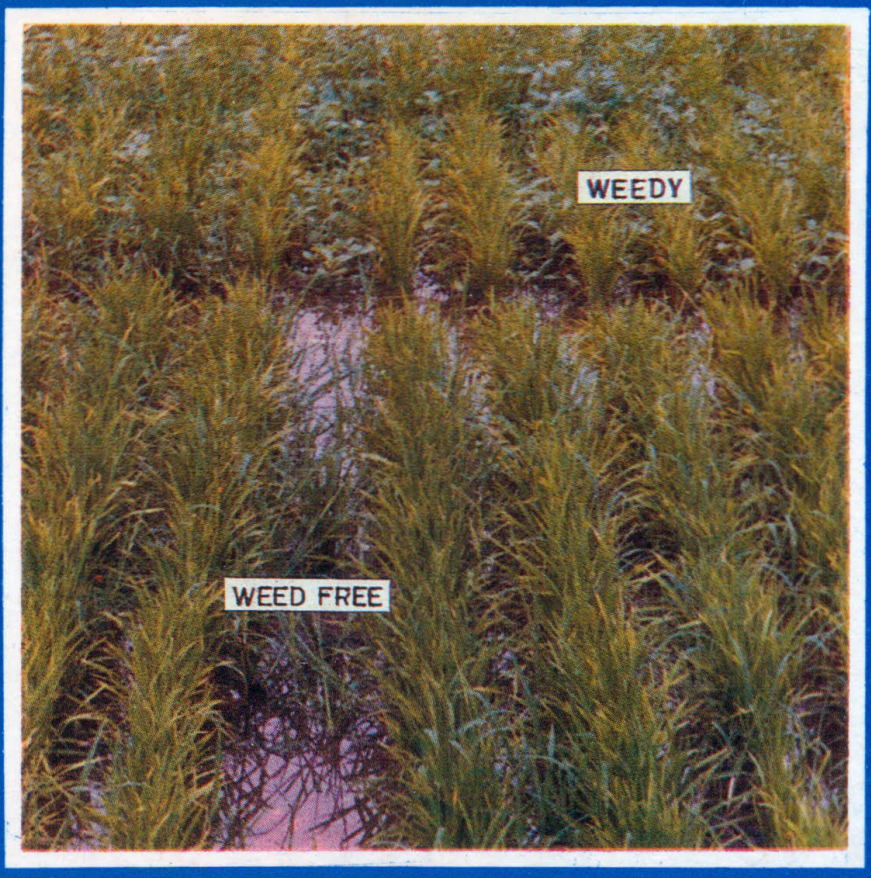
annual report

भाकृअनुप
ICAR

वार्षिक प्रतिवेदन
1993-94



राष्ट्रीय खरपतवार विज्ञान अनुसंधान केंद्र, जबलपुर (म.प्र.)
NRCWS

NATIONAL RESEARCH CENTRE FOR WEED SCIENCE
ADHARTAL, JABALPUR - 482 004. (M.P.) INDIA.

ANNUAL REPORT 1993-94

NATIONAL RESEARCH CENTRE FOR WEED SCIENCE,
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
JABALPUR - 482004

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COVER PHOTOGRAPH	:	WEED MANAGEMENT IN DRILLED RICE

From Director's Desk

National Research Centre for Weed Science has entered in the fifth year of its growth. However, the major activities have started after acquisition of experimental station and joining of 9 Scientists only. The total strenght 64 including one post of RMP. The main activities during period consisted of developing research programmes based on basic and applied sciences.

The major work programme were done in Weed Management in Cropping Systems, Vegetation Management, Weed Physiology and Research programme on Mechanical tools pertaining to Weed Control.The major thrust still continues on developing research programme on Weed Management on rainfed rice system, biological control of weeds and testing of new herbicides. A detailed test report has been published by NRC-Wed Science in this connection. The Depertment of Biotechnology has approved the project on Biological control of weeds using pathogen. The funds are expected any moment and project will start from April 94 onwards. this is a major thrust in the new line of specialization using biological pathogen. Efforts of Scientists deserve appreciation for getting project approved. The infrastructural facilities were further strengthened providing more space to the Scientists and strengthened research programme. The new equipments are being purchased to set laboratory which require lot of efforts for this new organization. The Scientists were sent to attend various Symposia Seminar at national & international levels where they presented research work done at this Centre.

The overall programme of works as budget is concerned, seems to be satisfactory. The architect division of CPWD has developed the plan which was approved by the council. Soon the funds will be alloted for works, construction programme is going to take shape. Efforts are on the develop the experimental research stat ion and provide mor facilities in lecture halls, implement shades and other structure which may be of direct and indirect help for developing research programme of NRC-Weed Science.

The library and computer facilities were further strengthened. The administration and field unit are complementary to each other to provide further development and infrastructural facilities to Scientists.

We hope that in the years to come, the building programme will get the momentum and Centre would be housed in the new acquired buildings of housinglk boards in Maharajpur in opposite to the experimental station.

V.M. BHAN

CONTENTS

1. GENERAL

1.1 INTRODUCTION

The National Research Centre for Weed Science (NRCWS) was established by the Indian Council of Agricultural Research (ICAR) on April 22nd, 1989, at Jabalpur, (Madhya Pradesh). The centre is located *adjoining to* the complex of the Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Krishi Nagar, Adhartal, Jabalpur, 482004. The experimental farm is 59.5 ha and is located 9 km. from the main Jabalpur railway station on Jabalpur Allahabad section of national highway no. 7.

1.2 MANDATE :

The mandate of the centre is :-

a. To undertake basic and applied research for developing strategies for efficient weed management in different agro-ecological zone.

b. To provide leadership role and coordinate the network research with State Agricultural Universities for generating location specific technologies for weed management in different crop, cropping and farming system.

c. To act as repository of information in weed science.

d. To act as a centre for training in research methodologies in area of weed science and management.

e. To collaborate with National and International agencies in achieving the above objectives.

f. To provide consultancy.

1.3 OBJECTIVES :

The objectives of the centre are :-

1. To undertake research work on biology, agro-ecology and physiology of weeds.

2. To study aquatic and problem weeds and their control.

3. Initial identification and evaluation of new herbicides and also development of bio-herbicides for problem weeds.

4. Biochemistry of herbicides and its long-term effect on the cropping system.

5. To develop technology for biological and non-chemical methods of weed control and also development and testing of weed control equipments.

6. To generate data on residue estimation and management of herbicides in soil, water and plants, cropped and non cropped situations and computer facility for data analysis and record making.

7. To initiate research programme on integrated weed management.

8. To conduct training programme in Weed Science.

9. To conduct "on farm testing" and operational research projects regarding the use of recommended and newly developed weed management technology at farmers' fields.

The AICRP on Weed Control with its Head Quarters at NRCWS and its 20 Centres inclusive of two voluntary Centres located at various SAUs will work on applied research and on problems of their region to provide instant answer to the socioeconomic needs concerning weed management of their areas.

1.4 AREA OF WORK OF VARIOUS SECTIONS AND UNITS :

Weed Management in cropping system :

I. Initial identification and evaluation of herbicides.

II. Weed Management in cropping system with emphasis on low land rainfed rice system.

III. Study of the long term effect of herbicides in important cropping systems.

IV. Designing and testing of weed control equipments (in association with Engineering Unit).

Biology and agroecology :

I. Study of biology and ecology of important weed species.

II. Study of weed shifts in crop and non crop situations.

III. Weed management in non-cropped situations.

Vegetation Management :

I. Biological and non-chemical control of weeds.

II. Biology and control of aquatic, parasitic, perennial and problem weeds.

III. Weed management in non-cropped system.

Herbicide management and weed physiology :

I. Behaviour of weeds

II. Chemistry and mode of action of herbicides

III. Herbicide residue estimation and their management in soil- water-plant in crop and non-crop situation

IV. Identification and development of bio-herbicides.

Social Science, Training and Transfer of Technology :

To generate information on socioeconomic aspects of weed management in different cropping systems, to develop computer laboratory to assist scientists in various types of analysis; to develop data base information system; to develop courses and conduct training programmes in weed sciences; to conduct 'on farm testing' and operational research projects to generate information on weed management technology at farmers field.

Engineering Unit :

Designing and testing of Weed Control equipments(in association with CIAE, Bhopal; IIT, Kharagpur and other AICRP-WC Centers having facility of designing and development of field equipments). The work is to be done in association with Agronomists of the weed management in cropping system unit.

Experiment station :

To provide infrastructural facilities for research at farm. Preparation of plan and to execute land development programme. Develop cropping plan and its execution for non-experimental area.

1.5 INFRASTRUCTURAL FACILITIES :

The National Research Centre for Weed Science acquired experimental farm of 59.5 ha. from Jawaharlal Nehru Krishi Vishwa Vidyalaya on January 1, 1990. The office is located in three private buildings at Ravindra Nagar, Adhartal, Jabalpur, which is 6 km. away from the Experimental Station.

The staff position during the period under report is depicted in

Table 1 : Staff Position as on 31.3.94

Category	Details of post sanctioned under VII Plan		
	Sanctioned	Filled	Vacant
Scientific	27 (*)	11	16
Technical	27	20	07
Administrative	17	11	06
Supporting	25	19	06
Auxiliary	03	03	–
	99	64	35

(*) Including two posts of RMP (Director and Project Coordinator)

Note : See Annexure - I.

Computer Services :

The institute has computer based data analysis and retrieval system to support scientists. Two computers, one is PC-AT 286 and other PC-AT 486 with colour monitor and 24 pins letter quality printer, are included in this system with facilities such as graphics and database management. The language available is BASIC. The short terms training programme is being organized for exposing NRC-WS scientists and technicals.

1.6 RESEARCH COLLABORATION WITH OTHER INSTITUTES :

The Centre has a collaborative project on phosphate management in soybean-wheat cropping sequence and on organic nitrogen management in rice-wheat cropping sequence with Indian Institute of Soil Science (IISS), Bhopal.

1.7 FORUMS :

The centre has various forums which serve the purpose of research planning, management, staff welfare etc.

Scientific Research Council (SRC) :

The SRC is a forum for discussion and finalization of all research projects of the institute. The scientists review the merits and demerits of various projects and their utility in relation to objectives of the centre. The SRC meets annually with the Director of the centre as its chairman all scientists as member. During 1993-94 SRC meeting held on 18th and 19th June, 1993. The members were Dr. V.M. Bhan, Director and Chairman; Dr. R.K. Malik and Dr. G.L. Bansal as special invitees, Dr. L.P. Kauraw, Sh. H.S. Bisen, Sh. D.K. Pandey, Dr. D. Swain, Dr. Singh, Dr. A.N. Singh, Dr. V.P. Singh, Sh. J.S. Mishra these scientist as members and Dr. M.S. Raghuwanshi (TO) as member Secretary.

Farm Advisory Committee :

The committee constituted of Dr.V.M. Bhan, Director & Chairman of the committee, all scientist namely Dr. L.P. Kauraw, Sh. H.S. Bisen, Sh. D.K. Pandey, Dr. D. Swain, Dr. S. Singh, Dr. A.N. Singh, Dr. V.P. Singh, Sh. J.S. Mishra and Dr. K.L. Bansal as members; Dr. M.S. Raghuwanshi, TO, Incharge Farm/Farm manager and member secretary, Field Asstt. namely Sh. J.N. Sen, Sh. S.K. Parey and Sh. R.S. Upadhyay member, met on 3.4.93, 24.4.93, 19.5.93, 21.8.93, 25.10,93, 3.1.94 and 11.02.94 discussing and reviewing the work at experimental station.

Institute Joint Staff Council :

It is a forum comprising of elected

representatives from the staff side and nominated members from the official side with Director as its chairman. This meets quarterly and deals with problems affecting a group or section as well as to look after the welfare of the staff.

Staff Meeting :

This meeting is arranged twice to know the problems of the staff if any.

Staff Welfare Club :

This club is constituted to encourage and develop athletic, cultural and social outlook of the members. This centre second time participated at ICAR Inter - Institutional Sports meet at CIAE, Bhopal. Shri S.C. Sharma Office Asstt. was ranked second in high jump event and Shri. K.K. Tiwari and Sh. Sunil Gupta was ranked as first and second, resp. in 200 m. race.

Publication Committee :

Publication committee consisted of Dr. V.M. Bhan, Director and Chairman; Dr. L.P. Kauraw, Sr. Sci.; Sh. H.S. Bisen, Sr. Sci. Dr. D. Swain, Sci; Dr. V.P. Singh, Sci.; Sh. J.S. Mishra, Sci. as members of the committee. This committee is constituted for editing and abridging the reports of the centre and the reports, submitted by the AICRP-WC or any section so that the pruning of unwanted general in information may give good format of the reports. The committee met on 6.9.93, 16.10.93 and 13.12.93 for finalization of reports.

Management Committee

The management committee is constituted for consideration of the proposal for annual and five year plan, periodical review of progress of development scheme, annual budget and expenditure which are beyond the power the director of the centre, policy issue relating to centre including the rights and obligations of staff etc. Committee constituted of Dr. V.M. Bhan as Chairman; Dr. P.C. Bhatia, ADG, ICAR; Sh. C.M.S. Patel, JDA, Agri. Bhopal; Dr. Mahavir Singh, P.C. IISS and Dr. Subba Rao, Sr. Scientist, IISS, Bhopal; Dr. D.S. Rajput, Head CPE, CIAE, Bhopal, Er. H.S. Bisen, Sr. Scientist and Sh. Balwant Rai, AAO & Member Sec., NRCWS, Jbp.) met on 12.10.93 and 08.03.94 for finalizing the above subjects.

1.8 BUDGET

The expenditure of plan and non-plan (In Rs.) for the year 1993-94 under different heads is given in Annexure-II.

1.9 PARTICIPATION IN SYMPOSIUM/SEMINAR

The details are given in Annexure-III.

2. AGROCLIMATE

Most of the researches reported here were carried out at NRC-WS, Adhartal, Jabalpur. This section presents a brief description of agro- climatic factors of maximum and minimum temperatures, humidity, wind velocity, sunshine hours and rainfall pattern.

2.1 LOCATION :

The centre is located between 22.49 and 24.8 North latitude, 78.21 and 80.58 East longitude and at an altitude of 411.78 metres above the mean sea level. Jabalpur comes under the agroclimatic region of Kymore plateau and Satpura hills and lies in the rice-wheat crop zone of the state. The climate of Jabalpur region is typically sub-humid and subtropical.

2.2 SEASON :

In Jabalpur, the rainy season, also known as the monsoon usually begins from 15th June and extends upto early October. More than 80% of the 1253.4 mm average annual rainfall falls in monsoon season. The post rainy season (mid October through January), also known as the postmonsoon or rabi is dry and cool with short days. The hot dry summer season starts from February and lasts until rains begin again in June.

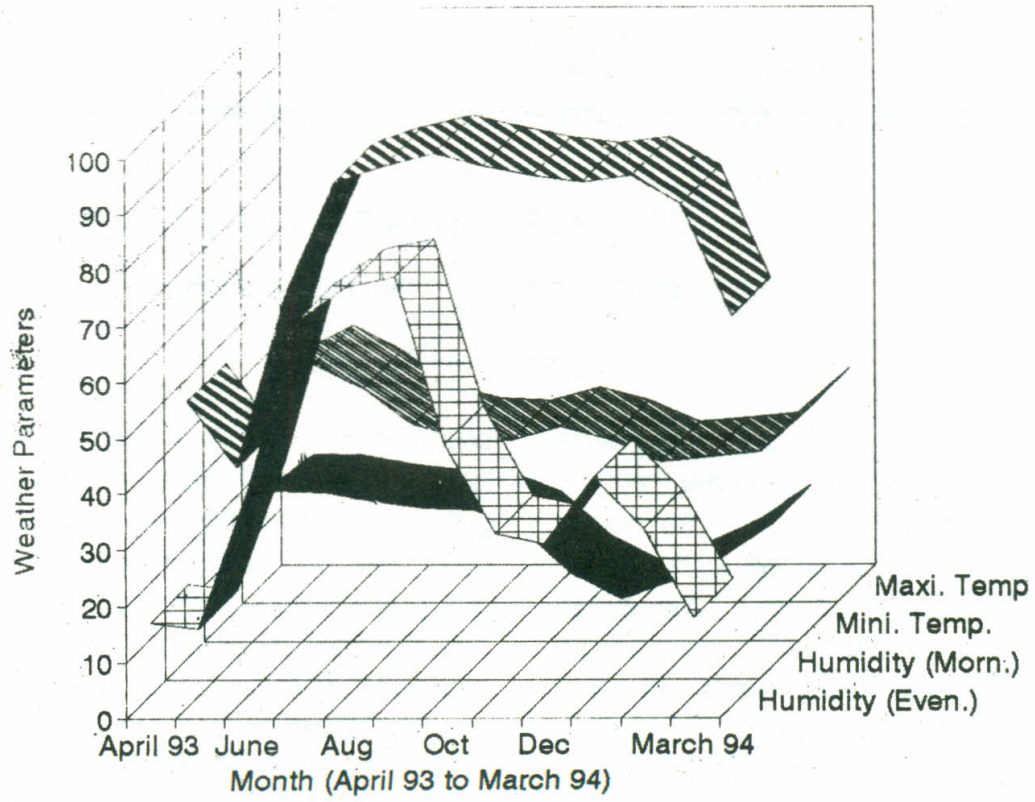
2.3 WEATHER AND SOIL :

The climatic parameters recorded during 1993-94 at Adhartal Farm, JNKVV, Jabalpur is presented in Table-2 and Fig.-1.

The soils of the farm belong to Kheri series. The Kheri series is a member of the very fine, montmorillonitic, hyperthermic family of Typic Chromusterts. Kheri soils have dark grayish brown moderately alkaline AC horizons. They have developed in basaltic alluvium on level to very gently sloping Piedmont plains in Jabalpur and Narsinghpur districts of Madhya Pradesh at an elevation of 375 to 400 metre above MSL. The principal associated soil is Adhartal series, a vertic Ustochrept.

Meteorological data for the year 1993-94 (April 1993 to March 1994)

MONTH	Rainfall (mm.)	Max. Temp. (C)	Min. Temp. (C)	Wind Velocity (Km/hr)	Mean relative humidity %	
					Morning	Evening
APRIL 93	2.0	38.4	20.6	4.4	50	17
MAY 93	11.5	42.7	26.6	5.9	38	16
JUNE 93	168.0	38.3	26.4	6.7	69	40
JULY 93	298.5	31.9	24.8	5.9	89	71
AUGUST 93	521.1	29.7	23.8	5.8	92	77
SEPTEMBER 93	441.3	29.1	23.3	3.3	94	79
OCTOBER 93	0.0	31.5	19.7	0.9	92	49
NOVEMBER 93	0.0	29.1	12.0	0.8	90	38
DECEMBER 93	0.0	25.2	7.7	0.8	89	31
JANUARY 94	2.1	26.1	10.8	0.9	90	43
FEBRUARY 94	6.7	26.9	14.9	1.6	85	34
MARCH 94	0.0	34.8	20.8	1.6	65	18
TOTAL	1451.2					



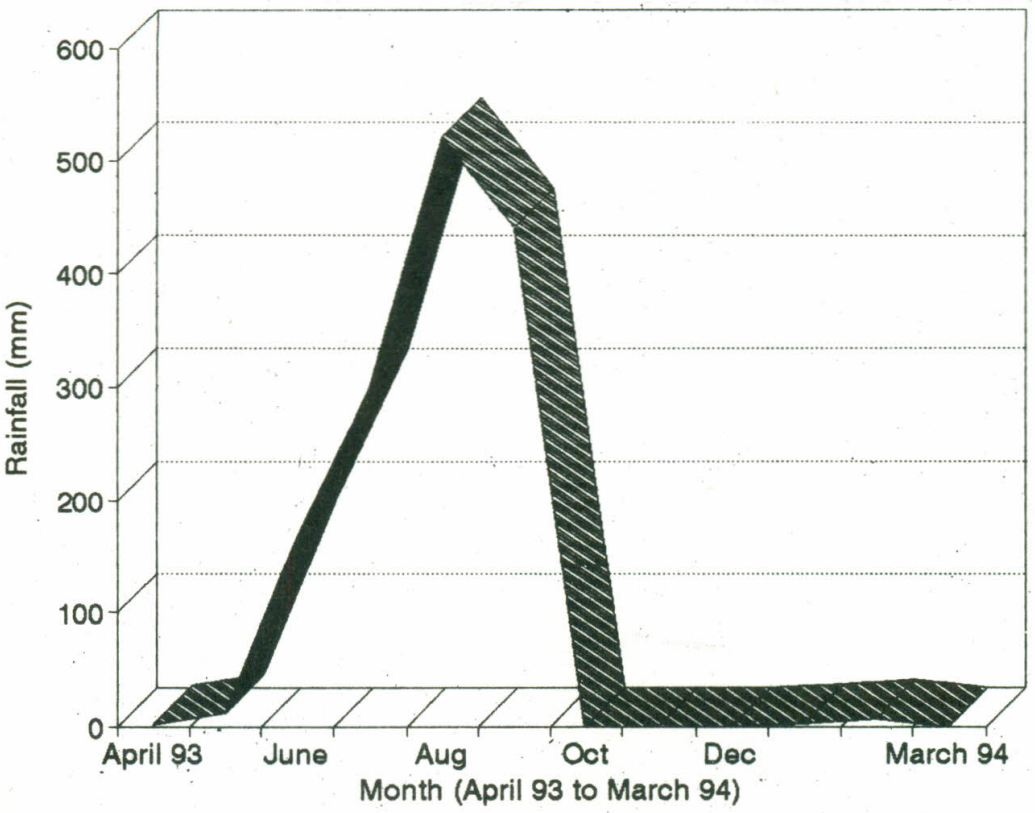


Fig. 1 : Changes in Air Temperature, Relative Humidity and Rainfall Parameters During 1992-93

3. RESEARCH HIGHLIGHTS

WEED MANAGEMENT IN CROPPING SYSTEM

Preliminary herbicide screening in soybean

S.Singh, A.N. Singh and V.M. Bhan

The field experiment was conducted during *kharif* season of 1993. The weed control treatments consisted of lactofen 100 g, 150 g and 200 g/ha, metribuzin 500, 750 and 1000 g/ha, metolachlor 500, 1000 and 1500 g/ha; hand weeding (20 & 40 DAS), weed free and control. The crop was sown on 23/6/94 in line 45cm apart by tractor drawn seeddrill. The herbicides metribuzim and metolachlor were applied as pre-emergence and lactofen as post emergence (15 days after sowing). The major weeds which infested the soybean crop consisted of *Commelina communis, Alternanthra sessilis, Echinochloa colonum,Cyperus* sp, *Legasia molis, Corchorus* spp, *Ipomea* sp. The treatment metolachlor 1500 g/ha has shown best results in reducing weed population and weed dry matter and consequently increased the grain yield of soybean. (Table -3)

Multicrop herbicide screening trials in *Kharif* and *rabi* season of 1993-94

S.Singh, A.N. Singhand V.M. Bhan

The multicrop herbicide screening trials were conducted during *kharif* and *rabi* season of 1993-94. During*kharif* season of 1993, five herbicides with three doses (0.5x, x and 2x) at three times of application i.e. pre-plant incorporation, pre-emergence and post-emergence (PPI, PE and PO) were tried in twelve crops and two weeds species. In the next season of rabi 1993-94, the five herbicides, with three doses (0.5x, x and 2x) at three times of application PPI, PE and PO were tried in fourteen crops and two weeds species. The detail technical report is being prepared separately to provide a guide for the potential usefulness of new herbicides, in crops and weeds, tested. The report gives herbicides selectivity data for five herbicides viz. PIL-HR, PIL- CR, Diclofop-methyl, Lactofen and Ethoxysulfuron (HOE 095404). Summary tables given for each herbicide tested against various cropsare given below. (Table 4-8).

Fig. 2. Herbicide Screening – An Important Step in Advance Research Programme

Table 4 : The tolerant crops and weeds against PIL-HR herbicide.

Sl. Herbicide	Dose	Mode of application		
		PPI	PE	PO
1. PIL-HR	H	Rice Wheat (D) Wheat (T) Radish Tomato Canary grass	Rice Sorghum Wheat (D) Wheat (T) Oat Canary grass	Rice Sorghum Wheat (D) Wheat (T) Oat Linseed Pea Tomato Canary grass
PIL-HR	M	Plus crops above Niger Cowpea Maize Sorghum Black gram Green gram Oat Linseed Pea Lentil French bean Carrot Sunflower Cichory	Plus crops above Maize Niger Pea Radish Tomato	Plus crops above Maize Barnyard grass E. glabraescense
PIL-HR	L	Plus crops above Cluster bean Okra Red gram Berseem Chickpea Barnyard grass E. glabraescense	Plus crops above Cluster bean Okra Red gram Black gram Green gram Linseed Lentil Chickpea Carrot Cichory	Plus crops above Carrot

Table 5 : The tolerant crops and weeds against PIL-CR herbicide.

Sl.	Herbicide	Dose	Mode of application		
			PPI	PE	PO
2.	PIL-CR	H	Rice Niger Sorghum Red gram Black gram Green gram Wheat (D) Wheat (T) Oat Linseed Pea Lentil French bean Radish Tomato Carrot Sunflower Canary grass Cichory	Niger Sorghum Black gram Green gram Wheat (D) Wheat (T) Oat Linseed Pea Lentil Radish Tomato Canary grass	Sorghum Wheat (D) Wheat (T) Oat Linseed Pea Tomato Canary grass
	PIL-CR	M	Plus crops above Soybean Okra Maize Mustard Chickpea	Plus crops above Rice Soybean Cluster bean Cowpea Okra Maize Red gram Mustard Chickpea French bean Carrot Cichory	Plus crops above Rice Maize Lentil French bean Barnyard grass
	PIL-CR	L	Plus crops above Cowpea Berseem Barnyard grass	Plus crops above Sesamum	Plus crops above Soybean Niger Cluster bean Berseem Chickpea Radish Sunflower E. glabrascense Cichory

Table 6 : The tolerantcrops and weeds against Diclofop-methyl herbicide.

Sl.	Herbicide	Dose	Mode of application		
			PPI	PE	PO
3.	Diclofopmethy1	H	Black gram Green gram Wheat (D) Wheat (T) Mustard Linseed Pea Berseem Lentil French bean Radish Tomato Carrot Sunflower Cichory	Black gram Green gram Wheat (D) Wheat (T) Oat Mustard Linseed Pea Berseem Lentil Chickpea French bean Radish Sunflower	Green gram Wheat (D) Wheat (T) Linseed Pea Lentil Radish Tomato Carrot Sunflower
	Diclofop-Methyl	M	Plus crops above Soybean Niger Cowpea Chickpea	Plus crops above Soybean Niger Okra Tomato Carrot Cichory	Plus crops above Soybean Niger Sorghum Red gram Black gram Mustard Berseem Chickpea French bean Cichory
	Diclofop-Methyl	L	Plus crops above Okra Sorghum Canary grass	Plus crops above Cowpea Sorghum Red gram Canary grass	Plus crops above Canary grass

Table 3: Preliminary herbicide screening in soybean kharif 1993.

Treatments	Total No. of weed/m^2		Total weed dry Wt. g/m^2		Grain yield q/ha
	60 Das	Harvest	60 DAS	Harvest	
1. Lactofen 100	3.43 (11.29)	3.58 (12.29)	4.12 (16.50)	3.81 (14.00)	11.11
2. Lactofen 150	2.34 (04.97)	2.37 (06.97)	3.24 (10.00)	2.91 (07.95)	12.85
3. Lactofen 200	1.77 (02.65)	2.27 (04.65)	2.97 (08.33)	2.52 (05.85)	13.35
4. Metribuzin 500	3.89 (14.64)	3.76 (13.64)	4.33 (18.35)	4.13 (16.55)	10.07
5. Metribuzin 750	3.08 (08.97)	2.79 (07.30)	2.60 (12.50)	3.44 (11.35)	12.65
6. Metribuzin 1000	2.67 (06.65)	2.34 (04.98)	3.00 (08.50)	3.14 (09.35)	13.05
7. Metolachlor 500	2.97 (08.32)	2.91 (07.98)	3.35 (10.75)	3.44 (11.35)	12.95
8. Metolachlor 1000	2.34 (04.98)	2.12 (03.98)	2.64 (06.50)	2.55 (06.00)	14.58
9. Metolachlor 1500	1.77 (02.65)	1.58 (01.99)	2.24 (04.55)	1.94 (03.25)	15.35
10. Hand weeding 20 & 40 DAS	3.62 (12.64)	2.67 (06.66)	3.43 (11.25)	3.98 (15.35)	12.25
11 Weed free	1.35 (01.32)	0.71 (0.00)	0.71 (00.00)	1.22 (01.00)	15.65
12. Weedy	5.58 (30.63)	5.21 (26.63)	6.27 (38.85)	5.99 (35.35)	9.20
Cd at 5%	0.401	0.861	0.290	0.293	1.25

Table 7 : The tolerant crops and weeds against Lactofen herbicide.

Sl.	Herbicide	Dose	Mode of application		
			PPI	PE	PO
4.	Lactofen	H	Rice	Rice	Soybean
			Niger	Soybean	Black gram
			Black gram	Maize	G. Gram
			Green gram	Sorghum	Wheat (D)
			Wheat (D)	Black gram	Wheat (T)
			Wheat (T)	Green gram	Oat
			Oat	Wheat (T)	Pea
			Mustard	Whrat (D)	Lentil
			Pea	Oat	Canary grass
			Lentil	Mustard	
			Chickpea	Pea	
			French bean	Chickpea	
			Radish	French bean	
			Tomato	Radish	
			Carrot	Tomato	
			Sunflower	Sunflower	
			Cichory	Canary grass	
	Lactofen	M	Plus crops above	Plus crops above	Plus crops above
			Soybean	Linseed	Rice
			Berseem	Lentil	Maize
			Barnyard grass	Carrot	Sorghum
			E. glabrascense		French bean
			Canary grass		
	Lactofen	L	Plus crops above	Plus crops above	Plus crops above
			Cluster bean	Cowpea	Berseem
			Cowpea	Okra	Carrot
			Okra	Cichory	Branyard grass
			Maize		E. glabrascense
			Sorghum		

Table 8 : The tolerant crops and weeds against Lactofen herbicide.

Sl.	Herbicide	Dose	Mode of application		
			PPI	PE	PO
5.	Ethoxysu-lfuron	H	Rice Sorghum Black gram Green gram Wheat (D) Wheat (T) Oat French bean Radish Branyard grass E. glabrascense Canary grass	Rice Maize Sorghum Black gram Green gram Wheat (D) Wheat (T) Oat Radish Canary grass	Cluster bean Sorghum Wheat (D) Wheat (T) Oat French bean Tomato Barnyard grass E. glabrascense
	Ethoxysu-lfuron	M	Plus crops above Cluster bean Cowpea Maize Linseed Pea Berseem Chickpea Carrot	Plus crops above Cowpea Red gram Pea Chickpea French bean	Plus crops above Rice Red gram Black gram Green gram Linseed Pea
	Ethoxysu-lfuron	L	Plus crops above Niger Okra Lentil Sunflower Cichory	Plus crops above Soybean Cluster bean Linseed	Plus crops above Berseem Lentil Carrot Cichory

L - Lower dose (0.5 x)
M - Medium (x i.e. recommended dose)
H - Higher dose (2 x)

Preliminary herbicides screening in wheat

S.Singh, A.N. Singh and V.M. Bhan

The field experiment was conducted during *rabi* season of 1993-94. The weed control treatment consisted of PIL-HR 10, 20 and 40 g/ha; PIL-CR 10, 20 and 40 g/ha; diclofop methyl 750, 1000 and 1250 g/ha; 2,4-D 500 g/ha; isoproturon 750 g/ha, hand weeding (30 & 40 DAS); weed free and weedy. All the herbicides were applied as post emergence. The crop was sown on 2nd December, 1993 by tractor drawn seeddrill and harvested on 31/3/94. The major weeds infested the wheat crop were*Chenopodium album, Chenopodium ficifolium,Phalaris minor,Rumex dentata,Ipomea, Physalis minima* and *Malachra capitata*. The treatment PIL-CR 40 g/ha has shown best result in reducing weed population and, weed dry matter and increasing grain yield of wheat. However, there was no significant difference between 20 and 40 g/ha PIL-CR (Table - 9).

Table 9 : Herbicide screening in wheat.

	Treatment (q/ha)	Total no. of weed/m^2		Total weed dry wt. q/m^2		Grain yield q/ha
		60 DAS	At Harvest	60 DAS	At Harvest	
1.	PIL-HR 10	4.93 (23.80)	4.14 (18.94)	3.42 (11.19)	3.43 (11.33)	61.96
2.	PIL-HR 20	3.92 (14.86)	3.66 (12.89)	3.00 (08.50)	2.84 (07.56)	63.10
3.	PIL-HR 40	3.30 (10.39)	3.10 (09.11)	2.26 (04.60)	2.34 (05.00)	64.07
4.	PIL-CR 10	3.96 (15.18)	4.24 (17.47)	2.66 (06.57)	3.13 (09.23)	62.22
5.	PIL-CR 20	3.00 (08.50)	2.91 (08.00)	2.11 (03.95)	2.40 (05.26)	64.77
6.	PIL-CR 40	2.51 (05.80)	2.25 (06.00)	1.68 (02.33)	2.12 (04.00)	65.01
7.	Disclofop methyl 750	5.86 (33.83)	6.53 (42.14)	4.26 (17.66)	5.10 (25.51)	57.36
8.	Diclofop methyl 1000	5.16 (26.12)	6.06 (36.22)	3.84 (14.24)	4.67 (21.30)	58.32
9.	Diclofop methyl 1250	4.90 (23.50)	5.57 (30.62)	3.32 (10.52)	4.33 (18.24)	59.29
10.	2,4--D 500 g/ha	5.14 (26.15)	6.00 (35.50)	4.02 (15.66)	4.70 (21.59)	56.59
11.	Isoproturon 750 g/ha	5.60 (30.86)	6.08 (36.36)	4.37 (18.66)	4.77 (22.58)	56.70
12.	Hand weeding 30 & 45 DAS	4.62 (20.84)	5.40 (28.55)	3.43 (11.26)	3.58 (12.24)	59.29
13.	Weedy free	0.89 (00.29)	1.04 (0.58)	0.81 (00.15)	0.80 (00.14)	65.68
14.	Weedy	8.22 (67.06)	8.99 (80.30)	6.06 (36.22)	7.49 (55.45)	48.44
	CD at 5%	0.608	0.580	0.679	0.511	2.12

Squre root transformation

Values in parenthesis are origional value.

Influence of Cropping Sequence on Emergence of Weeds.

S.Singh, A.N. Singh and V.M. Bhan

The experiment was conducted with the objective to study the long- term influence of cropping sequence on emergence of weeds. During *kharif* 1993, rice, soybean and maize were taken . The major weeds emerged out during the season were *Alternanthera sesslis, Echinochloa sp, Commelina Communis, Malachra capitata.*

In the *rabi* season, wheat and pea were taken. The major weeds observed are *Cichorium intybus, Chenopodium* sp. The density of *Chenopodium album* and *Chenopodium ficifolium* have increased under maize-wheat and maize-pea cropping system. *Chicorium intybus* density has also increased under maize-pea cropping system. There is a marked increase in *Commelina communis* under rice-wheat cropping system. However, the density of *Alternanthera sessilis* and *Echinochloa colonum* have been suppressed upto some extent under rice-wheat cropping system.

Table 10 : Influence of long term cropping sequence on emergence of weeds in *kharif* and *rabi*.

	Crop sequence	Crop	Total no. of weed/m^2		Total weed dry wt. g/m^2		Grain yield q/ha	
			60 DAS	At Harvest	60 DAS	At Harvest	Weedy	Weed free
			Kharif 1993					
1.	Rice-Wheat	Rice	69.00	35.66	53.33	28.80	2.83	13.66
2.	Rice-Pea	Rice	58.00	31.66	46.03	27.00	3.76	20.73
3.	Soybean-Wheat	Soybean	50.00	30.33	39.23	25.20	13.28	18.07
4.	Soybean-Wheat	Soybean	44.33	27.00	36.00	22.56	11.68	16.67
5.	Maize-Wheat	Maize	45.66	31.00	37.43	25.10	33.20	37.32
6.	Maize-Pea	Maize	40.00	24.66	32.77	20.93	35.44	39.22
	Cd at 5%		5.523	4.045	4.787	3.044	Soyban	0.712
							Rice	1.699
							Maize	1.052
			Rabi 1993-94					
1.	Rice-Wheat	Wheat	25.33	13.65	48.00	33.66	39.73	42.44
2.	Rice-Pea	Pea	48.31	36.64	60.66	61.00	5.63	7.46
3.	Soybean-Wheat	Wheat	28.99	12.99	48.00	41.33	46.42	47.02
4.	Soybean-Wheat	Pea	93.95	36.31	113.33	59.00	4.58	6.61
5.	Maize-Wheat	Wheat	61.00	35.65	76.00	48.66	45.80	48.14
6.	Maize-Pea	Pea	126.63	87.64	86.33	57.33	5.47	6.94
	CD at 5%		23.719	23.082	21.00	19.099	Wheat	0.681
							Pea	0.482

Table 11 : Influence of long term cropping sequence on emergence of weeds in *Kharif* 1993.

	Treatments	Cropping Sequence					
		Rice-Wheat	Rice-Pea	Soybean Wheat	Soybean pea	Maize-Wheat	Maize-Pea
AT 45 DAS							
1.	Commelina communis	12.33	6.33	5.66	5.00	4.33	4.33
2.	Alternanthera sessilis	15.00	15.33	15.33	12.33	14.33	11.33
3.	Echinochloa colonum	29.00	21.33	15.66	16.66	15.00	10.66
4.	Cyperus sp.	2.00	3.00	0.66	2.00	2.33	4.00
5.	Others	7.66	5.66	7.00	4.33	4.00	3.66
	Total	65.99	51.65	44.31	40.32	39.99	33.98
AT 60 DAS							
1.	Commelina communis	10.00	5.00	4.33	3.00	2.66	3.00
2.	Alternanthera sessilis	18.33	18.00	18.66	14.00	16.66	14.33
3.	Echinochloa colonum	29.00	24.33	17.33	19.00	17.33	13.00
4.	Cyperus sp.	2.00	2.33	1.00	1.66	2.00	5.33
5.	Others	10.00	8.33	8.66	6.66	7.00	6.00
	Total	69.33	58.00	49.98	44.32	45.65	41.66
AT HARVEST							
1.	Commelina communis	2.66	1.33	1.33	1.00	1.33	0.66
2.	Alternanthera sessilis	9.66	11.66	12.33	8.66	12.66	10.33
3.	Echinochloa colonum	15.33	11.66	10.66	12.00	13.00	8.66
4.	Cyperus sp.	2.00	3.00	0.66	1.00	1.00	2.00
5.	Others	6.00	4.00	5.33	4.00	3.00	3.00
	Total	35.65	31.65	30.31	26.66	30.99	24.65

Table 12 : Influence of long term cropping sequence on emergence of weeds in *rabi* 1993-94.

	Treatments	Cropping Sequence					
		Rice-Wheat	Rice-Pea	Soybean Wheat	Soybean pea	Maize-Wheat	Maize-Pea
AT 60 DAS							
1.	Cichorium intybus	5.33	11.33	3.00	33.30	6.00	10.66
2.	Chenopodiumalbum	2.00	1.00	3.33	3.66	5.00	6.32
3.	Chenopodium ficifolium	7.00	5.66	21.33	46.00	43.00	81.66
4.	Medicago denticulata	0.66	0.33	0.00	0.00	0.00	0.00
	Phalaris minor	0.00	0.66	0.00	0.33	0.00	0.00
	Ipomea sp.	1.00	0.00	0.00	0.33	0.00	0.00
	Alternanthera sessilis	8.33	19.00	1.33	3.33	1.00	16.33
	Wild oat	0.00	0.33	0.00	0.00	0.00	0.00
	Others	1.00	10.00	0.00	8.00	6.00	11.66
	TOTAL	25.32	48.31	28.99	94.95	61.00	126.63
AT HARVEST							
1.	Cichorium intybus	4.33	10.66	3.00	5.66	6.33	6.33
2.	Chenopodium album	0.00	1.00	2.33	4.00	4.00	3.00
3.	Chenopodium figifolia	1.00	7.00	7.33	18.00	23.33	57.33
4.	Medicago denticulata	0.00	0..33	0.00	0.66	0.00	1.00
5.	Phalaris minor	0.00	0.66	0.00	0.33	0.00	0.00
6.	Chrozofora plicata	0.00	1.66	0.00	0.00	0.33	1.66
7.	Alternanthera sessilis	6.66	9.33	0.33	3.33	1.00	10.66
8.	Others	1.66	6.00	0.00	4.33	0.66	7.66
	TOTAL	13.65	36.64	12.99	36.31	35.65	87.64

Effect of organic and inorganic manuring and weed management in direct seeded rice.

A.N. Singh, S. Singh and V.M. Bhan

Four level of N (0, 40, 80 & 120 kg/ha) supplied through urea and FYM combined with preemergence application of butachlor @ 1.5 kg/ha, weed free and unweeded check in RBD with three replication during 1993 to study the effect of urea and FYM and weed flora of drilled rice.

The pre-dominant weeds were broad leaved weeds- *Commelina communis, Alternanthera sessilis* and *Caesulia axillaris; grasses - Echinochloacolonum*; sedges- *Cyperus iria*.

Weed dry matter (g/m) increased with increasing level of N/ha. The highest dry matter was found with 120 kg/ha N treated plot when N supplied through the FYM as compared to when N applied through urea.

The grain yield of drilled rice increased significantly with increasing level of N through urea and FYM. The highest grain yield was the result of N applied @ 120 kg N/ha when N supplied through 40 kg as urea and 80 kg as FYM and it was at par to 80 kg N supplied through urea and 40 kg through FYM.

Table 13 : Dry matter of weeds and yield of drilled rice as affected by urea and FYM.

TREATMENT N kg/ha through	Weed dry weight (g/m2)			Grain yield (q/ha)
Urea : FYM	40 DAS	75 DAS	At harvest	
0 + 0 + Buta	5.97 (35.10)	8.54 (73.00)	7.79 (60.18)	6.84
0 + 0 + WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	13.51
0 + 0 + Weedy	6.97 (48.10)	9.46 (89.00)	8.31 (68.55)	7.21
40 + 0 + Buta	9.06 (81.60)	13.56 (183.7)	10.42 (103.7)	14.67
40 + 0 + WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	24.33
40 + 0 + Weedy	9.32 (86.36)	13.97 (197.1)	13.42 (179.5)	9.23
0 + 40 + Buta	6.68 (44.12)	0.71 (0.00)	10.54 (110.6)	15.30
0 + 40 + WF	0.71 (0.00)	14.00 (195.5)	0.71 (0.00)	27.67
0 + 40 + Weedy	7.92 (62.22)	16.43 (269.4)	11.56 (133.1)	7.46
40 + 40 + Buta	10.20 (103.5)	0.71 (269.4)	13.16 (172.7)	17.57
40 + 40 + WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	22.60
40 + 40 + Weedy	10.61 (112.0)	15.70 (245.8))	14.86 (220.3)	8.73
40 + 80 + Buta	6.08 (36.46)	14.09 (198.0)	13.04 (169.5)	7.49
40 + 80 + WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	37.53
40 + 80 + Weedy	12.01 (143.7)	18.19 (367.7)	14.12 (198.7)	4.27
80 + 40 + Buta	12.04 (143.8)	17.95 (321.7)	11.68 (135.9)	17.64
80 + 40 + WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	34.61
80 + 40 + Weedy	12.24 (149.3)	19.07 (363.2)	13.86 (191.6)	11.25
CDat 5%	2.80	2.89	3.92	3.90

Influence of level of N and weed management in drilled rice.

A.N. Singh, S. Singh and V.M. Bhan

The effect of N fertilizer alongwith weed control practices was studied on direct sown "Kranti" rice (*Oryza sativa* L.) under upland condition during 1993. The experiment consisted of four levels of N (0, 40, 80 and 120 kg/ha) as main plots and weed control measures butachlor @ 1.5 kg/ha, one hand weeding at 30 DAS, weed free and weedy check as sub plot laid out in split plot design and replicated thrice with plot size of 5 * 4.5 m. Half of N dose and 60kg P_2O_5 and 40 kg K_2O/ha applied as basal and remaining N in two equal split doses applied as top dressing at 30 & 60 DAS.

The dominating weed flora were *Commelina communius, Alternanthera sessilis* and *Caesulia axillaris, Echinochloa colonum, Cyperus irria.*

With the increasing N level, the dry matter of weeds/m increased significantly at each date (40 DAS, 75 DAS and at harvest). The grain yield of drilled rice was also recorded maximum (26.40 q/ha) with highest dose of N (120 kg/ha) as compared to lower levels. The highest weed dry matter was recorded in weedy plot and "grain yield under weed free plot. Since the broadleaved weeds covered 70% of total population hence butachlor remained ineffective in controlling weeds but the differences were significant in term of weed dry matter over weedy. One hand weeding at 30 DAS was superior than butachlor in terms of yield.

Table 14 : Effect of N level and weed control measure on dry wt. of weeds and yield of drilled rice.

TREATMENT	Weed dry weight (g/m2)			Grain yield (q/ha)
	40 DAS	75 DAS	At harvest	
N level (kg/ha)				
0	3.56 (12.18)	5.76 (32.67)	5.62 (31.08)	10.26
40	5.44 (29.09)	7.60 (57.26)	6.96 (47.94)	18.22
80	6.38 (40.30)	9.25 (85.06)	7.98 (63.14)	22.94
120	7.48 (54.41)	10.39 (107.4)	8.53 (72.26)	26.40
	1.57	1.16	2.10	1.18
Weed control				
Weedy	10.52 (110.1)	13.99 (195.2)	12.52 (156.2)	10.05
Butachior 1.5 kg/ha	8.64 (74.14)	11.18 (124.4)	10.95 (119.4)	15.74
One HW at 30 DAS	3.63 (12.67)	6.92 (47.38)	7.71 (58.94)	22.13
Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	29.90
CD at 5%	1.12	1.48	1.44	2.21

Effect of Plastic and Straw Mulching on Weed Population and yield of Drilled rice.

A.N. Singh, S. Singh and V.M. Bhan

The experiment was laid out in *kharif* 1993 on sandy clay loam soil in a randomized block design with nine treatment replicated thrice. The treatments were black and transparent polythene (plastic mulch) and wheat straw, chickpea straw and mustard straw as straw mulch with one herbicide butachlor @ 1.5 kg/ha along with unweeded control and hand weeding at 30 DAS and weed free. Rice cv. "Kranti" was grown in the experiment. The crop was sown at 30 cm spacing and fertilized with 100 kg N, 60 kg P_2O_5 and 40 kg K_2O per hectare. Density of weeds was counted by quadrat of 0.25 m randomly at four places in each plot.

Drilled rice was infested with *Echinochloa colonum* L., *Alternanthera sessilis, Commelina communis, Caesulia axillaris* Roxb. and *Cyperus iria* L. These constituted 90% of the total weed population. Black polythene suppressed the *Echinochloa* sp. as well as *Alternanthera sissilis* whereas transparent polythene and mustard straw reduced the population of*Cyperus* sp. and *Alternanthera* sp. Among the straw mulch mustard straw reduced the *Cyperus* sp. and total weed population significantly. Transparent & black polythene reduced the total weed population as compared to other mulches. The yield of drilled rice was found highest in weed free conditions among all the treatment and was significant over weedy check.

Table 15 : Weed population, Weed dry wt. and grain yield of rice as influenced by mulching.

Treatment		Total weed pop/m2		Weed dry wt. (g/m2)		Grain yield (q/ha)
		40 DAS	75 DAS	40 DAS	75 DAS	
1.	Black polythene	7.01 (48.64)	5.01 (24.60)	4.21 (120.60)	3.85 (61.27)	22.31
2.	Transparent polythene	6.67 (43.98)	5.02 (24.70)	8.39 (69.89)	8.61 (73.63)	24.61
3.	Wheat straw	7.14 (50.47)	6.67 (43.98)	12.83 (164.10)	9.87 (93.91)	17.11
4.	Mustard straw	6.83 (46.55)	5.03 (24.80)	12.71 (161.04)	10.38 (107.24)	20.33
5.	Chickpea straw	7.11 (50.05)	6.08 (36.46)	12.82 (163.85)	10.66 (113.13)	15.92
6.	Butachlor 1.0 kg/ha	4.62 (21.34)	5.30 (27.59)	8.48 (71.41)	8.71 (75.36)	23.09
7.	One HW at 30 Days	4.02 (16.78)	6.90 (47.11)	4.73 (21.87)	8.68 (74.87)	25.47
8.	Weedy	8.72 (75.54)	7.35 (53.52)	15.59 (242.54)	15.05 (226.04)	3.07
9.	Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	35.46
CD at 5%		1.85	1.14	2.36	1.64	5.31

Effect of phosphate and weed control treatments on dry matter of weeds and yield of chickpea.

A.N. Singh and V.M. Bhan

The experiment was laid out in split plot design with three replications, comprising of four level of phosphate (0, 30, 60 and 90 kg/ha) alloted to main plots and five weed control treatments such as fluchloralin and pendimethalin each at 1 kg/ha and sethoxydim 0.400 kg/ha along with weed free and weedy check adjusted in sub plots of 5 x 3.60 m.

The crop responded to phosphate fertilization significantly. Application of phosphate @ 90 kg/ha, affecting weed dry matter yield at 60 DAS, increased the grain yield by 6.1 q/ha over unfertilized control. All weed control treatments reduced mean dry weight of total weeds. Weed free situation enhanced grain yield significantly by 70%. Fluchloralin applied as pre-plant incorporation @ 1.0 kg/ha increased the grain yield significantly by 47% over un-weeded control whereas pendimethalin and sethoxydim increased yield by 49.26% and 48.91%, respectively.

Table 16 : Effect of Phosphorus and weed control measures on Weed dry matter and yield of chickpea.

Treatments	Weed dry wt g/m^2 (60 DAS)		Grain yield (q/ha)
Phosphorus Level (kg/ha)			
0	2.52	(5.85)	13.49
30	2.76	(7.1)	15.47
60	3.06	(8.86)	16.80
90	3.02	(8.62)	19.63
CD at 5%	0.23		1.61
Weed control			
Fluchloralin 1 kg/ha	3.13	(3.29)	17.00
Pendimethalin 1 kg/ha	2.89	(7.85)	17.27
Sethoxydim 0.40 kg/ha	2.90	(7.91)	17.23
Weedy	4.58	(20.48)	11.57
Weed Free	0.71	(00.0)	19.67
CD at 5%	0.26		1.60

Weed-Crop Competition in Chickpea.

A.N. Singh and V.M. Bhan

Treatment consisted of weedy conditions for the first 30,60,90, 120 days after sowing (DAS) and upto harvesting. Sowing was done with 80 kg/ha seed rate at a row spacing of 23 cm. The crop was fertilized with 20 kg N, 60 kg P_2O_5 and 40 kg K_20/ha as basal application. Crop was irrigated once at about 60 DAS. As prophylactic measures against insect two sprays of Endosulfon were made at flowering and at pod development stage. The experiment were laid out in RBD with three replication.

Cichorium intybus, Medicago sp, *Chenopodium album, Cyperus rotundus* were the predominant weeds in chickpea field, grain yield of which reduced by 18% due to competition with weeds in first 30 days of sowing which increased to about 50% when weeds competed with the crop for the entirte crop season. Grain yield was increased when the initial weed free duration was extended upto 60 DAS. Weed free had no beneficial effect on grain yield. The initial 60 DAS period considered to be critical with respect to weed crop competition in chickpea.

Table 17 : Effect of different period of weed free maintenancein chickpea.

Treatment	Weed density/m2				Weed dry matter (q/m2)				Grain yield (q/ha)
	30	60	90	Harv-est	30	60	90	Harv-est	
Weed free upto									
30	0	3.71 (13.2)	5.96 (35.0)	6.30 (39.1)	0	2.59 (6.20)	3.03 (8.6)	3.01 (8.5)	14.77
60	0	0	5.52 (29.9)	6.45 (41.1)	0	0	2.23 (4.5)	3.00 (8.5)	18.64
90	0	0	0	5.17 (26.2)	0	0	0	2.38 (5.1)	22.18
120	0	0	0	0	0	0	0	0	22.97
Harvest	0	0	0	0	0	0	0	0	24.63
Weed upto									
30	4.98 (24.3)	0	0	0	2.74 (7.0)	0	0	0	17.50
60	5.15 (26.0)	5.67 (31.6)	0	0	2.84 (7.5)	3.35 (10.7)	0	0	13.17
90	4.94 (23.9)	5.84 (33.6)	6.67 (43.9)	0	2.92 (8.0)	3.52 (11.9)	5.13 (25.8)	0	11.05
120	5.00 (24.5)	5.69 (31.8)	6.59 (42.9)	6.38 (40.2)	2.96 (8.2)	3.38 (10.9)	5.34 (28.0)	4.37 (18.6)	9.95
Harvest	4.77 (22.2)	5.86 (33.8)	6.48 (41.5)	6.25 (38.5)	2.99 (8.4)	3.41 (11.1)	5.33 (27.9)	4.12 (16.5)	9.61
CD at 5%	0.44	0.38	0.37	0.43	0.23	0.26	0.20	0.18	1.33

Weed-Crop Competition in Mustard in relation to Nitrogen Application.

A.N. Singh and V.M. Bhan

Experiment consisted of three nitrogen levels (0, 45 and 90 kg/ha) subjected to main plots treatment and eight sub treatments including weed free conditions for initial 30, 60, 90 DAS and at harvest and weedy condition for the same days as allotted in weed free condition. Variety "Pusa Bold" of mustard was sown in split plot design with 3 replication. Seed @ 5 kg/ha was used, keeping row 45 cm apart.

Density of total weeds increased at 30 DAS. Though the weed population increased with an increase in N level, but the differences were not significant except at harvest. The difference in the dry weight of weeds were significant with each increase in N levels. These results indicated that the effect of nitrogen on the growth of weeds was greater than on the population of weeds. Presence of weed upto 60 DAS affected mustard yield severly. Weed free maintenance for initial 30 and 60 DAS increased grain yield. Initial 30 to 60 DAS were the most critical periods weed-crop competition in mustard.

Table 18 : Effect of weed free maintenance in relation to N level on weed population and yield of mustard.

Treatment		Weed Population m^2						Grain yield (q/ha)
		30DAS		60DAS		90DAS		
N Level (kg/ha)								
0		3.77	(13.71)	3.93	(14.94)	3.75	(15.56)	664.79
45		4.02	(15.66)	4.01	(15.58)	3.76	(13.64)	965.42
90		4.10	(16.31)	4.13	(16.55)	3.83	(14.17)	1345.83
CD AT 5%		0.08		0.22		0.17		56.37
Weed management								
WF for Ist	30 DAS	0.71	(0.00)	4.60	(21.2)	5.24	(26.96)	847.78
	60 DAS	0.71	(0.00)	0.71	(0.00)	4.87	(23.22)	1097.78
	90 DAS	0.71	(0.00)	0.71	(0.00)	0.71	(0.00)	1160.00
	Harvest	0.71	(0.00)	0.71	(0.00)	0.71	(0.00)	1182.78
WY for Ist	30 DAS	7.37	(53.81)	0.71	(0.00)	0.71	(0.00)	1202.22
	60 DAS	7.20	(51.34)	8.19	(66.58)	0.71	(0.00)	917.22
	90 DAS	7.06	(49.34)	8.17	(66.25)	8.56	(72.77)	788.33
	Harvest	7.27	(52.35)	8.20	(66.74)	8.62	(73.80)	740.00
CD AT 5%		0.23		.18		0.155		68.36

WF = Weed Free, WY = Weedy

Figures in parenthesis are original values.

Studies on the influence of nitrogen level and weed control methods on yield of mustard.

A.N. Singh and V.M. Bhan

The treatment consisted of nitrogen levels (0, 30, 60 and 90 kg/ha) as main plot and weed control methods (fluchloralin, pendimethalin and isoproturon each at 1.0 kg/ha, weed free and weedy check) as sub plot. Dry matter of weeds increased significantly with increase in each increment of N level. Though the weed population was not affected. Herbicide treatments such as fluchloralin, pendimethalin and isopuroturon decreased the dry matter accumulation of weed (g/m) and differed significantly with weedy check. Seed yield of mustard increased significantly with the increase in N level from 0, 30, 60 & 90. All weed control treatments gave significantly higher seed yield over control, however, maximum seed yield of 14.43 q/ha was recorded with weed free treatment.

Table 19 : Influence of N level and herbicide on the weed emergence in mustard.

Treatment	Dary matter of weed (g/m2)		Grain yield (q/ha)
N level (kg/ha)			
0	2.61	(06.31)	6.84
30	3.25	(10.06)	11.51
60	3.41	(11.13)	13.35
90	3.79	(13.86)	16.05
CD at 5%	0.38		0.80
Weed control Treatments			
Fluchloralin 1.0 kg/ha	3.51	(11.82)	12.02
pendimethalin 1.0kg/ha	3.62	(12.60)	12.46
Isoproturon1.0 kg/ha	3.65	(12.82)	12.60
Weed Free	0.71	(0.00)	14.43
Weedy	4.83	(22.83)	8.16
CD at 5%	0.32		1.8

Efficacy of herbicides for weed control and yield of mustard.

A.N. Singh and V.M. Bhan

This experinment was conducted to study the effect of herbicides for weed control in mustard. Weed control treatments (sethoxydim-PE @ 200, 400 & 800 g/ha, Sethoxydim-PO @ 200 & 400 g/ha, tribenuron-PE @ 10 & 20 g/ha, fluchloralin-PPI @ 1.0 kg/ha, pendimethalin-PE @ 1.0 kg/ha isoproturon-PO @ 1.0 kg/ha, weedy and weed free) were tested in a randomised block design (RBD) with three replications. The crop was sown on 26th Oct., 1993 in rows 45 cm apart in plots measuring 5x3.6 m each. Post emergence application was made at 30 DAS.

Predominant weeds were *Chicorium intybus, Medicago sativa, Chenopodium album, Cyperus rotundus* and *Paspalidium paspaloides.* Total weed population and dry wt/m were reduced significantly with herbicides treatment except Cichorium intybus. The maximum grain yield of mustard was recorded when plot treated with sethoxydim PE 800 g, sethoxydim PO 400 g and pendimethalin.

Table 20 : Efficiency of herbicides for weed control in mustard.

Treatment	Application time	Rate kg/ha	Total population/m2	weed dry weight (g/m2)	Grain yield (q/ha)
Sethoxydim	PE	0.200	4.21 (17.22)	3.85 (14.32)	17.76
Sethoxydim	PE	0.400	3.31 (10.45)	4.02 (15.66)	19.18
Sethoxydim	PE	0.800	3.72 (13.35)	2.99 (8.44)	21.22
Sethoxydim	PO	0.200	4.37 (18.60)	3.45 (11.40)	16.26
Sethoxydim	PO	0.400	3.78 (13.79)	3.76 (13.64)	21.42
Tribenuron	PE	0.010	3.92 (14.87)	3.76 (13.63)	20.28
Tribenuron	PE	0.020	3.79 (13.86)	3.48 (11.61)	18.33
Pendimethalin	PE	1.0	3.24 (9.99)	3.22 (9.87)	21.06
Isoproturon	PO	1.0	4.61 (20.75)	3.53 (11.69)	16.00
Fluchloralin	PPI	1.0	4.4.33 (18.25)	3.04 (14.24)	18.98
Weedy			5.69 (31.87)	4.96 424.10)	12.46
Weed free			0.71 (0.00)	0.71 (0.00)	23.69
CD at 5%			1.09	0.63	6.96

Figures in parenthesis are original values .

Effect of Rice and Soybean based cropping intensity system on distribution of weed flora

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A field experiment was conducted to find out the effect of cropping intensity on the distribution of weed flora and their control in rice based cropping system. Major weeds observed during this system were Echinochloa colonum and *Commelina* spp. during *kharif* season and *Phalaris minor, Chenopodium* spp., *Chicorium* spp., *Trifolium flagiferum* during*rabi* season. The lowest weed population was observed with rice-mustard-moong (300% CI). While grain yield was not influenced by cropping intensity system during both the season. Application of butachlor (1.5 kg/ha) in rice and isoproturon (1.0 kg/ha) in wheat and mustard reduced the weed population and weed drymatter and increased grain yield by 11.03 and 9.04 per cent during *Kharif* and *rabi* season, respectively.

Table 21 : Effect of rice based cropping system on the distribution of kharif weed flora at 30 DAS

	TREATMENTS	Weed population/m2 (Specvies wise)						
		Rice-Wheeat (200% CI)		Rice-Mustard-Moong (300% CI)		Rice-Fallow (100% CI)		Fallow-Wheat (100%CI)
		W	H	W	H	W	H	W
1.	Cyperus rotundus	–	–	–	–	–	–	–
2.	Cyperus iria	–	–	–	–	–	–	–
3.	Cyperus Difformis	–	–	–	–	–	–	–
4.	Echinochloa colonum	10.67	5.33	7.33	5.33	6.00	9.33	10.00
5	Echionchloa	–	2.00	–	–	–	–	–
6.	glabrascence	–	–	–	–	–	–	–
7.	E. Crusqalli	12.67	6.00	10.00	6.67	18.00	6.00	22.67
8.	Commelina sp	2.67	2.67	–	–	2.00	–	–
9.	Caesulia auxillaris	–	–	–	–	4.67	–	0.80
	Alternanthera sessilis							
	TOTAL	26.01	16.00	17.33	12.00	30.67	15.33	33.47
AT 60 DAS								
1.	Cyperus rotundus	-	-	-	-	-	-	–
2.	Cyperus iria	0.67	0.67	2.67	8.00	3.33	2.67	2.00
3.	Cyperus difformis	-	-	-	-	-	–	–
4.	Echinochloa colonum	58.00	18.00	54.67	32.00	37.33	34.00	34.67
5.	Echinochloa	-	12.00	-	-	6.00	5.33	-
6.	glabrascence	-	-	-	-	-	–	–
7.	E. crusgalli	21.33	11.33	15.33	6.67	20.00	14.00	28.00
8.	Commelina sp.	0.67	2.67	1.33	-	-	5.33	12.80
9.	Caesulia auxillaris	-	0.67	3.33	0.67	-	0.67	7.33
10.	Alternathera sessilis	0.67	–	-	–	-	–	-
	Ammania baccifera							
	TOTAL	81.34	45.34	77.33	47.34	66.67	62.00	84.80

Table 22 : Effect of rice based cropping system on distribuation of rabi weed flora at 30 & 60 DAS

TREATMENTS		Weed population/m2 (Species wise)ce-Fallow								
		Rice-Wheat (200% CI)		Rice Mustard-Moong (300% CI)		Rice-Fallow (100% CI)	Fallow-Wheat (100% CI)		Weed Species	
		H	W	W	H	W	WF	H	W	H
AT 30 DAS										
1.	*Phalaris minor*	8.00	5.00	8.00	1.33	6.33	10.00	5.67	4.33	2.33
2.	*Chenopodium sp.*	19.33	8.00	9.33	6.33	34.00	34.67	62.67	6.00	8.67
3.	*Cichorium sp.*	70.00	54.67	75.33	50.00	95.33	66.67	69.33	70.67	70.00
4.	*Trifolium sp.*	42.67	58.67	7.33	15.33	22.00	15.33	7.33	66.00	28.00
5.	*Medicago denticulata*	2.67	5.33	2.67	–	–	1.33	0.67	2.67	2.67
	TOTAL	142.67	131.67	102.66	72.99	157.66	128.00	145.67	149.67	111.67
AT 60 DAS										
1.	*Phalaris minor*	11.67	3.33	13.33	4.00	32.67	–	46.33	15.67	4.00
2.	*Chenopodium sp.*	29.33	20.33	18.67	13.33	34.67	–	53.33	7.33	18.00
3.	*Cichorium sp.*	34.67	28.67	36.67	22.00	40.00	–	26.67	54.67	24.00
4.	*Trifolium sp.*	40.33	16.67	16.00	24.67	30.00	–	16.67	34.00	17.33
5.	*Medicago denticulata*	2.00	3.33	6.67	7.33	6.00	–	9.33	14.67	4.67
	TOTAL	117.67	72.00	91.34	71.33	143.34	–	152.33	126.34	68.00

In case of Soybean based cropping system, *Echinochloa colonum, Commelina* spp., *Alternanthera sessilis, Caesulia auxillaris* during*kharif* while in*rabi* season*Chenopodium* spp., *Chicorium* spp., *Ligacea molis* and *Cyperus rotundus* were the dominant weeds.

The density of *Cyprus* spp. were more in Soybean-Mustard-Moong (300% CI) followed by Soybean-Fallow (100% CI) and Soybean-Wheat (200% CI). The lowest weed population was recorded with fallow-wheat (100% CI) at 60 DAS during rabi season. The lowest weed drymatter was recorded with Soybean-Mustard-Moong (300% CI) during both seasons. The highest yield was recorded with Soybean-Mustard-Moong (300% CI) during both the seasons. Application of Pendimethalin (1.25 kg/ha) in Soybean and Isoproturon (1.0 kg/ha) in Wheat and Mustard significantly reduced the weed population, weed drymatter and increased the yield of crops.

Fig. 3. Herbicide applied in preceeding soyabean had a drastic reduction in weed population of subsequent season when compared with weed free situation maintained in preceeding soyabean.

Table 23 : Effect of Soybean based cropping intensity on distribution of *kharif* weed flora (specieswise) at 40 & 60 DAS.

TREATMENTS		Weed population/m2 (Species wise)						
		Soybean-Wheat (200%CI)		Soybean-Mustard-Moong (300% CI)		Soybean - Fallow (100% CI)		Fallow-Wheat (100% CI)
		H	W	W	H	W	H	W
AT 40 DAS								
1.	*Cyperus rotundus*	3.30	3.30	12.00	10.67	4.00	-	25.20
2.	*Cyperus iria*	-	2.67	-	-	-	12.67	-
3.	*Echinochloa colonum*	2.00	-	4.67	-	13.33	2.00	3.60
4.	*Echinochloa glabrescense Commelina sp.*	2.67	-	2.00	0.67	1.33	1.33	-
5.	*Alternanthera sessilis*	4.00	12.67	7.33	2.00	2.00	4.67	5.20
6.	*Corchorus sp.*	38.67	-	11.33	2.67	17.33	6.67	58.80
7.	*Caesulia auxillaris*	6.67	0.67	0.67	-	2.67	0.67	21.60
8.	*Phyllanthus sp.*	-	7.33	2.67	7.33	2.67	9.33	7.60
9.	*Ligacea molis*	9.33	4.00	2.00	3.00	8.67	1.33	16.80
10.	*Physalis minima*	-	1.33	-	-	-	1.33	-
11.	*Cichorium sp.*	-	-	-	-	2.00	-	6.80
12.		0.67	2.67	1.33	5.33	1.33	0.67	-
	TOTAL	67.31	34.64	44.00	31.67	55.33	40.67	145.60
AT 60 DAS								
1.	*Cyperus rotundus*	0.67	–	–	–	–	–	16.67
2.	*Cyperus iria*	6.67	2.00	26.00	4.67	4.00	26.67	–
3.	*Echinochloa colonum*	6.67	5.33	4.00	1.33	4.67	4.00	9.60
4.	*Echinochloa glabrescense Commelina sp.*	-	0.67	–	–	4.67	2.00	0.80
5.	*Alternanthera sessilis*	77.33	18.67	14.67	23.33	4.67	13.33	5.20
6.	*Corchorus sp.*	22.67	34.67	20.67	10.67	6.00	0.67	26.40
7.	*Caesulia auxillaris*	0.67	1.33	–	0.67	2.00	2.67	4.80
8.	*Phyllanthus sp.*	13.33	12.67	2.00	22.67	3.33	33.33	12.00
9.	*Ligacea molis*	2.00	5.33	6.00	2.00	9.33	10.67	13.60
10.	*Physalis minima*	1.33	2.67	–	–	0.67	0.67	0.67
11.	*Cichorium sp.*	-	–	5.33	2.00	6.00	–	4.40
12.		-	–	2.00	0.67	6.00	0.67	2.80
	TOTAL	131.34	82.67	80.67	68.01	141.34	94.68	96.94

Table 24 : Effect of Soybean based cropping intensity on distribution of *Rabi* weed flora (specieswise) at 30 & 60 DAS.

	TREATMENTS	Weed population/m2 (Species wise)								
		Soybean-Wheat (200%CI)		Soybean-Mustard-Moong (300% CI)		Soybean - Fallow (100% CI)			Fallow-Wheat (100% CI)	
		H	W	W	H	W	WF	H	W	H
AT 30 DAS										
1.	*Cyperus rotundus*	-	–	2.00	2.00	–	–	–	1.33	1.33
2.	*Alternanthera sessilis*	0.67	5.33	–	–	–	0.67	–	–	–
3.	*Cichorium sp.*	0.67	–	0.67	4.67	42.6	32.67	12.00	6.67	10.67
4.	*Chenopodium sp.*	82.67	7.33	95.33	47.33	68.0	156.67	114.33	97.33	65.33
5.	*Ligacea molis*	14.67	9.33	1.33	5.33	17.3	–	21.33	–	0.67
6.	*Physalis minima*	0.67	–	14.00	–	22.0	1.33	10.67	–	–
7.	*Trifolium flagiferum*	-	–	–	–	2.0	4.00	–	–	–
8.	*Ipomea sp.*	0.67	4.67	–	–	0.6	1.33	0.67	–	0.67
9.	*Medicago denticulata*	-	2.67	–	2.00	–	50.00	–	1.33	2.00
	TOTAL	100.02	29.33	113.33	61.33	152.0	246.67	159.00	106.66	80.69
AT 60 DAS										
1.	*Cyperus rotundus*	–	–	–	–	–	–	–	–	–
2.	*Alternanthera sessilis*	–	–	–	–	–	–	–	–	6.67
3.	*Cichorium sp.*	5.33	2.67	2.00	2.67	18.67	46.67	8.67	5.33	5.33
4.	*Chenopodium sp.*	99.33	20.00	97.33	78.67	47.3	63.33	68.00	52.00	8.67
5.	*Ligacea molis*	2.67	48.67	8.00	–	–	–	88.00	–	–
6.	*Physalis minima*	0.67	0.67	6.00	0.67	2.67	6.33	9.33	0.67	2.00
7.	*Trifolium flagiferum*	11.33	–	–	–	2.00	–	–	0.67	–
8.	*Ipomea sp.*	–	3.33	2.00	–	2.00	–	–	0.67	–
9.	*Medicago denticulata*	–	–	1.33	–	–	16.67	–	–	2.00
10.	*chrozophora plicata*	–	9.33	–	–	2.00	–	–	–	4.00
	TOTAL	119.33	84.67	116.67	82.01	74.67	133.00	174.00	59.34	28.67

Effect of date of sowing, row spacing and weed control measures in Soybean (*Glycine max* L.)

V.P. Singh and V.M. Bhan

This study was carried out to find out the suitable row spacing, date of sowing and weed control measure, for reducing the compatibility of weed and getting higher yield in Soybean. The treatments consisted of two DOS (25th June and 15th July), two row spacing (22.5 and 45.0 cm) and weed control measures such as weedy, fluchloralin (1.25 kg/ha), pendimethalin (1.25 kg/ha) and fluazifopbutyl (0.30 kg/ha), randomly allotted to split plot design. *Echinochloa colonum, Commelina communis, Alternanthera sessilis* and *Caesulia axillaris* were the dominant weeds during *Kharif* season. The weed population was significantly reduced and was the lowest under the fluchloralin (1.25 kg/ha) treatment which was at par to pendimethalin (1.25 kg/ha) and fluazifoputyl (300 g/ha). Date of sowing treatment had major influence over weed population at 40 DAS and weed drymatter at all the stages of crop. Significantly the lowest weed population and weed drymatter were noted under 15th July and narrow spacing (22.5 cm) as compared to 25th June and wider row spacing. Weed growth was suppressed to the tune of 18.63 per cent by closer spacing.

It was concluded that the presence of weeds during the season reduced the yield of Soybean by 31.78% . The significantly highest grain yield was recorded with fluchloralin (1.25 kg/ha) treated plots as compared to weedy check. Row spacing and date of sowing showed significant effect over grain yield and grain weight per plant. Sowing on 25th June and wider row spacing increased the yield by 39.64 and 16.02 per cent.

Fig. 4. Narrow row spacing (22.5 cm.) proved to be useful in suppressing the weeds tremandously as compare to wider row spacing

Table 25 : Effect of weed management, date of sowing and row spacing on weed population

Treatments		Weed population/m^2			Weed dry matter g/m^2			Grain wt.per plant (g)	Grain yield (q/ha)
		30 DAS	60 DA	Harvest	30 DAS	60 DA	Harvest		
WEED CONTROL METHODS									
M1	Fluchloralin @ 1.25 kg/ha	4.13 (16.56)*	6.49 (41.62)	3.47 (11.54)	5.67 (31.65)	7.01 (48.64)	4.62 (20.84)	6.38	13.86
M2	Pendimethalin @ 1.25 kg/ha	4.49 (19.66)	6.67 (43.99)	3.90 (14.71)	5.85 (33.72)	7.36 (53.67)	4.85 (23.02)	6.32	12.29
M3	Fluazifop–butyl @ 0.30 kg/ha	4.56 (20.30)	6.99 (48.36)	3.87 (14.48)	6.17 (37.57)	7.81 (60.50)	5.79 (33.02)	6.07	12.35
M4	Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	7.23	14.16
M5	Weedy	6.25 (38.56)	9.14 (83.04)	5.22 (26.75)	6.93 (47.52)	8.65 (74.32)	6.74 (44.93)	5.37	9.66
CD AT 5%		0.88	0.78	0.65	0.74	0.67	0.83	NS	1.47
DATE OF SOWING									
D1	25 th June	4.27 (17.73)	6.32 (39.44)	3.53 (11.96)	5.42 (28.88)	6.91 (47.25)	4.15 (16.72)	7.73	15.54
D2	15th July	3.79 (13.86)	5.68 (31.76)	3.34 (10.66)	4.71 (21.68)	5.71 (32.10)	4.93 (23.81)	4.82	9.38
CD AT 5%		0.41	NS	NS	0.33	0.60	0.22	0.87	0.50
ROW SPACING									
R1	22.cm	3.68 (13.04)	5.73 (32.33)	3.26 (10.13)	4.55 (20.20)	5.64 (31.31)	4.80 (16.15)	5.62	11.38
R2	45.0 cm	4.38 (18.68)	6.29 (39.06)	3.60 (12.46)	5.58 (30.64)	6.97 (48.08)	5.00 (24.50)	6.93	13.55
CD AT 5%		0.27	NS	0.27	0.37	0.64	0.44	0.48	0.50

* Data in parenthesis are original value.

Table 26. Weed population and grain yield of crops as influenced by organic farming in maize-pea rotation.

Treat ments	Weed population/m^2 grain						Weed dry matter g/m^2						Yield q/ha	
	40 DAS		60 DAS		Harvest		40 DAS		60 DAS		Harvest			
	Maize	Pea	Maize	Pea	Maize	Pea	Maize	Pea	Maize	Pea	Maize	Pea	Maize	Pea
Farming System														
T-1	4.59	5.68	5.84	5.69	3.60	4.44	3.00	1.74	4.14	3.86	6.34	4.43	20.23	16.11
	(20.57)*	(31.76)	(33.61)	(31.88)	(12.46)	(19.21)	(8.50)	(2.53)	(16.64)	(14.63)	(39.70)	(19.12)		
T-2	5.33	5.50	5.84	6.56	5.01	5.03	3.11	1.83	4.09	3.87	6.50	4.84	25.94	16.26
	(27.91)	(29.75)	(33.61)	(42.53)	(24.60)	(24.80)	(9.17)	(2.85)	(16.23)	(14.48)	(41.75)	(22.93)		
T-3	5.38	5.91	6.16	6.98	5.68	5.54	3.12	1.79	4.52	3.96	6.36	4.73	31.82	17.07
	(28.44)	(34.43)	(37.45)	(48.22)	(31.76)	(30.19)	(9.23)	(2.70)	(19.93)	(15.18)	(39.95)	(21.87)		
CD at 5%	0.39	NS	NS	0.90	1.41	0.67	NS	NS	0.37	NS	NS	NS	2.00	NS
Weed management														
Weedy	8.62	8.98	9.38	11.54	10.23	9.55	5.03	2.68	6.48	6.33	11.23	7.35	19.30	15.07
	(73.80)	(80.14)	(87.48)	(132.67)	(104.55)	(90.70)	(24.80)	(6.68)	(41.49)	(39.57)	(125.61)	(53.52)		
Weed free	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	30.58	18.03
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
Herbicide	5.97	7.40	7.76	6.99	3.36	4.76	3.48	1.98	5.57	4.16	7.26	5.95	28.10	16.24
	(35.14)	(54.26)	(59.72)	(48.36)	(10.79)	(22.16)	(11.61)	(3.42)	(30.52)	(16.81)	(52.20)	(34.90)		
CD at 5%	0.39	0.67	0.56	0.90	1.41	0.67	0.51	0.24	0.37	0.55	0.51	0.52	2.00	1.05

** Weed population and dry matter/m^2 in pea was taken at 30 DAS

* Data in parenthisis are original value
Data transformed by (X + 0.5)

Table 27. Weed population and grain yield of crops as influenced by organic farming in soybean - wheat rotation.

Treat ments	Weed population/m^2 grain						Weed dry matter g/m^2						Yield q/ha	
	40 DAS		60 DAS		Harvest		40 DAS		60 DAS		Harvest			
	Soybean	Weed	Soybean	Weed	Soybean	Weed	Soybean	Weed	Soybean	Weed	Soybean	Weed	Soybean	Weed
Farming System														
T-1	4.40	4.97	4.97	5.50	4.20	4.98	3.06	1.34	3.87	4.08	6.10	5.77	16.26	32.43
	(18.86)*	(24.20)	(24.20)	(29.75)	(17.14)	(24.30)	(8.86)	(1.30)	(14.48)	(16.15)	(36.71)	(32.79)		
T-2	4.18	5.94	3.80	6.06	4.18	4.99	3.05	1.44	4.47	4.34	6.34	3.90	19.27	41.70
	(16.97)	(34.78)	(13.94)	(36.22)	(16.97)	(24.40)	(8.80)	(1.57)	(19.48)	(18.34)	(39.70)	(14.71)		
T-3	4.42	5.09	4.46	6.05	3.57	4.78	3.35	1.35	4.48	4.20	5.74	3.86	24.75	56.37
	(19.02)	(25.40)	(19.39)	(36.10)	(12.25)	(22.35)	(10.06)	(1.32)	(19.57)	(17.14)	(32.45)	(14.40)		
CD at 5%	NS	0.96	0.35	0.54	0.34	NS	NS	NS	0.44	NS	0.38	0.62	4.03	2.99
Weed management														
Weedy	6.97	69.96	7.35	11.36	6.11	10.37	5.03	2.20	6.80	7.43	9.53	9.95	16.10	40.31
	(48.08)	(98.70)	(53.52)	(128..55)	(36.83)	(107.04)	(24.80)	(4.34)	(45.74)	(54.70)	(90.32)	(98.50)		
Weed free	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	24.90	46.95
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	0.00	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
Herbicide	5.32	5.34	5.18	5.54	5.13	3.67	3.73	1.23	5.31	4.48	7.95	2.87	19.27	43.24
	(27.80)	(28.02)	(26.33)	(30.19)	(25.82)	(12.97)	(13.41)	(1.01)	(27.70)	(19.57)	(62.70)	(7.74)		
CD at 5%	0.36	0.96	0.35	0.54	0.34	0.71	(0.48)	0.34	0.44	0.49	0.38	0.62	4.03	2.99

** Weed population and dry matter/m in wheat was taken at 30 DAS

* Data in parenthisis are original value
Data transformed by (X + 0.5)

Effect of farming system on the emergence of weeds and their management

V.P. Singh and V.M. Bhan

An experiment was conducted to evaluate the long term effect of animal system using manures on intensity and diversity of weed flora in diverse rotation of legumes and cereals. The treatments consisted of

T1 (low input animal system using manures i.e. 50% of recommended dose of nutrients supplied through FYM only);

T2 (low input animal system using manures i.e. 50% of recommended dose of nutrient of which 50% is supplied through FYM and 50% through fertilizers); and

T3 (Conventional method i.e. recommended dose of nutrients) alongwith weedy, weedfree and herbicide as per the crops, were replicated three times in factorial randomized block design. The diverse rotation were Soybean-Wheat and Maize-Pea.

In Soybean-Wheat system,*Commelina* spp.,*Alternanthera sessilis* and *Echinochloa colonum* were the major weeds in Soybean and*Chenopodium* spp., *Chicorium* spp., *Medicago denticulata* and *Trifolium flagiterum* were dominant in wheat. Farming systems significantly influenced the weed population, weed drymatter and grain yield of crop. At harvest, the highest weed population was noted with T1 but weed drymatter was maximum under T2, and both was significantly superior over T3. Similarly in wheat, the weed population under T2 (being at par with T3) was significantly superior over T1 at 40 and 60 DAS but it was only at par at harvest. The highest grain yield of Soybean (24.75 q/ha) and wheat (56.37 q/ha) were recorded with T3 which was significantly superior over T2 & T1.

Weeds caused 35.34% reduction in grain yield of Soybean and 14.15% in wheat. Application of pendimethalin @ 1.25 kg/ha in soybean and isoproturon 1.0 kg/ha in wheat significantly reduced the weed population and weed drymatter and increased the grain yield of both the crops.

In Maize-Pea system,*Commelina communis, Echinochloa colonum* and *Cyprus* sp. were the major weed in Maize and *Chenopodium* spp., *Chicorium* spp.,*Trifolium flagiferum* and *Medicago denticulata* were dominant in Pea. Data presented in the table indicated that farming system significantly influenced the weed population at 40 and at harvest in maize, and at 60 DAS and at harvest in pea. The highest weed population was recorded with T3 being at par with T2 but was significantly higher over T1 in both the crops. However, the weed drymatter was only significant at 60 DAS in maize where it was maximum (19.93 g/m2) with T^3, followed by T^2 and T^1. The maximum grain yield of maize (31.82 q/ha) and pea (17.07 q/ha) was obtained with T^3 which was significantly higher than T^2 and T^1 in Maize only. The weeds caused 36.89% and 16.62% reduction in grain yield of maize and pea, resp. Application of atrazine at 2.0 kg/ha in Maize and Pendimethalin at 1.25 kg/ha in pea significantly reduced the weed population and weed drymatter and increased the grain yield by 31.37% of maize and 7.2% of pea.

Influence of post emergence herbicides for control of weeds in Soybean (*Glycine max.* L.)

V.P. Singh and V.M. Bhan

The field experiment was carried out to evaluate the efficacy of post emergence herbicides for the control of weeds in Soybean. Herbicides brought in use were bentazon at 1.0, 1.5, 2.0 kg/ha, fluazifop-butyl at 100, 200, 300 g/ha and sethoxydim at 200, 300, 400 g/ha, applied as post emergence 20 DAS and were replicated three times in randomized block design.

The experimental field was infested mainly with *Cyprus* spp., *Alternanthera sessilis, Echinochloa* spp., *Caesulia auxillaris, Phyllanthus* spp., *Physalis minima* and *Chicorium* spp. All the herbicides caused significant reduction in the weed population and weed drymatter at all the crop growth stages over weedy check. The bentazon was found effective to reduce the sedges whereas fluazifop-butyl and sethoxydim were effective against grassy weed. The lowest weed population and weed dry weight were recorded with bentazon at 2.0 kg/ha.

Weed caused 38.82% reduction in grain yield of soybean. The highest grain yield (20.59 q/ha) was obtained with bentazon at 2.0 kg/ha which was at par with fluazifop-butyl at 200 g/ha and Sethoxydim at 400 g/ha, resp.

Table 28. Impact of post emergence herbicides on weed dry matter and yield of soybean.

Treatments		Weed populations/m^2 at			Grain yield (q/ha)
		40 DAS	60 DAS	Harvest	
T1	Bentazon 1.0 kg ai/ha	7.91*(62.07)	11.08 (122.27)	11.65 (135.22)	17.70
T2	Bentazon 1.5 kg ai/ha	58.48 (48.64)	10.84 (117.00)	11.45 (130.60)	18.12
T3	Bentazon 2.0 kg ai/ha	7.71 (58.94)	10.27 (104.97)	9.74 (94.37)	20.59
T4	Fluazifop-butyl 100 g ai/ha	6.594 (2.93)	11.74 (137.33)	11.84 (139.68)	16.04
T5	Fluazifop-butyl 200 g ai/ha	8.10 (65.11)	11.32 (127.64)	11.68 (135.92)	17.27
T6	Fluazifop-butyl 300 g ai/ha	7.68 (58.48)	10.57 (111.22)	10.95 (119.40)	18.92
T7	Sethoxydim 200 g ai/ha	8.07 (64.62)	12.13 (146.64)	11.06 (121.82)	16.83
T8	Sethoxydim 300 g ai/ha	7.71 (58.94)	11.07 (122.04)	10.21 (103.95)	17.70
T9	Sethoxydim 400 g ai/ha	7.05 (49.20)	10.62 (112.28)	9.78 (95.15)	18.53
T11	Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	23.52
T12	Weedy	8.93 (79.25)	12.76 (162.32)	12.20 (148.34)	14.39
	CD at 5%	0.64	0.84	0.71	2.70

* Figure in parenthesis are original values.
Data transformed by (X + 0.5)

Table 29. Effect of post emergence herbicdes on weed population in soybean (*Glycine max* L.) (1993).

Treatments		Weed populations/m^2 at											
		40 DAS				60 DAS				Harvest			
		BLW	G	S	TOTAL	BLW	G	S	TOTAL	BLW	G	s	TOTAL
T1	Bentazon 1.0 kg ai/ha	5.60	2.20	2.90	6.70	6.00	4.20	3.70	8.20	4.40	1.20	0.70	4.50
		(30.9)*	(4.3)	(7.9)	(44.4)	(35.5)	(17.1)	(13.0)	(66.7)	(18.9)	(0.9)	(0.0)	(19.8)
T2	Bentazon 1.5 kg ai/ha	4.90	2.20	2.10	5.70	6.00	2.60	2.70	7.00	3.10	3.10	0.70	4.40
		(23.5)	(4.3)	(3.9)	(32.0)	(35.5)	(6.30)	(06.8)	(48.5)	(9.10)	(9.1)	(0.0)	(18.9)
T3	Bentazon 2.0 kg ai/ha	4.00	1.90	2.80	5.30	5.30	3.10	1.00	6.20	3.60	1.40	0.70	4.00
		(15.5)	(3.1)	(7.3)	(27.6)	(27.6)	(09.1)	(0.50)	(37.0)	(12.5)	(1.5)	(0.0)	(15.5)
T4	Fluazifop-butyl 100 g ai/ha	6.60	2.50	3.60	7.90	8.30	1.80	5.30	10.00	4.80	1.50	1.30	5.20
		(43.1)	(5.8)	(12.5)	(62.0)	(68.4)	(02.7)	(27.6)	(99.5)	(22.5)	(1.8)	(1.2)	(26.5)
T5	Fluazifop-butyl 200 g ai/ha	5.30	1.00	3.70	6.50	8.10	2.50	3.70	9.20	4.20	1.80	0.70	4.50
		(27.6)	(0.5)	(13.2)	(41.8)	(65.1)	(05.8)	(13.8)	(84.1)	(17.1)	(2.7)	(0.0)	(19.8)
T6	Fluazifop-butyl 300 g ai/ha	4.50	1.60	3.30	5.90	7.80	1.90	3.00	8.60	4.10	0.70	0.70	4.10
		(19.8)	(2.1)	(10.4)	(34.3)	(60.3)	(03.1)	(08.5)	(73.5)	(16.3)	(0.0)	(0.0)	(16.3)
T7	Sethoxydim 200 g ai/ha	5.90	1.30	4.10	7.20	8.10	1.80	4.90	9.70	5.20	0.70	0.70	5.20
		(34.3)	(1.2)	(16.3)	(51.3)	(65.1)	(02.7)	(23.5)	(93.6)	(26.5)	(0.0)	(0.0)	(26.5)
T8	Sethoxydim 300 g ai/ha	4.90	1.60	3.80	6.50	7.10	2.30	4.50	8.80	4.80	1.00	1.00	4.90
		(23.8)	(2.1)	(13.9)	(41.8)	(49.3)	(04.8)	(19.8)	(76.9)	(22.5)	(0.5)	(0.5)	(23.5)
T9	Sethoxydim 400 g ai/ha	5.20	1.00	2.50	5.80	7.30	2.60	3.00	8.40	4.40	0.70	0.70	4.40
		(27.3)	(0.5)	(5.8)	(33.1)	(52.8)	(06.3)	(08.5)	(70.1)	(18.9)	(0.0)	(0.0)	(18.9)
T11	Weed free	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
		(00.00)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
T12	Weedy	8.40	2.50	2.3	9.20	8.40	1.80	6.40	11.00	5.70	3.00	0.70	6.40
		(70.1)	(5.8)	(4.8)	(84.1)	(70.1)	(2.70)	(40.5)	(120.5)	(32.0)	(8.5)	(0.0)	(40.5)
	CD at 5%	1.22	NS	1.55	1.30	1.49	1.38	1.26	1.20	0.19	1.09	NS	0.98

* Figure in parenthesis are original values. Data transformed by (X + 0.5)

Chemical control of Parthenium in Soybean

J.S. Mishra and V.M. Bhan

This experiments was conducted with the objective to control the parthenium in soybean crop. Treatments consisted of six herbicides viz. metolachlor 2.0 kg/ha, oxadiazon 1.0 kg/ha, alachlor 1.0 kg/ha pendimethalin 1.0 kg/ha, oxyflourfen 0.15 kg/ha (All as preemergence) and bentazon 1.5 kg/ha as post emergence alongwith Weedy and Weed free designed as rondomised block design. Major weed flora observed during the period are *Parthenium hysterophorus, Alternanthera sessilis, Commelina communis, Ipomoea* spp., *Corchorus acutangularis, Phyllanthus* spp. *Cyperus iria* and*Echinochloa colonum. Among different herbicides, bentazon* 1.5 kg/ha applied at 25 DAS was found most effective in controlling Parthenium and other broad leaved weeds. Metolachlor at 2.0 kg/ha gave good control of grassy weeds and sedges. Weeds caused 50 per cent reduction in grain yield of soybean. The highest grain yield (14.59 q/ha) was recorded under weedfree conditions which was found at par to bentazon (1.5 kg/ha), pendimethalin (1.0 kg/ha) and alachlor (1.0 kg/ha).

Table 30 : Effect of different treatments on population, dry wt. g/m of parthenium and grain yield of soybean.

Treatments	30 DAS		60 DAS		At Harvest		Grain Yield q/h
	(P)	(D)	(P)	(D)	(P)	(D)	
Metolachlor 2.0 kg	7.34	–	5.31	11.33	3.11	8.25	10.89
	(53.37)	–	(27.70)	(127.87)	(9.17)	(67.56)	
Oxadiazon 1.0 kg	7.93	–	3.43	6.21	2.11	4.70	11.70
	(62.38)	–	(11.26)	(38.06)	(3.95)	(21.59)	
Alachlor 1.0 kg	7.06	–	4.67	7.32	2.26	5.71	12.00
	(49.34)	–	(21.31)	(53.08)	(4.61)	(32.10)	
Pendimethalin 1.0 kg	4.71	–	4.28	6.80	2.53	8.75	12.82
	(21.68)	–	(17.82)	(45.78)	(5.90)	(76.06)	
Oxyflourfen 0.15 kg	3.06	–	2.91	4.05	1.77	6.82	11.33
	(8.86)	–	(7.97)	(15.90)	(2.63)	(46.01)	
Weed free	2.24	–	2.26	2.39	1.34	3.28	13.40
	(4.52)	–	(4.61)	(5.21)	(1.29)	(10.26)	
	0.71	–	0.71	0.71	0.71	0.71	14.59
	(0.0)	–	(0.0)	(0.0)	(0.0)	(0.0)	
Weedy	8.88	–	5.27	6.72	2.11	7.16	7.48
	(78.35)	–	(27.27)	(44.66)	(3.95)	(50.77)	
CD at 5%	0.57	–	0.65	0.88	0.53	0.79	3.28

P – Population D – Dry Weight

Chemical control of *Parthenium hysterophorus* in non-cropped areas.

J.S. Mishra and V.M. Bhan

Efficacy of herbicides viz; Atrazin (1.0 & 1.5 kg/ha), chlorimuron ethyl (20 and 40 g/ha), metsulfuron (3.5 and 4.5 g/ha) 2,4-DEE (1.5 and 2.0 kg/ha) and glyphosate (1.0 and 1.5 kg/ha) were tested against Parthenium in non-cropped areas. All the herbicides were applied as post emergence application. It is clear from the data that all the herbicides except atrazin were found effective in controlling parthenium at 15 and 30 DAS. Metsulfuron at 3.5 and 4.5 g/ha, 2,4-DEE 2 kg/ha and glyphosate 1.5 kg/ha resulted in 86, 93, 61 and 86 per cent control, resp. at 15 DAS. While at 30 DAS, all the herbicides gave complete control of parthenium. Atrazin though could not prevent parthenium emergence but it reduced the flowers and seed formation over control.

Table 31 : Effect of different herbicides on parthenium in non -cropped areas.

Treatments	Plant ht.(cm) (B.S.)	Leaves /plant (B.S.)	Percent mortality 15 DAS	Percent mortality 30 DAS	Dry wt. (g/plant)	Branches /plant	Flower /plant	Seeds /flower	Seeds /plant
Atrazine 1.0 kg	35.5	10.8	4.05 (0.0)	4.05 (0.0)	3.14 (9.36)	14.4	149.4	3.08	451.85
Atrazine 1.5 kg	31.8	10.1	4.05 (0.0)	4.05 (0.0)	2.98 (8.38)	11.3	73.3	2.67	197.08
Chlorimuron 20 g	33.45	11.5	38.67 (39.04)	85.94 (99.50)	1.43 (1.54)	–	–	–	–
Chlorimuron 40 g	36.6	12.9	32.90 (29.50)	85.94 (99.50)	1.74 (2.53)	–	–	–	–
Metsulfuron 3.5 g	32.4	11.6	68.36 (86.40)	85.94 (99.50)	1.67 (2.29)	–	–	–	–
Metsulfuron 4.5 g	32.4	11.0	74.69 (93.03)	85.94 (99.50)	1.53 (1.84)	–	–	–	–
2,4 – DEE 1.5 kg	35.4	12.0	26.56 (19.91)	85.94 (99.50)	1.75 (2.56)	–	–	–	–
2,4 – DEE 2.0 kg	31.1	10.8	51.33 (60.96)	85.94 (99.50)	1.37 (1.38)	–	–	–	–
Glyphosate 1.0 kg	32.3	11.7	39.23 (40.00)	85.94 (99.50)	1.89 (3.07)	–	–	–	–
Glyphosate 1.5 kg	39.6	11.5	68.36 (86.40)	85.94 (99.50)	1.75 (2.56)	–	–	–	–
Control	29.4	11.5	4.04 (0.00)	4.04 (0.0)	3.34 (10.66)	15.10	512.30	3.89	1994.75
CD at 5%	NS	NS	0.78	0.003	1.12	-	–	–	–

1 Arcsine Transformation Sin 0 = /P 2 Square root Transformation (X + 0.5)

* Values in parenthesis are original.

Effect of date of sowing and weed control measures on weed emergence in lentil

J.S. Mishra and V.M. Bhan

An experiment was conducted second time to evaluate the potentiality of effect of date of sowing and weed control treatment with the objective to prevent the weed emergence. The treatments consisted of four dates of sowing (23 Oct., 7 Nov., 22 Nov. and 7 Dec.) and five weed control treatments (weedy, weedfree, handweeding at 30 DAS, fluchloralin 1.0 kg/ha and fluchloralin 0.5 kg/ha + HW 30 DAS) randomized and replicated 3 times in split plot design. The major weed flora observed and recorded with their dry matter at 60 DAS and at harvest, were Chenopodium album, Chicorium intybus, Phalaris minor, Vicia sativa, Convolvulus arvensis and *Cuscuta* spp. Maximum weed population, weed dry matter and grain yield were noted when the crop was sown earlier i.e. on 23rd Oct. which was at par with 7th Nov. sowing. With the delay in sowing, weed population with drymatter declined accordingly. Minimum weed population and drymatter was recorded from fluchloralin 0.5 kg/ha + HW at 30 DAS treatment.

Delay in sowing though declined weed population from 23rd Oct. to 7th Dec. but caused 50% reduction in grain yield of lentil. Weeds caused 19% reduction in grain yield only when sowing was delayed for 23rd Oct. to 7th Nov. Amongst the weed control treatments, highest grain yield i.e. 15.70 q/ha was obtained from the weed free situation followed by fluchloralin 0.5 kg/ha + HW at 30 DAS (15.44 q/ha).

Table 32 : Effect of date of sowing and weed control measures on weed population, its dry matter and grain yield of lentil.

Treatments	Weed Population (Das)		Weed dry weight (g)		Grain Yield q/h
	60 DAS	At harvest	60 DAS	At harvest	
Dates of Sowing (D)					
23rd Oct.	4.21 (17.22)	3.04 (8.74)	2.78 (7.23)	6.23 (38.31)	17.96
7th Nov.	4.06 (15.98)	2.95 (8.20)	3.11 (9.17)	6.14 (37.20)	16.53
22nd Nov.	3.82 (14.09)	2.74 (7.00)	2.66 (6.58)	5.04 (24.90)	14.41
7th Nov	4.09 (16.23)	2.86 (7.68)	2.45 (5.60)	4.29 (17.90)	8.95
CD at 5%	0.27	0.11	0.14	0.41	1.22
Weed Control measure (W)					
Weedy	5.55 (30.3)	3.86 (14.40)	3.77 (13.71)	7.75 (59.56)	12.69
Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	15.70
H.W. at 30 DAS	4.87 (23.22)	3.35 (10.72)	3.25 (10.06)	6.30 (39.19)	13.72
Fluchloralin 1.0 kg/ha	4.68 (21.40)	3.41 (11.13)	3.18 (9.61)	6.65 (43.72)	14.75
Fluchloralin 0.5 kg/ha + at 30 DAS	4.42 (19.04)	3.15 (9.42)	2.88 (7.79)	5.72 (32.22)	15.44
CD at 5%	0.38	0.25	0.20	0.29	2.13

Effect of varieties and weed control measures on the weed emergence and their control in pea.

J.S. Mishra and V.M. Bhan

This trial was undertaken by taking different varieties of Pea with a view to have suppressing ability and sensitivity to different weed control measures. Two vareties such as Jawahar Matar-1 and Jawahar Pea- 885 were evaluated as main plot with sub-plot treatment viz. weedy, weedfree, fluchloralin (1.0 kg/ha), pendimethalin (1.0 kg/ha) and HW at 30 DAS. The major weeds observed during the season were *Chicorium intybus, Chenopodium album, Vicia sativa,* and *Cyperusspp.* The results indicated that varieties could not influence the weed population at 30 and 60 DAS, but the weed drymatter accummulation was significantly reduced under JP 885 at 60 DAS and harvest due to its suppressing ability Weeds caused 16% reduction in grain yield of peas. Maximum grain yield i.e. (24.13 q/ha) was obtained from weed free plots which was at par with the rest of the weed control measures but was significantly superior over weedy check (Table - 33).

Table 33 : Effect of varities and weed control measures in pea.

Treatments	Weed Population (Das)			Weed dry weight (g)		Grain Yield q/h
	30	60	Harvest	60 DAS	At harvest	
Varieties						
JM–1	3.12	4.13	3.21	2.67	6.91	17.06
JP–885	4.24	3.74	2.42	2.13	5.08	26.84
CD(P = 0.05)	0.36	0.56	0.09	0.08	0.50	3.12
Weed Control measure (W)						
Weedy	7.38	5.53	4.09	3.06	10.05	20.36
Weed free	0.71	0.71	0.71	0.71	0.71	24.13
Fluchloralin 1.0 kg	3.88	4.30	2.80	2.51	6.35	21.18
Pendimethalin 1.0 kg	3.24	4.70	3.30	3.48	7.43	22.38
H.W. at 30 DAS	0.71	4.45	3.17	2.25	5.45	21.70
CD (P = 0.05)	0.23	0.26	0.29	0.30	0.35	3.09
V * W	0.32	0.37	0.41	0.42	0.49	–

Studies on Ecology of*Vicia sativa* (Akri).

J.S. Mishra and V.M. Bhan

This experiment was conducted to study the growth pattern and reproductive behaviour of*Vicia sativa, a major weed of lentil. Vicia* seeds were planted in pots at different dates of sowing. Data presented in table - 33 indicated that early sown *Vicia* has more drymatter accumulation and reproductive capacity as compared to late sown condition. Dryweight and seed yield per plant were maximum under 15 Sept. sowing and reduced considerably due to delay in sowing. It may be concluded from the experiment that in*Vicia* affected areas, the crop should be grown in the month of November to avoid the infestation of *Vicia sativa.*

Table 34 : Effect of different dates of sowing on germination, growth and yield attributes of *Vicia sativa*

Date of Sowing	Germi-nation % at 30 DAS	Plant height (cm.)	Main branches /plant	Days to 50%	Pods/ plant	Seeds/ plant	1000 grain wt.(g)
15 Sept.	33.47 (30.41)	47.67	7.67	93.37	29.67	5.87	20.67
30 Sept.	61.75 (77.60)	51.33	4.33	93.00	17.00	6.67	20.83
15 Oct.	70.62 (88.98)	39.33	3.33	81.67	16.33	6.61	19.67
30 Oct.	65.77 (83.16)	36.33	4.00	80.00	10.00	5.00	20.33
14 Nov.	57.13 (70.54)	41.00	3.33	73.33	10.67	8.27	19.17
29 Nov.	65.45 (82.74)	25.50	3.00	73.33	6.67	6.67	19.00
14 Dec.	58.52 (72.73)	22.67	2.67	61.67	4.33	6.00	17.05
29 Dec.	71.19 (89.60)	21.67	3.33	60.00	3.33	5.00	17.33
CD at 5%	10.80	10.38	2.03	6.49	4.66	0.58	1.42

Arcsine Transformation Sin 0 = /P

* Values in parenthesis are original.

Table 35 : Effect of dates of sowing on dry matter accumulation (g/plant) of & *Vicia sativa*

Date of Sowing	Dry matter accumulation			
	0 DAS	60 DAS	90 DAS	At harvest
15 Sept.	0.09	0.56	2.52	9.27
30 Sept.	0.06	0.47	1.57	5.23
15 Oct.	0.18	0.88	1.33	4.73
30 Oct.	0.11	0.62	1.77	3.77
14 Nov.	0.08	0.52	2.10	2.70
29 Nov.	0.05	0.50	1.63	1.63
14 Dec.	0.06	0.60	1.03	1.03
29 Dec.	0.05	0.34	0.92	0.92
CD at 5%	0.02	0.16	0.39	0.61

VEGETATION MANAGEMENT

Survey of pathogens associated with *Parthenium hysterophorus* *Eichhornia crassipes* and*Lantana camara* and their isolation.

L.P. Kauraw and V.M. Bhan

During the month of August, September, October and November 1993, survey was made from Jabalpur to Katni, Seoni and Narsinghpur in search of diseases of *Parthenium, Waterhyacinth* and *Lantana camara.* Samples of infected, leaves and seeds were collected at a distance of 10 km each. Leaf spot symptoms were observed on leaves of Parthenium and *Water hyacinth. OnLantana* no disease symptoms could be found.

Three fungi i.e. *Aspergillus fumigatus, Fusarium oxysporum* and *Alternaria alternata* were isolated from *Parthenium* leaves and seeds and *Acremonium* sp. from *Water hyacinth* from Jabalpur to Seoni road. Four fungi *Alternaria alternata, Curvularia* sp., *Fusarium sp.* and *Colletotrichum dematium.* were isolated from parthenium leaves and seeds collected from Jabalpur to Katni road and two fungi Curvularia. sp., *Fusarium* sp. were isolated from parthenium leaves and seeds from the survey made Jabalpur to Narsinghpur road.

Testing the weed control efficacy of the pathogens

L.P. Kauraw and V.M. Bhan

The following field experiments were carried for testing the weed control efficacy of *Fusarium pallidorosum* against *Parthenium hysterophorus.*

i) **Effect of *Fusarium pallidoroseum* at different growth stages of *Parthenium hysterophorus.***

For knowing the critical stage of parthenium at which Fusarium can kill the plant, the fungus was sprayed at an interval of 8, 15, 21, 30, 40 and 60 DAS alongwith control (without spray) in a randomised block design. Observation were recorded at maturity of the plants i.e. plant height no. of branches and number of flowers. Spray of the fungus at 21 to 30 days after sowing could reduce plant height, number of branches and flowers per plants.

ii) **Effect of different amount of inoculum of *Fusarium pallidoroseum* at different**

Table 36 : Effect of*Fusarium pallidoroseum* at different growth stages of *Parthenium hysterophorus*

Treatment	Height/plant Cm	No. of branches/ plant	No. of flowers/ plant
8 DAS	112.00	4.6	257
15 DAS	106.00	4.2	251
21 DAS	96.00	4.8	221
30 DAS	101.00	4.4	191
40 DAS	103.00	4.4	264
60 DAS Control	114.00	5.6	246
	111.00	4.9	247

growth stages of *Parthenium hysterophorus.*

Different amount of inoculum of *Fusarium pallidoroseum* i.e. 100 gm. 150 gm, 200 gm was sprayed at different growth stages i.e. vegetative stage, before flowering stage and after flowering stage. Spray of 150 to 200 gm of wet mycelium at before flowering stage could reduce plant height, number of branches/plant and number of flowers/plants (Table - 37).

Table 37 : Effect of different amount of inoculum of *Fusarium pallidoroseum* at different growth stage of *parthenium hysterophorus.*

Treatment	Average height/ Plant (Cm)	Average Branching/ plant	Average No. of flowers/ plant
Vegetative stage			
100 gm/1 Mycelium	77.067	4.5	293.733
150 gm/q Mycelium	84.600	4.267	252.400
200 gm/1 Mycelium	76.533	3.867	234.733
Control	80.033	4.667	265.000
Before flowering stage			
100 gm/1 Mycelium	69.880	4.000	272.333
150 gm/q Mycelium	72.800	3.800	140.667
200 gm/1 Mycelium	76.000	3.667	173.667
Control	84.267	4.220	177.000
After flowering stage			
100 gm/1 Mycelium	74.933	3.362	233.667
150 gm/q Mycelium	87.800	4.500	300.333
200 gm/1 Mycelium	70.900	3.667	272.333
Control	85.943	4.067	295.535

Table 38 :Study on different methods of inoculation of *Fusarium Pallidoroseum* (field experiment) germination of parthenium seeds (Out of 100 seeds)

	Treatment			
Replication	Seed	Soil	Spray	Control
1	16	10	10	18
2	14	9	16	12
3	10	15	15	14
Mean	13.3	11.3	13.6	14.6

iii) Study on the different methods of inoculation of *Fusarium pallidoroseum* on parthenium growth.

Fusarium pallidoroseum was grown on Potato dextrose medium. Ten day old culture was used for inoculation by three methods i.e. seed inoculation, soil inoculation and spray of on the seeds. This experiment was carried out in each month for knowing the best month and best method of inoculation of *Fusarium* fungus for control of *Parthenium hysterophrous*. Soil treatment, seed treatment and spray could reduce seed germination and growth of parthenium as compared to control. Soil treatment was better as compared to seed treatment and spray on seeds (Table - 38).

iv) Effect of *Fusarium pallidoroseum* spray of spore suspension 4000/ml 5000/ml at different days of sowing in Petri plates. For knowing the critical time for spray of Fusarium for management of parthenium, spore suspension was sprayed on seeds after 0,1,2,3,4,5,6,& 7 day after sowing of seeds of parthenium. Only water was sprayed on seeds for control.

Inhibition of seed germination and death of seedling was more when the fungus was sprayed on seeds/seedling within 0 to 5 days of sowing (Table - 39 & 40).

Table 39 : Effect of spore suspension 4000/ml on different days of sowing of *Parthenium hysterophrous*.

Sl. No.	Days after sowing	Treated			Control			Total No. of seeds Colonised showing visual symption
		Total of of seeds sown	Germ inated	Death after germin-ation	Total no. of seeds sown	Germin-ated	Death after germin-ation	
1.	0	100	00	00	100	19	03	12
2.	1	100	16	02	100	18	02	19
3.	2	100	02	00	100	19	04	08
4.	3	100	14	03	100	20	04	11
5.	4	100	08	00	100	19	06	16
6.	5	100	12	02	100	12	01	06
7.	6	100	11	05	100	19	01	17
8.	7	100	25	11	100	20	08	10

Table 40 : Effect of *Fusarium* (spray of spore suspension 5000/ml) at different stages of seedling of parthenium.

Sl. No.	Day of spray	Germinated out of 100	Death after germination within 15 day	Germinated out of 100	Death after germination within 15 days
1.	0	35	09	36	18
2.	1	27	20	38	33
3.	2	36	29	52	07
4.	3	51	37	49	40
5.	4	26	12	06	02
6.	5	15	10	22	05
7.	6	14	08	15	02
8.	7	15	11	21	09

Study on the different methods of growing pathogens in the laboratory.

L.P. Kauraw and V.M. Bhan

For knowing the best media for the growth *Fusarium Pallidoroseum* different media like potato dextrose agar,potato dextrose broth, sterilized soil cornmeal flour, sterilized soil soybean flour, cornmeal soybean and calcium carbonate medium, sterilized potato chips, sterilized pumpkin, sterilized seeds of gram, pea, jowar, wheat, corn and soybean were tested.

Best growth of the fungus was obtained on these medium as compared to potato dextose agar and potato dextose broth. The viruleney of the fungus was increased and death of parthenium seedling was more when the fungus was grown on pumpkin soybean and wheat.

Table 41 : Effect of different media on virulency of *Fusarium* for *Parthenium*, seeds treated for 1 hr with spore suspension and sown in plates.

Sl. No.	Days after sowing	Treated			Control		
		Total no. of seeds sown	Germin-ated	Death after germina-tion	Total no. of seeds sown	Germin-ated	Deat fter germition
1.	P.D.A.	100	35	13	100	33	10
2.	Potato	100	39	11	100	27	08
3.	Pumpkin (Lauki)	100	61	36 d.	100	60	15

Table 42 :Study effects of the treated seeds of *Parthenium hysterophorus* with *Fusarium oxysporum* grown of P.D.A. medium for 30 minutes

Sl. No.	Date	Germinated	N.Germinated	White growth	Dead
1.	31/1/94	9	41	X	X
2.	2/2/94	15	35	1	X
3.	5/2/94	18	32	5	X
4.	10/2/94	18	32	5	3
			Controlled – 31/1/94		
1.	2/2/94	None	50	X	X
2.	5/2/94	10	40	1	X
3.	10/2/94	20	30	1	X
4.	14/2/94	24	26	1	X

Compatibility of *Fusarium pallidoroseum* with 2,4-D.

L.P. Kauraw and V.M. Bhan

The spore suspension of*Fusarium pallidoroseum* was mixed with 0.05 and 0.1% solution of 2,4-D solution and sprayed on parthenium seedlings. All the treatments could kill the seeds as compared to control (Table - 42)

Table 43: Effect of different concentration of 2,4-D and spore suspension of *Fusarium oxysporum* on seedlings of *Parthenium hysterophorus*.

Sl. No.	Concentration of 2,4–D	Treated		Control	
		No. of seedlings	Death after spray	No. of Seedlings	Death after spray
1.	0.1% Solu.	80	all	52	02
2.	0.1% + Fungus	72	all		
3.	0.05% Solu.	70	all		
4.	0.05% + Fungus	40	all		
5.	Fungus only	45	all		

Table 42 :Study effects of the treated seeds of *Parthenium hysterophorus* with *Fusarium oxysporum* grown of P.D.A. medium for 30 minutes

Sl. No.	Date	Germinated	N.Germinated	White growth	Dead
1.	31/1/94	9	41	X	X
2.	2/2/94	15	35	1	X
3.	5/2/94	18	32	5	X
4.	10/2/94	18	32	5	3
			Controlled – 31/1/94		
1.	2/2/94	None	50	X	X
2.	5/2/94	10	40	1	X
3.	10/2/94	20	30	1	X
4.	14/2/94	24	26	1	X

Compatibility of *Fusarium pallidoroseum* with 2,4-D.

L.P. Kauraw and V.M. Bhan

The spore suspension of*Fusarium pallidoroseum* was mixed with 0.05 and 0.1% solution of 2,4-D solution and sprayed on parthenium seedlings. All the treatments could kill the seeds as compared to control (Table - 42)

Table 43: Effect of different concentration of 2,4-D and spore suspension of *Fusarium oxysporum* on seedlings of *Parthenium hysterophorus*.

Sl. No.	Concentration of 2,4–D	Treated		Control	
		No. of seedlings	Death after spray	No. of Seedlings	Death after spray
1.	0.1% Solu.	80	all	52	02
2.	0.1% + Fungus	72	all		
3.	0.05% Solu.	70	all		
4.	0.05% + Fungus	40	all		
5.	Fungus only	45	all		

Host specificity testing.

L.P. Kauraw and V.M. Bhan

Thirteen crops were tested for the pathogenicity of the fungus *Fusarium pallidoroseum* in the pots and in the petriplates by seed inoculation. Out of thirteen seed crops, four i.e. cowpea cucumbar, Jowar, and paddy were resistant, brinjal and lady's finger was moderately resistant, and chlli, cauli-flower, coriander, maize, radish and tomato were susceptible (Table 44 & 45).

Table 44 : Host specificity testing (Pot experiment)

Sl. No	Crop	Treated			Control		
		No. of seedlings transplanted	establis-hed	death	No. of seedlings transpla-nted	establi-shed	death
1.	Brinjal	25	10	15	25	14	09
2.	Chilli	25	05	20	25	17	08
3.	Cow pea	25	25	00	25	25	00
4.	Cauliflower	25	07	08	25	09	14
5.	Cucumber	25	25	05	25	25	00
6.	Coriander	25	05	20	25	04	21
7.	Jowar	25	25	00	25	25	00
8.	Lady finger	25	12	13	25	25	00
9.	Maize	25	00	25	25	14	02
10	Paddy	25	20	05	25	17	08
11	Parthenium	25	00	25	25	04	21
12	Radish	25	00	25	25	04	21
13.	Tomato	25	03	22	25	03	22

Table 45 : Effect of *Fusarium Pallidorosum* on seed germination of different crops (in plates) after treatment for 1 hr. with spore supension (plates).

Sl. No	Crop	Treated			Control		
		No. of seeds sown/ plates	Germint-ated	death after germina-tion	Total no.seeds sown/ plates	Germint-ated	death after germi-tion
1.	Brinjal	100	60	All	100	54	ALL
2.	Chilli	100	76	08	100	72	06
3.	Cow pea (Lauki)	100	94	12	100	88	12
4.	Cauliflower	100	87	10	100	85	10
5.	Cucumber	100	78	ALL	100	80	ALL
6.	Coriander	100	17	ALL	100	01	00
7.	Jowar	100	82	00	100	100	00
8.	Lady finger	100	100	00	100	100	00
9.	Maize	100	08	00	100	80	00
10	Paddy	100	29	06	100	28	06
11	Parthenium	100	18	12	100	09	03
12	Radish	100	94	10	100	85	10
13.	Soybean	100	00	00	100	00	00
14.	Tomato	100	75	ALL	100	08	ALL

Integrated Management of *Saccharum* sp

V.P. Singh and V.M. Bhan

This experiment was laid out during rainy season 1993. The trial consisted of twelve treatments viz.; Dhaincha-Wheat, Soybean-Wheat and drilled rice-gram combined with glyphosate (1.5 kg/ha) and summer ploughing, separately integrated by and untreated treatments. As per the treatments, glyphosate (1.5 kg/ha) was applied on 5th May and field was kept undisturbed for 20 days after spray, thereafter it was ploughed with disc plough.*Kharif* crops were planted on 5th July, 1993 and*rabi* on 23rd Dec. 1993 and were raised with the recommended package of practices.

It was observed that application of glyphosate at 1.5 kg/ha alone and incombination with summer ploughing in deaincha-wheat cropping system significantly reduced the number of shoots per 0.25 m followed by soybean-wheat rotation. Similar response was also noticed during winter season. Application of glyphosate (1.5 kg/ha) alone was more effective in reducing the shoot number than summer ploughing.

AGRICULTURAL ENGINEERING

Performance evaluation of improved mechanical weeder for weed control in *Kharif* and*Rabi* crops

H.S. Bisen and V.M. Bhan

This investigation on performance evaluation of improved mechanical weeder i.e. twin wheel hoe, wheel hoe and grubber (3 tyned hand cultivator) was continued for *Kharif'93 and Rabi* 93-94 crop season in Soybean & Maize and Wheat & Gram, respectively. This experiment was conducted to evaluate the performance of weeding tools at different stages of weed growth. The trial consisted of twelve treatments viz.:

T-1 Weed removal by mechanical weeder at 15 DAS

T-2 Weed removal by mechanical weeder at 25 DAS

T-3 Weed removal by mechanical weeder at 35 DAS

T-4 Weed removal by mechanical weeder at 15 DAS and 30 DAS in Kharif and 15 DAS and 40 DAS in Rabi crops

T-5 Weed removal by mechanical weeder at 15 DAS and 40 DAS in Kharif and 15 DAS and 50 DAS in Rabi crops

T-6 Weed removal by mechanical weeder at 15 DAS and 50 DAS in Kharif and 15 DAS and 60 DAS in Rabi crops

T-7 Weed removal by mechanical weeder at 25 DAS and 40 DAS in Kharif and

25 DAS and 50 DAS in Rabi crops

T-8 Weed removal by mechanical weeder at 25 DAS and 50 DAS in Kharif and

25 DAS and 60 DAS in Rabi crops

T-9 Weed removal by mechanical weeder at 35 DAS and 50 DAS in Kharif and

35 DAS and 60 DAS in Rabi crops

T-10 Chemical spray of weedicide, one pre-em./post-em. spray.

T-11 Weedy check plot (Control)

T-12 Weed free plot by removal of weeds at 15 DAS, 30 DAS and 50 DAS in Kharif and 15 DAS, 40 DAS and 60 DAS in Rabi crops were allocated randomly in randomized block design with three replications.

The results during *Rabi* 1992-93 in wheat and gram indicated the better performance weeder at 25 DAS of crop with weeding efficiencies of 61 to 74% in wheat and 48 to 69% in gram crop. In wheat and gram crops, weed emergence was negligible at 15 DAS stage. The operation of the mechanical weeder was not convenient at 35 DAS in both the crops. The grain yield did not show any significant differences amongst the treatments.

The grain yield of control plots was lowest i.e. 39.23 q/ha when compared with yield of other treatments i.e. 44 to 55 q/ha in wheat. In case of gram yield of control plot was lowest i.e. 17.66 q/ha when compared to the yield of other treatments i.e. 22 to 27.3 q/ha.

The plot yield in different treatments of Soybean were varying between 11.90 to 17.79 q/ha. The lowest yield was in plot where no control measure was taken followed by treatments T-3 and T-9 where weeding operation was performed at 35 DAS stage i.e.

11.90, 12.82 and 13.22 q/ha . This indicates that the weeder operation at 35 DAS has not resulted in much gain in grain yield. Whereas, in treatments at 15 DAS, higher grain yield has been obtained. In maize crop non-significant difference of weeding operation was found in grain yield from 11.05 to 21.52 q/ha in treatments.

WEED PHYSIOLOGY

Effect of chemicals which break dormancy or stimulate germination on weed seeds difficult to germinate.

D.K. Pandey

The seeds collected from the centre's farm were dried in the sun and stored in water proof packaging in more than 400 gauge polythene bags and used for the studies. The seeds were germinated on top of filter paper placed on water or treatment solution in petri dishes. Germination was performed at 25 + 1°C and 90 RH in a seed germinator.

Results confirmed that ethrel at 1000 ppm was suitable for causing near total germination in *Cyperus iria* and *Sporobolus spp.* against 0% in untreated control. Gibberellic acid at 1000 ppm was found suitable for causing germination inPolypogon sp.

Investigations on parthenium and *Cassia sericea* seed emergence and stand establishment in response to varying seed rate.

D.K. Pandey

Seeds of parthenium and*Cassia sericea* were sown alone and in combinations at different rates in the field during*kharif. Effect of parthenium and*Cassia on each other was observed. Soil of the plots in which*Cassia* was grown was analysed for possible inhibitory substances.

The results showed that*Cassia* seeds at 100 to 400 in 2x3 m plot size grew into dominant stand suppressing parthenium. However, a few parthenium plants, wherever came up, grew well, flowered and formed seeds much like a parthenium plant growing in its natural stand. The cassia appears to impede parthenium with its competitive ability. Parthenium never dominated in the plots in which*Cassia* was sown.

Interestingly, no inhibitory activity was detectable in the soil even at the highest population density of *Cassia* when wheat seedings were used as a bioassay material. Even the soil extract did not test positive for phenolic acids. These ruled out build up and accumulation of phototoxic substances in the soil. Thus *Cassia* appears to inhibit parthenium by interferences involving those other than allelopathy.

Effect of chemicals on parthenium seed emergence and stand establishment.

D.K. Pandey

Parthenium seeds (800) were sown in each of the 2x3 m plots during *kharif*. The plots were treated with diammonium phosphate (DAP) at 1.2, 1.8, 2.4, and 3.0 kg per plot and HNO3 at 5, 10 and 20 ml per plot. Emergence and stand establishment of parthenium were monitored.

The results given below revealed that DAP at higher levels especially at and above 1.8 kg per plot was inhibitory to parthenium seed germination and emergence though the data were statistically not significant. *Alternanthera sessilis* was the dominant and flourishing weed in DAP applied plots. The HNO_3 did not have inhibitory effect on parthenium at the levels applied in the field. The finding clearly states that the DAP is not as effective in inhibiting parthenium seed germination under field conditions as has been earlier found in Petridish germination under laboratory conditions.

Table 47 : Effect of DAP and HNO_3 at higher doses on parthenium germination and stand establishment

Treatment	Number of parthenium plants after days		Biomass of other weeds after 31 days (Kg/sq.m. fresh wt.)
	24	31	
Control	34.3	68.0	3.36
DAP 1.2 Kg/plot	26.6	45.0	12.01
DAP 1.8 Kg/plot	12.6	16.6	8.11
DAP 2.4 Kg/plot	6.3	10.3	4.21
DAP 3.0 Kg/plot	9.6	12.0	13.35
HNO_3 5 ml/plot	46.6	58.0	3.0
HNO_3 10 ml/plot	17.6	62.0	3.58
HNO_3 20 ml/plot	48.3	83.0	4.28
CD at 5%	NS	NS	NS

Effect of treatments causing seed deterioration on incidence of weeds in upland paddy.

D.K. Pandey

Plots (2.25x5 m) were given treatments for causing seed deterioration in the soil seed bank of weed seeds. The treatments were based on the fact that seed deterioration through ageing is the function of seed moisture and temperature. The more the temperature and moisture of seeds, the faster is the rate of ageing. The treatments were irrigation and covering with transparent polythene, irrigation and covering with black polythene, irrigation

and left open and unirrigated plots as controls. The plots were left undisturbed for about a month till onset of monsoon when paddy was drilled into them. Weed incidence was monitored 28 days after planting.

The results revealed that irrigation and covering the field with transparent andblack polythene were very effective in reducing weed incidence, and these treatments were next to the irrigated and left open in weed reduction efficiency. However, subsequently the weeds overtook the entire experimental site and further work could not be carried out. The experimental results unequivocally proved effectiveness of the treatments causing seed deterioration by drastically reducing incidence of weeds in upland paddy.

Table 48 : Effect of treatments causing seed deterioration on weeds inupland paddy.

	Treatment	Mean weed dry weight g/m2 after 28 days
1.	Irrigated and covered with transparent polythene	31.1
2.	Irrigated and covered with black polythene	34.0
3.	Irrigated and left open	51.3
4.	Weedy	94.0
	CD at 5%	25.53

Herbicidal property of phytotoxins.

D.K. Pandey

Attempts were made to standardize isolation and separation of phytotoxins. The work was started with extraction, isolation and purification of a major phytotoxin - sesquiterpene lactone from parthenium plants. Some of the physiological effects of the phytotoxin on an aquatic weed water hyacinth were studied. Phytotoxicity of parthenin to aquatic weeds was studied.

The parthenin was lethal to submerged aquatic weeds - ceratophyllum, hydrilla and najas at 25 ppm. Among the floating weeds, pistia was the most sensitive as the lethal dose for it was about 25-50 ppm. This was followed by water hyacinth, salvinia, azolla, spirodella, and lemna with lethal dose in the range of 50-100 ppm.

Physiological effects of parthenin on treated water hyacinth plants included loss of water use, loss of biomass, desiccation, root disfunction, loss of chlorophyll contents in the leaves, loss of both membrane integrity and dehydrogenase activity in the roots. These physiological changes altogether imply that parthenin killed the treated plants by affecting macromolecules - proteins, nucleic acids and lipids.

Effect of parthenium plant residue on aquatic weeds in larger water bodies.

D.K. Pandey

Parthenium leaf residue suspension was prepared in a larger water volume and all nine aquatic weeds such as *Ceratophyllum, Hydrilla, Najas, Pistia, Salvinia, Lemna, Spirodella, Azolla* and *Water hyacinth* were allowed to grow in the medium under outdoor conditions.

The results showed that lethal doses of parthenium leaf residue for different aquatic weeds as determined earlier in 20 litre volume were consistent even in larger water volumes. Thus the earlier findings with smaller volume was consistent with larger volume, confirming the results.

To study the effect of Soybean based cropping system and herbicide sequence on the distribution of weed flora in soybean and wheat.

D. Swain and V.M. Bhan

The experiment was under taken consequitively for three years starting from rabi 1992-93. The treatments for first year were fluchloralin (FL)-2,4-D; pendimethalin (PM)-2,4-D and PM-isoproturon (IPU) in addition to weedy and weed check. In the second year i.e. *kharif* 1993 and rabi 1993-94, the treatment were FL-2,4-D/PM-IPU, PM-2,4-D/-2,4- D and PM-IPU/PM-IPU in addition to weedy and weed free. Observations on weed dry matter at 40 and 60 DAS and harvest and crop yield were taken.

In soybean, the dominant weed species were *A. sessilis, C. communis, C iria* and *C axillaris* FL-2,4-D/PM-2,4-D treatment was found to be better for comtolling*A. sessilis* and PM-IPU/PM-IPU was better for controlling*C. communis.* The weed drymatter was significatly decreased in all herbicide treatd plots and the grain yield was highest in weed free (15.67 g/ha.) followed by PM-IPU/PM-IPU. In wheat, the most dominant weed species were *C ficifolium, C intybus.* PM-IPU/PM-IPU and FL-2,4-D/PM-2,4- D were found to be better for the control ofC ficifolium. PM-IPU/PM-IPU was found to be good for cotrolling *C intybus* while PM-2,4-D/PM-IPU was proved to be better forP. minor control. The weed drymatter was significantly lower in all herbicide treatment sequence as compared to control. The grain yield of wheat was highest in weed free (55.32 q/ha) followed by PM-IPU/PM-IPU (50.89 g/ha); FC-2,4-D/PM-IP (48.18 g/ha) and weedy check (41.39 g/ha).

Table 49 : Weed dry weight at different intervals and grain yield as influenced by various weed control treatments on Soybean CV JS 75-46.

Treatments	Weed dry Weight (g/m^2)			Grain yield (q/ha)
	40 DAS	60 DAS	At harvest	
Flu–PU/PM–IP4	8.20 (66.74)	9.61 (91.85)	9.82 (95.93)	12.53
Flu–2, 4–D/PM–IP4	8.70 (75.20)	9.55 (90.70)	10.43 (108.28)	11.78
PM–2, 4–D/PM–IP4	8.00 (63.50)	9.90 (97.51)	10.35 (101.62)	12.60
Weedy	12.78 (162.8)	13.85 (191.32)	15.18 (229.93)	8.94
Weed Free	4.43 (19.12)	6.27 (38.81)	6.16 (37.44)	15.65
CD at 5%	2.08	2.62	1.31	1.77

Table 50 : Weed dry weight at different intervals and grain yield as influencedby various weed control treatments on wheat CV-WH-147 during *Rabi*.

Treatments	Weed dry Weight (g/m^2)			Grain yield (q/ha)
	40 DAS	60 DAS	At harvest	
PM–IPU/PM–IPU	1.64 (2.19)	1.66 (2.25)	1.45 (1.60)	50.89
Flu–2, 4–D/PM–2,4–D	1.80 (2.74)	1.91 (3.15)	1.47 (1.66)	48.89
PM–2, 4–D/PM–IPU	1.40 (1.46)	1.37 (1.37)	1.21 (0.96)	48.18
Weedy	5.45 (29.2)	7.28 (52.5)	4.90 (23.51)	41.39
Weed Free	1.02 (0.54)	0.70 (0.00)	0.70 (0.00)	55.52
CD at 5%	0.60	0.38	0.63	6.47

Original values are given in the parantheis

Abbreviation : FLU -Fluchloralin IPU -Isoproturon PM - Pendimethalin

To study the effect of rice-based cropping system and herbicide sequence on the distribution of weed flora in rice and wheat.

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The experiment was started from rabi 1992-93 with the five treatments*viz. butachlor (BC), isoproturon (IPU),* weedy and weed free in the first year, in second year were BC-IPU, thiobencarb (TC)-IPU and anifophos (AP)-IPU and that for 3rd year were BC-IPU, BC-2,4-D and BC- starane (SN) respectively in addition to weedy and weed free. The observations on drymatter of weeds at 40 and 60 DAT/S and at harvest and grain yield were recorded.

In rice, the predominant weeds were*E. colonum* and*C. communis.* All herbicide treatments have effectively controlled both these predominant weed species.*C. iria* was more prevalent during 60 DAT and those of *C. axillaris, A. sessilis* and*I. rogosum* at the later part of crop growth. The lowest weed dry matter among herbicide treated plots were noted with BC-IPU/BC-IPU (5.57 g/m) followed by BC-IPU/TC-IPU (7.1 g/m) and BC-IPU/AP-IPU (7.39 g/m) as against weedy check (10.04 g/m).

In wheat, the predominant weed species were *C. intybus; R. dentatus* and *P. minor.* All herbicide treatments have effectively controlled the weeds and their dry matter was adversely affected. The grain yield was recorded highest in weed free (56.28 q/ha followed by BC-IPU/TC-IPU (55.67 q/ha); BC-IPU/BC-IPU (53.98 q/ha); BC-IPU/AP-IPU (51.1 q/ha) and weedy check (46.83 q/ha).

Table 51 : Weed dry weight at different intervals and grain yield as influenced by various weed control treatments on rice CV-Kranti during *Kharif.*

Treatments	Weed dry Weight (g/m^2)		
	40 DAS	60 DAS	At harvest
BC–IPU/BC–IPU	7.61	8.08	5.57
	(57.4)	(64.1)	(30.5)
BC–IPC/TC–IPU	6.24	7.35	7.11
	(38.4)	(53.5)	(50.1)
BC–IPU/AP–IPU	5.82	8.21	7.30
	(33.4)	(66.9)	(52.8)
Weedy	10.24	11.50	11.04
	(104.4)	(131.8)	(121.4)
Weed Free	3.37	4.64	3.57
	(10.9)	(21.0)	(12.24)
CD at 5%	2.63	1.70	1.45

Table 52 : Weed dry weight at different intervals and grain yield as influenced by various weed control treatments on wheat CV-WH-147 during *Rabi.*

Treatments	Weed dry Weight (g/m^2)			Grain yield (q/ha)
	40 DAS	60 DAS	At harvest	
BC–IPU/BC–IPU	4.10	4.42	3.50	53.98
	(16.31)	(19.03)	(11.73)	
BC–IPC/TC–IPU	4.17	4.14	3.52	55.67
	(16.89)	(16.64)	(11.90)	
BC–IPU/AP–IPU	4.09	5.03	3.60	51.10
	(16.23)	(24.80)	(12.64)	
Weedy	11.30	12.07	9.84	46.83
	(127.20)	(145.18)	(96.32)	
Weed Free	1.17	1.80	0.70	56.28
	(0.87)	(2.74)	(0.00)	
CD at 5%	0.52	0.82	0.80	6.07

Effect of different growth retardants on growth and yield of Wheat CV. C- 306 and its associated weeds.

D. Swain and V.M. Bhan

An experiment was conducted to see whether different growth retardants (GRS) like chlorocholine chloride (C3), ethephon (EP) and paclobutrazol or cultar (CT) can retard the growth of wheat as well as its associated weeds so as to get the triple advantage of viz.(i) making the crop resistant to lodging (ii) to reduce the weed growth and crop- weed compition and (iii) to increase the crop yield.

The crop and individual weeds were grown together and standard dose of growth retardants were applied (C3 3kg/ha, EP-2kg/ha and CT 0.5 kg/ha) at 10 and 70 DAS. Various observations like plant height, dryweight accumulation at monthly intervals and yield of the crop were taken into consideration. The height of the crop was at par with the application of GRS at 10 DAS but reduced significantly with 70 DAS applications. Although there was not much effect on weed height and density, the weed dry matter was highly reduced and there in corresponding increase in yield. The 70 DAS treatment was very effective in retarding the growth (flowering growth) of the crop. All the three growth retardants, tried, proved to be equally effective in reducing the crop hight when applied at 70 DAS. Both the grain and straw yield was significantly higher than the control and plant height was significantly lower. This shows that the straw contained more dry matter per unit height and thus become stronger to protect the plant height and lodging. Among the weeds,*C. intybus* was least affected by the growth retardants.

Table 53 : Effect of different growth retardants on the growth and yield of wheat (C-306) and its associated weed *Phalaris minor.*

Treatment	Crop height at harvest	Grain yield (g/m2)	Straw yield (g/m2)	Weed height at 75 DAS	Weed density per m2	Weed dry matter at harvest g/m
DAS 10	133.3	91.4	154.8	73.6	233.7	10.3
70	124.7	93.4	155.8	82.9	177.7	11.0
CD at 5%	4.04	NS	NS	NS	47.62	NS
GR C3	129.1	93.0	160.2	74.8	188.0	9.8
EP	124.5	103.5	159.5	80.7	194.7	10.0
CT	127.3	102.2	160.0	82.5	165.3	8.8
CONTROL	135.0	71.0	141.5	75.0	158.7	14.0
CD at 5%	6.14	5.05	4.75	NS	NS	1.44

Table 54 : Effect of different growth retardants on the growth and yield of wheat (C-306) and its associated weed *Chicorium intybus.*

Treatment		Crop height at harvest	Grain yield (g/m2)	Straw yield (g/m2)	Weed height at 75 DAS	Weed density per m2	Weed dry matter at harvest g/m
DAS	10	140.0	93.5	158.8	41.3	209.7	22.1
	70	126.6	98.0	158.7	42.2	113.0	22.1
CD at	5%	9.86	2.15	NS	NS	25.8	NS
GR	C3	130.0	99.0	167.0	43.2	150.7	20.6
	EP	127.3	100.5	158.1	36.8	176.7	17.7
	CT	132.8	104.5	161.0	43.2	157.3	22.0
	CON	143.0	79.0	148.7	44.0	160.7	28.7
CD at	5%	5.68	8.32	8.15	4.22	NS	2.97

Table 55 : Effect of different growth retardants on the growth and yield of wheat (C-306) and its associated weed *Rumex denata*

Treatment		Crop h eight at harvest	Grain yield (g/m2)	Straw yield (g/m2)	Weed height at 75 DAS	Weed density per m2	Weed dry matter at harvest g/m
DAS	10	126.8	89.3	152.3	39.6	182.3	13.3
	70	122.0	89.0	148.0	38.7	142.3	12.9
CD at	5%	4.01	NS	NS	NS	NS	NS
GR	C3	120.0	82.0	147.5	42.5	131.33	10.5
	EP	125.2	99.5	162.7	44.1	181.3	14.0
	CT	131.5	94.0	151.5	35.8	160.0	9.5
	CON	140.3	81.0	139.0	34.0	176.6	18.5
CD at	5%	3.88	4.10	3.80	NS	NS	1.87

Table 56 : Effect of different growth retardants on the growth and yield of wheat (C-306) and its associated weed *Chenopodium album.*

Treatment		Crop height at harvest	Grain yield (g/m2)	Straw yield (g/m2)	Weed height at 75 DAS	Weed density per m2	Weed dry matter at harvest g/m
DAS	10	133.9	98.7	159.5	63.3	188.0	12.5
	70	118.4	100.7	154.0	67.9	143.3	15.0
CD at	5%	9.99	NS	2.23	NS	NS	NS
GR	C3	118.0	106.0	160.5	64.8	168.7	12.0
	EP	125.2	102.5	164.0	59.2	154.7	11.8
	CT	124.8	102.5	159.5	65.7	160.0	11.3
	CON	136.3	88.0	143.0	72.7	179.3	20.0
CD at	5%	4.01	9.36	4.53	8.48	NS	4.18

Studies on the Screening of bioherbicidal effect of different weeds on crops.

D. SWAIN & V.M. BHAN

An experiment was carried out to study the bioherbicidal effect of different weeds viz. (i)*Sphaeranthus indicus, (ii) Eschaemum rogosum (iii) Commelina communis, (iv)Caesulia axillaris* and (v) *Echinochloa glabrascence* on different crops viz. (i) Mustard (ii) tomato, (iii) wheat, (iv) gram, (v) rice and (vi) maize. The bioherbicides were prepared by decomposing the whole plant powder for 24 hr in water and filtering through muslin cloth. Dilutions of 5% and 1% was prepared from the 10% stock the seeds were treated with these extracts @ 7 ml per petridish on germination paper and incubated at 25 C, in a seed germinator.

Observations on percentage germination, root and shoot growth were recorded 5-7 days after treatment. The results revealed that germination of mustard was adversely affected by all weed extracts in all concentrations tried and the high concentration affected the root and shoot growth. Germination of wheat was not adversely affected by any of the lechates but higher concentration affected the root and shoot growth except in case of *E. rogosum* which has stimulated the shoot growth of wheat as it stimulated the growth in all dilutions. Tomato and gram were found to be highly sensitive to all extracts. *C. axillaris* extracts was found to be highly toxic to gram and tomato and that of *Sphaerenthus indicus* to maize.

Table 57 : Effect of lechates of different weeds on germination, root and shoot growth of the crop in petridish culture

Weed Species	Extract Conc.	MUSTARD G	R	S	WHEAT G	R	S	TOMATO G	R	S	GRAM G	R	S	RICE G	R	S	MAIZE G	R
Sphaeranthus	C1	–	–	–	*	–	–							–	+	–	–	–
indicus	C2	–	+	–	+	–	–							*	+	–	*	–
	C3	–	+	+	+	+	+							–	+	–	–	+
Echaemum	C1	–	–	+	*	–	+	–	–	–	–	–	–					
rogosum	C2	–	+	+	*	+	+	–	–	–	–	–	–					
	C3	–	+	+	*	+	+	–	+	+	–	–	+					
Commelina	C1	–	–	–	–	–	–	–	–	–	–	–	–					
communis	C2	*	+	+	*	+	+	–	–	+	–	–	–					
	C3	–	+	–	*	+	+	–	+	+	–	–	*					
Caesulia	C1	–	–	–	–	–	–	–	–	–	–	–	–					
axillaris	C2	–	+	+	*	–	–	–	–	–	–	–	–					
	C3	–	+	+	*	+	–	–	–	+	–	–	–					
Echinocloa	C1	–	–	–	*	–	–	–	–	–	–	–	–					
glabrasence	C2	+	+	+	*	+	–	–	–	–	–	–	+					
	C3	–	+	+	–	+	–	–	+	+	–	+	+					

C1 = 10% Lechate
C2 = 5% Lechate
C3 = 1% Lechate

G = Germination
R = Root Growth
S = Shoot growth

\- = Toxic (< Control)
\+ = Stimulatory (> Control)
* = At par with control

To study the influence of rabi crop residues of pea, mustard and linseed on transplanted rice,*cv.* "Kranti" and its associated weed flora.

D. Swain and V.M. Bhan

An experiment was conducted during 1993 to evaluate the influence of rabi crop residue on transplanted rice and its associated weed flora. The treatments consisted of control, 15, 30 and 45 q/ha of residue of each crop. The observations on dry matter of weed at 30 and 60 DAT and at harvest, and growth and yield parameters of the crop were taken into consideration.

The crop residue treatment did not produce any significant stimulatory or inhibitory effect on weed growth except *C. axillaris* was adversely affected in pea bhusa at 40 and 60 DAT. All the residue treatments have increased the number of plants/m at 30 DAT and that of mustard residue at 60 DAT. The plant dry weight was increased significantly by mustard and linseed residue at 30 DAT and that of weed dry matter incase of mustard residue at harvest.

Influence of different *kharif* crop residue on germination, growth and yield of wheat and its associated weed flora.

D. Swain and V.M. Bhan

This experiment was conducted to study the ffect of *kharif* crop residue viz. rice, maize and soybean on the germintion, growth and yield of wheat and its weed flora during *rabi* 1993-94. The treatments consisted of control, 15, 30, and 45 q/ha of residue of each crop. The observations on drymatter production of weed and yield of the crop were taken. Seven weed species viz. *Chicorium intybus, Rumex dentatus, Chenopodium album, Chenopodium ficifolium, Phalaris minor, Avena fatua, Trifolium flagiferum* were found to be associated with the crop. The most predominant weed at 60 DAS and at harvest were*C. ficifolium* and *C. album.* The weed dry matter was not affected much by crop residue treatment but the plant dry weight at 60 DAS and crop yield was significatly higher in case of rice and soybean residue treatment.

Table 58 : Effect of different doses of *kharif* residue and weed management on weed & plant dry weight and yield of wheat

Treatment	Plant dry wt.		Weed dry wt.		Grain yield (q/ha)
	30 DAS	60 DAS	60 DAS	Harvest	
Maize Bhusa q/ha					
45	12.43	17.20	2.70	2.41	54.67
30	12.16	15.88	2.58	2.03	51.54
15	12.18	15.35	2.53	2.02	49.53
0	12.34	15.63	2.61	2.04	49.13
CD at 5%	NS	0.91	NS	NS	NS
Weed management					
Weedy	12.20	15.67	4.51	3.41	49.89
Weed Free	12.35	16.35	0.70	0.70	52.54
CD at 5%	NS	0.51	0.20	0.23	1.80
Rice Bhusa q/ha					
45	11.80	16.25	2.66	2.12	55.56
30	12.26	15.83	2.62	2.10	51.26
15	12.48	15.03	2.51	1.97	47.61
0	12.60	16.11	2.53	2.10	48.11
CD at 5%	NS	1.17	NS	NS	5.09
Weed management					
Weedy	12.23	15.98	4.45	3.44	49.44
Weed Free	12.34	16.63	0.70	0.70	51.82
CD at 5%					
Soybean Bhusa q/ha					
CD at 5%	NS	0.46	0.19	0.24	1.66
45	12.05	17.58	2.80	2.30	59.78
30	11.86	16.48	2.60	2.06	53.36
15	12.53	15.56	2.60	2.11	53.68
0	12.86	14.86	2.67	2.20	50.74
CD at 5%	NS	1.15	NS	NS	5.46
Weed management					
Weedy	12.27	16.15	4.63	3.63	51.70
Weed Free	12.38	17.10	0.70	0.70	55.58
CD at 5%	NS	0.88	0.16	0.19	2.21

4. FARM PROGRESS

The Centre has 59.5 ha. land acquired from Jawaharlal Nehru Krishi Vishwavidhyalay, Jabalpur. During *kharif* season of 1993, 29.8 ha. of area was covered under cultivation. Major area was under the main*kharif* crops such as rice and soybean covering 17.0 and 6.8 ha. with the production of 817.42 and 55.99 quintals , respectively. Maize was taken only for research experiments, covering an area of 0.8 ha. produced about 7.22 q/ha. Dhaincha was grown in area of 5.2 ha. with the purpose of green manuring and seed production for next season.

During *rabi* season 1993-94, the area of 39.6 ha. was covered for growing wheat, gram, lentil, pea, linseed, mustard and these crops covered the area of 20.0, 3.2, 0.2, 2.8, 6.0 and 7.4 ha. respectively.

Area mentioned under various crops also include the experimental area.

A total amount of Rs. 9,35,955.00 has been obtained by the centre on account of sale/auctions from farm produce during the financial year 1993-94 and it is Rs. 3,82,721.00 more when compared with the financial year 1992-93 (Rs. 5,53,234.00).

Table 59 : Area and production of *kharif* and *rabi* 1993-94.

Crop	Area (ha)	Production (q)	Crop	Area (ha)	Production (q)
Rice	17.0	817.42	Wheat	20.0	596.09
Soybean	6.8	55.99	Gram	3.2	38.04
Maize	0.8	7.22	Lentil	0.2	1.32
Dhaincha	5.2	4.00	Pea	2.8	23.51
			Linseed	6.0	44.00
			Mustard	7.4	46.74

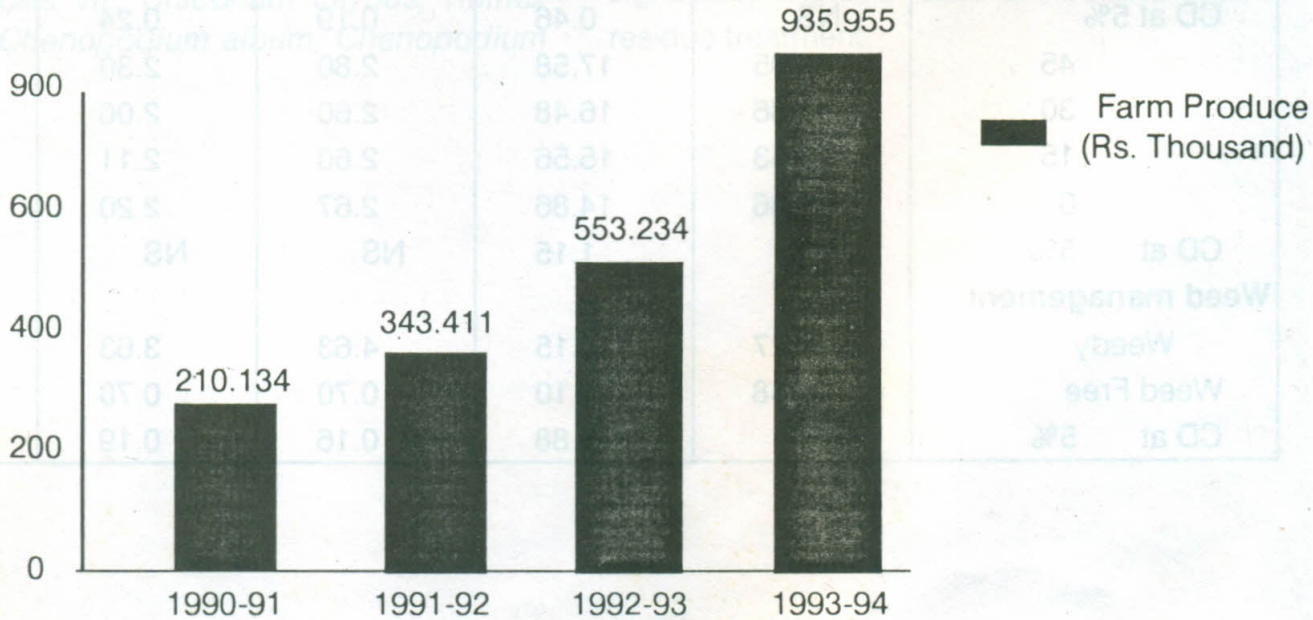

Fig. 5. Return from the sale of farm produce / auction for the last four years.

Fig. 6. Wheat harvesting by vertical conveyer reaper (Self-propelled)

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6. EXECUTIVE SUMMARY

The National Research Centre fo Weed Science is a centre under the administrative control of Indian Council of Agricultural Research (ICAR). The whole country is served through 20 centres inclusive of two voluntary centres of All India Coordinated Research project on weed control, hearing headquarter at NRC Weed Science, Jabalpur. These centre have their staff and research laboratory.

The centre was set up in the year 1989 with the mandate of undertaking basic and applied research for developing strategies for efficient weed management in different agroecological zones, providing leadership role and coordinate the network research with SAU for generating location specific technologies for weed management in different crops,cropping and farming systems, acting as respectory of information in weed science, acting as a centre for training in research methodologies in area of weed science and management, collaborating with national and international agencies in achieving the above objectives and providing consultancy.

SOILS :

The soils of the centre are dark grayish brown moderately alkaline AC horizon.

THRUST AREAS :

The thrust areas of Centre's activities are weed management in cropping system, biology and agroecology of important weed species, biological and non-chemical control of aquatic, parasitic, perennial and problem weeds in non-cropped system, behaviour of weeds, chemistry and mode of action of herbicides, herbicide residue estimation, identification and development of bio-herbicides, generation of information on socio economic aspects of weed management in different cropping systems, to development data base information system, to development of courses and conduct training programmes in weed sciences and to conduction of "on farm testing" and operation research projects to generate information on weed management technology at farmers field.

FACILITIES

Recently, the centre brought modern techniques in its laboratories at Head Quarter by installing spectrophotometer, leaf area meter, pH meter, BOD & hot air incubators, seed germinator, high speed centrifuge, leminar flow, balances, microscopes, U-V chamber, Gel electrophoresis ovens etc.

STAFF AND BUDGET

The existing staff strength of the centre is 64 against the sanctioned strength of 99 (Table 1). The Centre had total budget of Rs. 1,23,18,932 during the year reported in which Rs. 1,01,21,895 and 21,97,037 were spent in plan and non-plan respectively, Each AICRP-WC centre is provided with a separate budget depending upon its need.

REPORT STRUCTURE

Annual Report 1993-94 has been divided into separate chapters. Each chapter has the format of an introductory defining overall objectives of the centre, its manpower, resources and publications brought out so far during the period followed by research highlights pertaining to each research project discussed in terms of its objectives, activities and description of work undertaken during the year.

RESEARCH HIGHLIGHTS

The research undertaken are mainly based on crops which are of economic and commercial importance. The crops were rice, soybean,maize, dhaincha during *kharif* while in*rabi, wheat, gram, mustard, lentil, linseed, pea were taken. The work over problem weeds such as Saccharum* sp. and *Parthenium hysterophorus* was also started with the biological study and their control in cropped and non-cropped area. The dominant weed flora observed during *kharif* were *Echinochloa colonum, E. crusgalli, E. glabrascence, Parthenium hysterophorus, Malachra vaginallis, Dactyloctaneum aegypticum, Ludwigia sp., Phyllanthus sp. Eclipta alba, Alternanthera sessilis, Cyperus rotundus* etc. and in *rabi, Phalaris minor, Chicorium intybus, Chenopodium album, Rumex dentata, Vicia sativa, Lathyrus afaca, Melilotus album.*

WEED MANAGEMENT IN CROPPING SYSTEM :

This head includes the study of initial identification and evaluation of herbicides i.e. multicrop herbicide screening trial in *kharif* and*rabi* 1993-94, preliminary herbicide screening in soybean with major emphasis over weed management in crops and cropping systems and long term effect of farming system on the emergence of weeds and their management.

Screening trial

In multicrop herbicide testing, some of the new herbicides were tested at various doses. These herbicides are PIL-HR, PIL-CR, Diclofop- methyl, Lactofen and HOE 095404 were used in various *kharif* and *rabi* crops (Table 4-8).

Soybean

Weed control studies in soybean were carried out with the objective to shift the intherene of preliminary herbicide screening, date of sowing, row spacing and weed control treatments. Results concluded that metolachlor (1500 g) in screening trial, fluchloralin (1.25 kg/ha ppi) at par with pendimethalin (1.25 kg/ha Preem.) and fluazifop butyl (300 g/ha) in combination with narrow row spacing (22.5 cm) and sowing a 15th July reduced the weed population significantly and consequently increased the seed yield. Trial conducted on effect of post emergence herbicides in controlling weeds in soybean recorded significant control of sedges by bentazon (2.0 kg/ha) while population of grassy weeds were remarkably reduced by fluazifop butyl (200 g) and sethoxydim (400 g/ha) all applied at 20 DAS. On the other hand, Metolachlor @ 1.5 kg/ha applied at 25 DAS significantly controlled both sedges and grassy weeds. It was reported that seed yield reduced by the various weeds was in the range of 30-50.

Rice

Experiments were carried out to study the effect of organic and inorganic manuring, N-levels, mulching and weed management in direct seeded and drilled rice. In direct seeded rice, weed dry matter increased with increasing level of nitrogen, particularly, it was highest when 120 kg/ha nitrogen was applied as 80 kg through FYM + 40 through urea in combination with weed free condition. Seed yield also increased due to vigorous growth of rice plants in the presence of FYM. Butachlor did not play any significant role in reducing weed population.

In drilled rice, 120 kg nitrogen leel (half basal + half in two splits 30 & 60 DAS) when combined with weed free cohibited highest yield but butachlor remined ineffetive. In case of mulching effect over weeds, black plastic mulch suppressed especially *Echinochloa* and *Alternanthera* while transparent reduced the population of*Cyperus* and *Alternanthera.* Amongst the straw *mulch, mustard mulch* had significant reduction in total weed population particularly *Cyperus* spp. Significantly

maximum yield of 35.46 QH/has was obtained from weed free condition when compared to HW 30 DAS (25.47 QH/ha),butachlor (2309 q/ha), transparent mulch (2461 q), and mustard straw (20.33 q/ha) which were at par to each other.

Wheat

In the screening trial of new herbicides, the treatment PIL-CR 40 g/ha showed best results in reducing weed population and weed dry matter and increased the seed yield consequently though there was no significant difference betwen 20 g (64.77 q/ha) and 40 g (65.01 q/ha) levels of PIL- CR herbicide.

Chickpea

Studies on phosphate fertilization, crop-weed competition and weed control techniques were undertaken with the objective to find out the suitable dose of phosphate fertilization, competitional period, herbicide for controlling weeds and increasing yield of chickpea. Phosphate @ 90 kg/ha though have not affected weed dry matter but significantly increased grain yield (15.63 q/ha) as compared to lower doses and unweeded control. On the other hand all the herbicides, namely fluchloralin, pendimethalin each at 1.0 kg/ha and sethoxydim 0.40 kg/ha, have equally and significantly affected the weed dry matter as compared to control but significantly inferious to weed free condition. Weed free enhanced the grain yield by 70% while fluchloralin, pendimethalin and sethoxydim increased the yield by 47, 49.26 and 48.91% respectively. While grain yield of chickpea reduced by 18 per cent due to competition with weeds in first 30 days but this reduction increased to 50 per cent when crop was kept unweeded for entire season. On the other side, grain yield increased when initial weed free was extended to 60 DAS

Lentil

Effect of date and sowing and weed control measures reflected from the data that delay in sowing though declined weed population from 23rd Oct. to 7th Nov. but caused 80% reduction in grain yield of lentil. While early sowing i.e. 23rd Oct. resulted in highest grain yield and was also at par with with 7th Nov. resulted in highest grain yield was also at par with 7th Nov. Weeds caused 19% reduction when sowing was delayed from 23rd Oct. to 7th Nov. Amongst the weed control techniques, weed free situation showed highest grain yield of 15.70 q/ha followed by fluchloralin 0.5 kg/ha + HW at 30 DAS (15.44 q/ha).

Pea

Varietal trial was conducted to study the suppression effect of pea varieties over Weeds in combination with weed control techniques. Results concluded that variation had no any significant influence over weed population at 30 & 60 DAS but weed dry matter was significantly reduced under JP-8856 at 60 DAS & harvest. Weeds caused 16% reduction in grain yield of pea. Weed free condition resulted in maximum yield of 24.13 q/ha.

Mustard

Weed-crop competition in relation to nitrogen application was studied in mustard. Density of total weed increased with an increase in N level. Presence of weeds upto 60 DAS affected mustard yield severely. Weed free maintainance for initial 30 and 60 days were the most critical days in crop-weed competition studies in mustard.

Dry matter of weeds increased significantly with increase in each increment of N level but the weed density was not at all affected. Amongst the weed control treatments, fluchloralin, pendimethalin and isoproturon each applied at 1.0 kg/ha reduced the weed dry matter remarkably over weedy check but they were at par to each other. Seed yield increased with an increase of nitrogen level from 0, 30, 60 and 90 kg N/ha. Maximum

yield of 14.43 q/ha was recorded in weed free treatment.

The highest grain yield of 21.22, 21.42 and 21.06 q/ha from the plots treated with sethoxydim PE 800 g, and PO 400 g and pendimethalin PE 1.0 kg/ha respectively.

Cropping System

The experiment was carried out with the objectives to study the longterm influence of cropping sequence on emergence of weeds. The density of *Chenopodium album* and *Chenopodium ficifolium* have increased under maize-wheat and maize-pea cropping system, respectively. *Cichorium intybus* density has also increased under maize-pea system. There was marked increase of Commelina under rice-wheat system. While, the density of Alternanthera sessilis and Echinochloa colonum have been suppressed upto some extent under rice-wheat cropping system.

Cropping intensity

Studies on cropping intensity was carried out with an objectives to observe its affect over distribution of weed flora. For this purpose, rice and soybean based cropping intensity were studied. Under rice based cropping intensity, the lowest weed population was observed with rice- mustard -moong (300% cropping intensity) without affecting significantly seed yield in the season. Application of butachlor (1.5 kg/ha) in rice and isoproturon (1.0 kg/ha) in wheat and mustard reduced the weed density and its drymatter and increased grain yield by 11.03 and 9.04 per cent duing kharif and rabi season respectively.

In case of soybean based cropping intensity, the density of *Cyperus* spp. was more in soybean-mustard-moong (300% CI) followed by soybean-fallow (100% CI) and soybean-wheat (200% CI). The lowest weed population was recorded with fallow-wheat (100% CI) at 60 DAS and harvest. The highest yield was recorded with soybean-mustard-moong (300% CI). Application of pendimethalin (1.25 kg/ha) in soybean and isoproturon (1.0 kg/ha) in wheat and mustard significantly reduced the weed population, weed dry matter and increased the yield of crops.

Farming System

An experiment was conducted to evaluate the long term effect of animal system using manures on intensity and diversity of weed flora in diverse rotation of legumes and cereals. The highest weed population in soybean-wheat rotation was noted with low input animal system using manures i.e. 50% of the recommended dose of nutrient supplied through FYM only but weed dry matter was maximum under low input animal system using manures i.e. 50% of dose of nutrient of which 50% is supplied through FYM and 50% through fertilizer and these both were significantly superior over conventional method i.e recommended dose of nutrients. Similarly in wheat, the trend was same. In this soybean-wheat system, weeds caused 35.34% reduction in grain yield of soybean and 14.15% in wheat. Application of pendimethalin @ 1.25 kg/ha in soybean and isoproturon in wheat significantly reduced weed population and drymatter production and increased the grain yield of both the crops.

In maize-pea system, weeds caused 36.89% and 16.62% reduction in grain yield of maize and pea, resp. application of atrazine at 2.0 kg/ha in maize and pendimethalin at 1.25 kg/ha in pea significantly reduced the weed population and weed dry matter and increased the grain yield by 31.37% in maize and 7.2% of pea.

Vicia sativa

Experiment on the ecology of Vicia sativa was conducted to study the growth pattern and reproductive behaviour of Vicia sativa a major weed of lentil. Results showed that early sown Vicia had more drymatter accumulation and reproductive capacity as compared to late

sown condition. It was concluded that in Vicia affected areas, the crop of lentil should be grown in November to avoid the infestation of Vicia sativa.

VEGETATION MANAGEMENT

Survey during the month of August, September, October and November 1993 was made in search of diseases of Parthenium, water hyacinth and Lantana camara. Leaf spot symptoms were observed on leaves of *Parthenium* and *water hyacinth.* Some fungi i.e. *Aspergillus fumigatus, Fusarium oxysporum, Alternaria alternata, Curvularia, Colletotrichum dematium-* from the *Parthenium* leaves and seeds while *Alternaria* and Acremonium from water hyacinth were isolated from the collected infected parts. The weed control efficiency of Fusarium pallidoroseum against the Parthenium at its various stages were evaluated 21 and 30 days were the critical period for reducing plant height , branches and ...vers. Inhibition of seed germination and ...ath of seedling was more when the Fusarium ... sprayed on seeds/seedling within 0-5 days of sowing.

Compatibility of *Fusarium pallidoroseum* with 2,4-D was also evaluated. All the treatments consisted of 0.0-5 and 0.1% solution of 2,4-D mixed with Fusarium could kill the seeds of Parthenium as compared to control.

Experiment on pathogenicity of Fusarium pallidoroseum was carried out on thirteen crops. Cowpea, cucumber, jowar, paddy wre found resistant; brinjal and lady finger were moderately resistant and chilli, radish, maize, coriender, tomato and Parthenium were susceptible to *F. pallidoroseum.* In the integrated management of *Saccharum spontaneum,* application of glyphosate (1.5 kg/ha) alone and in combination with summer ploughing in dhaincha wheat system significantly reduced the no. of shoots per 0.25 m followed soybean-wheat rotation.

AGRICULTURAL ENGINEERING

Experiments on performance evaluation of improved mechanical weeder for weed control in *kharif* and *rabi* crops were conducted. The results indicated the better performance of weeder at 25 DAS of crops of weeding efficiencies of 61 to 74% in wheat and 48 to 69% in gram crops. The grain yield did not show any significant differences amongst various mechanical weeding tools carried out at various stage treatment. In case of soybean, weeding efficiencies were between the 52.97 to 61.96 at 15 DAS followed by 32.8 to 53.15 at 25 DAS. Similarly in maize crop, the weeding efficiency were in the range of 57.05 to 69.64% at 15 DAS followed by 34.13 to 48.31% at 25 DAS.

WEED PHYSIOLOGY

An experiment carried out to evaluate the effect of chemicals which break dormancy or stimulate germination on weed seeds difficult to germinate indicated that ethrel (1000 ppm) was suitable for causing near total germination in*Cyperus iria* and *Sporobolus* spp. against 0% in untreated control. Gibbrallic acid (1000 ppm) was suitable for causing germination of *Polypogon* sp.

In another experiment on*Parthenium* and *Cassia sericea* seed emergence, results showed that*Cassia* seeds at 100 to 400 in 2X3 m plot size grow into dominant stand suppressing *Parthenium,* however, a few *Parthenium* plants wherever came up, grew well, flowered and formed seeds. The *Cassia* appears to impede *Parthenium* with its competitive ability. *Parthenium* did not dominate in plots where *Cassia* was sown.

In one of the experiments, carried out to evaluate the effect of chemicals on *Parthenium* seed emergence and stand establishment,it showed that DAP at higher levels especially at and above 1.8 kg/plot (2 X 3 m) was inhibitory to Parthenium.

In upland paddy, the field covered with

transparent and black polythene were very effective in reducing weed incidence.

Attempts were made to standardize isolation and separation of phytotoxins. The parthenium was lethal to submerged aquatic weeds *Ceratophyllum, Hydrilla* and *Najas* at 25 ppm. Among floating weeds, Pistia was the most sensitive. This was followed by water hyacinth, Salvinia, Azolla, Spirodella and Lemna with lethal dose in the range of 50-100 ppm.

In case of soybean based cropping system and herbicide sequence, fluchloralin-2, 4-D pendimethalin-2,4-D treatment was found to be better for contolling Alternanthera sessilis and pendimethalin-isoproturon/ pendimethalin -ipu was better for *C. communis* in soybean. While in wheat, pendimethalin-IPU/PM-IPU and fluchloralin 2,4-D /pendimethalin-2, 4- D/ pendimethlin-2, 4-D were found to be better for the control of *C. ficifolium* and pendimethalin -IPU/PM was good for *C. intybus* control and PM-2, 4-D/PM-IPU was good for*P. minor* control.

In case of rice based cropping system and herbicide sequence, the lowest weed dry matter amongs the herbicide sequence were noted with Butachlor (BC)-IPU/BC-IPU i.e. 5.57 g/m followed by BC-IPU/thiobencarb (TC)-IPU (7.1 g/m) and BC-IPU/Anilophos (AP)-IPU (7.35 g/m) as against weedy check (10.04 g/m). While in wheat, all the herbicides have effectively controlled the weeds and their drymatter was adversely affected. The grain yield was recorded highest in weed free condition (56.28 q/ha) followed by BC-IPU/TC-IPU (55.67 q/ha); BC-IPU/BC-IPU (53.98 q/ha); BC-IPU/AP-IPU (51.1 q/ha) and weedy check (46.83 q/ha).

An experiment was carried out on the effect of different growth retardants on growth and yield of wheat and its associated weeds which revealed that the height of crop was at par with application of growth retardants at 10 DAS but reduced significantly with 70 DAS application. The weed drymatter was highly reduced and there was a corresponding increase in grain yield. 70 DAS period was very effective in retarding growth of the crop to prevent lodging. *C. intybus* was least affected by the growth of retardants.

In another experiment of residue management and screening of bio- herbicidal properties of weeds, it was shown that germination of mustard was adversely affected by all weed extracts in all the concentration tried. Germination of wheat was not affected by any of the leachetes except *E. rogosum* which has stimulated the wheat growth. Tomato and gram were found to be highly sensitive to all extracts (Table-57).

In case of the effect of rabi crop resiue on transplanted rice and its weeds, it was concluded that crop residue treatment i.e. of pea, mustard and linseed did not produce any significant, stimulatory or inhibitory effect on weed growth except*C. axillaris* which was affected by pea bhusa at 40 & 60 DAT. The plant dry weight was increased significantly by mustard and linseed residue at 30 DAT.

On the other hand, the effect of kharif crop residue on germination, growth and yield of wheat and its weeds, it showed that, the weed dry matter was not affected much by crop residue but the plant dry weight at 60 DAS and yield was significantly higher in case of rice and soybean residue.

संक्षेप कार्यकारिणी

यह केन्द्र, राष्ट्रीय खरपतवार विज्ञान अनुसंधान केन्द्र (भारतीय कृषि अनुसंधान परिषद) के प्रशासनिक नियंत्रण के अंतर्गत आता है। खरपतवार नियंत्रण की अ. भ. स. अनु. परियोजना का मुख्यालय राष्ट्रीय ख. वि. अनु. केन्द्र में होने के साथ–साथ 20 केन्द्र, दो स्वैच्छिक केन्द्रों सहित कार्यरत है।

यह केन्द्र वर्ष 1989 में प्रतिकूल जलवायु वाले क्षेत्रों में प्रभावी खरपतवार प्रबंधन की प्राथमिक एवं व्यवहारिक अनुसंधानों की निश्चित विकास करने का उत्तरदायित्व, राज्य के कृषि विश्वविद्यालयों को स्थानीय क्षेत्र के लिए विशेष तकनीक प्रदान करने हेतु उचित नेतृत्व एवं अनुसंधान तंत्रों के बीच उचित समन्वय, खरपतवार विज्ञान से संबंधित समस्त जानकारियों का कार्य विवरण खरपतवार विज्ञान एवं प्रबंधन के क्षेत्र में अनुसंधान प्रणाली हेतु प्रशिक्षण इस क्षेत्र द्वारा प्रदान करना, राष्ट्रीय एवं अंतराष्ट्रीय माध्यमों के द्वारा उपरोक्त उद्देश्य की प्राप्ति एवं खरपतवार विज्ञान हेतु परामर्श के अधिदेशों से स्थापित किया गया।

भूमि :–

इस केन्द्र के प्रक्षेत्र प्रभाग के खेतों की मिट्टी सामन्य धारीय ए. सी. क्षितिज वाली गहरे धूसर भूरे रंग की है।

कार्यक्षेत्र :–

इस केन्द्र के क्रियाकलापों के कार्य क्षेत्र सस्यन प्रणाली में खरपतवार प्रबंधन मुख्य खरपतवारों की जीव विज्ञान एवं कृषि परिस्थिति की गैर फसली प्रणाली में खरपतवार रोंको जैवकीय एवं गैर रसायनिक पद्धति से नियंत्रण, खरपतवारों की प्रकृति, रसायन और और अपशिष्ट आकलन और फसली, गैर फसली अवस्था में मिट्टी, जल, पौध में प्रबंधन जैवीय शाकनाशियों की पहचान एवं उनका विकास, विभिन्न सस्यन, प्रणालियों में खरपतवार प्रबधन में सामाजिक, आर्थिक पहलुओं पर जानकारी एकत्र करना, वैज्ञानिकों को विभिन्न प्रकार के विश्लेषणों में सहयोग करने के लिए कम्प्यूटर शाला विकसित करना, ऑकड़ों पर आधारित सूचना प्रणाली विकसित करना, खरपतवार प्रबंधन प्रोद्योगिक विषयक जानकारी देने के लिए खेतों में परीक्षण आयोजित करना और किसानों के खेतों में प्रचालन अनुसंधान परियोजनाओं के तहत परीक्षण करना आदि।

सुविधायें –

इस केन्द्र की प्रयोगशाला में वैज्ञानिकों हेतु स्पेक्ट्रोफोटोमीटर, लीफएरिया मीटर, पी.एच. मीटर, बी. ओ. डी. एवं हाट इन्क्यूवेटर, बीज अंकुरित करने वाला यंत्र, हाई स्पीड सेन्ट्रीफ्यूज लेमिनर फ्लो, तुलायें, माइक्रोस्कोप, यू. बी. चेम्बर जेल इलेक्ट्रोफोरेसिस, ओवेन्स आदि।

कर्मचारी और बजट –

रिपोर्ट अवधि के दौरान केन्द्र की 99 स्वीकृत पदों की संख्या में से कुल भर्ती संख्या 64 रही। इस केन्द्र के कुल बजट रु. 1,23,18,932 का रु. 1,01,21,895 योजना के तहत तथा रु. 21 लाख 97 हजार 37 रु. योजनोत्तर के तहत् खर्च किया गया। अ. भा. स. अनु. परियोजना के लिए उनकी जरूरत के हिसाब से अलग से बजट का प्रावधान है।

प्रतिवेदन संरचना –

इस वार्षिक प्रतिवेदन 1993–94 को अलग–अलग भागों में बांटा गया है। हर भाग का अपना एक प्रारूप एवं उद्देश्य है।

अनुसंधान विशिष्टतायें –

अनुसंधान कार्य ज्यादातर उन फसलों पर आधारित है जिनका आर्थिक एवं व्यापारिक महत्व है। खरीफ मौसम के दौरान धान, मक्का, सोयाबीन एवं ढेवा लिया गया। जबकि रबी के दौरान गेहूं, चना, मटर, अलसी, एवं सरसौं आदि फसलों को अनुसंधानत्मक कार्यो हेतु लिये गये। आपत्तिजनक खरपतवारों जैसे गाजरघास एवं कांस पर भी कार्य

चालू किया गया। उनकी कार्य की, वानस्पतिक अध्ययन एवं उनकी रोकथाम का कार्य फसलीय एवं गैर फसलीय क्षेत्रों के लिये भी किया गया।

रबी एवं *खरीफ* मौसम में कई खरपतवार जैसे *ईकाईनोक्लोबा कोलो नम, ई. ग्लेब्रेसेंस, ई. क्रसगलाई, आल्टर नेनथरा सेसेलिस , फाईलेन्थस निरूरी , एकलिपटा अल्वा,* कामेलिना कम्यूनिस, पारथिनियम हिस्टेरोफोरस, *साइप्रस स्पी.*, लुडविजिया स्पी. डेक्टीलोटेनियम ईजीप्सीयम खरीफ मौसम में तथा *फैलेरिस माइनर,* चिनोपोडियम अल्वम, चिकोरियम इनटाईबस, *रूमेक्स डेन्टाटा,* विसिया सटाईवा, *लैथाइरस अफाका,* मेलिलोटस अल्वम आदि खेंतों एवं अनुसंधान प्लाटो में पाये गये।

सस्यन प्रणाली में खरपतवार प्रबंधन –

इसके अंतर्गत *खरीफ* एवं *रबी* मौसम में शाकनासियों की प्रारंभिक पहचान, सोयबीन में शाकनासियों की प्रारंभिक पहचान, फसलों एवं फसली पद्धति में खरपतवार प्रबंधन तथा खेती पद्धति में खरपतवारों के ऊगने एवं उनके प्रबंधन का अध्ययन किया गया।

शाकनासियों की प्रारंभिक पहचान –

बहुफसलीय शाकनासी जांच में विभिन्न शाकनासी, उनकी विभिन्न दरो के हिसाब से फसलों में उपयोग किया गया। इन शाकनासियों में पी. आई. एल., – एच. आर., पी. आई. एल.– सी. आर., डाइक्लोफाप, –मिथाइल, लेफ्टोफेन एवं हो – 095404 खरीफ एवं रबी मौसम की फसलों में उनकी क्षमता की जांच करने हेतु उपयोग किया गया है। तालिका

धान –

खरपतवारों के ऊगने एवं उनके नियंत्रण हेतु सीधे बोयी गई धान में कार्बनिक एवं अकार्बनिक खादों, नाइट्रोजन दरों, मलचिंग तथा खरपतवारों प्रबंधन का अध्ययन किया गया। सीधे बोयी गई धान में जैसे–जैसे नाइट्रोजन की दर बढ़ाते है, वैसे–वैसे खरपतवारों के शुष्क पदार्थ की बढ़त पायी गई। तथा खरपतवारीय शुष्क पदार्थ की वृद्धि सबसे ज्यादा तब पायी गई जब 120 किलो नाइट्रोजन को 80 कि. ग्रा. खाद से एवं 40 किलो यूरिया से खरपतवार रहित क्षेत्र में दिया गया। ब्यूटाक्लोर नामक शाकनासी खरपतवारों की संख्या को सीधे बोयी धान में कम करने में नाकामयाब रहा। एक परीक्षण में 120 किलो. ग्रा. नाइट्रोजन को जब से 60 कि. के हिसाब से बोआई पर तथा 30–30 किलो नाइट्रोजन 30 एवं 60 दिन पर देने से धान की उपज सबसे ज्यादा पायी गई। खरपतवारों पर मलाचिंग के प्रभाव को जानने के लिए काले एवं पारदर्शी प्लास्टिकस् तथा सरसौं के अवशिष्टों का प्रयोग किया गया। जिससे यह ज्ञात हुआ कि काले प्लास्टिक से *इकानोक्लोबा* एवं *आल्टरनेनथेरा* स्पी. संख्या में कमी आई। तथा पारदर्शी प्लास्टिक से *साइप्रस* एवं *आल्टरनेनथेरा* की संख्या में कमी आई। अवशिष्टों में सरसौ के अवशिष्ट से कुल खरपतवारों की संख्या तथा साइप्रस की संख्या में कमी आई।

खरपतवार रहित क्षेत्र में निंदाई 30 दिन पर (25.5 क्वि. प. हे.), ब्यूटाक्लोर 23.09 पारदर्शी प्लास्टिक 24.6 तथा सरसौं के अवशिष्ट (20.33) की अपेक्षा ज्यादा उपज (35.46) पायी गई।

गेहूं –

गेहूं में नये शाकनासियों की पहचान प्रारंभिक परीक्षण से यह पाया गया है कि पी. आई. एल. सी. आर. 40 ग्राम प्रति. हे. खरपतवारों एवं उनके शुष्क पदार्थो को कम करने में तथा उपज बढ़ाने में काफी सहायक सिद्ध हुआ, परंतु पी. आई. एल. – सी. आर. 20 ग्रा. (64.77 कुंटल) एवं 40 ग्रा. (65.01 क्वि./हे.) में कोई अर्थपूर्ण अंतर नही पाया गया।

सोयाबीन –

सोयाबीन की फसल में नये खरपतवार शाकनासियों का प्रारंभिक परीक्षण, बोआई के समय, कतारों की दूरी तथा खरपतवार नियंत्रण विधियों के प्रभाव को जानने हेतु अध्ययन किया गया। परिणामों से यह ज्ञात होता है कि प्रारंभिक जांच में मेटालाक्लोर (1500 ग्रा.) खरपतवारों को कम करने में सक्षम रहा और बोआईके समय, दूरी तथा खरपतवारों के नियंत्रण के परीक्षण में पेन्डीमिथलिन (1.25 कि. ग्रा.) तथा फ्लूजीफॉप ब्यूटाइल (300 ग्रा.), फ्लूक्लोरेलिन (1.25 कि. ग्रा.) के समकक्ष तथा इन शाकनासियों का 22.5 से. मी. दूरी तथा 15 जुलाई की बुआई के साथ सम्मिलित करने से खरपतवारों की संख्या में कमी

आई। तथा उपज बढ़ाने में इन उपचारों को काफी चरितार्थ पाया गया। बोआई के बाद छिड़कने वाले शाकनासियों के प्रभाव के परीक्षण से ज्ञात होता है कि बेंटाजोन (2. कि. ग्रा.) 20 दिन पर) डालने के सैज खरपतवारों के नियंत्रण में और फलूजीफाप ब्यूटाईल (200 ग्रा.) व सिथाक्सीडिम (400 ग्रा.) 20 दिन के बाद डालने से घासीय खरपतवारों को कम करने में काफी अर्थपूर्ण, सफलता दर्ज की गई। जबकि मेटोलाक्लोर 1.5 कि. ग्रा. को 25 दिन बाद डालने पर सैज एवं घासीय दोनों खरपतवारों को नष्ट करने में सफलता पायी । इनहीं परीक्षणों में खरपतवारों से सोयाबीनी की उपज में 30 से 50 प्रतिशत तक की कमी आंकी गई।

चना –

फास्फेट फर्टिलाईजेशन, फसल–खरपतवार स्पर्धा तथा खरपतवार नियंत्रण विधियों का चने की फसल में ऊगने वाले खरपतवारों तथा उपज पर प्रभाव का अध्ययन हेतु परीक्षण किया गया है। फास्फेट 90 कि. प्रति/हे. के हिसाब से डालने पर खरपतवारों के शुष्क पदार्थ में कोई कमी नहीं आयी। लेकिन चने की उपज में अर्थपूर्ण वृद्धि जो कि 0 कि. ग्रा. फास्फेट की दर के अंतर से 6.1 क्विं./हे. ज्यादा नोट की गई। दूसरी तरफ सभी शाकनासियों जैसे फ्लूक्लोरेलिन, पेंथीमिथलिन दोनों 1 कि. ग्रा./हे. तथा सिथाक्सीडिम 0.40 कि. ग्रा./हे. ने खरपतवारों के शुष्क पदार्थ में बिना उपचार की तुलना में अर्थपूर्ण कमी लाने में सफलता पाई। लेकिन ये सभी शाकनासी खरपतवार रहित उपचार से तुलना करने पर अनुत्तम रहे। खरपतवार रहित उपचार ने चने की उपज में 70% बढ़ाने में समर्थता हासिल की। जबकि फ्लूक्लोरेलिन, पेन्डीमिथालिन एवं सिथाक्सी ने उपज को क्रमशः 47, 49.26 तथा 48.91 प्रतिशत तक बढ़ाया। फसल खरपतवार स्पर्धा परीक्षण के दौरान यह पाया गया कि खरपतवार स्पर्धा से चने की फसल में 18 प्रतिशत उपज में कभी पहले 30 दिन पर आंकी गई, जबकि यह हानि 18 से बढ़कर 50 प्रतिशत तक पहुंची जब फसल को पूरे मौसम में घासीय रखा गया। परिणामों से ज्ञात होता है कि फसल को शुरू से लेकर 60 दिन तक खरपतवार रहित रखने से उपज में वृद्धि प्राप्त होती है।

मसूर –

मसूर की फसल में ऊगने वाले खरपतवारों पर बोआई के समय तथा खरपतवार नियंत्रण विधियों का अध्ययन किया गया। इससे यह पता चलता है कि जैसे–जैसे मसूर की बोआई के समय को 23 अक्टूबर से 7 नवम्बर तक विलंब करते है वैसे–वैसे खरपतवार संख्या में कमी आती है। परंतु फसल की औसत उपज में 50 प्रतिशत तक की कमी नोट की गई। 23 अक्टूबर पर बोने से मसूर की सबसे ज्यादा उपज प्राप्त होती है। तथा 7 नवंबर पर बुआई के तुलनात्मक अध्ययन करने पर उपज समकक्ष प्राप्त होती है। खरपतवारों से मसूर की उपज में 19% की कमी नोट की गई। खरपतवार नियंत्रण विधियों में, खरपतवार रहित क्षेत्र से 15.70 क्वि./हे. की दर से सबसे ज्यादा उपज प्राप्त हुई, जो कि फ्लूक्लोरेलिन 0.5 कि. ग्रा. + 30 दिन पर निंदाई (15.44 क्विं./हे.) के तुल्य रहा।

मटर –

मटर की किस्मों के खरपतवारों के उगने पर प्रभाव देखने हेतु परीक्षण किया गया। परीक्षण के परिणामों से यह ज्ञात होता है कि किस्मों का खरपतवारों के ऊगने पर 30 एवं 60 दिनों में कोई प्रभाव प्राप्त नहीं हुआ। परंतु जे. पी. 885 नामक किस्म फसल की 60 दिन तथा कटाई की अवधि में खरपतवारों के शुष्क पदार्थ को कम करने में काफी सहायक सिद्ध हुई। खरपतवारों से मटर की फसल में 16 प्रतिशत की कमी आई। दूसरी तरफ, खरपतवार रहित क्षेत्र से मटर की सबसे ज्यादा उपज 24.13 क्वि./हे. प्राप्त हुई।

सरसों –

फसल – खरपतवार स्पर्धा एवं नाइट्रोजन एप्लीकेशन का खरपतवारों के ऊगने पर से प्रभाव का सरसौं की फसल में अध्ययन किया गया। जैसे–जैसे नाइट्रोजन की दर बढ़ाते जाते हैं वैसे–वैसे कुल खरपतवारों की संख्या बढ़ती जाती। खरपतवारों की 60 दिन तक की उपस्थिति से सरसौं की उपज में भारी कमी आई। सरसौं की फसल को शुरू के 30 एवं 60 दिन तक फसल को खरपतवार रहित रखना काफी जरूरी है। ये दिन ही फसल की उपज बढ़ाने में खरपतवार रहित होना बहुत जरूरी है।

खरपतवारों का शुष्क पदार्थ में नाइट्रोजन की दर से काफी वृद्धि हुई, परंतु खरपतवार की संख्या पर कोई प्रभाव नहीं हुआ। खरपतवार नियंत्रण विधियों में फलूक्लोरेलिन,

पेन्डीमिथालिन एवं आइसोप्रोटूरान (सभी 1.0 कि. ग्रा./हे.) नामक शाकनासियों से खरपतवार के शुष्क पदार्थ में काफी कमी आई। ये शाकनासी आपस में समकक्ष थे पर इनका प्रभाव घासीय उपचार की तुलना में काफी रहा। सरसौं की उपज भी नाइट्रोजन की दर बढ़ाने से बढ़ी । खरपतवार रहित क्षेत्र में सरसौं की उपज 14.43 क्वि./हे. प्राप्त की गई। एक और परीक्षण में, सरसौ की सबसे ज्यादा उपज सिथाक्सीडिम 800 ग्रा. (अंकुरण पूर्व) तथा 400 ग्रा.) अंकुरण पश्चात्) और पेन्डीमिथालिन (अंकुरण पूर्व) 1.0 कि. ग्रा./हे. क्रमशः 21.22, 21.42 एवं 21.06 क्वि./हे. के हिसाब से प्राप्त की गई।

फसलीय क्रम का प्रभाव –

खरपतवारों के ऊगने पर एक लंबी अवधि वाले सस्यक्रम के प्रभाव को जानने के लिये एक परीक्षण किया गया। मक्का–गेहूं एवं मक्का –मटर सस्यक्रम में *चिनोपोडियम अलबम* तथा *चिनोपोडियम फिसीफोलियम* की संस्था काफी हद तक बढ़ी। जबकि दूसरे सस्यक्रम (मक्का –मटर) में *चिकोरियम इनटाइबस* की संख्या भी बढ़ी।

धान –

गेहूं सस्यक्रम में *कामेलिना* स्पी. की संख्या बढ़ी परंतु *आल्टरनेनथेंरा सिसिलिस* एवं *ईकाईनोक्लोबा कोलोनम* की वृद्धि काफी हद तक प्रभावित हुई।

फसलीय तीव्रता

धान पर आधारित फसलीय तीव्रता जैसे धान–सरसौं–मूंग (300 प्रतिशत तीव्रता) में उपज को प्रभावित किये बिना सबसे कम खरपतार संख्या प्राप्त हुई। ब्यूटाक्लोर (1.0 कि.ग्रा./हे.) धान में तथा आइसोप्रोटूरान (1.0 कि. ग्रा.) गेहूं एवं सरसौं में खरपतवारों की संघनता एवं इसके शुष्क पदार्थ को कम करने तथा उपज बढ़ाने में सहायक सिद्ध हुआ। उपज को *खरीफ* एवं *रबी* में क्रमशः 11.03 एवं 9.04 प्रतिशत बढ़ाया।

सोयाबीन पर आधारित फसलीय तीव्रता में, साइप्रस स्पी. की सघनता सोयाबीन–सरसौं–मूंग के फसलीय तीव्रता में ज्यादा पाई गई। सबसे कम खरपतवार संख्या गेहूं (100 प्रतिशत फसलीय तीव्रता) 60 दिन पर प्राप्त की गई। पेंडीमथालिन (1.25कि. ग्रा./हे.) ने सोयाबीन में तथा आइसोप्रोटूरान (1.0 कि. ग्रा./हे.) ने सोयाबीन में तथा आइसोप्रोटूरान (1.0 कि. ग्रा./हे.) ने गेहूं एवं सरसौं की फसल में खरपतवार संख्या इसके शुष्क पदार्थ को कम करने एवं उनकी उपज बढ़ाने में काफी योगदान दिया।

कृषि पद्धति –

भिन्न प्रकार के खाद्यान एवं दलहनी फसलों के चक्र में खरपतवारों की तीव्रता एवं उनकी विषमता पर लंबी अवधि वाले पशु खाद पद्धति के प्रभाव का अध्ययन किया गया। कम निवेश वाले पशु खाद पद्धति (जिसमें 50% तत्वों की मात्रा का 50 प्रतिशत गोबर की खाद से एवं 50 प्रतिशत फर्टिलाइजर से) उपचार के अंतर्गत नोट की गई। यही दो पद्धतियां लौलिक पद्धति (जिसमें सभी अनुशंसित तत्व) से कही ज्यादा प्रभावी मानी गई है।

उसी तरह गेहूं में, वैसे ही परिणाम प्राप्त हुये है। खरपतवारों से सोयाबीन की उपज 35.34 प्रतिशत तथा गेहूं की उपज में 14.15 प्रतिशत की हानि दर्ज की गई। खरपतवारों की संख्या एवं उनके शुष्क पदार्थ का कम करने तथा फसलों के उत्पादन बढ़ाने में सोयाबीन की फसल में पेन्डीमिथालिन (1.25 कि. ग्रा. /हे.) तथा गेहूं की फसल में आइसोप्रोटूरान (1.0 कि. ग्रा./हे.) ने अर्थपूर्ण योगदान दिया।

मक्का –मटर फसलीय पद्धति में, मक्का की उपज, 36.89 तथा मटर की उपज में 16.62 प्रतिशत की हानि खरपतवारों द्वारा की गई। इसी संदर्भ में मक्के में एट्राजिन (2.0 कि. ग्रा./हे.) तथा मटर में पेन्डीमिथालिन (1.25 कि. ग्रा./हे.) का छिड़काव खरपतवारों को ऊगने एवं उनके शुष्क पदार्थ को कम करने में काफी सहायक सिद्ध हुये। इन शाकनासियों के छिड़काव से मक्के की उपज से 31.37 तथा मटर की उपज में 7.2 प्रतिशत ज्यादा का हिजाफा दर्ज किया गया।

अकरी (*विसिया सटाईवा*) –

खरपतवारों की प्रमुख प्रजातियों के जीव विज्ञानीय तथा परिस्थितिकीय विषयक अध्ययन इस केन्द्र में प्रारंभ किया गया है। इसके तहत् मसूर की फसल में पाये जाने वाले मुख्य खरपतवार जैसे *विसिया सटाईवा* के उनके

परिस्थितिकीय तथा उनके नियंत्रण हेतु परीक्षण किया गया। परिणामों से ज्ञात होता है कि जल्दी बोये गये विसिया नामक खरपतवार देर से बोये गये की तुलना में ज्यादा शुष्क पदार्थ उत्पादित करता है। इन परिणामों से यह निष्कर्ष निकाला गया है कि विसिया प्रभावित इलाकों में मसूर की फसल की बुआई नवंबर के माह में कर सकते है।

वानस्पतिक प्रबंधन –

केन्द्र के प्रक्षेत्र एवं जबलपुर के समीपवर्ती क्षेत्र में गाजर, घास, जलकुंभी एवं *लेन्टाना केमारा* पर रोगों का पता लगाने हेतु सर्वेक्षण किया गया। इस सर्वेक्षण के दौरान, गाजरघास एवं जलकुंभी पत्तियों पर लीफ स्पाट के लक्षण पाये गये। कुछ रोग की उत्पत्ति करने वाले मूलकों (फफूदों) को प्रयोगशाला में रोगयुक्त पत्तियों से अलग किया गया। ये फफूंद जैसे *स्परजीलस फ्यूमीगेटस, फ्यूजेरियम आक्सीस्पोरम, अल्टरनेरिया आल्टरनाटा करवूलेरिया, कोलेटोट्राइक्रम डिमेटम* पार्थेनियम की पत्तियों एवं बीजों से तथा *एक्रेमोनियम* तथा *आल्टरनेरिया* नामक फफूंद जलकुंभी के पौधों से अलग की गई। *फ्यूजेरियम पेलेडोरोसियम* फफूंद के प्रभाव का पार्थेनियम पर उसकी खरपतवार नियंत्रण क्षमता का पता लगाने हेतु परीक्षण किया गया। इसी परीक्षण में फफूंद को 21 एवं 30 दिनों में पार्थेनियम पर छिड़कने का पौधों की उंचाई शाखायें एवं फूल आने पर बुरा प्रभाव पड़ा। बीजों का अंकुरण तथा छोटे कोमल पौधे की वृद्धि पर रोक लगी जब फ्यूजेरियम को 0–5 दिनों (बोआई के बाद) पर छिड़का गया।

फ्यूजेरियम पेलेडोरोसियम का 2–4 डी नामक शाकनासी के साथ र्स्पधिक अध्ययन से यह पता चला कि 2–4 डी के 0.05 तथा 0.1 प्रतिशत घोल में *फ्यूजेरियम* को मिलाकर छिड़कने पर पार्थेनियम के अंकुरित हो रहे बीजों तथा कोमल पौधे बिना छिड़काव की तुलना में ज्यादा मरे।

विभिन्न प्रकार फसलों में *फ्यूजेरियम पेलेडोरोसियम* के छिड़काव का उसकी क्षमता जानने हेतु अध्ययन किया गया। परिणामों से यह पता चलता है कि बरबटी, ककड़ी, ज्वार धान इस फफूंद के प्रति प्रतिरोधक रहे जबकि भटा एवं भिण्डी मंद प्रतिरोधक तथा मिर्ची, मूली, मक्का, धनिया, टमाटर एवं पार्थेनियम पौधे काफी कमजोर रहे।

कांस की एकीकृत प्रबंधन

कांस के एकीकृत प्रबंधन के परीक्षण से यह ज्ञात होता है कि ढेचा –गेहूं फसल चक्र मे ग्लाईफोसेट (1.5 कि. ग्रा./हे.) को अकेले एवं गर्मी की जुताई के साथ डालने से कांस के कक्लों की संख्या में भारी कमी दर्ज की गई। यह विधि सोयाबीन –गेहूं फसल चक्र के समतुल्य रही।

खरपतवार कार्यिकी –

कठिनाईयों से ऊगने वाले खरपतवारी बीजों के अंकुरण को उत्तेजित करने हेतु रसायनों के प्रभाव को जानने के लिये परीक्षण किया गया। जिससे यह ज्ञात हुआ कि इथ्रेल नामक रसायन 100 पी. पी. एम. पर *साइप्रस ईरिया* एवं *स्पोरोबोलस स्पी.* के अंकुरण को उत्तेजित करने के लिये 0 प्रतिशत घोल की अपेक्षा तथा जिब्रेलिक एसिड (1000 पी. पी. एम.) *पोलीपोगोन स्पी.* के अंकुरण को उत्तेजित करने में काफी उचित पाया गया है।

एक दूसरे परीक्षण जिसमें *पार्थेनियम* एवं *केशिया सिरेसिया* के बीजों के ऊगने पर अध्ययन किया गया से ज्ञात होता है कि 100 से 400 केशिया बीच (23 मी. 2 प्लाट में) प्रभावशाली रूप से ऊगा। जिससे पार्थेनियम की वृद्धि पर काफी रोक लगी। इस पर भी कुछ पार्थेनियम के पौधे फिर से ऊग आये जो अच्छी तरह से ऊगे एवं फूलों एवं बीजों का उत्पादन हुआ। लेकिन प्रतिस्पर्धा के हिसाब से यह निष्कर्ष निकलता है कि *केशिया सिरेसिया* पार्थेनियम के अंकुरण को काफी प्रतिबंधित करती है।

एक अन्य परीक्षण जिसमें पार्थेनियम के बीजों के ऊगने एवं उनकी स्थापना पर रसायनों के प्रभाव से अध्ययन से यह ज्ञात होता है कि डायमोनियम फास्फेट 1.8 किग्रा. /2.3 मी. 2 प्लाट एवं इससे अधिक दर पर उपयोग करने से पार्थेनियम की वृद्धि रोकने में काफी सफलता हासिल की। वानस्पतिक रसायनों जैसे पार्थेनियम से अलग किये गये फाइटोटाक्सीन – पार्थेनिन का जलीय खरपतवारों पर प्रभाव देखा गया। पार्थेनियम नामक फाइटोटाक्सीन को जब 25 पी. पी. एम. पर उपयोग किया गया तब डूबे हुये खरपतवारों जैसे *सिरेटोफाइलम*, *हाईड्रिला* एवं *नाजस* पर काफी घातक सिद्ध हुआ। जलकुंभी *सेलवेनिया*, ऐजोला, *स्पायरोडिला* एवं *लेमना* आदि खरपतवारों पर पार्थेनिन 50 –100 पी. पी. एम. पर प्रभावशाली रहा।

सोयाबीन पर आधारित फसलीय एवं शाकनासी चक्र के सोयाबीन में फ्लूक्लोरोलिन 2–4, डी/पेन्डीमिथलिन ळ 2–4, – डी नामक उपचार से *आल्टरनेनथेरा सिसलिस* को तथा पेन्डीमिथालिन आइसोप्राटूरान/पेन्डीमिथालीन आइसोप्रोटूरान उपचार से *कामेलिना कम्यूनिस* जैसे खरपतवारों की संख्या को कम करने सहायक रहे। जबकि गेहूं की फसल में, पेन्डीमिथालीन–आइसोप्रोटूरान/पेन्डीमिथालिन– आइसोप्रोटूरान एवं फ्लूक्लोरोलिन 2, 4– डी/पेन्डीमिथालिन 2, 4 –डी उपचारों से *चिनोपोडियम फिसीफोलियम* को पेन्डीमिथालिन आइसोप्रोटूरान/पेन्डीमिथालिन–आइसोप्रोटूरान उपचार *चिकोरियम इनटाइबस* को तथा पेन्डी मिथालिन 2, 4 –डी/पेन्डीमिथालिन–आइसोप्रोटूरान *फेलेरिस माइनर* की संस्था को कम करने में काफी सफल रहे।

धान पर आधारित फसलीय एवं शाकनासी चक्र की फसल धान में सबसे कम खरपतवारीय शुष्क पदार्थ ब्यूटाक्लोर–आइसोप्रोटूरान/ब्यूटाक्लोर–आइसोप्रोटूरान ब्यूटाक्लोर–आइसोप्रोटूरान/थेयोवेनक़ार्ब–आइसोप्रोटूरान ब्यूटाक्लोर–आइसोहप्रोटूरान/ऐनीफोफास–आइसोप्रोटूरान/ उपचारों के अंतर्गत नोट किया गया। गेहूं में सभी शाकनासियों से खरपतवार वृद्धि प्रभावित हुई। सबसे ज्यादा गेहूं की उपज (56.28 क्वि./हे.) खरपतवार रहित क्षेत्र से प्राप्त हुई जो कि ब्यूटाक्लोर–आइसोप्रोटूरान/थियोबेनकार्ब–आइसोप्रोटूरान (55.67 क्वि./हे.) ब्यूटाक्लोर–आइसोप्रोटूरान/ ब्यूटाक्लोर–आइसोप्रोटूरान (53.98 क्वि./हे.) ब्यूटाक्लोर–आइसोप्रोटूरान/ एनीलोफास–आइसोप्रोटूरान (51.0 क्वि./हे.) घासीय उपचार की उपज (56.83 क्वि./हे.) की तुलना में समतुल्य रही।

गेहूं की फसल में ऊगने वाले खरपतवारों की वृद्धि एवं तथा फसल की उपज पर विभिन्न वृद्धि में रुकावट डालने वाले रसायनों का प्रभाव देखा गया। परिणामों से ज्ञात होता है कि इन रसायनों से पौधा की ऊंचाई 10 दिन की अपेक्षा 70 दिन पर अर्थ पूर्ण कम हुई। खरपतवारों के शष्क पदार्थ में भारी कमी पाई गई। जिससे फसल की उपज में ज्यादा हिजाफा दर्ज किया गया। इन रसायनों के डालने से फसल की वृद्धि में रूकावट 70 दिन पर व्यक्त की गई, परंतु इन रसायनों का *चिकोरियम इनटाइबस* पर कोई प्रभाव नहीं पड़ा।

एक दूसरे परीक्षण में खरपतवारों पर अवशेषों तथा शाकनासी जांच के प्रभाव को देखा गया। सरसौं का अंकुरण गेहूं के अंकुरण को छोड़कर खरपतवार के विभिन्न सांद्रता वाले घोलो से बुरी तरह प्रभावित हुआ। परंतु *ई. रोगोसम* ने गेहूं के अंकुरण को बढ़ावा दिया। टमाटर एवं चना खरपतवारों के अवशेषों के घोलों के प्रति काफी प्रभावित हुये। धान एवं उसके खरपतवारों पर रबी की फसलों के अवशेषों के प्रभाव से यह पता चलता है कि मटर, सरसौं एवं अलसी के अवशेषों का *सिसुलिया आक्श्रीलरिस* को छोड़कर ऊगने वाले खरपतवारों पर कोई प्रभाव नहीं पड़ा। सिलिया आक्जीलरिस खरपतवार की संख्या पर मटर के अवशेषों का 60 रोपाई के बाद अर्थपूर्ण कमी आई। पौधे का शुष्क पदार्थ में सरसौं एवं अलसी के अवशेषों से उपचारित क्षेत्रों में 30 दिन की रोपाई पर अर्थपूर्ण वृद्धि दर्ज की गई।

दूसरी ओर गेहूं एवं उसमें ऊगने वाले खरपतवारों के अंकुरण एवं वृद्धि पर खरीफ फसलों के अवशेषों का प्रभाव देखा गया। खरपतवारों के शुष्क पदार्थ पर इन अवशेषों का कोई प्रभाव नहीं देखा गया। परंतु धान एवं सोयाबीन के अवशेषो से उपचारित क्षेत्रों में पौधे की वृद्धि एवं फसल की उपज ज्यादा प्राप्त हुई।

कृषि अभियांत्रिकी

खरीफ एवं रबी फसलों में उन्नत यांत्रिक वीडर का खरपतवारों के नियंत्रण हेतु इनके प्रयोगों का मूल्यांकन किया गया। इन प्रयोगों के मूल्यांकन से यह ज्ञात हुआ कि इन उन्नत किये वीडरों के प्रयोगों से नियंत्रण क्षमता सोयाबीन एवं मक्का की फसल में 15 दिन के आ 25 एवं 35 दिन पर प्राप्त हुई। सोयाबीन की सबसे ज्यादा उपज वीडरो का 15 वें दिन उपयोग करने से प्राप्त हुई जबकि मक्के की उपज में कोई अर्थपूर्ण वृद्धि नोट नहीं की गई।

रिपोर्ट अवधि के दौरान *रबी* की फसलों में उन्नत वीडरों का उपयोग किया गया। गेहूं की फसल में, वीडरों की बुआई के 25 दिन बाद उपयोग करने से खरपतवार नियंत्रण क्षमता 61 से 74 प्रतिशत प्राप्त हुई। जबकि चने की फसल में यह क्षमता 48 से 69 प्रतिशत तक की रही। दोनों फसलो में बुआई के 35 दिन बाद पर वीडरो के उपयोग न ही ज्यादा असरदार रहे बल्कि 35 दिन की फसल में इन वीडरो का प्रवेश ही नही हो सका तथा क्षमता कम प्राप्त हुई।

7. SUMMARY OF WORK CONDUCTED AT DIFFERENT AICRP-WEED CONTROL CENTRES

Salient findings of the research work done at different AICRP-WC Centres for the year 1993 are as follows -

Weed Survey

Survey of weed flora was conducted at most of the cooperative centres to identify the weeds and their distribution pattern in different crops and cropping systems, waste lands, pasture and water bodies.

At most of the centres it was found that in lowland transplanted rice, *Fimbristylis miliacea, Echinochloa colona, Lindernia spp., Ischaemum spp., Panicum repens, Monochoria vaginalis, Ludwigia parviflora and Marcilia quadrifoliata* were found in abundance. In maize, sorghum, pearlmillet, sugercane and cotton, weeds like *Ischaemum indicum, Commelina benghalensis, Tridax procumbens, Corchorus acutangulus, Euphorbia hirta, Parthenium hysterophorus and Ageratum conyzoides* were dominant.

In *Kharif* oilseeds and pulses, the major weeds were*E. crusgalli, Commelina communis, Fimbristylis miliacea, Phyllanthus niruri, Cyperus spp., Portulaca oleracea, Corchorus acutangulus* etc.

Biology and control of problem weeds :

Studies on biology of*Asphodelus tenuifolius* at Jabalpur indicated that fresh seed can germinate 25% while one year old seeds have 15.2% germination. Among herbicides, oxyfluorfen 0.2 kg/ha and pendimethalin 1.5 kg/ha were found effective to reduce the germination. Studies on biology of *Lantana camara* at Palampur indicated that basal cutting of *Lantana camara* produced maximum rootmass and green foliage compared middle and apical cuttings. Application of glycel 1% 0.75% + surfactant on regenerated bushes in October were quite effective in controlling *Lantana camara.* Use of glyphosate 2.0 kg/ha with and without surfactants completely killed *Eupatoruim.*

Crop-weed competition :

Weed competition reduces the grain yield of mustard and wheat by 24.9% and 19.7% respectively at Anand. The critical period of crop-weed competition varies from 30-40 DAS in mustard, and 30-45 DAS in mustard at Anand. At Sriniketan in direct seeded upland rice, the critical period was found for the first 45 days after sowing.

Weed management research in crops and cropping system :

Studies conducted at Ludhiana indicated that application of thiobencarb immediately after sowing at 0.5 kg/ha under puddled condition was found safe and effective. In transplanted lowland rice, pre emergence application of pretilachlor at 0.75-1.0 kg/ha, anilophos plus 1.25 kg/ha at 7 DAT, oxyfluorfen 0.1 kg/ha, cinmethalin 0.80 kg/ha and metsulfuron methyl 0.03 kg/ha have been found quite effective. Pre emergence application of oxyfluorfen 0.15 kg/ha + one hand weeding at 40 DAT proved most effective against weeds. In direct seeded upland rice, combination of 2,4-DEE with anilophos, butachlor, oxyfluorfen, and pretilachlor were proved to be good for control of weeds at Hyderabad. Application of anilophos plus (Anilophos 24% + 2,4-DEE 32%) at 1.562l o 1.875 kg/ha applied at 7-9 DAS produced higher grain yield of rice at Coimbatore. In direct seeded lowland rice application of butachlor at 1.5 kg/ha at 6 DAS fb HW 30 DAS resulted effective control of weeds at Palampur.

Studies conducted on weed management research in wheat at Ludhiana revealed that tralkoxydim 0.35 kg/ha at 25 DAS gave very good control of wild oats. Application of isoproturon before irrigation (3

WAS) gave good control of both grasses and broad leaf weeds. In rainfed wheat, isoproturon 1.0 kg/ha + Teepol 0.2% gave good control of weeds and increased the grain yield at Palampur.

Pre emergence application of atrazine at 1.0-1.5 kg/ha gave effective control of weeds and recorded higher yield of maize at most of the centres.

As regards the weed management in pulses, integrated weed management involving pre emergence use of herbicides viz., metolachlor, oxadiazon, pendimethalin and oxyfluorfen followed either by fluazifop- butyl 0.25 kg/ha or bentazon 1.25 kg/ha or inter cultivation at 45 DAS were found promising in contorlling weeds in pigeonpea at Hyderabad, Trifluralin 0.7 kg/ha + HW or metolachlor 0.75 kg/hakk + HW gave effective weed control and higher yield in greengram at Ludhiana. In *rabi* pulses viz.,metribuzin (0.25 kg/ha) and oxyfluorfen (0.10 k/ha) demonstrated satisfactory control of associated weeds.

Weed management studies in oilseeds indicated that for controlling the weeds in soybean, chlorimuron ethyl 6 g/ha (at 20 DAS) + 1 HW at 35 DAS) showed effectiveness against grasses and broad leaf weeds at Bangalore. In groundnut, metolachlor 1.0 kg/ha or oxyfluorfen 0.12 kg/ha + hand hoeing at 45 DAS and fluazifop-butyl (15 DAS fb HW at 35 DAS were found effective. In sunflower application of fluchloralin 1.0 kg/ha supplimented with HW at 6 WAS has recorded highest seed yield at Parbhani. In sesamum, application of trifluralin at 0.75 kg/ha was found effective at Anand. For controlling the weeds in rapeseed-mustard and linseed, post emergence application of isoproturon 0.75-1.0 kg/ha (after first irrigation) was found promising at Ludhiana.

In cotton, fluchloralin 1.0 kg/ha and pendimethalin 0.75 kg/ha alongwith two hoeings (6 & 9 WAS) were found quite effective at Anand.

As regard the weed control in vegetables application of oxyfluorfen at 0.10 kg/ha followed by one intercultivation at 25 DAT appears to control weeds well and recorded more tomato yield. Alachlor 1.0 kg/ha and pendimethalin 0.75 kg/ha gave better weed control efficiency in brinjal at Bhubaneshwar. In chillies at Hyderabad, pre- emergence application of pendimethalin, metolachlor, butachlor each at 1.0 kg/ha or oxyfluorfen at 0.10 kg/ha fb intercultivation at 30 DAT gave maximum weed control and chilli yield. In garlic at Kanpur, pendimethalin 1.0 kg/ha and isoproturon 0.75 kg/ha have been found effective. Similarly in onion, metolachlor 1.0 kg/ha fb 1 HW showed promise at Palampur. In potato at Sriniketan, application of alachlor 1.0 kg/ha pre emergence recorded higher tuber yield.

Besides the weed control in individual crops, the studies were also taken up on weed management in cropping sequences and intercropping systems. In rice-wheat rotation at Jabalpur, continuous use of butachlor and thiobencarb in rice increased the population of*Sehima nervosum* in rice. Similarly in wheat, due to continuous use ofisoproturon the population of Anagalis arvensis and Digitaria adscendens was increased. *Medicago denticulata* also showed the increased tolerance to isoproturon. None of the herbicides showed their residual effects. At Palampur, as a result of continuous paddy-wheat sequence; Polygonum monsplensis, Alopecurus myosurodes and Poa annua population increase over previous year. There was not much change in weed flora due to continuous use of herbicides.

Studies conducted in wheat + mustard intercropping system indicated that pendimethalin 1.5 kg/ha or oxyfluorfen 0.2 kg/ha as PE were effective at Jabalpur, however, isoproturon 1.0 kg/ha as post em. was found superior at Ranchi. In maize + soybean intercropping, application of fluchloralin 1.0 kg/ha was comparable with HW thrice at 20, 30 & 45 DAS in arresting weed density. At Kanpur in chickpea + linseed and potato + linseed intercropping system, pendimethalin 1.0 kg/ha (PE) or isoproturon 0.75 kg/ha have been found effective. In groundnut + pigeonpea intercropping system, pendimethalin 1.0 kg/ha, oxyfluorfen 0.1 kg/ha were found quite effective to check the emergence of*Trianthema monogyna*.

Weed Physiology

Studies conducted at Coimbatore to find out the allelopathic effect of Eucalyptus leaf leachate on growth of Cyperus rotundus and

Cynodon dactylon indicated that fresh leaf leachates at 20 & 40% concentration significantly suppressed the growth of the two weeds in terms of tuber establishment and dry matter production. Similarly at Sriniketan indicated that extracts of Eucalyptus leaves delayed the crop seed germination. At the highest concentration (150,000 ppm) 3-4 folds more time were required for 100% of crop seeds. Higher concentrations significantly reduced the weed seed germination. It was concluded that leaf extracts of Eucalyptus may be used to control rabi weeds without any detrimental effect on germination of rabi crops.

Herbicide residue/Bio-assay

At Palampur residual studies of pendimethalin and atrazine revealed that residues of pendimethalin 1.5 kg/ha in soils varied from 0.002 to 0.003 ppm and between 0 to 0.001 ppm. Studies conducted on the persistence of butachlor in direct seeded rice under rainfed condition at Jorhat revealed that butachlor degraded slowly and maximum persistence was recorded at 2.0 kg/ha at 10 days after application, however, the limit was 0.001 ppm. Fate of atrazine in problem soils (acid and saline/alkaline) was studied at Coimbatore. Results revealed that higher adsorption of atrazine was noticed in peat soil followed by acid soils. The lowest adsorption was in alkaline soils. Similarly the persistence of atrazine was also studied in black and red soils at Hyderabad. The results indicated that atrazine persisted upto 120 days in black soil at 2.0 kg/ha level and upto 20 days at 1.0 kg/ha level and upto 90 days in red soils. Standardization of bioassay technique for fluchloralin indicated that ragi was found to be the best bioassay based on germination and plant height.

Fertilizer use economy through weed control :

Experiments conducted on fertilizer use economy through weed control in wheat at Jabalpur indicated that 40 kg N/ha can be saved by weed control either through herbicides or hand weeding. Similarly at Ranchi interaction effect of nitrogen level and weed control methods suggested that sustainable yield of wheat could be obtained at 80 kg N with post-em. application of isoproturon @ 0.75 kg/ha + 2,4-D sodium salt @ 0.75 kg/ha.

Evaluation of weed control tools and implements :

At Jorhat in summer rice dryland weeder (20 & 30 days after emergence) recorded minimum weed dry matter. Maximum performance index was recorded with peg weeder followed by twin wheel hoe. In rainfed wheat the performance index at 20 DAS was maximum in twin weeder blade type. At 40 DAS Twin Wheel Hoe and Grubber proved effective.

ANNEXURE - I

Total strength of the staff in the centre in 64 (Scientist-10, Technical-17, Administrative-12, Auxiliary-3 and Supporting staff-18) A list of staff position is given below.

STAFF IN POSITION (as on 31.03.94)

Sl. No.	Designation	Name	Joining	Date of No. selection, promotion if any
RESEARCH MANAGEMENT PERSONNEL				
1.	Director	Dr. V.M. Bhan	22.04.89	
2.	Project Coordinator	Dr. V.N. Saraswat	18.08.89	Transferred to CRI for J&AF wef. /04/93
3.	Project Coordinator	Dr. K.C. Gautam	03.02.94	
SCIENTIFIC PERSONNEL				
4.	Sr. Scientist	Dr. L.P. Kauraw	10.07.91	
5.	Sr. Scientist (Ag. Engg.)	Sh. H.S. Bisen	01.01.92	
6.	Scientist (Pl. Physio.)	Dr. D. Swain	25.02.91	
7.	Scientist (Pl. Physio.)	Sh. D.K. Pandey	29.11.91	
8.	Scientist (Agronomy)	Dr. Sahadeva Singh	20.11.90	
9.	Scientist (Agronomy)	Dr. A.N. Singh	01.04.91	
10.	Scientist (Agronomy)	Dr. V.P. Singh	28.05.92	
11.	Scientist (Agromomy)	Sh. J.S. Mishra	24.07.92	
12.	Scientist (Soil Sci.)	Dr. Khanchilal	30.08.93	
TECHNICAL PERSONNEL				
13.	T-5 (Technical Officer)	Dr. M.S. Raghuwanshi	24.08.92	
14.	T-5 (Farm Manager)	Sh. R.S. Upadhyay	17.03.90	Selected on 29.01.94
15.	T-4 (Librarian)	Sh. M.N. Jadhav	08.07.91	
16.	T-4 (Sr. Tech. Asstt.)	Sh. Ravi R. Saxena	18.12.91	
17.	T-4 (Sr. Photographer)	Sh. Basant Mishra	19.12.91	
18.	T-4 (Sr. Tech. Asstt.)	Sh. M.K. Rabha	25.01.92	Resigned on 24.12.93

Sl. No.	Designation	Name	Joining	Date of No. selection, promotion if any
19.	T-II-3 (Tech. Asstt.)	Sh. Sandeep Dhagat	05.11.90	
20.	T-II-3 (Artist)	Sh. V.K.S. Meshram	05.11.90	
21.	T-II-3 (Draftsman)	Sh. G.R. Dongre	19.09.91	
22.	T-I-3 (Tech. Asstt.)	Sh. O.N. Tiwari	01.02.94	Transferred from ICAR Complex, Shillong
23.	T-II (Mechanic)	Sh. M.P. Tiwari	21.05.92	
24.	T-1 (Field Assistant)	Sh. J.N. Sen	13.03.90	
25.		Sh. S.K. Parey	15.03.90	
26.		Sh. K.K. Tiwari	14.01.92	
27.		Sh. S.K. Tiwari	14.01.92	
28.		Sh. Somitra Bose	14.01.92	
29.		Sh. G. Vishwakarma	28.03.92	
30.		Sh. Ajay Pal Singh	28.03.92	
31.		Sh. Man Singh	08.02.94	
32.		Sh. R.K. Meena	11.02.94	
33.		Sh. Mukesh Meena	22.02.94	
ADMINISTRATIVE				
34.	Asstt. Admn. Officer	Sh. Balwant Rai	21.08.89	
35.	Asstt. Fin.& A/C Officer	Sh. B.C. Pal	11.10.90	On deput-
36.	Office Assistant	Sh. S.C. Sharma	19.03.90	ation
37.	Sr. Clerk	Sh. S.K. Sharma	02.12.89	
38.	Jr. Stenographer	Ku. Nidhi Kaushik	28.11.89	
39.		Sh. Ajay Bhowal	24.10.92	
40.	Jr. Clerk	Sh. J.P. Kori	21.05.90	
41.		Sh. R.K. Hadge	26.11.90	
42.		Sh. T. Lakhera	26.11.90	
43.		Sh. Sunil Gupta	17.02.90	

Sl. No.	Designation	Name	Joining	Date of No. selection, promotion if any
44.		Sh. Manoj Gupta	24.05.91	
45.		Sh. Beni Pd. Uriya	25.03.92	
SUPPORTING				
46.	Messenger (SSG-I)	Sh. Francis Xavier	17.02.90	
47.		Sh. Veer Singh	02.03.90	
48.		Sh. A.K. Tiwari	31.03.92	
49.		Sh. Shiv K. Patel	28.03.92	
50.		Sh. Pyare Lal	31.03.92	
51.		Sh. Sukha Singh	03.04.92	
52.	Lab. Attendant (SSG-I)	Sh. Sebasten	28.03.92	
53.		Sh. Shanker Lal Koshta	28.03.92	
54.		Sh. J.P. Dahiya	31.03.92	
55.		Sh. Madan Sharma	31.03.92	
56.		Sh. J. Vishwakarma	08.04.92	
57.	Farm Mazdoor (SSG-I)	Sh. Raju Prasad	19.03.90	
58.		Sh. Jagoli Prasad	21.03.90	
59.		Sh. Jagat Singh	23.03.90	
60.		Sh. Chhote lal Yadav	30.03.90	
61.		Sh. Anil Sharma	23.04.91	
62.		Sh. Ram Kumar	10.05.91	
63.		Sh. Naresh Singh	10.05.91	
64.		Sh. Gajjulal	26.10.93	
AUXILIARY				
65.	Driver	Sh. Prem Lal	23.03.90	
66.	Driver	Sh. Dilip Kumar Sahu	23.03.90	
67.	Tractor Driver	Sh. Bhagunte Prasad	15.05.90	

ANNEXURE - II

The expenditure (In rupees) for the year 1993-94 under different heads is as follows:

Statement of expenditure during the year 1993-94

Sl. No.	Name of Heads	Plan (Rs.)	Non-Plan (Rs.)	Total (Rs.)
1.	Establishment charge	18,42,303	6,26,605	24,68,908
2.	Travelling Expenses	80,000	16,000	96,000
3.	Expenditure acquiring assets :			
	a. Land	-	-	-
	b. Building & other original works	23,53,812	24,000	23,77,812
	c. Tools and Plants	15,06,445	-	15,06,445
	d. Furniture & other office equipment	2,92,924	-	2,92,924
	e. Typerwriters & Accounting Machines	–	–	–
	f. Vehicles	–	–	–
	g. Live stock	–	–	–
	h. Library Books & Journals	2,23,771	-	2,23,771
4.	Other continget expenditure	13,89,515	12,56,337	26,45,852
5.	Additional expenditure :			
	a. Pension & Gratuity	–	–	–
	b. P-Loans	3,19,000	600	3,19,600
	c. Q-funded Debts	2,79,471	34,800	3,14,271
	d. R-Deposits	28,000	-	28,000
	e. S-Advances	15,600	6,600	22,200
	f. T-Suspense	–	–	–
	g. Remittance	16,91,054	1,07,095	17,98,149
	h. Closing Balanace :			
	a. Cash in hand	10,000	-	10,000
	b. Cash in Bank	90,000	1,25,000	2,15,000
	GRAND TOTAL	1,01,21,895	21,97,037	1,23,18,932

ANNEXURE - III

VISITS IN SYMPOSIUM/SEMINAR/CONFERENCE

Dr. V.M. Bhan, Director, NRC-WS, Jabalpur

- Participated in National Symposium on Pesticide : Future Scenario, Society of Pesticide Science, IARI, New Delhi from 15- 17, 1993.

- Attended Summer Instt. on Advances in Agronomy, IGKV, Raipur on 10.06.93.

- Participatedin the International Symposium on Integrated Weed Management in Sustainable Agriculture, Hisar from 18-20 Nov., 1993.

Dr. L.P. Kauraw, Sr. Scientist; Sh. H.S. Bisen, Sr. Sci; ; Sh. D.K. Pandey, Sci; Dr. D. Swain, Sci.; Dr. S. Singh, Sci; Dr. A.N. Singh, Sci.; Dr. V.P. Singh, Sci.; Sh. J.S. Mishra,Sci.

- Participatedin the International Symposium on Integrated Weed Management in Sustainable Agriculture, Hisar from 18-20 Nov., 1993.

Sh. D.K. Pandey, Scientist (Physiol)

- Participated in National Symposium on Pesticide : Future Scenario, Society of Pesticide Science, IARI, New Delhi from 15- 17, 1993.

Sh. J.S. Mishra, Scientist (Agro)

- Attended Summer Instt. on Advances in Agronomy, IGKV, Raipur on 10.06.93.

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