave effective control of nutsedge upto 98 per cent (Rao, 1983; Bhargavi and Yellamanda Reddy, 1992).

Mehta (1991) observed that application of glyphosate at 0.45 per cent significantly reduces the number of tubers plot<sup>-1</sup>, dry weight of shoots, roots and rhizomes of nutsedge as compared to control.

While Tewari and Singh (1991) stated that deep ploughing during summer followed by 1.2 kg ha<sup>-1</sup> of glyphosate as commercial product was effective on nutsedge, Madhavi et al. (1992) obtained good control of nutsedge through 1.5 kg ha<sup>-1</sup> of glyphosate with 2 per cent ammonium sulphate.

Sandhu and Bhatia (1992) found that split application of glyphosate twice @ 1.0 kg ha<sup>-1</sup> of commercial product was effective on nutsedge. Similar results with initial spraying of 2.0 to 3.5 kg ha<sup>-1</sup> of glyphosate were documented by Hawton et al. (1992); Derr and Wilcut (1993) and Maligeppagol et al. (1994).

According to Bhatia and Sandhu (1993) effective nutsedge control could be attained through 2 kg ha<sup>-1</sup> of glyphosate as commercial product along with 50 ppm of NAA. Similarly, Manickam and Gnanamurthy (1992) noticed significant reduction of nutsedge biomass through 1.0 per cent glyphosate with 0.05 per cent of 2, 4-D sodium salt (or) 1.0 per cent ammonium sulphate.

#### **2. 5. 2. 2. Pre-emergence**

##### **2. 5. 2. 2. 1. Fluchloralin**

Soil incorporation of fluchloralin @ 1.0 to 2.0 Kg a.i. ha<sup>-1</sup> gave good control of weeds in groundnut (Mehra et al., 1987 ; Shankaranarayana Rao and Jaganathan, 1987).

Selvamani and Sankaran (1989) reported higher pod yield along with least weed density in groundnut with pre-emergence application of fluochloralin @ 1.0 Kg a.i. ha<sup>-1</sup>. Geethalakshmi et al. (1989) too corroborate the findings.

#### **2. 5. 2. 2. 2. Oxyfluorfen**

Pre-emergence application of oxyfluorfen @ 0.10 to 0.15 kg a.i. ha<sup>-1</sup> recorded the maximum weed control efficiency in groundnut (Prasad et al., 1987; Ravikumar and Ramakrishna Reddy 1989 ; Rafey and Prasad, 1995). Kumar and Reddy (1991) and Kumar (1993) noticed improvement in yield parameters and yield in groundnut with 0.2 and 0.5 kg a.i. ha<sup>-1</sup> of oxyfluorfen.

In contrast a temporary chlorosis in groundnut at early stage with the use of oxyfluorfen was earlier noticed by Ramachandra Prasad et al. (1987).

#### **2. 5. 2. 2. 3. Pendimethalin**

Pendimethalin @ 1.0-1.5 Kg a.i. ha<sup>-1</sup> gave broad spectrum of weed control in groundnut compared to two hand weedings ( Kulandaivelu and Sankaran, 1985; Kondap et al., 1989). A moderate control of nutsedge through pre-emergence application of pendimethalin @ 1.5 Kg a.i. ha<sup>-1</sup> in rice was documented by Bhargavi and Yellamanda Reddy (1992). The nodulation, weed control index and pod yield in groundnut were maximum with pre-emergence application of pendimethalin @ 1.0 Kg a.i. ha<sup>-1</sup> (Deshmuk and Dev, 1995).

In redgram + sorghum intercropping systems, Ali (1991) obtained the maximum pod and grain yields along with minimum DMP of Weeds through application of pendimethalin @ 1.5 kg a.i. ha<sup>-1</sup>.

#### **2. 5. 2. 2. 4. Metalochlor**

Lagoke **et al.** (1981) obtained appreciable groundnut pod yield through effective weed suppression, using metolachlor at 0.75 to 1.0 kg a.i. ha<sup>-1</sup>. Chambler **et al.** (1982) and Keeling **et al.** (1990) noticed satisfactory weed control in groundnut and onion through soil incorporation of metolachlor @ 1.0 Kg a.i.ha<sup>-1</sup>. Application of metolachlor at 0.5 kg a.i. ha<sup>-1</sup> was found to gave pod yield comparable to that of weed free conditions in groundnut (Mishra and Singh, 1995).

The earlier weed management studies by Dixon and Stroller (1982) showed a moderate control of nutsedge through pre-emergence application of metolachlor @ 1.0 Kg a.i. ha<sup>-1</sup>.

However, the studies by Vairavan **et al.** (1995) in groundnut concludes that the pre-emergence herbicides such as pendimethalin, alachlor and metolachlor can control only the dicot weeds, leaving the grasses and sedges unchecked and this might have resulted in their dominance. Since their eradication by manual weeding was also limited, the use of post-emergence tranlocative herbicide prior to sowing of groundnut might be of reliable measure.

#### **2. 5. 3. Integrated Weed Management**

The literature reviewed under weed management clearly indicated that none of the above management approaches alone could eradicate the weeds completely. Hence, adoption of integrated weed management practices might be effective and economical. In line with this Guggari **et al.** (1995) observed that herbicides alone could only control

weeds from 30 to 55 per cent. However, when combined with one hand weeding the weed control was up to 85 per cent.

### 2. 5. 3. 1. Fluchloralin Combination

According to Thangamuthu et al. (1988) appreciable control of weeds could be achieved with pre-emergence application of fluchloralin @ 1.0 Kg a.i. ha<sup>-1</sup> along with one hand weeding on 45 DAS. Similar results with soil incorporation of fluchloralin @ 1.0 to 1.5 Kg a.i. ha<sup>-1</sup> was documented by Panwar et al. (1989).

Prusty et al. (1990) recorded the maximum mean pod yield of 2300 Kg ha<sup>-1</sup> through soil incorporation of fluchloralin @ 0.9 kg a.i.ha<sup>-1</sup> combined with one intercultivation on 25 DAS. In-line with this, Pannu et al. (1991) and Devidayal et al. (1994) obtained the maximum weed control efficiency through soil incorporation of fluchloralin 1.5 kg a.i.ha<sup>-1</sup> with one hand weeding on 25 DAS.

White Patel et al. (1992) found that the pre-emergence application of fluchloralin @ 0.9 kg a.i.ha<sup>-1</sup> coupled with one hand weeding on 35 DAS was effective. Murthy et al. (1994) reported that for groundnut in addition to the pre-emergence application of fluchloralin @ 1.0 Kg a.i ha<sup>-1</sup>, three hand weedings on 15, 30 and 45 DAS were necessary.

In groundnut + blackgram intercropping system maximum weed control and higher pod yields were obtained with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one hand weeding on 2 J DAS (Kalaiselvan et al., 1994).

### 2. 5. 3. 2. Oxyfluorfen Combination

*Integrating one hand weeding on 35 DAS with pre-emergence application of oxyfluorfen @ 0.15 kg a.i. ha<sup>-1</sup> resulted in higher pod yields through effective weed control in groundnut (Raghvani et al., 1984). In redgram, Sinha et al. (1989) using oxyfluorfen @ 0.14 kg a.i. ha<sup>-1</sup> with two hand weedings on 20 and 40 DAS obtained the maximum weed control index and grain yield.*

In contrary, Sudhargar and Muniyappa (1991) summarised that the weed suppression effect of oxyfluorfen alone or in combination with hand weeding was lesser compared to pendimethalin or alachlor.

### 2.5.3.3. Pendimethalin Combination

Mohamed Ali and Sudhakara Rao (1990) obtained maximum pod yield of 3682 kg ha<sup>-1</sup> with minimum weed population of 12 m<sup>2</sup> through pre-emergence application of pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> along with hand weeding on 35 DAS. Wardhane and Lanjewar (1992) reported that application of pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> with one hand weeding on 20 DAS was good for better weed control in groundnut. Similar results in redgram was also observed by Itnal et al. (1993).

In groundnut + sesame inter cropping system application of pendimethalin @ 0.5 kg a.i. ha<sup>-1</sup> with one hand weeding on 20 DAS gave 85 per cent of weed control (Maliwal and Rathore, 1994).

Yellamanda Reddy and Padmalatha (1994) reported that in groundnut + redgram intercropping system, minimum weed dry weight of 5.30 g m<sup>-2</sup> and number of weeds of 4.0 m<sup>-2</sup> were obtained using pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> with hand weeding on

30 DAS. Similar findings in groundnut + redgram were documented at Regional Research Station, Vridhachalam (AICORPO, 1994).

Appreciable increment in pod yield of groundnut and seed yield of redgram using pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> with one hand weeding on 40 DAS were obtained by Raj Singh and Munda (1995) and Pazhanivelan and Kandasamy (1995).

#### **2. 5. 3. 4. Metolachlor Combination**

Application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> with one hand weeding on 45 DAS significantly improves the yield attributes and oil content in groundnut (Suresh, 1984).

Ramakrishna *et al.* (1991) noticed that the combination of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> with one hand weeding on 30 DAS significantly increased the pod yield in groundnut through maximum control of weeds. AICORPO (1993) reports too revealed the similar finding.

Maximum groundnut pod yield of 1452 kg ha<sup>-1</sup> with least weed dry weight of 675 kg ha<sup>-1</sup> were found to be attributed with pre-emergence application of metolachlor @ 1.0 kg ha<sup>-1</sup> with one hand weeding on 35 DAS (Guggari *et al.*, 1995).

#### **2. 6. Nutrient Uptake by Weeds and Crops**

Prabhakara Setty and Hosmani (1977) observed negative correlation co-efficient between weeds and crops regarding nutrient uptake. Doubling of nutrient uptake by

groundnut with weed free conditions compared to unweeded check were reported by Soundararajan et al. (1981) and Naidu et al. (1982). Similarly, the nutrient removal under unweeded check was found to be 5 to 10 times higher than weed control treatments (Suresh, 1984).

Weed control measures assure saving of soil nutrients and helps in better uptake by crops (Yadav et al., 1986). Pannu et al. (1991) show that integrating one hand weeding on 40 DAS with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> facilitates the maximum uptake of 183.6, 27.4 and 106.7 kg NPK ha<sup>-1</sup> in groundnut compared to hand weeding or fluchloralin alone.

Ambulkar (1993) found that nitrogen uptake of groundnut was minimum in unweeded control, wherein the weed uptake was higher. In addition, different weed management practices were also found to improve the post harvest available soil nitrogen and phosphorus.

The uptake studies by Satao et al. (1995) in hariyali, under non-cropped situations revealed that the NPK uptake was higher in unweeded check compared to treated plots.

## **2. 7. Residual Effect of Herbicides**

A wide spectrum of herbicides was found to be effective in weed control which resulted in higher crop yields. However, identification of effective herbicide for groundnut based intercropping system without causing any residual toxicity is of most important.

### **2. 7. 1. Pre-Emergence Herbicides**

Seshiah (1978) pointed out that the pre-sowing application of fluchloralin

@ 0.72 to 1.44 kg a.i. ha<sup>-1</sup> had no residual effect on succeeding groundnut. Similar report in succeeding field peas was documented by Patel and Patel (1991).

According to Choudhary (1983) there was no residual effect of metolachlor @1.0 kg a.i. ha<sup>-1</sup> on succeeding wheat. Suresh (1984) and Blanco et al. (1989) also demonstrated non-phytotoxicity of metolachlor on succeeding crops of groundnut.

Using bio-assay Utulu et al. (1986) found the complete detoxification of pendimethalin at 12 weeks after treatment. Kulshretta and Yaduraju (1987) too confirms the above findings. The residue of pendimethalin was found to be below 1.0 ppm which was safer for soil and the succeeding crops (Rajvir Sharma and Mehta, 1989).

No residual phytotoxicity of oxyfluorfen at 1.35 kg ha<sup>-1</sup> as commercial product, in edible parts of taro was recorded by De Frank et al. (1990). Similar findings in succeeding groundnut was done by Sundararajan et al. (1993).

In contrary, a slight residual effect on cucumber with the application of fluchloralin, pendimethalin and oxyfluorfen was earlier reported by Jeyakumar et al. (1988).

## **2. 7. 2. Post - Emergence Herbicides**

Madhavi et al. (1992) observed no residual toxicity on succeeding greengram with application of glyphosate @ 1.5 kg a.i. ha<sup>-1</sup> along with 2 per cent ammonium sulphate. Similar results in succeeding cereals was noticed by Kumar and Singh (1992).

Manickam and Gnanamurthy (1994) found that application of glyphosate @ 1.0 per cent with 0.05 per cent 2,4-D or 1.0 per cent ammonium sulphate shows no toxicity on

on greengram and blackgram. Chandra and Singh (1995) too corroborated these findings with 1.0 kg a.i. ha<sup>-1</sup> of glyphosate application.

## **2. 8. Intercropping**

Intercropping implies growing two or more crops simultaneously in the same piece of land with rows of geometrical pattern (De et al., 1978). Krantz (1979) opined that intercropping and mixedcropping systems were evolved as a low cost technology in traditional agriculture for evading risk factors, besides inter cropping have conferred substantial benefits.

### **2. 8. 1. Benefits of Intercropping**

#### **2. 8. 1. 1. Soil Characters**

Lomte et al. (1993) noticed improvement in soil bulk density, infiltration rate, hydraulic conductivity, soil PH and organic carbon content by intercropping of redgram in sorghum from their longterm experiments.

#### **2. 8. 1. 2. Nitrogen and Moisture Economy**

The nitrogen fixation was estimated around 10 kg ha<sup>-1</sup> through growing greengram or redgram in sorghum (AICORPO, 1973).

Kulkarni and Sojitra (1986) pointed out that nodulation and nitrogen fixation in groundnut were improved when intercropped with grain legumes.

Maheswara Reddy et al. (1994) found that 100 per cent fertilizer dose of groundnut

and 50 per cent of redgram is sufficient, instead of applying 100 per cent for each crop when redgram was intercropped with groundnut.

The moisture use efficiency of redgram was found to be higher when intercropped with greengram rather than as sole crop (Dharam Singh and Singh, 1995).

#### **2. 8. 1. 3. Solar Radiation Interception**

Penetration of direct sunlight on plant canopy has significant effect on canopy microclimate and photosynthetic rate in groundnut (Uchijima, 1976).

Reddy and Willey (1979) and Jeyarama Reddy and Reddy (1981) stated that *intercropping as a whole intercept maximum solar radiation and have higher potential for photosynthesis than single crop stand.*

While Lim and Hamdan (1984); Dhaliwal et al. (1984) Rao and Mittra (1988) indicated that the shading reduces assimilates translocation and imparts low flower number and ineffective pegging. Patel and Mehta (1992) found that the conversion of photosynthetic active radiation was high when legumes were intercropped with redgram.

According to Rao and Mittra (1994), yield increment in groundnut could be attained through widening the row spacings of the associated intercrops.

#### **2. 8. 1. 4. Weed Suppression**

Though the problem of weed competition could be completely scrubbed through intercropping, the severity might be minimised through selection of compatible intercrops. Patterson (1982) pointed out that the weeds competition, especially of nutsedge was

maximum during first 20 DAS due to its early germination and vigorous growth. Later on it tends to decline since the nutsedge was highly sensitive to shading.

In addition to shade and competitive effect on weeds, allelopathic effect of redgram was noticed by Balakrishnan and Rajendran (1987)

Weed menace in redgram could be minimised upto 38 per cent with intercropping of leguminous crops (Ali, 1987). Weed suppression upto 17, 16 and 31 per cent respectively with intercropping of blackgram, greengram and groundnut in redgram was recorded by Tewari et al. (1989).

Mahapatra (1991) obtained minimum weed dry weight of 47.0 g m<sup>-2</sup> when redgram was intercropped in groundnut. Similarly, Kalaiselvan et al. (1991) also documented the maximum weed control efficiency of 31.2 per cent under groundnut + redgram intercropping system.

#### **2. 8. 1. 5. Nutrient Uptake and Post Harvest Soil**

Nitrogen uptake was maximum in mixed stand of groundnut and sunflower than sole crops (Gopalasundaram, 1976). Similar results, when blackgram intercropped with redgram was reported by Asokaraja and Ramiah (1987).

From the intercropping studies, Jaganathan (1987) stated that nitrogen and phosphorus uptake of groundnut was increased, when pulses like redgram and blackgram were intercropped. Similarly Athnathan (1988) showed that NPK uptake of groundnut was maximum under intercropped stand with blackgram and greengram.

In redgram based intercropping system also the NPK uptake was found to be higher when groundnut was intercropped (Shinde et al., 1989).

#### **2. 8. 1. 6. Post harvest Soil Nutrient**

Kothari and Saraf (1987) observed high organic carbon content of soil when greengram was included in intercropping system.

The post harvest NPK content of the soil was found to be enriched when groundnut was intercropped with redgram or blackgram (Jaganathan, 1987). Similar reports with inclusion of blackgram and greengram was stated by Athmanathan (1988).

Shinde et al. (1989) noticed the maximum phosphorus uptake of 32.2 kg ha<sup>-1</sup> when groundnut was intercropped in redgram. In accordance, Rai and Sinha (1993) found that nitrogen and phosphorus status of the soil was improved when groundnut was intercropped in redgram.

#### **2. 9. Intercropping of Legumes in Legumes**

It was confirmed that there is no reduction in yield of long duration leguminous base crop when raised with short duration legumes.

Experiments on pulses improvement project showed promising results when greengram was intercropped in groundnut, compared to other cereals and pulses (AICORPO 1977). Among different intercrops evaluated, greengram was more compatible with groundnut (Athmanathan 1988 and AICORPO, 1991). For groundnut the redgram was found to be the most suitable intercrop (Christopher et al., 1994).

Bhondave *et al.* (1994) and Kathmale *et al.* (1995) documented that soyabean as the most successful intercrop in groundnut.

The advantage of intercropping blackgram, greengram, groundnut and cowpea in redgram were highlighted by several workers (Saxena *et al.*, 1977; Rama Subbha Reddy *et al.*, 1984; Tripathi, 1987 ; Singh and Singh, 1994; Sarkar *et al.*, 1995).

## 2. 10. Effective Row Arrangements

The wide variations in row arrangements recommended for groundnut based intercropping situations is due to the type of crops selected and that too the morphology of dominant crop.

In Tamilnadu at Tindivanam intercropping of blackgram, with groundnut in 3:1 ratio was the most profitable (Rajah *et al.*, 1978). However, adoption of 4:1 row proportion in groundnut + blackgram intercropping was advantageous (AICORPO, 1987). Similarly in groundnut + greengram intercropping situation 4:1 row arrangement was compatible and remunerative (Athmanathan, 1988 ; AICORPO, 1991).

While Kavimani *et al.* (1991) recorded the maximum land equivalent of 1.22 with 6:1 row arrangement in groundnut + redgram intercropping, Kalaiselvan *et al.* (1991a) and Solaiyappan *et al.* (1994) noticed appreciable effect on LER with 4:1 row proportion.

In Karnataka 4:1 ratio of groundnut + redgram was promising (Hegde *et al.*, 1980). The maximum land equivalent ratio of 1.29 was found to be associated with 5:1 row arrangement in groundnut + redgram intercropping system was reported by Hulihalli and Sheelavantar (1987). Similar findings with 4:2 and 6:1 row arrangement were documented by Itnal *et al.* (1992); Shivkumar and Reddy (1993).

In Andhra Pradesh, Verma and Srivastava (1987) found 6:1 row proportion of groundnut + redgram was promising. However, Chandrasekar et al. (1988) and Selvam and Soundararajan (1991) noticed the maximum groundnut pod equivalent under 7:1 row arrangement with redgram.

In Orissa, Mahapatra et al. (1989) obtained the maximum groundnut pod equivalent of 1.55 q ha.<sup>-1</sup> with 2:1 row proportion with redgram.

In redgram based intercropping Ahmed and Srivastava (1991) and Das et al. (1991) observed that 1:2 row arrangement with groundnut was profitable. Shinde et al. (1991) found that 1:3 row proportion was also found to be remunerative.

In contrary to the above finding Moinbasha and Singh (1988) and Reddy et al. (1994) noticed that the population densities under the intercropping situations do not alter base crop yields.

## **2. 11. Effect of Intercrops on Growth and Yield of Component Crops**

In general the type of intercrop selected have significant influence on the base crop either favorably or adversely.

Gopalsundaram (1976) noticed the increase in plant height of groundnut when sunflower was intercropped. Growing greengram in groundnut markedly improved the groundnut yield (AICORPO, 1977 ; Athmanaban, 1988). Intercropping in groundnut with redgram gave 2.1 to 2.9 Q ha<sup>-1</sup> of additional groundnut pod yield (Sawhney et al., 1989).

However, Reddy et al. (1991) observed adverse effect on LAI and DMP in groundnut when redgram was intercropped. In-line with this, Shivakumar and Reddy

(1993) recorded significant reduction in number of pods plant<sup>-1</sup>, pod weight, and 100 kernel weight in groundnut.

In redgram based intercropping situations also, the reduction in growth and yield attributes of the base crop was documented by several workers (Venkateswaralu, 1986; Rafey *et al.*, 1989; Singh *et al.*, 1990; Dubey *et al.*, 1991).

In contrast to the above investigations intercropping in groundnut or redgram do not significantly influence the growth, yield attributes and yield of the base crop (Selvam and Soundararajan, 1991; Kavimani *et al.*, 1991; Shinde *et al.*, 1991). They also added that under inter cropped stand the base crop yield declined with the corresponding reduction in population. However, the yield attributes were almost similar in their expression indicating only the role of population at harvest.

## **2. 12. Economics**

### **2. 12. 1. Weed Management**

#### **2. 12. 1. 1. fluchloralin**

In groundnut integrating fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> with one intercultivation on 25 DAS fetches the maximum net profit of Rs 8881 ha<sup>-1</sup> compared to other weed management practices (Prusty *et al.*, 1990). Murthy *et al.* (1994) also obtained a maximum net income of Rs. 24,229 ha<sup>-1</sup> through fluchloralin 1.0 kg a.i. ha<sup>-1</sup> along with intercultivation on 15, 30 and 45 DAS.

In groundnut + blackgram, Kalaiselvan *et al.* (1994) obtained maximum return per rupee invested was 1.72 using fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one hand weeding on 20 DAS.

### **2. 12. 1. 2. Oxyfluorfen**

Prasad et al. (1987) noticed a maximum net return of Rs. 2481 ha<sup>-1</sup> with 0.15 kg a.i. ha<sup>-1</sup> of oxyfluorfen in groundnut. Rafey and Prasad (1995) got a maximum of Rs. 3764 ha<sup>-1</sup> with 0.10 kg a.i. ha<sup>-1</sup> of oxyfluorfen.

### **2. 12. 1. 3. Pendimethalin**

Girijesh and Patel (1991) recorded the maximum net return of Rs. 20,268 ha<sup>-1</sup> with 0.75 kg a.i. ha<sup>-1</sup> of pendimethalin in groundnut + sunflower intercropping situation. Similarly a maximum net income of Rs. 9254 ha<sup>-1</sup> was obtained with application of pendimethalin @ 1.0 kg a. i. ha<sup>-1</sup> with hand weeding on 30 DAS compared to other weed management practices under groundnut + redgram intercropping systems (Yellamanda Reddy and Padmalatha, 1994).

### **2. 12. 1. 4. Metolachlor**

Pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one hand weeding on 30 DAS gave maximum net income of Rs. 11,748 ha<sup>-1</sup> and 1.5 of benefit cost ratio, compared to other weed management practices (AICORPO, 1993). Ramakrishna et al. (1991) and Mishra and Singh (1995) too corroborated the above findings.

## **2. 12. 2. Intercropping Situation**

### **2. 12. 2. 1. Groundnut**

Experiments in pulses improvement, projected that pure groundnut gave net return of Rs. 1204 ha<sup>-1</sup> where as when intercropped with greengram it was Rs 1461 ha<sup>-1</sup> (AICORPO,1977)

Athmanathan (1988) obtained a maximum net return of Rs.12,888 ha<sup>-1</sup> when greengram was intercropped with groundnut in 4:1 row arrangements. Similarly, maximum net return of Rs. 16,135 ha<sup>-1</sup> with 2.15 of benefit cost ratio was recorded under groundnut + greengram intercropping situation (AICORPO, 1991).

The data on net income, clearly brought out the economic advantages of intercropping of redgram in groundnut (Kavimani et al., 1991). Selvam and Soundarajan (1991); Solaiyappan et al. (1994) and Christopher et al. (1994) too confirm the above findings.

#### **2. 12. 2. 2. Redgram**

Among different intercropping situations in redgram, higher net return of Rs 4350 ha<sup>-1</sup> obtained when groundnut was intercropped (Misra and Majumdar 1989). Similar results were reported by Ahmed and Srivastava (1991).

In contrary, several authors documented the non-economic impact of intercropping situations compared to sole groundnut and redgram (Rama Subba Reddy et al., 1984; Das et al., 1991; Shivkumar and Reddy, 1993).

The perusal of the literatures cited revealed the following facts which needs adequate attention.

Though the advantage of raising intercrops in 4 : 1 ratio along with groundnut was ascertained, the most accomodative one under groundnut ecosystem with high economic advantage have to be test verified.

The weed menace in groundnut impose severe losses. Among the weed species the problem of nutsedge in groundnut cultivated areas, especially at Vridhachalam tract was acute.

*Through the existing practice of hand weeding on 25 and 45 DAS or application of pre-emergence herbicides like fluchloraline followed by one hand weeding on 30 DAS, the possibility of simultaneous control of perennials and annual weeds were very limited. Moreover, the continuous application of similar type herbicide for a particular location in longrun may cause resistance in weed species and paved the way for weed shift.*

Considering the above facts in view, the present investigation was carried out to evolve an effective integrated weed management system for groundnut based intercropping.

## MATERIALS AND METHOD

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## **CHAPTER III**

### **MATERIALS AND METHODS**

Field investigations were carried out during Rabi seasons of 1992, 1994 and 1995 and kharif 1994 at Regional Research Station, Vridhachalam to assess the effect of integrated weed management practices in groundnut (cv. VRI 2) based intercropping system with greengram (VBN 1) and redgram (CO 5) under irrigated conditions. The experimental materials and methods used during the investigations are presented in this chapter.

#### **3.1 Materials**

##### **3.1.1. Field Location**

Field experiments were conducted at Regional Research station, Vridhachalam, which is located at 11° 3" north latitude and at 79° 26" east longitude. The elevation of the Research Station is 42.67 m above MSL.

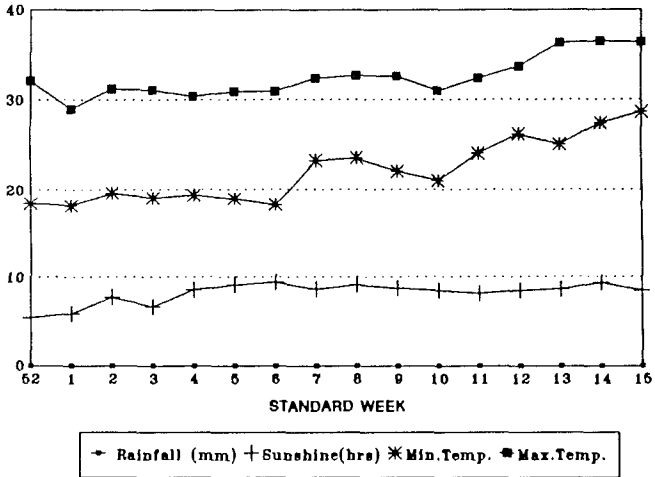
##### **3.1.2. Weather and Climate**

The mean annual rainfall of this centre is 953 mm. The mean maximum temperature ranges from 27° to 42° C and the minimum temperature varies from 19° to 24° C. The weather condition that prevailed during the cropping periods of the present study are furnished in Appendix I and Fig. 1 & 1a.

Among the Rabi seasons, only during Rabi '94 crop received 25.7 mm of rainfall in 5 rainy days. However, the kharif '94 crop received comparatively a higher rainfall of 346.4 mm in 38 rainy days. The mean maximum temperature of 39.1° C was prevailed

Fig 1. WEATHER PARAMETERS DURING THE CROPPING PERIOD

RABI - 1992



RABI - 1994

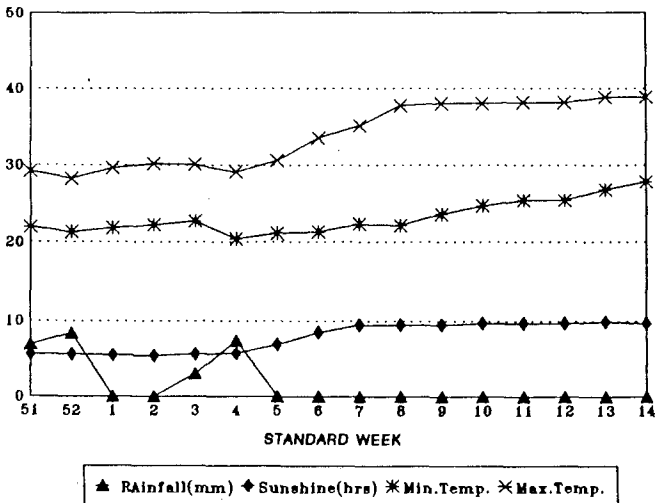
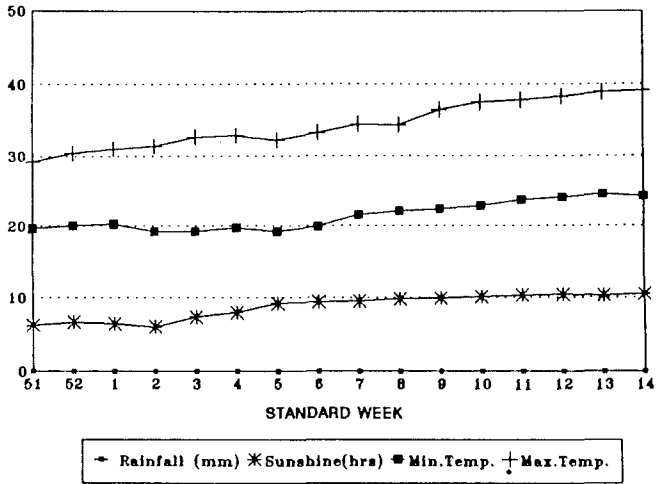
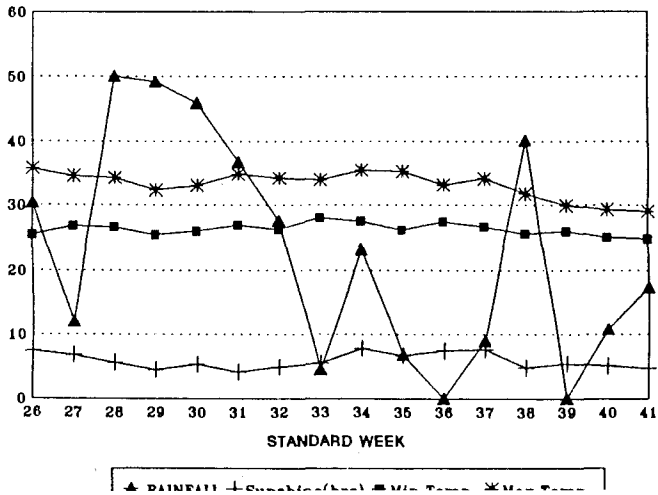


Fig 1a. WEATHER PARAMETERS DURING THE CROPPING PERIOD

RABI- 1995



KHARIF- 1994



at harvest stage during Rabi '95. A less flexuation in maximum and minimum temperature coupled with an consistant sunshine hours from pod filling till harvest stage was observed with Rabi '94 and '95 crops.

### 3.1.3. Soil

The field experiments were conducted at "C" Block of new farm area at the Regional Research Station, Vridhachalam. The texture of soil in the experimental site was sandyloam and the fertility status of the soil was low in avilaible nitrogen and potassium and high in phosphorus. The soil characteristics of the experimental field are presented in table 1.

Table 1. Soil Characteristics of the Experimental Site.

<u>Particulars</u>	<u>Seasons</u>			
	R'92	R'94	R'95	K'94
<b>A. Mechanical Analysis:</b> (International pipette method, Piper,1966)				
Clay (%)	14.03	13.83	13.04	13.92
Silt (%)	3.83	3.96	4.27	3.80
Fine sand (%)	33.89	33.46	32.75	34.21
Coarse Sand (%)	48.25	48.75	49.94	48.06
<b>B. Chemical Analysis:</b>				
Available Nitrogen (Kg ha <sup>-1</sup> ) (Subbiah and Asija, 1956)	148.30	154.60	158.30	151.40
Available Phosporus (Kg ha <sup>-1</sup> ) (Olsen et al.,1954)	34.20	34.80	35.10	34.30
Available Potassium (Kg ha <sup>-1</sup> ) (Stanford and English, 1948)	71.40	75.20	79.60	75.60
PH (1:2 Soil water extract)	6.20	6.50	6.80	6.40
Ec (m.mhos cm <sup>2</sup> )	0.09	0.11	0.10	0.10

### 3.1.4. Crops and Variety

For the base crop of groundnut the variety VRI 2 was used as test crop in all the seasons. Similarly, the variety VBN 1 in greengram and CO 5 in Redgram were selected as intercrops. The salient features of the above crop varieties are furnished as below:

Crop	Variety	Parentage	Duration	Salient features
a) Groundnut	VRI 2	JL 24 X CO 2	105days	Bunch type, Suitable for rainfed and irrigated situations. High yielding. Average yield Irrigated 2000 Kg ha <sup>-1</sup> Rainfed 1800 Kg ha <sup>-1</sup>
b) Greengram	VBN 1	S 8 X P1MS 3	65days	Suitable for rainfed and irrigated situations. Early maturing, High yielding. Irrigated -1020Kg ha <sup>-1</sup> Rainfed 770Kg ha <sup>-1</sup>
c) Redgram	CO 5	Mutant from CO 1	110days	Short duration, compact plant type, photoinsensitive, High grain yield. Irrigated-1440 Kgha <sup>-1</sup> Rainfed-760 Kg ha <sup>-1</sup>

## 3.2. Methods

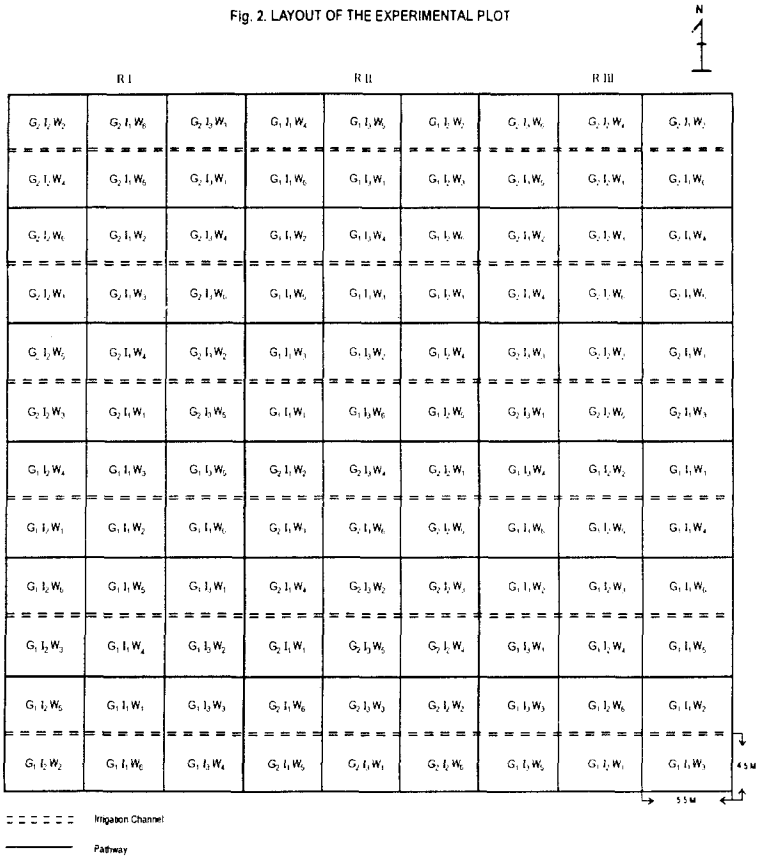
### 3.2.1. Experimental Design and Field Layout

The experiments were laidout in split plot design with three replications. A uniform layout was adopted for all the seasons as given in figure 2. The treatments were allotted at random. The gross plot size of the individual sub plot was 24.75 m<sup>2</sup> (5.5.x4.5m) and the net plot size was 20m<sup>2</sup> (5x4m) The treatments structure are as follows.

TREATMENTS	NOTATIONS USED
<b>I. Main plot</b>	
<b>a) Nutsedge control</b>	
i. Pre-sowing application of glyphosate**	G <sub>1</sub>
ii. No application of glyphosate	G <sub>2</sub>
<b>b) Intercropping system</b>	
i. groundnut (base crop)	I <sub>1</sub>
ii. groundnut + greengram (4:1 ratio)	I <sub>2</sub>
iii. groundnut + redgram (4:1 ratio)	I <sub>3</sub>
<b>II. Sub plot</b>	
i. pre-emergence application of fluchloralin @ 1.0 Kg a.i. ha <sup>-1</sup> + one hand weeding on 30 days after sowing (DAS)	W <sub>1</sub>
ii. pre-emergence application of pendimethalin @ 1.0 kg a.i. ha <sup>-1</sup> + one hand weeding on 30 DAS	W <sub>2</sub>
iii. pre-emergence application of metolachlor @ 1.0 kg a.i. ha <sup>-1</sup> + one hand weeding on 30 DAS	W <sub>3</sub>
iv. pre-emergence application of oxyflourfen @ 0.1 kg a.i. ha <sup>-1</sup> + one hand weeding on 30 DAS	W <sub>4</sub>
v. recommended practice of two hand weeding on 25 and 45 DAS	W <sub>5</sub>
vi. control (no weeding)	W <sub>6</sub>

\*\* One and half months prior to the sowing of groundnut and intercrops the experimental field was given one disc ploughing followed by one harrowing. Then the field was uniformly divided into six plots as shown in fig. 2. Then the plots were saturated with irrigation water and allowed for weeds to grow. As and when the nutgrass in the field attained the active growing (4-6 leaf) stage i.e., after 25 to 30 days, the respective plots for spraying glyphosate were randomly ear marked. Glyphosate at 1.0 per cent with 1.0 per cent of ammonium sulphate and teepol @ 0.1 per cent were uniformly mixed and

Fig. 2. LAYOUT OF THE EXPERIMENTAL PLOT



sprayed through hand operated knapsac sprayer fitted with ultra low volume spray nozzle (ULV) as recommended by Manickam and Gnanamurthy (1994). Then uniform ploughing of the respective plots of the experimental field was carried out 15 days after pre-sowing application of glyphosate and prepared for the sowing of groundnut with intercrops.

### **3.2.2. Manures and Fertilizers**

Farm yard manure @ 12.5 t ha<sup>-1</sup> and gypsum @ 200 Kg ha<sup>-1</sup> were applied basally, before last ploughing and incorporated uniformly to all the plots. The recommended dose of 17:34:54 Kgs of NPK ha<sup>-1</sup> were applied through urea, superphosphate and muriate of potash in lines and incorporated at the time of sowing of groundnut and the intercrops.

### **3.2.3. Sowing**

The seeds of groundnut (VRI 2) greengram (VBN 1) and redgram (CO 5) were treated with carbendazim at @ 2 g Kg<sup>-1</sup> of seed against seedborne diseases. The seeds were again treated with TNAU 14 rhizobial culture 24 hrs after seed treatment and shade dried for fifteen minutes before sowing. The groundnut seeds were sown in lines 30 cm apart and 10cm between plants. The seeds of intercrops viz., greengram and redgram were sown in 4:1 ratio with groundnut. An inter row spacing of 10 cm for greengram and 15 cm for redgram were followed. To workout the Land Equivalent Ratio (LER) the pure crop of intercrops were raised in the same experimental plot with recommended spacings.

### **3.2.4. Gap Filling and Thinning**

Gap filling was done on 7th day after sowing and thinning on 15th day after sowing for both the main and intercrops.

### **3.2.5. Irrigation and After Care**

The experimental field was irrigated immediately after sowing. Life irrigation was given on fourth day after sowing. Subsequent irrigations were given as and when required. Adequate prophylactic plant protection measures were taken up against pest and disease.

### **3.2.6. Weed Control**

Pre-emergence herbicides were applied to the respective plots as per the treatments immediately after the sowing irrigation. The herbicides were applied through hand operated knapsac sprayer fitted with ultra low volume spray nozzle (ULV). One hand weeding on 30th day for herbicidal applied plots, and two weedings on 25th and 45th days were given as recommended practice of hand weeding.

### **3.2.7. Harvesting and Drying**

Harvesting of groundnut and the intercrops redgram and greengram were done through removal of whole plants followed by stripping of pods. The wet weight of pods and haulms were recorded for each treatment. The plotwise pods and haulms were sundried for five days to reduce the moisture content to 10 per cent and the dry weight was recorded.

## **3.3. Bio-metric Observations**

In the net plot area for each treatment, five plants in sole and intercrops were selected at random, tagged and used for recording biometric observations. The biometric observations were recorded on 30 and 60 days after sowing and at harvest.

### **3.3.1. Growth Parameters (Groundnut)**

#### **3.3.1.1. Plant Height (cm)**

The height of the plant was measured in cm from the cotyledonary node to tip of the unfolded leaf for each treatment from the randomly selected five plants and mean arrived.

#### **3.3.1.2. Leaf Area Index ( LAI )**

The leaf area index was computed as suggested by Padalia and Patel (1980) by using the following formula

$$\text{Leaf area Index} : \frac{\text{Length (cm)} \times \text{Breadth (cm)} \times 0.70 \times \text{No.of leaves}}{\text{Spacing adopted}}$$

#### **3.3.1.3. Dry Matter Production (g plant<sup>-1</sup>)**

Five plants from the row next to the guard row, were selected at random for each treatment and the plants were removed excluding roots. The samples were sundried first and then oven dried to get a constant weight. The dry weight of the sample was weighed in an electronic digital display balance and expressed in g plant<sup>-1</sup>.

### **3.3.2. Growth components (intercrops)**

#### **3.3.2.1. Plant Height**

The plant height of intercrops were measured at harvest and expressed in cm.

### **3.3.2.2. Leaf Area Index**

The leaf area was worked out using the formula suggested by Puttasamy et al. (1976) for greengram and by Hughes et al. (1979) for redgram.

$$\text{Leaf area (greengram)} \quad A = 1.84 \pm 0.027 (L \times W) 0.890$$

$$\text{Leaf area (redgram)} \quad A = 1.705 (L \times W) \pm 0.0316 \times 0.979$$

where L and W denotes length and width of terminal leaflet.

Then the leaf area index was worked out through computing number of leaves and the respective spacings adopted.

### **3.3.2.3. Drymatter Production (g plant<sup>-1</sup>)**

Five plants were randomly selected for each treatment and the plants were removed excluding roots. The samples were sundried first and then oven dried to get a constant weight. The dry weight of the sample was expressed in g plant<sup>-1</sup>.

### **3.3.3. Yield Components and Yield**

#### **3.3.3.1. Number of Matured Pods Plant<sup>-1</sup>**

The number of matured pods per plant was counted from the five plants selected at random for each treatment at harvest and the mean arrived.

#### **3.3.3.2. Number of Immature Pods Plant<sup>-1</sup>**

The number of immature pods per plant was counted from the above five plants for each treatment at harvest and the mean arrived.

#### **3.3.3.3. One hundred Kernels Weight (g)**

One hundred kernels were randomly selected from each treatment and the weight recorded in gram.

#### **3.3.3.4. Shelling Percentage**

One hundred pods were randomly selected from each treatment, dried weighed, shelled and the weight of the kernels and shells was recorded. From this the shelling percentage was calculated.

#### **3.3.3.5. Sound Matured Kernels (SMK) percentage**

From the above shelled kernels sound matured kernels were selected and the percentage was worked out and given as SMK percentage.

#### **3.3.3.6. Total Number of Nodules ( No. Plant<sup>-1</sup> )**

Number of nodules plant<sup>-1</sup> was counted in the tagged plants at harvest. The plants were removed with roots intact carefully and the total number of nodules per plant were counted and the mean worked out.

#### **3.3.3.7. Pod Yield ( Kg ha<sup>-1</sup> )**

After recording wet weight at harvest the pods were sundried to 10 per cent moisture level and then the individual plot yield recorded and expressed in kg ha<sup>-1</sup>.

#### **3.3.3.8. Oil Content (percentage)**

The oil content for the kernels of the sample plants were estimated by NMR instrument and expressed in percentage.

### 3.3.3.9. Haulm Yield ( t ha<sup>-1</sup> )

After stripping the pods, the haulms were sundried to obtain constant weight and dry weight of haulms recorded and expressed in t ha<sup>-1</sup>.

### 3.3.3.10. Land Equivalent Ratio (LER)

The land equivalent ratio was computed by the following formula

$$\text{LER} = \frac{Y_{ab}}{Y_{aa}} + \frac{Y_{ba}}{Y_{bb}}$$

Where

LER = Land equivalent ratio

Y<sub>ab</sub> = Yield of base crop in mixed stand

Y<sub>aa</sub> = Yield of base crop in pure stand

Y<sub>ba</sub> = Yield of intercrop in mixed stand

Y<sub>bb</sub> = Yield of intercrop in pure stand

### 3.3.4. Yield components and yield of intercrops

#### 3.3.4.1. No. of pods plant<sup>-1</sup>

Pods were collected from ten plants at harvest and the average number of pods plant<sup>-1</sup> was calculated for each plot.

#### 3.3.4.2. Test weight (g)

Hundred seeds were randomly selected, weighed and recorded in gram.

#### **3.3.4.3. Grain Yield (t ha<sup>-1</sup>)**

Seed yield of greengram and redgram from the net plot was recorded in kilogram and converted for hectare.

#### **3.3.5. Weed Characters**

The weed characters were studied at 30th, 60th and on 105 DAS (at harvest) after imposing respective treatments.

##### **3.3.5.1. Weed Flora**

The predominant weed species prevailed in the experimental fields were studied, from the control plot, classified and presented.

##### **3.3.5.2. Weed Population (No.m<sup>2</sup>)**

Weeds were recorded as broad leaved weeds, grasses and sedges using 0.25 m<sup>2</sup> quadrat area, randomly selected within the net plot on 30th,60th and on 105 DAS (at harvest) and expressed in number m<sup>-2</sup>.

##### **3.3.5.3. Weed Dry Matter Production ( g m<sup>2</sup> )**

The quadrat was placed in four places at random, outside the net plot and the weeds enclosed were cut close to the ground level, and dried until attaining an constant weight. The drymatter production of weeds was expressed in g m<sup>-2</sup> .

#### 3.3.5.4. Weed Control Efficiency (WCE)

The formula as suggested by Mani et al. (1973) was adopted to calculate weed control efficiency

$$\text{WCE (\%)} = \frac{\text{WPC} - \text{WPT}}{\text{WPC}} \times 100$$

Where

WCE = Weed control efficiency

WPC = Weed population in control plot

WPT = Weed population in treated plot

#### 3.3.5.5. Weed Control Index (WCI)

The formula as given by Misra and Josh (1979) was followed to calculate the weed control index.

$$\text{WCI (\%)} = \frac{\text{Dry wt. of weed in control plot} - \text{Dry wt. of weed in treated plot}}{\text{Dry wt. of weeds in control plot}} \times 100$$

### 3.4. Chemical Analysis

#### 3.4.1. Soil

During each season pre-sowing and post-harvest composite soil sample from 0 to 15 cm depth was taken from each plot of the experimental field and analysed for available nitrogen (Subbiah and Asija, 1956), phosphorus (Olsen et al., 1954) and potassium

(Stanford and English,1948) and were expressed in Kg ha<sup>-1</sup>. Soil PH and EC were estimated by using glass electrode in Elico PH meter and Elico Conductivity Bridge respectively.

#### 3.4.2. Uptake of Nutrients by Crops and Weeds

Chemical analysis of plant and weed samples were done for total nitrogen, phosphorus and potassium content after oven drying and grinding by willey mill. Uptake of nutrients was computed from the DMP of crop recorded at different stages and expressed in Kg ha<sup>-1</sup>.

S.No.	Nutrients	Methods	Suggested by
1.	Total Nitrogen	Micro kjeldahl	Humphries (1956)
2.	Total Phosphorus	Triple acid digestion	Jackson (1973)
3.	Total Potassium	Triple acid digestion using flame photometer	Jackson (1973)

#### 3.5. Statistical Analysis

The data collected on various characters were statistically analysed following the procedure suggested by Panse and Sukhatme (1978). The critical difference was worked out at 5 per cent probability wherever the results were significant. Analysis of variance for the data on weed count was carried out after subjecting the data to log transformation [Log (x + 2)]as suggested by Bartlett, 1947; Murugesan et al. 1974. Similarly the analysis of variance for the data on weed control index, weed control efficiency were carried out after transforming the data to arc sine values.

### **3.6. Economics**

The gross and net income per hectare for each treatment based on the prevailing market rates were worked out. The net income was calculated by deducting the cost of cultivation from the gross return. Gross income per rupee invested was worked out by dividing the gross return by the expenditure.

## RESULT

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## CHAPTER IV

### EXPERIMENTAL RESULTS

The results of the experiments conducted during Rabi seasons of 1992, 1994, 1995 and Kharif 1994 to work out an effective and economic integrated weed management practice for groundnut based intercropping system are presented in this chapter.

#### 4.1. Studies on weeds

##### 4.1.1. Weed flora of the experimental site

The weed flora of the experimental site consisted of 17 weed species; sedge(1), grasses (5) and the broad leaved weeds (11) (Table 2)

Among the weed flora, the relative dominance of the nutsedge, **Cyperus rotundus** was noticed irrespective of the cropping seasons over the years. In respect to the grasses, the population of **Cynodon dactylon** (L), **Panicum repens** Linn., and **Dactyloctenium aegyptium** Beauv. were higher. Other important weeds recorded were **Boerhaavia diffusa** L., **Gynondropsis pentaphylla** and **Cleome viscosa** L., in broad leaved weeds. Thus, the sedge was predominant followed by grasses and broad leaved weeds at different cropping years.

##### 4.1.2. Population of sedge (m<sup>2</sup>) (Tables 3, 3a, and 3b)

The lowest sedge population was recorded under pre-sowing application of glyphosate, 15 days prior to land preparation (G<sub>1</sub>) compared to no spraying of glyphosate (G<sub>2</sub>). The trend was identical in all crop stages and seasons. The effect of glyphosate on reduction of sedge population was well established during rabi season

Table 2. Weed flora of the Experimental field

	Botanical Name	Common Name	Habit
<b>I. Sedges</b>			
*1.	<i>Cyperus rotundus</i> L.	Korai (T) Nutsedge	Perennial
<b>II Grasses</b>			
*1.	<i>Cynodon dactylon</i> (L.) Pers.	Arugam pullu (T)	Perennial.
*2.	<i>Panicum repens</i> Linn.	Ingi pullu (T)	Annual
*3.	<i>Dactyloctenium aegyptium</i> Beauv.	Crow foot grass	Annual
4.	<i>Elusine indica</i> Gaertn.	Goose grass	Annual
5.	<i>Chloris barbata</i> L.	Mayl kondai pullu (T)	Perennial
<b>III. Broad leaved Weeds</b>			
*1.	<i>Boerhaavia diffusa</i> L.	Mukkarattai keerai (T)	Annual
*2.	<i>Gynandropsis pentaphylla</i> Dc.	Manjal kadugu (T)	Annual
*3.	<i>Cleome viscosa</i> L.	Naikadugu (T)	Annual
4.	<i>Amerathus viridis</i> Linn.	Kuppai keerai (T)	Annual
5.	<i>Euphorbia hirta</i> L.	Amman pacharisi (T)	Annual
6.	<i>Phyllanthus niruri</i> L.	Keela nelli (T)	Annual
7.	<i>Phyllanthus madaraspatensis</i> L.	Mela rielli (T)	Annual
8.	<i>Eclipta alba</i> Hassk.	Karisalanganni (T)	Annual
9.	<i>Tridax procumbense</i> L.	Manja poove (T)	Annual
10.	<i>Lucas aspera</i> (wild) Link.	Thumbai (T)	Annual
11.	<i>Croton sparciflorus</i> L.	Rail poondu (T)	Annual
(T) - Tamil Name		* - Prominent weed	

than kharif through registering the least mean population of 15.40, 16.24 and 15.01 m<sup>-2</sup> accordingly on 30th, 60th DAS and 105 days after sowing (DAS) i.e at harvest.

Regardless of stages of crop growth and seasons, intercropping of greengram in groundnut (I<sub>2</sub>) considerably reduced the sedge population compared to groundnut + redgram (I<sub>2</sub>) and sole groundnut (I<sub>1</sub>). However, the reduction was significant only from 60 DAS onwards. Among seasons, the maximum reduction of sedge was during rabi with the mean of 58.46 and 46.45 m<sup>-2</sup> respectively on 60 and 105 DAS. The sedge population under groundnut + redgram intercropping system (I<sub>2</sub>) was comparatively higher than sole groundnut (I<sub>1</sub>) upto 30 DAS. Then it tends to decrease over sole groundnut in accordance with the age of the crop, at both the seasons.

Among the different integrated weed management measures, the recommended practice of hand weeding on 25 and 45 DAS (W<sub>2</sub>) significantly recorded the minimum sedge population on 30 DAS, and the same trend was observed at different cropping years. It was followed by pre-emergence application of metolachlor @ 1.0 kg a.i.ha<sup>-1</sup> + one Hand Weeding (H.W.) on 30 DAS (W<sub>3</sub>) and fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS(W<sub>4</sub>).However, the supremacy of pre-emergence metolachlor @1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) application in containing sedge population was highly pronounced beyond 30 DAS and the distinct difference was observed at both seasons. The sedge population was comparatively lower during rabi seasons with the mean number of 52.82 and 43.52 m<sup>-2</sup> respectively on 60 and 105 DAS.

TABLE - 3. NUMBER OF SEDGES ON 30 DAS (m<sup>2</sup>)

TREATMENT	RABI SEASON						KHARIF SEASON							
	1992		1994		1995		1994		1994		1994			
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN		
<b>G X I</b>														
I1	16.19 (1.260)	67.98 (1.815)	33.68 (1.553)	16.62 (1.270)	78.53 (1.906)	36.72 (1.588)	14.67 (1.222)	70.94 (1.863)	32.87 (1.543)	15.82 (1.250)	72.48 (1.871)	20.59 (1.354)	87.74 (1.953)	54.16 (1.653)
I2	13.13 (1.180)	70.61 (1.861)	31.15 (1.521)	14.67 (1.222)	79.84 (1.913)	34.94 (1.568)	12.06 (1.148)	73.33 (1.877)	30.54 (1.513)	13.28 (1.183)	74.59 (1.883)	17.86 (1.298)	82.91 (1.929)	50.38 (1.613)
I3	17.23 (1.284)	78.91 (1.908)	37.44 (1.596)	19.33 (1.329)	86.30 (1.946)	41.40 (1.638)	14.78 (1.225)	77.79 (1.902)	34.60 (1.564)	17.11 (1.279)	81.00 (1.918)	22.77 (1.394)	93.94 (1.982)	58.35 (1.688)
<b>G X W</b>														
W1	13.20 (1.182)	98.00 (2.200)	36.90 (1.591)	14.63 (1.221)	100.32 (2.010)	39.20 (1.615)	10.94 (1.112)	90.03 (1.963)	32.43 (1.537)	12.92 (1.171)	96.11 (1.991)	18.89 (1.320)	109.17 (2.046)	46.19 (1.683)
W2	14.98 (1.230)	101.03 (2.013)	39.83 (1.622)	15.94 (1.254)	104.90 (2.029)	41.80 (1.642)	13.38 (1.187)	96.40 (1.993)	36.90 (1.590)	14.76 (1.223)	100.77 (2.011)	20.33 (1.349)	113.87 (2.064)	48.87 (1.707)
W3	10.70 (1.104)	82.14 (1.925)	30.65 (1.514)	12.48 (1.161)	94.82 (1.986)	35.41 (1.573)	8.64 (1.027)	89.20 (1.960)	29.15 (1.493)	10.60 (1.097)	88.72 (1.957)	16.40 (1.265)	100.56 (2.011)	41.45 (1.638)
W4	17.63 (1.293)	103.68 (2.024)	43.55 (1.659)	19.42 (1.331)	109.94 (2.049)	46.97 (1.690)	16.66 (1.271)	102.95 (2.021)	42.25 (1.646)	17.90 (1.298)	105.52 (2.031)	23.82 (1.412)	116.30 (2.073)	53.27 (1.743)
W5	8.94 (1.039)	12.68 (1.167)	10.67 (1.103)	8.32 (1.014)	19.38 (1.330)	12.85 (1.172)	8.99 (1.041)	18.74 (1.317)	13.10 (1.179)	8.75 (1.031)	16.93 (1.271)	8.06 (1.151)	22.54 (1.390)	13.72 (1.197)
W6	37.90 (1.601)	123.31 (2.098)	68.71 (1.850)	44.02 (1.663)	131.96 (2.127)	76.52 (1.895)	33.15 (1.546)	117.95 (2.079)	62.93 (1.813)	38.35 (1.603)	124.40 (2.101)	52.70 (1.738)	137.95 (2.146)	85.49 (1.942)
MEAN	15.43 (1.241)	72.35 (1.871)		16.77 (1.273)	81.49 (1.921)		13.78 (1.198)	73.97 (1.880)		15.40 (1.237)	76.02 (1.890)	20.31 (1.348)	88.08 (1.954)	
G	SED	CD		SED	CD		SED	CD		SED	CD	SED	CD	
G	0.022	0.049		0.015	0.034		0.021	0.046		0.013	0.030	0.018	0.030	
I	0.031	NS		0.023	NS		0.025	NS		0.025	NS	0.024	NS	
W	0.040	0.080		0.026	0.054		0.037	0.076		0.037	0.076	0.029	0.058	
G x I	0.037	NS		0.026	NS		0.036	NS		0.036	NS	0.024	NS	
W at G	0.057	0.113		0.037	0.075		0.053	0.107		0.053	0.107	0.041	0.082	
G at W	0.056	0.112		0.038	0.077		0.053	0.107		0.053	0.107	0.039	0.080	

DAS=Days After Sowing Figures in parenthesis denotes log (x + 2) transformed values. Rm - Rabi mean All Other interactions are not significant

TABLE - 3a. NUMBER OF SEDGES ON 60 DAS (m<sup>2</sup>)

TREATMENT	1992				1994				RABI SEASON				1995				K HARIF SEASON						
	G1		G2		G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN		
	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	
<b>G X I</b>																							
I1	17.27 (1.285)	114.14 (2.065)	65.70 (1.675)	20.49 (1.352)	116.03 (2.072)	68.23 (1.712)	15.98 (1.255)	105.15 (2.030)	60.56 (1.643)	17.91 (1.297)	111.76 (2.055)	64.83 (1.535)	17.23 (1.284)	113.61 (2.063)	65.42 (1.674)	25.04 (1.432)	127.71 (2.113)	76.37 (1.773)					
I2	13.74 (1.197)	104.90 (2.029)	59.32 (1.613)	15.78 (1.250)	105.89 (2.032)	60.83 (1.641)	11.77 (1.139)	98.69 (2.003)	55.23 (1.571)	13.76 (1.195)	103.16 (2.021)	58.46 (1.608)	20.75 (1.375)	117.12 (2.076)	68.93 (1.717)	20.75 (1.375)	117.12 (2.076)	68.93 (1.717)					
I3	16.49 (1.267)	112.28 (2.058)	64.38 (1.663)	19.03 (1.323)	106.64 (2.037)	62.83 (1.680)	15.66 (1.247)	98.00 (2.000)	56.83 (1.624)	17.06 (1.279)	105.64 (2.031)	61.35 (1.655)	23.82 (1.412)	120.74 (2.089)	72.82 (1.759)	23.82 (1.412)	120.74 (2.089)	72.82 (1.759)					
<b>G X W</b>																							
W1	11.55 (1.132)	107.23 (2.018)	56.89 (1.575)	12.72 (1.168)	94.82 (1.986)	53.77 (1.577)	10.47 (1.096)	91.32 (1.970)	50.89 (1.533)	11.58 (1.132)	96.12 (1.991)	53.85 (1.561)	17.23 (1.284)	113.61 (2.063)	65.42 (1.674)	17.23 (1.284)	113.61 (2.063)	65.42 (1.674)					
W2	12.82 (1.171)	105.64 (2.032)	59.23 (1.602)	14.33 (1.213)	106.39 (2.035)	60.36 (1.624)	11.09 (1.117)	94.82 (1.986)	52.95 (1.552)	12.74 (1.167)	102.28 (2.017)	57.51 (1.592)	19.33 (1.329)	117.67 (2.078)	68.50 (1.704)	19.33 (1.329)	117.67 (2.078)	68.50 (1.704)					
W3	8.64 (1.027)	100.80 (2.012)	54.72 (1.520)	10.47 (1.096)	98.69 (2.003)	54.58 (1.550)	7.03 (0.956)	91.32 (1.965)	49.17 (1.456)	8.71 (1.026)	96.93 (1.993)	52.82 (1.509)	14.63 (1.221)	112.55 (2.059)	63.59 (1.640)	14.63 (1.221)	112.55 (2.059)	63.59 (1.640)					
W4	15.06 (1.232)	107.39 (2.039)	61.22 (1.636)	18.13 (1.304)	110.98 (2.053)	64.55 (1.679)	14.78 (1.225)	101.99 (2.017)	58.38 (1.621)	15.99 (1.253)	106.78 (2.036)	61.38 (1.644)	22.94 (1.397)	120.46 (2.088)	71.70 (1.743)	22.94 (1.397)	120.46 (2.088)	71.70 (1.743)					
W5	16.88 (1.276)	117.95 (2.079)	67.41 (1.678)	19.97 (1.342)	113.34 (2.062)	66.65 (1.702)	16.28 (1.262)	105.39 (2.031)	60.83 (1.647)	17.71 (1.293)	112.22 (2.057)	61.96 (1.675)	24.18 (1.418)	122.16 (2.094)	73.17 (1.756)	24.18 (1.418)	122.16 (2.094)	73.17 (1.756)					
W6	43.81 (1.661)	131.04 (2.124)	87.42 (1.893)	51.21 (1.726)	137.31 (2.144)	94.26 (1.935)	40.56 (1.629)	125.64 (2.106)	83.10 (1.868)	45.19 (1.672)	131.33 (2.124)	88.26 (1.898)	54.62 (1.753)	147.27 (2.174)	100.94 (1.964)	54.62 (1.753)	147.27 (2.174)	100.94 (1.964)					
MEAN	15.76 (1.249)	110.37 (2.050)	61.22 (1.636)	18.13 (1.308)	110.98 (2.047)	64.55 (1.679)	14.78 (1.213)	101.99 (2.011)	58.38 (1.621)	15.99 (1.257)	106.78 (2.035)	61.38 (1.644)	22.94 (1.400)	120.46 (2.092)	71.70 (1.743)	22.94 (1.400)	120.46 (2.092)	71.70 (1.743)					
G	0.008 (0.009)	0.016 (0.020)	0.020 (0.015)	0.012 (0.034)	0.028 (0.049)	0.028 (0.048)	0.009 (0.021)	0.125 (0.042)	0.009 (0.037)	0.012 (0.016)	0.025 (0.060)	0.009 (0.030)	0.010 (0.023)	0.020 (0.035)	0.020 (0.046)	0.010 (0.023)	0.020 (0.035)	0.020 (0.046)					
I	0.009 (0.021)	0.020 (0.043)	0.034 (0.029)	0.015 (0.048)	0.034 (0.049)	0.034 (0.048)	0.015 (0.021)	0.125 (0.042)	0.009 (0.037)	0.012 (0.016)	0.025 (0.060)	0.009 (0.030)	0.010 (0.023)	0.020 (0.035)	0.020 (0.046)	0.010 (0.023)	0.020 (0.035)	0.020 (0.046)					
W	0.021 (0.013)	0.043 (0.029)	0.043 (0.029)	0.024 (0.048)	0.049 (0.048)	0.049 (0.048)	0.024 (0.021)	0.042 (0.042)	0.024 (0.037)	0.049 (0.016)	0.049 (0.060)	0.049 (0.030)	0.017 (0.023)	0.033 (0.046)	0.033 (0.046)	0.017 (0.023)	0.033 (0.046)	0.033 (0.046)					
G x I	0.013 (0.022)	0.029 (0.044)	0.029 (0.044)	0.021 (0.035)	0.049 (0.048)	0.049 (0.048)	0.021 (0.021)	0.042 (0.042)	0.021 (0.030)	0.049 (0.016)	0.049 (0.060)	0.049 (0.030)	0.023 (0.023)	0.033 (0.046)	0.033 (0.046)	0.023 (0.023)	0.033 (0.046)	0.033 (0.046)					
W at G	0.022 (0.021)	0.044 (0.043)	0.044 (0.043)	0.035 (0.034)	0.070 (0.069)	0.070 (0.069)	0.035 (0.029)	0.060 (0.059)	0.035 (0.034)	0.070 (0.069)	0.070 (0.069)	0.035 (0.034)	0.046 (0.046)	0.046 (0.046)	0.046 (0.046)	0.046 (0.046)	0.046 (0.046)	0.046 (0.046)					
G at W	0.021 (0.021)	0.043 (0.043)	0.043 (0.043)	0.034 (0.034)	0.069 (0.069)	0.069 (0.069)	0.029 (0.029)	0.059 (0.059)	0.034 (0.034)	0.069 (0.069)	0.069 (0.069)	0.034 (0.034)	0.046 (0.046)	0.046 (0.046)	0.046 (0.046)	0.046 (0.046)	0.046 (0.046)	0.046 (0.046)					

DAS Days After Sowing Figures in parenthesis denotes log (x + 2) transformed values. RM - Rabi mean All Other interactions are not significant

TABLE - 3b. NUMBER OF SEDGES ON 105 DAS (m<sup>2</sup>) - HARVEST

TREATMENT	RABI SEASON						KHARIF SEASON							
	1992		1994		1995		1994		1995		1994			
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN		
<b>G X I</b>														
I1	17.67 (1.294)	95.94 (1.991)	56.80 (1.642)	18.89 (1.320)	90.68 (1.967)	54.74 (1.643)	13.20 (1.182)	78.90 (1.908)	16.58 (1.265)	46.05 (1.545)	88.50 (1.955)	23.06 (1.399)	112.02 (2.057)	67.54 (1.728)
I2	14.21 (1.210)	87.94 (1.954)	51.07 (1.582)	14.94 (1.229)	81.75 (1.923)	48.34 (1.576)	11.12 (1.118)	68.79 (1.850)	13.42 (1.185)	39.95 (1.484)	79.49 (1.909)	17.76 (1.296)	97.77 (1.999)	57.76 (1.647)
I3	15.21 (1.236)	92.62 (1.976)	53.91 (1.606)	17.40 (1.288)	84.49 (1.937)	50.94 (1.613)	12.48 (1.161)	71.79 (1.868)	15.03 (1.514)	42.13 (1.228)	82.96 (1.927)	20.75 (1.357)	103.92 (2.025)	72.71 (1.691)
<b>G X W</b>														
W1	12.19 (1.152)	87.12 (1.930)	49.65 (1.551)	12.65 (1.166)	79.84 (1.913)	46.24 (1.539)	8.61 (1.026)	67.50 (1.842)	11.15 (1.114)	38.05 (1.434)	78.15 (1.901)	16.62 (1.270)	100.32 (2.010)	58.47 (1.640)
W2	13.06 (1.178)	89.41 (1.961)	51.23 (1.569)	13.84 (1.200)	82.33 (1.926)	48.08 (1.563)	9.64 (1.066)	69.94 (1.857)	12.18 (1.148)	39.79 (1.461)	80.56 (1.914)	46.37 (1.279)	100.80 (2.012)	58.90 (1.645)
W3	10.05 (1.081)	86.10 (1.945)	48.07 (1.513)	11.48 (1.130)	79.28 (1.910)	45.38 (1.520)	6.93 (0.951)	67.34 (1.841)	9.48 (1.054)	37.13 (1.396)	77.57 (1.898)	14.82 (1.226)	97.08 (1.996)	55.95 (1.611)
W4	15.06 (1.232)	91.97 (1.973)	53.51 (1.602)	16.83 (1.275)	84.89 (1.939)	50.86 (1.607)	12.06 (1.148)	72.81 (1.874)	14.65 (1.511)	42.43 (1.218)	83.22 (1.928)	19.33 (1.329)	103.19 (2.022)	61.26 (1.675)
W5	15.61 (1.246)	92.40 (1.975)	54.00 (1.610)	17.72 (1.295)	86.71 (1.948)	52.21 (1.621)	14.21 (1.210)	74.20 (1.882)	15.84 (1.250)	44.20 (1.546)	126.50 (1.935)	20.59 (1.354)	105.39 (2.031)	62.99 (1.692)
W6	37.17 (1.593)	106.89 (2.037)	72.03 (1.815)	38.83 (1.611)	102.95 (2.021)	70.89 (1.816)	31.03 (1.519)	88.36 (1.956)	35.67 (1.737)	59.69 (1.574)	99.40 (2.004)	41.85 (1.642)	122.16 (2.094)	82.00 (1.868)
MEAN	15.66 (1.247)	91.97 (1.973)		17.01 (1.279)	85.49 (1.942)		12.22 (1.153)	72.98 (1.875)	15.01 (1.226)		83.65 (1.930)	20.38 (1.350)	104.41 (2.027)	
G	SEd	CD	SEd	SEd	CD	SEd	SEd	CD	SEd	CD	SEd	SEd	CD	SEd
G	0.004	0.009	0.006	0.006	0.013	0.004	0.008	0.008	0.012	0.024	0.012	0.012	0.024	0.024
I	0.005	0.011	0.007	0.007	0.017	0.005	0.010	0.010	0.013	0.026	0.013	0.013	0.026	0.026
W	0.013	0.026	0.018	0.018	0.027	0.014	0.028	0.028	0.018	0.036	0.018	0.018	0.036	0.036
G x I	0.007	0.016	0.018	0.018	0.024	0.006	0.014	0.014	0.004	0.093	0.004	0.004	0.093	0.093
W at G	0.018	0.037	0.019	0.019	0.039	0.019	0.039	0.039	0.059	0.118	0.059	0.059	0.118	0.118
G at W	0.017	0.035	0.018	0.018	0.037	0.018	0.037	0.037	0.059	0.118	0.059	0.059	0.118	0.118

DAS:Days After Sowing. Figures in parenthesis denotes log (x + 2) transformed values.

Rm - Rabi mean. All Other interactions are not significant

The interaction effect of pre-sowing application of glyphosate with intercropping of greengram in groundnut ( $G_1 I_2$ ) on reduction of sedge population was highly significant. Though the effect was not distinctly different on 30 DAS, the reduction on 60 and 105 DAS was significant. Irrespective of crop stages and seasons, combining of pre-sowing application of glyphosate with pre-emergence application of metolachlor @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $G_1 W_3$ ) significantly superior over other combination.

#### 4.1.3. Grassy weeds population( $m^2$ ) : (Tables 4, 4a, and 4b)

The number of grassy weeds recorded under pre-sowing glyphosate applied 15 days prior to land preparation ( $G_1$ ) was significantly minimum compared to unsprayed control ( $G_2$ ). The reduction of grassy weeds under this treatment was observed at different stages of crop growth and seasons. Among the seasons, the least mean population of 30.53, 22.61 and 20.10  $m^{-2}$  respectively on 30,60 and 105 DAS was registered during rabi season.

Among intercropping systems the population of grassy weeds was significantly suppressed under groundnut + greengram intercropping ( $I_2$ ) and the reduction was, noticed at different crop stages and seasons. The mean population of grassy weeds on 30,60 and 105 DAS respectively with 28.08, 30.01 and 26.81 obtained during rabi was the lowest. The number of grassy weeds under groundnut+ redgram ( $I_3$ ) was comparatively higher than sole groundnut on 30 DAS. However, from 60 DAS onwards the grassy weed population under this system tends to reduce significantly.

TABLE - 4. NUMBER OF GRASSES ON 30 DAS (m<sup>2</sup>)

TREATMENT	1992				1994				1995				1994				1994				
	G1	G2	MEAN	SED	G1	G2	MEAN	SED	G1	G2	MEAN	SED	G1	G2	MEAN	SED	G1	G2	MEAN	SED	
<b>G X I</b>																					
I1	15.29 (1.238)	39.78 (1.612)	27.53 (1.520)	23.94 (1.414)	43.60 (1.659)	33.77 (1.537)	20.08 (1.344)	38.27 (1.605)	29.17 (1.475)	45.92 (1.332)	40.55 (1.628)	43.23 (1.48)	28.06 (1.478)	48.69 (1.705)	38.37 (1.592)						
I2	21.38 (1.369)	36.45 (1.477)	28.91 (1.375)	21.71 (1.375)	41.35 (1.637)	31.53 (1.506)	18.46 (1.494)	29.18 (1.494)	23.82 (1.403)	20.51 (1.351)	35.66 (1.572)	28.08 (1.461)	25.66 (1.479)	47.09 (1.567)	36.37 (1.626)						
I3	25.60 (1.441)	45.20 (1.674)	35.40 (1.558)	27.78 (1.474)	48.23 (1.701)	38.00 (1.588)	22.15 (1.383)	43.81 (1.661)	32.98 (1.522)	25.17 (1.432)	45.74 (1.678)	35.45 (1.555)	32.35 (1.536)	53.08 (1.741)	42.71 (1.639)						
<b>G X W</b>																					
W1	20.08 (1.344)	42.18 (1.655)	31.63 (1.499)	21.28 (1.367)	46.30 (1.684)	33.79 (1.522)	16.66 (1.271)	36.54 (1.586)	26.60 (1.429)	19.34 (1.327)	42.00 (1.641)	30.67 (1.484)	25.79 (1.444)	52.82 (1.739)	39.30 (1.591)						
W2	23.52 (1.407)	45.53 (1.677)	34.52 (1.542)	24.48 (1.423)	48.81 (1.706)	36.64 (1.565)	18.74 (1.317)	37.17 (1.593)	27.95 (1.455)	22.24 (1.382)	43.83 (1.658)	33.03 (1.52)	28.13 (1.479)	57.29 (1.773)	42.71 (1.626)						
W3	18.13 (1.304)	40.18 (1.625)	29.15 (1.464)	17.49 (1.290)	42.87 (1.652)	30.18 (1.471)	12.45 (1.150)	33.36 (1.548)	22.90 (1.354)	16.02 (1.251)	38.80 (1.608)	27.41 (1.429)	21.82 (1.377)	51.70 (1.730)	36.76 (1.553)						
W4	25.29 (1.436)	48.46 (1.703)	36.87 (1.570)	26.84 (1.460)	52.70 (1.738)	39.77 (1.599)	22.49 (1.389)	45.86 (1.680)	34.17 (1.535)	24.87 (1.428)	49.00 (1.707)	36.93 (1.567)	31.11 (1.520)	59.51 (1.789)	45.31 (1.655)						
W5	12.96 (1.175)	15.94 (1.254)	14.45 (1.215)	12.32 (1.156)	22.88 (1.396)	17.60 (1.276)	12.28 (1.155)	16.88 (1.276)	14.58 (1.216)	12.52 (1.162)	18.56 (1.308)	15.54 (1.235)	14.78 (1.225)	19.08 (1.324)	16.93 (1.275)						
W6	59.94 (1.792)	67.98 (1.845)	63.96 (1.819)	64.06 (1.820)	65.60 (1.830)	64.83 (1.825)	58.25 (1.780)	58.67 (1.783)	58.46 (1.782)	60.75 (1.797)	64.08 (1.819)	62.41 (1.808)	71.36 (1.866)	81.45 (1.921)	76.40 (1.894)						
MEAN	23.68 (1.409)	40.31 (1.626)		24.36 (1.421)	44.30 (1.665)		20.18 (1.346)	36.60 (1.586)		30.53 (1.371)	40.65 (1.626)		28.56 (1.485)	49.60 (1.712)							
G	0.015	0.033		0.010	0.021		0.018	0.039		0.011	0.024		0.011	0.024							
I	0.018	0.041		0.015	0.030		0.012	0.047		0.007	0.023		0.003	0.025							
W	0.028	0.056		0.038	0.076		0.037	0.075		0.022	0.045		0.022	0.045							
G x I	0.026	NS		0.037	NS		0.035	NS		0.021	NS		0.021	NS							
W at G	0.039	0.079		0.049	0.098		0.050	0.101		0.032	0.064		0.032	0.064							
G at W	0.038	0.078		0.048	0.098		0.049	0.100		0.031	0.063		0.031	0.063							

DAS: Days After Sowing      Figures in parenthesis denotes log (x + 2) transformed values.      Rm : Rabi mean      All Other interactions are not significant

TREATMENT	RABI SEASON				KHARIF SEASON											
	1994		1995		1994		1995									
	G1	G2	G1	G2	G1	G2	G1	G2								
	MEAN	CD	MEAN	CD	MEAN	CD	MEAN	CD								
	27.04	52.32	39.68	27.99	55.01	41.50	21.55	51.23	36.39	25.52	52.85	39.18	34.39	63.01	48.70	
	(1.463)	(1.735)	(1.599)	(1.477)	(1.756)	(1.616)	(1.372)	(1.712)	(1.542)	(1.437)	(1.734)	(1.585)	(1.561)	(1.813)	(1.688)	
	20.80	40.26	30.53	21.33	45.31	33.32	18.09	34.29	26.19	20.07	39.95	30.01	28.97	55.14	42.05	
	(1.358)	(1.626)	(1.492)	(1.368)	(1.675)	(1.521)	(1.303)	(1.541)	(1.422)	(1.343)	(1.614)	(1.478)	(1.491)	(1.757)	(1.625)	
	24.00	43.49	33.74	24.00	46.08	35.04	18.74	45.97	32.35	22.24	45.18	33.71	30.21	56.47	43.34	
	(1.415)	(1.658)	(1.536)	(1.415)	(1.682)	(1.548)	(1.317)	(1.681)	(1.499)	(1.382)	(1.673)	(1.527)	(1.508)	(1.767)	(1.638)	
	16.53	34.98	25.75	16.96	38.92	27.94	13.38	35.23	24.30	15.62	36.37	25.99	23.11	50.84	36.97	
	(1.268)	(1.568)	(1.418)	(1.278)	(1.612)	(1.445)	(1.187)	(1.571)	(1.379)	(1.244)	(1.583)	(1.413)	(1.400)	(1.723)	(1.562)	
	19.03	43.39	31.21	19.38	43.29	31.33	15.37	38.92	27.14	17.92	41.86	29.89	26.97	53.97	40.47	
	(1.323)	(1.657)	(1.490)	(1.330)	(1.656)	(1.493)	(1.240)	(1.612)	(1.426)	(1.297)	(1.641)	(1.469)	(1.462)	(1.748)	(1.605)	
	15.33	30.26	22.79	13.56	33.70	23.63	9.85	34.98	22.41	12.91	32.98	22.94	20.59	49.88	35.23	
	(1.239)	(1.508)	(1.373)	(1.192)	(1.552)	(1.372)	(1.074)	(1.568)	(1.321)	(1.168)	(1.542)	(1.355)	(1.354)	(1.715)	(1.535)	
	24.46	45.75	35.10	22.66	49.40	36.03	19.72	42.97	31.34	22.28	46.04	34.16	29.62	56.21	42.91	
	(1.406)	(1.679)	(1.543)	(1.392)	(1.711)	(1.552)	(1.337)	(1.653)	(1.495)	(1.378)	(1.681)	(1.529)	(1.500)	(1.765)	(1.633)	
	24.79	47.88	36.33	28.06	52.20	40.13	21.01	44.88	42.50	24.62	48.32	36.47	31.18	57.97	44.57	
	(1.428)	(1.698)	(1.563)	(1.478)	(1.734)	(1.606)	(1.362)	(1.671)	(1.517)	(1.422)	(1.701)	(1.561)	(1.521)	(1.778)	(1.650)	
	63.01	76.16	69.58	69.45	78.35	73.90	58.39	60.39	59.39	63.61	71.63	67.62	74.73	87.12	80.92	
	(1.813)	(1.893)	(1.853)	(1.854)	(1.905)	(1.880)	(1.781)	(1.794)	(1.788)	(1.816)	(1.864)	(1.84)	(1.885)	(1.950)	(1.918)	
MEAN	23.87	44.46	-	24.34	47.54	-	19.38	42.14	-	22.61	45.99	-	31.11	58.11	-	
	(1.412)	(1.667)	-	(1.420)	(1.695)	-	(1.330)	(1.642)	-	(1.387)	(1.673)	-	(1.520)	(1.779)	-	
	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD
	0.020	0.040	0.004	0.004	0.020	0.008	0.010	0.023	0.010	0.023	0.008	0.018	0.008	0.018	0.008	0.018
	0.025	0.053	0.009	0.009	0.019	0.013	0.029	0.013	0.029	0.013	0.029	0.013	0.017	0.034	0.017	0.034
	0.037	0.075	0.012	0.012	0.023	0.012	0.024	0.048	0.012	0.023	0.012	0.024	0.017	0.034	0.017	0.034
x1	0.035	0.077	0.018	0.018	0.039	0.018	0.039	0.018	0.039	0.018	0.039	0.018	0.014	0.031	0.014	0.031
at.C	0.053	0.106	0.022	0.022	0.044	0.022	0.044	0.034	0.069	0.034	0.069	0.024	0.024	0.048	0.024	0.048
at.W	0.052	0.107	0.027	0.027	0.054	0.027	0.054	0.033	0.067	0.033	0.067	0.023	0.023	0.049	0.023	0.049

Figures in parenthesis denotes log ( x + 2 ) transformed values. Rm - Rabi mean All Other interactions are not significant

TABLE - 4b. NUMBER OF GRASSES ON (m<sup>2</sup>) - HARVEST

TREATMENT	1992			1994			1995			1996			KHARIF SEASON			
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	RM	G1	G2	MEAN
<b>G X I</b>																
I1	24.85 (1.427)	43.34 (1.666)	34.09 (1.552)	26.24 (1.451)	49.52 (1.712)	37.88 (1.581)	17.14 (1.282)	39.87 (1.622)	28.50 (1.452)	22.74 (1.386)	43.91 (1.666)	33.32 (1.526)	33.48 (1.550)	57.15 (1.772)	45.31 (1.661)	
I2	19.82 (1.339)	37.08 (1.592)	28.45 (1.471)	19.57 (1.334)	39.02 (1.613)	29.29 (1.473)	15.70 (1.248)	29.69 (1.501)	22.69 (1.374)	18.36 (1.307)	35.26 (1.568)	26.81 (1.437)	28.61 (1.486)	49.99 (1.716)	39.30 (1.601)	
I3	20.96 (1.361)	40.75 (1.651)	30.85 (1.502)	19.72 (1.377)	42.46 (1.648)	31.09 (1.512)	16.87 (1.276)	32.04 (1.532)	24.45 (1.404)	19.18 (1.338)	38.41 (1.603)	28.79 (1.470)	30.12 (1.508)	53.08 (1.741)	41.64 (1.624)	
<b>G X W</b>																
W1	16.62 (1.270)	37.73 (1.595)	26.98 (1.432)	16.66 (1.271)	39.02 (1.613)	27.84 (1.442)	12.35 (1.157)	29.91 (1.504)	21.13 (1.330)	15.21 (1.232)	35.42 (1.570)	25.31 (1.401)	24.94 (1.431)	48.35 (1.702)	36.66 (1.556)	
W2	17.67 (1.294)	39.49 (1.618)	28.58 (1.456)	19.23 (1.327)	40.95 (1.633)	30.09 (1.480)	13.06 (1.178)	30.88 (1.517)	21.97 (1.347)	16.65 (1.266)	37.10 (1.589)	26.87 (1.427)	26.97 (1.462)	50.11 (1.717)	38.54 (1.589)	
W3	14.74 (1.359)	35.49 (1.574)	25.11 (1.495)	14.21 (1.210)	36.72 (1.588)	25.46 (1.399)	9.72 (1.069)	28.19 (1.480)	18.95 (1.274)	12.89 (1.167)	33.46 (1.547)	23.17 (1.357)	22.83 (1.395)	47.09 (1.691)	34.96 (1.543)	
W4	20.85 (1.359)	40.75 (1.631)	30.80 (1.495)	22.54 (1.390)	42.15 (1.645)	32.34 (1.517)	16.62 (1.270)	32.11 (1.533)	24.36 (1.401)	20.00 (1.339)	38.33 (1.603)	29.16 (1.471)	28.54 (1.485)	51.70 (1.730)	40.12 (1.607)	
W5	22.15 (1.383)	41.65 (1.640)	31.9 (1.511)	23.94 (1.414)	44.23 (1.665)	34.08 (1.539)	19.13 (1.325)	32.83 (1.542)	25.98 (1.433)	21.74 (1.374)	39.57 (1.615)	30.65 (1.494)	30.13 (1.507)	52.95 (1.740)	41.54 (1.623)	
W6	50.48 (1.720)	50.80 (1.798)	55.64 (1.759)	41.65 (1.640)	60.80 (1.798)	51.22 (1.719)	39.11 (1.614)	52.20 (1.734)	45.65 (1.674)	43.74 (1.658)	57.93 (1.776)	50.83 (1.717)	61.67 (1.804)	73.68 (1.879)	67.67 (1.841)	
MEAN	21.71 (1.375)	40.55 (1.629)		22.39 (1.387)	43.39 (1.657)		16.53 (1.268)	33.56 (1.551)		20.10 (1.334)	39.21 (1.612)		30.65 (1.514)	53.33 (1.743)		
G	0.006	0.013		0.016	0.036		0.009	0.021		0.009	0.011		0.005	0.011		
I	0.007	0.016		0.018	0.038		0.011	0.026		0.011	0.014		0.006	0.014		
W	0.015	0.030		0.028	0.063		0.018	0.037		0.011	0.022		0.009	0.022		
G x I	0.010	NS		0.028	0.062		0.016	0.036		0.009	NS		0.009	NS		
W x G	0.020	0.043		0.044	0.089		0.026	0.052		0.016	0.031		0.016	0.031		
G x W	0.021	0.041		0.043	0.089		0.026	0.052		0.015	0.030		0.015	0.030		

DAS Days After Sowing Figures in parenthesis denotes log (x + 2) transformed values. Rm - Rabi mean All Other interactions are not significant

The recommended practice of hand weeding on 25 and 45 DAS ( $W_3$ ) appreciably minimises the number of grassy weeds on 30 DAS, compared to other integrated weed management practices and the significant difference was prevailed in both the cropping seasons. The reduction of grassy weeds under pre-emergence application of metolachlor @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS( $W_3$ ) was next in order and was on par with pre-emergence application of fluchloralin @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS( $W_1$ ). However, the distinct influence of pre-emergence application of metolachlor @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $W_3$ ) in reduction of grassy weeds was evident only from 60 DAS onwards. During rabi season, the mean grassy weed number of 22.94 and 23.17  $m^2$  respectively on 60 and 105 DAS was comparatively the lowest.

Irrespective of seasons a remarkable reduction in grassy weed population was noticed when pre-sowing application of glyphosate was followed by groundnut + greengram intercropping ( $G_1$ ). However, the impact was significant from 60 DAS onwards. Similarly considerable reduction in grassy weed population was recorded with pre-sowing application of glyphosate followed by pre-emergence application of metolachlor @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $G_1W_3$ ).

#### 4.1.4. Population of dicots ( $m^2$ ) (Tables 5, 5a, and 5b)

Pre-sowing application of glyphosate prior to land preparation ( $G_1$ ) resulted in significant control of dicot population than untreated control ( $G_2$ ). The decrease in dicot population under this treatment was significant among the different crop stages and seasons. The population of dicot recorded during rabi season was the lowest than

TABLE - 5. NUMBER OF DICOTS ON 30 DAS (m<sup>-2</sup>)

TREATMENT	1992				1994				1995				1994				
	G1		G2		G1		G2		G1		G2		G1		G2		
	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	
<b>G X I</b>																	
I1	18.60 (1.314)	25.22 (1.435)	21.71 (1.375)	17.45 (1.289)	30.35 (1.510)	23.80 (1.399)	12.68 (1.167)	26.64 (1.457)	18.51 (1.312)	16.24 (1.256)	27.40 (1.467)	21.82 (1.361)	22.83 (1.395)	30.88 (1.517)	26.57 (1.456)		
I2	13.99 (1.204)	23.64 (1.409)	18.27 (1.307)	15.78 (1.250)	20.80 (1.466)	10.82 (1.358)	10.82 (1.108)	19.72 (1.310)	14.18 (1.209)	13.53 (1.187)	23.53 (1.395)	18.53 (1.291)	19.08 (1.324)	27.85 (1.475)	23.09 (1.400)		
I3	18.94 (1.321)	29.55 (1.499)	23.52 (1.407)	19.23 (1.327)	31.49 (1.525)	24.66 (1.426)	13.81 (1.199)	30.83 (1.496)	20.25 (1.348)	17.32 (1.282)	30.62 (1.506)	23.97 (1.394)	23.94 (1.414)	31.96 (1.531)	27.68 (1.473)		
<b>G X W</b>																	
W1	15.17 (1.235)	23.41 (1.35)	18.89 (1.320)	15.62 (1.246)	28.06 (1.478)	21.01 (1.362)	9.40 (1.057)	23.76 (1.411)	15.14 (1.234)	13.39 (1.179)	25.07 (1.431)	19.23 (1.305)	22.43 (1.388)	29.69 (1.501)	25.82 (1.445)		
W2	16.07 (1.257)	25.79 (1.444)	20.41 (1.351)	16.49 (1.267)	29.47 (1.498)	22.12 (1.383)	10.88 (1.110)	25.29 (1.436)	16.75 (1.273)	14.48 (1.211)	26.85 (1.459)	20.66 (1.335)	22.26 (1.385)	32.27 (1.535)	26.84 (1.460)		
W3	12.85 (1.172)	22.83 (1.395)	17.20 (1.284)	12.62 (1.165)	27.17 (1.465)	18.65 (1.315)	7.37 (0.972)	23.23 (1.402)	13.38 (1.187)	10.94 (1.103)	24.41 (1.420)	17.67 (1.261)	18.04 (1.302)	29.55 (1.499)	23.14 (1.401)		
W4	20.33 (1.349)	26.97 (1.462)	23.43 (1.406)	20.54 (1.353)	30.88 (1.517)	25.22 (1.435)	14.10 (1.207)	25.35 (1.437)	18.98 (1.322)	18.32 (1.303)	27.73 (1.472)	23.02 (1.387)	26.184 (1.450)	33.31 (1.548)	29.55 (1.499)		
W5	10.91 (1.111)	15.62 (1.246)	13.08 (1.179)	10.47 (1.096)	15.33 (1.239)	12.70 (1.168)	8.54 (1.023)	13.41 (1.188)	10.75 (1.106)	9.97 (1.076)	14.78 (1.224)	12.37 (1.15)	10.134 (1.084)	11.93 (1.144)	11.00 (1.114)		
W6	33.64 (1.552)	53.08 (1.741)	42.31 (1.647)	38.08 (1.603)	62.41 (1.809)	45.81 (1.706)	36.01 (1.580)	42.66 (1.649)	39.21 (1.615)	35.91 (1.578)	52.71 (1.733)	44.31 (1.655)	43.29 (1.655)	64.22 (1.821)	52.76 (1.739)		
MEAN	17.02 (1.297)	26.10 (1.448)		17.42 (1.288)	29.69 (1.501)		12.39 (1.158)	24.33 (1.421)		15.69 (1.241)	27.18 (1.456)		21.85 (1.377)	30.21 (1.508)			
G	0.011 (0.013)	0.024 (0.029)		0.009 (0.014)	0.020 (0.028)		0.017 (0.021)	0.038 (0.047)		0.010 (0.014)	0.023 (0.024)		0.008 (0.011)	0.019 (0.023)			
W	0.090 (0.011)	0.045 (0.025)		0.020 (0.015)	0.040 (0.034)		0.024 (0.029)	0.048 (0.066)		0.024 (0.034)	0.048 (0.066)		0.023 (0.015)	0.046 (0.033)			
G x I	0.023 (0.021)	0.060 (0.058)		0.031 (0.030)	0.061 (0.060)		0.034 (0.035)	0.066 (0.068)		0.034 (0.035)	0.066 (0.068)		0.031 (0.029)	0.061 (0.059)			
G at W																	

DAS:Days After Sowing Figures in parenthesis denotes log (x + 2) transformed values. Rm - Rabi mean All Other interactions are not significant

TABLE - 5a. NO OF DICOTS ON 60 DAS (m<sup>2</sup>)

TREATMENT	1982				1984				1985				1994				KHARIF SEASON			
	G2		MEAN		G1		MEAN		G2		MEAN		G1		MEAN		G2		MEAN	
	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd
<b>G X I</b>																				
I1	18.60 (1.314)	32.99 (1.544)	25.79 (1.429)	18.84 (1.319)	33.39 (1.549)	26.11 (1.434)	13.70 (1.196)	29.11 (1.493)	13.70 (1.196)	29.11 (1.493)	21.40 (1.344)	17.04 (1.276)	31.83 (1.528)	24.43 (1.402)	37.17 (1.593)	31.38 (1.517)	25.60 (1.441)	31.18 (1.593)	28.57 (1.521)	28.57 (1.521)
I2	13.20 (1.180)	20.75 (1.357)	16.95 (1.269)	14.98 (1.230)	29.69 (1.501)	22.33 (1.365)	7.74 (0.989)	21.17 (1.365)	7.74 (0.989)	21.17 (1.365)	14.45 (1.171)	11.97 (1.133)	23.87 (1.407)	17.92 (1.271)	30.49 (1.352)	25.83 (1.436)	20.49 (1.352)	31.18 (1.521)	28.57 (1.521)	28.57 (1.521)
I3	17.95 (1.300)	24.54 (1.424)	21.24 (1.362)	15.21 (1.236)	30.06 (1.506)	22.63 (1.371)	10.24 (1.088)	28.83 (1.489)	10.24 (1.088)	28.83 (1.489)	19.53 (1.288)	14.46 (1.208)	27.81 (1.473)	21.13 (1.340)	24.48 (1.423)	28.57 (1.481)	24.48 (1.423)	32.67 (1.540)	28.57 (1.540)	28.57 (1.540)
<b>G X W</b>																				
W1	12.52 (1.162)	1 <sup>c</sup> 77 (1.338)	16.14 (1.250)	11.67 (1.136)	24.85 (1.429)	18.26 (1.283)	6.75 (0.942)	21.22 (1.366)	6.75 (0.942)	21.22 (1.366)	13.98 (1.154)	10.71 (1.08)	21.94 (1.377)	16.32 (1.228)	27.99 (1.477)	23.41 (1.398)	18.84 (1.319)	27.99 (1.477)	23.41 (1.398)	23.41 (1.398)
W2	14.36 (1.214)	20.85 (1.350)	17.60 (1.287)	13.52 (1.191)	26.57 (1.456)	20.04 (1.324)	7.48 (0.977)	23.46 (1.406)	7.48 (0.977)	23.46 (1.406)	15.47 (1.192)	11.78 (1.127)	23.62 (1.404)	17.70 (1.265)	20.85 (1.359)	25.12 (1.428)	20.85 (1.359)	29.40 (1.497)	25.12 (1.497)	25.12 (1.497)
W3	10.02 (1.080)	18.23 (1.306)	14.12 (1.193)	9.58 (1.064)	24.24 (1.419)	16.91 (1.242)	4.44 (0.809)	20.64 (1.355)	4.44 (0.809)	20.64 (1.355)	12.54 (1.082)	8.01 (0.984)	21.03 (1.36)	14.52 (1.172)	16.03 (1.235)	21.5 (1.359)	16.03 (1.235)	26.97 (1.462)	21.5 (1.462)	21.5 (1.462)
W4	16.32 (1.263)	21.98 (1.380)	19.15 (1.322)	16.45 (1.266)	29.69 (1.501)	23.07 (1.384)	11.15 (1.119)	25.60 (1.441)	11.15 (1.119)	25.60 (1.441)	18.37 (1.280)	14.74 (1.216)	25.75 (1.440)	20.24 (1.328)	24.91 (1.430)	27.63 (1.470)	24.91 (1.430)	30.35 (1.510)	27.63 (1.510)	27.63 (1.510)
W5	18.55 (1.313)	27.90 (1.474)	23.22 (1.393)	19.38 (1.330)	28.20 (1.459)	23.79 (1.405)	11.45 (1.129)	26.57 (1.456)	11.45 (1.129)	26.57 (1.456)	19.01 (1.293)	16.46 (1.257)	27.55 (1.46)	22.00 (1.358)	26.57 (1.455)	29.34 (1.495)	26.57 (1.455)	32.11 (1.533)	29.34 (1.495)	29.34 (1.495)
W6	29.47 (1.498)	56.74 (1.796)	43.10 (1.634)	36.19 (1.582)	65.76 (1.831)	50.97 (1.707)	35.58 (1.575)	44.88 (1.671)	35.58 (1.575)	44.88 (1.671)	40.23 (1.623)	33.74 (1.551)	55.79 (1.776)	45.76 (1.658)	39.02 (1.613)	52.94 (1.838)	39.02 (1.613)	66.86 (1.838)	52.94 (1.838)	52.94 (1.838)
MEAN	15.98 (1.255)	25.68 (1.442)		16.25 (1.261)	31.06 (1.519)		10.33 (1.091)	26.12 (1.449)	10.33 (1.091)	26.12 (1.449)		14.49 (1.205)	27.83 (1.469)		23.43 (1.405)	33.71 (1.552)	23.43 (1.405)	33.71 (1.552)		
G	0.034 (0.042)	0.076 (0.094)		0.021 (0.025)	0.049 (0.057)		0.028 (0.060)	0.051 (0.110)	0.028 (0.060)	0.051 (0.110)		0.028 (0.060)	0.051 (0.110)		0.022 (0.034)	0.045 (0.069)	0.022 (0.034)	0.045 (0.069)		
W	0.055 (0.059)	0.110 (0.129)		0.041 (0.036)	0.083 (0.079)		0.060 (0.014)	0.110 (0.032)	0.060 (0.014)	0.110 (0.032)		0.060 (0.029)	0.110 (0.059)		0.034 (0.020)	0.069 (0.040)	0.034 (0.020)	0.069 (0.040)		
G x I	0.059 (0.091)	0.129 (0.182)		0.036 (0.055)	0.079 (0.109)		0.014 (0.029)	0.032 (0.059)	0.014 (0.029)	0.032 (0.059)		0.029 (0.028)	0.059 (0.057)		0.020 (0.018)	0.040 (0.037)	0.020 (0.018)	0.040 (0.037)		
G at W	0.090 (0.090)	0.183 (0.183)		0.054 (0.054)	0.110 (0.110)		0.028 (0.028)	0.057 (0.057)	0.028 (0.028)	0.057 (0.057)		0.028 (0.028)	0.057 (0.057)		0.018 (0.018)	0.037 (0.037)	0.018 (0.018)	0.037 (0.037)		

DAS: Days After Sowing. Figures in parenthesis denotes log (x + 2) transformed values. Rm - Rabi mean. All Other interactions are not significant.

TABLE - 5D. NUMBER OF DICOTS ON 105 DAS (m<sup>2</sup>) - HARVEST

TREATMENT	1992				1994				1995				1996				KHARIF SEASON						
	G1		MEAN		G1		MEAN		G1		MEAN		G1		MEAN		RM		G1		MEAN		
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	
<b>XI</b>	17.23	26.37	21.8	15.02	28.33	21.67	11.36	18.09	14.72	14.53	24.26	19.39	22.17	24.30	23.50								
	(1.284)	(1.453)	(1.368)	(1.231)	(1.482)	(1.356)	(1.126)	(1.303)	(1.214)	(1.213)	(1.412)	(1.312)	(1.393)	(1.420)	(1.406)								
	15.29	21.55	18.42	11.09	21.49	16.29	4.67	15.82	10.24	10.35	19.62	14.98	18.94	21.55	20.24								
	(1.238)	(1.372)	(1.305)	(1.117)	(1.371)	(1.244)	(0.822)	(1.251)	(1.036)	(1.059)	(1.331)	(1.195)	(1.321)	(1.372)	(1.346)								
	15.33	23.58	19.45	12.79	23.00	17.89	7.84	17.58	12.71	11.98	21.38	16.68	20.96	23.88	22.42								
(1.239)	(1.408)	(1.323)	(1.170)	(1.398)	(1.284)	(0.993)	(1.292)	(1.142)	(1.134)	(1.366)	(1.250)	(1.361)	(1.413)	(1.387)									
<b>XW</b>	13.17	20.33	16.75	10.30	18.79	14.54	4.64	15.61	10.12	9.37	18.24	13.80	18.18	23.76	20.97								
	(1.181)	(1.349)	(1.265)	(1.090)	(1.318)	(1.204)	(0.822)	(1.246)	(1.034)	(1.031)	(1.304)	(1.167)	(1.305)	(1.411)	(1.358)								
	14.78	21.17	17.97	11.06	19.87	15.46	6.05	16.11	11.08	10.63	19.05	14.84	19.13	24.79	21.96								
	(1.225)	(1.365)	(1.295)	(1.116)	(1.340)	(1.228)	(0.906)	(1.258)	(1.082)	(1.082)	(1.321)	(1.201)	(1.325)	(1.428)	(1.376)								
	12.25	19.47	15.86	8.81	18.37	13.59	3.49	12.96	8.225	8.18	16.93	12.55	16.66	22.43	19.54								
(1.154)	(1.332)	(1.243)	(1.034)	(1.309)	(1.171)	(0.740)	(1.176)	(0.958)	(0.976)	(1.272)	(1.124)	(1.271)	(1.388)	(1.329)									
15.41	22.09	18.86	12.96	21.12	17.04	8.13	16.87	12.5	12.04	20.02	16.03	21.06	25.73	23.39									
(1.241)	(1.382)	(1.311)	(1.175)	(1.364)	(1.269)	(1.006)	(1.276)	(1.141)	(1.140)	(1.340)	(1.240)	(1.363)	(1.443)	(1.403)									
15.94	22.32	18.75	13.84	27.85	20.84	8.71	17.81	13.26	12.83	22.66	17.74	21.71	26.90	24.30									
(1.254)	(1.386)	(1.320)	(1.200)	(1.475)	(1.337)	(1.030)	(1.297)	(1.163)	(1.161)	(1.386)	(1.273)	(1.375)	(1.461)	(1.418)									
27.51	43.18	35.34	24.19	47.88	36.03	21.98	25.54	23.76	24.55	38.86	31.70	30.56	53.71	42.14									
(1.470)	(1.655)	(1.562)	(1.418)	(1.698)	(1.558)	(1.380)	(1.440)	(1.41)	(1.422)	(1.597)	(1.509)	(1.513)	(1.746)	(1.629)									
15.95	23.79	-	12.85	24.12	-	7.54	17.14	-	12.93	21.68	-	20.80	28.13	-									
(1.254)	(1.411)	-	(1.172)	(1.417)	-	(0.980)	(1.282)	-	(1.174)	(1.370)	-	(1.358)	(1.479)	-									
SED	CD	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	
0.004	0.009	0.014	0.033	0.030	0.075	0.40	0.30	0.075	0.004	0.010	0.004	0.010	0.004	0.010	0.004	0.010	0.004	0.010	0.004	0.010	0.004	0.010	
0.005	0.011	0.017	0.038	0.042	0.103	0.42	0.32	0.103	0.005	0.012	0.005	0.012	0.005	0.012	0.005	0.012	0.005	0.012	0.005	0.012	0.005	0.012	
0.016	0.031	0.035	0.070	0.068	0.137	0.68	0.137	0.137	0.012	0.025	0.012	0.025	0.012	0.025	0.012	0.025	0.012	0.025	0.012	0.025	0.012	0.025	
0.007	0.015	0.025	0.057	0.057	0.159	0.79	0.159	0.159	0.008	0.017	0.008	0.017	0.008	0.017	0.008	0.017	0.008	0.017	0.008	0.017	0.008	0.017	
0.022	0.044	0.049	0.099	0.099	0.214	0.107	0.214	0.214	0.018	0.036	0.018	0.036	0.018	0.036	0.018	0.036	0.018	0.036	0.018	0.036	0.018	0.036	
0.020	0.042	0.047	0.096	0.096	0.216	0.108	0.216	0.216	0.017	0.034	0.017	0.034	0.017	0.034	0.017	0.034	0.017	0.034	0.017	0.034	0.017	0.034	

AS: Days After Sowing      Figures in parenthesis denotes log (x + 2) transformed values.      Rm - Rabi mean      All Other interactions are not significant

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kharif with the mean population of 15.69, 14.49 and 12.93 m<sup>2</sup> respectively on 30, 60 and 105 DAS.

Adoption of groundnut + greengram intercropping (I<sub>2</sub>) was found to reduce the dicot population. The trend was similar regardless of stages of crop growth and seasons. The mean dicot population of 18.53, 17.92 and 14.98 m<sup>2</sup> respectively on 30, 60 and 105 DAS, recorded under this system during rabi was the lowest among the seasons. Intercropping of redgram in groundnut (I<sub>3</sub>) showed poor influence on reduction of dicot population until 30 DAS. However, from 60 DAS onwards this system exerts significant reduction, than the sole crop of groundnut (I<sub>1</sub>).

Among the integrated weed management methods, the least number of dicot weeds on 30 DAS was recorded with recommended practice of hand weeding on 25 and 45 DAS (W<sub>8</sub>) and the reduction was noted at both the seasons. The pre-emergence spraying of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) was next in order of reduced dicot population. However, the data on 60 and 105 days clearly revealed the profound influence of this treatment in reduction of dicot population. Among the seasons, the least mean dicot weed number of 14.52 and 12.55 m<sup>2</sup> respectively on 60 and 105 DAS was registered during rabi. The population under pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> (W<sub>1</sub>) and pre-emergence application of pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> (W<sub>2</sub>) respectively coupled with one hand weeding on 30 DAS was also comparable.

Regarding interactions, pre-sowing application of glyphosate accompanied with groundnut + greengram intercropping (G<sub>1</sub>I<sub>2</sub>) significantly minimises the population of dicots and the results were similar among the stages of crop growth and seasons.

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The integrated weed management package of pre-sowing application of glyphosate followed with pre-emergence spraying of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (G<sub>1</sub>W<sub>3</sub>) had shown significant reduction of dicot population.

#### 4.1.5. Total weeds (m<sup>2</sup>) (Tables 6, 6a, and 6b) (Fig.3)

The data on total number of weeds revealed the significant influence of pre-sowing application of glyphosate prior to land preparation (G<sub>1</sub>) compared to no spraying (G<sub>2</sub>). Despite, the stages of crop growth and seasons this treatment maintains its superiority by registering the least weed density. Among the seasons, the reduction in total weed number was much pronounced during rabi, with the mean minimum of 53.65, 53.13 and 51.63 m<sup>2</sup> respectively on 30,60 and 105 DAS.

Raising of compatible intercrops with groundnut was also found to restrict the weed population. Intercropping of greengram in groundnut (I<sub>2</sub>) appreciably minimises the total weed population and the same was well established among different growth stages and seasons. The decline in total weed density under sole groundnut (I<sub>1</sub>) was next in order and it was statistically on par with groundnut + redgram (I<sub>3</sub>) upto 30 DAS, Later, this system recorded considerable reduction in total weed number than sole crop of groundnut (I<sub>1</sub>).

In general, the total weed population during rabi seasons was comparatively lower than kharif crop at all stages of crop growth. Moreover, the total weed population under integrated weed management practices showed a declining trend in accordance with advancement in age of the crop.

TABLE - 6. TOTAL NUMBER OF WEEDS ON 30 DAS (m<sup>2</sup>)

TREATMENT	1992				1994				1995				1999				KHARIF SEASON											
	G1		MEAN		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN			
	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	
<b>G X I</b>																												
I1	58.95 (1.785)	136.99 (2.143)	97.97 (1.964)	57.56 (1.775)	154.31 (2.194)	105.93 (1.984)	47.31 (1.693)	137.31 (2.144)	92.31 (1.918)	54.60 (1.751)	142.87 (2.160)	98.72 (1.955)	71.62 (1.867)	166.26 (2.226)	118.94 (2.046)													
I2	48.35 (1.702)	134.77 (2.136)	91.56 (1.919)	52.07 (1.733)	150.40 (2.183)	101.23 (1.958)	40.85 (1.632)	129.02 (2.097)	81.93 (1.864)	47.09 (1.689)	136.06 (2.138)	91.57 (1.913)	62.41 (1.809)	163.19 (2.218)	112.8 (2.013)													
I3	61.53 (1.803)	158.32 (2.205)	109.92 (2.004)	66.07 (1.833)	168.21 (2.231)	117.14 (2.032)	50.23 (1.718)	152.88 (2.190)	101.55 (1.954)	59.27 (1.784)	159.80 (2.208)	109.53 (1.99)	79.09 (1.909)	176.23 (2.251)	127.66 (2.080)													
<b>G X W</b>																												
W1	48.58 (1.704)	164.58 (2.221)	89.72 (1.962)	51.08 (1.725)	174.69 (2.247)	94.82 (1.986)	37.17 (1.593)	151.09 (2.185)	75.44 (1.889)	45.61 (1.674)	163.48 (2.217)	104.54 (1.945)	67.60 (1.842)	191.64 (2.287)	114.01 (2.064)													
W2	55.01 (1.756)	172.58 (2.242)	97.77 (1.999)	57.29 (1.773)	183.35 (2.267)	102.71 (2.020)	43.39 (1.657)	158.86 (2.206)	83.40 (1.931)	51.89 (1.728)	171.59 (2.238)	111.74 (1.983)	70.94 (1.863)	204.53 (2.315)	120.74 (2.089)													
W3	41.75 (1.641)	155.14 (2.193)	80.60 (1.917)	42.77 (1.651)	164.87 (2.222)	84.39 (1.936)	28.40 (1.483)	145.80 (2.169)	64.98 (1.826)	37.64 (1.591)	155.27 (2.194)	96.45 (1.892)	56.61 (1.768)	181.81 (2.264)	101.75 (2.016)													
W4	63.46 (1.816)	179.47 (2.258)	106.89 (2.037)	67.18 (1.840)	193.43 (2.291)	114.27 (2.065)	53.46 (1.744)	174.23 (2.246)	96.85 (1.995)	61.36 (1.800)	182.37 (2.265)	121.86 (2.032)	81.36 (1.921)	208.37 (2.393)	130.43 (2.122)													
W5	32.99 (1.544)	144.34 (1.656)	38.27 (1.605)	31.18 (1.521)	177.76 (1.776)	42.51 (1.648)	29.76 (1.502)	49.64 (1.713)	38.50 (1.607)	31.31 (1.522)	50.56 (1.718)	40.93 (1.62)	32.99 (1.544)	53.71 (1.746)	42.15 (1.645)													
W6	131.48 (2.125)	241.37 (2.391)	179.13 (2.258)	147.70 (2.175)	258.43 (2.415)	195.24 (2.295)	127.41 (2.111)	219.28 (2.344)	166.84 (2.227)	135.53 (2.171)	240.69 (2.383)	188.11 (2.29)	167.35 (2.228)	283.62 (2.455)	217.53 (2.341)													
MEAN	56.12 (1.764)	143.15 (2.161)		58.37 (1.780)	157.58 (2.203)		46.04 (1.681)	137.26 (2.143)		53.65 (1.741)	146.24 (2.168)		70.61 (1.861)	168.47 (2.231)														
G	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD
I	0.011	0.025	0.021	0.046	0.012	0.027	0.015	0.034	0.015	0.034	0.015	0.034	0.015	0.034	0.015	0.034	0.015	0.034	0.015	0.034	0.015	0.034	0.015	0.034	0.015	0.034	0.015	0.034
W	0.020	0.043	0.041	0.082	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054
G x I	0.022	NS	0.058	NS	0.038	NS	0.038	NS	0.038	NS	0.038	NS	0.044	NS	0.044	NS	0.044	NS	0.044	NS	0.044	NS	0.044	NS	0.044	NS	0.044	NS
W x I	0.025	0.051	0.076	NS	0.039	0.078	0.039	0.078	0.039	0.078	0.039	0.078	0.065	0.130	0.065	0.130	0.065	0.130	0.065	0.130	0.065	0.130	0.065	0.130	0.065	0.130	0.065	0.130
G x W	0.026	0.053	0.076	NS	0.040	0.080	0.040	0.080	0.040	0.080	0.040	0.080	0.066	0.132	0.066	0.132	0.066	0.132	0.066	0.132	0.066	0.132	0.066	0.132	0.066	0.132	0.066	0.132

DAS-Days After Sowing. Figures in parenthesis denotes log (x + 1.2) transformed values. Rm - Rabi mean. All Other interactions are not significant.

TABLE - 6a. TOTAL NUMBER OF WEEDS ON 60 DAS (m<sup>2</sup>)

TREATMENT	1992				1994				1995				1996				KHARIF SEASON															
	G1		G2		G1		G2		G1		G2		G1		G2		G1		G2													
	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED												
<b>X I</b>	63.01	(1.813)	198.90	(2.303)	130.95	(2.058)	66.36	(1.838)	203.58	(2.313)	135.22	(2.075)	50.961	(1.724)	183.35	(2.268)	117.15	(1.996)	60.27	(1.791)	195.27	(2.042)	127.77	(2.042)	85.09	(1.940)	228.67	(2.363)	156.88	(2.151)		
	47.77	(1.697)	173.79	(2.226)	110.78	(1.961)	51.70	(1.730)	179.55	(2.259)	115.62	(1.994)	37.08	(1.673)	151.81	(2.187)	94.44	(1.889)	45.51	(1.673)	168.38	(2.224)	106.94	(1.948)	70.27	(1.859)	204.53	(2.315)	137.4	(2.087)		
	57.56	(1.775)	188.78	(2.262)	123.27	(2.018)	59.09	(1.986)	183.78	(2.269)	121.43	(2.027)	44.23	(1.665)	172.18	(2.241)	108.20	(1.953)	53.62	(1.742)	181.64	(2.257)	117.63	(1.999)	76.72	(1.907)	210.32	(2.327)	144.52	(2.117)		
	40.75	(1.631)	156.99	(2.201)	98.87	(1.916)	41.55	(1.639)	158.60	(2.204)	100.07	(1.921)	30.60	(1.513)	147.79	(2.175)	89.19	(1.844)	37.63	(1.594)	154.46	(2.193)	96.04	(1.893)	59.23	(1.787)	193.88	(2.292)	126.55	(2.040)		
	46.30	(1.684)	170.58	(2.237)	108.44	(1.961)	47.43	(1.694)	176.13	(2.250)	111.78	(1.972)	33.97	(1.555)	157.10	(2.201)	95.58	(1.878)	42.96	(1.644)	167.93	(2.229)	105.24	(1.936)	67.34	(1.841)	201.23	(2.308)	134.28	(2.075)		
<b>X W</b>	34.64	(1.564)	149.43	(2.180)	92.03	(1.872)	33.64	(1.552)	156.65	(2.200)	95.14	(1.876)	21.38	(1.369)	143.27	(2.162)	82.32	(1.765)	29.88	(1.495)	149.78	(2.180)	89.83	(1.837)	51.21	(1.726)	189.42	(2.282)	120.31	(2.004)		
	54.88	(1.755)	175.41	(2.249)	115.14	(2.002)	57.56	(1.775)	190.08	(2.283)	123.82	(2.029)	45.86	(1.680)	171.38	(2.239)	108.62	(1.959)	52.80	(1.736)	178.95	(2.257)	115.87	(1.996)	77.79	(1.902)	206.93	(2.320)	142.36	(2.111)		
	60.66	(1.797)	193.74	(2.291)	127.2	(2.044)	68.14	(1.846)	193.69	(2.291)	130.91	(2.068)	49.05	(1.708)	176.85	(2.252)	112.95	(1.783)	59.28	(1.783)	188.09	(2.278)	123.68	(2.030)	82.33	(1.926)	212.78	(2.332)	147.55	(2.129)		
	136.29	(2.140)	263.94	(2.424)	200.11	(2.282)	156.35	(2.200)	281.42	(2.452)	78.42	(2.326)	134.53	(2.135)	230.91	(2.367)	182.72	(2.251)	142.55	(2.158)	258.75	(2.414)	200.65	(2.286)	168.37	(2.231)	301.25	(2.481)	234.81	(2.356)		
	55.78	(1.761)	181.51	(2.263)	98.87	(1.916)	58.86	(1.784)	188.54	(2.280)	100.07	(1.921)	43.70	(1.660)	168.87	(2.232)	89.19	(1.844)	53.13	(1.735)	181.76	(2.258)	96.04	(1.893)	77.83	(1.902)	214.68	(2.335)	126.55	(2.040)		
at G	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD
	0.014	0.031	0.011	0.023	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030
	0.015	0.033	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030	0.014	0.030
	0.022	0.044	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037	0.018	0.037
	0.031	0.067	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052	0.026	0.052
at W	0.032	0.070	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054	0.027	0.054

Figures in parenthesis denotes log (x + 2). Transformed values. Rm - Rabi mean. All Other interactions are not significant.

TABLE - 6b. TOTAL NUMBER OF WEEDS ON 105 DAS (m<sup>2</sup>) - HARVEST

ATTNMENT	1992						1994						1995						1996						KHARIF SEASON								
	G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN				
	G1	G2	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd			
<b>3 X I</b>																																	
1	62.56 (1.810)	175.01 (2.248)	118.78 (2.029)	63.76 (1.818)	183.35 (2.268)	123.55 (2.043)	46.30 (1.684)	147.96 (2.176)	97.13 (1.930)	57.54 (1.770)	168.77 (2.230)	113.15 (2.000)	84.89 (1.939)	211.30 (2.329)	148.09 (2.134)																		
2	52.07 (1.733)	154.67 (2.195)	103.37 (1.964)	50.60 (1.721)	155.39 (2.197)	102.99 (1.959)	34.72 (1.565)	124.18 (2.101)	79.45 (1.833)	43.79 (1.673)	144.74 (2.164)	95.26 (1.918)	69.94 (1.857)	185.06 (2.272)	127.5 (2.064)																		
3	56.07 (1.764)	165.49 (2.224)	110.78 (1.994)	57.42 (1.774)	163.95 (2.220)	110.68 (1.997)	41.25 (1.636)	131.65 (2.126)	86.45 (1.881)	51.58 (1.724)	153.69 (2.190)	102.63 (1.957)	77.25 (1.899)	197.52 (2.300)	137.38 (2.099)																		
<b>3 X W</b>																																	
W1	43.08 (1.654)	136.67 (2.142)	77.59 (1.900)	40.95 (1.633)	138.92 (2.149)	75.90 (1.891)	26.97 (1.462)	115.76 (2.071)	56.41 (1.766)	37.00 (1.583)	130.45 (2.120)	83.72 (1.851)	61.24 (1.801)	173.79 (2.245)	117.51 (2.023)																		
W2	46.64 (1.687)	151.10 (2.185)	98.87 (1.936)	45.42 (1.676)	144.55 (2.166)	94.98 (1.921)	31.03 (1.519)	117.12 (2.076)	74.07 (1.795)	41.03 (1.627)	137.59 (2.142)	89.31 (1.884)	64.22 (1.821)	176.64 (2.252)	120.43 (2.036)																		
W3	38.08 (1.603)	126.23 (2.108)	82.15 (1.855)	35.67 (1.576)	136.35 (2.141)	86.01 (1.858)	21.76 (1.376)	109.68 (2.048)	65.72 (1.712)	31.83 (1.518)	124.08 (2.099)	77.96 (1.808)	55.41 (1.759)	167.82 (2.230)	111.61 (1.994)																		
W4	52.45 (1.736)	156.12 (2.199)	104.28 (1.968)	53.59 (1.745)	149.35 (2.180)	101.47 (1.962)	38.08 (1.603)	123.02 (2.097)	80.55 (1.850)	48.04 (1.694)	142.83 (2.158)	95.43 (1.926)	69.94 (1.857)	181.65 (2.264)	125.79 (2.060)																		
W5	54.88 (1.755)	157.95 (2.204)	106.41 (1.980)	56.88 (1.770)	159.80 (2.209)	108.34 (1.989)	42.97 (1.653)	125.93 (2.107)	84.45 (1.880)	51.57 (1.726)	147.89 (2.173)	99.73 (1.949)	73.35 (1.877)	186.36 (2.275)	129.85 (2.076)																		
W6	153.51 (2.191)	279.23 (2.449)	216.37 (2.327)	168.43 (2.231)	301.42 (2.356)	142.50 (2.356)	142.50 (2.159)	253.60 (2.407)	198.05 (2.283)	154.81 (2.193)	278.08 (2.446)	216.44 (2.319)	186.06 (2.274)	344.34 (2.539)	265.2 (2.406)																		
MEAN	56.74 (1.769)	164.72 (2.222)		57.13 (1.771)	164.34 (2.221)		40.46 (1.628)	134.24 (2.134)	51.63 (1.722)	155.73 (2.194)		77.06 (1.898)	197.52 (2.300)																				
3	0.006	0.013		0.003	0.005		0.005	0.011				0.007	0.014																				
I	0.007	0.016		0.005	0.010		0.009	0.021				0.010	0.020																				
W	0.011	0.022		0.016	0.036		0.019	0.042				0.012	0.028																				
G x I	0.010	NS		0.013	NS		0.032	NS				0.013	NS																				
W at G	0.016	0.032		0.017	0.037		0.048	0.097				0.017	0.035																				
G at W	0.016	0.032		0.017	0.037		0.048	0.097				0.018	0.036																				

Figures in parenthesis denotes log (x + 2) transformed values. Rm - Rabi mean All Other interactions are not significant

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Regarding the different integrated weed management practices on 30 DAS, the least total weed number was recorded under recommended practice of hand weeding on 25 and 45 DAS ( $W_2$ ), and the trend was eventually noticed in all the cropping years. It was followed by pre-emergence application by of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) and fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_1$ ). However, the results on total weed number beyond 30 DAS confirms the superiority of applying pre-emergence metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) in minimising the total weed number. Compared to kharif season, the magnitude of weed suppression under this practice was higher during rabi with the least total weeds of 96.45, 89.83 and 84.42 m<sup>-2</sup> respectively on 30, 60 and 105 DAS.

Among interactions, pre-sowing application of glyphosate along with groundnut + greengram intercropping ( $G_1 I_2$ ) significantly reduced the total weed population. Though a significant reduction in total weed population was not observed under this combination at initial stage, the system exerts critical difference with advancement in age of the crop. Regardless of stages of crop growth and seasons pre-sowing application of glyphosate coupled with pre-emergence spraying of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $G_1 W_3$ ) distinctly minimised the total weed population than other combination.

#### **4.1.6. Weed Control Efficiency (WCE) at harvest (Table 7) (Fig.4)**

The adoption of pre-sowing glyphosate application 15 days prior to the land preparation ( $G_1$ ) recorded the maximum weed control efficiency (WCE) compared to unsprayed control ( $G_2$ ). The increase in WCE under this treatment was identical on all the cropping periods. Among the seasons the WCE registered in rabi was comparatively maximum with the mean of 57.44 per cent.

TABLE - 7. WEED CONTROL EFFICIENCY ON 105 DAS - HARVEST

TREATMENT	RABI SEASON						KHARIF SEASON					
	1992		1994		1995		1996		1997		1998	
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2
<b>G X I</b>												
I1	50.13 (45.074)	33.90 (35.614)	42.01 (40.344)	33.65 (35.461)	43.25 (41.050)	34.73 (36.113)	46.14 (42.728)	53.51 (47.019)	34.09 (35.729)	43.80 (41.374)	45.99 (42.700)	32.48 (38.725)
I2	57.18 (54.128)	39.36 (38.859)	48.27 (43.993)	42.73 (40.822)	51.74 (46.019)	43.92 (41.518)	55.10 (48.014)	61.41 (51.621)	42.00 (40.397)	51.70 (46.009)	39.89 (47.480)	47.10 (43.326)
I3	49.47 (47.564)	35.76 (36.617)	45.11 (42.090)	39.93 (39.191)	48.21 (43.961)	41.00 (39.819)	51.16 (45.683)	57.42 (49.281)	38.89 (43.911)	43.15 (45.082)	36.36 (37.090)	43.25 (41.086)
<b>G X W</b>												
W1	71.96 (58.026)	51.15 (45.658)	61.55 (51.842)	53.91 (47.242)	64.79 (53.846)	54.35 (47.495)	67.71 (55.852)	76.23 (60.895)	53.13 (46.798)	64.68 (53.846)	67.08 (54.987)	58.30 (49.855)
W2	69.60 (56.539)	43.89 (42.642)	57.74 (49.590)	52.04 (46.169)	62.53 (52.440)	53.81 (47.185)	78.22 (64.682)	73.61 (59.143)	50.58 (45.332)	62.09 (52.237)	48.70 (54.017)	57.09 (49.136)
W3	75.20 (60.132)	54.79 (47.748)	64.99 (53.940)	54.76 (47.731)	66.79 (55.164)	56.75 (48.879)	70.73 (57.934)	79.58 (63.239)	55.43 (48.119)	67.50 (55.679)	51.26 (45.722)	60.73 (51.321)
W4	65.82 (54.222)	44.08 (41.600)	54.95 (47.911)	50.45 (45.257)	59.31 (50.458)	51.49 (45.853)	62.38 (52.360)	69.09 (56.250)	48.67 (44.236)	58.88 (50.243)	47.24 (52.179)	54.82 (47.798)
W5	64.42 (53.381)	43.43 (41.224)	53.92 (47.302)	46.98 (43.268)	56.60 (48.866)	50.34 (45.194)	60.11 (50.957)	66.84 (66.855)	46.91 (43.228)	56.87 (49.041)	45.87 (42.630)	53.22 (46.866)
W6	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)	0.05 (1.280)
MEAN	53.94 (47.259)	35.70 (36.692)		56.71 (48.860)	38.737 (38.491)	61.59 (51.707)	39.84 (39.143)		57.44 (49.307)	38.32 (38.222)	50.13 (45.080)	36.22 (37.004)
G	0.360	0.820		0.178	0.356	0.490	1.110		0.410	0.910	0.410	0.910
I	0.450	1.000		0.353	0.706	0.600	1.200		0.500	1.110	0.500	1.110
W	0.720	1.450		0.658	1.316	0.870	1.750		0.715	1.430	0.715	1.430
G x I	0.630	1.260		0.980	1.96	0.860	1.72		0.710	1.420	0.710	1.420
W at G	1.030	2.060		1.050	2.100	1.230	2.470		0.960	1.920	0.960	1.920
G at W	1.010	2.050		1.070	2.140	1.240	2.510		0.967	1.930	0.967	1.930

DAS-Days After Sowing      Figures in parenthesis denotes arc sin transformed values.      RM - Rabi mean      All Other interactions are not significant

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The weed control efficiency (WCE) was also found to be influenced by different intercropping systems. Intercropping of greengram in groundnut ( $I_2$ ) significantly recorded the highest WCE per cent. It was followed by groundnut + redgram intercropping ( $I_3$ ). The same trend was maintained in all the cropping years. The mean WCE of 51.70 per cent obtained in rabi season was comparatively maximum.

The pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) significantly excels all other pre-emergence herbicides based weed management, with regard to WCE. Irrespective of cropping periods the increment in WCE with this treatment was similar. Among the seasons the mean WCE of 67.50 recorded during rabi season was maximum with an increase of 10.63 per cent over the recommended practice of hand weeding on 25 and 45 DAS ( $W_6$ ). It was followed by pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_1$ ) and the pre-emergence application of pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_2$ ). Among the integrated weed management measures the lowest weed control efficiency was observed under pre-emergence application of oxyfluorfen @ 0.1 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_4$ ).

Regarding interaction, pre-sowing application of glyphosate in groundnut + greengram intercropping ( $G_1 I_2$ ) registered the maximum WCE. The increase was uniformly observed at all the cropping years. Similarly, the WCE obtained through combination of pre-sowing application of glyphosate and pre-emergence spraying of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $G_1 W_3$ ) was significantly higher.

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#### 4.1.7. Dry matter production of weeds (gm<sup>2</sup>) (Table 8, 8a & 8b) (Fig.5)

The weed drymatter obtained under pre-sowing application of glyphosate (G<sub>1</sub>) was considerably minimum when compared to no spraying of glyphosate (G<sub>2</sub>). The reduction in weed drymatter due to this practice was identical over different stages of crop growth and seasons. The mean drymatter of weeds with 40.72, 39.38 and 39.35 g m<sup>2</sup> respectively on 30, 60 and 105 DAS recorded with this treatment during rabi season was the lowest.

Among intercropping systems the drymatter accumulation of weeds declined significantly when greengram was intercropped in groundnut (I<sub>2</sub>). The quantity of drymatter accumulated by weeds under groundnut + redgram intercropping (I<sub>3</sub>) was significantly higher than sole crop of groundnut (I<sub>1</sub>) on 30 DAS. Later, with the advancement in age of the crop the DMP of weeds under this system reduced significantly over sole crop of groundnut (I<sub>1</sub>). Regardless of stages of crop growth and seasons, the same trend was observed.

The drymatter production of weeds was also positively influenced by the various integrated weed management practices. The recommended practice of hand weeding on 25 and 45 DAS (W<sub>2</sub>) registered the minimum DMP of weeds on 30 DAS, and the reduction was evenly seen at all the cropping years. It was closely followed by pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>).

However, the data on 60 and 105 DAS at both seasons, revealed the significant influence of pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) in reducing the weed DMP. Among the seasons, the reduction was

TABLE - 8. WEED DRY MATTER PRODUCTION - 30 DAS (g m<sup>-2</sup>)

TREATMENT	1992						1994						1995						1996						
	G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN		
	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	
<b>G X I</b>																									
I1	42.34	81.98	62.16	44.76	96.03	70.39	36.24	73.62	54.93	41.11	83.87	62.49	52.57	112.98	82.78										
I2	38.49	76.91	57.70	43.33	88.10	65.71	32.77	67.97	50.37	38.19	77.66	57.92	49.20	103.36	76.28										
I3	44.06	86.58	65.32	48.64	99.68	74.16	35.96	77.15	56.56	42.88	87.80	65.34	57.56	117.71	87.63										
<b>G X W</b>																									
W1	32.30	84.97	58.63	33.33	97.03	65.18	24.80	73.66	49.26	30.14	85.22	57.68	41.16	115.56	78.36										
W2	35.13	87.17	61.15	36.13	100.74	68.43	27.83	76.20	52.01	33.03	88.03	60.53	44.46	118.53	81.49										
W3	27.40	81.83	54.61	28.80	91.83	60.31	19.46	68.60	44.03	25.22	80.75	52.98	37.66	110.76	74.21										
W4	42.53	91.16	66.84	44.23	108.24	76.23	35.96	81.80	58.88	40.90	93.73	67.31	51.10	121.73	86.41										
W5	4.70	11.75	8.23	6.92	13.28	10.10	6.21	16.50	11.35	5.94	13.84	9.89	13.21	24.30	18.75										
W6	107.76	134.06	120.91	124.10	156.56	140.33	95.70	120.71	108.20	109.18	137.11	123.14	131.03	177.23	154.13										
MEAN	41.63	81.82		45.58	94.61		34.99	72.91		40.72	83.11		53.10	111.35											
G	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD									
I	0.79	1.76		0.56	1.25		0.57	1.27		1.02	2.27		1.02	2.27		1.02									
W	0.96	2.15		0.68	1.53		0.69	1.55		1.25	2.78		1.25	2.78		1.25									
G x I	1.82	3.64		1.61	3.23		1.58	3.17		1.73	3.46		1.73	3.46		1.73									
WatG	1.37	2.87		0.97	2.13		0.98	2.15		1.77	3.89		1.77	3.89		1.77									
WatW	2.57	5.14		2.28	4.56		2.24	4.48		2.44	4.89		2.44	4.89		2.44									
GratW	2.47	5.01		2.15	4.35		2.12	4.28		2.45	5.01		2.45	5.01		2.45									

NS - Not Significant RM - Rabi mean Other interactions are not significant

TABLE - 8a. WEED DRY MATTER PRODUCTION - 60 DAS (g m<sup>-2</sup>)

TREATMENT	RABI SEASON						KHARIF SEASON								
	1992		1994		1995		1994		1995		1994				
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2			
	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN			
<b>G X I</b>															
I1	43.55	98.48	71.01	44.72	115.00	79.86	38.08	38.10	63.09	42.11	100.52	71.31	56.77	130.01	93.39
I2	36.30	89.37	62.83	40.05	104.58	72.32	30.50	80.10	55.35	35.65	91.35	63.50	48.08	115.75	81.92
I3	40.86	96.03	68.44	43.76	109.23	76.49	36.63	85.35	60.99	40.41	96.87	68.64	54.08	125.30	89.69
<b>G X W</b>															
W1	21.44	80.96	50.99	20.79	92.40	56.59	15.17	70.68	42.92	18.77	81.34	50.05	31.10	108.56	69.83
W2	23.27	83.76	53.31	24.33	95.36	59.84	19.47	72.96	46.21	21.99	84.02	53.00	33.93	111.26	72.30
W3	17.04	76.76	46.69	16.28	88.23	52.25	9.17	65.30	37.23	13.80	76.76	45.28	26.93	104.01	65.47
W4	31.81	89.25	60.32	32.06	105.96	69.01	28.74	80.16	54.45	30.51	91.79	61.15	41.71	117.18	79.45
W5	34.41	92.03	63.01	34.03	108.80	71.41	29.84	83.0	56.42	32.06	94.61	63.23	44.80	119.35	82.08
W6	113.90	145.01	129.25	129.59	166.86	148.22	108.24	135.1	121.67	116.88	148.99	132.93	139.41	181.73	166.57
MEAN	40.23	94.62		42.84	109.60		35.10	85.51		39.38	96.24		52.98	123.68	
	SED	CD		SED	CD		SED	CD		SED	CD		SED	CD	
G	0.61	1.37		0.75	1.67		0.62	1.39		0.73	1.62		0.73	1.62	
I	0.75	1.68		0.91	2.04		0.76	1.71		0.89	1.99		0.89	1.99	
W	1.77	3.54		1.87	3.74		1.72	3.45		1.85	3.70		1.85	3.70	
G x I	1.07	2.35		1.29	2.89		1.07	2.35		1.26	2.82		1.26	2.82	
W x I	2.50	5.00		2.64	5.29		2.44	4.90		2.61	5.23		2.61	5.23	
G x W	2.36	4.77		2.53	5.11		2.31	4.67		2.49	5.04		2.49	5.04	

NS - Not Significant      RM - Rabi mean      Other interactions are not significant

TABLE - 8b. WEED DRY MATTER PRODUCTION ON 105 DAS (g m<sup>-2</sup>) - HARVEST

TREATMENT	RABI SEASON						KHARIF SEASON								
	1992		1994		1995		1994		1995		1994				
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN			
<b>G X I</b>															
I1	45.70	101.20	73.45	45.15	110.33	78.98	41.15	89.20	65.17	44.00	100.24	72.12	60.10	127.10	93.60
I2	36.22	90.32	63.27	37.43	99.17	69.54	31.46	76.22	53.84	35.03	88.57	61.80	50.13	112.68	81.40
I3	40.19	96.19	68.19	41.18	106.37	75.02	35.71	79.22	57.46	39.02	93.92	66.47	55.15	121.25	88.20
<b>G X W</b>															
W1	18.03	77.41	47.71	15.60	88.06	51.83	13.66	60.93	37.29	15.76	75.46	45.61	29.10	102.46	65.78
W2	21.16	80.64	50.90	20.18	91.04	55.61	17.00	65.03	41.01	19.44	78.90	49.17	32.30	102.46	67.38
W3	14.20	72.30	43.25	11.16	82.82	46.99	6.36	56.16	31.26	10.57	70.42	40.49	24.90	97.23	61.06
W4	28.67	87.26	57.96	26.93	100.15	63.54	25.83	73.53	49.68	27.14	86.98	57.06	39.07	112.10	75.58
W5	31.02	89.53	60.27	29.60	103.80	66.70	29.30	76.43	52.86	29.97	89.92	59.94	44.36	115.06	79.71
W6	130.13	168.27	149.20	144.06	182.31	163.18	124.30	157.16	140.73	132.83	169.24	151.03	160.73	192.76	176.73
MEAN	40.70	95.90		41.25	105.53		36.07	81.54		39.35	94.24		55.07	120.34	
G	SED	CD		SED	CD		SED	CD		SED	CD		SED	CD	
I	0.69	1.53		0.83	1.86		0.95	2.12		0.88	1.96		0.88	1.96	
W	1.80	3.60		2.01	4.02		2.14	4.28		1.95	3.91		1.95	3.91	
G x I	1.19	2.62		1.44	3.17		1.64	3.61		1.52	3.34		1.52	3.34	
W at G	2.55	5.10		2.84	5.69		3.02	6.05		2.69	5.39		2.69	5.39	
G at W	2.42	4.90		2.72	5.51		2.92	5.92		2.61	5.29		2.61	5.29	

NS - Not Significant RM - Rabi mean Other interactions are not significant

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maximum during rabi with the mean minimum of 45.28 and 40.49 g m<sup>-2</sup> on 60 and 105 DAS. The next treatment in order of reduced DMP was pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>) and it was comparable with application of pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS(W<sub>2</sub>) at both seasons.

Regarding interactions, the results with pre-sowing application of glyphosate prior to land preparation in combination with intercrops and also with pre-emergence herbicides based integrated weed management practices revealed appreciable influence on DMP of weeds. Pre-sowing application of glyphosate followed with groundnut + greengram intercropping considerably mimises the weed DMP. Similarly pre-sowing application of glyphosate along with pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS significantly excells other combinations.

#### **4.1.8. Weed Control Index (WCI) at harvest (Table 9) (Fig.6)**

The highest weed control index (WCI) was registered with pre-sowing application of glyphosate 15 prior to land preparation (G<sub>1</sub>) compared to unsprayed control (G<sub>2</sub>). The increased WCI under this treatment was observed at all the cropping years. The mean WCI of 68.98 obtained during rabi season was comparatively maximum.

Among intercropping systems, raising of greengram in groundnut (I<sub>2</sub>) recorded the maximum WCI per cent. Among the seasons, the mean WCI of 57.61 obtained during rabi, under this treatment was comparatively maximum. The groundnut + redgram (I<sub>3</sub>) intercropping system stood next in order. Similar trend was noticed at all the cropping years.

TABLE 9. WEED CONTROL INDEX ON 105 DAS - HARVEST

TREATMENT	1992			1994			1995			1996			KHARIF SEASON		
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN
	RABI SEASON			RABI SEASON			RABI SEASON			RABI SEASON			RABI SEASON		
V1	62.92	35.64	49.28	67.35	33.86	50.60	65.63	39.05	52.34	65.30	36.18	50.745	59.85	30.09	44.97
	(52.492)	(36.655)	(44.573)	(55.154)	(35.589)	(45.371)	(54.109)	(38.676)	(46.392)	(53.918)	(36.973)	(45.445)	(50.683)	(33.271)	(41.977)
V2	70.32	42.00	56.16	72.82	39.79	56.30	73.52	47.24	60.38	72.22	43.01	57.61	65.96	37.38	51.67
	(56.990)	(40.401)	(48.695)	(58.583)	(39.114)	(48.848)	(59.033)	(43.421)	(51.227)	(58.202)	(40.978)	(49.59)	(54.311)	(37.696)	(46.003)
V3	67.21	38.56	52.88	70.20	35.93	53.06	70.86	45.341	58.10	69.42	39.94	54.68	62.98	33.03	48.00
	(55.071)	(38.389)	(46.730)	(56.917)	(36.832)	(46.874)	(57.334)	(42.327)	(49.830)	(56.440)	(39.182)	(47.811)	(52.524)	(35.085)	(43.804)
V4	86.14	53.99	70.06	89.17	51.69	70.43	89.01	61.23	75.12	88.10	55.63	71.86	81.89	46.84	64.36
	(68.143)	(47.28)	(57.715)	(70.786)	(45.968)	(58.377)	(70.639)	(51.489)	(61.064)	(69.856)	(48.248)	(59.052)	(64.813)	(43.188)	(54.000)
V5	83.73	52.07	67.90	85.99	50.06	68.02	86.32	58.62	72.47	85.34	53.58	69.46	79.90	46.84	63.37
	(66.211)	(46.186)	(56.198)	(68.018)	(45.034)	(56.526)	(68.292)	(49.963)	(59.127)	(67.507)	(47.061)	(57.284)	(63.363)	(43.188)	(53.275)
V6	89.08	57.03	73.05	92.25	54.57	73.41	94.88	64.26	79.57	92.07	58.62	75.34	84.50	49.55	67.02
	(70.703)	(49.041)	(59.872)	(73.835)	(47.622)	(60.728)	(76.922)	(53.285)	(65.103)	(73.82)	(49.982)	(61.901)	(66.815)	(44.574)	(55.778)
V7	77.96	48.14	63.05	81.34	45.06	63.20	79.21	53.26	66.23	79.50	48.82	64.16	75.69	41.84	58.76
	(62.000)	(43.934)	(52.967)	(64.407)	(42.164)	(53.285)	(62.873)	(46.869)	(54.871)	(63.09)	(44.322)	(53.706)	(60.458)	(40.303)	(50.380)
V8	76.16	46.79	61.47	79.45	43.06	61.25	76.42	51.69	64.05	77.34	47.18	62.26	72.40	40.30	56.35
	(60.773)	(43.159)	(51.966)	(63.043)	(41.010)	(52.026)	(60.948)	(45.968)	(53.458)	(61.588)	(43.379)	(52.483)	(58.307)	(39.406)	(48.856)
V9	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)	(1.281)
MEAN	66.85	38.72		70.16	36.51		70.05	43.863		68.98	39.71		62.951	33.47	
	(54.851)	(38.481)		(56.895)	(37.179)		(56.825)	(41.475)		(56.186)	(39.044)		(52.506)	(35.351)	
	SED	CD		SED	CD		SED	CD		SED	CD		SED	CD	
	0.570	1.27		0.10	0.22		0.506	1.115		0.590	1.300		0.590	1.300	
	0.700	1.54		0.22	0.42		0.629	1.385		0.710	1.590		0.710	1.590	
	1.160	2.32		0.990	2.360		1.160	2.325		1.200	2.410		1.200	2.410	
	0.95	1.90		0.820	1.65		0.690	1.380		1.010	2.02		1.010	2.02	
	1.28	2.56		1.530	3.06		1.440	2.880		1.700	NS		1.700	NS	
	1.27	2.54		1.450	2.90		1.410	2.870		1.660	NS		1.660	NS	

DAS Days After Sowing - Figures in parenthesis denotes arc sin transformed values.

RM - Rabi mean All Other interactions are not significant

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Regardless of seasons, the pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) considerably increased the WCI. The mean WCI of 75.34 obtained during rabi seson was comparatively higher with an increase of 13.08 per cent than the recommended practice of hand weeding on 25 and 45 DAS. However, it was comparable with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>). The WCI obtained under pre-emergence application of oxyfluorfen @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>4</sub>) was comparatively the minimum.

Appreciable increment in WCI was noticed under the interaction of pre-sowing glyphosate application with intercropping of greengram in groundnut (G, I<sub>2</sub>). Similar increase was observed at all the cropping periods. The WCI was also found to be distinctly improved with pre-sowing glyphosate in combination with pre-emergence metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (G<sub>1</sub>W<sub>3</sub>). However, the significant impact was not ascertained during kharif season.

#### 4.1.9. NPK uptake by weeds at harvest (kg ha<sup>-1</sup>) : (Table 10)

The results on NPK uptake by weeds revealed that under pre-sowing application of glyphosate (G<sub>1</sub>) the quantum of nutrient removal by weeds was significantly lesser compared to untreated control (G<sub>2</sub>). The reduction in uptake with this treatment was uniformly observed at all the cropping years. The least mean NPK uptake of 21.99, 2.56 and 7.11 kg ha<sup>-1</sup> respectively, was registered during rabi season.

The nutrient removal by weeds was also considerably influenced by different intercropping practices. Intercropping of greengram in groundnut (I<sub>2</sub>) markedly restrict

Table - 10. Mean Nitrogen, Phosphorus and Potassium uptake by Weeds at 105 DAS (Kg ha<sup>-1</sup>) - Harvest

TREATMENTS	RABI SEASON												KHARIEF SEASON											
	1992				1994				1995				RM				1994							
	N	P	K	SE	N	P	K	SE	N	P	K	SE	N	P	K	SE	N	P	K	SE				
Pre - sowing glyphosate spray	21.98	2.44	7.02		23.11	2.89	7.68		20.90	2.35	6.65		21.96	2.56	7.11		24.30	3.10	8.17					
No Spraying of glyphosate	25.87	3.26	7.88		26.99	3.67	8.60		24.19	3.13	7.60		25.68	3.35	8.02		27.83	3.94	8.96					
SED	0.51	0.07	0.18		0.43	0.08	0.17		0.51	0.07	0.20		-	-	-		0.95	0.08	0.16					
CD	1.13	0.15	0.42		0.97	0.18	0.37		1.13	0.17	0.44		-	-	-		1.22	0.19	0.36					
Groundnut (sole)	24.85	2.98	7.85		25.81	3.43	8.55		23.20	2.92	7.37		24.62	3.11	7.92		26.72	3.63	8.76					
Groundnut + greengram	23.07	2.71	7.16		24.19	3.14	7.78		21.74	2.57	6.86		23.00	2.80	7.26		25.28	3.37	8.33					
Groundnut + redgram	23.86	2.84	7.34		25.14	3.27	8.10		22.70	2.76	7.16		23.90	2.95	7.53		26.20	3.56	8.61					
SED	0.62	0.08	0.23		0.53	0.10	0.20		0.62	0.09	0.22		-	-	-		0.58	0.10	0.19					
CD	1.39	0.19	0.51		1.18	0.22	0.46		1.39	0.20	0.48		-	-	-		1.21	NS	0.41					
P.E. fluchloralin @ 1.0kg a.i.ha <sup>-1</sup> +H.W. on 30DAS	18.54	2.37	6.45		19.40	2.81	6.98		17.40	2.32	6.10		18.44	2.50	6.51		20.30	2.95	7.45					
P.E. pendimethalin @ 1.0kg a.i.ha <sup>-1</sup> +H.W. on 30DAS	19.54	2.49	6.69		20.65	2.92	7.33		18.72	2.45	6.42		19.63	2.62	6.81		21.69	3.12	7.63					
P.E. metolachlor @ 1.0kg a.i.ha <sup>-1</sup> +H.W. on 30DAS	16.49	1.93	5.50		17.38	2.38	6.16		15.31	1.86	5.08		16.39	2.05	5.58		18.52	2.57	6.71					
P.E. oxyfluorfen @ 0.1kg a.i.ha <sup>-1</sup> +H.W. on 30DAS	22.58	2.86	7.48		23.50	3.28	8.19		21.43	2.76	7.41		22.50	2.96	7.69		24.48	3.50	8.38					
Recommended practice (Two H.W. on 25&45 DAS)	24.12	2.98	7.55		24.88	3.41	8.55		22.51	2.68	7.62		23.83	3.09	7.90		25.64	3.61	8.77					
Control (No weeding)	42.27	4.47	11.02		44.47	4.69	11.66		39.85	4.24	10.14		42.21	4.53	10.94		45.76	5.39	12.47					
SED	1.32	0.23	0.66		1.25	0.24	0.61		1.05	0.26	0.68		-	-	-		1.28	0.27	0.59					
CD	2.64	0.47	1.32		2.51	0.48	1.22		2.09	0.52	1.36		-	-	-		2.56	0.54	1.19					

P.E. - Pre-emergence DAS - Days after Sowing RM - Rabi/mean Interactions are not significant

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the nutrient removal by weeds. However, its was comparable with groundnut + redgram intercropping ( $I_3$ ) in minimising NPK uptake, except during rabi 1994. Among the season, the mean minimum uptake of NPK of with 23.0, 2.80 and 7.26 kg $ha^{-1}$  was recorded during rabi season.

Among the different integrated weed management practices, the NPK removal by the weeds was minimum under pre-emergence application of metolachlor @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $W_3$ ) and it was on par with pre-emergence fluchloralin @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $W_1$ ) at all the cropping years. Though the pre-emergence application of pendimethalin @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $W_2$ ) was next in order of reduced nitrogen and phosphorus removal, the quantity of potash uptake by the weeds with this treatment was comparable to the above treatments. The mean NPK uptake of 16.39, 2.05 and 5.58 kg  $ha^{-1}$  recorded during rabi season was comparatively the lowest.

#### **4.2. Growth components (Groundnut)**

##### **4.2.1. Plant height (cm) (Table 11)**

The pre sowing application of glyphosate ( $G_1$ ) distinctly increased the groundnut plant height, compared to the unsprayed control ( $G_2$ ). Irrespective of stages of crop growth and seasons the increase was maintained. The mean plant height of 15.20, 25.73 and 45.56 cm respectively on 30,60 and 105 DAS registered during rabi season was maximum.

The data on plant height with respect to different intercropping situations did not differ significantly. Though the numerical maximum was with groundnut + greengram intercropping ( $I_2$ ) it was on par with groundnut + redgram ( $I_3$ ) and sole groundnut ( $I_1$ ), at all the stages of crop growth and seasons.

Table - 11. Mean Plant Height at different growth stages (cm) - Groundnut

TREATMENTS	RABI SEASON						KHARIF SEASON								
	1992		1994		1995		RM		1984		DAS				
	30	60	105	30	60	105	30	60	105	30	60	105			
Pre-sowing glyphosate spray	14.9	25.5	44.8	15.2	25.5	45.5	15.5	26.2	46.4	15.2	25.7	45.5	14.1	23.7	42.9
No spraying of glyphosate	13.0	21.8	40.4	13.7	21.2	39.6	13.4	22.6	41.2	13.3	21.8	40.4	12.5	21.2	39.1
SED	0.31	0.45	0.46	0.34	0.44	0.49	0.26	0.41	0.49	-	-	-	0.30	0.34	0.53
CD	0.68	1.0	1.02	0.75	0.98	1.07	0.56	0.91	1.07	-	-	-	0.68	0.78	1.18
Groundnut (Sole)	14.0	23.0	41.9	14.2	22.7	42.0	14.5	23.9	43.0	14.3	23.2	42.3	13.1	22.0	40.6
Groundnut + greengram	14.2	24.4	43.1	14.5	24.1	43.2	14.7	25.0	44.7	14.4	24.5	43.6	13.7	23.0	41.4
Groundnut + redgram	13.8	23.5	42.9	13.9	23.3	42.5	14.2	24.5	43.7	13.9	23.7	43.0	13.3	22.6	41.0
SED	0.37	0.55	0.56	0.41	0.54	0.59	0.29	0.51	0.61	-	-	-	0.37	0.42	0.65
CD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
P.E. fluchloralin @ 1.0kg a.i.ha <sup>-1</sup> + H.W. on 30DAS	14.9	23.7	45.1	15.2	25.3	44.7	15.7	27.1	46.6	15.2	26.0	45.4	14.2	24.5	44.0
P.E. pendimethalin @ 1.0kg a.i.ha <sup>-1</sup> + H.W. on 30DAS	14.5	24.9	44.6	14.8	24.8	44.3	15.2	26.5	46.0	14.8	25.4	44.9	14.0	23.8	43.3
P.E. metolachlor @ 1.0kg a.i.ha <sup>-1</sup> + H.W. on 30DAS	15.4	26.9	46.7	16.0	26.8	46.8	16.4	28.8	48.5	15.9	27.5	47.3	14.6	25.5	45.4
P.E. oxyfluorfen @ 0.1kg a.i.ha <sup>-1</sup> + H.W. on 30DAS	13.9	23.3	42.9	13.8	23.1	42.7	14.1	22.8	43.9	13.9	23.0	43.1	13.1	22.2	41.6
Recommended practice (Two H.W. on 25 and 45 DAS)	12.7	22.6	41.9	12.8	21.4	41.8	12.9	22.0	42.1	12.8	22.0	45.2	12.1	21.1	40.7
Control (No Weeding)	12.5	18.6	34.4	12.5	18.8	35.2	12.5	19.4	35.8	12.5	18.9	35.1	12.0	17.9	31.0
SED	0.57	0.94	0.92	0.59	0.81	1.01	0.37	0.86	0.92	-	-	-	0.56	0.69	0.90
CD	1.15	1.89	1.84	1.19	1.62	2.03	0.75	1.72	1.84	-	-	-	1.10	1.38	1.98

P.E. - Pre-emergence DAS - Days after Sowing RM - Rabi mean Interactions are not significant

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The groundnut plant height was found to be considerably influenced by different integrated weed management practices. Regardless of seasons and crop stages, the plant height registered under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) was superior. Among the seasons, the mean plant height of 15.93 27.50 and 47.33 cm on 30, 60 and 105 DAS obtained during the rabi season was comparatively higher. However, this treatment was comparable with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>).

The plant height of groundnut was found to be unaltered due to the interaction effect of various treatments.

#### 4.2.2. Leaf Area Index (LAI) (Tables 12)

In general, the leaf area index (LAI) in groundnut increase with the advancement of crop age upto 60 DAS and thereafter it tends to decline.

The significantly maximum LAI was registered under pre-sowing spraying of glyphosate (G<sub>1</sub>) compared to unsprayed check (G<sub>2</sub>). The increase in LAI under this treatment was noticed at all stages of crop growth and seasons. The mean LAI of 1.79, 4.62 and 4.10 respectively on 30,60 and 105 DAS recorded during rabi season was higher.

Among the intercropping systems the LAI obtained under groundnut + greengram (I<sub>2</sub>) was much pronounced and it was comparable with groundnut + redgram (I<sub>3</sub>) intercropping at different stages of crop growth and seasons. Though the LAI under sole groundnut (I<sub>1</sub>) was also comparable at initial stages, it could not putforth

Table - 12. Mean Leaf Area Index at different growth stages (Groundnut)

TREATMENTS	RABI SEASON						KHARIEF SEASON								
	1992		1994		1995		RM		RM		1984				
	30	60	105	30	60	105	30	60	105	30	60	105			
Pre-sowing glyphosate spray	1.67	4.13	3.66	1.83	4.65	4.15	1.89	5.10	4.50	1.79	4.62	4.10	1.53	3.79	3.10
No spraying of glyphosate	1.50	2.78	2.49	1.62	3.10	2.83	1.58	3.43	2.99	1.56	3.10	2.77	1.41	2.58	2.17
SED	0.20	0.04	0.06	0.03	0.07	0.09	0.02	0.06	0.69	-	-	-	0.03	0.06	0.05
CD	0.60	0.09	0.14	0.07	0.16	0.19	0.04	0.13	0.16	-	-	-	0.07	0.14	0.12
Groundnut (sole)	1.58	3.29	2.81	1.72	3.52	3.16	1.72	4.01	3.42	1.67	3.63	3.13	1.44	2.96	2.43
Groundnut + greengram	1.60	3.62	3.25	1.74	4.13	3.74	1.80	4.46	3.99	1.71	4.07	3.66	1.50	3.72	2.77
Groundnut + redgram	1.58	3.46	3.17	1.72	3.97	3.57	1.69	4.32	3.83	1.66	3.91	3.52	1.49	3.36	2.73
SED	0.03	0.12	0.07	0.04	0.08	0.11	0.05	0.07	0.08	-	-	-	0.03	0.18	0.07
CD	NS	0.24	0.17	NS	0.19	0.23	NS	0.16	0.19	-	-	-	NS	0.36	0.14
P.E. fluchlorain @ 1.0kg a.i/ha <sup>1</sup> + H.W. on 30DAS	1.75	4.10	3.83	1.81	4.46	4.15	1.83	4.93	4.51	1.79	4.49	4.16	1.69	3.72	3.30
P.E. pendimethalin @ 1.0kg a.i/ha <sup>1</sup> + H.W. on 30DAS	1.74	3.92	3.64	1.76	4.31	4.15	1.79	4.70	4.28	1.76	4.32	4.02	1.66	3.61	3.17
P.E. metolachlor @ 1.0kg a.i/ha <sup>1</sup> + H.W. on 30DAS	1.84	4.36	4.09	1.86	4.70	4.40	1.92	5.17	4.72	1.87	4.74	4.40	1.73	3.89	3.48
P.E. oxyfluorfen @ 0.1kg a.i/ha <sup>1</sup> + H.W. on 30DAS	1.64	3.21	2.89	1.74	3.71	3.46	1.74	4.12	3.71	1.70	3.68	3.35	1.61	3.09	2.50
Recommended practice (Two H.W. on 25 and 45 DAS)	1.28	3.01	2.71	1.60	3.34	3.08	1.58	3.72	3.30	1.48	3.35	3.03	1.13	2.71	2.14
Control (No weeding)	1.26	2.13	1.29	1.58	2.70	1.72	1.53	2.96	1.96	1.46	2.59	1.65	1.09	2.12	1.23
SED	0.12	0.22	0.17	0.06	0.19	0.15	0.13	0.21	0.24	-	-	-	0.13	0.19	0.18
CD	0.24	0.44	0.33	0.12	0.38	0.31	0.27	0.42	0.48	-	-	-	0.26	0.38	0.36

PE - Pre-emergence DAS - Days after Sowing RM - Rabi/mean Intractions are not significant

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appreciable results beyond 30 DAS. Among the seasons, the LAI recorded under groundnut + greengram (I<sub>2</sub>) during rabi season was higher with the mean of 4.07 and 3.66 respectively on 60 and 105 DAS.

The data on LAI revealed the positive influence of pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>). The significant increment in LAI under this treatment was observed at different crop stages and seasons with a mean maximum of 1.87, 4.74 and 4.40 respectively on 30, 60 and 105 DAS during rabi season. However, it was on par with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>) and pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>2</sub>).

The interaction effect of the above weed management practice with other treatments do not exerts significant variations in LAI of groundnut.

#### 4.2.3. Drymatter production (g plant<sup>-1</sup>) (Table 13)

The dry matter production (DMP) in groundnut was found to be increased in accordance with the age of the crop. The quantum of DMP under pre-sowing glyphosate application prior to land preparation (G<sub>1</sub>) was significantly superior compared to untreated control (G<sub>2</sub>). The trend was well established at different stages of crop growth and seasons. The mean DMP of 2.26, 6.84 and 16.25 g plant<sup>-1</sup> respectively on 30, 60 and 105 DAS recorded during rabi season was maximum.

The result revealed that appreciable influence of intercropping practices on groundnut DMP. Regardless of seasons, the groundnut + greengram intercropping (I<sub>2</sub>) registered the maximum DMP and it was statistically on par with groundnut +

Table - 13. Mean Dry matter production at different growth stages (g plant<sup>-1</sup>) Groundnut

TREATMENTS	RABI SEASON						KHARIEF SEASON								
	1992		1994		1995		RM		RM		1994				
	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS				
30	60	105	30	60	105	30	60	105	30	60	105				
Pre - sowing glyphosate spray	2.09	6.38	15.32	2.31	6.94	16.37	2.39	7.22	17.07	2.26	6.84	16.25	1.90	6.31	14.72
No spraying of glyphosate	1.36	4.09	10.47	1.49	4.40	11.06	1.53	4.80	12.22	1.46	4.43	11.25	1.25	4.10	9.85
SEd	0.05	0.09	0.29	0.04	0.11	0.15	0.05	0.11	0.29	-	-	-	0.03	0.08	0.16
CD	0.10	0.21	0.64	0.09	0.24	0.33	0.13	0.23	0.64	-	-	-	0.08	0.19	0.35
Groundnut (sole)	1.73	4.93	12.66	1.87	5.43	13.56	1.94	5.73	13.96	1.81	5.36	13.39	1.56	5.00	12.10
Groundnut + greengram	1.77	5.40	13.22	1.96	5.86	14.10	2.01	6.21	15.26	1.91	5.82	14.19	1.61	5.35	12.51
Groundnut + redgram	1.71	5.37	12.86	1.87	5.71	13.81	1.92	6.07	14.69	1.83	5.71	13.78	1.57	5.26	12.23
SEd	0.05	0.12	0.24	0.05	0.13	0.18	0.04	0.12	0.35	-	-	-	0.04	0.11	0.17
CD	NS	0.27	0.52	NS	0.29	0.39	NS	0.28	0.79	NS	0.28	0.79	NS	0.24	0.37
P.E. fluchloralin @ 1.0kg a i ha <sup>-1</sup> + HW on 30DAS	1.97	6.20	14.59	2.14	6.60	15.12	2.22	7.07	16.58	2.11	6.52	15.43	1.77	6.09	13.57
P.E. pendimethalin @ 1.0kg a i ha <sup>-1</sup> + HW on 30DAS	1.86	5.76	13.44	2.06	6.50	14.92	2.11	6.76	15.87	2.01	6.34	14.74	1.71	5.42	13.33
P.E. metolachlor @ 1.0kg a i ha <sup>-1</sup> + HW on 30DAS	2.19	6.69	15.75	2.37	7.01	16.38	2.55	7.57	18.06	2.37	7.09	16.73	1.96	7.02	14.95
P.E. oxyfluorfen @ 0.1kg a i ha <sup>-1</sup> + HW on 30DAS	1.67	5.12	12.20	1.83	5.56	13.48	1.90	5.83	14.27	1.80	5.56	13.31	1.54	4.99	11.52
Recommended Practice (Two HW on 25 and 45 DAS)	1.39	4.72	11.54	1.52	5.06	12.83	1.52	5.24	13.49	1.47	5.00	12.62	1.27	4.62	10.88
Control ( No weeding)	1.30	2.92	9.87	1.48	3.29	9.59	1.43	3.59	9.63	1.40	3.26	9.69	1.23	2.69	9.47
SEd	0.16	0.29	0.81	0.17	0.31	0.72	0.23	0.32	0.78	-	-	-	0.14	0.46	0.77
CD	0.31	0.59	1.61	0.34	0.62	1.44	0.46	0.65	1.57	-	-	-	0.28	0.92	1.53

P.E. - Pre-emergence DAS - Days after Sowing RM - Rat. mean Interactions are not significant

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redgram ( $I_3$ ). Though the DMP under sole groundnut ( $I_2$ ) was comparable at initial stage, it tends to decrease significantly beyond 30 DAS. Among the season, the DMP during rabi season was higher with the mean of 1.91, 5.82 and 14.19 g plant<sup>-1</sup> on 30,60 and 105 DAS.

The DMP recorded under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W.on 30 DAS ( $W_3$ ) was significantly higher with mean maximum increase of 0.97, 2.09 and 4.11 g plant<sup>-1</sup> respectively on 30,60 and 105 DAS over the recommended practice of hand weeding on 25 and 45 DAS ( $W_2$ ) during rabi season. However, it was comparable with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W.on 30 DAS ( $W_1$ ) at all stages of crop growth and seasons. Though the DMP in groundnut under pre-emergence application of pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W.on 30 DAS ( $W_2$ ) was comparable at initial stage of crop growth, it could not able to maintain the trend beyond 30 DAS.

Irrespective of stages of crop growth and seasons, the combination of various weed management measures and intercropping did not exert significant influence on groundnut DMP.

#### **4.2.4. Number of Nodules plant<sup>-1</sup> (Table 14)**

The number of nodules plant<sup>-1</sup> was found to be higher with the pre-sowing spraying of glyphosate ( $G_1$ ) than unsprayed control ( $G_2$ ). The increased nodulation of groundnut under this treatment was observed at all the cropping years. Comparatively higher mean number of nodules plant<sup>-1</sup> of 110.62 was accounted during rabi.

TABLE - 14. NO OF NODULES PLANT<sup>-1</sup> (GROUNDNUT)

TREATMENT	1992				1994				RABI SEASON				1995				KHARIF SEASON					
	G1		G2		G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN	
	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD
XI	105.58	99.21	104.23	107.93	113.97	105.50	109.74	119.90	112.13	116.02	115.16	107.28	111.22	107.16	100.47	103.82	101.63	95.13	98.38	101.63	95.13	98.38
	108.18	101.90	105.04	110.18	102.51	106.35	116.68	109.83	113.26	111.68	104.74	108.21	103.53	97.06	100.30	102.52	96.58	99.55	102.52	96.58	99.55	102.52
	107.56	99.96	103.76	109.51	102.05	105.78	115.68	109.10	112.39	110.91	103.70	107.30	102.52	96.58	99.55	102.52	96.58	99.55	102.52	96.58	99.55	102.52
XW	111.63	104.23	107.93	113.97	105.50	109.74	119.90	112.13	116.02	115.16	107.28	111.22	107.16	100.47	103.82	101.63	95.13	98.38	101.63	95.13	98.38	101.63
	110.60	103.10	106.85	112.86	104.67	108.77	118.63	110.93	114.78	114.03	106.23	110.13	106.27	99.53	102.90	106.27	99.53	102.90	106.27	99.53	102.90	106.27
	113.86	106.27	110.07	116.60	107.90	112.25	122.43	114.36	118.40	117.63	109.51	113.57	109.13	102.30	105.72	109.13	102.30	105.72	109.13	102.30	105.72	109.13
	106.23	100.06	103.15	108.67	101.08	104.88	114.96	107.96	111.46	109.95	103.03	106.49	102.20	96.30	99.25	102.20	96.30	99.25	102.20	96.30	99.25	102.20
	104.57	98.23	101.40	107.26	99.90	103.58	113.80	106.06	109.93	108.54	101.39	104.96	100.90	94.50	97.70	100.90	94.50	97.70	100.90	94.50	97.70	100.90
	95.76	90.26	93.01	97.93	91.40	94.67	101.73	97.23	99.48	98.47	92.96	95.71	89.70	84.47	87.09	89.70	84.47	87.09	89.70	84.47	87.09	89.70
MEAN	107.11	100.36	103.40	109.55	101.74	105.50	111.22	107.28	111.22	107.28	111.22	107.28	107.28	107.28	107.28	107.28	107.28	107.28	107.28	107.28	107.28	107.28
SEd	0.54	1.22	0.54	1.22	0.64	1.42	0.53	1.18	0.53	1.18	0.53	1.18	0.53	1.18	0.53	1.18	0.53	1.18	0.53	1.18	0.53	1.18
CD	0.67	1.49	0.67	1.49	0.78	NS	0.65	1.45	0.65	1.45	0.65	1.45	0.65	1.45	0.65	1.45	0.65	1.45	0.65	1.45	0.65	1.45
at G	1.21	2.49	1.21	2.49	1.32	2.64	1.23	2.47	1.23	2.47	1.23	2.47	1.23	2.47	1.23	2.47	1.23	2.47	1.23	2.47	1.23	2.47
at W	0.95	NS	0.95	NS	1.11	NS	0.92	NS	0.92	NS	0.92	NS	0.92	NS	0.92	NS	0.92	NS	0.92	NS	0.92	NS
at G x W	1.71	NS	1.71	NS	1.87	NS	1.75	NS	1.75	NS	1.75	NS	1.75	NS	1.75	NS	1.75	NS	1.75	NS	1.75	NS
at W x G	1.66	NS	1.66	NS	1.82	NS	1.68	NS	1.68	NS	1.68	NS	1.68	NS	1.68	NS	1.68	NS	1.68	NS	1.68	NS

NS - Not significant

RM - Rabi mean

Other interactions are not significant

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The practice of intercropping in groundnut do not influence the nodulation number plant<sup>-1</sup>. Eventhough the numerical increase was accompanied under groundnut + greengram intercropping (I<sub>2</sub>), the system was comparable with groundnut + redgram intercropping (I<sub>3</sub>) and sole groundnut (I<sub>1</sub>). The trend was almost similar at different cropping periods.

The nodulation behaviour of groundnut was significantly improved under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. son 30 DAS (W<sub>3</sub>). The mean number of nodules plant<sup>-1</sup> of 113.57 recorded during rabi was maximum among the seasons. Despite the cropping years, the nodule number registered under pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>) was comparable with the above treatment.

The interaction effect of various weed management practice and combinations with intercropping fails to alter the nodulation number in groundnut significantly.

#### **4.3. Growth components of intercrops ( Table 15)**

The different weed management practices exerts commendable influence on growth components of intercrops viz. plant height, leaf area index (LAI) and drymatter production (DMP).

Regardless of the cropping years, the pre-sowing application of glyphosate (G<sub>1</sub>) favourably improves the growth parameters of greengram and redgram. The mean values of plant height with 43.56 and 96.31 cm, LAI with 2.53 and 1.93, DMP with 11.53 and 40.65 g plant<sup>-1</sup> respectively recorded with greengram and redgram, during

TABLE -15. Mean Growth Components of Intercrops at Harvest

TREATMENTS	PLANT HEIGHT (cm)				LEAF AREA INDEX				DRY MATTER PRODUCTION (g plant <sup>-1</sup> )						
	R'92	R'94	R'95	RM	K'94	R'92	R'94	R'95	RM	K'94	R'92	R'94	R'95	RM	K'94
W1	46.4	44.9	47.3	46.2	42.3	2.80	2.72	2.99	2.83	2.35	12.6	12.1	13.0	12.5	11.4
W2	45.0	43.5	46.0	44.8	42.3	2.73	2.68	2.92	2.77	2.30	12.0	11.5	12.6	12.0	11.0
W3	47.8	46.6	49.3	47.9	43.6	2.96	2.91	3.17	3.01	2.43	13.5	12.8	13.9	13.4	12.1
W4	43.5	42.2	44.7	43.4	40.7	2.56	2.52	2.78	2.62	2.04	11.3	10.7	11.5	11.1	10.5
W5	41.9	41.0	43.4	42.1	40.3	2.54	2.48	2.72	2.58	1.98	10.8	10.5	11.2	10.8	10.3
W6	36.9	36.4	37.9	37.0	34.5	1.40	1.29	1.48	1.39	1.07	9.5	8.9	9.8	9.4	8.4
Mean	43.5	42.4	44.7	43.5	40.6	2.49	2.43	2.67	2.53	2.02	11.6	11.0	12.0	11.5	10.6
W1	100.2	97.0	102.3	99.8	95.9	2.17	2.14	2.33	2.21	2.03	43.5	39.2	45.8	42.8	38.2
W2	100.2	95.4	101.8	99.1	95.0	2.09	1.98	2.30	2.12	1.94	42.8	38.6	44.3	41.9	37.4
W3	103.8	100.7	106.2	103.5	96.4	2.35	2.31	2.53	2.39	2.25	45.5	41.3	48.7	45.1	40.2
W4	77.4	74.3	100.4	90.7	93.4	1.97	1.93	2.16	2.02	1.85	40.6	36.7	41.2	39.5	35.7
W5	97.7	93.5	99.2	96.8	92.5	1.92	1.90	2.13	1.98	1.85	40.2	36.0	40.5	38.9	34.4
W6	87.8	85.1	91.2	88.0	83.7	0.98	0.63	1.14	0.91	0.84	36.3	33.5	37.4	35.7	31.2
Mean	94.5	94.3	100.1	96.3	92.8	1.91	1.81	2.09	1.93	1.79	41.4	37.5	42.9	40.6	36.1
W1	44.0	41.2	43.7	42.9	38.6	2.42	2.19	2.21	2.27	1.95	11.5	10.3	11.3	11.0	9.7
W2	43.4	41.0	43.0	42.4	38.2	2.38	2.17	2.20	2.25	1.91	11.5	9.8	11.0	10.7	9.3
W3	46.6	42.7	45.2	44.8	40.3	2.56	2.30	2.35	2.40	2.04	12.2	11.0	11.9	11.7	10.4
W4	42.7	39.4	42.1	41.4	37.4	2.27	2.08	2.14	2.16	1.84	10.6	9.2	10.2	10.0	8.5
W5	42.5	38.8	41.3	40.8	36.6	2.21	2.01	2.06	2.09	1.79	9.9	9.0	9.6	9.5	8.2
W6	33.5	32.6	35.6	33.9	30.8	1.23	1.07	1.14	1.14	0.78	7.2	6.7	7.0	6.9	6.3
Mean	42.1	39.2	29.6	41.0	36.9	2.17	1.97	2.01	2.05	1.71	10.4	9.3	10.1	9.9	8.7
W1	94.4	91.3	95.3	93.6	89.5	1.79	1.67	1.70	1.72	1.56	41.4	37.6	39.1	39.3	35.2
W2	91.8	90.5	94.4	92.2	87.8	1.75	1.62	1.70	1.69	1.52	40.3	37.0	38.3	38.5	34.7
W3	97.5	94.8	98.7	97.0	91.6	1.96	1.84	1.91	1.90	1.71	43.5	69.4	41.2	51.3	36.8
W4	88.3	88.0	94.9	90.4	87.2	1.63	1.50	1.54	1.55	1.46	37.6	35.5	36.4	36.5	33.2
W5	87.6	85.9	91.2	88.2	84.4	1.60	1.45	1.47	1.50	1.38	36.4	33.0	34.9	34.7	32.5
W6	80.8	78.5	84.3	81.2	78.0	0.82	0.76	0.73	0.77	0.63	34.1	30.7	32.8	32.5	29.4
Mean	90.0	88.1	93.1	90.4	86.4	1.59	1.47	1.50	1.52	1.12	38.8	40.5	37.1	38.8	33.6

RM : Rabi mean  
NA - Data Not Analysed

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rabi seasons was higher. Similarly, considerable increase in growth parameters were accounted with pre-emergence application of metolachlor @ 1.0 kg a.i.ha<sup>-1</sup> + one H.W.on 30 DAS (W<sub>3</sub>) either with or without the combination of glyphosate application. The increment with this treatment was noticed at all the cropping years. Regarding the interactions, the mean values of the above growth components of both the intercrops were higher with the pre-sowing application of glyphosate combined with pre-emergence application of metolachlor @ 1.0 kg a.i.ha<sup>-1</sup> + one H.W. on 30 DAS (G<sub>1</sub>W<sub>3</sub>). Among the seasons, the maximum values of 47.9 and 103.5 cm in plant height, 3.01 and 2.39 in LAI and 13.4 and 45.1 g plant<sup>-1</sup> in DMP were obtained during rabi.

#### 4.4. Yield components (Groundnut)

##### 4.4.1. Number of matured pods plants<sup>-1</sup> (Table 16) (Fig.7)

The results with respect to number of matured pods plant<sup>-1</sup> in both the seasons of study showed positive response to pre-sowing glyphosate application (G<sub>1</sub>) compared to untreated control (G<sub>2</sub>). The mean number of matured pods plant<sup>-1</sup> of 16.06 documented during rabi season was higher.

Regardless of seasons the the practice of intercropping in groundnut did not alter the number of matured pods plant<sup>-1</sup>. Though the numerically higher number of matured pods plant<sup>-1</sup> was noticed under groundnut + greengram intercropping (I<sub>2</sub>) it was statistically on par with intercropping of groundnut + redgram (I<sub>3</sub>) (or) the sole groundnut (I<sub>1</sub>).

The pre-emergence application of metolachlor @ 1.0 kg a.i.ha<sup>-1</sup> + one H.W.on 30 DAS (W<sub>3</sub>) significantly registered the maximum number of matured pods plant<sup>-1</sup>.

TABLE - 16. NUMBER OF MATURED PODS PLANT<sup>-1</sup> (GROUNDNUT)

TREATMENT	1992						RABI SEASON			1995			KHARIF SEASON					
	G1		G2		MEAN		G1	MEAN	G2	MEAN	G1	MEAN	G2	MEAN	G1	MEAN	G2	MEAN
	G1	G2	G1	G2	MEAN	G1	MEAN	G2	MEAN	G1	MEAN	G2	MEAN	G1	MEAN	G2	MEAN	
<b>G X I</b>																		
I1	15.3	11.6	13.4	15.3	11.7	13.5	16.5	12.6	14.6	15.70	11.97	13.84	13.8	10.3	12.1			
I2	15.9	12.1	14.0	16.3	12.3	14.3	17.2	13.1	15.2	16.47	12.50	14.49	14.6	11.1	12.9			
I3	15.5	11.7	13.6	15.9	12.0	14.0	16.7	12.7	14.7	16.03	12.13	14.08	14.3	10.9	12.6			
<b>G X W</b>																		
W1	16.9	12.9	14.9	16.9	12.8	14.9	18.2	13.8	16.0	17.33	13.17	15.25	15.6	11.7	13.7			
W2	16.4	2.5	14.5	16.7	12.7	14.7	17.8	13.5	15.7	16.97	12.90	14.94	15.4	11.5	13.5			
W3	18.0	13.7	15.9	18.4	14.0	16.2	19.6	14.8	17.2	18.67	14.17	16.42	16.6	12.7	14.7			
W4	15.6	11.7	13.6	15.7	11.7	13.7	16.5	12.6	14.6	15.97	12.00	13.99	14.2	10.6	12.4			
W5	15.0	11.4	13.2	15.2	11.5	13.4	16.1	12.3	14.2	15.43	11.73	13.58	13.7	10.3	12.0			
W6	11.3	8.6	10.0	12.1	9.2	10.7	12.5	10.1	11.3	11.97	9.30	10.64	9.9	7.8	8.9			
MEAN	15.5	11.8		15.8	12.0		16.8	12.9		16.06	12.20		14.2	10.8				
	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD
G	0.37	0.82	0.34	0.76	0.36	0.79	0.36	0.79	0.31	0.68	0.31	0.68	0.31	0.68	0.31	0.68	0.31	0.68
I	0.45	NS	0.41	NS	0.43	NS	0.43	NS	0.37	NS	0.37	NS	0.37	NS	0.37	NS	0.37	NS
W	0.87	1.75	0.81	1.62	0.91	1.82	0.91	1.82	0.78	1.56	0.78	1.56	0.78	1.56	0.78	1.56	0.78	1.56
G x I	0.64	NS	0.59	NS	0.62	NS	0.62	NS	0.53	NS	0.53	NS	0.53	NS	0.53	NS	0.53	NS
W at G	1.24	NS	1.14	NS	1.29	NS	1.29	NS	1.10	NS	1.10	NS	1.10	NS	1.10	NS	1.10	NS
G at W	1.19	NS	1.1	NS	1.23	NS	1.23	NS	1.05	NS	1.05	NS	1.05	NS	1.05	NS	1.05	NS

NS - Not significant

RM - Rabi mean

Other interactions are not significant

However, the effect of pre-emergence application of fluchloralin @ 1.0kg a.i. ha<sup>-1</sup> + one H.W.on 30 DAS (W<sub>1</sub>) and pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>2</sub>) on number of pods plant<sup>-1</sup> were also comparable. Among seasons, the highest mean number of pods plant<sup>-1</sup> of 16.42 under the pre-emergence application of metolachlor @ 1.0 kg a.i ha<sup>-1</sup> + one H.W.on 30 DAS (W<sub>3</sub>) was recorded during rabi, with an improvement of 2.84 pods plant<sup>-1</sup> over recommended practice of hand weeding on 25 and 45 DAS (W<sub>5</sub>).

#### 4.4.2. Number of immature pods plant<sup>-1</sup> (Table 17)

The trend that observed with number of matured pods plant<sup>-1</sup> got reversed for this character. Irrespective of cropping seasons the highest number of immature pods plant<sup>-1</sup> was observed with glyphosate unsprayed control plots (G<sub>2</sub>) than treated plots (G<sub>1</sub>). The mean number of immature pods plant<sup>-1</sup> of 6.29 noticed under the glyphosate application during rabi season was comparatively minimum.

The number of immature pods plant<sup>-1</sup> in regard to different intercropping practices did not differ distinctly. Though the numerical minimum was observed with groundnut + greengram (I<sub>2</sub>) system it was comparable with groundnut + redgram (I<sub>3</sub>) and the sole groundnut (I<sub>1</sub>). The trend was identical at all the cropping seasons.

Irrespective of the seasons, the results showed that the number of immature pods plant<sup>-1</sup> was significantly minimum under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W.on 30 DAS (W<sub>3</sub>). However, this treatment was on par with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> and pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> respectively followed by one hand weeding on 30 DAS (W<sub>1</sub> and W<sub>2</sub>).

TABLE - 17. NUMBER OF IMMATURE PODS PLANT<sup>-1</sup> (Groundnut)

TREATMENT	1992			1994			RABI SEASON			1995			MEAN			KHARIF SEASON			
	G1	G2	MEAN	G1	G2	MEAN	MEAN	G1	G2	MEAN	MEAN	G1	G2	MEAN	MEAN	G1	G2	MEAN	
	SED	CD		SED	CD			SED	CD			SED	CD			SED	CD		
<b>G X I</b>																			
I1	6.1	7.8	7.0	6.4	8.9	7.7	6.6	6.6	8.7	7.7	6.37	8.47	7.42	5.4	7.4	6.4			
I2	5.7	7.1	6.4	6.1	8.6	7.4	6.4	8.3	7.4	7.4	6.07	8.00	7.04	5.3	6.9	6.1			
I3	5.9	7.3	6.6	6.4	8.7	7.6	7.0	8.8	7.9	6.43	8.27	7.35		5.3	6.9	6.1			
<b>G X W</b>																			
W1	5.2	6.6	5.9	5.6	8.0	6.8	6.8	8.5	7.7	5.57	7.50	6.54	4.7	6.2	5.5				
W2	5.4	6.9	6.2	5.8	8.1	7.0	5.9	7.9	6.9	6.00	7.83	6.92	4.9	6.6	5.8				
W3	4.8	6.2	5.5	5.2	7.5	6.4	5.3	7.3	6.3	5.10	7.00	6.05	4.2	5.8	5.0				
W4	6.1	7.7	6.9	6.6	9.1	7.9	6.8	8.8	7.8	6.50	8.53	7.52	5.6	7.3	6.5				
W5	6.5	8.0	7.3	6.8	9.3	8.1	7.1	9.1	8.1	6.80	8.13	7.80	5.9	7.7	6.8				
W6	7.4	9.1	8.3	7.7	10.3	9.0	8.1	10.1	9.1	7.73	9.83	8.78	6.8	8.7	7.8				
MEAN	5.9	7.4	-	6.3	8.7	-	6.7	8.6	-	6.29	8.24	-	-	5.4	7.1	-			
<b>G</b>	0.16	0.37		0.16	0.36		0.32	0.73		0.19	0.43			0.23	NS				
<b>I</b>	0.21	NS		0.20	NS		0.40	NS		0.47	0.94			0.33	NS				
<b>W</b>	0.49	0.99		0.51	1.10		0.75	1.41		0.67	NS			0.64	NS				
<b>G x I</b>	0.28	NS		0.28	NS		0.57	NS		0.67	NS			0.67	NS				
<b>W at G</b>	0.71	NS		0.92	NS		1.10	NS		0.67	NS			0.67	NS				
<b>G at W</b>	0.66	NS		0.85	NS		1.00	NS		0.64	NS			0.64	NS				

NS - Not significant

RM - Rabi mean

Other interactions are not significant

The mean number of immature pods plant<sup>-1</sup> of 6.05 documented during rabi was minimum. The reduction was to the tune of 1.75 immature pods plant<sup>-1</sup> under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) than the recommended practice of hand weeding on 25 and 45 DAS (W<sub>6</sub>).

#### 4.4.3. 100 Kernel weight (g) (Table 18)

The data on 100 kernel weight confirmed the fact of supremacy of pre-sowing glyphosate application (G<sub>1</sub>) compared to untreated check (G<sub>2</sub>). Despite the cropping seasons a positive influence was observed. Among seasons, the mean 100 kernel weight of 26.59 g, documented during rabi season was fairly higher.

The critical variations in 100 kernel weight of groundnut was not noticed among the intercropping systems. Intercropping of greengram in groundnut (I<sub>2</sub>) or redgram (I<sub>3</sub>) and the sole groundnut (I<sub>1</sub>) were identical in their expression at all the cropping years.

A deviation from that of other yield parameters in groundnut, the different weed management practices exerts poor impact on 100 kernel weight. Irrespective of the cropping seasons, the pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) recorded higher 100 kernel weight in groundnut. However, the significant increase was seen only from that of unweeded control (W<sub>8</sub>).

The combination of different weed management packages and intercropping were also found ineffective in altering the 100 kernel weight in groundnut. Irrespective of seasons the trend was similar.

TABLE -18. 100 KERNAL WEIGHT (g) (GROUNDNUT)

TREATMENT	1992				1994				1995				1996				KHARIF SEASON					
	G1		G2		G1		G2		G1		G2		G1		G2		G1		G2			
	MEAN	CD	MEAN	CD	MEAN	CD	MEAN	CD	MEAN	CD	MEAN	CD	MEAN	CD	MEAN	CD	MEAN	CD	MEAN	CD		
<b>G X I</b>																						
I1	25.60	23.80	24.70	26.12	24.13	25.13	26.86	25.12	25.99	26.19	24.35	25.27	24.90	23.16	24.03							
I2	26.30	24.40	25.35	26.80	24.73	25.77	27.95	25.76	26.86	27.02	24.96	25.99	25.58	23.96	24.77							
I3	26.03	24.20	25.12	26.58	24.33	25.46	27.13	25.41	26.27	26.58	24.65	25.62	25.46	23.70	24.58							
<b>G X W</b>																						
W1	26.90	24.90	25.90	27.23	25.06	26.15	28.30	26.33	27.32	27.48	26.81	27.15	26.03	24.20	25.12							
W2	26.60	24.60	25.60	27.16	24.93	26.05	28.06	26.20	27.13	27.27	25.24	26.26	25.86	24.10	24.98							
W3	27.30	25.20	26.25	27.86	25.56	26.71	28.90	26.70	27.80	28.02	25.82	26.92	26.46	24.56	25.51							
W4	26.10	24.30	25.20	26.70	24.50	25.60	27.36	25.63	26.50	26.72	24.81	25.77	25.40	23.70	24.55							
W5	25.80	24.00	24.90	26.33	24.36	25.35	27.10	25.30	26.20	26.41	24.55	25.48	25.03	23.43	24.23							
W6	23.20	21.90	22.55	23.70	21.96	22.83	24.16	22.43	23.30	23.69	22.10	22.89	23.10	21.66	22.38							
MEAN	25.98	24.15	25.43	26.50	24.40	25.43	27.31	25.43	26.59	24.65	25.31	23.60										
<b>G</b>	0.42	0.94	0.42	0.95	0.35	0.79	0.35	0.79	0.35	0.79	0.33	0.73										
<b>I</b>	0.52	NS	0.52	NS	0.43	NS	0.43	NS	0.41	NS	0.41	NS										
<b>W</b>	0.95	1.90	1.10	2.01	0.93	1.87	0.93	1.87	0.86	1.73	0.86	1.73										
<b>G x I</b>	0.73	NS	0.73	NS	0.62	NS	0.62	NS	0.57	NS	0.57	NS										
<b>W x I</b>	1.34	NS	1.42	NS	1.32	NS	1.32	NS	1.23	NS	1.23	NS										
<b>G x W</b>	1.30	NS	1.37	NS	1.26	NS	1.26	NS	1.17	NS	1.17	NS										

NS - Not Significant RM - Rabi mean Other interactions are not significant

#### 4.4.4. Shelling per centage (Tables 19)

The effect of pre-sowing glyphosate application ( $G_1$ ) on shelling per centage was much pronounced than no spraying of glyphosate ( $G_2$ ). The increment under this treatment was noticed at different cropping years. The mean shelling per cent of 71.37 recorded during rabi season was comparatively higher, with an increase of 2.35 per cent over kharif.

The data with respect to shelling per centage revealed the non-significant impact of different intercropping practices in groundnut. The intercropping of greengram in groundnut ( $I_2$ ) though recorded the numerically maximum shelling per cent, it could not differ distinctly from groundnut + redgram ( $I_3$ ) and sole crop of groundnut ( $I_1$ ). Regardless of cropping years the trend was similar.

The integrated weed management practices exerts considerable influence on shelling per centage at different cropping periods. Among them the shelling per cent obtained with pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) was superiorly higher but it was statistically comparable with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> and pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> respectively with one hand weeding on 30 DAS ( $W_1$  and  $W_2$ ). During rabi the mean maximum shelling per cent of 71.82 documented under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) and it was 1.67 per cent increased over the recommended practice of hand weeding on 25 and 45 DAS ( $W_5$ ).

The significant variation in shelling per centage of groundnut was not observed under different combinations of weed management practices and intercropping at all the cropping years.

TABLE - 19. SHELLING PER CENTAGE (GROUNDNUT)

TREATMENT	1992				1994				1995				1996				
	G1		G2		G1		G2		G1		G2		G1		G2		
	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	
<b>G X I</b>																	
I1	70.33	67.98	69.16	70.90	68.31	69.61	71.43	68.73	70.08	70.89	68.34	67.12	68.98	67.10	68.04		
I2	71.21	69.06	70.14	71.73	69.45	70.59	72.58	70.48	71.53	71.84	69.66	70.75	69.96	67.86	68.91		
I3	70.65	68.83	69.74	71.16	68.96	70.06	72.38	69.46	70.92	71.40	69.08	73.24	69.21	67.56	68.39		
<b>G X W</b>																	
W1	71.73	69.63	70.68	72.13	69.80	70.97	73.20	70.83	72.02	72.35	70.09	71.22	70.43	68.30	69.37		
W2	71.43	69.33	70.38	72.00	69.66	70.83	73.03	70.26	71.65	72.15	69.75	70.95	70.10	68.16	69.13		
W3	72.26	70.76	71.16	72.93	70.36	71.65	73.93	71.36	72.65	73.04	70.59	71.82	70.93	68.73	69.83		
W4	70.90	68.76	69.83	71.36	69.10	70.23	72.23	69.63	70.93	71.50	69.16	70.33	69.40	67.73	68.57		
W5	70.56	68.46	69.51	71.10	68.76	69.93	71.76	69.20	70.48	71.14	68.80	70.15	69.10	67.40	68.25		
W6	67.50	65.50	66.50	68.06	65.76	66.91	68.63	66.06	67.35	68.06	65.77	66.92	66.36	64.73	65.55		
MEAN	70.73	68.62		71.26	68.91		72.13	69.56		71.37	69.02		69.39	67.51			
	SED	CD		SED	CD		SED	CD		SED	CD		SED	CD			
G	0.29	0.65		0.23	0.53		0.46	1.03		0.29	0.57		0.29	0.57			
I	0.35	0.80		0.29	0.65		0.56	NS		0.41	NS		0.41	NS			
W	0.63	1.26		0.58	1.16		0.83	1.67		0.76	1.53		0.76	1.53			
G x I	0.50	NS		0.41	NS		0.80	NS		0.74	NS		0.74	NS			
W at G	1.29	NS		1.17	NS		1.44	NS		1.16	NS		1.16	NS			
G at W	1.22	NS		1.09	NS		1.39	NS		1.13	NS		1.13	NS			

NS - Not Significant RM - Rabi mean Other interactions are not significant

TABLE - 20. SMK PER CENTAGE (GROUNDNUT)

TREATMENT	RABI SEASON						KHARIF SEASON								
	1992		1994		1995		1994		1994		1994				
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN			
<b>G X I</b>															
I1	60.17	54.30	57.24	60.87	54.67	57.77	61.98	56.15	59.07	61.01	55.04	58.03	56.95	51.28	54.12
I2	60.76	55.43	58.10	61.48	55.67	58.58	62.50	56.78	59.64	61.58	55.96	58.77	58.08	52.65	55.37
I3	60.73	54.42	57.58	61.23	54.88	58.06	62.28	56.57	59.43	61.41	55.29	58.35	57.34	51.76	54.55
<b>G X W</b>															
W1	62.53	56.63	59.58	63.33	56.90	60.12	64.76	58.43	61.60	63.54	57.32	60.43	59.27	53.67	56.47
W2	62.20	56.13	59.17	63.06	56.47	59.77	64.26	57.90	61.08	63.17	56.83	60.00	58.98	53.23	56.11
W3	64.33	58.70	61.52	64.97	59.27	62.12	66.93	60.60	63.77	65.41	59.52	62.47	61.33	55.80	58.57
W4	59.60	53.63	56.62	60.27	54.03	57.15	61.10	55.63	58.37	60.32	54.43	57.38	56.57	50.86	53.72
W5	59.10	53.27	56.19	59.57	53.40	56.49	60.13	54.80	57.47	59.60	53.82	56.71	55.77	50.33	53.05
W6	55.57	49.93	52.75	55.97	50.37	53.17	56.33	51.63	53.98	55.96	50.64	53.30	52.82	47.50	50.16
MEAN	60.56	54.72	-	61.20	55.07	-	62.25	56.50	-	61.33	55.43	-	57.46	51.90	-
	SEd	CD		SEd	CD		SEd	CD		SEd	CD		SEd	CD	
G	0.41	0.92		0.39	0.87		0.57	1.14		0.59	1.17		0.59	1.17	
I	0.51	NS		0.47	NS		0.66	NS		0.64	NS		0.64	NS	
W	1.02	2.04		0.96	1.92		1.09	2.18		1.08	2.16		1.08	2.16	
G x I	0.71	NS		0.67	NS		0.86	NS		0.78	NS		0.78	NS	
W at G	1.45	NS		1.37	NS		1.54	NS		1.44	NS		1.44	NS	
G at W	1.38	NS		1.31	NS		1.54	NS		1.37	NS		1.37	NS	

NS - Not Significant RM - Rabi mean Other interactions are not significant

#### 4.4.5. SMK percentage (Table 20)

Appreciable increment in SMK percentage was obtained under pre-sowing glyphosate application ( $G_1$ ) than unsprayed control ( $G_2$ ). The behaviour of this treatment was similar at different cropping years. While comparing the seasons, the mean SMK per centage of 61.33 noticed during rabi season was higher.

Eventhough the inter cropping system of groundnut + greengram ( $I_2$ ) registered higher values of SMK percentage, the critical increment over groundnut + redgram ( $I_2$ ) and sole groundnut ( $I_1$ ) was not seen from the results. The trend was uniformly seen at all the cropping years.

The data on SMK per centage over different cropping seasons, confirmed the profound influence of pre-emergence application of metolachlor @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $W_3$ ). The SMK percentage values obtained under pre-emergence fluchloralin @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $W_1$ ) was also comparable with the above treatment. The maximum SMK percent of 62.47 recorded under pre-emergence application of metolachlor @ 1.0 kg a.i.  $ha^{-1}$  + one H.W. on 80 DAS ( $W_2$ ) during rabi seasons was comparatively higher.

The SMK per centage in groundnut was not differed significantly with respect to the combination of various weed management measures and intercropping at both the cropping seasons.

#### 4.5. Pod yield (kg $ha^{-1}$ ) (Table 21) (Fig.8)

The data regarding pod yield confirmed the influence of seasonal effect on flowering , pod development and subsequently on net pod production. Regarding seasons, the quantum of pod production was comparatively higher during rabi.

TABLE - 21. POD YIELD (Kg ha<sup>-1</sup>)

EATMENT	RABI SEASON						KHARIF SEASON							
	1992		1994		1995		MEAN		RM		MEAN		G2	
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2
<b>G X I</b>														
I1	1887.8	1599.5	1743.7	1947.0	1623.6	1785.3	2057.7	1734.7	1896.2	1964.1	1652.6	1808.3	1598.7	1327.0
I2	1764.9	1474.2	1619.6	1804.7	1494.5	1649.6	1899.7	1592.3	1746.0	1823.1	1520.3	1671.7	1499.3	1211.0
I3	1642.2	1359.8	1501.0	1705.3	1394.7	1550.0	1753.5	1460.7	1607.1	1700.3	1405.0	1552.7	1373.8	1124.3
<b>G X W</b>														
W1	1947.3	1646.7	1797.0	2002.1	1664.3	1833.2	2101.1	1789.7	1945.4	2016.8	1700.2	1858.5	1638.7	1332.3
W2	1948.6	1630.7	1789.7	1996.3	1661.7	1829.0	2088.0	1774.0	1931.0	2010.9	1688.8	1849.8	1633.3	1325.7
W3	1989.7	1702.0	1845.9	2059.0	1731.0	1895.0	2170.6	1835.0	2002.8	2073.1	1756.0	1914.5	1675.0	1365.7
W4	1905.3	1591.3	1748.3	1961.0	1614.3	1787.7	2055.3	1716.7	1886.0	1973.8	1640.7	1807.3	1585.3	1285.0
W5	1890.0	1573.0	1731.5	1959.7	1601.3	1780.5	2045.3	1697.0	1871.2	1965.0	1623.7	1794.3	1579.7	1275.3
W6	909.0	723.3	816.2	936.0	753.0	844.5	961.3	763.0	862.2	935.4	746.4	840.9	831.7	740.7
MEAN	1765.0	1477.8	-	1819.0	1504.3	-	1903.6	1595.9	-	1829.2	1526.0	-	1490.6	1220.8
G	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD	SED	CD
I	19.6	43.8	22.0	49.0	25.2	56.1	25.2	56.1	14.4	32.2	14.4	32.2	17.7	39.4
W	24.1	53.6	26.9	59.9	30.8	68.7	30.8	68.7	39.8	79.6	39.8	79.6	25.0	NS
G X I	34.0	NS	38.1	NS	43.6	NS	43.6	NS	56.3	NS	56.3	NS	56.3	NS
W at G	65.3	NS	68.8	137.5	72.7	NS	72.7	NS	71.0	NS	71.0	NS	53.9	NS
G at W	62.8	NS	66.5	134.6	71.0	NS	71.0	NS	71.0	NS	71.0	NS	53.9	NS

NS - Not Significant      RM - Rabi mean      Other interactions are not significant

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The pod yield of groundnut was found to be substantially increased with pre-sowing application of glyphosate, 15 days prior to land preparation ( $G_1$ ) than that of untreated check ( $G_2$ ). Regardless of the cropping seasons over the years the increment under this treatment was well maintained. The mean pod yield of 1829 kg ha<sup>-1</sup> obtained during rabi season was higher and the degree of increase over the kharif season was worked out to 22.75 per cent.

The groundnut pod yield recorded under sole groundnut ( $I_1$ ) was significantly superior than intercropping of greengram ( $I_2$ ) or redgram ( $I_3$ ) in groundnut and the increase under this treatment was evenly noticed at all the cropping years. Among the seasons, the mean pod yield of sole groundnut registered during rabi season was higher, with a percentage increase of 8.17 and 16.49 over groundnut + greengram ( $I_2$ ) and groundnut + redgram ( $I_3$ ) respectively.

Among the integrated weed management practices, the pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) appreciably increased the pod yield of groundnut. The resulted pod yield of 1914 kg ha<sup>-1</sup> under this treatment during the rabi season was higher, and the magnitude of increase over the recommended practice of hand weeding on 25 and 45 DAS ( $W_5$ ) was 6.69 per cent. Irrespective of cropping years this treatment was statically on par with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> ( $W_1$ ) and pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> ( $W_2$ ) respectively with one hand weeding on 30 DAS. In both the seasons of study the unweeded control ( $W_6$ ) recorded the poor pod yields.

In regard to the different combination of weed management practices and intercropping the pod yield of groundnut did not differ significantly and the trend was similar at both the cropping seasons.

#### 4.6. Haulm yield (kg ha<sup>-1</sup>) (Table 22) (Fig.9)

The seasonal influence noticed in the case of pod yield was found to be unchanged under haulm yield also. The haulm production in groundnut was fairly higher in rabi sown crops than that of kharif.

The results on haulm yield revealed the profound influence of pre-sowing application of glyphosate (G<sub>1</sub>) compared to control (G<sub>2</sub>). The increasing trend in haulm yield with this treatment was identically observed among the cropping seasons. The maximum mean increment of 20.94 per cent over the untreated control (G<sub>2</sub>) was obtained during rabi season.

Irrespective of the cropping seasons over the years the haulm yield registered under the intercropping system viz. groundnut + greengram (I<sub>2</sub>) and groundnut + redgram (I<sub>3</sub>) were found inferior to the sole crop of groundnut (I<sub>1</sub>). Among the seasons, the maximum quantity of haulm yield under sole groundnut was recorded during rabi, with a mean of 2930 kg ha<sup>-1</sup>. It was found to be 10.10 and 18.81 percent increase over greengram (I<sub>2</sub>) and redgram (I<sub>3</sub>) intercropping systems.

The response of haulm yield to the different integrated weed management practices are highly significant. The haulm yield registered under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) was distinctly superior. It was closely followed by pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> (W<sub>1</sub>) and pendimethal. i @ 1.0 kg a.i. ha<sup>-1</sup> (W<sub>2</sub>) respectively followed by one hand weeding on 30 DAS. The trend was identical at different cropping years. Regarding the seasons, the maximum mean haulm yield of 3174 kg ha<sup>-1</sup> was registered

TABLE -22. HAULM YIELD (Kg ha<sup>-1</sup>)

TREATMENT	RABI SEASON						KHARIF SEASON									
	1992		1994		1995		1996		1997		1998					
	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd	G1	G2	MEAN	SEd				
X	1	3035.2	2541.2	2788.2	3172.0	2662.5	2917.3	3357.0	2812.3	3084.7	3188.0	2672.0	2930.0	2401.7	1998.3	2200.0
	2	2795.8	2265.5	2530.7	2931.0	2386.6	2658.8	3031.2	2560.2	2795.7	2919.3	2404.1	2661.7	2190.0	1774.2	1982.1
	3	2610.1	2075.0	2342.6	2737.5	2229.5	2483.5	2798.3	2351.2	2574.8	2715.3	2218.5	2466.9	2009.5	1574.8	1792.2
	4	3189.0	2634.3	2911.7	3297.3	2751.3	3024.3	3479.3	2953.3	3216.3	3321.8	2779.6	3050.7	2440.3	1997.3	2218.8
	5	3126.7	2564.0	2845.4	3274.3	2734.6	3004.5	3430.6	2909.7	3170.2	3277.2	2736.1	3006.6	2409.3	1939.3	2174.3
	6	3298.7	2756.0	3027.4	3425.6	2889.6	3157.6	3608.0	3067.7	3337.9	3444.1	2904.4	3174.2	2568.6	2142.6	2355.6
XW	1	3064.0	2491.7	2777.9	3238.6	2629.0	2933.8	3355.3	2785.3	3070.3	3219.3	2635.3	2927.3	2385.0	1895.0	2142.0
	2	3031.8	2408.7	2720.3	3219.3	2552.0	2885.7	3243.3	2727.3	2985.3	3164.8	2562.6	2863.7	2304.3	1825.0	2064.7
	3	1172.0	908.7	1040.4	1225.7	1000.7	1113.2	1256.3	1004.0	1130.2	1218.0	971.1	1094.5	1094.6	891.3	993.0
	4	2813.7	2293.9	2553.8	2946.8	2426.2	2687.0	3062.1	2574.6	2818.7	2940.8	2431.5	2687.0	2200.4	1782.4	2000.0
	5	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd
	6	21.1	46.9	33.0	73.6	23.1	51.4	18.4	41.1	22.6	50.3	48.9	97.8	31.9	NS	69.2
atC	1	25.8	57.4	40.5	90.1	28.3	62.9	25.8	57.4	40.5	90.1	28.3	62.9	25.8	57.4	40.5
	2	51.9	103.8	65.7	131.4	53.2	106.5	51.9	103.8	65.7	131.4	53.2	106.5	51.9	103.8	65.7
	3	36.4	NS	57.2	NS	39.9	NS	36.4	NS	57.2	NS	39.9	NS	36.4	NS	57.2
atW	1	73.4	146.8	108.5	NS	75.0	150.6	73.4	146.8	108.5	NS	75.0	150.6	73.4	146.8	108.5
	2	70.2	141.9	104.4	NS	72.5	146.7	70.2	141.9	104.4	NS	72.5	146.7	70.2	141.9	104.4

NS - Not Significant RM - Rabi Mean Other interactions are not significant

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with pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) during rabi season. It was 10.86 per cent increase over recommended practice of hand weeding on 25 and 45 DAS (W<sub>2</sub>).

The interaction effect of pre-sowing glyphosate application in combination with different intercroppings do not significantly influence the haulm yield. However, the haulm yield registered under the integrated application of pre-sowing glyphosate along with pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (G<sub>1</sub>W<sub>3</sub>) was significantly superior than the other combinations.

#### **4.7. Oil content (per centage) : (Table 23)**

The perusal of results revealed the non significant influence of pre-sowing glyphosate applied 15 days prior to land preparation (G<sub>1</sub>) in improving oil content in groundnut compared to unapplied control (G<sub>2</sub>).

Despite the cropping seasons, poor response with regard to oil accumulation in groundnut was noticed among the intercropping system. Though the numerical maximum was recorded with groundnut + greengram intercropping (I<sub>2</sub>), the critical difference remained non-significant.

The different integrated weed management practices shown only insignificant variations in oil content. Eventhough the oil content under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H. W. on 30 DAS (W<sub>3</sub>) was numerically higher, a distinct variation among the weed management practices was not attributed.

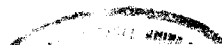


TABLE - 23. OIL CONTENT ( per cent )

EATMENT	1992				1994				1995				1994				KHARIF SEASON								
	G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN		G1		G2		MEAN		
	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	
I1	43.88	43.15	43.51	44.08	43.85	44.46	44.82	44.15	44.48	44.59	43.71	44.15	43.84	43.04	43.44										
I2	44.56	43.77	44.16	44.15	44.25	44.70	45.25	44.44	44.84	44.98	44.15	44.56	44.22	43.70	43.96										
I3	44.37	43.55	43.96	44.93	42.12	44.52	45.05	44.29	44.67	44.78	43.98	44.38	44.14	43.46	43.80										
<b>G X W</b>																									
W1	44.70	43.90	43.30	45.33	44.16	44.74	45.63	44.66	45.14	45.22	44.24	44.73	44.36	43.73	44.04										
W2	44.60	43.73	43.17	45.26	44.10	44.68	45.46	44.53	44.99	45.10	44.12	44.61	44.06	43.57	43.81										
W3	44.86	44.43	44.64	45.60	44.56	45.08	45.71	44.85	45.28	45.39	44.61	45.00	44.51	43.86	44.01										
W4	44.08	43.23	43.65	44.92	44.00	44.46	44.83	44.04	44.43	44.61	43.75	44.18	43.93	43.31	43.62										
W5	43.76	43.00	42.38	44.70	43.83	44.26	44.50	43.92	44.21	44.32	43.58	43.95	43.87	43.03	43.43										
W6	43.66	42.65	43.16	44.55	43.80	44.17	44.13	43.80	43.96	44.11	43.41	43.76	43.65	42.94	43.29										
MEAN	44.27	43.49		45.06	44.07		45.04	44.03		44.78	43.94		44.06	43.40											
J	SEd	CD	SEd	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	
J	0.35	NS	0.47	NS	0.36	NS	NS	0.36	NS	0.36	NS	NS	0.3	NS	NS	NS	0.38	NS	0.56	NS	0.54	NS	1.18	NS	
J	0.40	NS	0.51	NS	0.43	NS	NS	0.43	NS	0.57	NS	NS	0.56	NS	NS	NS	0.54	NS	0.54	NS	1.18	NS	1.12	NS	
J	0.91	NS	0.64	NS	0.64	NS	NS	0.64	NS	0.67	NS	NS	1.28	NS	NS	NS	1.20	NS	1.20	NS	1.12	NS	1.12	NS	
J x I	1.02	NS	0.65	NS	0.65	NS	NS	0.65	NS	0.67	NS	NS	1.28	NS	NS	NS	1.20	NS	1.20	NS	1.12	NS	1.12	NS	
J at G	1.55	NS	1.17	NS	1.17	NS	NS	1.17	NS	1.28	NS	NS	1.28	NS	NS	NS	1.20	NS	1.20	NS	1.12	NS	1.12	NS	
J at W	1.46	NS	1.12	NS	1.12	NS	NS	1.12	NS	1.20	NS	NS	1.20	NS	NS	NS	1.20	NS	1.20	NS	1.12	NS	1.12	NS	

NS - Not Significant RM - Rabi mean Other interactions are not significant

TABLE - 24. MEAN YIELD COMPONENTS AND YIELD OF INTERCROPS AT HARVEST

TREATMENTS	NUMBER OF PODS PLANT <sup>-1</sup>						TEST WEIGHT (g)						GRAIN YIELD (kg ha <sup>-1</sup> )					
	R'92	R'94	R'95	RM	K'94		P'92	R'94	R'95	RM	K'94		R'92	R'94	R'95	RM	K'94	
W1	29.4	28.3	30.7	29.4	25.5		33.31	32.56	33.80	33.22	31.64		262.0	255.0	274.0	263.6	186.0	
W2	28.6	29.3	29.6	28.8	25.0		32.94	32.56	33.42	32.97	31.23		264.0	253.0	271.0	175.5	188.0	
W3	31.4	28.9	32.8	31.3	27.4		34.13	33.28	34.73	34.04	32.57		272.0	264.0	295.0	277.0	198.0	
W4	27.3	26.7	28.1	27.3	24.3		32.20	31.97	32.64	32.27	30.63		258.0	240.0	267.0	255.0	175.0	
W5	26.0	26.4	27.5	26.6	24.0		31.93	31.45	32.31	31.89	30.35		244.0	240.0	254.0	246.0	170.0	
W6	23.3	23.0	24.1	23.4	22.4		30.54	30.23	30.97	30.58	29.73		98.0	98.0	103.0	99.6	73.0	
Mean	27.6	27.1	28.8	27.8	24.7		32.50	32.0	32.97	32.49	31.02		233.0	255.0	244.0	219.4	165.0	
W1	121.2	117.9	122.7	120.6	116.8		82.14	80.95	82.65	81.91	80.42		280.0	231.0	292.0	267.6	210.0	
W2	120.5	117.3	121	119.6	116.3		82.07	80.83	82.20	81.70	79.74		294.0	225.0	287.0	265.3	208.0	
W3	124.8	121.4	126.4	124.2	120.5		83.05	81.74	83.74	82.84	81.04		287.0	246.0	313.0	285.3	222.0	
W4	117.3	115.6	119.5	117.4	114.5		81.24	80.25	81.54	81.01	79.28		265.0	217.0	280.0	254.0	197.0	
W5	115	112.7	119.2	115.6	114		80.67	79.87	81.16	80.56	78.91		249.0	214.0	272.0	245.0	191.0	
W6	109.6	108.3	112.3	110.0	106.2		79.23	78.35	79.57	79.05	77.67		110.0	105.0	110.0	108.3	96.0	
Mean	118.0	115.5	120.1	117.9	114.7		81.4	80.33	81.81	81.17	79.51		247.5	206.3	259.0	237.5	187.3	
W1	27.1	24.9	26.4	26.1	21.6		32.77	31.32	32.15	32.08	30.47		199.0	168.0	193.0	186.6	117.0	
W2	26.3	24.5	25.8	25.5	21.0		32.64	30.97	32.10	31.90	30.41		195.0	166.0	193.0	184.6	118.0	
W3	28.9	26.5	28.1	27.8	23.3		33.50	32.05	32.84	32.80	30.94		211.0	178.0	203.0	197.3	125.0	
W4	25.2	22.8	24.9	24.3	20.5		32.11	30.43	31.62	31.38	30.06		183.0	148.0	181.0	170.6	112.0	
W5	24.7	22.7	24.5	23.9	20.2		31.94	30.18	31.43	31.18	29.75		181.0	145.0	169.0	165.0	108.0	
W6	21.9	20.6	22.2	21.5	18.5		30.46	29.14	30.05	29.88	28.38		92.0	90.0	94.0	92.0	65.0	
Mean	25.6	23.6	25.3	24.8	20.8		32.23	30.68	31.69	31.53	30.00		176.0	149.1	172.1	166.0	107.5	
W1	114.8	113.1	117.8	115.2	110.6		80.10	79.43	80.67	80.06	78.05		197.0	171.0	204.0	190.6	141.0	
W2	113.6	111.5	117.0	114.0	110.2		79.24	78.84	80.45	79.51	77.94		188.0	164.0	198.0	183.3	137.0	
W3	117.5	115.7	120.3	117.8	112.4		80.76	80.13	81.53	80.80	78.73		212.0	182.0	218.0	204.0	149.0	
W4	110.2	109.5	115.4	111.7	108.7		78.51	78.30	79.67	78.82	77.53		166.0	150.0	190.0	168.6	135.0	
W5	104.4	109.0	114.6	111.0	106.3		78.24	78.04	79.35	78.54	77.05		153.0	148.0	183.0	161.3	128.0	
W6	105.3	104.6	109.2	106.3	101.8		77.43	77.20	78.21	77.61	76.20		98.0	98.0	100.0	98.6	70.0	
Mean	111.8	110.5	115.7	112.6	108.3		79.04	78.65	79.98	79.22	77.58		169.0	152.1	182.1	167.7	126.6	

NA - Data Not Analysed

RM - Rabi mean

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At all the cropping years, the significant impact on oil content due to the combined effect of weed management practices and intercropping system was not noticed.

#### **4.8. Yield components of Intercrops (Table 24)**

The yield components of intercrops viz. number of pods plant<sup>-1</sup>, test weight (g) and the grain yield kg ha<sup>-1</sup> were found to be highly responsive in regards to varied weed management practices.

The data on yield parameters of intercrops revealed the profound effect of pre-sowing glyphosate application (G<sub>1</sub>) compared to untreated control (G<sub>2</sub>). The trend was unaltered among the cropping years. The mean values of the yield components of greengram and redgram were comparatively higher during rabi season, with 27.8 and 117.9 of pods plant<sup>-1</sup>, 32.49 and 81.17g of testweight and 219.4 and 237.5 kgha<sup>-1</sup> of grain yield respectively. Similarly, appreciable increment in yield parameters of intercrops were documented under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>). In spite of the combined application of pre-sowing glyphosate, the increase in yield components with the above treatment (W<sub>3</sub>) was identically observed in different cropping years.

#### **4.9. Pod equivalent (kg ha<sup>-1</sup>) (Table 25) (Fig.10)**

In general the seasonal fluctuations imparted significant variations in pod equivalent. The expressions under pod equivalent with respect to the seasons was similar that of pod and haulm yields.

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The increase in pod equivalent under pre-sowing application of glyphosate prior to land preparation ( $G_1$ ) was significantly superior when compared to unsprayed control ( $G_2$ ). The remarkable increase in pod equivalent with this treatment was found to be unaffected at different cropping years. Among the seasons the mean pod equivalent of 2071 kg ha<sup>-1</sup> realized during rabi was higher with distinct increase of 24.30 per cent over kharif crop.

The trend observed with pod and haulm yield in respect of intercropping practices tends to deviate under pod equivalent. The improvement in pod equivalent observed with groundnut + greengram intercropping system ( $I_2$ ) was commendable. This system recorded the mean maximum pod equivalent of 1947 kg ha<sup>-1</sup> during rabi season which was much higher than kharif with an increase of 28.9 per cent. Moreover, the percentage increase over groundnut + redgram ( $I_3$ ) and sole groundnut ( $I_1$ ) was 2.60 and 7.67 respectively. However, the significant variations among the different intercropping system in regard to pod equivalent was not observed during kharif crop.

The results under pod equivalent revealed a remarkable influence of integrated weed management practices. The pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) significantly enhanced the pod equivalent. The mean pod equivalent of 2162 kg ha<sup>-1</sup> noticed during rabi was 27.50 per cent higher than kharif season. In addition it was found to be 7.64 per cent increase over the recommended practice of hand weeding on 25 and 45 DAS ( $W_5$ ). Regardless of the seasons, this treatment was on par with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_1$ ). Though the data under pre-emergence application of pendimethalin ( $W_2$ ) was also comparable during rabi and kharif season of 1994, it could not exhibit comparable results during the other cropping periods.

TABLE - 25. POD EQUIVALENT (kg ha<sup>-1</sup>) GROUNDNUT

TREATMENT	RABI SEASON						KHARIF SEASON								
	1992		1994		1995		1996		1997		1998				
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN			
<b>G X I</b>															
I1	1890.6	1599.5	1745.1	1947.0	1624.0	1785.5	2058.2	1734.7	1896.5	1965.2	1652.7	1809.0	1598.7	1327.0	1462.9
I2	2103.3	1739.0	1921.2	2104.6	1693.2	1898.9	2221.3	1826.0	2023.7	2143.0	1752.7	1947.9	1685.8	1335.2	1510.5
I3	2087.5	1663.5	1875.5	2046.4	1648.4	1847.4	2181.3	1764.0	1922.7	2105.1	1691.9	1898.5	1713.7	1297.8	1505.8
<b>G X W</b>															
W1	2251.8	1864.2	2058.0	2243.7	1834.7	2039.2	2384.7	1988.7	2186.7	2293.4	1895.8	2094.6	1836.7	1462.7	1649.7
W2	2228.7	1840.7	2034.7	2228.1	1826.3	2027.2	2367.7	1969.7	2168.7	2274.8	1878.9	2076.8	1822.7	1342.9	1582.8
W3	2303.6	1933.3	2119.0	2313.0	1911.0	2112.0	2463.0	2046.0	2254.5	2359.9	1963.8	2161.8	1886.3	1503.7	1695.0
W4	2193.3	1782.0	1987.7	2188.3	1764.3	1976.3	2329.3	1902.3	2115.8	2236.9	1816.2	2026.6	1772.3	1409.7	1591.0
W5	2161.3	1755.0	1958.2	2185.3	1747.7	1966.5	2309.0	1873.7	2091.4	2218.5	1798.2	2008.3	1761.0	1394.3	1577.7
W6	1024.0	828.0	926.0	1037.7	847.3	942.5	1068.0	869.0	968.5	1043.2	848.1	945.7	917.3	806.7	862.0
MEAN	2027.1	1667.4		2032.7	1655.2		2153.6	1774.9		2071.1	1699.1		1666.1	1320.0	
<b>G</b>	SEd	CD		SEd	CD		SEd	CD		SEd	CD		SEd	CD	
G	12.1	27.0		19.0	42.4		15.8	35.3		23.7	52.8		23.7	52.8	
<b>I</b>	14.8	33.1		23.3	51.9		19.4	43.3		29.1	64.7		29.1	64.7	
<b>W</b>	37.3	74.5		43.4	86.8		40.6	81.3		56.8	113.7		56.8	113.7	
<b>G x I</b>	20.9	46.7		32.7	73.4		27.4	61.2		41.1	91.5		41.1	91.5	
<b>W at G</b>	52.7	105.4		61.3	122.6		57.4	114.9		80.4	160.8		80.4	160.8	
<b>G at W</b>	49.6	99.9		59.1	119.6		54.8	110.7		77.1	155.9		77.1	155.9	

NS - Not significant

RM - Rabi mean

Other interactions are not significant

Irrespective of cropping seasons over the years, the pre-sowing application of glyphosate prior to the land preparation followed by groundnut + greengram intercropping ( $G_1 I_2$ ) significantly increased the pod equivalent than other combinations. The mean pod equivalent of 2143 kg ha<sup>-1</sup> obtained during rabi was higher. Similarly the combination of pre-sowing glyphosate application followed by pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $G_1 W_3$ ) recorded the maximum pod equivalent, with a mean maximum of 2359 kg ha<sup>-1</sup> during rabi .

#### 4.10. Land equivalent ratio (Table 26)

The land equivalent ratio (LER) under pre-sowing glyphosate application ( $G_1$ ) was fairly higher than no spraying of glyphosate ( $G_2$ ). The similar performance of the treatment was noticed at different cropping years. The mean LER of 1.17 obtained during rabi season was higher.

High degree of fluctuation in LER was registered in accordance with intercropping practices in groundnut. Regardless of cropping years, significantly maximum LER was accounted under groundnut + greengram intercropping ( $I_2$ ) with a mean maximum of 1.20 recorded during rabi season. It was then followed by groundnut + redgram intercropping ( $I_3$ ) and sole crop of groundnut ( $I_1$ ) which were comparable among themselves.

The integrated weed management practices exert lesser influence on LER. Though the LER under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) was higher, this treatment significantly differed only from that of recommended practice of hand weeding on 25 and 45 DAS ( $W_5$ ) and the

TABLE - 26. LAND EQUIVALENT RATIO

EATMENT	1992				1994				1995				1996				
	G1		G2		G1		G2		G1		G2		G1		G2		
	MEAN	SEd	MEAN	SEd	MEAN	SEd	MEAN	SEd	MEAN	SEd	MEAN	SEd	MEAN	SEd	MEAN	SEd	
<b>G X I</b>																	
I1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
I2	1.28	1.06	1.17	1.30	1.10	1.20	1.32	1.11	1.22	1.30	1.09	1.20	1.24	1.03	1.14	1.03	1.14
I3	1.12	0.94	1.03	1.11	0.96	1.04	1.14	0.98	1.06	1.23	0.96	1.09	1.10	0.98	1.04	0.98	1.04
<b>G X W</b>																	
W1	1.23	1.08	1.16	1.23	1.09	1.16	1.25	1.11	1.18	1.24	1.09	1.17	1.21	1.08	1.15	1.08	1.15
W2	1.22	1.07	1.15	1.22	1.08	1.15	1.24	1.11	1.18	1.22	1.08	1.15	1.21	1.07	1.14	1.07	1.14
W3	1.26	1.11	1.19	1.26	1.13	1.20	1.29	1.14	1.22	1.27	1.13	1.20	1.23	1.10	1.17	1.10	1.17
W4	1.21	1.04	1.13	1.21	1.09	1.15	1.23	1.07	1.15	1.22	1.07	1.15	1.18	1.05	1.12	1.05	1.12
W5	1.19	1.02	1.11	1.21	1.05	1.13	1.22	1.06	1.14	1.21	1.04	1.13	1.17	1.04	1.10	1.04	1.10
W6	0.69	0.67	0.68	0.70	0.67	0.69	0.70	0.68	0.69	0.69	0.67	0.68	0.69	0.66	0.68	0.66	0.68
MEAN	1.13	1.00	1.02	1.14	1.02	1.11	1.16	1.03	1.11	1.17	1.01	1.12	1.12	1.00	1.12	1.00	1.12
	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd	CD	SEd
G	0.02	0.04	0.02	0.04	0.02	0.04	0.03	0.08	0.03	0.08	0.01	0.02	0.01	0.02	0.01	0.02	0.01
I	0.02	0.05	0.03	0.06	0.03	0.06	0.04	0.09	0.04	0.09	0.01	0.02	0.01	0.02	0.01	0.02	0.01
W	0.04	0.08	0.05	0.10	0.05	0.10	0.06	0.12	0.06	0.12	0.03	0.06	0.03	0.06	0.03	0.06	0.03
G x I	0.03	0.07	0.04	0.08	0.04	0.08	0.05	0.10	0.05	0.10	0.02	0.04	0.02	0.04	0.02	0.04	0.02
W at G	0.06	NS	0.07	0.16	0.07	0.16	0.08	0.17	0.08	0.17	0.04	0.08	0.04	0.08	0.04	0.08	0.04
G at W	0.05	NS	0.07	0.16	0.07	0.16	0.08	0.17	0.08	0.17	0.04	0.08	0.04	0.08	0.04	0.08	0.04

NS - Not Significant RM - Rabi mean Other interactions are not significant

unweeded check ( $W_0$ ) in rabi '92 and kharif '94 seasons. Even the LER recorded under recommended practice of hand weeding in rabi '94 and '95 crops were comparable with the above pre-emergence herbicide based weed management practice. Among seasons, the mean LER of 1.20 recorded during rabi season was higher.

Regarding interactions, the LER was found to be significantly increased with pre-sowing glyphosate application prior to land preparation followed with groundnut + greengram intercropping system. Similarly the integrated application of pre-sowing glyphosate followed by pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $G_1W_3$ ) maximises the LER.

#### **4.11. Total nutrient uptake of groundnut and intercrops**

##### **4.11.1. Nitrogen (kg ha<sup>-1</sup>): (Tables 27,27a and 27b )**

The data on nitrogen removal revealed the increasing uptake pattern of nitrogen by groundnut and intercrops in accordance with age of the crop.

The pre-sowing application of glyphosate prior to land preparation ( $G_1$ ) recorded significantly the maximum nitrogen uptake than unsprayed control ( $G_2$ ). Regardless of stages of crop growth and seasons the trend was similar. The mean nitrogen removal of 53.53, 101.13 and 182.4 kg ha<sup>-1</sup> accordingly on 30,60 and 105 DAS under rabi season was maximum.

The uptake of nitrogen by groundnut and intercrops differed with respect to different intercropping practices. Intercropping of greengram in groundnut ( $I_2$ ) recorded the maximum nitrogen uptake, irrespective of stages of crop growth and seasons. Among the seasons, the mean nitrogen removal of 52.39, 100.15 and 183.54 kg ha<sup>-1</sup>

TABLE-27. TOTAL NITROGEN UPTAKE OF GROUNDNUT AND INTERCROPS (Kg ha<sup>-1</sup>) - 30 DAS

TREATMENT	RABI SEASON						KHARIF SEASON					
	1992		1994		1995		1995		1996		1994	
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN
<b>XI</b>												
	52.25	47.03	49.64	54.79	43.80	49.30	59.44	50.90	55.17	55.49	47.24	51.36
	53.73	48.90	51.32	55.30	45.29	50.30	59.73	51.41	55.57	56.25	48.53	52.39
	48.49	40.73	44.61	46.69	41.58	44.14	51.36	44.89	48.13	48.85	42.40	45.63
<b>XW</b>												
1	53.81	48.90	51.36	55.18	46.58	50.88	60.79	51.93	56.36	56.59	49.13	52.87
2	52.03	47.83	49.93	53.75	45.23	49.49	58.53	50.74	54.64	54.77	47.93	51.96
3	60.84	50.54	55.69	62.13	49.80	55.97	66.93	55.15	61.04	63.30	51.83	56.83
4	50.87	46.15	48.51	50.73	42.72	46.73	55.70	48.21	51.96	52.43	45.69	49.06
5	46.33	42.02	44.18	46.92	39.74	43.33	50.81	44.78	47.80	48.02	42.18	45.10
6	45.05	37.89	41.47	44.86	37.26	41.06	48.32	43.59	45.96	46.08	39.58	45.83
EAN	51.49	45.56		52.26	43.56		56.85	49.07		53.53	46.05	
	SED	CD		SED	CD		SED	CD		SED	CD	
	0.45	1.00		0.21	0.47		0.33	0.73		0.45	1.01	
	0.55	1.23		0.25	0.57		0.40	0.90		0.55	1.24	
	1.37	2.74		1.14	2.29		0.98	1.99		1.21	2.42	
x1	0.78	1.74		0.36	NS		0.57	NS		0.78	NS	
atG	1.51	3.03		1.26	NS		1.41	2.83		1.71	3.43	
atW	1.45	2.94		1.17	NS		1.33	2.67		1.63	3.20	

NS - Not Significant RM - Rabi mean Other interactions are not significant

TABLE - 27a. TOTAL NITROGEN UPTAKE OF GROUNDNUT AND INTERCROPS (Kg ha<sup>-1</sup>) - 60 DAS

TREATMENT	RABI SEASON						KHARIF SEASON								
	1992		1994		1995		1994		1995		1994				
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN			
<b>X I</b>															
1	88.60	81.41	85.01	95.81	89.93	92.87	97.63	92.28	94.96	94.01	87.87	90.94	86.31	75.47	80.89
2	101.92	92.81	97.37	107.85	94.09	100.97	108.87	95.38	102.10	106.21	94.09	100.15	94.37	88.88	91.63
3	98.37	89.08	93.73	103.77	93.40	98.59	107.43	95.82	101.63	103.19	92.76	97.97	94.73	87.41	91.07
<b>X W</b>															
1	104.12	96.75	100.44	108.58	98.77	103.68	112.04	102.75	107.40	108.25	99.42	88.84	99.08	91.77	95.43
2	101.68	92.95	97.32	107.91	97.04	102.48	108.93	100.93	104.93	106.17	96.97	101.57	97.92	90.61	94.27
3	113.20	98.67	105.94	117.27	102.83	110.05	121.89	106.53	114.21	117.45	102.68	110.07	106.88	93.09	99.99
4	97.45	90.09	93.77	103.83	92.93	98.38	106.43	97.06	101.75	102.57	93.36	97.97	95.54	88.14	91.84
5	94.03	86.14	90.09	101.10	89.81	95.46	102.21	92.75	97.48	99.11	89.57	94.34	91.91	84.06	87.99
6	67.32	61.98	64.65	76.19	71.49	73.84	76.37	66.78	71.58	73.29	66.75	70.02	59.48	55.85	57.67
MEAN	96.30	87.76		102.48	92.15		104.65	94.47		101.13	91.57		91.80	83.92	
	SEd	CD		SEd	CD		SEd	CD		SEd	CD		SEd	CD	
	0.61	1.35		0.45	1.00		0.41	0.91		0.65	1.45		0.65	1.45	
	0.74	1.65		0.54	1.22		0.50	1.12		0.79	1.78		0.79	1.78	
	1.56	3.12		1.20	2.40		1.25	2.49		1.34	2.69		1.34	2.69	
	1.05	NS		0.78	1.73		0.71	1.58		1.13	2.51		1.13	2.51	
St G	1.97	3.94		1.69	3.39		1.71	3.42		1.90	3.81		1.90	3.81	
t W	1.89	3.84		1.61	3.25		1.61	3.25		1.85	3.76		1.85	3.76	

NS - Not Significant      RM - Rabi mean      Other interactions are not significant

TABLE - 27b. TOTAL NITROGEN UPTAKE OF GROUNDNUT AND INTERCROPS (Kg ha<sup>-1</sup>) - HARVEST

TMENT	RABI SEASON						KHARIF SEASON								
	1992		1994		1995		1994		1994		1994				
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN			
<b>X I</b>	164.07	156.02	160.05	168.54	157.32	162.93	175.31	163.65	169.48	169.31	158.99	164.15	162.54	157.86	160.20
	187.80	174.52	181.16	190.29	174.26	182.28	193.36	181.03	187.20	190.48	176.60	183.54	183.86	170.33	177.10
	183.62	169.20	176.41	189.62	173.08	181.35	189.45	176.32	182.89	187.56	172.87	180.22	179.59	166.79	173.19
<b>X W</b>	196.89	184.07	190.48	200.90	185.81	193.36	204.05	191.52	197.79	200.61	187.13	193.87	191.90	179.79	185.85
	194.07	181.69	187.88	197.22	182.57	189.90	201.50	189.16	195.33	197.59	184.47	191.03	190.21	178.44	184.33
	204.89	188.60	196.75	211.53	191.98	201.76	213.38	195.61	204.50	209.93	192.06	200.99	197.92	185.53	191.73
	189.87	177.18	183.53	192.83	179.05	185.94	196.77	184.58	190.68	193.16	180.27	186.72	185.45	175.31	180.38
	186.92	174.83	180.88	188.21	173.84	181.03	193.14	181.35	187.25	189.42	176.67	183.05	181.71	170.55	176.13
	98.34	93.12	95.73	106.23	96.09	101.16	107.39	99.78	103.59	103.99	96.33	100.16	104.81	100.34	102.58
AN	178.50	166.58	-	182.82	168.22	-	186.04	173.67	-	182.45	169.48	-	175.33	164.99	-
	SED	CD		SED	CD		SED	CD		SED	CD		SED	CD	
	0.56	1.23		0.85	1.70		0.52	1.17		0.46	1.03		0.46	1.03	
	0.68	1.51		0.95	1.94		0.64	1.43		0.56	1.26		0.56	1.26	
	1.36	2.72		1.74	3.48		1.34	2.69		1.24	2.49		1.24	2.49	
I	0.96	2.14		1.18	2.36		0.91	NS		0.80	1.78		0.80	1.78	
t G	1.92	3.80		2.17	4.34		1.90	3.80		1.76	3.53		1.76	3.53	
t W	1.84	3.72		2.08	4.16		1.81	3.66		1.67	3.38		1.67	3.38	

NS - Not Significant RM - Rabi mean Other interactions are not significant

obtained during rabi season was maximum. The quantity of nitrogen uptake on 30 DAS under groundnut + redgram ( $I_2$ ) was inferior to sole groundnut ( $I_1$ ). However, with advancement in age of the crop the nitrogen uptake under this system increased significantly.

Regardless of stages of crop growth and seasons, the quantum of nitrogen uptake under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_2$ ) was significantly superior. The maximum percentage increase in nitrogen uptake with this treatment over the recommended practice of hand weeding on 25 and 45 DAS ( $W_0$ ) was recorded during rabi '95 with 21.6, 14.7 and 8.0 respectively on 30,60 and 105 DAS. It was followed by the pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. 30 DAS ( $W_1$ ) and pre-emergence pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. 30 DAS ( $W_2$ ). Among the seasons, in rabi the nitrogen uptake by groundnut and intercrops are maximum with the mean of 56.83, 110.07 and 200.99 kg ha<sup>-1</sup> respectively on 30,60 and 105 DAS.

Regarding interactions the total nitrogen uptake by groundnut and intercrops was distinctly higher under pre-sowing application of glyphosate coupled with groundnut + greengram intercropping and the trend was similar in all the cropping seasons. Similarly, the interaction effect of pre-sowing application of glyphosate combined with pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $G_1W_2$ ) significantly excelled other combinations of weed management practices.

#### **4.11.2. Phosphorus (kg ha<sup>-1</sup>): (Tables 28, 28a and 28b)**

In accordance with the advancement in age of the crop an inclination in total phosphorus removal by the groundnut and intercrops were noticed.

The quantity of total phosphorus removal was significantly maximum under pre-sowing application of glyphosate (G<sub>1</sub>) compared to untreated control (G<sub>2</sub>). The increase was evenly noticed among different crop stages and seasons. The mean total phosphorus uptake of 1.60, 2.59 and 5.49 kg ha<sup>-1</sup> respectively on 30, 60 and 105 DAS during rabi season was higher.

Among intercropping situations the total phosphorus uptake was distinctly higher under groundnut + greengram intercropping (I<sub>2</sub>) which was on par with groundnut + redgram (I<sub>3</sub>). The similar trend was prevailed at all stages of crop growth and seasons. It is interesting to note that the increased uptake of nitrogen on 30 DAS noticed with sole groundnut than groundnut + redgram intercropping (I<sub>3</sub>) got reversed under phosphorus uptake. The mean total phosphorus uptake under groundnut + greengram intercropping (I<sub>2</sub>) during rabi season was comparatively higher with 1.49, 2.41 and 4.67 kg ha<sup>-1</sup> respectively on 30, 60 and 105 DAS.

The amount of phosphorus removal by groundnut and intercrops under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) was significantly maximum. The maximum per centage of increase in phosphorus uptake compared to recommended practice of hand weeding of 25 and 45 DAS (W<sub>5</sub>) was registered during rabi '95 with 47.0, 25.0 and 34.4 respectively on 30, 60 and 105 DAS. However, this treatment was comparable with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>).

Though the total phosphorus uptake noticed under pre-emergence application of pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>2</sub>) was comparable with above treatments, it could not maintain its influence beyond 60 DAS. Similar trend

TABLE - 28. TOTAL PHOSPHOROUS UPTAKE OF GROUNDNUT AND INTERCROPS (Kg ha<sup>-1</sup>) - 30 DAS

TREATMENT	RABI SEASON						KHARIF SEASON							
	1992		1994		1995		1994		1995		1994			
	G1	MEAN	G1	MEAN	G1	MEAN	G1	MEAN	G1	MEAN	G1	MEAN		
1	1.49	1.18	1.34	1.56	1.20	1.38	1.57	1.24	1.41	1.54	1.38	1.34	1.08	1.21
2	1.59	1.30	1.45	1.67	1.33	1.50	1.71	1.37	1.54	1.66	1.33	1.49	1.43	1.31
3	1.56	1.27	1.42	1.64	1.30	1.47	1.67	1.34	1.51	1.62	1.30	1.46	1.40	1.17
3 X W														
M1	1.86	1.46	1.66	1.94	1.49	1.72	2.00	1.54	1.77	1.93	1.49	1.71	1.65	1.33
M2	1.83	1.43	1.63	1.92	1.46	1.69	1.94	1.49	1.72	1.89	1.46	1.68	1.64	1.31
M3	2.03	1.53	1.82	2.12	1.63	1.88	2.19	1.68	1.94	2.11	1.64	1.88	1.79	1.44
M4	1.68	1.30	1.49	1.75	1.32	1.54	1.76	1.34	1.55	1.73	1.32	1.53	1.51	1.19
M5	0.98	0.90	0.94	1.04	0.92	0.98	1.05	0.98	1.02	1.02	0.93	0.98	0.91	0.84
M6	0.90	0.82	0.86	0.97	0.84	0.91	0.97	0.87	0.92	0.95	0.84	0.89	0.83	0.76
MEAN	1.55	1.25	1.42	1.62	1.28	1.46	1.65	1.32	1.51	1.60	1.28	1.51	1.39	1.15
SED	CD			SED	CD		SED	CD				SED	CD	
	0.02	0.05		0.02	0.05		0.03	0.06				0.03	0.06	
	0.03	0.08		0.03	0.06		0.03	0.08				0.04	0.08	
	0.12	0.24		0.13	0.26		0.12	0.25				0.12	0.25	
1 X I	0.05	NS		0.04	NS		0.05	NS				0.16	NS	
1 at G	0.17	NS		0.17	NS		0.17	NS				0.17	NS	
1 at W	0.15	NS		0.16	NS		0.16	NS				0.16	NS	

NS - Not Significant

RM - Rabi mean

Other interactions are not significant

TABLE - 28a. TOTAL PHOSPHOROUS UPTAKE OF GROUNDNUT AND INTERCROPS (Kg ha<sup>-1</sup>) - 60 DAS

TREATMENT	RABI SEASON						KHARIF SEASON									
	1992			1994			1995			1994			1994			
	G1	MEAN	G2	G1	MEAN	G2	G1	MEAN	G2	G1	RM	MEAN	G1	G2	MEAN	
<b>G X I</b>																
I1	2.37	1.92	2.15	2.48	1.96	2.22	2.62	2.02	2.32	2.49	1.96	2.23	2.12	1.75	1.94	
I2	2.58	2.08	2.33	2.66	2.14	2.40	2.83	2.21	2.52	2.69	2.14	2.41	2.29	1.84	2.07	
I3	2.51	2.02	2.27	2.59	2.08	2.34	2.74	2.17	2.46	2.61	2.09	2.35	2.23	1.73	1.98	
<b>G X W</b>																
W1	2.84	2.30	2.57	2.96	2.36	2.66	3.17	2.47	2.82	2.99	2.37	2.68	2.52	2.01	2.27	
W2	2.79	2.26	2.53	2.91	2.34	2.63	3.04	2.39	2.72	2.91	2.33	2.64	2.48	1.98	2.23	
W3	3.05	2.44	2.76	3.18	2.55	2.87	3.37	2.67	3.02	3.20	2.56	2.88	2.69	2.17	2.43	
W4	2.60	2.08	2.34	2.65	2.08	2.37	2.76	2.12	2.44	2.67	2.09	2.38	2.29	1.79	2.04	
W5	2.40	1.88	2.14	2.46	1.89	2.18	2.59	1.92	2.26	2.48	1.89	2.18	2.13	1.56	1.90	
W6	1.26	1.07	1.17	1.32	1.13	1.23	1.46	1.24	1.35	1.35	1.14	1.40	1.19	1.02	1.11	
MEAN	2.49	2.01		2.58	2.06		2.73	2.14		2.59	2.06		2.22	1.77		
	SED	CD		SED	CD		SED	CD		SED	CD		SED	CD		
	0.05	0.13		0.06	0.14		0.05	0.12		0.06	0.14		0.06	0.14		
	0.07	0.16		0.07	0.16		0.06	0.14		0.07	0.16		0.07	0.16		
	0.17	0.34		0.21	0.43		0.21	0.42		0.19	0.38		0.19	0.38		
	0.10	NS		0.13	NS		0.10	NS		0.11	NS		0.11	NS		
	0.24	NS		0.30	NS		0.29	NS		0.28	NS		0.28	NS		
	0.22	NS		0.29	NS		0.28	NS		0.27	NS		0.27	NS		

NS - Not Significant

RM - Rabi mean

Other interactions are not significant

TABLE - 28b. TOTAL PHOSPHOROUS UPTAKE OF GROUNDNUT AND INTERCROPS (kg ha<sup>-1</sup>) - HARVEST

TREATMENT	1992				1994				1995				1996				
	G1		G2		G1		G2		G1		G2		G1		G2		
	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	MEAN	SED	
<b>G X I</b>																	
I1	5.02	3.22	4.12	5.47	3.49	4.48	5.53	3.70	4.62	5.34	3.47	4.41	4.71	3.01	3.86		
I2	5.26	3.51	4.39	5.73	3.68	4.71	5.86	3.97	4.92	5.62	3.72	4.67	4.98	3.31	4.15		
I3	5.23	3.40	4.32	5.63	3.64	4.64	5.73	3.96	4.85	5.53	3.67	4.60	4.93	3.25	4.09		
<b>G X W</b>																	
W1	6.03	3.98	5.01	6.52	4.25	5.39	6.67	4.64	5.66	6.41	4.29	5.35	5.62	3.70	4.66		
W2	5.84	3.83	4.84	6.36	4.12	5.24	6.41	4.38	5.40	6.20	4.11	5.15	5.55	3.64	4.60		
W3	6.81	4.64	5.73	7.52	5.02	6.27	7.59	5.36	6.48	7.31	5.01	6.16	6.38	4.36	5.37		
W4	4.95	3.05	4.00	5.38	3.23	4.31	5.43	3.48	4.46	5.25	3.25	4.25	4.70	2.87	3.79		
W5	4.77	2.89	3.83	5.10	3.02	4.06	5.23	3.27	4.25	5.03	3.05	4.04	4.54	2.73	3.64		
W6	2.61	1.89	2.25	2.78	1.98	2.38	2.91	2.14	2.53	2.77	2.00	2.38	2.44	1.83	2.14		
MEAN	5.17	3.38		5.61	3.60		5.71	3.88		5.49	3.62		4.87	3.19			
<b>G</b>	SED	CD		SED	CD		SED	CD		SED	CD		SED	CD			
G	0.10	0.23		0.08	0.18		0.10	0.23		0.10	0.22		0.10	0.22			
<b>I</b>	0.11	0.25		0.09	0.21		0.12	0.27		0.12	0.27		0.12	0.27			
W	0.40	0.80		0.42	0.92		0.39	0.79		0.34	0.74		0.34	0.74			
G x I	0.20	NS		0.18	NS		0.17	NS		0.17	NS		0.17	NS			
W at G	0.56	NS		0.54	NS		0.56	NS		0.55	NS		0.55	NS			
G at W	0.53	NS		0.50	NS		0.52	NS		0.51	NS		0.51	NS			

NS - Not Significant RM - Rabi mean Other interactions are not significant

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was observed irrespective of stages of crop growth and seasons. Among seasons, the increased mean total phosphorus uptake was under pre-emergence metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) with 1.88, 2.88 and 6.16 kgha<sup>-1</sup> respectively on 30,60 and 105 DAS.

Regarding interactions, maximum phosphorus removal by groundnut and intercrops were noticed under the combination of pre-sowing application of glyphosate under groundnut + greengram (G<sub>1</sub> I<sub>1</sub>) intercropping. Similarly, higher amount of total phosphorus uptake was accompanied with pre-sowing application of glyphosate followed by pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (G<sub>1</sub> W<sub>3</sub>). Irrespective of stages of crop growth and seasons the same trend was maintained.

#### 4.11.3. Potassium (kg ha<sup>-1</sup>) (Tables 29, 29a and 29b)

The total potassium uptake by groundnut and intercrops was noticed to increase with ageing of the crop.

The results on uptake of nutrients, revealed the significant effect of pre-sowing application of glyphosate (G<sub>1</sub>) on quantum of total potassium removal compared to no spraying of glyphosate (G<sub>2</sub>). The increment was similar at all the stages of crop growth and seasons. The mean potassium uptake of 17.17, 34.94 and 59.35 kg ha<sup>-1</sup> respectively recorded on 30,60 and 105 DAS during rabi season was higher.

Regardless of stages of crop growth and seasons the system of greengram as an intercrop in groundnut (I<sub>2</sub>) registered the maximum potassium uptake in groundnut and intercrops. The mean total potassium removal with this system during rabi was higher

TABLE - 29. TOTAL POTASSIUM UPTAKE OF GROUNDNUT AND INTERCROPS (kg ha<sup>-1</sup>) - 30 DAS

TREATMENT	RABI SEASON						KHARIF SEASON								
	1992		1994		1995		1995		1996		1997				
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN			
<b>G X I</b>															
I1	16.56	13.55	15.06	17.56	13.95	15.76	17.69	14.88	16.29	17.27	14.13	15.70	15.43	12.85	14.14
I2	17.29	14.39	15.84	17.84	14.61	16.23	18.34	15.41	16.88	17.82	14.80	16.31	16.07	13.37	14.72
I3	15.72	12.82	14.27	16.35	12.98	14.67	17.23	13.96	15.60	16.43	13.07	14.75	14.35	11.98	13.17
<b>G X W</b>															
W1	19.42	16.06	17.74	20.06	16.19	18.13	21.08	17.68	19.38	20.19	16.64	18.42	18.12	14.92	16.52
W2	18.85	15.27	17.06	19.32	15.98	17.65	20.46	17.20	18.83	19.54	16.15	17.85	17.77	14.60	16.19
W3	20.80	17.43	19.02	21.65	17.29	19.47	22.67	18.83	20.75	21.70	17.78	19.74	19.09	15.89	17.49
W4	17.58	14.37	15.98	17.91	14.87	16.39	18.62	15.85	17.24	18.04	15.03	16.54	16.53	13.47	15.00
W5	12.13	10.04	11.09	12.48	9.94	11.21	12.69	10.08	11.39	12.43	10.02	11.23	11.31	9.78	10.55
W6	10.36	8.55	9.46	12.09	8.81	10.45	11.01	8.88	9.95	11.15	8.75	9.95	8.88	7.74	8.31
MEAN	16.52	13.59		17.25	13.85		17.76	14.75		17.17	14.00		15.28	12.73	
<b>G</b>	SEd	CO		SEd	CD		SEd	CD		SEd	CD		SEd	CD	
	0.37	0.82		0.33	0.75		0.38	0.84		0.29	0.64		0.36	0.81	
<b>I</b>	0.45	1.01		0.41	0.92		0.46	1.04		0.36	0.81		0.36	0.81	
<b>W</b>	0.82	1.64		0.69	1.38		0.81	1.61		0.57	1.15		0.57	1.15	
<b>G x I</b>	0.64	NS		0.58	NS		0.66	NS		0.51	NS		0.51	NS	
<b>W at G</b>	0.99	NS		0.97	NS		0.99	NS		0.82	NS		0.82	NS	
<b>G at W</b>	0.88	NS		0.95	NS		0.97	NS		0.80	NS		0.80	NS	

NS - Not Significant

RM - Rabi mean

Other interactions are not significant

TABLE - 29 a. TOTAL POTASSIUM UPTAKE OF GROUNDNUT AND INTERCROPS (kg ha<sup>-1</sup>) - 60 DAS

TREATMENT	1992			1994			1995			KHARIF SEASON			
	G1	MEAN	G2	G1	MEAN	G2	G1	MEAN	G2	RM	G1	MEAN	G2
<b>G X I</b>													
I1	30.72	26.16	28.44	32.31	27.05	29.68	34.72	29.14	31.93	30.02	28.39	25.08	26.74
I2	35.22	29.52	32.37	36.20	31.15	33.68	38.96	33.51	36.24	34.09	32.33	27.59	29.96
I3	33.42	29.58	31.50	35.06	29.89	32.48	37.86	32.27	35.07	33.02	31.23	27.02	29.13
<b>G X W</b>													
W1	37.47	32.30	34.89	38.49	33.04	35.77	41.89	35.94	38.92	36.52	34.24	30.06	32.15
W2	36.47	31.59	34.03	38.16	32.82	35.49	41.42	35.40	38.41	35.98	33.99	29.82	31.91
W3	39.33	33.76	36.55	41.09	34.84	37.97	44.03	37.96	41.01	38.51	35.91	31.57	33.74
W4	34.75	29.67	32.21	36.06	30.95	33.51	38.89	33.23	36.06	33.93	31.95	28.00	29.98
W5	33.11	28.50	30.81	34.76	29.69	32.23	37.30	31.78	34.54	32.53	30.96	27.10	29.03
W6	18.19	14.69	16.44	18.59	14.84	16.72	19.51	15.52	17.52	16.89	16.86	12.84	14.85
MEAN	33.22	28.42		34.53	29.36		37.18	31.64		34.94	30.65	26.57	
<b>G</b>	SED	CD		SED	CD		SED	CD			SED	CD	
	0.41	0.93		0.48	1.05		0.56	1.25			0.24	0.54	
<b>I</b>	0.51	1.14		0.55	1.23		0.68	1.53			0.38	0.85	
<b>W</b>	0.93	1.87		1.10	2.21		1.07	2.14			0.80	1.60	
<b>G x I</b>	0.72	NS		0.48	NS		0.97	NS			0.42	NS	
<b>W at G</b>	1.32	NS		1.07	NS		1.52	NS			1.01	NS	
<b>G at W</b>	1.26	NS		1.02	NS		1.49	NS			0.95	NS	

NS - Not Significant RM - Rabi mean Other interactions are not significant



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with the mean of 16.31, 34.09 and 58.09 kg ha<sup>-1</sup> accordingly on 30,60 and 105 DAS. The quantity of potassium removal on 30 DAS under groundnut + redgram was lower than sole groundnut (I<sub>1</sub>). However, this system gained significance beyond 30 DAS.

The pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS significantly improved the total potassium uptake. The trend was same at all stages of crop growth and seasons. The percentage increase over the recommended practice of hand weeding on 25 and 45 DAS (W<sub>2</sub>) was the highest during rabi '95 with 45.1, 15.7 and 11.4 respectively on 30,60 and 105 DAS. However, upto 60 DAS the above treatment was on par with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>). During rabi, the total uptake of potassium under this treatment was comparatively maximum with 19.74, 38.51 and 65.34 kg ha<sup>-1</sup> respectively on 30,60 and 105 DAS.

Among interaction, pre-sowing application of glyphosate under groundnut + greengram intercropping (G<sub>1</sub> I<sub>2</sub>) improves the total potassium uptake. The increment with this combination was uniformly noticed at all stages of crop growth and seasons. The total potassium uptake was also found to be higher with pre-sowing application of glyphosate in combination with pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (G<sub>1</sub> W<sub>2</sub>). Regardless of stages of crop growth and seasons the trend was well established.

#### 4.12. post-harvest soil available NPK (kg ha<sup>-1</sup>) (Table 30)

The results on post harvest soil available NPK indicated the availability of nitrogen in soil was higher followed by potassium and phosphorus.

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The availability of NPK under pre-sowing application of glyphosate prior to land preparation ( $G_1$ ) was significantly higher than unsprayed control ( $G_2$ ). The trend was uniformly observed at different cropping years. The mean soil available NPK of 155.96, 34.53 and 78.50 kg ha<sup>-1</sup> respectively was the maximum during rabi season.

Among the intercropping systems, the amount of nitrogen and potassium contribution to the soil stratum by the groundnut + greengram intercropping ( $I_1$ ) was significantly higher. The maximum mean soil available nitrogen and potassium of 155.97 and 78.57 kg ha<sup>-1</sup> recorded during rabi was comparatively higher. However, the availability of soil phosphorus was significantly lower when groundnut was intercropped with greengram ( $I_2$ ) or redgram ( $I_3$ ). The reduction in soil available phosphorus with the above treatments was similar in all the cropping years.

The post harvest soil available NPK status was significantly improved under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) and it was on par with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> ( $W_1$ ), pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> ( $W_2$ ) and oxyfluorfen @ 1.0 kg a.i. ha<sup>-1</sup> ( $W_4$ ) respectively with one hand weeding on 30 DAS. The mean soil available NPK of 157.34, 36.31 and 80.05 kg ha<sup>-1</sup> respectively obtained during rabi under pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) was maximum.

The combinations of different weed management measures and intercropping systems did not influence the post harvest NPK status of the soil.

Table - 30. Mean Post - Harvest available soil Nitrogen, Phosphorus and Potassium (Kg ha<sup>-1</sup>)

TREATMENTS	RABI SEASON												KHARIEF SEASON					
	1992				1994				1995				RM					
	N	P	K		N	P	K		N	P	K		N	P	K	N	P	K
G1. Pre - sowing glyphosate spray	153.70	35.37	77.20		155.77	31.32	77.77		158.42	36.92	80.54		155.96	34.53	78.50	152.20	34.52	75.10
G2. No spraying of glyphosate	151.31	33.72	75.83		154.56	34.78	76.40		156.38	35.85	79.45		154.08	34.78	77.22	151.14	33.30	73.60
SEd	0.26	0.12	0.34		0.16	0.11	0.23		0.25	0.13	0.15		-	-	-	0.14	0.09	0.60
CD	0.59	0.27	0.77		0.36	0.25	0.51		0.57	0.30	0.31		-	-	-	0.29	0.19	1.35
I1. Groundnut (sole)	150.88	34.93	75.62		154.11	36.05	76.46		156.01	36.90	79.39		153.66	35.96	77.15	150.73	34.20	73.54
I2. Groundnut + greengram	153.70	34.30	77.39		155.84	35.42	77.80		158.37	36.21	80.53		155.97	35.31	78.57	152.30	33.94	75.11
I3. Groundnut + redgram	152.43	34.00	77.00		155.56	35.17	76.98		157.32	36.05	80.07		155.10	35.07	78.01	151.99	33.69	74.42
SEd	0.32	0.15	0.42		0.19	0.13	0.28		0.31	0.16	0.19		-	-	-	0.16	0.12	0.70
CD	0.73	0.33	0.94		0.45	0.31	0.63		0.71	0.37	0.42		-	-	-	0.35	0.25	1.54
W1. P.E fluchloralin @1.0kg a i ha <sup>-1</sup> +H.W. on 30DAS	154.02	33.07	77.83		156.61	36.06	78.51		158.92	36.94	81.70		156.51	36.02	79.34	152.58	34.49	75.53
W2. P.E pendimethalin @1.0kg a i ha <sup>-1</sup> +H.W. on 30DAS	153.72	34.83	77.48		155.95	35.98	77.97		158.48	36.85	81.28		156.05	35.88	64.91	152.31	34.25	75.28
W3. P.E metolachlor @1.0kg a i ha <sup>-1</sup> +H.W. on 30DAS	154.71	35.35	78.51		157.12	36.37	79.24		160.19	37.22	82.42		157.34	36.31	80.05	153.18	34.68	76.09
W4. P.E oxyfluorfen @0.1kg a i ha <sup>-1</sup> +H.W. on 30DAS	153.01	34.44	76.69		155.22	35.47	77.14		157.77	36.35	80.35		155.33	35.42	78.06	151.73	33.85	74.65
W5. Recommended practice (Two H.W. on 25&45DAS)	151.76	34.22	76.38		154.74	35.24	76.81		157.31	36.99	79.72		154.60	35.18	77.63	151.49	33.71	74.35
W6. Control (No weeding)	148.81	34.38	72.22		151.59	34.15	72.85		152.75	34.69	74.52		151.05	33.51	73.19	148.76	32.02	70.35
SEd	1.11	0.56	1.01		1.01	0.55	1.04		1.15	0.43	0.90		-	-	-	0.83	0.40	1.25
CD	2.21	1.13	2.03		2.03	1.10	2.08		2.32	0.87	1.81		-	-	-	1.66	0.81	2.50

PE - Pre-emergence DAS - Days after Sowing RM - Rabi/mean Interactions are not significant

#### 4.13. Economics (Table 31 & Appendix III)

The data on the economics on different intercropping systems and integrated weed management practices revealed that the net income and the benefit cost ratio were comparatively higher during rabi season than that of kharif.

A mean maximum net income of Rs. 9590 ha<sup>-1</sup> with B:C ratio of 1.65 were obtained during rabi season with regard to the pre-sowing application of glyphosate 15 days prior to land preparation (G<sub>1</sub>). The practice of intercropping in groundnut was also found to be economical. Raising of greengram as an intercrop in groundnut fetches a mean maximum net income of Rs. 8,959 ha<sup>-1</sup> and B : C ratio of 1.65 during rabi season. Similarly, the mean maximum net income of Rs. 11,417 ha<sup>-1</sup> with the B:C ratio of 1.84 were accounted with pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) with an increase of Rs. 1,766 ha<sup>-1</sup> in net income over the recommended practice of hand weeding on 25 and 45 DAS (W<sub>2</sub>). The overall mean maximum net income of Rs. 12,871 ha<sup>-1</sup> and B:C ratio of 1.90 were obtained during rabi season with the combined application of pre-sowing glyphosate followed by pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) for groundnut + greengram intercropping system (I<sub>2</sub>).

From the overall persual of the results it could be summarised that the practice of intercropping greengram in groundnut under 4:1 row propotions, preceeded with pre-sowing application of glyphosate, 15 days prior to land preparation followed by pre-emergence application of metolachlor or fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS, effectively controled both the perennial and annual weeds and resulted in appreciable increment in economic yield of both groundnut and intercrops.

TABLE - 31. ECONOMICS

TREATMENT	RABI SEASON						KHARIF SEASON						
	1992		1994		1995		1994		1994		1994		
	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	G1	G2	MEAN	
	<b>I - NET INCOME (Rs. ha<sup>-1</sup>)</b>												
<b>G XI</b>													
I1	7051	5782	6417	8710	6441	7576	10042	7816	8929	8601	6679	7640	3660
I2	8996	6963	7980	10336	7068	8702	11784	8608	10186	10372	7546	8959	4300
I3	8705	6079	7392	9517	6414	7966	11175	7739	9457	9799	6744	8271	3826
<b>G XW</b>													
W1	10303	8093	9198	11968	8770	10369	13648	10551	12100	11973	9138	10555	5579
W2	9898	7628	8763	11589	8358	9974	13208	10086	11647	11565	8690	10127	5276
W3	10946	8869	9908	12847	9746	11297	14821	11278	13050	12871	9964	11417	6189
W4	9351	6844	8098	10823	7357	9090	12553	9045	10799	10909	7748	9328	4428
W5	9750	7289	8520	11285	7612	9449	12772	9203	10988	11269	8034	9651	4754
W6	-744	-1077	-911	-1387	-1995	-1691	-1001	-1838	-1420	-1044	-1636	-1340	-2656
MEAN	8251	6274	-	9521	6641	-	11000	8054	-	9590	6989	-	2782
	<b>II - BENEFIT COST RATIO</b>												
<b>G XI</b>													
I1	1.59	1.54	1.57	1.57	1.48	1.53	1.66	1.58	1.62	1.60	1.53	1.56	1.25
I2	1.72	1.64	1.68	1.67	1.51	1.59	1.77	1.63	1.70	1.72	1.59	1.65	1.29
I3	1.86	1.56	1.71	1.45	1.46	1.46	1.72	1.56	1.64	1.67	1.52	1.59	1.33
<b>G XW</b>													
W1	1.83	1.76	1.80	1.45	1.64	1.55	1.90	1.78	1.84	1.83	1.73	1.78	1.31
W2	1.78	1.70	1.74	1.75	1.61	1.68	1.85	1.73	1.79	1.79	1.68	1.74	1.36
W3	1.89	1.83	1.86	1.85	1.72	1.79	1.98	1.83	1.91	1.90	1.79	1.84	1.43
W4	1.76	1.61	1.69	1.69	1.53	1.61	1.80	1.65	1.73	1.75	1.59	1.67	1.35
W5	1.80	1.70	1.75	1.74	1.57	1.65	1.84	1.68	1.76	1.79	1.65	1.72	1.30
W6	0.93	0.88	0.91	0.90	0.87	0.89	0.93	0.85	0.89	0.92	0.86	0.89	1.25
MEAN	1.67	1.58	-	1.56	1.61	-	1.72	1.59	-	1.65	1.54	-	1.33
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

RM - Rabi mean

NA - Not analysed

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## DISCUSSION

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## CHAPTER V

### DISCUSSION

Field experiments were conducted during rabi seasons of 1992, 1994, 1995 and kharif 1994 at Regional Research Station, Vridhachalam. The main objective of the investigation was to formulate an effective and economical integrated weed management package for the groundnut based intercropping system. The results of the experimental data presented in the previous chapter are discussed in this chapter.

#### 5.1. Season and climate

The weather parameters that prevailed during the cropping season had significant impact on crop growth and yield. The existence in types, and the intensity of weeds also differed according to the seasonal fluctuations. In general, compared to kharif, the yield of tropical crops under rabi and summer seasons are higher due to ample supply of solar radiation together with the least variations in temperature gradients (Subramanian et al., 1979). Further, the unfavourable excess precipitation with uneven distribution under kharif season was absent during rabi season.

The high temperature coupled with the sufficient hours of solar radiation, prevailed at flowering, pod development and maturity stages of groundnut and intercrops during rabi season might have promoted the photosynthetic efficiency of the crops and resulted in increased productivity. The results are in conformity with the reports of Weiss (1983) who claimed that peanut would be adversely affected by low light intensity during early growth and flowering, and the cloudy weather at flowering.

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## 5.2. Weed Characters

### 5.2.1. Weed flora of the experimental site

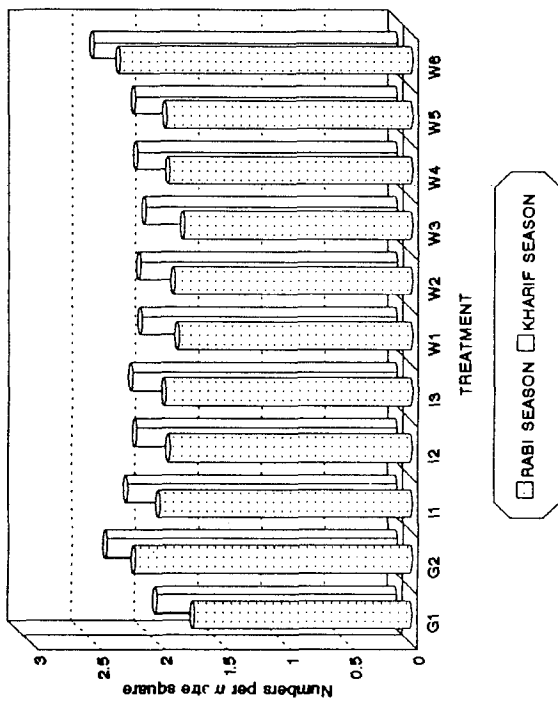
It is well understood from the findings of Vairaven et al. (1995) that pre-emergence herbicides have better control on dicot weeds leaving the grasses and sedges unchecked. Thus the dominance of nutsedge, observed during the present investigations might be due to the practice of monocropping of groundnut, together with prolonged application of pre-emergence herbicides like fluchloralin for control of weeds. Rangaiah (1981) also inferred the relative dominance of nutsedge due to continuous use of similar type of pre-emergence herbicides. The relative dominance of nutsedge observed with the present study was in line with the weed survey done by Venkatakrishnan et al. (1995).

### 5.2.2. Relative efficiency of weed management and intercropping practices on weed characters. (Fig. 3,4,5 & 6)

The total population of weeds and amount of weed drymatter produced were comparatively higher during kharif season, since the excess and uncontrollable precipitation received during initial stages of crop growth might have created a conducive atmosphere for the weeds growth. As the character of weed drymatter production was dependent on nature of weed population, the pattern of variations under DMP of weeds with respect to different weed management and intercropping practices are invariably similar, at all the cropping periods.

The accountable reduction in total weed population and drymatter production of weeds under pre-sowing application of glyphosate, 15 days prior to land preparation ( $G_1$ ) confirms the effectiveness of the treatment. As a post-emergence herbicide, when sprayed on foliage it gets translocated into the plant system and restricts protein and

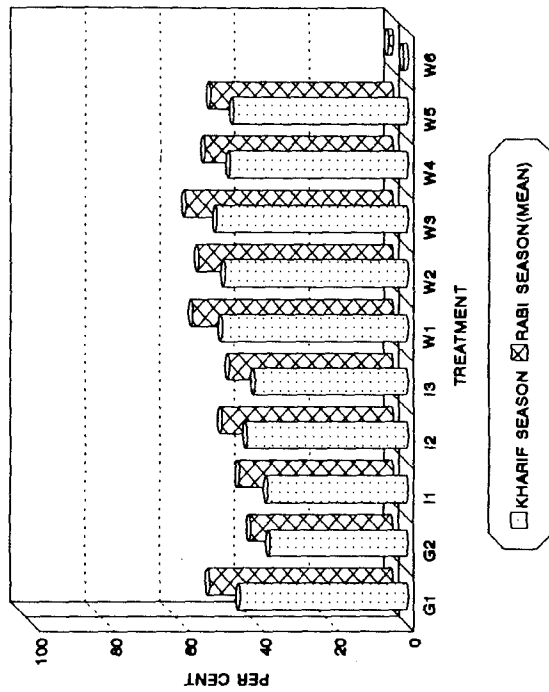
Fig. 3 . TOTAL NUMBER OF WEEDS AT HARVEST



chlorophyll biosynthesis, through inhibition of chlorophyll precursor-5-amino levulinic acid and leads to the collapse of the plant tissue (Kitchen *et al.*, 1981). Use of such herbicide might be of most effective especially for the weed species like nutsedge and perennial grasses which are mainly propagated through underground vegetative rhizomes. Since the intensity of these weeds are gaining dominance in groundnut, application of such translocative herbicide is to be considered. The significant impact of glyphosate on control of nutsedge and other weed species were also documented by Madhavi *et al.* (1992); Manickam and Gnanamoorthy (1994). The appreciable increment in weed control efficiency (WCE) and weed control index (WCI) under this treatment indicate the profound influence of the treatment.

The considerable decline in total weeds population and weed drymatter under groundnut + greengram intercropping ( $I_2$ ) revealed the beneficial effect of greengram in groundnut ecosystem. Being a crop of vigorous growth habit, greengram offers an effective competition with weeds at initial stages and form a dense soil cover along with the groundnut. Shetty and Rao (1981) found that in addition to the crop competition the shading effect of leguminous intercrops might also smother the weed growth, that inturn restricts the drymatter accumulation. In line with the results of the present investigations, the favourable impact of leguminous intercrops like greengram and blackgram on weed suppression was reported by Tewari *et al.* (1989). The high intensity of weeds noticed at early stages under groundnut + redgram intercropping ( $I_3$ ) might be due to the initial slow growth habit of redgram that permit the free growth of weeds. Later, with advancement in crop age, the redgram intercropping system exerts appreciable influence on weed flora through its dense crop canopy.

Fig. 4 . WEED CONTROL EFFICIENCY AT HARVEST



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The decreasing trend of weed density and drymatter accumulation in accordance with the advancement in crop age under integrated weed management practices was due to the intercultivation practices of hand weeding (30 DAS) and earthing up operation (45 DAS). Moreover, the mutual shading of grown up crops and natural senescence of weeds might have also declined the weed population and the drymatter production.

Regardless of the cropping years, the significant reduction in total weed population and weed drymatter on 30 DAS as noticed with recommended practice of hand weeding on 25 and 45 DAS ( $W_3$ ) was due to the fact that the plots under this treatment were given one hand weeding on 25 DAS i.e. prior to the documentation of the data. However, the drastic reduction in plant height, leaf area index and drymatter production of groundnut and intercrops noticed under this treatment revealed its poor efficiency on weed control.

Metolachlor, a pre-emergence herbicide of anilide group of compounds, showed high degree of efficacy in the control of diversified weed flora in groundnut. A moderate control of even the perennial nutsedge by metolachlor was reported by Dixon and Stroller (1982). As pointed out by Hill et al. (1968) the pre-emergence herbicides rapidly deplete the photosynthate reserves within the weed system, through the process of induced respiration, inhibition of protein synthesis and photosynthetic activity. Thus, the pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) exerted significant reduction in weed population and drymatter production which resulted in higher WCE and WCI. The findings of Ramakrishna et al. (1991) and Guggari et al. (1995) lends support to the present investigation.

Fig. 5 . WEED DRY MATTER PRODUCTION AT HARVEST

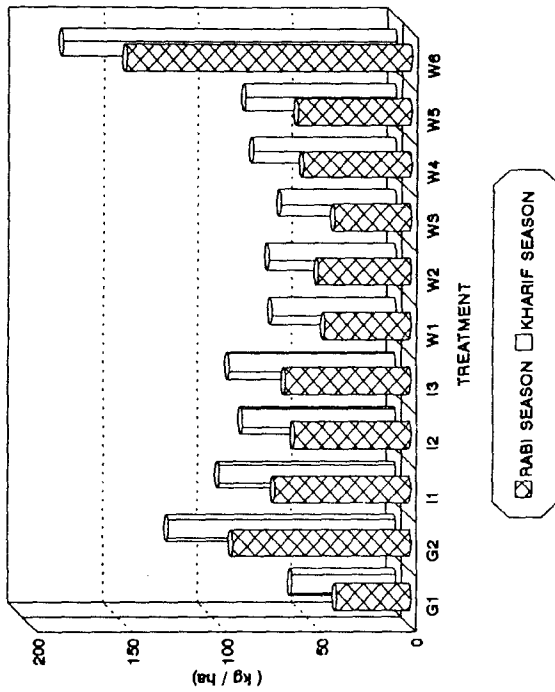
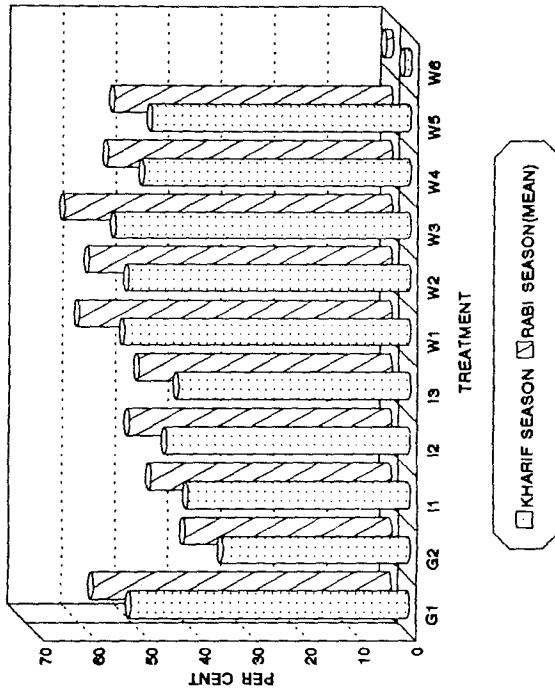


Fig. 6. WEED CONTROL INDEX AT HARVEST



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The comparable values of weed control efficiency and weed control index with the pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>) revealed the effect of the chemical in containing weed population and weed dry matter, in next to metolachlor. The high WCE and WCI under pre-emergence application of oxyfluorfen @ 0.1 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS indicated the ineffectiveness of the chemical in containing the weed flora.

Since the weed population under the recommended practice of hand weeding on 25 and 45 DAS was undisturbed until first hand weeding it might have facilitated the weed flora for its sound establishment. Consequently, the least weed control efficiency and weed control index observed with this treatment at initial stages tends to maintain at all the stages of crop growth.

The outstanding efficacy of glyphosate on reducing the weed flora in combination with the competitive and shading effect of greengram in groundnut intercropping (G<sub>1</sub>I<sub>2</sub>) might have appropriately reflected on increased values of weed control efficiency and weed control index. Similarly, the effective performance of metolachlor @ 1.0 a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) preceded with pre-sowing glyphosate application (G<sub>1</sub>W<sub>3</sub>) resulted in appreciable reduction of weed population and weed drymatter production.

### 5.2.3. Nutrient removal by weeds

In general, the behaviour of drymatter production and the NPK uptake were positively correlated. Hence, the higher drymatter of weeds that obtained during the kharif season might be the reason for increased uptake of NPK by weeds.

The significant effect of pre-sowing glyphosate application prior to land preparation (G<sub>1</sub>) in containing weeds growth have well reflected on uptake of NPK. Under the

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inhibited conditions of protein synthesis, the physiological system of weeds gets affected and resulted in the poor uptake of nutrients. In conformity with this, Satao et al. (1995) noticed least uptake of NPK by weeds under glyphosate application, compared to unapplied check.

The accommodative nature of greengram in groundnut ecosystem, besides with its competitive and shading behaviour exerts considerable reduction in NPK uptake of weeds, through reducing their growth and drymatter accumulation. The lower uptake of NPK by weeds under groundnut + greengram (I<sub>2</sub>) and groundnut + redgram intercropping (I<sub>3</sub>) compared to sole groundnut (I<sub>1</sub>) revealed the favourable effect of intercropping on weed suppression.

Since, the NPK uptake by weeds was dependent factor on weed drymatter production, the trend of reduced NPK accumulation in accordance with the age of the crop was noticed. The lowest quantity of NPK uptake documented with pre-emergence application of metolachlor @ 1.0 kg a.i.ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) might be due to the consequent effect of this treatment on the depression in weed growth and drymatter production. Similar report of reduced NPK removal by weeds due to the practice of integrated weed management in groundnut was reported by Murthy et al. (1993). It was also inferred that the application of pre-emergence fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. (W<sub>1</sub>) was next in order regarding reduced NPK removal by the weeds, showing the effectiveness of the chemical.

### 5.3. Growth and yield components of groundnut

The favourable climatic conditions that prevailed during the rabi season might have distinct effect on the improvement of growth and yield components in groundnut.

### 5.3.1. Growth characters

As the magnitude of weed control was high under pre-sowing application of glyphosate ( $G_1$ ) it might permit the groundnut to exploit the available resources at the maximum extent and resulted in appreciable improvement in growth characters viz. plant height, leaf area index and the drymatter production. In addition under glyphosate untreated plots ( $G_2$ ), the exudates from nutgrass might also inhibit the germination and growth of groundnut as reported by Velu *et al.* (1992). It inturn retards the plant height, LAI and subsequently on drymatter accumulation.

In addition to the complementary effect of greengram in groundnut ecosystem ( $I_2$ ) the effect on weed suppression through mutual shading with groundnut might have improved the growth parameters like plant height, leaf area index and drymatter production. The improved nodulation behaviour of groundnut under intercropping with greengram as reported by Kulkarni and Sojitra (1986) might have also favoured growth components indirectly. Similar results under groundnut + greengram intercropping situations were inferred from the reports of AICORPO (1977). The comparable increment of the above growth components under groundnut + redgram intercropping ( $I_3$ ) confirmed the earlier investigations made by Balakrishnan and Rajendran (1987) that the root exudates of redgram also exerts allelopathic effect on weed flora.

It is evident from the crop weed competition studies by Kaliselvan *et al.* (1991a) that groundnut requires an initial weed free environment from 0 to 45 DAS to exhibit their maximum growth and yield potentials. Since the pre-emergence application of metolachlor @1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) had assure a

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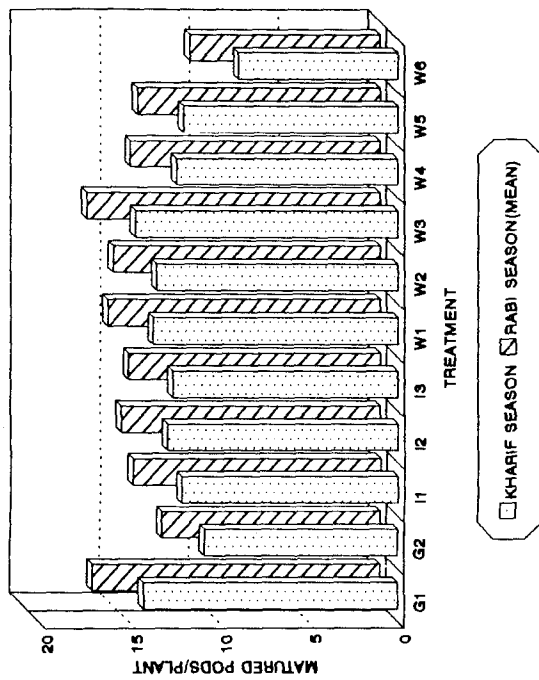
comparatively weed free environment, higher values of plant height, leaf area index, dry matter production and nodule number were attributed. The results were in agreement with the findings of Ramakrishna et al. (1991). The increase in growth parameters with pre-emergence application of fluchloralin @ 1.0 kg a.i ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>) also showed the comparable efficacy of the treatment. Similar report that reveals the higher efficacy of pre-emergence application of fluchloralin @ 0.9 kg a.i ha<sup>-1</sup> + one H.W on 35 DAS was documented by patel et al. (1992).

### 5.3.2. Yield components

The high response of yield contributing charaters of groundnut, viz. number of pods plant<sup>-1</sup> ( Fig.7),100 kernal weight, shelling and SMK percentage to the pre-sowing application of glyphosate confirmed the profound efficacy of the chemical in containing the weed population. Under low level of weed competition at critical phases of crop growth, groundnut utilized the available resources at the maximum extent, which ultimately reflected on growth and yield components. The effectiveness of glyphosate on weed flora especially on nutsedge, reported by Howton et al. (1992) and Derr and Wilcut (1993) were in favour of our findings.

A distinct improvement in yield parameters were not noticed among the different intercropping situations. However, the numerical high values under groundnut + greengram (I<sub>2</sub>)system clearly explains the complementary effect of the system. In accordance, Reddy and Willy (1979) showed that conversion of photosynthetic active radiation to assimilate synthesis and their accumulation, under combined canopy are higher compared to sole crop of groundnut. Athmanathan (1988) and Kavimani et al. (1991) also noticed the appreciable improvement in yield parameters of groundnut when intercropped with greengram and redgram respectively.

Fig. 7. NUMBER OF MATURED PODS PER PLANT



Among the integrated weed management practices, the significant improvement in yield deciding characters as noticed under the application of metolachlor @ 1.0 a.i. ha<sup>-1</sup> + H.W. on 30 DAS (W<sub>3</sub>) clearly illustrated the high potentiality of the treatment in weed control. The increase in leaf area index and drymatter production recorded under this treatment might have contributed for this substantial increase in yield components. In addition the studies on relative partitioning of drymatter in groundnut by Pannu et al. (1991) revealed that, under weed free conditions, the internal translocation of photosynthetic substrates to pods and kernels were higher due to appreciable improvement in leaf area index (LAI), leaf area duration (LAD) and the crop growth rate (CGR). Suresh (1984) and Ramakrishna et al. (1991) also obtained appreciable improvement in yield parameters through application of pre-emergence metolachlor in groundnut. The comparable improvement in yield parameters as observed with pre-emergence application of fluchloralin @ 1.0 a.i.ha<sup>-1</sup> and pendimethalin @ 1.0 kg a.i ha<sup>-1</sup> respectively with one hand weeding on 30 DAS showed on par excellence of the treatments. The effectiveness of the above pre-emergence herbicides in groundnut and groundnut based intercroppings were respectively claimed by Patel et al. (1992) and Yellamanda Reddy and Padmalatha (1994). Moreover, the decrease in the case of number of immature pods plant<sup>-1</sup> under these treatments confirmed their appreciable effect on pod filling character of groundnut indirectly. The least improvements in growth and yield components of groundnut under pre-emergence application of oxyfluorfen @ 0.1 kg. a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>4</sub>) revealed the poor efficacy of the herbicide.

#### **5.4. Growth, yield components and yield of intercrops**

The comparable upgradation in growth and yield parameters of intercrops during rabi season might be due to the prevalence of favourable climatic condition as discussed

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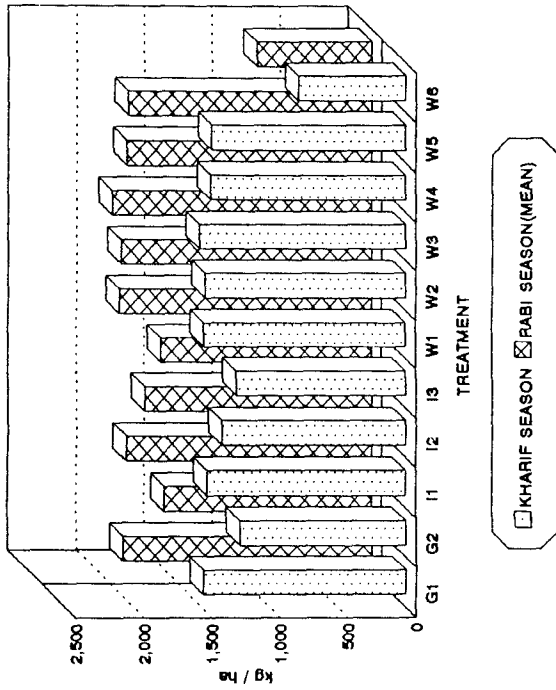
earlier. Compared to the glyphosate unsprayed plots ( $G_2$ ), the weed free conducive environment noticed under pre-sowing glyphosate applied plots ( $G_1$ ) might be the probable reason for appreciable improvement in growth attributes such as plant height, leaf area index and the drymatter production of intercrops. The overall increase in growth components has invariably reflected upon the yield parameters like number of pods plant<sup>-1</sup>, test weight and the total grain yield.

Among the sub plot treatments, application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> with one hand weeding on 30 DAS ( $W_3$ ) registered maximum weed reduction, thereby creating a favourable environment for the intercrops to exhibit their relative yield potentials. The improvement in growth and yield attributes obtained under pre-emergence application of fluchlorlin @ 1.0 kg a.i ha<sup>-1</sup> + one H.W. on 30 DAS showed the comparable efficacy of the herbicide. Similar report in improvement in growth and yield attributing characters of greengram and redgram through application of fluchloralin was noticed by Balyan(1993)and Rajput and Pandey (1994).

#### 5.5. Pod yield (kg ha<sup>-1</sup>) (Fig.8)

Being  $C_3$  plant, the climatic fluctuations, especially the hours of sunshine, temperature gradients and the precipitation had significant influence on the productivity of groundnut (Pallas and Samish 1974). The high productivity of pods during rabi season might be due to the prevalence of lengthy hours of sunshine and high temperature, during flowering and pod development stages. On the other hand, the cloudy weather with undesirable precipitation that prevailed at vegetative and flowering stages under kharif season might have considerably reduced the groundnut productivity.

Fig. 8. POD YIELD (Kg/ha)



Besides its rapid translocative behaviour, glyphosate accumulates at high concentrations at the actively growing regions of roots and shoots and resulted in effective suppression of weed flora (Wyrill and Burnside, 1976). Hence, the pre-sowing glyphosate application prior to land preparation ( $G_1$ ) offered an ideal situation for groundnut to exhibit its relative yield potential. The consistent improvement in growth and yield parameters obtained under this treatment might have imparted similar expressions on pod production. Accordingly, the studies conducted by Manickam and Gnanamurthy (1994) also revealed the effectiveness of glyphosate on weed population under non-cropped situations.

The numerical improvement in growth and yield characters in intercropped groundnut failed to express their superiority in pod yield over sole cropping of groundnut ( $I_1$ ). Under the present investigations, the groundnut with the intercrops are raised in 4:1 ratio (replacement series). Thus the reduction in pod yield of groundnut under intercropped stand was mainly due to the reduction of groundnut population per unit area. Similar report of yield reduction in intercropped groundnut and redgram under intercropped situations were reported by Selvam and Sundararajan (1991); Shinde et al. (1991); Maheswara Reddy et al. (1994) and Subbiah et al. (1995 b).

The distinct improvement in groundnut pod yield realized under pre-emergence application of metolachlor @ 1.0 a.i.  $ha^{-1}$  + one H.W on 30 DAS ( $W_3$ ) indicated the profound effectiveness of the treatment in weed control. The pre-emergence herbicides like metolachlor, rapidly depletes the assimilate reserves in weeds through induced respiration, protein synthesis and restriction in photosynthetic activity might have resulted in mortality of the weed species. Further, through the practice of hand weeding on 30 DAS, the weeds that germinate inspite of the application of herbicides were

effectively suppressed. Thus, under lower level of weed competition at the critical stages of crop growth the groundnut could utilize the available resources at maximum level and put forth better improvement in growth and yield attributing characters and finally on crop yields. The results were in agreement with the findings of Suresh (1984) and Ramakrishna et al. (1991) The yield obtained with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS (W<sub>1</sub>) revealed the comparable efficiency of the treatment. Appreciable increase in pod yield of groundnut with this treatment combination was also reported by Kumar (1993) and Yellamanda Reddy and Padmalatha (1994).

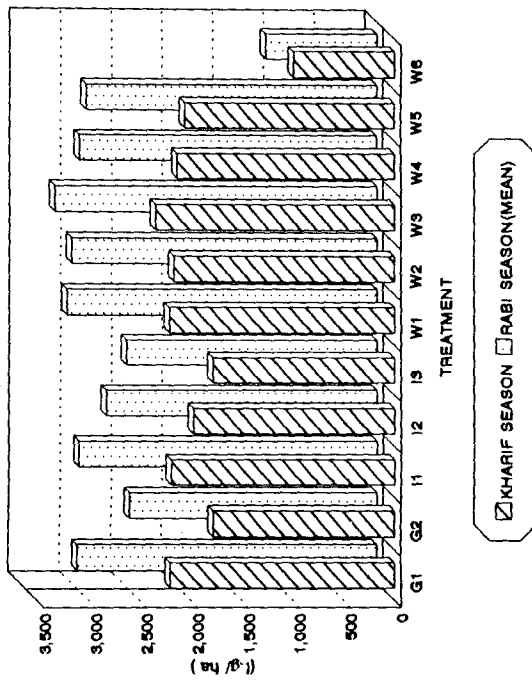
#### 5.6. Haulm yield (kg ha<sup>-1</sup>) (Fig.9)

The drymatter accumulation of groundnut was comparatively higher during rabi season due to the favourable climatic conditions.

The perusal of the earlier literature revealed that the weed free conditions during the initial stages of crop growth resulted in appreciable improvement in growth components viz. plant height, leaf area index and subsequently on plant drymatter production. Hence, the accountable increase in haulm yield obtained with the pre-sowing glyphosate application (G<sub>1</sub>) was owing to the effective suppression of weed population.

The base crop of groundnut significantly recorded the maximum haulm yield has compared to its intercrop situations. Since the intercrops of greengram and redgram were raised in 4:1 ratio with groundnut under replacement series, the reduction of haulm yield in groundnut under intercropped situation was mainly because of the reduction in population rather than the treatmental effect. It was evident from the fact that the performance of growth components that decides the ultimate haulm production viz. plant

Fig. 9. HAULM YIELD (Kg/ha)



height, leaf area index and the drymatter production were fairly higher under intercropped situations. The findings are in line with the results of Maheswara Reddy *et al.* (1994) and Subbiah *et al.* (1995a).

The considerable increment in haulm yield under pre-emergence application of metolachlor @ 1.0 kg a.i.ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) confirmed the effectiveness of the treatment. Studies by Soundararajan *et al.* (1981) and Naidu *et al.* (1982) showed that under weed free conditions, inspite of maximum utilization of available resources, the nutrient uptake by groundnut was doubled. Since the practice of pre-emergence application of metolachlor @ 1.0 kg a.i ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) assured a weed free environment at the critical stages of crop growth, the increased uptake of nutrient was resulted. It ultimately reflected upon the drymatter accumulation. The results are in line with the findings of Suresh (1984). The haulm yield as obtained under pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>) indicated the comparable effectiveness of the treatment.

### 5.7. Oil content

The data on oil content revealed that though a distinct variation was not ascertained, the oil content of kernels was numerically higher during rabi seasons. The higher values as obtained during rabi season might be due to the high temperture gradients that favoured oil accumulation, as found out by Smartt (1976).

The identical values of groundnut oil content, with regard to different intercropping and pre-emergence herbicides based weed managment methods clearly explained the ineffectiveness of the measures in improving the oil content. As the factor of oil

accumulation was dependent on genetic makeup of the cultivar, the increase could not be attributed.

#### 5.8. Pod Equivalent (kg ha<sup>-1</sup>) (Fig. 10)

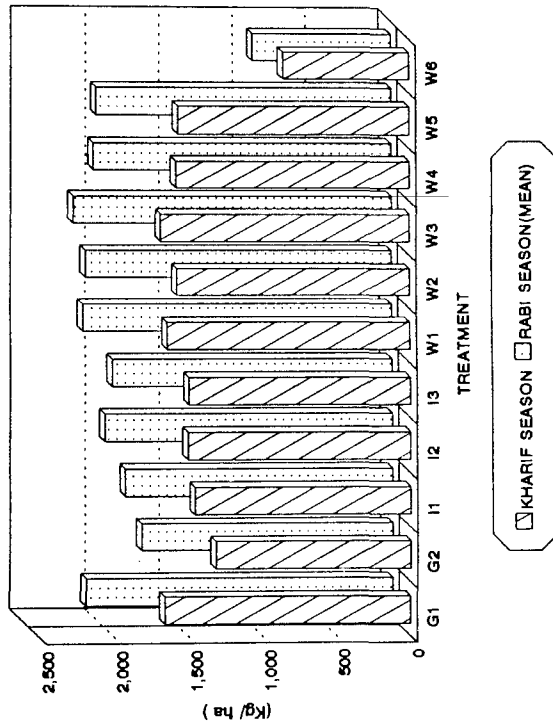
Pod equivalent a viable indice, computed with economic produces of sole and intercrops, used to ascertain the economic advantage of an intercropping system. The increasing trend in pod equivalent denotes the high efficiency of an intercropping system.

Reddy (1988) summarised that if water stress is not a constraint, clear, cloudless days with high temperature gradients have the greatest potential for photosynthetic activity leading to higher crop yields in groundnut. Hence, the accountable increment in yield of groundnut and intercrops obtained during rabi season, might be due to the congenial climatic conditions.

Studies by Maligeppagol et al. (1994) revealed that under unweeded condition, nutsedge develops series of shoots connected by bulbs, rhizomes and tubers that ultimately retards root proliferation, nutrient uptake, pegging, pod development and harvesting process. Since their population was effectively suppressed under pre-sowing glyphosate applied 15 days prior to the land preparation (G), a favourable environment was attributed for groundnut and intercrops to show their relative yield potentials. Similar report of reduction in nuts, tubers of nutsedge through application of glyphosate @ 1.5 kg ha<sup>-1</sup> with ammonium sulphate was reported by Ahuja and Yaduraju (1995).

Detailed studies have been carried out regarding the beneficial effects due to inclusion of legumes under intercropping systems. Lomte et al. (1995) obtained a appreciable improvement in soil bulk density, infiltration rate and organic carbon content

Fig. 10. POD EQUIVALENT (Kg/ha)



when legumes were intercropped in groundnut and it facilitated better root proliferation and nutrient uptake of both the crops. Jeyaram Reddy and Reddy (1981) and Patel and Mehta (1992) pointed out that the conversion of photosynthetic active radiation was higher when legumes were intercropped in groundnut, that leads to higher accumulation of photosynthates. Athmanathan (1988) found the high uptake of nutrients by both the crops, when groundnut was intercropped with greengram. Moreover, the studies by Patterson (1982) revealed that through mutual shading, intercropping practices might also suppress the weeds like nutsedge, which are sensitive to shading. Hence, these above facts might have favourably improved the growth and yield components of both the crops, and resulted in substantial yield increments.

The appreciable pod equivalent obtained with the pre-emergence application of metolachlor @ 1.0 kg a.i ha<sup>-1</sup> + one H.W on 30 DAS (W<sub>3</sub>) confirmed the significant impact of the treatment on weed control. Suresh and Nanjappa (1994) stated that the most critical period of weed competition ranged from 0 to 45 DAS. Hence, the effective weed suppression that obtained through this treatment might have offered a weed free environment leading to considerable increase in yield of groundnut and intercrops that might have appropriately reflected upon the pod equivalent. The substantial yield increase in groundnut through pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) was also reported by Guggari et al. (1995). The pod equivalent as obtained with the pre-emergence application of fluchloralin @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS (W<sub>1</sub>) indicates the comparable effect of the treatment. Similarly the reduction in pod equivalent under pre-emergence application of oxyfluorfen @ 0.1 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS (W<sub>2</sub>) revealed the poor efficacy of the herbicide.

The interaction effect of pre-sowing glyphosate in combination with intercropping of greengram ( $G_1I_2$ ) or with the pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W on 30 DAS ( $G_1W_3$ ) were found to be much pronounced, since the adoption of individual management practices itself can contribute appreciable increase in yield of both the *groundnut and intercrops*.

#### 5.9. Land Equivalent Ratio

The Land Equivalent Ratio (LER), is an appropriate indice to ascertain the effectiveness of an intercropping system. Since, under the pre-sowing application of glyphosate ( $G_1$ ) the economic produce of both the groundnut and intercrops are higher, it might have resulted in the increased LER values.

LER values with groundnut + greengram intercropping ( $I_2$ ) was higher confirming the beneficial effect of greengram in groundnut. Similar results of appreciable increment in values of LER under 4:1 row arrangement of groundnut with greengram, blackgram and redgram were obtained by Athmanathan (1988) and Solaiyappan et al. (1994).

The effective suppression of weed population under pre-emergence application of metolachlor @ 1.0 kg a.i ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ), considerably increased the yield of *groundnut and intercrops* which ultimately reflected upon the higher values of land equivalent ratio.

The distinctly higher values of LER noticed with the combination of pre-sowing glyphosate application respectively with intercropping of greengram ( $G_1I_2$ ) and pre-

emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W one 30 DAS (G<sub>1</sub> W<sub>3</sub>) clearly revealed the effective interaction of the treatments.

#### 5.10. Nutrient removal by groundnut and intercrops

The appreciable quantity of NPK removal by groundnut and intercrops as ascertained under *rabi* seasons might be due to the favourable environmental condition which augment the drymatter production of groundnut and intercrops. Since the NPK uptake was a dependent factor of drymatter production, the pattern of increase under DMP accumulation was well expressed with NPK removal.

The practice of application of pre-sowing glyphosate prior to the land preparation (G<sub>1</sub>) offered a conducive environment for groundnut, through effective control of weed population compared to the unsprayed control (G<sub>2</sub>). Hence, the quantum of NPK uptake was remarkably higher under this treatment. Accordingly, Yadav et al. (1986) pointed out that the weed control measures assure saving of soil nutrients and subsequently it helps in better uptake by the crops.

The considerable improvement in NPK uptake of groundnut and intercrops under the groundnut + greengram intercropping system (I<sub>2</sub>) revealed that greengram in accomodation with groundnut imparted adequate suppression effect on weed population, which inturn facilitated higher uptake of NPK of individual crops. Athmanthan (1988) also documented higher NPK uptake of groundnut and greengram, under intercropped situations. The poor uptake of nitrogen and potassium under groundnut + redgram intercropping (I<sub>3</sub>) on 30 DAS might be due to the slow growth habit of redgram at initial stages. Later on N and K uptake got increased since the biomass production in redgram gets accelerated beyond

30 DAS. However, the uptake pattern of phosphorus under groundnut + redgram ( $I_3$ ) showed an increasing trend over sole crop of groundnut from initial stage onwards. This confirmed the earlier findings of positive response of pulse crops to phosphorus application (Rajpurochit and Gaur, 1986).

The distinct reduction in weed drymatter production under pre-emergence application of metolachlor @ 1.0 kg a.i ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) might have offered a weed free environment for groundnut and intercrops for their free uptake of NPK. Thus the results are in accordance to the findings of negative correlation between weeds and crops as reported by Phabhara Setty and Hosmani (1977) and Girijesh and Patel (1989). Through integrated system of weed management in groundnut higher uptake of NPK was reported by Pannu et al. (1991) and Murthy et al. (1993). The NPK uptake by groundnut and intercrops under pre-emergence application of fluchloralin @ 1.0 kg a.i ha<sup>-1</sup> + one H.W on 30 DAS ( $W_1$ ) showed its second best efficacy in weed control. Under the recommended practice of hand weeding (25 and 45 DAS) the NPK uptake of groundnut and intercrops was lower since the weed population in this treatment was undisturbed until the first hand weeding on 25 DAS.

The interactions of pre-sowing glyphosate with intercropping of greengram in groundnut ( $G_1I_2$ ) under pre-emergence application of metolachlor @ 1.0 kg a.i ha<sup>-1</sup> + H.W. on 30 DAS ( $G_1W_3$ ) were superior in NPK uptake of both the crops, since the effect of these practices on weed control was much pronounced.

### 5.11. Post harvest available soil NPK

Through effective suppression of weed population under pre-sowing glyphosate application the exhaustive removal of nutrients from the soil reserve by the weeds might have been restricted. This attributed for the increased availability of NPK in soil after the harvest of the crops.

The greengram, being an accommodative legume in groundnut ecosystem, tends to accumulate higher quantum of nitrogen through their nodulation behaviour (Kulkarni and Sojitra 1986). Through addition of disintegrated root nodules at harvest, large quantity of leaf fall, addition of roots portion to soil and the humic acid substances secreted by the greengram roots favoured an increased availability of nutrients in soil stratum (Athmanathan, 1988). Moreover, due to their competitive and shading effect on weed flora, it restricted the nutrient uptake by weeds. These effects might have contributed for the higher availability of nitrogen and potassium in the soil. The findings of Kothari and Saraf (1987) and Jaganathan (1987) are in accordance with the present finding. The low quantity of available soil phosphorus under groundnut + greengram ( $I_1$ ) and groundnut + redgram ( $I_2$ ) intercroppings than sole groundnut ( $I_3$ ) confirms the response of pulses to applied phosphorus.

The maximum available NPK under the pre-emergence application of metalochlor @ 1.0 kg a.i ha<sup>-1</sup> + one H.W on 30 DAS ( $W_3$ ) revealed the distinct effectiveness of treatment. Through integration of this herbicide application with hand weeding operation, the vigorous competition offered by the weed flora for nutrients and other resources might have been contained. It resulted in poor nutrient uptake by the weeds and offered higher availability of nutrients in soil. The findings are in agreement with that of Ambulkar et.al.

(1993) who observed that the soil available nitrogen and phosphorus were improved through adoption of weed management practices. The comparable nutrient status of soil as obtained under pre-emergence application of fluchloralin @ 1.0 kg a.i ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>1</sub>) and pendimethalin @ 1.0 kg a.i ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>2</sub>) showed comparable efficacy of the treatments.

### 5.12. Economics

The maximum net income coupled with higher benefit cost ratio, under pre-sowing glyphosate application prior to land preparation (G<sub>1</sub>) confirmed the economic viability of the treatment.

Among the practices of intercropping, groundnut + greengram (I<sub>2</sub>) was considered to be the most remunerative since the monetary profit and the return per rupee investment were fairly higher. The ultimate increase in both the crop yield might be the cause for high net income under this system. The results are in accordance with the reports of AICORPO (1991).

The highest net profit and the return per rupee invested as offered by the pre-emergence application of metolachlor @ 1.0 kg a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>) emphasised the economic advantage of the practice.

Taking into consideration of the overall economic aspects it can be ascertained that, for an assured maximum monetary returns, adoption of pre-sowing application of glyphosate in conjunction with pre-emergence application of metolachlor @ 1.0 kg a.i ha<sup>-1</sup> + one H.W on 30 DAS for groundnut + greengram intercropping was the best, followed by pre-sowing application of glyphosate + pre-emergence application of fluchloralin @ 1.0 kg a.i ha<sup>-1</sup> + one H.W on 30 DAS for groundnut and greengram.

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## SUMMARY AND CONCLUSION

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## CHAPTER VI

### SUMMARY AND CONCLUSION

Field experiments were conducted during rabi seasons of 1992, 1994, 1995 and kharif 1994 to elicit informations on the effect of different integrated weed management practices on groundnut based intercropping system at Regional Research Station, Vridhachalam.

The experiments were laidout in split plot design with three replications. The treatments consisted of pre-sowing application of glyphosate @ 1.0 per cent + ammonium sulphate @ 1.0 per cent, 15 days prior to land preparation in comparison with unsprayed control and the practice of intercropping greengram and redgram in 4:1 ratio with groundnut (replacement series) were accomodated under main plot. The pre-emergence herbicides viz. fluchloralin @ 1.0 k.g a.i. ha<sup>-1</sup>, pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup>, metolachlor @ 1.0 kg a.i. ha<sup>-1</sup>, oxyfluorfen @ 0.1 kg.a.i. ha<sup>-1</sup>, respectively with one hand weeding on 30 DAS in comparison with the recommended practice of hand weeding on 25 and 45 DAS and the unweeded control were allocated to the sub-plot.

The data on weed flora of the experimental site prior to pre-sowing application of glyphosate, the individual population of sedge, grasses and dicots on 30,60 and 105 DAS (at harvest) were recorded and from that the total weed population was computed. The weed control efficiency and weed control index at harvest stage were workedout. The data on growth parameters of groundnut viz. plant height, Leaf area index (LAI), drymatter production respectively on 30,60 and 105 DAS and the yield parameters such as number of pods plant<sup>-1</sup>, number of immature pods plant<sup>-1</sup>, hundred kernel weight, shelling per centage, sound matured kernel per centage, oil content, pod and haulm yield on 105 DAS

(at harvest) were documented. Similarly, the growth components viz. plant height, LAI and DMP and the yield parameters viz. number of pods plant<sup>-1</sup>, test weight and the grain yield of both the intercrops were recorded at harvest. Based on the quantum of economic produce from groundnut and intercrops the land equivalent ratio (LER) and groundnut pod equivalent were worked out. The N, P and K uptake of weeds at harvest stage of groundnut and the uptake by groundnut on 30, 60 and 105 DAS were analysed. Pre-sowing and post harvest soil available NPK were also estimated. Economic aspects of the different intercropping and weed management practices were calculated. The observed data were subjected to statistical analysis.

The conclusions inferred from the present investigations are summarised below.

In general, the performance of both the groundnut and intercrops were comparatively better during rabi season due to the favourable climatic conditions.

Nutsedge was found to be dominated among the weed flora, followed by grasses and dicots regardless of the different cropping years.

The pre-sowing application of glyphosate prior to land preparation (G<sub>1</sub>) significantly suppressed the population of sedges, grasses and dicots resulting in accountable decrease in drymatter production of weeds. The practice of intercropping of greengram in groundnut (I<sub>2</sub>) under 4:1 ratio was also found to impart considerable reduction in weed population and weed drymatter production. The weed intensity and the quantum of drymatter accumulation were appreciably reduced under pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS (W<sub>3</sub>). The reduction in weed population and drymatter production under the combinations of the above practices were much pronounced.

A considerable increment in weed control efficiency (WCE), and weed control index (WCI) were obtained through pre-sowing application of glyphosate ( $G_1$ ). Regarding intercropping systems the higher values of WCE and WCI were accounted under groundnut + greengram intercropping system followed by groundnut + redgram. The pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) registered the maximum WCE and WCI and it was followed by pre-emergence application of fluchloralin @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_1$ ). Accordingly, the higher values of WCE and WCI were achieved through the combination of these management practices.

The pre-sowing application of glyphosate ( $G_1$ ) appreciably improved the growth components in groundnut viz. plant height, leaf area index and the drymatter production. Regarding intercropping systems, though the numerical improvement in growth parameters were under groundnut + greengram ( $I_2$ ), a distinct variations was not exhibited. The performance of the growth components of groundnut was better under pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ).

The yield attributes of groundnut viz. number of pods plant<sup>-1</sup>, 100 kernel weight, shelling per centage and SMK per centage showed positive response to the pre-sowing application of glyphosate ( $G_1$ ). Among the intercropping systems, the significant variations in regard to the yield deciding characters of groundnut were not observed. The increased values of yield components in groundnut were obtained under the pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ). Comparable results were also noticed with pre-emergence application of fluchloralin @ 1.0 kg.a.i. ha<sup>-1</sup> + H.W. on 30 DAS ( $W_1$ ).

A distinct increment in pod yield of groundnut was obtained under pre-sowing application of glyphosate ( $G_1$ ). As compared to sole groundnut, the pod yield of intercropped groundnut was reduced considerably, due to less population of groundnut. The pod yield of groundnut was found to be significantly improved under pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ). The pre-emergence application of fluchloralin @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_1$ ) also registered comparable pod yields.

The haulm yield of groundnut was also substantially increased with the application pre-sowing glyphosate ( $G_1$ ). The practice of intercropping of greengram in groundnut ( $I_2$ ) do not exerts accountable variations in haulm yield of groundnut. As observed under pod yield, the haulm yield of base crop was also reduced considerably under intercropped situations. The haulm yield of groundnut under pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS increased considerably.

The significant variations in percentage of oil accumulation in groundnut was not noticed with respect to the different practices of intercropping and integrated weed management practices.

Both the practices of weed management viz. pre-sowing application of glyphosate ( $G_1$ ) and pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) exerted appreciable improvement in the growth and yield attributes of intercrops.

The appreciable increase in yield of groundnut and intercrops under pre-sowing application of glyphosate, 15 days prior to the land preparation ( $G_1$ ) resulted in significant increment in pod equivalent. Among intercropping systems, a consistent improvement in

pod equivalent was noticed under groundnut + greengram ( $I_2$ ) followed by groundnut + redgram ( $I_3$ ) intercropping. Similarly, the pod equivalent that obtained under pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) was distinctly higher. It was then followed by pre-emergence application of fluchloraline @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_1$ ). The combination of these practices also fetched considerable increment in pod equivalent of groundnut.

Higher values of land equivalent ratio (LER) was obtained through pre-sowing application of glyphosate ( $G_1$ ). The increase in LER values under groundnut + greengram intercropping ( $I_2$ ) system denoted the effective and economic viability of the system). The pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) also improved the LER values significantly. Moreover, the combinations of these practices also imparted accountable increment in LER values.

The reduction in the uptake of N, P and K by weeds under pre-sowing application of glyphosate was pronounced. The quantum of N, P and K uptake by weeds were appreciably restricted under groundnut + greengram intercropping system ( $I_2$ ). Similarly the pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ) considerably minimised the weeds NPK uptake followed by the pre-emergence application of fluchloralin @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_1$ ).

The amount of N, P and K removal by the groundnut and intercrops under pre-sowing application of glyphosate ( $G_1$ ) was appreciably higher. The practice of intercropping of greengram in groundnut ( $I_2$ ) resulted in significant increment in the removal of N,P and K. The nutrient uptake of groundnut and intercrops were significantly higher under pre-emergence application of metolachlor @ 1.0 kg.a.i. ha<sup>-1</sup> + one H.W. on 30 DAS ( $W_3$ ).

The combination of these practices have also shown significant impact on NPK removal by both the crops.

The availability of N,P and K in the soil under groundnut + greengram intercropping ( $I_2$ ) was considerably higher. However, the system of intercroppings depletes appreciable quantity of phosphorus from the soil. The considerable increase in N P and K status of the post harvest soil indicated the effectiveness of pre-emergence application metolachlor @ 1.0 kg. a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $W_3$ ) in lowering the loss of nutrients through weeds.

The net income and the benefit cost ratio were higher under pre-sowing application of glyphosate, prior to land preparation ( $G_1$ ). The maximum net profit obtained with groundnut + greengram intercropping ( $I_2$ ) revealed the remunerative advantage of the system. The maximum net income and benefit cost ratio were also realized through pre-emergence application of metolachlor or fluchloralin @ 1.0 kg.a.i.  $ha^{-1}$  + one H.W. on 30 DAS ( $W_3$ ).

To sum up the results, the pre-sowing application of glyphosate @ 1.0 per cent + 1.0 per cent of ammonium sulphate, 15 days prior to land preparation followed by pre-emergence application of metolachlor @ 1.0 kg.a.i.  $ha^{-1}$  + one H.W. on 30 DAS for groundnut + greengram intercropping may be advocated, since the above treatment combination effectively suppressed the weed population and resulted in higher yields of groundnut and greengram besides increased the net return per unit area. Alternatively, the practice of intercropping of greengram with groundnut and the integrated weed management through pre-sowing application of glyphosate and pre-emergence application of fluchloralin @ 1.0 kg.a.i.  $ha^{-1}$  + one H.W. on 30 DAS may be followed. In general intercropping was found to be better than sole crop of groundnut.

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**APPENDIX**

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**APPENDIX - I**  
**METEOROLOGICAL DATA OF THE CROPPING SEASONS**

Std. week & Months	Date	Temperature° C		Sunshine (hrs)	Total Rainfall (mm)	No of Rainy days
		Max	Min			
<b>Rabi - 1992</b>						
52 Dec'92	25-31	32.1	18.4	5.4	-	-
1 Jan'93	1-7	29.0	18.1	5.8	-	-
2 Jan'93	8-14	31.2	19.6	7.7	-	-
3 Jan'93	15-21	31.1	19.0	6.8	-	-
4 Jan'93	22-28	30.4	19.3	8.5	-	-
5 Feb'93	29-4	30.9	18.9	9.1	-	-
6 Feb'93	5-11	30.2	18.2	9.4	-	-
7 Feb'93	12-18	32.4	23.3	8.6	-	-
8 Feb'93	19-25	32.7	23.6	9.1	-	-
9 Mar'93	26-4	32.6	22.1	6.7	-	-
10 Mar'93	5-11	31.0	21.0	8.4	-	-
11 Mar'93	12-18	32.4	24.1	8.1	-	-
12 Mar'93	19-25	33.7	26.2	8.4	-	-
13 Apr'93	26-1	36.3	25.1	8.6	-	-
14 Apr'93	2-8	36.5	27.4	9.3	-	-
15 Apr'93	9-15	36.4	28.6	8.4	-	-
<b>Rabi - 1994</b>						
51 Dec	15-21	29.2	21.9	5.6	6.9	2
52 Dec	22-28	28.2	21.3	5.6	8.4	1
1 Jan	29-4	29.6	21.6	5.5	-	-
2 Jan	5-11	30.0	22.2	5.4	-	-
3 Jan	12-18	30.1	22.7	5.6	3.0	1
4 Jan	19-25	29.1	20.4	5.7	7.4	1
5 Feb	26-1	30.6	21.1	6.9	-	-
6 Feb	2-8	33.6	21.3	8.5	-	-
7 Feb	9-15	35.2	22.3	9.5	-	-
8 Feb	16-22	37.6	22.0	9.5	-	-
9 Mar	23-1	38.1	23.6	9.5	-	-
10 Mar	2-5	38.1	24.7	9.7	-	-
11 Mar	9-15	36.2	25.4	9.7	-	-
12 Mar	16-22	36.2	25.4	9.7	-	-
13 Mar	23-29	38.9	26.8	9.9	-	-
14 Apr	30-5	36.9	27.2	9.7	-	-
<b>Rabi - 1995</b>						
51 Dec	17-23	29.2	19.6	6.3	-	-
52 Dec	24-30	30.4	20.0	6.7	-	-
1 Jan	31-6	31.0	20.2	6.5	-	-
2 Jan	7-13	31.4	19.2	6.1	-	-
3 Jan	14-20	32.7	19.2	7.4	-	-
4 Jan	21-27	32.9	19.7	8.0	-	-
5 Feb	28-3	32.2	19.2	9.2	-	-
6 Feb	4-10	33.3	19.9	9.4	-	-
7 Feb	11-17	34.4	21.5	9.5	-	-
8 Feb	18-24	34.4	22.0	9.8	-	-
9 Mar	25-2	36.5	22.3	9.9	-	-
10 Mar	3-9	37.5	22.8	10.1	-	-
11 Mar	10-16	37.8	23.6	10.1	-	-
12 Mar	17-23	38.3	24.3	10.2	-	-
13 Mar	24-30	38.9	24.4	10.3	-	-
14 Apr	31-6	39.1	24.1	10.5	-	-
<b>Kharif - 1994</b>						
25 July	2-8	35.8	25.4	7.4	39.4	3
27 July	9-15	34.6	26.8	6.8	12.0	2
28 July	23-29	34.3	26.6	5.6	50.0	4
29 Aug	30-5	32.4	25.4	4.5	49.2	5
30 Aug	6-12	33.1	26.0	5.3	45.9	3
31 Aug	13-19	34.9	27.0	4.1	36.8	4
32 Aug	20-26	34.3	26.3	4.9	27.6	2
33 Sep	27-2	34.0	26.1	5.5	4.5	2
34 Sep	3-9	35.5	27.6	7.8	23.2	3
35 Sep	10-16	35.3	26.2	6.7	6.8	1
36 Sep	17-23	33.2	27.5	7.6	-	-
37 Sep	24-30	34.2	26.7	7.6	9.0	3
38 Oct	1-7	31.8	26.7	4.8	40.2	4
39 Oct	8-14	30.0	26.0	5.4	-	-
40 Oct	15-21	29.4	25.1	5.1	10.8	2

APPENDIX II

PARTICULARS OF HERBICIDES

Common and Trade Name	Group and chemical Name	Manufacturer	Time of application	Mode of Action
Glyphosate	Organophosphorus Compound	Excel Monsanto	Post-emergence	The specific mode of action is to inhibit protein synthesis.
(Glycel & Round-up)	(N-[Phosphonomethyl] glycine)			
Fluchloralin (Basalin)	Dinitroanilines. N(2-chloroethyl)-2,6-dinitro-N Propyl - 4 (trifluoromethyl) aniline	BASF	Pre-emergence and pre-plant soil incorporation	Inhibit ATP formation in Mitochondria, by interfering either energy generation or energy transport or both
Metolachlor (Dual)	Anilides 2- chloro-6'-ethyl - N-(2-methoxy - 1-methyl)ethyl) acet - o- toluidide)	Ciba Geigy	Pre-emergence	Primary mechanism of action is to inhibit protein synthesis.
Oxyfluorfen (Goal)	Nitrophenyl ethers 2'- Chloro - $\alpha\alpha$ trifluoro - p - tolyl 3 - ethoxy - 4 - nitrophenyl ether)	Indofil	Pre-emergence	It inhibits non-cyclic photo phosphorylation and electron transport and promotes membrane permeability
Pendimethalin (Stomp)	Dinitroanilines N-(1-ethyl propyl) 2,6 dinitro - 3, 4- xylylidine)	Cynamide India	Pre-emergence and pre-plant soil incorporation	Inhibit ATP formation in Mitochondria, by interfering either energy generation or energy transport or both.



PLATE

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PLATE



FIELD VIEW AFTER PRE-SOWING APPLICATION OF GLYPHOSATE

PLATE - II



G.nut + Glyphosate + Metolachlor

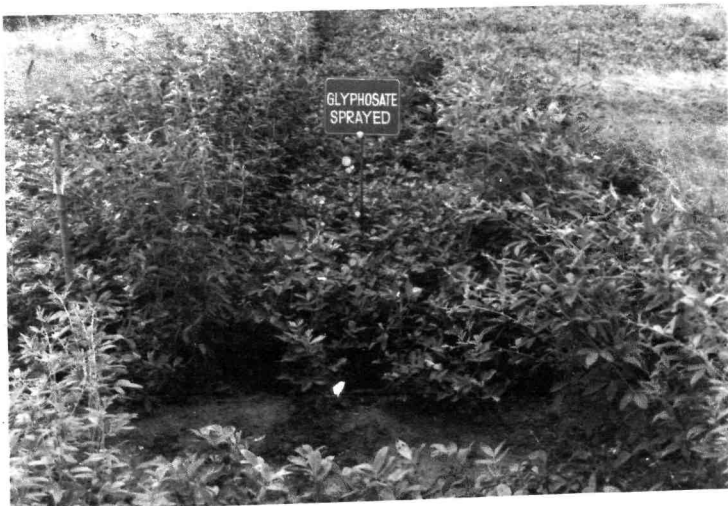


G.nut + No Glyphosate + Metolachlor

PLATE - III



(G.nut + G.gram) + Glyphosate + Metolachlor



(G.nut + R.gram) + Glyphosate + Metolachlor