annual report

भाकृअनुप
ICAR

वार्षिक प्रतिवेदन
1994-95

NRCWS

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

ANNUAL REPORT

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ADHARTAL, JABALPUR - 482004

Annual Report 1994-95

(1st April 1994 to 31st March 1995)

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Annexures

List of Abbreviation

BI	-	Before irrigation
Buta	-	Butachlor
CI	-	Cropping intensity
Cm	-	Centimetre
DAS	-	Days after sowing
DAT	-	Days after transplanting
FYM	-	Farm yard manure
IPU	-	Isoproturon
LR	-	Leaf residue
Maxi	-	Maximum
Mini	-	Minimum
mm	-	Millimetre
OBLW	-	Other broad leaved weeds
Parth	-	Parthenium
Pendi	-	Pendimethalin
PPi	-	Pre Plant incorporation
PE	-	Pre Emergence
PO	-	Post Emergence
Sp	-	Species
WCT	-	Weed control treatment
WF	-	Weed free
W/V	-	Weight per volume
WY	-	Weedy

FROM DIRECTOR'S DESK

National Research Centre for Weed Science has started its functioning since 1989 and engaged in research and development of weed management technology based on modern techniques and available resources in agriculture. Researches conducted by the NRCWS Scientists have been highlighted in this report. The major programmes are based on basic and applied approaches in the direction of Weed Management in Cropping Systems, Vegetation management, Weed physiology and mechanical tools pertaining to weed control. The major thrust is concentrated on developing research programmes on rainfed direct sown rice system, pulses, oilseeds, biological control of weeds and testing of new herbicides. The project on biological control of weed using plant pathogen funded by DBT has started giving its results. Another project approved by ICAR has also started. During the year, centre published 17 research papers in various journals, one review paper and one article with 29 abstracts in various Symposium, Seminars and workshops. Almost all the scientists of the centre were sent to attend various seminars, symposias, workshops etc.

The infrasturctural facilities are being further strengthened by providing modern research equipments, computer facilities and a need based library to strengthened research programmes. Field researches on different aspects of weed management are being conducted at experiment station of NRCWS.

Short term training course on Weed Management for subject matter specialist and officers of different state Deptt. of Agriculture was also arranged by the centre.

Scientists and other staff members of NRCWS deserve appreciation in developing, executing and reporting the various researches done at this centre which is still in its developing phase.

Grateful thanks to Secretary, DBT for financing the research project on biological control of weeds using pathogen and also to DG (ICAR) for giving a project on Pest Potential by mexican beetle for biocontrol of parthenium plants.

(V.M.Bhan)

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 zones.

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

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 cropping system.
5. To develop technology for biological and non-chemical methods ofweed 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 noncropped situations and computer facility for data analysis and recordmaking.

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 Agril.Engineering Unit).

Biology and agroecology :

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

II. Study of weed shifts in cropped and noncropped 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 cropped and non-cropped situations

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.

Agricultural Engineering Unit :

Research, development and testing of weed control equipment, crop protection equipment and technologies related to crop production of food grains, oilseeds, pulses etc. To work on integrated weed management practices in crop production using mechanical and chemical and other methods of weed control. To generate energy requirements and economics of integrated weed management practices in cropping systems.

1.5 INFRASTRUCTURAL FACILITIES

NRCWS Farm

The National Research Centre for Weed Science has total area of 59.5 ha. Out of which 29.76 ha area was covered under *kharif* crops and 36.5 ha under *rabi* crops. NRCWS farm provides facilities for field research and other field experimental activities.

Computer Services

The centre has computer based data analysis and retrieval system to support scientists. Centre, more are two computers and both of them belong to PC/AT-486 with VGA color monitor and 24 pins letter quality printer, are included in this system with fecilities such as graphics and data base management.

Fig. 1 : Computer Cell - A facility for research work and information

Other Facilities

The centre has brought modern techniques in its laboratories by installing spectrophotometer, BOD incubators, leaf area meters,pH meter, seed germinator, leminar air flow, universal research microscope with photomicrographic attachment, stereozoom research microscope, fine analytical balances, high speed refrigerated centrifuge,table top centrifuge, vaccum evaporator, hot air ovens, deep freezer, plateform shakers etc..

1.6 STAFF POSITION :

The staff position during the period under report is depicted in Table - 1.

Table 1 : Staff Position as on 31.3.95

Category	Details of post sanctioned under VII Plan		
	Sanctioned	Filled	Vacant
Scientific	27(*)	13	14
Technical	27	19	08
Administrative	17	11	06
Supporting	25	18	07
Auxiliary	03	03	-
	99	**64**	**35**

(*) Including one post of Director

Note : For detail See Annexure - I.

1.7 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.

1.8 BUDGET

The centre has total budget of Rs. 1,83,18,875 during the year out of which Rs.1,50,52,659 was spent in plan and Rs. 22,76,192 in non-plan. (for details, see Annexure II).

1.9 Participation in seminar, symposia, conference,meeting etc.and honours and awards. (for details, see Annexure III).

2. AGROCLIMATE

This section presents a brief description of agro-climatic factors of maximum and minimum tempreture, humidity, wind velocity 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 WEATHER AND SOILS :

Monsoon timely set in over sub humid portion of Jabalpur on 15 June. It covered the entire region by 17 June. During the period, rains amounting 384 mm were received by 25 June,1995. The south west rainfall (June to October) was 2184 mm which was almost 50 per cent more than the normal rainfall i.e. 1253.4 mm. The seasonal rainfall in its early days of monsoon damaged the kharif crops like soybean and maize. Research programme based on these two crops were completely disturbed. From the date of mansoon till 15 August, it experienced many rainy days with higher intensities which surpassed the normal rainfall by 80 per cent. Weekly meterological parameters are presented in Table -2.

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.

Table 2 : Meteorological data for the year 1994-95.

Weeks	Temperature		Relative Humidity		Rainfall (mm)	Wind Velocity (km/hr)	No. of rainy days
	Maxi.	Mini.	AM.	PM.			
13	37.8	18.2	54	16	1.5	4.0	-
14	36.7	19.8	54	24	5.6	3.5	-
15	34.6	19.5	63	25	4.6	3.2	1
16	37.6	21.6	52	22	-	4.2	1
17	39.3	21.7	48	16	1.0	3.0	-
18	40.7	25.5	40	16	6.9	5.1	-
19	40.7	24.9	44	19	-	4.8	1

Weeks	Temperature		Relative Humidity		Rainfall	Wind Velocity	No. of rainy
	Maxi.	Mini.	AM.	PM.	(mm)	(km/hr)	days
20	43.4	26.1	29	14	-	5.0	-
21	44.6	28.6	38	15	-	4.5	-
22	45.5	30.9	37	16	1.8	5.5	-
23	42.1	29.7	52	27	48.5	7.4	-
24	35.8	25.5	84	61	130.9	6.1	5
25	31.8	23.8	89	70	57.7	8.2	3
26	28.4	24.4	93	78	57.2	4.6	3
27	30.2	24.4	92	78	554.9	4.7	3
28	29.2	23.3	96	85	253.8	7.5	6
29	26.3	23.6	97	94	37.4	6.8	6
30	28.9	24.2	93	79	409.0	6.3	3
31	27.8	23.4	97	90	191.0	5.3	6
32	25.6	23.3	97	93	68.9	3.5	6
33	28.7	24.2	95	81	113.0	4.2	6
34	29.5	24.2	95	80	84.4	5.7	3
35	29.7	23.8	94	80	32.5	3.3	5
36	29.6	24.2	91	79	1.8	3.4	4
37	31.1	23.8	95	78	8.2	1.1	-
38	30.2	22.7	91	65	-	1.4	1
39	31.6	20.1	86	47	-	2.4	-
40	31.4	19.4	90	51	2.8	1.2	-
41	31.9	20.3	85	45	-	1.3	1
42	30.4	17.1	92	49	-	1.1	-
43	31.3	15.4	91	34	-	1.0	-
44	30.8	15.7	88	35	-	1.1	-
45	30.4	13.0	90	32	-	1.3	-
46	29.8	12.5	89	29	-	0.9	-
47	27.7	10.1	86	31	-	0.9	-
48	28.4	9.6	89	28	-	1.5	-
49	27.9	10.3	91	3	-	0.8	-
50	25.9	7.8	91	35	-	0.8	-
51	23.6	5.4	92	31	-	1.7	-
52	25.7	8.1	89	31	3.8	3.0	-
1	25.6	9.5	88	4	32.2	1.8	1
2	20.6	10.1	95	60	-	1.4	3
3	22.2	8.2	94	47	-	1.9	-
4	24.0	6.3	91	32	9.7	1.5	-
5	25.4	9.1	91	44	-	2.6	1
6	27.0	10.8	90	36	2.0	2.7	-
7	29.5	14.2	82	32	-	3.0	-
8	27.6	9.6	81	25	1.3	3.6	-
9	29.3	12.2	79	32	71.1	2.7	-
10	27.2	16.0	84	59	15.8	1.8	3
11	27.7	15.0	88	49	-	1.0	2
12	34.8	17.8	77	34	18.0	4.0	-
13	33.6	16.5	79	36	-	3.3	-

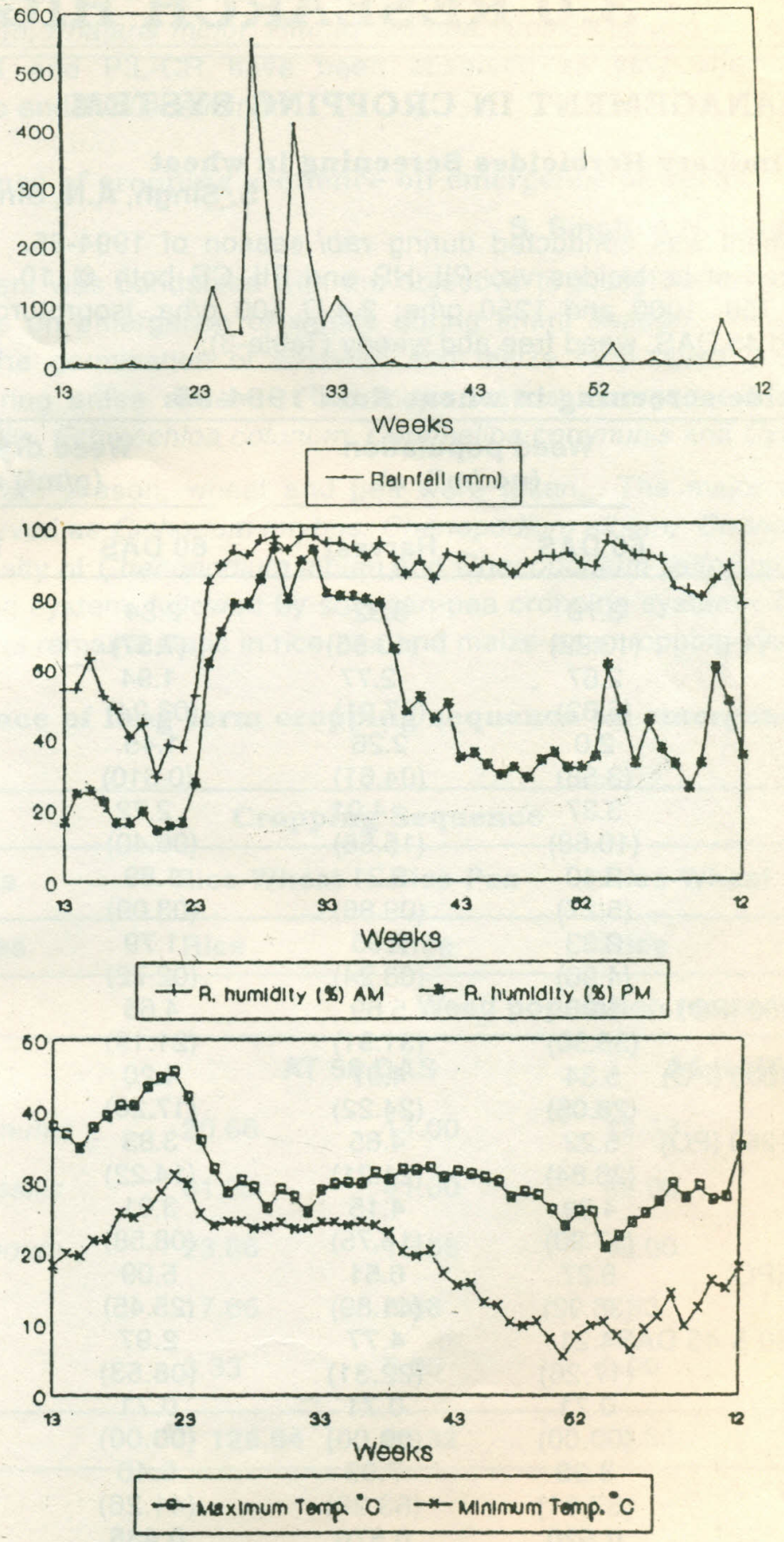

Fig.2 : Change in rainfall, relative humidity and air temperature during 1994-95

3.0 RESEARCH HIGHLIHTS

3.1 WEED MANAGEMENT IN CROPPING SYSTEM

WM-2-c : Preliminary Herbicides Screening in wheat

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

This experiment was conducted during *rabi* season of 1994-95. The weed control treatment consisted of herbicides viz. PIL-HR and PIL-CR both @ 10, 20 & 40 g/ha and dichlofop methyl 750, 1000 and 1250 g/ha; 2,4-D 500 g/ha, isoproturon 750 g/ha, hand weeding at 30 and 45 DAS, weed free and weedy (Table-3).

Table 3: Herbicide screening in wheat *Rabi* 1994-95.

Herbicidal Treatments	Weed population (no./m²) at		Weed dry wt. (g/m²) at		Grain - yield
(g/ha)	60 DAS	Harvest	60 DAS	Harvest	(q/ha)
PIL-HR 10 (PO)	3.70 (13.22)	3.32 (10.55)	2.84 (7.57)	2.74 (07.04)	56.62
PIL-HR 20 (PO)	2.67 (6.62)	2.77 (07.21)	1.94 (03.24)	2.28 (04.73)	57.96
PIL-HR 40 (PO)	2.0 (3.58)	2.26 (04.61)	1.45 (0.610)	1.85 (02.95)	58.75
PIL-CR 10 (PO)	3.37 (10.88)	4.01 (15.58)	2.72 (06.40)	2.89 (07.87)	7.00
PIL-CR 20 (PO)	2.40 (5.27)	3.21 (09.86)	1.89 (03.09)	2.26 (04.63)	58.32
PIL-CR 40 (PO)	2.33 (4.96)	2.95 (08.24)	1.79 (02.72)	2.10 (03.91)	59.21
Diclofop methyl 750 (PO)	5.98 (35.30)	5.69 (31.91)	4.65 (21.19)	4.35 (18.42)	52.63
Diclofop methyl 1000 (PO)	5.34 (28.05)	4.97 (24.22)	4.20 (17.20)	3.80 (13.95)	53.95
Diclofop methyl 1250 (PO)	5.22 (26.84)	4.65 (21.21)	3.83 (14.22)	3.75 (13.58)	54.64
2,4-D 500 (PO)	4.29 (17.90)	4.15 (16.75)	3.01 (08.58)	3.07 (08.92)	53.25
Isoproturon 750 (PO)	6.27 (38.92)	6.51 (41.89)	5.09 (25.45)	4.97 (24.20)	50.42
Hand weeding 30 & 45 DAS	4.21 (17.26)	4.77 (22.31)	2.97 (08.53)	3.47 (11.59)	52.00
Weed free	0.71 (00.00)	0.71 (00.00)	0.71 (00.00)	0.71 (00.00)	59.95
Weedy	8.25 (67.61)	7.98 (63.28)	6.46 (41.26)	6.07 (36.42)	48.32
CD at 5%	**0.520**	**0.570**	**0.435**	**0.444**	**6.66**

* Values in parenthesis are original.

All the herbicides were applied as post emergence. The major weeds emerged were *Chenopodium album, Phalaris minor, Rumex dentata, Ipomea* sp.and *Physalis minima.* The herbicides PIL-HR and PIL-CR have been observed as very effective in controlling broadleaved weeds and *Phalaris minor*

WM-1-a : 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 season. Rice crop was taken successfully but the germination of soybean and maize crop failed due to unpresented excessive rain during entire season. The major weeds emerged out in rice crop were *Alternanthera sesillis, Echinochloa colonum, Commelina communis* and *Cyperus sp.*

, In the next rabi season, wheat and pea were taken. The major weeds during the season were observed as *Cichorium intybus, Chenopodium album, Chenopodium fisifolium.* The maximum density of *Chenopodium album* and *Chenopodium fisifolium* were observed in maize-pea cropping system, followed by soybean-pea cropping system. The predominance of *Cichorium intybus* remains static in rice-pea and maize-pea cropping system.

Table 4 : Influence of long term cropping sequence on emergence of weeds in *kharif* 1994.

	Cropping Sequence			
Treatments	**Rice-Wheat**	**Rice-Pea**	**Rice-Wheat**	**Rice-Pea**
Weed Species	**Rice**	**Rice**	**Rice**	**Rice**
	Weed population (no./m²)			
	AT 60 DAS		**AT HARVEST**	
Commelina communis	20.66	14.00	12.33	8.66
Alternanthera sessilis	61.33	41.00	42.00	29.00
Echinochloa colonum	23.66	16.66	18.00	11.00
Cyperus sp.	17.66	8.66	4.33	4.00
Others	3.33	5.00	2.00	2.66
Total	**126.64**	**85.32**	**78.65**	**55.32**

Table 5 : Influence of long term cropping sequence on emergence of weed in *kharif* 1994.

	Cropping Sequence			
Treatments	**Rice-Wheat**	**Rice-Pea**	**Rice-Wheat**	**Rice-Pea**
Characters	**Rice**	**Rice**	**Rice**	**Rice**
	Total weed count/m²		**Dry weight (g/m²)**	
At 60 DAS	126.64	85.32	68.45	52.45
At Harvest	78.66	55.32	56.33	32.81
Grain yield (q/ha)				
Weedy	6.62	7.75		
Weed free	19.65	23.25		

Table 6 : Influence of long term cropping sequence on emergence of weeds in *rabi* 1994-95.

	Weed population (no./m²)					
TREATMENTS	**Rice-Wheat**	**Rice-Pea**	**Soybean-Wheat**	**Soybean-Pea**	**Maize-Wheat**	**Maize-Pea**
Weed Species	**Wheat**	**Pea**	**Wheat**	**Pea**	**Wheat**	**Pea**
AT 60 DAS						
Cichorium intybus	2.33	10.66	0.66	16.00	3.33	9.00
Chenopodium album	10.66	6.00	30.66	44.66	18.66	1.33
Chenopodium figifolium	17.33	28.00	62.00	162.00	116.66	188.66
Medicago denticulata	0.00	0.00	0.00	0.00	0.66	0.00
Phalaris minor	0.00	2.00	0.00	0.00	0.66	0.00
Ipomea sp.	0.66	0.00	2.00	0.66	0.66	0.00
Alternanthera sessilis	0.66	3.00	0.66	1.33	2.00	10.66
Wild oat	0.00	0.00	0.00	0.33	0.00	0.00
Others	1.00	4.66	2.00	4.00	0.66	27.66
Total	**31.98**	**54.32**	**97.98**	**228.98**	**143.29**	**297.31**
AT HARVEST						
Cichorium intybus	1.33	12.00	1.00	13.66	2.00	5.33
Chenopodium album	7.00	4.00	20.66	22.66	8.33	34.66
Chenopodium figifolium	16.33	20.66	43.00	72.00	61.66	81.33
Medicago denticulata	0.00	0.00	0.00	0.33	0.00	0.00
Phalaris minor	0.00	1.33	0.66	1.00	0.00	2.00
Chrozofora	0.00	0.00	0.33	0.00	0.00	0.00
Ipomea sp.	0.00	0.00	0.66	1.33	0.00	0.00
Alternanthera sessilis	2.00	2.66	3.00	10.66	2.00	11.33
Others	2.00	4.66	2.66	13.33	4.00	9.33
Total	**28.66**	**45.31**	**71.97**	**134.97**	**77.99**	**143.98**

Table 7: Influence of long term cropping sequence on emergence of weeds in *rabi* 1994-95.

Weed population emergence (no./m²)						
Treatments	Rice-Wheat	Rice-Pea	Soybean-Wheat	Soybean-Pea	Maize-Wheat	Maize-Pea
Characters	Wheat	Pea	Wheat	Pea	Wheat	Pea
Total weed count/m²						
AT 60 DAS	31.98	54.32	97.98	228.98	143.29	297.31
AT HARVEST	28.66	45.31	71.97	134.97	77.99	143.98
		CD at 5% (60 DAS)	**32.617**			
		CD at 5% (Harvest)	**27.521**			
Dry weight (g/m²)						
AT 60 DAS	52.00	67.50	113.28	197.53	160.56	277.00
AT HARVEST	53.00	77.30	125.60	167.90	135.30	182.00
		CD at 5% (60 DAS)	**25.601**			
		CD at 5% (Harvest)	**23.300**			
Grain yield (q/ha)						
Weedy	55.31	13.96	57.09	11.35	54.37	11.30
Weed free	59.95	21.89	64.19	16.60	60.84	18.40
		CD at 5% (Wheat yield)	**0.921**			
		CD at 5% (Pea yield)	**0.620**			

WM-4-C : Effect of phosphate and weed control treatments on weeds in chickpea

A.N. Singh and V.M. Bhan

The experiment was laid out in split plot design with 3 replications to findout the effect of phosphate and weed control treatments on weeds in chickpea. The combination of treatment was planned by taking four level of P (0, 30, 60 and 90 Kg P_2O_5/ha) as main plot and five weed control treatments consisting of fluchloralin (1 kg/ha), pendimethalin (1 kg/ha) and sythoxydim (0.4 kg/ha) as PO alongwith weedy and weed free in subplot.

The crop responded to phosphate fertilization. With increasing level of phosphate, weed drymatter increased and it was double with 90 kg/ha P_2O_5 over 0 kg P_2O_5. Though the difference were nonsignificant. Grain yield increased with the increase in the level of P_2O_5. All the herbicides increased the grain yield over weedy check.

Table 8 : Effect of P level and weed management practices in chickpea.

Treatments (kg/ha)	Weed population (no./m²)	Total weed dry weight (g/m²)	Grain yield (q/ha)
Phosphorus Level			
0	4.58	3.01	16.41
	(20.48)	(8.56)	
30	304.7	93.52	19.33
	(22.44)	(11.89)	
60	604.3	53.82	20.21
	(18.42)	(14.09)	
90	904.8	93.91	21.41
	(23.41)	(14.79)	
CD at 5%	**NS**	**NS**	**NS**
Weed Control			
Basalin 1.0 (PPI)	4.12	3.53	20.22
	(16.47)	(11.96)	
Pendimethalin1.0 (PE)	4.33	3.42	21.55
	(18.25)	(11.20)	
Sythoxydim 0.4 (PO)	4.01	3.71	19.44
	(15.56)	(13.26)	
Weedy	5.76	4.98	15.20
	(32.67)	(24.30)	
Weed Free	0.71	0.71	24.55
	(0.00)	(0.00)	
CD at 5%	**0.43**	**0.33**	**2.27**

* Values in parenthesis are original.

WM-4-b : Crop-weed competition in Chickpea

A.N. Singh and V.M. Bhan

Studies on crop weed competition was carried out with the objective to observe the critical period of crop weed competition. Treatment connisted of weedy and weed free condition maintained at first 30, 60, 90 and 120 DAS and upto harvest. Sowing was done with 80 kg seed rate/ha at a row spacing of 23 cm. apart. Crop was irrigated at about 60 DAS. As prophalytic measures against *Heliothis armigera*. Two spraying of monochrotophos were made at flowering and at early pod formation stage. The experiment was laid out in RBD with three replications.

The predominant weeds infested the field were *Medicago sp., Cichorium intybus, Chenopodium album, Malachra sp.* found in chickpea. Grain yield of chickpea was reduced by 346 kg/ha when field was kept weed free upto 30 DAS as compared to the field kept weed free upto 60 DAS. Further increase in weed free period beyond 60 DAS. had no beneficial effect on grain yield. It was concluded that initial 60 days period was considered to be the critical period for keeping the crop weed free.

Table 9 : Weed parameters at various stages of crop growth as affected by crop-weed competition in chickpea.

Treatments	Weed population (no./m²)				Weed Dry wt. (g/m²)				Grain yield (kg/ha)
	30 DAS	60 DAS	90 DAS	AH	30 DAS	60 DAS	90 DAS	AH	
Weed free for Ist									
30 DAS	0	72	81	68	0	11.2	26.8	32.7	1862
60 DAS	0	0	53	42	0	0	9.7	15.8	2028
90 DAS	0	0	0	24	0	0	0	6.7	2120
At harvest	0	0	0	0	0	0	0	0	2105
Weedy for Ist									
30 DAS	97	0	0	0	14.5	0	0	0	1827
60 DAS	105	158	0	0	21.3	41.3	0	0	1421
90 DAS	192	139	105	0	20.8	49.8	72.5	0	1242
At harvest	107	151	111	88	19.5	35.6	65.6	93.4	1210
CD AT 5%									**215**

* AH = At Harvest

WM-4-d : Efficacy of herbicides for weed control in mustard

A.N. Singh and V.M. Bhan

Weed control treatments (sethoxydim-PE at 200, 400 and 800 g/ha; post emergence @ 200 and 400 g/ha, tribenuron-PE @ 10 and 20 g/ha fluchloralin PPI, pendimethalin-PE and isoproturon-PO each at 1.0 kg/ha weedy and weed free) were tested in a RBD with three replications. The crop was sown on 2nd Nov. 1994 in rows 45 cm. apart. Post emergence application was made at 30 DAS.

Predominant weeds were *Cichorium intybus, Medicago sativa, Chenopodium album, Cyperus rotundus* and *Paspelidium* sp. Total weed population and dry weight (g/m²) were reduced significantly with herbicidaltreatments. *Cichorium intybus* and *Medicago sativa* were not controlled by any of the herbicides. The maximum grain yield of mustard was recorded when plot was treated with sethoxydim PE (800 g)and Pendimethalin (1.0 kg/ha).

Table 10 : Efficiency of herbicides for weed control in mustard.

Treatments (g/ha)	Weed population no./m²		Weed dry wt. (g/m²)		Grain yield (q/ha)
	at 30 DAS	at 60 DAS	at 30 DAS	at 60 DAS	
Sethoxydim PE 200	5.85 (33.72)	6.68 (44.12)	3.95 (15.10)	6.13 (37.08)	16.18
Sethoxydim PE 400	5.48 (29.53)	6.55 (42.40)	4.12 (16.47)	6.02 (35.74)	18.45
Sethoxydim PE 800	4.74 (21.97)	6.03 (35.86)	3.11 (9.17)	5.68 (31.76)	22.05
Sethoxydim PO 200	4.18 (16.97)	6.35 (39.82)	3.68 (13.04)	6.23 (38.31)	18.15
Sethoxydim PO 400	4.60 (20.66)	5.76 (32.68)	3.88 (14.55)	6.15 (37.32)	19.50
Tribenuron PE 10	5.19 (29.64)	7.10 (49.91)	3.56 (12.17)	5.45 (29.90)	21.58
Tribenuron PE 20	5.37 (28.34)	5.97 (35.14)	3.41 (11.13)	5.11 (25.61)	20.06
Pendimethalin PE1000	5.46 (29.31)	6.28 (28.31)	3.65 (12.82)	5.28 (27.38)	23.05
Fluchloralin PPI 1000	6.37 (40.07)	6.86 (45.56)	3.24 (10.00)	5.69 (37.87)	19.95
Isoproturon PO 1000	5.41 (28.77)	7.44 (54.85)	3.38 (10.92)	6.13 (37.08)	16.50
Weedy	9.17 (83.59)	8.79 (76.76)	5.07 (25.20)	12.19 (148.10)	10.70
Weed Free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	23.62
CD at 5%	**1.42**	**1.27**	**1.11**	**1.53**	**5.88**

* Values in parenthesis are original.

WM-3-A-b : Influence of level of N and weed management in drilled rice

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

The effect of nitrogen fertilizers alongwith weed control treatments was studied in direct sown rice under upland condition. The experiment consisted of four level of Nitrogen (0, 40, 80 and 120 N kg/ha) as main plots and four weed control measures such as, butachlor 1.5 kg/ha, one hand weeding at 30 DAS, weed free and weedy check which were laid out in split plot design and replicated thrice. Half of nitrogen doze and 60 kg P_2O_5 and 40 kg K_2O/ha applied as basal and remaining nitrogen was topdressed in two equal splits at 30 and 60 DAS.

Dry matter of weeds and grain yield of crop increased significantly with the increase in the nitrogen level from 0 to 120 kg/ha. Weed dry weight increased upto 65 DAS but it declined at harvest. The highest grain yield was noted with 120 kg/ha nitrogen level followed by 80 kg/ha. Amongst the weed management treatments, lowest weed dry weight was noted with weed free situation as compaired to one hand weeding 30 DAS (12.23 q/ha), butachlor (11.58 q/ha) and weedy (9.43 q/ha).

The predominant weeds in the field were *Alternanthera sessillis, Commelena communis* and *Caesulia axillaris* among the broad leaved weeds and *E. colonum and Cyperus iria* in grasses and sedges, respectively.

The grain yield of rice also increased significantly when the level of N increased from 0 kg N to 120 Kg N/ha.

Table 11 : Influence of level of N and Weed Management in drilled rice.

Treatments (kg/ha)	Dry weight (g/m²) at 25 DAS	at 65 DAS	at Harvest	Grain yield (kg/ha)
Nitrogen level (kg/ha)				
0	2.66 (6.57)	4.58 (20.48)	4.29(17.90)	7.72
40	3.34(10.66)	6.40(40.46)	5.97(35.14)	11.45
80	3.69(13.12)	7.23(51.77)	6.56(42.53)	14.09
120	4.18(16.97)	10.50(109.95)	7.13(50.34)	16.22
Weed Control				
Butachlor 1.5	5.07(25.20)	9.28(85.62)	7.66(58.18)	11.58
One HW at 30 DAS	3.86(14.40)	5.44(29.09)	7.63(57.72)	12.23
Weedy	4.23(17.39)	13.29(176.12)	7.94(62.54)	9.43
Weed free	0.71(00.00)	0.71(00.00)	0.71(00.00)	16.43

* Values in parenthesis are original.

WM-3-A-c : Effect of organic and inorganic manuring and weed management in direct seeded rice

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

This experiment was conducted to study the effect of organic and inorganic manuring on weed flora of drilled rice. Four levels of nitrogen (0, 40, 80 and 120 Kg N/ha) supplied through urea and FYM were combined with preemergence application of butachlor @ 1.5 Kg/ha weed free and unweeded check in RBD replicated three times.

Butachlor significantly reduced weed dry matter as compared to control. The predominant weeds such as *Alternanthera sessilis* and *Caesulia axillaris* among broadleaved weeds and in grasses *Echinochloa colonum* whereas in sedges, *Cyperus iria* were observed. The population of weeds differed significantly when N applied through FYM. The drymatter of weed also increased with the application of FYM weed drymatter (g/m^2) also increased with increasing level of N/ha. The highest drymatter of weed was recorded with 120 kg N/ha treated plots. The grain yield of rice increased with increasing level of N through urea and FYM.

Table 12 : Influence of organic and inorganic manuring on the emergence and growth pattern of weed flora in drilled rice.

Urea+FYM+WCT (kg/ha)	Weed dry wt. (g/m^2)			Grain yield (q/ha)
	at 35 DAS	at 60 DAS	at harvest	
0+0+Buta (PE)	2.53 (5.90)	7.42 (55.30)	7.60 (57.26)	7.69
0+0+WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	11.57
0+0+Weedy	3.91 (14.79)	8.89 (78.53)	10.07 (100.90)	5.68
40+No FYM+Buta (PE)	3.24 (9.99)	6.78 (42.79)	8.31 (68.57)	10.44
40+No FYM+WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	16.06
40+No FYM+Weedy	4.05 (15.90)	10.77 (115.49)	11.00 (120.50)	9.54
40+40+Buta (PE)	3.75 (13.56)	10.25 (104.56)	8.13 (65.59)	9.79
40+40+WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	17.97
40+40+Weedy	5.11 (25.61)	11.88 (140.63)	10.18 (103.13)	9.39

Urea+FYM+WCT (kg/ha)	Weed dry wt. (g/m²)			Grain yield (q/ha)
	at 35 DAS	at 60 DAS	at harvest	
40+80+Buta (PE)	3.76 (13.64)	10.43 (108.28)	10.12 (101.90)	10.64
40+80+WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	10.69
40+80+Weedy	5.48 (29.53)	12.41 (153.51)	11.35 (128.32)	9.52
0+40+Buta (PE)	2.85 (7.62)	5.97 (35.14)	8.10 (65.11)	12.14
0+40+WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	16.18
0+40+Weedy	3.93 (10.99)	8.09 (64.94)	10.15 (102.52)	8.11
80+40+Buta (PE)	3.82 (14.09)	8.79 (76.76)	9.08 (81.94)	14.74
80+40+WF	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	22.25
80+40+Weedy	4.37 (18.60)	11.13 (123.38)	9.50 (89.75)	10.08
CD at 5%	**1.10**	**2.82**	**1.83**	**2.80**

* Values in parenthesis are original.

WM-3-A-d : 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 randomized block design with treatments such as black and transparent polythene, straw of wheat, chickpea and mustard with herbicide butachlor 1.5 kg/ha, one hand weeding at 30 DAS alongwith weed free and unweeded check replicated thrice. The crop was fertilized with 100 kg N/ha and 60 kg P_2O_5.

The highest weed drymatter was noted under weedy check condition with which mustard straw treatment and butachlor. The lowest weed drymatter was recorded under weed free condition. While the black and transparent polythene,wheat straw and hand weeding 30 DAS were atpar to each other regarding weed biomass.

The maximum grain yield of drilled rice was obtained with weed free situation i.e. 19.99

q/ha followed by transparent and black polythene treatment.

Table 13 : Effect of mulching on the patteren of weed flora emergence in direct seeded rice.

Treatments (kg/ha)	Weed dry wt. (g/m^2)			Grain yield (q/ha)
	at 30 DAS	at 65 DAS	at harvest	
Black Polythene	5.07 (25.20)*	5.89 (34.19)	7.92 (62.23)	18.44
Transparent Polythene	4.63 (20.94)	7.33 (53.23)	8.44 (71.56)	19.13
Wheat Straw	5.08 (23.31)	9.05 (81.40)	9.87 (96.92)	14.40
Mustard Straw	7.02 (48.78)	12.97 (167.72)	9.89 (97.31)	15.59
Chickpea Straw	6.887.11 (46.83)	10.22 (50.05)	11.53 (103.95)	
Butachlor 1.5 (PE)	5.90 (34.31)	12.78 (162.37)	12.37 (152.52)	12.97
One HW 30 DAS	4.06 (15.98)	11.24 (125.84)	9.05 (81.40)	15.64
Weedy	7.55 (56.50)	15.79 (248.82)	14.18 (200.57)	11.24
Weed Free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	19.99
CD at 5%	**1.08**	**3.29**	**3.24**	**2.54**

* Values in parenthesis are original.

WM-6-a : Effect of animl manure input on the emergence of weeds and their management.

V.P. Singh, Khajanchilal and V.M. Bhan

The field 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 nutrients (of which 50% is supplied through FYM and 50% through fertilizers). T3 (conventional method i.e. recommended dose nutrients supplied through fertilizers), T4 (recommended dose of nutrients supplied through FYM only), along with sub reatment *viz* weedy, weed free and herbicides as per crops. The treatments were replicated thrice in factorial randomised block design. The diverse rotations were soybean-wheat and maize-pea.

In both diverse rotation i.e. Soybean-wheat and Maize-pea the *kharif* experimental crops could not be sown because of heavy and continous rainfall. In soybean-wheat system, *Chenopodium album, C. fisifolium, Cichorium intybus, Medicago denticulata, Trifolium flagiferum* and *Anagalis arvensis* were dominant weed flora in wheat. The weed population, wed dry matter production and grain yield were significantly influenced with farming system . The highest weed population was recorded with T2 where as the highest weed dry matter with T3 at both the crop growth stages. The highest grain yield (4920.02 kg/ha) was recorded with T3 which was significantly higher over rest of the treatments.

Weed caused 20.90% reduction in grain yield of wheat. Application of isoproturon significantly reduced the weed population and weed dry matter production at both crop growth stages.

In maize-pea rotation, *Chenopodium album, C. fisifolium* and *Cichorium intybus* were dominant weeds in pea. It revealed that farming system significantly influenced the weed population, weed dry matter production and grain yield. The highest weed population (136.40 and 122.93/m^2) and weed dry matter (6.31 and 17.14 g/m^2) were recorded with T4 at 30 and 60 DAS, respectively. Which was significantly higher over rest treatments. The farming system also influenced the grain yield. The highest grain yield (1973.16 kg/ha) of pea was recorded with T3 being at par with T2 but significantly higher over T1 and T4.

Application of pendimethalin @ 1.25 kg/ha in pea significantly reduced the weed population and weed dry matter production and increased the grain yield by 13.74%. The presence of weeds throughout growing season caused 29.60% reduction in grain yield.

Table 14 :Influence of organic farming system on weed population, weed dry matter and grain yield of Pea in Maize-pea rotation

Treatments	Weed population (no./m²) at 30 DAS	Weed population (no./m²) at 60 DAS	Weed dry wt. (g/m²) at 30 DAS	Weed dry wt. (g/m²) at 60 DAS	Grain Yield (kg/ha)
Organic farming system					
T1	9.40	7.47	1.76	3.55	1808.33
	(87.86)*	(55.30)	(2.60)	(12.10)	
T2	8.47	8.23	2.09	3.92	1944.90
	(71.24)	(67.23)	(3.87)	(14.87)	
T3	9.47	8.43	2.17	4.18	1973.16
	(89.18)	(70.56)	(4.21)	(16.97)	
T4	11.70	11.11	2.61	4.20	1862.04
	(136.40)	(122.93)	(6.31)	(17.14)	
CD at 5%	**0.40**	**0.39**	**0.20**	**0.27**	**89.81**
Weed Control					
Weedy	18.87	17.26	3.65	6.32	1589.93
	(355.58)	(297.41)	(12.82)	(39.44)	
Weed free	0.71	0.71	0.71	0.71	2258.33
	(0.00)	(0.00)	(0.00)	(0.00)	
Pendimethalin (PE)	9.69	8.46	2.11	4.85	1843.06
1.5 kg/ha	(93.40)	(71.07)	(3.95)	(23.02)	
CD at 5%	**0.35**	**0.34**	**0.18**	**0.23**	**77.78**

* Values in parenthesis are original.

Table 15 :Influence of organic farming system on weed population/m², weed dry matter(g/m²) and grain yield of Wheat in Soybean-wheat rotation

Treatments	Weed population (no./m²) at 30 DAS	Weed population (no./m²) at 60 DAS	Weed dry wt. (g/m²) at 30 DAS	Weed dry wt. (g/m²) at 60 DAS	Grain Yield (kg/ha)
Organic Farming system					
T1	7.44	6.95	1.41	3.29	2837.44
	(54.85)*	(47.80)	(1.49)	(10.32)	
T2	8.32	7.49	1.56	3.24	3763.42
	(68.72)	(55.60)	(1.93)	(10.00)	
T3	7.35	5.77	1.60	3.89	4920.82
	(53.52)	(32.79)	(2.06)	(14.63)	
T4	7.88	5.99	1.53	3.47	3337.97
	(61.59)	(35.38)	(1.84)	(11.54)	
CD at 5%	**0.43**	**0.46**	**NS**	**0.18**	**190.70**
Weed Control					
Weedy	15.41	13.51	2.42	6.20	3294.40
	(236.97)	(182.02)	(5.36)	(37.94)	
Weed free	0.71	0.71	0.71	0.71	4164.92
	(0.00)	(0.00)	(0.00)	(0.00)	
Isoproturon (PO)	7.08	5.43	1.45	3.51	3685.42
1.0 kg/ha	(49.63)	(28.98)	(1.60)	(11.82)	
CD at 5%	**0.38**	**0.40**	**0.18**	**0.15**	**165.15**

* Values in parenthesis are original.

WM-5-b : Study on the effect of soybean based cropping intensity on distribu tion of weed flora.

V.P. Singh and V.M. Bhan

The field experiment was conducted to findout the effect of cropping intensity on the distribution of weed flora and their control in different cropping system. The treatments were replicated thrice in split plot design.

During **kharif** season, the experiment crop could not be sown due to heavy and

continuous rain. The experimental field was mainly infested with *Chenopodium spp., Cichorium intybus, Medicago denticulata* and *Phalaris minor* during *rabi* season. In soybean-Fallow (100% CI), the weed density and weed dry weight were more in preceding weed free plot followed by herbicide treated and weedy plots.

It revealed that different cropping intensity system significantly influenced the weed population/m², weed dry matter (g/m²) and grain yield. The lowest weed density and weed dry matter were recorded with Fallow-wheat (100% CI) system at both the crop growth stages. The highest soybean equivalent grain yield (2363.98 kg/ha) was also recorded with Fallow-wheat (100% CI) system which was significantly higher over 300% and 200% cropping intensity system.

The presence of weeds throughout growing season caused 29.81% reduction in grain yield. Application of isoproturon @ 1.0 kg/ha in wheat and mustard significantly reduced the weed density and weed dry matter and increased grain yield by 19.60%.

Table 16 :Effect of soybean based cropping intensity system on weed population, weed dry weight and soybean equivalent grain yield

Treatments	Weed population (no./m²)		Weed dry wt. (g/m²)		Soybean equivalent Grain Yield (kg/ha)
	at 30 DAS	at 60 DAS	at 30 DAS	at 60 DAS	
Cropping intensity					
Soybean-Wheat (200%)	10.03 (100.10)*	8.43 (70.56)	2.23 (4.47)	4.66 (21.22)	2167.37
Soybean-Mustard-Moong (300%)	7.85 (61.12)	5.65 (31.42)	2.82 (7.45)	5.52 (28.88)	1519.58
Soybean-Fallow (100%)	-	-	-	-	-
Fallow-Wheat (100%)	6.53 (42.14)	5.59 (30.75)	2.00 (3.50)	3.64 (12.75)	2363.98
CD at 5%	**0.85**	**0.86**	**0.46**	**0.53**	**156.51**
Weed Control					
Weedy	17.31 (299.14)	13.47 (180.94)	4.14 (16.89	7.63 (57.72)	1649.47
Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	2349.82
Herbicide	6.40 (40.46)	5.49 (29.64)	2.17 (4.21)	5.38 (28.44)	2051.65
CD at 5%	**0.80**	**0.51**	**0.32**	**0.47**	**141.53**

* Values in parenthesis are original.

WM-5-b : Study on the effect of rice based cropping on distribution of weed flora.

V.P. Singh and V.M. Bhan

Echinochloa spp., Commelina communis and *Aeschynomen rugosum* during *kharif* season and *Chenopodium* spp, *Phalaris minor, Cichorium* sp. and *Medicago denticulata* were main dominant weed flora during *rabi* season During *kharif* season in fallow-wheat (100% CI) there was no difference in weed density in weedy, weed free and herbicide treated plots. However in Rice-Fallow (100% CI) the weed density was more in proceeding weedy plot followed by weed free and herbicide treated plots during *rabi* season.

Cropping intensity system influenced the weed dry matter only during *kharif* season and weed population and weed dry matter at 30 DAS during *rabi* season. During *kharif* season, the lowest weed dry matter was recorded with Rice-Fallow (100% CI) which was significantly lower than 200% and 300% cropping intensity system. While *rabi* season, the lowest weed population and weed dry matter production were recorded with Rice-Wheat (200% CI). Different cropping intensity system also significantly influenced the grain yield during both season. The highest grain yield was recorded with Rice-Fallow (100% CI) during *Kharif* season and Rice-wheat (200% CI) during *rabi* season.

Table 17 :Effect of Rice based cropping intensity system on weed population, weeddry weight and grain yield of Rice

	Weed population (no./m²) at			Weed dry wt.(g/m²)at			Grain Yield
Treatments	**30 DAS**	**60 DAS**	**Harvest**	**30 DAS**	**60 DAS**	**Harvest**	**(kg/ha)**
Cropping intensity							
Rice-Wheat(200%)	4.68 (21.40)*	4.32 (18.16)	3.67 (12.97)	4.51 (19.84)	7.32 (53.08)	8.01 (63.66)	5089.50
Rice-Mustard-Moong (300%)	4.71 (21.68)	3.98 (15.34)	3.54 (12.03)	5.32 (27.80)	7.14 (50.48)	8.38 (69.71)	4849.90
Rice-Fallow (100%)	4.62 (20.84)	3.91 (14.79)	3.30 (10.39)	3.94 (15.02)	5.93 (34.67)	8.19 (66.58)	5219.40
Fallow-Wheat(100%)	-	-	-	-	-	-	
CD at 5%	**NS**	**NS**	**NS**	**0.51**	**0.60**	**NS**	**218.90**
Weed Control							
Weedy	7.84 (60.97)	6.40 (40.46)	5.87 (33.96)	7.16 (50.77)	11.04 (121.38)	14.36 (205.71)	4254.20
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)	5867.40
Butachlor (PE) 1.5 kg/ha	5.46 (29.31)	5.11 (25.61)	3.91 (14.79)	5.90 (34.31)	8.64 (74.15)	9.51 (89.94)	5037.20
CD at 5%	**0.32**	**0.37**	**0.36**	**0.30**	**0.31**	**0.34**	**339.4**

* Values in parenthesis are original.

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 dry matter and increased the grain yield by 15.55 and 16.57 percent during *kharif* and *rabi* season, respectively.

Table 18 :Effect of Rice based cropping intensity system on weed population, weed dry weight and rice equivalent grain yield

Treatments	Weed population (no./m²)		Weed dry wt. (g/m²)		Rice equivalent Grain Yield (kg/ha)
	30 DAS	60 DAS	30 DAS	60 DAS	
Cropping intensity					
Rice-Wheat (200%)	7.60 (57.26)	7.78 (60.03)	1.55 (1.90)	4.19 (17.06)	4168.24
Rice-Mustard-Moong (300%)	8.00 (63.50)	6.67 (43.99)	1.75 (2.56)	4.41 (18.95)	3871.55
Rice-Fallow (100%)	-	-	-	-	-
Fallow-Wheat (100%)	11.09 (122.49)	8.31 (68.56)	2.28 (4.70)	4.84 (22.93)	3806.53
CD at 5%	**0.70 NS**	**0.43**	**NS**	**256.10**	
Weed Control Treatments					
Weedy	18.00 (323.50)	15.94 (253.58)	2.99 (8.44)	7.68 (58.48)	3344.01
Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	4493.95
Herbicide	7.98 (63.18)	6.12 (36.95)	1.87 (3.00)	5.05 (25.00)	4008.36
CD at 5%	**0.73**	**1.54**	**0.25**	**0.31**	**138.51**

* Values in parenthesis are original.

WM-7-c : Competitive behaviour of pea cultivars with associated weeds

J.S. Mishra and V.M. Bhan

The experiment was conducted with the objective to evaluate the suppressing effect of pea varieties on weeds in conection with weed control treatments. The dominant weed flora was *Chenopodium ablum, Cichorium intybus* and *Vicia sativa* it is clear from the table that weed population, weed dry matter and grain yield were significantly influenced by the varieties. Minimum weed dry matter and maximum grain yield of pea were recorded with the

variety JP 88-5 because of the fast growth habit which ultimately suppressed the weeds better than the **CV** JM-1. weeds caused 28.7% reduction in grain yield of pea. Maximum grain yield of 2798 kg/ha was recorded in weed free plot which was atpart with fluchloralin 1.0 kg/ha (2602 kg/ha) and Handweeding 30 DAS (2586 kg/ha). Pendimethalin applied @ 1.0 kg/ha could not control the ***Cichorium intybus*** (Table - 19).

Table-19 : Effect of varieties and weed control in peas

Treatments	Weed population (no./m²) at 60 DAS	Weed dry weight (g/m²) at 60 DAS	Grain yield (kg/ha)
Varieties			
JM-1	9.89 (97.3)	5.98 (35.3)	1917
JP-885	8.33 (68.9)	4.36 (18.5)	3043
CD (P=0.05)	**0.56**	**1.44**	**278**
Weed Control (kg/ha)			
Weedy	12.89 (165.6)	7.00 (48.5)	1994
Weed free	0.71 (0.00)	0.71 (0.00)	2798
Fluchloralin 1.0 PPI	10.47 (109.1)	6.39 (40.3)	2602
Pendimethalin 1.0 PE	11.70 (136.4)	6.78 (45.5)	2422
HW at 30 DAS	9.74 (94.4)	4.98 (24.3)	2586
CD (P=0.05)	**1.05**	**0.61**	**228**

* Values in parenthesis are orignial

WM-7-b-i : Studies on nitrogen use economy through weed control in rajmash.

J.S. Mishra, Khazanchilal and V.M. Bhan

Chenopodium album and *Cichorium intybus* were the major weeds which caused 50 percent reduction in the grain yield of rajmash. Increasing levels of nitrogen from 0 to 80 kg/ha significantly increased weed population, however, it declined significantly at 120 kg N/ha. the weed drymatter at 60 DAS was not influenced by the increasing levels to nitrogen.

The highest grain yield (1015 kg/ha) was recorded with 120 kg/ha followed by 80 kg N/ha (974 kg/ha). Amongst the weed control measures; minimum weed dry matter was recorded with Pendimethalin (1.0kg/ha) followed by hand weeding at 30 DAS. Maximum grain yield was obtained from weed free plot (1061 kg/ha) followed by pendimethalin at 1.0 kg/ha (824 kg/ha).

Table-20 : Effect of nitrogen levels and weed control on weeds and yield of rajmash

Treatments	Weed population (no./m²) at 60 DAS		Weed dry weight (g/m²) at 60 DAS		Grain yield (kg/ha)
N-levels (kg/ha)					
0	6.14	(37.2)	5.17	(26.2)	570
40	6.44	(41.0)	5.53	(30.1)	865
80	7.37	(53.8)	5.65	(31.4)	974
120	6.85	(46.4)	5.59	(30.7)	1015
CD at 5%	**0.49**		**NS**		**111**
Weed control					
Weedy	9.40	(87.9)	8.47	(71.2)	557
Weed free	0.71	(0.0)	0.71	(0.0)	1061
Pendi. 1.0 Kg/ha PE	7.19	(51.2)	6.28	(38.9)	824
HW at 30 DAS	8.50	(71.8)	6.49	(41.6)	782
CD at 5%	**0.57**		**0.47**		**87**

* Values in parenthesis are orignial

WM-7-b-ii : Studies on crop-weed competition in rajmash

J.S. Mishra, Khajanchilal and V.M. Bhan

This experiment was conducted with the aim to findout the critical period for crop-weed competition. The field was found infested with *Chenopodium album* and *Vicia sativa* which caused 82% reduction in grain yield of rajmash. The highest weed population and its drymatter was recorded where the plots were weedy upto harvest followed by weedy upto 60 DAS and weed free upto first 15 DAS.

Grain yield of rajmash significantly increased from 30 DAS to 45 DAS as also indicated in fig... The highest grain yield was recorded with weedfree upto harvest (1176 kg/ha) followed by weed free upto 60 DAS (1124 kg/ha). Therefore, it may be concluded that initial 60 days weed free period for maximum yield of rajmash.

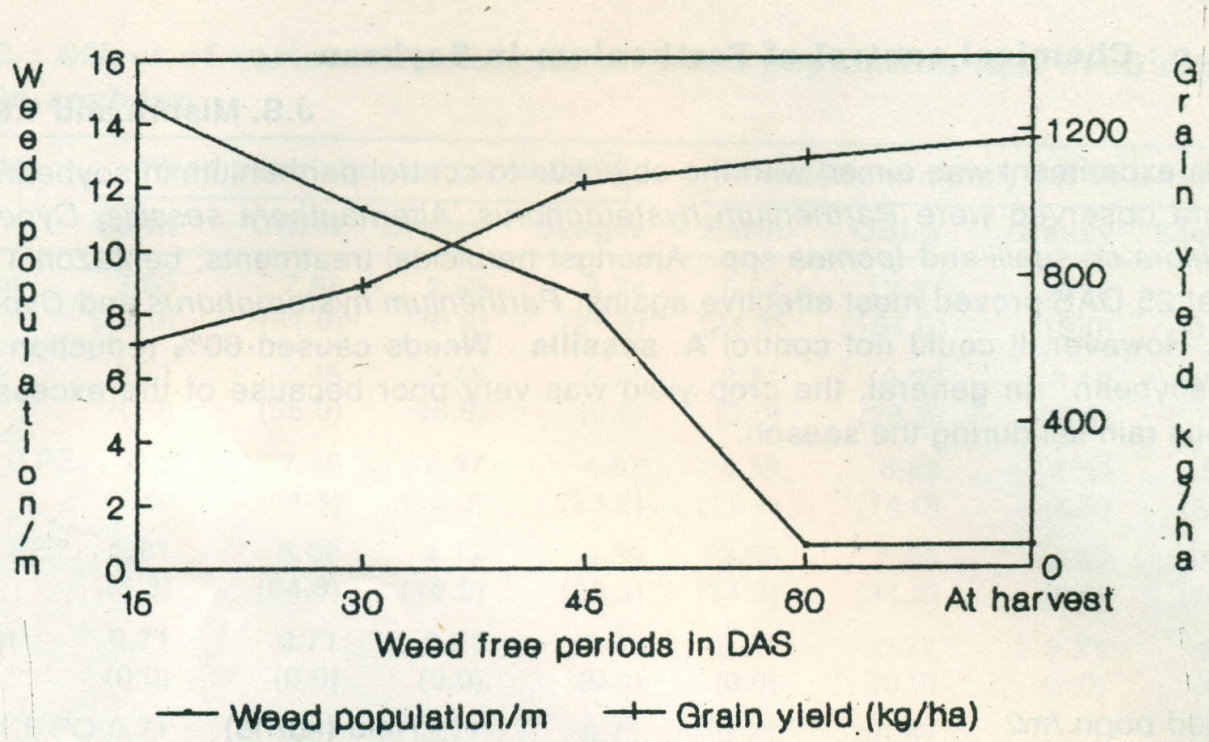

Fig.3 : Critical period for crop weed competition in rajmash.

Table 21 : Effect of crop-weed competition in rajmash

Treatments	Weed population (no./m²) at 60 DAS		Weed dry weight (g/m²) at 60 DAS		Grain yield (kg/ha)
Weedy upto first					
15 DAS	0.71	(0.0)	0.71	(0.0)	996
30 DAS	0.71	(0.0)	0.71	(0.0)	897
45 DAS	0.71	(0.0)	0.71	(0.0)	784
60 DAS	19.29	(371.6)	9.26	(85.2)	749
At harvest	26.23	(687.5)	12.33	(149.1)	296
Weed free upto					
15 DAS	14.66	(214.4)	9.41	(88.0)	619
30 DAS	11.29	(126.9)	3.32	(10.5)	777
45 DAS	8.50	(71.70)	2.79	(7.30)	1057
60 DAS	0.71	(0.00)	0.71	(0.00)	1124
At harvest	0.71	(0.00)	0.71	(0.00)	1176
CD (P=0.05)	**0.96**		**0.44**		**117**

* Values in parenthesis are orignial.

VM-3-A-c : Chemical control of Parthenium in Soybean

J.S. Mishra and V.M. Bhan

This experiment was aimed with the objective to control parthenium in soybean. Major weed flora observed were *Parthenium hysterophorus, Alternauthera sessilis, Cyperus iria, Echinochlora crusgalli* and *Ipomea* spp. Amongst herbicidal treatments, bentazon 1.5 kg/ha applied at 25 DAS proved most effective against *Parthenium hysterophorus* and *Cyperus iria* (Fig.). However, it could not control **A. sessilis**. Weeds caused 60% reduction in grain yield of soybean. In general, the crop yield was very poor because of the excessive and continuous rain fall during the season.

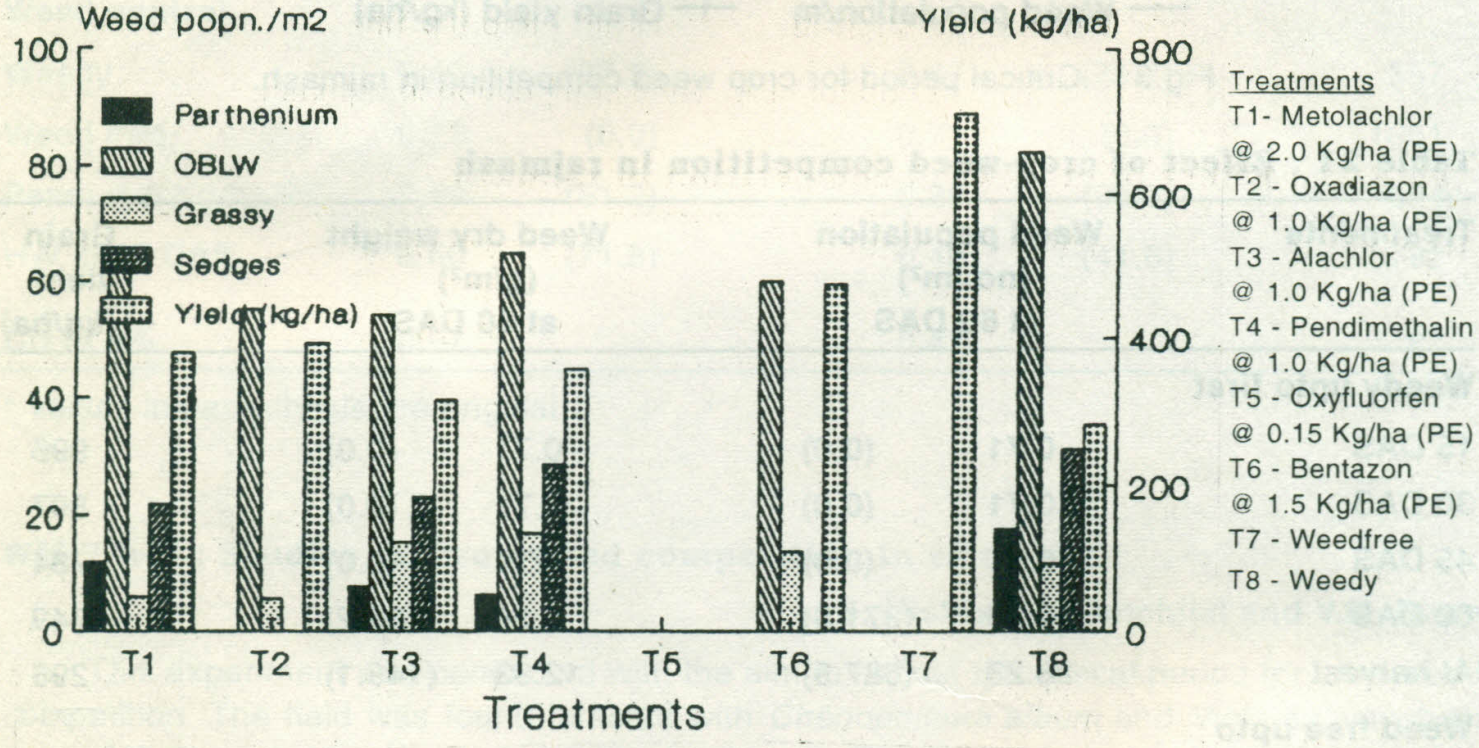

Fig.4 : Density of parthenium, OBLW, grasses, sedges and yield of soybean as influenced by herbicides.

Table 22 : Effect of various treatments on weed population and weed dry matter in soybean

Treatments	Weed population/m² (at 60 DAS)				Weed dry wt.(g/m²) (at 60 DAS)			
kg/ha	Parth	OBLW	Grassy	Sedges	Parth	OBLW	Grassy	Sedges
Metolachlor 2.0 PE	3.53 (12.0)	7.88 (61.6)	2.53 (5.9)	4.74 (21.9)	5.01 (24.6)	12.31 (151.0)	4.30 (18.0)	4.30 (18.0)
Oxadiazon 1.0 PE	0.71 (0.0)	7.45 (55.0)	2.48 (5.6)	0.71 (0.0)	0.71 (0.0)	5.36 (28.2)	3.12 (9.2)	0.71 (0.0)
Alachlor 1.0 PE	2.8 (7.6)	7.40 (54.3)	3.97 (15.3)	4.87 (23.2)	4.19 (17.1)	8.63 (74.0)	2.53 (5.9)	6.31 (39.3)
Pendi. 1.0 PE	2.61 (6.3)	8.08 (64.8)	4.17 (16.9)	5.39 (28.5)	3.85 (14.3)	5.63 (31.2)	3.02 (8.6)	8.90 (78.7)
Oxyfluorfen 0.15 PE	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Bentazon 1.5 PO	0.71 (0.0)	7.77 (59.9)	3.77 (13.7)	0.71 (0.0)	0.71 (0.0)	10.67 (113.3)	2.71 (6.80)	0.71 (0.0)
Weed free	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Weedy	4.25 (17.6)	9.09 (82.1)	3.50 (11.7)	5.63 (31.2)	5.70 (3.20)	15.91 (252.6)	2.53 (5.9)	13.2 (173.7)
CD at 5%	**0.28**	**1.67**	**0.73**	**0.42**	**0.63**	**2.79**	**0.59**	**0.76**

* Values in parenthesis are orignial

Table 23 : Effect of different treatments on yield attributes and yield of soybean

Treatments (kg/ha)	Pods/Plant	Seeds/Plant	1000 grains wt. (g)	Grain yield ** (kg/ha)
Metolachlor 2.0 PE	27.87	38.8	91.43	381
Oxadiazon 1.0 PE	29.57	37.5	92.10	394
Alachlor 1.0 PE	30.37	34.8	92.90	316
Pendimethalin 1.0 PE	27.50	33.4	92.00	358
Oxyfluorfen 0.15 PE *	-	-	-	-
Bentazon 1.5 PO	29.73	38.2	94.10	476
Weed free	34.60	57.9	100.83	712
Weedy	22.70	32.1	90.60	283
CD at 5%	**8.06**	**7.94**	**4.02**	**144**

* Delayed spraying (3-4 days after sowing) of oxyfluorfen caused complete mortality of the crop.

** Grain yields are poor because of the continuous high rainfall during cropping season.

VM-3-A-a : Studies on the biology of *Parthenium hysterophorus*

J.S. Mishra and V.M. Bhan

Growth and reproductive behaviour of Parthenium was studied in pots. Sowing of 50 parthenium seeds was done every month in pots starting from August 1993 to July 1994. Data on germination, plant height, leaf number, dry weight, flowers and seeds were taken at monthly intervals. Results revealed that the maximum seeds germinated within a week when they were sown in August and September however the germination process delayed by 2 to 3 weeks from October to January (for maximum germination). The seeds sown in February and March resulted in very poor germination and from April onwards the germination of Parthenium was almost nil. Plant height and dry weight/plant were maximum in August and September sowing and declined considerably with advancement of sowing dates. maximum flowers and seeds/plant were also recorded in August and September sowing.

VM-3-A-b : Chemical control of Parthenium in noncropped areas

J.S. Mishra and V.M. Bhan

An experiment was conducted with the objective to control the parthenium, a problem of noncropped situation through chemicals. For the study, various herbicides viz. chlorimuron ethyl (20 & 40 g/ha), metsulfuron methyl (3.5 & 4.5), 2,4-DEE (1.5 & 2.0 kg/ha), glyphosate (1.0 & 1.5 kg/ha), atrazine (1.0 & 1.5 kg/ha) were used with control treatment. Results revealed that all the herbicides except atrazine were found quite effective in controlling Parthenium. Metsulfaron (3.5 and 4.5 g/ha) and chlorimumron at 20 Kg/ha, 2,4-D at 2.0 Kg/ha and glyphosate 1.5 kg/ha resulted in 67, 91, 33, 47 and 97% control respectively at 15 DAS spray. However, at 30 DAS, all the herbicides except atrazine gave complete killing of parthenium.

Table 24 : Effect of different treatments on growth and development of *Parthenium* (1994)

Herbicidal Treatments	Dose/ha	Plant height (cm) before spray	Leaves per plant before spray	Percent* mortality 15 DAS	30 DAS	Dry weight (g/plant) before spray	at 30 DAS	Branches per plant	Flowers /plant	Seeds /flower	Seeds /plant
Chlorimuron ethyl	20g	34.3	8.3	35.0 (32.9)	90 (100)	4.7	1.9	-	-	-	-
Chlorimuron ethyl	40g	36.2	9.9	43.1 (46.7)	90 (100)	4.7	1.4	-	-	-	-
Metsulfuron methyl	3.5g	36.4	8.9	55.0 (67.1)	90.4 (100)	62.1	- -	- -	- -	- -	- -
Metsulfuron methyl	4.5g	33.4	9.1	72.3 (90.7)	90.4 (100)	1.7	-	-	-	-	-
2,4-DEE	1.5kg	33.4	8.7	28.8 (23.2)	77.7 (95.5)	4.7 -	2.1 -	- -	- -	- -	- -
2,4-DEE	2.0kg	33.3	9.4	43.1 (46.7)	90.4 (100)	1.6	-	-	-	-	-
Glyphosate	1.0kg	32.7	8.8	37.2 (36.5)	81.1 (97.6)	5.0	2.2	-	-	-	-
Glyphosate	1.5kg	33.1	8.9	81.1 (97.6)	90 (100)	4.8	1.7	-	-	-	-
Atrazine	1.0kg	33.1	8.8	0 (0)	0 (0)	4.9	7.9	10.5	138.8	2.90	421.8
Atrazine	1.5kg	34.7	9.2	0 (0)	0 (0)	4.7	7.5	8.4	89.5	2.68	247.4
Control	-	33.9	9.6	0 (0)	0 (0)	4.5	9.4	11.3	468.4	3.62	1700.4
CD at 5%		**NS**	**NS**	**14.0**	**9.4**	**NS**	**0.6**	-	-	-	-

* Values in parenthesis are original

** All the herbicide were applied as post emergence.

WM-7-a-i : Study on the biology of *Vicia sativa*

J.S. Mishra and V.M. Bhan

Experiment was conducted during winter season (1993-94) to findout the effect of environmental factors on the emergence, growth and reproductive behaviour of Vicia sativa. It was sown on Sept. 15 and 30; October 15 & 30; Nov. 14 and 29; Dec. 14 and 29, 1993. Results revealed that minimum seeedling emergence and maximum plant dry weight of *V. sativa* was observed from 15 sept. sowing. Later data resulted marked decline in plant dry weight due to decrease in plant growth in terms of plant height, leaf number and branches. 50% flowering, number of plots, seeds and seed weight per plant was also reduced due to delay in sowing *V. sativa* sown in sept. and Oct. took 120 days for whereas sown after 14 Nov. completed their life cycles within 90 days.

Table 25: Effect of different dates of sowing on germination, growth and reproductive attributes of *Vicia sativa*.

Dates of sowing	Germination (%) at 30 DAS	Plant ht. (cm)	Main branches /plant	Days to 50% flower-ing	No. of pods/ plant	No.of seed/ pod	No. of seeds/ plant	1000 seed wt. (g)	Seed wt/ plant (g)
15 Sept.	33.47 (30.41)	47.67	5.67	93.37	20.67	6.87	124.67	20.67	2.60
30 Sept.	61.75 (77.60)	51.33	4.33	93.00	17.00	6.67	116.67	20.83	2.40
15 Oct.	70.54 (88.9)	39.33	4.00	81.67	16.33	6.61	95.00	19.67	1.88
30 Oct.	65.77 (83.16)	36.33	3.33	80.00	12.00	6.27	75.67	20.33	1.52
14 Nov.	62.27 (82.5)	31.00	3.33	73.33	10.67	6.00	59.00	19.17	1.02
29 Nov.	65.42 (82.70)	25.50	3.00	70.33	6.67	6.67	38.33	19.00	0.60
14 Dec.	65.65 (89.6)	22.67	3.33	61.67	4.33	6.00	25.00	17.35	0.43
29 Dec.	71.19 (89.6)	21.67	2.67	60.00	3.33	5.00	16.00	17.05	0.28
CD at 5%	**10.8**	**10.38**	**2.03**	**6.49**	**4.66**	**0.58**	**9.02**	**1.42**	**0.17**

* Values in parenthesis are original

WM-7-a-i : Screening of herbicides against *Vicia sativa* in lentil

J.S. Mishra, V.P. Singh and V.M. Bhan

During 1994-95, nine herbicides with different doses viz; linuron (0.375 and 0.750 kg/ha), metribuzen (0.375 and 0.750 kg), oxadiazen (0.50 and 0.75 kg), oxyflourfen (0.20 and 0.30 Kg), bentazon (0.75 and 1.0 kg/ha), diuron (0.75 and 1.0 kg/ha), isoproturon (0.75 and 1.0 kg/ha) pendimethalin (1.5 kg/ha) and fluchloralin (1.5 kg/ha) were tested against *Vicia sativa* and isoproturon were applied at 20 DAS whereas fluchloralin was applied PPI. Results revealed that none of these could be followed suitable for effective control of *Vicia sativa* in lentil.

Table 26 : Effect of different herbicides on *Vicia sativa* and lentil

Treatments (Kg/ha)		Germination (%) Vicia	Lentil	Dry wt. of Vicia (g/m^2)	Grain wt. of Vicia (g/m^2)	Grain wt. of Lentil (g/m^2)
Linuron	0.375 PE	50.2	59.6	13.59	8.28	65.0
Linuron	0.750 PE	39.6	48.9	12.73	7.55	164.8
Metribuzin	0.375 PE	42.5	41.7	13.12	7.88	102.5
Metribuzin	0.70 PE	34.0	27.9	14.39	8.87	92.5
Oxadiazon	0.50 PE	51.4	60.1	12.75	7.65	132.5
Oxadiazon	0.75 PE	40.0	58.6	12.20	6.92	135.8
Oxyflourfen	0.20 PE	46.2	57.4	11.31	6.67	116.7
Oxyflourfen	0.30 PE	47.5	57.9	11.38	7.03	134.2
Bentazon	0.75 PE	42.3	63.1	13.35	7.66	49.2
Bentazon	1.00 PE	49.6	58.8	11.23	6.59	38.3
Diuron	0.75 PE	45.8	56.6	12.09	7.25	158.3
Diuron	1.00 PE	44.6	53.5	11.98	10.00	113.3
Isoproturon	0.75 PO	59.0	14.1	8.34	8.29	130.0
Isoproturon	1.00 PO	52.6	62.3	13.07	8.34	136.7
Pendimethalin	1.5 PE	31.7	36.2	12.62	7.33	75.5
Fluchloralin	1.5 PPI	35.6	46.5	12.00	7.14	113.3
Weed free		4.0	61.9	0.71	0.71	235.7
Weedy		52.0	62.0	12.13	7.28	117.5
CD at 5%		**6.0**	**6.9**	**2.31**	**1.18**	**18.9**

* Values on germination percentage were transformed by Arcsin transformation

** Values on dry wt. and grain wt. of Vicia were transferred by square foot transformation

WM-7-a-ii : Interaction of Vicia densities in lentil

J.S. Mishra, V.P. Singh and V.M. Bhan

Seven densities at Vicia ranged from O, 30, 60, 90, 120, 150 and 180 were trial to find out the effect of different densities on yield and yield attributes of lentil results revealed that increasing densities *Vicia sativa* from 0 to 180/m significantly reduced the grain yield of lentil. However, the difference in yield by increasing densities at Vicia/m2 from 90 to 180 were at par. The significant reduction in grain yield was obtained evenat 30 Vicia/m2. The dry weight of Vicia and yield of lentil both increased significantly with increasing levels of densities.

Table 27 : Interference of Vicia densities in lentil

Vicia densities (no./m²)	Branches per plant	Pods per plant	Grains per plant	Grain yield (g/m²)	Vicia dry biomass/ (g/m²)*	Grain wt. of vicia (g/m²)*
0	4.87	48.93	57.6	280	0.71	0.71
					(0.00)	(0.0)
30	4.27	32.60	40.5	237	12.26	7.67
					(149.8)	(58.3)
60	3.80	31.53	35.7	216	14.40	8.55
					(206.9)	(72.6)
90	3.53	23.53	28.3	193	16.03	9.06
					(256.5)	(81.6)
120	3.67	20.20	23.8	188	17.12	9.93
					(292.6)	(98.1)
150	3.73	19.20	21.1	186	16.03	9.93
					(256.5)	(98.1)
180	3.20	14.73	17.1	172	19.11	11.19
					(364.7)	(124.7)
CD at 5%	**1.17**	**4.59**	**7.0**	**36**	**1.72**	**0.76**

* Values in parenthesis are original

WM-9-a : Effect of nitrogen sources on floristic distribution of weeds and nitrogen use effeciency in rice-wheat cropping sequence

Khajanchilal, V.P. Singh and V.M. Bhan

The field experiment was carried out to findout how the nitrogen use efficiency and weed parameters are influenced in rice-wheat cropping sequence when a uniform dose of N @ 120 Kg/ha applied in transplanted rice but through different sources viz FYM, dhaincha green leaf manuring (GM) and urea and their combinations. The main treatments were urea (120 Kg/ha), FYM (120 Kg/ha), dhaincha GM (120 Kg/ha), FYM (60 Kg/ha), urea (60 Kg/ha) and the subtreatments were weedy, weed free and anilophos (0.4 Kg/ha), were replicated three times in split plot. During rabi, wheat crop was taken to study the residual effects of treatments applied in rice.

The dominant weed flora during *kharif* was *Echinochloa sp. Commelina sp., Caesulia sp.* and *Alternanthera sp.* While *Phalaris minor, Chenopodium album, Medicago sp.* and *Cichorium* intybus with wheat in rabi season. Results revealed that application of nitrogen @ 120 Kg/ha through urea significantly produced higher weed drymatter as compared to its applications thorugh FYM and dhaincha (Green) which were atpart to each other. Combination of two sources of nitrogen showed no consistent results regarding weed drymatter. Amongst weed central treatments, anilophos caused significant reduction in weed drymatter.

Grain yield of rice obtained with urea alone and its combination with FYM or green menuring (dhaincha) were at part but were significantly better than yields obtained with N-applied either FYM or dhaincha and their combination.

Residual effect of treatments applied in rice had no significant results on weed drymatter recorded at 60, 90 DAS and at harvest of wheat. Hewever, weed dry matter was slightly higher in case of urea and FYM at 30 DAS in comparision to other treatments. Herbicidal treatments applied in rice during Kharif could reduce weed growth only upto 60 DAS of wheat over weedy check. Application of N through two different sources in roce proved beneficial in terms of wheat grain yield as compared to application of N through single sources.

Table 28 : Effect of N sources on weed dry matter, grain and total dry matter yield of rice.

Treatments	Weed dry matter (g/m^2) at				Grain yield (Kg/ha)	Total dry matter (Kg/ha)
	30 DAS	45 DAS	90 DAS	Harvest		
Nitrogen sources (Kg/ha)						
U120	3.1	4.8	5.3	4.9	5397	12196
	(8.9)	(22.3)	(27.8)	(23.9)		
F120	2.7	3.5	4.3	4.2	5188	11504
	(6.7)	(11.7)	(17.8)	(16.9)		
D120	2.4	3.3	4.1	3.9	5301	11765
	(5.3)	(10.4)	(16.6)	(14.9)		
F60 U60	2.8	4.7	4.0	4.5	5524	12063
	(7.4)	(21.4)	(15.8)	(19.9)		
F60 D6	3.0	4.1	4.0	4.0	5257	11765
	(8.4)	(16.6)	(15.8)	(15.8)		
D60 U60	2.6	3.7	3.9	3.8	5448	12050
CD at 5%	**0.4**	**0.3**	**0.4**	**0.4**	**149**	**349**
Weed control						
Weedy	4.5	6.5	7.3	7.4	4968	10965
	(19.7)	(42.1)	(52.6)	(54.4)		
Anilophos 0.4 Kg/ha	3.1	4.8	4.8	4.6	5337	11891
	(8.9)	(22.6)	(22.6)	(20.4)		
Weed Free	0.7	0.7	0.7	0.7	5752	12815
	(0.0)	(0.0)	(0.0)	(0.0)		
CD at 5%	**0.2**	**0.1**	**0.3**	**0.3**	**83**	**178**

* F = Farm yard manure D= Dhaincha U = Urea

** Values in parenthesis are original

Table 29 : Residual effect of N sources on weed dry matter, grain and totla dry matter yield of wheat.

Treatments	Weed dry matter (g/m^2) at				Grain yield	Total dry matter
	30 DAS	45 DAS	90 DAS	Harvest	(Kg/ha)	(Kg/ha)
Nitrogen sources (Kg/ha)						
U120	3.6	6.4	10.5	10.1	4006	9100
	(12.5)	(40.3)	(110.4)	(101.9)		
F120	3.6	6.2	11.1	9.5	4077	9243
	(12.5)	(38.0)	(123.3)	(90.3)		
D120	3.3	6.4	11.1	10.0	4118	9271
	(10.7)	(40.4)	(122.9)	(100.3)		
F60 U6	3.2	6.4	10.9	10.1	4232	9323
	(9.7)	(40.4)	(117.7)	(102.1)		
F60 D6	3.1	6.3	10.8	10.2	4232	9480
	(9.4)	(38.9)	(115.6)	(103.9)		
D60 U60	3.2	6.3	10.9	10.3	4191	9349
	(9.5)	(38.9)	(119.2)	(106.2)		
CD at 5%	**0.2**	**NS**	**NS**	**NS**	**91**	**143**
Weed Control						
Weedy	3.7	6.6	11.3	10.6	4045	9143
	(13.0)	(42.7)	(126.3)	(111.4)		
Anilophose . 4 Kg/ha	3.3	6.3	10.9	9.9	4148	9313
	(10.3)	(39.3)	(117.9)	(97.5)		
Weed Free	3.1	6.1	10.5	9.7	4224	9427
	(8.9)	(36.5)	(110.1)	(93.6)		
CD at 5%	**0.1**	**0.2**	**0.5**	**0.9**	**54**	**105**

* F = Farm yard manure D = Dhaincha U = Urea

** Values in parenthesis are original

WM-9-b : Effect of time of nitrogen application on growth of weeds and fertil izer use efficiency in rice-wheat cropping sequence.

Khajanchilal, V.P. Singh and V.M. Bhan

This experiment was laid out with the objective to study the effect of split aplication of nitrogen on weeds fertilizer use efficiency and soil fertility in rice-wheat cropping sequence. For this purpose, a uniform dose of 120 Kg N/ha was aplied into 3 splots system, such as basal, 30 DAS (after first weding) and 45 DAS (after second weeding) giving total 15 treatment combinations rendomized in RBD design.

The dominant weed flora in rice was *Commelina sp., Caesulia sp. Cyperus sp. Echinochloa sp.* and *Alternanthera sp.* while in wheat, *Chenopodium album.*

The results revealed that basal application of nitrogen produced significantly higher weed drymatter in rice recorded at 30 and 45 DAS compared with no nitrogen application. The grain yield of paddy obtained with the treatments involving three splits was significantly higher in comparision to one split of N application. The total drymatter production of rice obtained either by two or three splits was at par but were significantly higher than single split application.

Table 30 : Effect of time of N application on weed dry matter grain yield and total dry matter yield of rice.

Treatments (Kg N/ha)			Weed dry matter (g/m²)			Grain yield (Kg/ha)	Total dry matter (Kg/ha)
			at 30 DAS	at 45 DAS	at Harvest		
Basal	**30 DAS**	**45 DAS**					
0	120	0	1.73 (2.49)	1.95 (3.29)	4.54 (20.11)	3905	10138
30	90	0	1.89 (3.09)	201 (3.53)	4.36 (18.48)	44005	11190
60	60	0	2.07 (3.80)	2.14 (4.07)	4.29 (17.91)	4286	10952
90	30	0	2.04 (3.65)	2.04 (3.65)	4.71 (21.69)	4138	10952
120	0	0	2.05 (3.69)	2.04 (3.65)	4.56 (20.29)	4143	10000
0	0	120	1.70 (2.40)	1.73 (2.50)	5.81 (33.23)	3833	9405
30	0	90	1.97 (3.40)	1.64 (2.19)	5.62 (31.04)	3905	10230
60	0	60	2.04 (3.65)	1.67 (2.29)	5.73 (32.38)	4333	11191
90	0	30	1.91 (3.15)	1.76 (2.60)	5.69 (31.91)	4571	11701
0	30	90	1.79 (2.70)	1.86 (2.94)	5.50 (29.78)	4524	11071
0	60	60	1.68 (2.33)	1.87 (2.99)	5.67 (31.64)	4214	10833
0	90	30	1.73 (2.40)	1.92 (3.18)	5.08 (25.30)	4238	10714
60	30	30	2.02 (3.56)	1.92 (3.20)	5.57 (30.49)	4619	10517
30	60	30	1.87 (3.00)	1.83 (2.86)	5.26 (26.11)	4688	11667
30	30	60	1.91 (3.17)	1.89 (3.06)	5.50 (29.71)	4786	11905
CD at 5%			**0.19**	**0.20**	**0.71**	**389**	**1152**

* Values in parenthesis are original

In wheat, application of 120 Nitrogen/ha as basal produced maximum and significantly higher weed dry matter recorded at 30 DAS of wheat compared over other reatments. The treatment effect was not significant in case of weed dry matter ricorded 45 DAS of wheat except treatment o, o, 120 Kg N/ha in which no nitrogen was applied till sampling date and produced significantly lower weed biomass.

Table 31 : Effect of time of N application on weed dry matter, grain yield and total dry matter yield of wheat.

Treatments (Kg N/ha)			Weed dry matter (g/m^2)			Grain yield (Kg/ha)	Total dry matter (Kg/ha)
			30 DAS	45 DAS	Harvest		
Basal	**30 DAS**	**45 DAS**					
0	120	0	1.25 (1.06)	1.00 (0.49)	2.02 (3.59)	4249	9616
30	90	0	1.30 (1.20)	1.01 (0.52)	1.96 (3.32)	4598	10432
60	60	0	1.37 (1.38)	1.01 (0.52)	2.04 (3.67)	4496	9957
90	30	0	1.42 (1.69)	1.08 (0.66)	2.01 (3.54)	4352	10552
120	0	0	1.53 (1.83)	1.03 (0.56)	1.88 (3.03)	4200	9577
0	0	120	1.26 (1.09)	0.93 (0.36)	1.94 (3.26)	3931	8454
30	0	90	1.31 (1.21)	1.01 (0.52)	2.07 (3.79)	4531	10129
60	0	60	1.40 (1.46)	1.05 (0.59)	2.03 (3.62)	4594	10069
90	0	30	1.38 (1.39)	1.06 (0.62)	1.96 (3.33)	4446	9621
0	30	90	1.28 (1.12)	1.00 (0.49)	2.03 (3.62)	4363	9715
0	60	60	1.25 (1.06)	1.06 (0.63)	1.99 (3.47)	4319	9703
0	90	30	1.21 (0.96)	1.03 (0.56)	2.05 (3.69)	4280	9410
60	30	30	1.35 (1.32)	1.05 (0.59)	2.01 (3.54)	4765	10326
30	60	30	1.33 (1.26)	1.09 (0.69)	1.94 (3.25)	4580	10129
30	30	60	1.26 (1.09)	1.063 (0.62)	2.06 (3.76)	4727	10468
CD at 5%			**0.15**	**0.11**	**-**	**534**	**1229**

* Values in parenthesis are original

WM-14-a : Studies on concentration gradient of isoproturon for the control of grassy and broad leaved weeds in wheat.

Anil Dixit, D. Swain and V.M. Bhan

The experiment conducted in rabi 1994-95 at NRCWS, Jabalpur. The objective of the experiment was to conduct research in developing suitable measures to overcome the problem of poor effect of isoproturon on Phalaris minor.

The data revealed that isproturon 1 Kg/ha in combination with 2, 4-D 0.5 Kg/ha applied at 30 DAS gave the least weed dry weight as well as minimum number of weed population.

As far as yield is concerned, isoproturon 1.25 Kg/ha gave the highest yield (50 q/ha) as compared to the other treatments and were at par with the said treatment. Heghest grain yield was recorded due to better weed control efficiency and higher crop dry matter production.

Table 32 : Effect of Isoproturon concentration on phalaris minor in wheat.

Treatment (Kg/ha)	Weed dry wt. g/m² at 60 DAS		Weed dry wt. g/m² at 90 DAS		Grain yield (q/ha)
IPU 0.50	3.92	(14.86)	7.75	(59.56)	41.50
IPU 0.75	3.39	(10.99)	6.83	(46.14)	43.00
IPU 1.00	3.17	(9.54)	6.58	(42.79)	49.00
IPU 1.25	2.61	(6.31)	6.12	(36.95)	50.00
IPU 1.50	2.36	(5.06)	5.99	(35.38)	49.00
IPU 0.75+2, 4-D 0.5 PO	2.23	(4.47)	5.38	(28.44)	47.16
IPU 1.00+2, 4-D 0.5 PO	2.04	(3.66)	5.15	(26.02)	48.03
Weed free	0.71	(0.00)	0.71	(0.00)	50.36
Weedy Check	4.98	(24.30)	10.08	(101.1)	30.16
CD at 5%	**0.45**		**0.74**		**2.87**

* Values in parenthesis are original

WM-14-b : Influence of isoproturon application for controlling *Phalaris minor* in wheat

Anil Dixit, D.Swain and V.M.Bhan

This experiment was conducted in rabi 1994-95. It was found that wherever the isoproturon was applied before irrigation the weed population and weed dry weight was less.

The data pertaining to weed dry weight revealed that isoproturon 1 Kg/ha (before irrigation) was the best treatment which gave the minimum dry wieght of weeds. Isoproturon applied just before irrigation yielded more as compared to its application at 30 DAS. It gave the highest yield (48.60 q/ha) as compared to the other weed control treatments and was at par with weed free plot. The population of Phalaris minor was significantly reduced by the application of isoproturon (before irrigation) compared with other treatments. The weed population and dry matter accumulation in the plots treated with pendimethalin were significantly higher than isoproturon 1 Kg/ha applied just before irrigation.

Table 33 :Effect of time of application of isoproturon concentration on *Phalaris minor* in wheat.

Treatments (Kg/ha)	Weed dry wt. g/m² at 60 DAS		at 90 DAS		Grain yield (q/ha)
IPU 0.50 (BI)	4.04	(51.82)	7.88	(61.59)	40.00
IPU 0.50 30 DAS	3.81	(14.01)	7.66	(58.17)	41.20
IPU 0.75 (BI)	3.32	(10.52)	6.41	(40.58)	44.60
IPU 0.75 30 DAS	3.75	(13.56)	6.71	(44.52)	43.00
IPU 1.00 (BI)	2.26	(4.60)	4.53	(20.02)	48.60
IPU 1.00 30 DAS	3.18	(9.61)	6.25	(38.56)	45.66
Pendi. 1 Kg/ha (PE)	3.39	(10.99)	6.56	(42.53)	41.70
Weed Free	0.71	(0.00)	0.71	(0.00)	50.00
Weed Check	5.24	(26.95)	9.72	(93.97)	29.60
CD at 5%	**0.46**		**0.76**		**3.98**

* Values in parenthesis are original

WM-14-d : Effect of isoproturon doses on the emergence and growth of Phalaris minor resistant biotypes

Anil Dixit, D.Swain and V.M. Bhan

Five resistant biotypes of Phalaris minor collected from different location of Punjab and Haryana. These biotypes were planted at 4 dates of sowing i.e. 15 Nov., 30 Nov., 15 December and 30 December under 3 levels of isoproturon i.e. 0 kg., and 2 kg/ha.

Table 34 : Pot culture experiment.

Resistance bio-types	Isoproturon dose			Isoproturon dose		
	0 kg	1 kg	2 kg	0 kg	1 kg	2 kg
	(Mortality %)			(Shoot weight)		
A	-	74.0	94.0	1.9	1.3	0.7
B	-	63.0	90.0	2.1	1.6	0.8
C	-	71.0	95.0	1.8	1.1	0.4
D	-	70.0	96.0	2.1	0.9	0.3
E	-	80.0	90.0	1.7	0.8	0.2
N	-	90.0	100.0	1.9	0.4	0.1
W	-	0.0	0.5	1.9	3.3	3.1

Data revealed that there was a resistance at 1 kg/ha but at 2 kg/ha the mortality percentage of *Phalaris minor* was 100. In early dates of sowing the mortality percentage is less as compared to later sowing. Mean of mortality percentage and shoot wt. of *Phalaris minor* in November sowing has been indicated in table. The mortality percentage varies from 64-70 among A, B and C biotypes. The shoot wt. was high in B type of resistance biotypes. This findings confirm the resistance occurring in N-W India region.

WM-14-C : Screening of herbicides against *Phalaris minor* in wheat.

Anil Dixit, D. Swain and V. M. Bhan

Six herbicides were tested against *Phalaris minor* in rabi 1994-95 at NRCWS, Jabalpur. The herbicides were isoproturon, pendimethalin, triallate, oxyflourfen, butachlor and alachlor of their three levels of doses.

The data revealed that isoproturon, triallate, oxyflourfen, butachlor and alachlor effected an excellent control of *Phalaris minor* at their medium level of dose and all are at per with each other. The oxyfluorfen at higher dose gave the least number of weed population and dry wt. of weeds. As far as yield is concerned the triallate and oxyfluorfen gave the highest yield as compared to all other treatments. At higher level of oxyflourfen there was an adverse effect on growth and was found stunted. Alachlor and butachlor gave an excellent control of *Phalaris minor* but gave poor control of *Chenopodium album.*

Table 35 : Screening of herbicides against Phalaris minor resistance in wheat.

Treatments (kg/ha)	Dry weight *P. minor* (g/m^2)		Grain yield (g/ha)
	at 60 DAS	at 90 DAS	
Isoproturon 0.75	3.46 (11.47)	6.47 (41.36)	40.66
Isoproturon 1.00	3.23 (9.93)	6.32 (39.44)	44.00
Isoproturon 1.50	2.68 (6.68)	5.95 (34.90)	49.00
Pendimethal in 0.75	3.25 (10.06)	6.35 (39.82)	44.00
Pendimethal in 1.50	3.11 (9.17)	6.22 (38.18)	47.00
Pendimethal in 2.00	3.07 (8.92)	6.07 (36.34)	48.00
Triallate 1.0 (PPI)	3.03 (8.68)	6.11 (36.83)	46.00
Triallate 1.5	2.63 (6.41)	5.65 (31.42)	51.00
Triallate 2.0	2.55 (6.00)	5.79 (33.02)	48.20
Oxyfluorfen 0.2	3.06 (8.86)	6.16 (37.44)	44.50
Oxyfluorfen 0.4	2.61 (6.31)	5.56 (30.41)	50.10
Oxyfluorfen 0.6	2.58 (6.15)	5.68 (31.76)	43.30
Butachlor 1.0	3.09 (9.04)	6.19 (37.81)	43.10
Butachlor 1.5	2.73 (6.95)	5.74 (32.44)	48.00
Butachlor 2.0	2.79 (7.28)	5.86 (33.83)	45.00
Alachlor 1.0	3.38 (10.92)	6.51 (41.88)	43.00
Alachlor 1.5	2.73 (6.95)	5.76 (32.67)	47.20
Alachlor 2.0	2.67 (6.62)	5.73 (32.33)	48.00
Weed Free	0.71 (0.00)	0.71 (0.00)	53.00
Weed Check	4.66 (21.21)	8.60 (73.46)	25.60
CD at 5 %	**0.34**	**0.58**	**6.20**

* Values in parenthesis are original

3.2 VEGETATION MANAGEMENT

VM -1-A : Survey and isolation of pathogens associated with Perthenium hysterophorus, Cyperus rotundus, Phalaris minor and Eichhornia crassipes.

L. P. Kauraw and V. M. Bhan

A survey was conducted from August 94 upto March 95 to the adjoining areas to Jabalpur, Karnal and Ludhiana Samples collected showed leaf spots and wilting of Parthenium plants, deep brown spots on water hyacinth brown spots on cyperus rotundus were observed.

From the infested samples of *Parthenium hysterophorus*, fungi like *_Fusarium sp., Sclerotium rolfsii* and *Curvularia sp.* were isolated from katni, *Alternaria alternata* from Mandla. *Alternaria altenata* and *Curvulavia* sp. from Gadarwada visit were on isolated. From *Cyperus rotundus, Fusarium* sp. from Katni area and rust *Puccinia* sp. from Karnaland Ludhiana were isolated. On *Water hyacinth, Acromouinm* sp. and *Alternaia alternata* from Katni were isolated.

Table 36 : Survey of Pathogens.

Sl.	Host Part	Plant Katni	Jabalpur to Mandla Ludhiyana	Jabalpur to Gadarwara	Jabalpur to Karnal &	Around
1.	*Parthenium hysterophorurus*	Leaf Stem/ root seeds	*Fusarium sp.* *Curvularia sp.* *Sclerotium rolfsii*	*Alternaria alternata*	*Fusarium sp.* *Curvnlaria sp.*	-
2.	*Cyperus rotundus*	Leaf	*Fusarium sp.*	-	-	Rust *(Puccinia sp.)*
3.	*Phalaris minor*	Leaf Seeds	-	-	-	
4.	*Eichhornia crassipes*	Leaf Bullb	*Acromonium sp.* *Alternaria*	- -	- -	-

VM-1-d-i : Evaluation of *Fusarium pallidoroseum* for its efficacy over *Parthenium hysterophorus*

L. P. Kauraw and V. M. Bhan

For testing the weed control efficacy of *Fusarium pallidoroseum* against *Parthenium hysterophorus,* an experiment entitled effect of spray of *Fusarium pallidoroseum* at different dates of sowing (DAS) on *Parthenium hysterophorus* was conducted with the objective to findout the critical period of parthenium at which fusarium kills the plant. It is clear from the table that maximum reduction in height, number of branches/plant and number of flowers/ plant was obtained in spraying of fungus from 8 to 30 DAS and very when sprayed at 60 and 75 DAS. It was concluded that Fusarium is able to affect parthenium at early stage of its growth.

Table 37 : Effect of *Fusarium pallidoroseum* at different growth stages of *Parthenium hysterophorus*.

Treatments	Height/plant (cm)	Branches (no./ plant)	Flowers (no./plant)
8 DAS	50.66	3.53	255.40
15 DAS	55.70	3.60	208.50
21 DAS	62.23	4.06	185.06
30 DAS	64.13	4.33	222.60
40 DAS	67.13	5.00	273.60
60 DAS	72.33	4.50	289.73
75 DAS	72.60	4.60	277.49
Control	78.80	5.00	299.46
CD at 5 %	**5.77**	**1.02**	**41.14**

In another experiment entitled effect of spray of different amount of inoculum of *Fusarium pallidoroseum* at different growth stages of *Parthenium hysterophorus,* it revealed that spray of 100, 150 and 200 g wet mycelium/litre of water at vegetative stage and before flowering state although could reduce plant heights, number of branches and flowers/plant but maximum reduction in these parameters was obtained when Fusarium was sprayed at 150 to 200 g/l of water.

Table 38 : Effect of different amount of inoculum of *Fusarium pallidoroseum* at different growth stage of *parthenium hysterophorus.*

Treatments weight/plant	Average branching (cm)	Average flowers (no./plant)	Average (no./plant)
Vegetative stage			
100 gm/1 Mycelium	65.33	4.40	167.33
150 gm/1 Mycelium	63.33	4.46	149.66
200 gm/1 Mycelium	57.93	3.60	138.00
Control	67.70	4.66	204.33
Before flowering stage			
100 gm/1 Mycelium	50.86	3.60	169.66
150 gm/1 Mycelium	57.13	3.67	165.00
200 gm/1 Mycelium	61.06	3.53	188.00
Control	63.13	4.20	198.66
After flowering stage			
100 gm/1 Mycelium	65.13	3.73	212.00
150 gm/1 Mycelium	56.13	3.16	191.33
200 gm/1 Mycelium	54.20	3.46	162.00
Control	67.60	4.06	150.00

For knowing the best methods of inoculation and critical period for control of *Parthenium hysterophorus. Fusarium pallidoroseum* was grown on potato dextrose broth solution. Ten days old culture was used for inoculation by three methods i. e. seed inoculation, soil inoculation and spray on the seed. It was noted that all these three methods could reduce the germination of parthenium seeds and its growth. Different methods performed best in different months. Seed & Soil treatment resulted best during June, 94 and January 95. While effect of spray was best in July, Sept., November and December 94. Highest reduction in seed germination by all methods was obtained during August and October, 1994.

Table 39 : Study of different method of *Fusarium* sp. inoculation.

Month		Parthenium germination in (%)		
Seed Trt.	Soil Trt.	Spray Trt.	Control	
June 94	15.66	26.66	27.33	53.00
July	51.66	51.33	41.66	79.00
August	11.66	13.00	19.66	43.33
September	Failed	Failed	Failed	Failed
October	9.33	15.66	8.66	9.33
Noverber	42.33	30.66	16.00	22.66
December	17.66	14.66	11.66	18.00
January 95	18.33	21.33	26.00	38.33

The fungus was sprayed on 1, 2, 3, 4, 5, 6 and 7 days of planting in petridishes for knowing the critical time of spray for effective control. Maximum infection in the seed/ seedling occurred when the fungus was sprayed from 0 - 5 days of sowing.

Table 40 : Effect of *Fusarium pallidoroseum* fungus on the parthenium seed germination in different day spray by the spray method.

Fusarium spray at	Total No. of inoculated seeds	No. of germinated seeds	No. of dead seedlings	No. of infested seed	No. of neutral seed
0 Day	100	15	3	24	58
1 Day	100	13	-	7	80
2 Day	100	19	-	-	81
3 Day	100	19	-	12	69
4 Day	100	18	-	2	80
5 Day	100	20	5	5	70
Control	100	20	-	-	80

Table 41 : Effect of *Sclerotium rolfsii* on parthenium seed.

Date	Germination	
	Treated seed	Control seed
12-12-94	10.00	33.50
14-12-94	10.66	44.50
16-12-94	22.66	58.00
22-12-94	29.00	60.00
27-12-94	00.00	60.00

VM-1-A-d-iii : Effect of *Trichoderma* fungus on *parthenium* and Water hya cinth

L.P. Kauraw and V.M. Bhan

Seeds of parthenium were inoculated by mixing *Trichoderma* fungus @ 60 g in one litre of water/4 sq.m. It was noted that spray of fungus on the seedling could also kill the plants in petridishes by infecting flowers badly. On testing its efficacy over water hyacinth, solution was prepared by mixing 100 ml of the fungus; in 1000 ml. of water for spray over water hyacinth. It resulted into the killing of the plants.

VM-1-d-iv : Host specificity testing of *F. pallidoroseum* on vegetable crops

L.P. Kauraw and V.M. Bhan

20 vegetables crops as indicated in table 42 were tested for their pathogenity to F. pallidoroseum by seed inoculation method and were sprayed in pots. No

Table 42 : Host specificity testing (Spray)

Sl.	Crop	Germinated	Death of the plant
1.	Carrot	20	0
2.	Radish	18	0
3.	Turnip	17	0
4.	Cabbage	15	0
5.	Cauliflower	16	0
6.	Leady vegetable	22	0
7.	Carrinder	21	0
8.	Palak	20	0

Sl.	Crop	Germinated	Death of the plant
9.	Methi	24	0
10.	Pea	17	0
11.	Tomato	16	0
12.	Brinjal	19	0
13.	Onion	21	0
14.	Ridge Gourd	8	0
15.	Cowpea	15	0
16.	Chilli	18	0
17.	Cucumber	7	0
18.	Bottle Gourd	6	0
19.	Bean	13	0
20.	Pumpkin	7	0

VM-1-A-d-v : Effect of Trichoderma on growth of *Fusarium pallidoriseum* and *Sclerotium rolfsii.*

L.P. Kauraw and V.M. Bhan

This experiment was laid out with the objective for testing the antagonistic effect of *Trichoderma* on *Fusarium* and *Sclerotium* for their biological control. *Trichoderma* and *Fusarium* were grown together on potato dextrose agar medium. *Trichoderma* could completely inhibit the growth of *Fusarium* and *Sclerotium* both but it was less in case of *Sclerotium* as compared to *Fusarium.*

Table 43 : Effect of Trichoderma on growth of *Fusarium pallidoroseum* and *Sclerotium rolfsii.*

Sl.	Name of organism	Radial growth	% inhibition
1.	*Trichoderma viride*	8.2	8.88
	Fusarium sp.	1.8	80.00
2.	*Trichoderma viride*	6.8	24.44
	Sclerotium	4.9	45.55
	Control		
1.	*Trichoderma viride*	9.00	
2.	*Fusarium sp.*	9.00	
3.	*Sclerotium*	9.00	

Effect of different non-toxic chemicals on water hyacinth

L.P. Kauraw and V.M. Bhan

Sodium Chloride @ 100, 150 and 200 g/l of water, Oxalic acid and Calcium Chloride @ 15, 20, 25 and 30 g/l of water. All these chemicals could control water hyacinth but maximum number of leaves were killed by Sodium Chloride as compared to other treatments.

Table 44 : Effect of different chemical spray on *Water hyacinth*

Spray Treatments	Growth of leaves (No.)		
	0 days	05 days	10 Days
Sodium chloride			
100 g/l	40.00	4.33	1.00
150 g/l	40.00	0.66	0.00
200 g/l	40.00	0.00	0.00
250 g/l	40.00	0.00	0.00
Control	40.00	70.00	76.00
Oxalic acid			
15 g/l	40.00	10.00	18.66
20 g/l	40.00	7.33	10.66
25 g/l	40.00	3.00	8.66
30 g/l	40.00	0.83	5.00
Control	40.00	94.66	92.00
Calcium chloride			
15 g/l	40.00	22.00	36.66
20 g/l	40.00	23.00	28.66
25 g/l	40.00	18.66	26.33
30 g/l	40.00	17.00	20.00
Control	40.00	92.00	108.66

No. of leaves = 4 leaves stage X 10 plants = 40 leaves

VM-1-A-e : Testing media for growth of different pathogens.

L.P. Kauraw and V.M. Bhan

For knowing the best medium for growth of *Fusarium pallidoroseum, Sclerotium rolfsii* and *Alternaria alternata*, these were grown on potato dextrose agar, potato dextrose broth. Fusarium pallidorseum was grown on prescribed rice, jowar, soybean and wheat. Best growth of *F. Pallidoroseum* was obtained on these media. While *Sclerotium rolfsii* grew better on potato dextrose broth media.

VM-1-A-g : Competition between weeds and different crops

L.P. Kauraw and V.M. Bhan

A preliminary trial of crop weed competition was conducted with the objective to see ability to suppress Parthenium population. Marigold, sunhemp and niger were grown together with *Parthenium hysterophorus.* These could inhibit seedling growth and further development of Parthenium. These could also reduce height, tillering and flowering in *Parthenium* plants (Table 45-49).

Table 45 : Competition between parthenium and Marigold plants.

Date	Plot No.	When grown mixed		Control	
		Mari gold	Parthenium	Mari gold	Parthenium
31-01-95	1	697	804	2260	999
	2	973	500	2260	999
% age of inhibition		96.91	19.51		
		56.94	49.94		
20-04-95	1	600	496	1236	1030
	2	708	456	1236	1030
% age of inhibition		51.45	51.84		
		42.71	55.72		
No. of flower			37		78
20-04-95			19		
% Reduction in flowering			52.56%		
			74.64%		

Table 46 : Effect of marigold plant (leaf, root and flower) extract on the parthenium seed germination by the dipped method.

Marigold plant etract	Total no. of inoculated seeds	No. of germinated seeds	No. of dead seedlings	No. of infested seed	No. of neutral seed
Control	100	50	13	-	37
Leaf	100	43	13	2	42
Root	100	42	17	-	41
Flower	100	3	323	-	44

Table 47 : Effect of different part of marigold plant (leaf, root and flower) etract on the parthenium seed germination in different day spray by the spray method.

Marigold plant etract		Total no. of inoculated seeds	No. of germinated seeds	No. of dead seedlings	No. of infested seed	No. of neutral seed
Control		100	33	-	-	67
Leaf	0 Day	100	2	-	-	98
	1 day	100	1	2	-	94
	2 Day	100	4	-	2	88
	3 Day	100	4	4	4	90
	4 Day	100	4	1	5	96
	5 Day	100	4	-	-	91
Root	0 Day	100	8	1	2	92
	1 day	100	7	1	-	79
	2 Day	100	13	1	7	70
	3 Day	100	27	-	3	81
	4 Day	100	19	-	-	85
	5 Day	100	10	3	2	97
Flower	0 Day	100	3	-	-	92
	1 day	100	3	3	2	88
	2 Day	100	6	3	3	98
	3 Day	100	1	1	-	79
	4 Day	100	4	12	5	81
	5 Day	100	6	2	11	67

Table 48 : Study on competition between parthenium and sannhemp

Date	Stage	Mixed seed of		Control (Pure)	
		Parthenium	Sunhemp	Parthenium	Sunhemp
02-01-95	Germination	130.0	137.0	348.0	96.0
07-02-95	Pre-Flowering stage	128.0	136.0	324.0	95.0
10-04-95	Flowering stage	128.0	134.0	324.0	95.0
12-04-95	Pl. height	16.2 cm No flowering	75.4	68.0cm 15 plants flowers	114.0

Table 49 : Study on competition between parthenium and Niger

Date	Stage	Mixed seed of		Control (Pure)	
		Parthenium	Nigar	Parthenium	Nigar
02-01-95	Germination	135.0	95.0	244.0	115.0
07-02-95	Pre-Flowering stage	175.0	164.0	315.0	175.0
10-04-95	Flowering stage	172.0	164.0	318.0	175.0
12-04-95	Pl. height	41.9 cm 10 plant flower	61.2	73.0cm 14 flowers	45.6

VM-1-B-a : Biological control of water hyacinth by insects

Sushilkumar and V.M. Bhan

Water hyacinth is amongst the most troublesome weed of aquatic but floating weeds. It reproduces very rapidly under favourable condition and pose hazardous in the smooth flood of water. A study was conducted with the objective to assess the overall water hyacinth problems and to develop programme on its management using biological approach as well as survey and identification of natural insects enemies. In this connection, survey of ponds located in different part of Jabalpur was made during August 94 for observing water hyacinth intensity and its problem. In one of the ponds i.e. Mansingh Ka Talab seven lakhs has been spent for cleaning of water infested with water hyacinth. Though it was noted that severe infestation is still there due to its rapid reproductivity. The pond named 'Mahanada' was severely infested with the weevils (Neochetina spp.) (Fig. 5). It was noted visually that about half of the area infested with water hyacinth was killed by weevils by the end of October 94, showing clean water with brownish appearance of killed water hyacinth.

Fig. 5 : A *Neochetina* weevil Adult feeding on a leaf of Water hyacinth in Mahanada Pond

VM-1-B-b : Survey of insect and non-insect fauna of weeds in Jabalpur and adjoining areas.

Sushilkumar and V.M. Bhan

The survey of insect and non-insect fauna of weeds was conducted with the objective to develop insect collection of various weeds of cropped and non-cropped area of Jabalpur division and to record non-insect pest of weeds.

Regular survey were made at NRCWS farm, waste lands and road side to record insects on various weeds. It was recorded that *Heliothis armigera* lavishly feed on *Cichorium intybus* and occasionally on *Chenopodium* spp. and *Parthenium hysterophorus.*

During survey at Sidhi, *Zygogramma bicolorata* an exotic beetle introduced from Bangalore to Vindhyachal Nagar in 1990 was observed in September-October 1994 on Parthenium. It has brought good biological control and during survey, it was found that it has spread upto 20 km. from the releasing point.

On *Lantana camara*, tinged bug *Teleonemia scrupulosa* was found However, its impact to suppress lantana was almost negligible in September-October but in March a few bushes of Lantana were found dry due to attack of this bug.

3.3 AGRICULTURAL ENGINEERING

AE-1 : Performance evaluation of improved mechanical weeder for weed control in *Kharif* and *rabi* crops.

H.S. Bisen and V.M. Bhan

This experiment was laid out with the objective to evaluate the performance of improved mechanical weeds i.e. twin wheel hoe, wheel hoe and grubber. During kharif season, crops like soybean and maize were sown but due to heavy and continuous rain in the month of June, July and August, emergence of plants was very poor. While during rabi, wheat and gram crops were raised. In wheat, no weed emergence was found at 15 DAS stage. However at 25 and 35 DAS, single tyned grubber was operated in wheat and it controlled 90.2 and 78.25% of weeds at first weeding stage. The operation of weeder was not possible at 50 and 60 DAS due to crop canopy. The yield of wheat crop varied between 34.2 to 41.26 q/ha.

In gram crop, at 25 and 35 DAS, twin wheel hoe was operated and it controlled 70.54 and 77.20% of weeds during first weeding stage. The yield of crop varied between 16.73 to 24.0 q/ha.

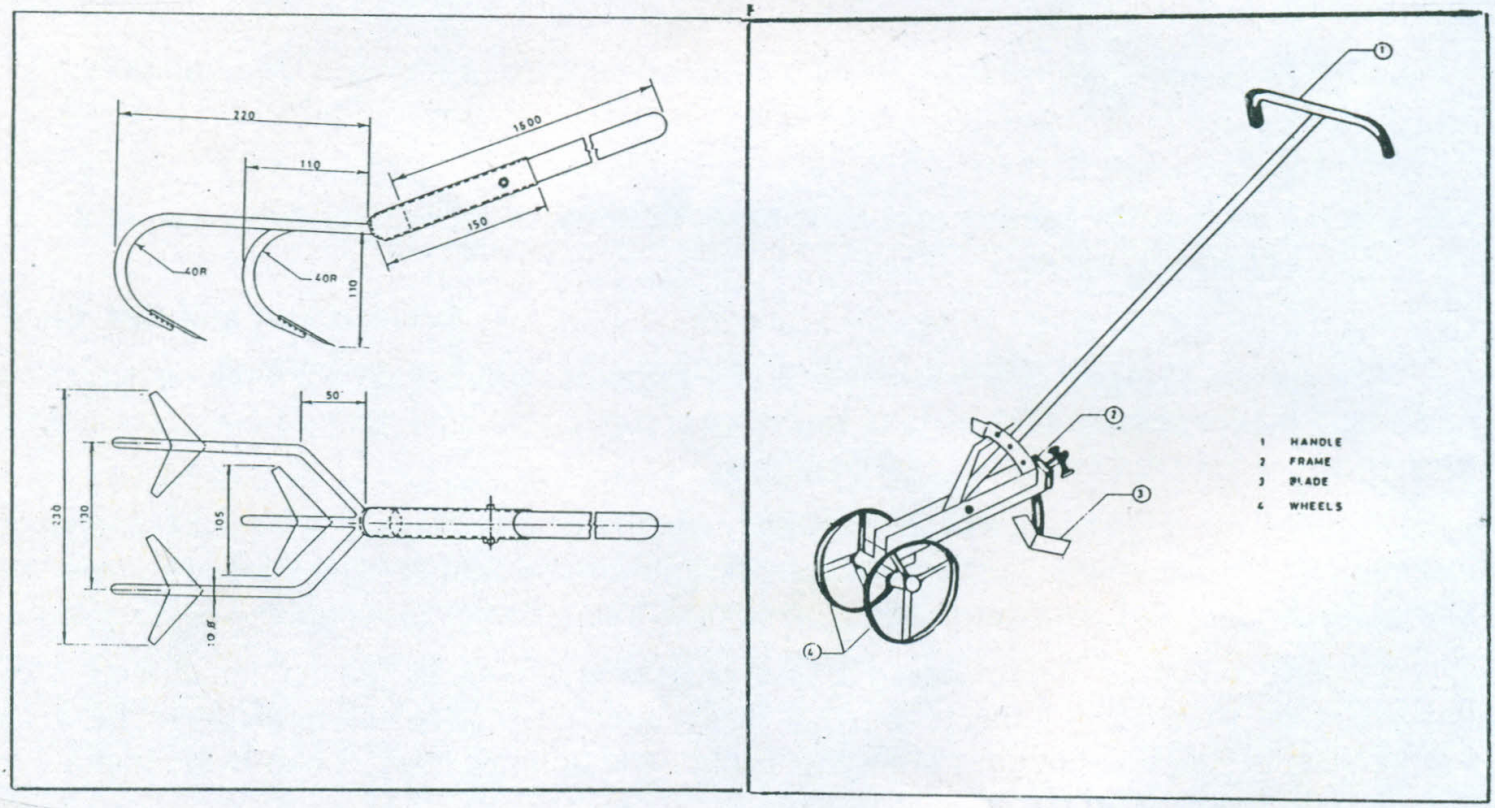

Fig. 6 : Naveen Three Tined Hand Cultivator (a) and Twin Wheel Hoe (b)

3.4 WEED PHYSILOGY

WP-5-a : Effect of different growth retardants on growth and yield of wheat vr. C-306 and its associated weeds.

D. Swain and V.M. Bhan

The 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 Vr. C-306 and its associated weeds so that in addition to their effect in preventing the lodging of the crop, can also help in that control of weeds by reducing their growth.

The crop and the individual weeds like (i) *Phalairs minor*, (ii) *Cichorium intybus*, (iii) *Rumex dentata* and (iv) *Chenopodium album* were grown together and standard dose of growth retardants were applied (C3-3 kg/ha, EP-2 kg/ha and CT-0.5 kg/ha) at 30 and 50 DAS. Various observations like crop height, weed population, weed drymatter, grain and straw yield were taken into consideration.

In case of *Phalaris minor*, the weed dry matter was considerably reduced by CT with corresponding increase in grain yield,; when applied at 30 DAS. The treatment at 50 DAS was not effective.

In case of *C. intybus*, both EP and CT were equally effective in decreasing weed dry weight with corresponding increase in grain yield when applied at 30 DAS. *R. dentata* was also not affected by the growth retardants. EP was better than C3 and CT in retarding the crop growth and increasing crop yield whether appplied at 30 or 50 DAS.

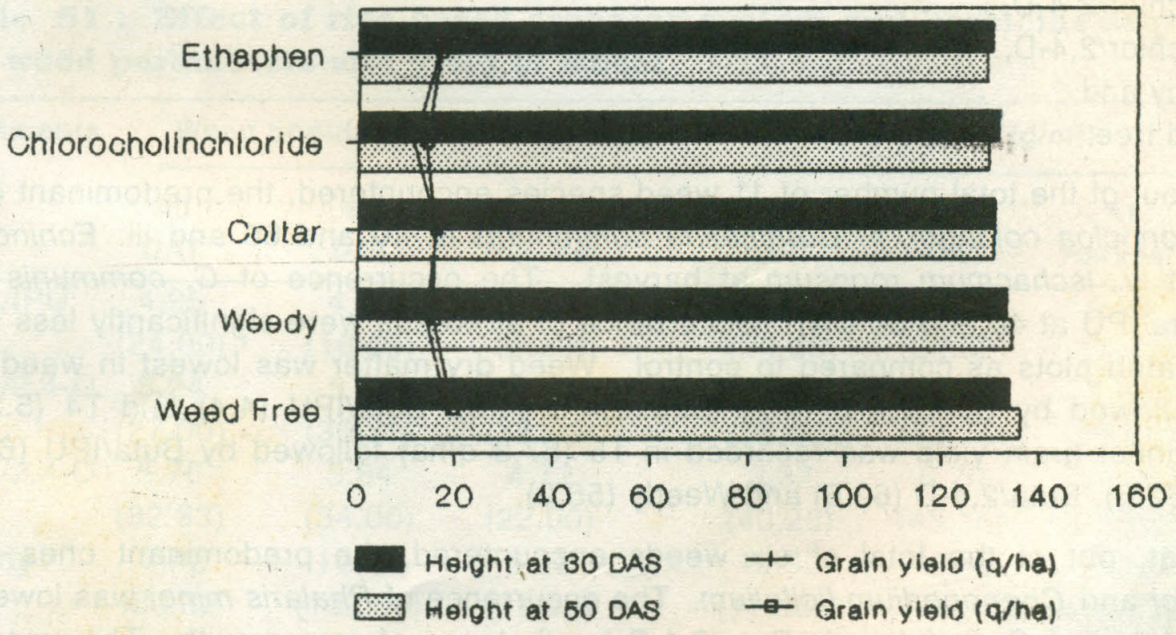

Fig. 7 : Effect of growth retardants on growth and yield of Wheat and associate weed i.e. P. minor at 30 & 50 DAS

WP-6-a : To determine the age of maximum relative susceptibility of resistant and susceptible biotype of *Phalaris minor* and wheat cv WH-147.

D. Swain, Anil Dixit and V.M. Bhan

The experiment was conducted in pots to determine the age of maximum relative susceptibility of resistant and susceptible biotype of *P. minor.* 100 seeds of *Phalaris minor* and 25 seed of wheat were sown in each pot and isoproturon at the rate of 0, 1, 2 and 3 kg/ha was applied to weed and crop plants at 20, 30 and 40 DAS. Various observation like weeds and crop height and weed and crop number per pot were recorded at 15 days interval for a month.

It was observed that the resistant biotype was relatively resistant to isoproturon when applied late i.e. at 40 DAS. But when isoproturon was applied at 20 and 30 DAS, both the resistant and susceptible biotypes were equally adversely affected by the recommended dose of isoproturon (1 kg/ha) and above.

The wheat plant was found to be tolerant to 3 kg/ha isoproturon and the height of the plant and plants/pot were not adversely effected by any of the concentration of isoproturon applied at any stage of growth.

WP-3-a-i : To study the effect of rice based cropping system and herbicide sequence on the distribuition of weed flora in rice and wheat.

D. Swain and V.M. Bhan

The experiment was conducted for the third year starting from rabi 1992-93. During 1994, the treatment given in rice are as under :

T1- Butachlor/isoproturon,
T2- Butachlor/2-4-D,
T3- Butachlor/2,4-D,
T4- Weedy and
T5- Weed free.

In rice out of the total number of 11 weed species encountered, the predominant ones were i. *Echionocloa colonum*, ii. *Commelina commnunis* at 40 and 60 and iii. *Echinocloa crusgalli* and iv. *Ischacmum rogosum* at harvest. The occurrence of *C. communis* was lowest in Buta/IPU at 40 and 60 DAT. Occurrence of all weeds were significantly less in all herbicide treated plots as compared to control. Weed dry matter was lowest in weed free (1.20 gm) followed by Buta/2,4-D (4.2), Buta/2,4-D (4.3); Buta/IPU (4.4) and T4 (5.2) at harvest. Highest grain yield was recorded in T5 (67.3 q/ha) followed by Buta/IPU (62.7), Buta/2,4-D (62.6), Buta/2,4-D (62.5) and Weedy (56.0).

In wheat, out of the total of six weeds encountered, the predominant ones were *Phalaris minor* and *Chenopodium ficifolium.* The occurrence of *Phalaris minor* was lowest in Buta/IPU and that of *C. ficifotium* in Buta/2,4-D in all stages of crop growth. The weed dry matter was lowest in weed free (0.7 gm) followed by Buta/IPU (4.9), Buta/2,4-D (5.2), Buta/2,4-D (5.8) and T4 (7.4). The crop yield was highest in Weed free (44.9 q/ha) followed by Buta/IPU (42.9), Buta/2,4-D (41.5) and lowest in weedy (36.1).

Table 50 : Effect of rice-based cropping system and herbicide sequence on the weed parameters and yield of rice

Treatments	Weed population (no./m²)			Weed dry wt. (g/m²)			Grain yield (q/ha)
	40 DAT	60 DAT	At Harvest	40 DAT	60 DAT	At Harvest	
Buta/IPU	5.33 (28.33)	4.45 (19.66)	3.09 (9.33)	5.60 (31.13)	5.19 (26.73)	4.24 (17.66)	62.24
Buta/2,4-D	5.58 (31.00)	4.65 (21.33)	3.10 (9.34)	5.87 (34.16)	5.45 (29.36)	4.23 (17.56)	62.62
Buta/2,4-D	5.73 (33.00)	4.55 (20.33)	3.29 (10.33)	5.90 (34.90)	5.33 (28.10)	4.30 (18.03)	62.65
Weedy	7.75 (59.66)	7.98 (63.33)	4.24 (17.66)	8.26 (67.80)	8.88 (78.66)	5.20 (26.73)	56.00
Weed Free	1.55 (2.00)	1.28 (1.33)	1.05 (0.66)	1.89 (3.50)	1.26 (1.26)	0.87 (0.30)	67.27
CD at 5%	**1.06**	**0.60**	**0.57**	**1.03**	**0.75**	**0.59**	**1.71**

* Values in parenthesis are original

Table 51 : Effect of rice-based cropping system and herbicide sequence on the weed parameters and yield of wheat

Treatments	Weed population (no./m²)			Weed dry wt. (g/m²)			Grain yield (q/ha)
	40 DAT	60 DAT	At Harvest	40 DAT	60 DAT	At Harvest	
Buta/IPU	4.95 (24.00)	4.13 (16.66)	3.13 (9.33)	5.43 (29.06)	4.82 (22.83)	4.23 (17.43)	42.94
Buta/2,4-D	5.24 (27.00)	5.54 (30.33)	4.30 (18.00)	6.01 (35.60)	6.63 (43.76)	4.94 (23.93)	41.57
Buta/2,4-D	5.78 (32.33)	5.84 (34.00)	4.72 (22.00)	6.37 (40.26)	6.70 (45.16)	5.42 (29.06)	39.71
Weedy	7.42 (80.33	10.15 (102.66)	8.45 (71.33)	10.90 (113.03)	12.30 (145.10)	9.32 (86.70)	36.13
Weed Free	2.91 (4.00)	1.86 (3.00)	0.70 (0.00)	2.52 (5.90)	2.55 (6.03)	0.70 (0.00)	44.93
CD at 5%	**2.39**	**1.07**	**0.92**	**1.54**	**1.61**	**0.92**	**2.25**

* Values in parenthesis are original

WP-3-b-i : To study the effect of soybean based cropping system and herbicide sequence on the distribution of weed flora in wheat.

D. Swain and V.M. Bhan

The experiment was conducted for the 3rd year starting from rabi 1992-93. During kharif 1994, it was not possible to grow the soybean crop due to heavy rains. However, the rabi wheat of 1994-95 was taken and reported here. The treatments for the year for wheat are given as under :

T1 - Isoproturon (1 kg/ha),
T2 - 2,4-D (1 kg/ha),
T3 - Fluchloralin (1 kg/ha)
T4 - Weedy and
T5 - Weed Free

Observations on weed dry matter at 40 and 60 DAS and at harvest, crop yield and species wise weed count at 40, 60 DAS and at harvest were taken.

A total of six species of weeds were noted to be associated with the wheat crop Viz. *Chanopodium ficifolium, Chicorium intybus, Trifolium flagiferum, Phalaris minor, Cynodon dactylon* and, *Parthenium hysterophorus.* The dominant weeds were *Phalaris minor, C. ficifolium* and *C. intybus.* the incidence of *Phalaris minor* was lowest with IPU. *C. ficifolium* and *C. intybus* were effectively controlled by all the herbicides treatment. The weed population and weed dry matter were significantly lower in all herbicide treatments as compared to control. The grain yield of wheat was highest in weed free (46.9 q/ha) followed by IPU (44.3 q/ha), 2,4-D (41.4 q/ha), Fluchloralin (41.3 q/ha) and weedy (38.1).

Table 52 : Effect of soybean based cropping system and herbicide sequence on the weed parameters and yield of wheat.

Treatment	Weed population (no./m²)			Weed dry wt. (g/m²)			Grain yield (q/ha)
	40 DAT	60 DAT	At Harvest	40 DAT	60 DAT	At Harvest	
Isoproturon 1.0	3.75 (13.66)	3.65 (13.00)	3.00 (8.66)	5.11 (25.83)	4.49 (20.00)	4.22 (17.63)	44.34
2-4-D 1.0	4.87 (24.00)	5.65 (32.66)	4.42 (19.66)	6.16 (38.33)	6.70 (45.20)	5.63 (31.86)	41.40
Fluchloralin 1.0	4.47 (19.66)	5.35 (28.33)	4.16 (17.00)	5.91 (34.53)	6.62 (43.43)	5.32 (27.96)	41.36
Weedy check	7.54 (57.33)	8.80 (77.66)	6.9 (48.33)	38.24 (68.56)	9.83 (97.76)	7.64 (58.90)	38.10
Weed free	1.96 (3.66)	1.64 (2.33)	1.3 (1.33)	42.59 (6.80)	1.97 (3.53)	1.64 (2.33)	46.97
CD at 5%	**1.23**	**0.94**	**1.00**	**1.43**	**1.10**	**1.23**	**2.01**

* Values in parenthesis are original

WP-2-a-i : To study the influence of rabi crop residues of pea, mustard and linseed on transplanted rice, vr. "Kranti" and its associated weed flora

D. Swain and V.M. Bhan

The experiment was conducted during 1993-94 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 (dry matter) of each crop. Observations on the weed flora i.e. dry matter of weed at 30 and 60 DAT and at harvest; and growth and yield parameters of the crop were taken into consideration.

Effect on crop

Pea residue increased plant height and plant dry weight at 60 DAT and grain yield.

Mustard bhusa increased plant height and plant dry weight at 60 DAT and has increased grain yield.

Linseed bhusa increased number of tillers/m length, plant height and plant dry weight at 60 DAT. It has also increased the yield significantly.

The highest yield was noted with weed free (46.81 q/ha) followed by pea bhusa at high dose (46.4 q/ha).

Effect on weeds

Pea bhusa reduced weed dry matter at 60 DAT significantly. High dose of pea bhusa had adverse effect on the density of weeds like *Commelina communies, Cyperus iria, Echienocloa colomum* and *Monocharia vaginalis*. Various other weed species like *Caesulia axillaris,Ammania baccifera,* at 40 DAT also exhibited reduced occurrence.

Mustard bhusa reduced weed dry weight at 40-60 DAT and at harvest. It has also redeuced the weed density of weeds like *E. colonum, C. communis, C. axillaris, Cyperus iria, A. baccifera, M. vaginalis, A. sessilis* and *P. distichum* at 40-60 DAT and at harvest. Linseed bhusa adversely affected the accumulation of weed dry matter at 40-60 DAT and at harvest. The occurrence of the above referred weeds were also reduced particularly those of *C. communis, C. axillaris* and *E. colonum*, at the high dose (45 q/ha).

Table 53 : Effect of different doses of *Rabi* crop residue viz Pea, Mustard & Linseed) and weed management on growth and yield of *kharif* Rice variety "Kranti".

Crop residue and Weed managemnt		No. of tillers/m row length		Plant height (cm)		Pl. dry weight (g)		Weed dry weight (g/m²)			Grain yield (q/ha)
		30 DAT	60 DAT	30 DAT	60 DAT	30DAT	60 DAT	30 DAT	60 DAT	Harvest	
Pea Bhusa q/ha											
	45	30.83	65.16	39.22	96.74	12.23	21.90	3.00	3.47	2.47	46.40
	30	31.83	61.00	39.98	94.93	12.43	20.90	3.14	3.91	2.66	45.27
	15	35.00	60.50	40.80	93.43	12.75	19.58	3.67	4.48	2.70	43.40
	03	5.16	57.00	44.12	92.28	13.77	19.57	3.78	4.89	3.06	40.84
CD at	**5%**	**NS**	**NS**	**1.72**	**2.15**	**1.36**	**1.40**	**NS**	**0.63**	**NS**	**2.73**
Weed Management											
Weedy		32.58	56.08	40.68	91.65	12.59	20.17	6.09	7.66	4.74	41.14
Weed Free		33.83	65.75	41.38	97.04	13.00	20.80	0.70	0.70	0.70	46.81
CD at 5%		**NS**	**3.56**	**NS**	**1.10**	**0.31**	**0.53**	**0.60**	**0.62**	**0.37**	**1.21**
Mustard Bhusa q/ha											
	45	31.67	65.16	40.05	95.65	12.17	21.50	3.36	4.03	2.58	45.48
	30	32.83	64.16	38.84	94.45	11.95	20.80	3.59	4.27	2.44	44.92
	15	35.50	57.16	40.90	92.45	12.68	19.60	4.09	4.73	2.81	42.36
	03	6.67	57.00	44.33	91.75	13.22	19.35	4.17	5.31	3.23	40.98
CD at	**5%**	**5.15**	**NS**	**1.75**	**2.14**	**NS**	**1.53**	**0.75**	**0.50**	**0.65**	**1.28**
Weed Management											
Weedy		32.25	53.34	40.69	90.77	12.36	19.76	6.90	8.46	4.83	40.41
Weed Free		34.08	66.42	41.36	96.37	12.65	20.87	0.70	0.70	0.70	46.46
CD at 5%		**NS**	**4.24**	**NS**	**1.00**	**0.27**	**0.49**	**0.63**	**0.34**	**0.51**	**0.82**
Linseed Bhusa q/ha											
	45	29.17	66.34	32.75	94.88	11.82	21.67	3.42	3.76	2.53	44.72
	30	30.00	62.00	40.51	94.35	12.28	20.68	3.64	4.13	2.54	43.89
	15	35.83	58.16	39.54	93.38	13.48	19.65	4.05	4.74	2.91	42.10
	0	37.00	55.50	44.15	90.65	12.45	19.25	4.44	5.13	3.20	41.24
CD at	**5%**	**4.94**	**4.42**	**9.36**	**1.14**	**1.45**	**2.02**	**0.64**	**0.84**	**0.63**	**1.49**
Weed Management											
Weedy		32.42	56.58	38.11	91.00	12.43	20.00	7.07	8.17	4.89	39.82
Weed Free		33.58	64.41	40.37	95.63	12.48	20.62	0.70	0.70	0.70	46.15
CD at 5%		**NS**	**1.57**	**NS**	**1.06**	**0.21**	**0.43**	**0.41**	**0.69**	**0.40**	**1.38**

WP-7-a-i : Inhibition of lemna by parthenium

D.K. Pandey

Herbicidal property of parthenium leaf, flower, stem and root residue on lemna (**Lemna pausicostata** Hegelm.) was studied. The plant parts dry residue powders were suspended at 0.25, 0.50, 0.75, 1.00 and 1.25%, w/v, in tap water in 20 liter plastic tubs. Preweighed lemna plants were placed on the water and allowed to grow under outdoor conditions. Biomass of the plants was monitored at an interval of 5 days. Solute leakage (OD at 264 nm), chlorophyll a, b, total chlorophyll and carotenoids were monitored in untreated and treated (at lethal dose of parthenium leaf powder) lemna plants.

The results showed herbicidal property of parthenium residue on the floating aquatic weed lemna. This is due to leaching out of allelochemicals into the medium. Parthenium flower residue was lethal at 0.50%, leaf residue was lethal at 1.00%. The stem residue was inhibitory at 1.00% but non-lethal even at 1.25%, and the root residue was inhibitory but non-lethal even at the highest concentration 1.25%. The treatment at lethal dose caused massive leakage of solutes and loss of chlorophyll a, b, total chlorophyll and carotenoids. The symptoms of phytotoxicity appeared as early as 8 hours after initiation of the treatment in bright daylight.

Desiccation and drying appeared from the margins of the old fronds spreading to growing points and subsequently resulting in death of the treated plants. The results implicate that the parthenium residue killed the treated lemna plants by affecting macromolecules - proteins, lipids and nucleic acids. Accumulation of allelochemicals at threshold level in an aquatic environment due to washing off of parthenium residue by rain water in catchment area might affect population dynamics and survival of lemna species in a natural ecosystem and use of parthenium residue can be explored as a natural herbicide for lemna in paddy.

WP-7-b-i : Relative toxicity of allelochemicals to aquatic weeds

D.K. Pandey

Investigations were undertaken on relative toxicity of twelve allelochemicals to nine aquatic weeds namely water hyacinth, pistia, salvinia, azolla, spirodella, lemna, hydrilla, ceratophyllum and najas. Allelochemicals tested included p-hydroxybenzoic acid, anisic acid, cinnamic acid, salicylic acid, coumeric acid, fumaric acid, tannic acid, gallic acid, chlorogenic acid, vanillic acid, caffeic acid and ferulic acid. For preparing required concentrations of 25, 50 and 100 ppm the allelochemicals were, wherever necessary, dissolved in a small quantity of acetone or ethanol directly prepared in distilled water. The solutions were made up to one half the total volume with distilled water and the remaining half with the nutrient medium used in earlier studies with salvinia. The small quantity of the solvent used for dissolving the allelochemicals did not affect growth of the aquatic weeds. The plants grown in half strength nutrient medium served as controls. The submerged weeds

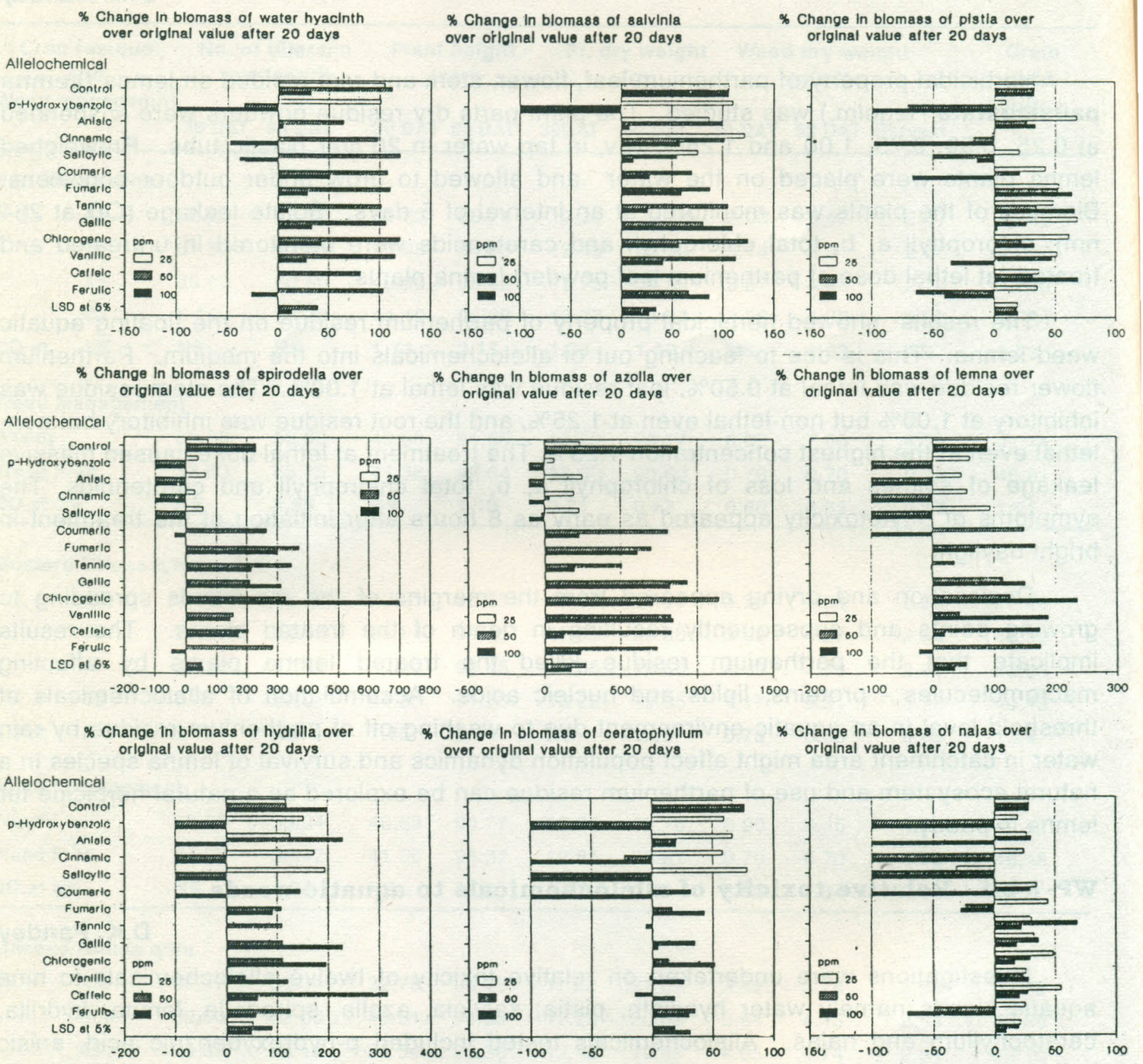

Fig. 8 : Percentage change in biomass of aquatic weeds as influenced by different allelochemicals.

- hydrilla, ceratophyllum and najas were allowed to grow individually as well as altogether under the stand of floating weeds lemna and spirodella. Direct sunlight had some inhibitory effect on these weeds. In each case 1 liter solution in beakers with their side walls covered with black paper were used for the experiments. The plants were grown under natural outdoor conditions. The volume of solutions in the beakers was kept constant by replenishing evapotranspiratory loss, wherever occurred, twice daily with distilled water. Biomass of the weeds was monitored.

The results showed that p-hydroxybenzoic acid was lethal to the aquatic weeds - *water hyacinth, pistia, salvinia, azolla, lemna, spirodella, hydrilla, ceratophyllum* and *najas* at 50-100 ppm. Anisic acid was lethal at 50 ppm to azolla, spirodella and lemna, and at 100 ppm to hydrilla and najas. Salicylic acid was lethal at 50 ppm to spirodella, lemna, hydrilla, ceratophyllum and najas, and at 100 ppm to azolla. Coumeric acid was lethal at 100 ppm to lemna, hydrilla, ceratophyllum and najas. The concentrations below lethal were usually inhibitory. Fumeric acid, tannic acid, gallic acid, chlorogenic acid, vanillic acid, caffeic acid and ferulic acid were not lethal even at 100 ppm though in some cases inhibitory effect was conspicuous. Water hyacinth, salvinia and pistia were relatively more tolerant to phytotoxicity of the allelochemicals when compared with other floating and submerged weeds (Fig. 8).

WP-7-b-ii : Physiological effects of parthenin on water hyacinth

D.K. Pandey

Purified parthenin was dissolved in a small volume of ethanol and diluted to half the total volume with distilled water and remaining half was made up with a nutrient medium used earlier in the studies with salvinia. Preweighed water hyacinth plants were placed in parthenin solution at 100 ppm in the nutrient medium. The plants were allowed to grow under outdoor conditions. Effect of parthenin on water use, solute leakage out of roots, dehydrogenase activity in roots and chlorophyll contents in the leaves were monitored using the procedures described earlier. Persistence of parthenin toxicity was studied by incubating 100 ppm parthenin solution under outdoor conditions for 0, 10, 20, 30 and 40 days and bioassying inhibitory activity by measuring change in biomass of the pistia plants.

Parthenin caused root disfunction, loss of both membrane integrity and dehydrogenase activity in the roots and loss of chlorophyll contents in the leaves. These physiological changes altogether imply that parthenin killed the treated plants by affecting macromolecules - proteins, nucleic acids and lipids. The results on persistence of phytotoxicity under outdoor conditions revealed that in about 30 days incubation under outdoor conditions a lethal dose of parthenin became non-lethal.

WP-7-a-ii. : Inhibition of ceratophyllum by parthenium

D.K. Pandey

Effect of parthenium plant parts residue on ceratophyllum was studied. Biomass, solute leakage and chlorophyll contents were studied using the procedures as described for lemna in the preceeding experiment.

The results showed that parthenium leaf, flower and stem residue were more phytotoxic (lethal dose at and above 0.75%, w/v) than root residue (lethal dose at and above 1.00%). The ceratophyllum plants treated at lethal dose of the residue turned dull green, lost turgidity and biomass rapidly, and showed massive fragmentation, death and decay in 10-15 days. Inhibition of *ceratophyllum* at a lethal dose of parthenium leaf residue was associated with drastic increase in leakage of electrolytes and UV absorbing substances and loss of chlorophyll a, b, total chlorophyll and carotenoid pigments. The results revealed that due to release of phenolic-, sesquiterpene lactone- and organic acid-allelochemicals from the residue, massive damage to cellular membranes as evidenced by drastic increase in leakage of cellular constituents following the treatment (and possibly resultant damage to other macromolecules - proteins, nucleic acids and lipids) and loss of chlorophyll and carotenoids mainly killed the ceratophyllum plants.

WP-7-b : Phytotoxicity of *Cassytha* sp. plant residue on aquatic weeds.

D.K. Pandey

Cassytha sp. collected locally was dried at 70 $\pm$ 5°C, powdered to about < 80 mesh and used for the experiments. The dry powder (residue) suspensions were prepared at 0.25, 0.50, 0.75 and 1.00%, w/v) each in 20 liter tap water in plastic tubs. Preweighed nine aquatic weeds namely water hyacinth, salvinia, pistia, azolla, lemna, spirodella, hydrilla, ceratophyllum and najas were allowed to grow in the medium under outdoor conditions. Plants grown in tap water similarly served as controls. Biomass was monitored. Total phenolics were measured in the suspensions after filtering through Whatman No. 1 filter paper discs.

Results showed that the *Cassytha sp.* residue was lethal at and above 0.75%, w/v, to all aquatic weeds. Total phenolics at 1% residue suspension in water estimated at 620 µg ml^{-1} and it declined to about 11 µg ml^{-1} by 53 days.

WP-1-f : Relative toxicity of urea to aquatic weeds

D.K. Pandey

Urea solutions at 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.08, 0.10, 0.20, 0.30 and 0.40% (w/v) were prepared each in 20 litre tap water in triplicate. Preweighed aquatic weeds were placed on the solutions and allowed to grow under outdoor conditions. Biomass was monitored. Water hyacinth and pistia were used as representatives of relatively tolerant and sensitive species respectively for studying mechanism of tolerance to urea. Ammonia was measured in root and leaf tissues of the treated and untreated plants. Effect of urea at lethal

dose on solute leakage from - and dehydrogenase activity in - the roots, chlorophyll and carotenoid contents in leaves were measured in pistia.

The results showed that all aquatic weeds namely *salvinia, pistia, spirodella, azolla, lemna, ceratophyllum, hydrilla* and *najas* were killed at 0.04%, w/v, urea whereas water hyacinth was killed at 0.30% urea. Urea killed plants by causing damage to cellular membranes as evidenced by increase in solute leakage from the roots, drastic reduction in dehydrogenase activity in the roots and loss of chlorophyll and carotenoid pigments in the leaves. Association of these changes with urea toxicity at lethal dose indicates that urea killed the treated plants by affecting key macromolecules - proteins, nucleic acids and lipids. For a given concentration of urea the pistia plants accumulated more ammonia than water hyacinth plants suggesting that relative tolerance to urea in water hyacinth was probably due to avoidance of ammonia accumulation in root and leaf tissues.

WP-1-d : Effect of parthenium residue on paddy.

D.K. Pandey

The experiment was conducted in plastic buckets under outdoor conditions. Parthenium leaf powder (dry residue) was suspended at 0.25, 0.50, 0.75 and 1.00% in 2 liter tap water and finally 2 liter acid washed sand was added and stirred to make even mixture. Twenty seedlings of paddy var. Kranti were planted in each bucket. Equal biomass of 8 aquatic weeds viz., 15 g *salvinia*, 10 g *pistia*, 250 mg *azolla*, 40 mg *spirodella*, 40 mg *lemna*, 150 mg *hydrilla*, 500 mg *ceratophyllum* and 150 mg *najas*. The plants were allowed to grow under outdoor conditions. Daily evapotranspiratory loss of water was replenished by adding tap water and the volumes of water or the suspensions were kept constant throughout the experiment duration. Observation on biomass of the aquatic weeds and yield parameters of paddy were monitored.

Results showed that the parthenium leaf residue at higher levels (1.00%, w/v) inhibited all aquatic weeds except *spirodella* and *lemna* which continued to grow.

Table 54 : Effect of parthenium leaf residue (LR) on biomass of aquatic weeds in paddy in pot culture

Treatment	Salvinia	Pistia	Cetrophyllum	Hydrilla	Azolla	Najas	Spriodella	Lemna
Initial biomass of weeds--> % LR dry w/v	15gm	10gm	500mg	150mg	250mg	150mg	40mg	40mg
LR 0.25%	133.6	24.3	1234	1003.0	2697	149	55.0	77.0
LR 0.50%	147.3	16.6	2246	43.3	597	332	234.0	82.0
LR 0.75%	56.3	9.3	0	678.3	80	0	64.6	153.0
LR 1.00%	25.3	9.3	2986	0.0	0	0	182.0	85.0
Tap water control	45.3	17.0	2936	47.2	2133	220	11.6	293.0

Paddy plant growth was supported by parthenium leaf residue. Number and weight of grains per ear sharply increased with parthenium leaf residue. In tap water, the number and weight of grains per ear were the lowest and at 1.00% it was the maximum but was lower when compared with the commercial crop in the field.

The findings revealed that parthenium leaf residue at 1.00%, w/v, supressed aquatic weeds supported growth of paddy plants. Some of the aquatic weeds were not killed at the concentrations tried. This was probably due to lack of intense sun light during rainy season.

Inhibitory activity and phenolics in the medium were depleted completely by the time paddy plants matured.

Table 55 : Effect of parthenium leaf residue (LR) on paddy var. Kranti yield in pot culture

Parthenium leaf residue % (w/v) in the medium	Length of ear (cm)	Number of grains per ear	Dry weight of grain per ear (g)
0.25	10.0	20.8	0.26
0.50	13.4	39.5	0.66
0.75	15.7	66.1	0.99
1.00	16.57	2.7	1.26
Tap water control	3.3	4.0	0.08
Control from field experiment	18.7	96.0	1.63
Control from commercial field	22.8	178.7	1.32
LSD at < 0.05	**1.91**	**18.2**	**0.309**

7. EXPERIMENT STATION

The Centre has 59.5 ha land adjoining to Jawaharlal Nehru Krishi Vishwavidhyalay, Jabalpur. During *kharif* season of 1994, 29.76ha of area was covered under cultivation. Due to very heavy rainfall crops like soybean and maize were damaged severely during early period of the sowing season. Major area was under the main *kharif* crops such as rice and soybean covering 22.36 and 2.9 ha with the production of 903.34 and 1.50 quintals, respectively. Maize was taken only for research experiments, covering an area of 0.7 ha Dhaincha was grown in area of 3.8 ha with the purpose of green manuring and seed production for next season.

During *rabi* season 1994-95, the area of 36.5 ha was covered for growing wheat, gram, lentil, pea, linseed, mustard, rajmash and these crops covered the area of 13.7, 4.0, 0.3, 1.4, 10.4, 8.5 and 0.2 ha respectively.

Area mentioned under various crops also include the experimental area.

Table 56 : Area and production of *kharif* and *rabi* 1994-95.

Crop	Area (ha)	Production (q)	Crop	Area (ha)	Production (q)
Rice	22.36	903.34	Wheat	13.7	393.31
Soybean	2.90	1.50	Gram	4.0	89.94
Maize	0.70	-	Lentil	0.3	6.00
Dhaincha	3.80	-	Pea	1.4	12.00
			Linseed	10.4	108.00
			Mustard	8.55	0.85
			Rajmash	0.2	0.60
Total	29.76			36.5	

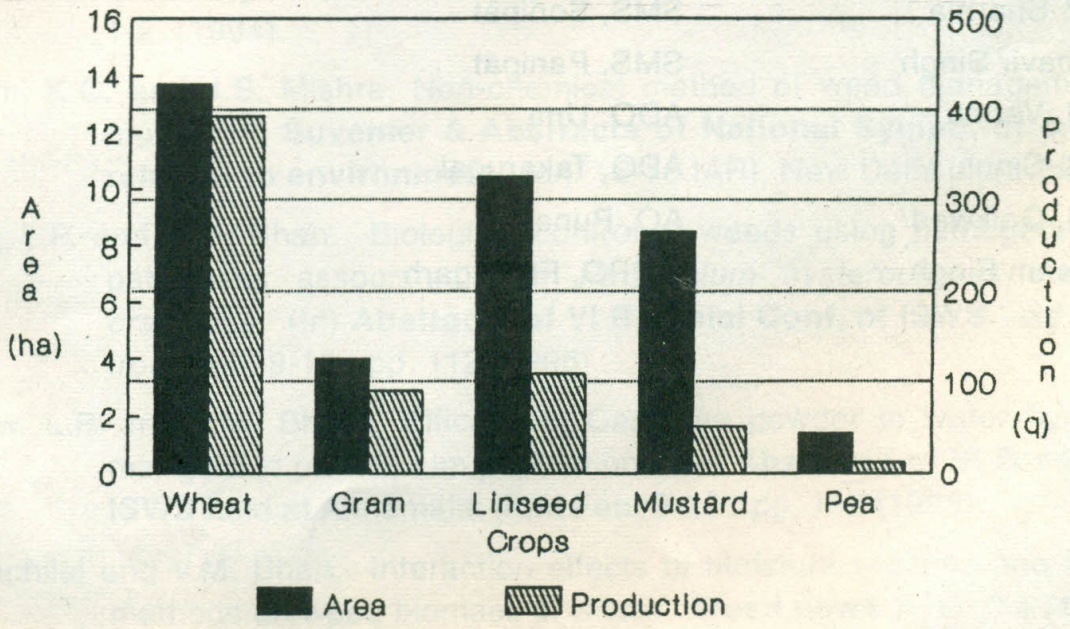

Fig.9 : Area and production of rabi crops during 1994-95.

8. TRANSFER OF TECHNOLOGY

Training

Short term training course programme on "**Weed Management : A tool for improving crop production**" of eight days from 16-23 Jan.,1995 was sponsored by the Ministry of Agri. (Deptt. of Agri. & Coopn.), Directorate of Extension, Krishi Vistar Bhawan, New Delhi & conducted by NRC - Weed Science, Jabalpur with a basic objective of imparting specialised training for subject matter specialist (SMS) and officers of state governments. The participants were also taken on field trips for practical orientation of latest weed management technology. The training programme also helped the centre's scientists to assess the effectiveness of the programme and know whether set objectives were achieved or not. Sofar, 15 SMS and officers have been trained in the light of recent weed management technology. List of participants is given below :-

1.	Dr. Anil Thakur	ADO, Shimla
2.	Shri B.S. Pasupathy	AO, Perambdur
3.	Shri C.K. Sharma	AARO, Jaipur
4.	Dr. H.S. Bhatti	SMS, Amritsar
5.	Shri J.L. Raina	DEPO, Jammu
6.	Shri J.S. Kamble	AO, Ahmadnagar
7.	Shri K.G. Chothe	AO (WM) Panaji, Goa
8.	Shri O.M. Fernandes	AO (Pub.) Panaji, Goa
9.	Shri R.K. Chandrawanshi	ADA, Raipur
10.	Shri O.P. Sharma	SMS, Sonipat
11.	Shri Mahavir Singh	SMS, Panipat
12.	Shri R.S. Verma	ADO, Una
13.	Shri S.R. Singh	ADO, Takarugal
14.	Shri S.S. Gaikwad	AO, Pune
15.	Shri Tarsem Singh	APPO, Fatehgarh

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10. SUMMARY

WEED MANAGEMENT IN CROPPING SYSTEM

Rice

In an experiment entitled "effect of organic and inorganic manuring and weed management in direct seeded rice", butachlor significantly reduced the weed dry matter when compared with control. In a mulching experiment, it was observed that black and transparent polythene reduced the weed dry matter production and was comparable to weed free situation regarding grain yield.

Soybean

Experiment conducted on chemical control of parthenium in soybean revealed that bentazon @ 1.5 kg/ha applied 25 DAS proved most effective against *Parthenium hysterophorus* and *Cyperus iria*. Weeds caused 60% reduction in grain yield of soybean.

Wheat

In a preliminary herbicide screening conducted on wheat, it was noted that DIL-HR and PIL-CR have been observed very effective in controlling broadleaved weeds and *Phalaris minor.*

Chickpea

In a crop-weed competition studies conducted in chickpea revealed that initial 60 days period is critical for keeping the crop weed free. Amongst weed control treatments, basalin, pendimethalin and sythoxydim performed equally well in reducing weed population.

Mustard

Experiment conducted on crop weed competition in mustard revealed that initial 30 to 60 DAS is the most important period for crop weed competition. In a herbicidal control of weed studies showed that sythoxydim 800 g/ha PE and pendimethalin 1.0 kg/ha controlled the weeds and recorded significantly higher grain yield almost equal.

Animal manure input system

Weeds caused 21% reduction in grain yield of wheat. In Soybean-wheat rotation system, the highest weed population was recorded with low input animal system using manures i.e. 50% of the recommended dose of nutrient (of which 50% is supplied through FYM) 50% through fertilizer). The highest grain yield of wheat i.e. 49.20 q/ha was noted with the conventional method. In maize-pea rotation, highest grain yield of pea i.e. 19.73 q/ha was recorded with conventional method which reduced significantly the weed population as well as their dry weight as compared to other treatments. Application of pendimethalin @ 1.25 kg/ha in pea significantly reduced the weed population and weed dry matter production and increased the grain yield by 14% by decreasing weeds which were reported to have decreased the yield by 30%.

Cropping Intensity (C.I.)

Presence of weeds through out growing season, caused 30% reduction in grain yield. Application of isoproturon @ 1.0 kg/ha in wheat and mustard significantly reduced the weed density and its dry matter and increased grain yield by 20%. The lowest weed population and its dry matter were noted with 100% cropping intensity (fallow-wheat) and rice-fallow (100% C.I.). Highest grain yield was recorded with rice-fallow (100%) during kharif season and rice-wheat (200% CI) during Rabi 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 dry matter and increased the grain yield by 15.5 and 16.5 per cent, respectively.

Pea

Competitive behaviour of pea cultivar was studied to see suppressing ability of cultivars over emergence of weed. Minimum weed dry matter and maximum grain yield of pea were recorded with the variety JP-885 because of fast growth habit consequently weed could not improve. Maximum dry matter was recorded in weed free plot followed by fluchloralin 1.0 kg/ha (28.02 q/ha) and hand weeding 30 DAS (25.8 q/ha).

Rajmash

Studies on nitrogen use economy through weed control in rajmash revealed that increasing nitrogen level from 0 to 80 increased weed population but decreased when N-level was increased to 120 kg/ha at which grain yield of rajmash i.e. 10.15 q/ha was the highest. Pendimethalin @ 1.0 kg/ha reduced the weed dry matter followed by HW (30 DAS). In a crop-weed competition study, it was found that it was conducive bo keep the crop initially weed free for 60 days for obtaining maximum yield of rajmash.

Parthenium hysterophorus

Studies on chemical control of *Parthenium* in non-cropped areas were carried and it revealed all the herbicides like metsulfuron (3.5 and 4.5 g/ha) and chlorimuron at 20 kg/ha, 2,4-D at 2.0 kg/ha and glyphosate 1.5 kg/ha resulted in 67, 91, 33, 47 and 97% control respectively at 15 DAS spray. Experiment conducted on biology of parthenium revealed that the maximum seeds germinated within a week when it was sown in August and September however, germination process went on delaying from October to January. Seeds sown in February and March resulted in very poor germination and from April onwards the germination was almost nil.

Vicia sativa

Biology of Vicia sativa was studied to observe the emergence, growth and reproductive behaviour. It was sown at an interval of 15 days from September to December. It was concluded that minimum seedling emergence and maximum plant dry weight was observed from 15 September sowing.

In case of study carried out as interaction of *Vicia* densities in lentil, it revealed that increasing densities of *Vicia* from 0 to 80/m significantly reduced the grain yield of lentil. The significant reduction in grain yield was obtained even at 30 *Vicia* sp./m.

Cropping system

Studies on effect of nitrogen sources on distribution of weeds revealed that nitrogen @ 120 kg/ha through urea significantly produced higher weed dry matter as compared to applications through FYM and dhaincha. Anilophos caused significant reduction in weed dry matter. In case, of effect of time of N-application, the grain yield of paddy obtained with the treatments involving three splits as compared to one split.

Wheat

In an experiment conducted on effect of concentration gradient of isoproturon on *Phalaris minor* in wheat, it revealed that isoproturon 1 kg/ha in combination with 2,4-D 0.5 kg/ha applied at 30 DAS gave least weed dry weight with minimum weed population. In the screening of herbicides against *Phalaris minor* in wheat, all the herbicides tried such as isoproturon, triallate, oxyflourfen, butachlor and alachlor (all at medium level) resulted in an excellent control of *Phalaris minor* but amongst herbicides, only triallate and oxyflourfen gave the highest yield of wheat.

VEGETATION MANAGEMENT

Survey was conducted to collect the infected plant parts of *Parthenium, Cyperus, Phalaris* and *Eichhornia crassipes. Fusarium sp., Sclerotium rolfsii and Curvularia* sp. were isolated from Parthenium. *Cyperus, Fusarium* sp. and rust *Puccinia* sp. (rust) were isolated and from water hyacinth, *Acromonium* sp. and *Alternaria alternata* were isolated.

In an experiment to study the testing of weed control efficiency of *Fusarium* on *Parthenium*, it was observed that maximum reduction in height, number of branches/plant and number of flowers/plant was obtained in spraying of *Fusarium* from 8 to 30 DAS and very less when sprayed at 60 and 75. It was concluded that parthenium is killed in its early stage by spraying of *Fusarium* @ 150 to 200 g/l of water reduced the growth of parthenium significantly. Soil and seed treatment used as inoculation method resulted best in controlling *Parthenium* during June, Aug., 1994 and January, 1995. Effect of *Sclerotium rolfsii* on *Parthenium hysterophorus* concluded that *Sclerotium* fungus is very virulent for control of *Parthenium*. Phalaris leaves were slightly infested by the same fungus, while on the other hand, it completely killed water hyacinth within 35 days of treatment. *Trichoderma* fungus also killed Parthenium and water hyacinth. In case of effect of non toxic chemical treatment on water hyacinth, it revealed that maximum number of leaves were killed by sodium chloride. *Trichoderma* grown together with *Fusarium* and *Sclerotium* for their mutual interaction, could completely inhibit the growth of both the fungus.

In an experiment carried out in laboratory for testing media for growth of pathogens, it revealed that best growth of Fusarium was obtained on potato dextrose agar and potato

dextrose broth medias, while Sclerotium fungus grow better on potato dextrose broth media only.

During studies conducted on biological control of water hyacinth by insects, survey of ponds located at Jabalpur was made during August 94 for observing water hyacinth intensity and problem. It was noted from the survey that about half of the area infested with water hyacinth was killed by weevil by the end of October 1994, showed later on the clean water. The survey of insect and non-insect fauna weeds was conducted at Sidhi, NRC-WS Farm, roadside and waste land. On lantana, tinged bug Teleonemia scrupulosa was found and few bushes were found dry due to its attach within six months.

WEED PHYSISOLOGY

Studies, conducted to findout the effect of different growth retardants on growth and yield of wheat and its associated weeds revealed that the weed dry matter of *P. minor* was considerably reduced by Pachlobutrazol or cultar (CT) with corresponding increase in grain yield applied at 30 DAS. While growth of *Cichorium intybus* was reduced by Ethephan and cultar both.

In an experiment of effect of rice-based cropping system herbicide sequence on distribution of weeds, the occurance of *Commelina communis* was lowest in butachlor/ isoproturon herbicide at 40 and 60 DAS. Weed dry matter and grain yield of rice was recorded lowest and highest resp. in weed free plot followed by butachlor/isoproturon treatment. In wheat, the occurance of *Phalaris minor* was lowest in butachlor/isoproturon and that of *C. ficifolium* in butachlor/2,4-D treated plot. In case of soybean based cropping system and herbicide sequence experiment, the incidence of *P. minor* was lowest in isoproturon treated plot (1 Kg/ha).

Experiment, carried out on effect of rabi crop debris on transplanted rice, revealed that Pea, mustard and linseed bhusa increased the growth and yield of crop. The highest yield was noted with weed free (46.81 q/ha) followed by pea bhusa (46.4 q/ha). Pea bhusa reduced weed dry matter at 60 DAT stage of transplanted rice significantly.

In studies of inhibition of lemna and ceratophyllum by Parthenium, results implicate that the parthenium residue killed the lemna plants by affecting macromolucules -protein, lipids and nucleic acid while ceratophyllum treated at lethal dose of residue turned dull green, lost trigidity & biomass rapidly and showed death and decay within 10-15 days.

In the experiments, phyto toxicity of cassytha plant residue on aquatic weeds, it resulted that cassgtha residue was lethal at and above 0.75% W/v to all aquatic weeds, such as *najas, lemna, salvinia, water hyacinth, ceratophyllum, Pistia, azolla, Spirodella* and *hydrilla*. While cuscuta residue @ 1% W/v dry residue inhibited these aquatic weeds. In case of allelochemicals, P-hydroxy benzoic acid was lethal to all these aquatic weeds at 50-100 ppm and Anisic acid was lethal at 50 ppm to *azolla, srirodella* and *lemna*, and at 100 ppm to *hydrilla* and *najas*. Parthenin caused root disfunction, loss of both membrane integrity and dehydrogenase activity in roots and loss of chlorophyll content in the leaves of

water hyacinth. All the aquatic weeds were killed at 0.04% W/v by urea by damaging cellular membranes.

An experiment, conducted to study the effect of parthenium residues on paddy revealed that parthenium leaf residues at higher levels i.e. 1.0% W/v inhibited all the aquatic weeds except *spirodella* and *lemna* which continued to grow. While paddy plant was supproted by Parthenium leaf residue. Number and weight of grains per ear sharply increared with parthenium leaf residues.

AGRICULTURAL ENGINEERING

Experiment entitled "Performance evaluation of improved mechanical weeder for weed control in rabi crops, resulted that at 25 and 35 DAS single tyned grubber controlled 90.2% and 78.25% of weeds at first weeding in wheat, resp.In gram crop, twin wheel hoe operated at 25 and 35 DAS, controlled 70.5% and 77.2% of weeds during first weeding stage resp.

सारांश

सस्यन प्रणाली में खरपतवार प्रबंधन

धान :- धान की फसल में उगने वाले खरपतवारों पर कार्बनिक एवं अकार्बनिक खादों एवं खरपतवार प्रबंधन पर किये गये परीक्षण से यह पाया गया है कि घासीय उपचार की तुलना में ब्यूटाक्लोर नामक खरपतवारनाशक ने खरपतवारीय शुष्क पदार्थ को काफी हद तक कम करने में सफलता प्राप्त हुई। खरपतवारों पर मलचिंग के प्रभाव को जानने के लिए काले एवं पारदर्शी प्लास्टिकस का प्रयोग किया गया। जिससे यह ज्ञात हुआ कि काले एवं पारदर्शी प्लास्टिकस् के उपयोग वाले क्षेत्रों में खरपतवारों के शुष्क पदार्थ में भारी कमी दर्ज की गई।

सोयाबीन :- सोयाबीन की फसल में उगने वाली गाजर घास के नियंत्रण हेतु एक परीक्षण किया गया जिसमें यह पाया गया कि बेटाजोंन (1.5 किग्रा. / है.) शाकनाशी को बुआई के 25 दिन पर डालने से गाजर घास तथा साइप्रस ईरिया नामक खरपतवारों की संख्या में भारी कमी दर्ज की गई।

गेहूँ : नये शाकनाशियों के प्रारंभिक परीक्षण से यह पाया गया कि पी.आई.एल-एच. आर. तथा पी.आई.एल-सी.आर. गेहूँ में पाये जाने वाले खरपतवार जैसे फेलेरिस माइनर एवं चौड़ी पत्ति वाले खरपतवारों को कम करता है।

गेहूँ में फेलेरिस माइनर नामक खरपतवार पर आइसोप्रोट्रान शाकनाशी की विभिन्न सान्द्राताओं के प्रभाव के अध्ययन से यह पाया गया है कि आइसोप्रोट्रान (1 किग्रा./हे.) को 2, 4 - डी (0.5 किग्रा./हे.) के साथ मिलाकर 30 दिन पर डालने से खरपतवारों की संख्या एवं उनके शुष्क पदार्थ को कम करने में काफी चरितार्थ पाया गया। उसी फसल में फेलेरिस माइनर के विरुद्ध विभिन्न शाकनाशियों के प्रारंभिक परीक्षण से पाया गया कि आइसोप्रोट्रान, ट्रायअलीट, आक्सीफ्लोरफेन, ब्यूटाक्लोर एवं ऐलाक्लोर नामक शाकनाशियों ने फेलेरिस माइनर को प्रभावी रूप से कम किया है परंतु इनमें से दो शाकनाशियों जैसे ट्रायअलीट एवं आक्सीफ्लोरफेन ने गेहूं की उपज में काफी बढ़ोत्तरी करी।

चना :- चने की फसल में किये गये फसल खरपतवार प्रतिस्पर्धा अध्ययन के दौरान यह ज्ञात हुआ कि चने की फसल को इसकी ज्यादा से ज्यादा उपज प्राप्त करने के लिए शुरू के 60 दिन तक खरपतवार रहित रखना चाहियें। खरपतवार नियंत्रण विधियों के अन्तर्गत पेन्डीमिथालिन एवं सिथाक्सीडिम नामक शाकनाशी खरपतवारों की संख्या को नियंत्रण करने में काफी प्रभावी पाये गये।

सरसों : सरसों की फसल में किये गये परिक्षण ''फसल खपतवार प्रतिस्पर्धा''

अध्ययन से यह पाया गया कि फसल को शुरू के 30 से 60 दिन तक खरपतवार रहित रखने से फसल की उपज में बढ़ोत्तरी होती है। शाकनाशीय नियंत्रण में सिथाक्सीडिम 800 ग्रा./हे. तथा पेन्डीमिथालिन 1.0 ग्रा./हे. शाकनाशियों (दोनों उगने पूर्व) से खरपतवार को काफी हद तक नियंत्रित किया गया और साथ ही फसल की उपज में बढ़ोत्तरी से आशातीत सफलता मिली।

पशु खाद लागत पध्दति :

इस परिक्षण में खरपतवारों से गेहूं की उपज 21 प्रतिशत की कमी दर्ज की गई। सोयाबीन–गेहूं फसलीय परम्परागत पद्वति से 49.20 क्वि./हे. गेहूं की उपज प्राप्त हुई। मक्का–मटर फसलीय चक्र में, इसी पद्वति से खरपतवार की संख्या एवं उसके शुष्क पदार्थ को कम करते हुये 19.73 क्वि./हे. मटर की उपज में बढ़ोत्तरी से अर्थपूर्ण सफलता मिली। इसी चक्र में मटर की फसल में पेन्डीमिथालिन 1.25 किग्रा. के हिसाब से डालने पर खरपतवार की संख्या में कमी आई जिससे फसल की उपज में 14 प्रतिशत तक बढ़ोत्तरी हुई। खरपतवारों से मटर की फसल की उपज में 30 प्रतिशत की कमी आंकी गई।

फसलीय तीव्रता : खरीफ मौसम में, खरपतवारों से फसल की उपज में 30 प्रतिशत तक की कमी दर्ज की गई। सोयाबीन पर आधारित फसलीय तीव्रता वाले परीक्षण में ज्यादा बारिश से सोयाबीन की फसल को काफी नुकसान पहुंचा तत्पश्चात फसल नष्ट हो गई। रबी मौसम में, गेहूं की फसल में खरपतवारों के नियंत्रण हेतु आइसोप्रोट्रान को 1.0 किग्रा./हे. के हिसाब से डालने पर खरपतवारों की संख्या एवं उनके शुष्क पदार्थ को कम करने में अर्थपूर्ण सफलता पाई गई साथ ही साथ फसल की उपज को 20 प्रतिशत बढ़ाने में सफलता प्राप्त की। सबसे कम खरपतवार, 100 प्रतिशत वाली फसलीय तीव्रता जैसे : फेलो – गेहूं एवं धान – फेलो के परीक्षणों में दर्ज की गई। सबसे ज्यादा उपज, धान फेलो (100 प्रतिशत फसलीय तीव्रता) एवं धान –गेहूं (200 प्रतिशत फसलीय तीव्रता) वाले फसल चक्र से प्राप्त हुई। धान की फसल में ब्यूटाक्लोर 1.5 किग्रा./हे. की दर से एवं गेहूं एवं सरसों में आइसोप्रोट्रान 1.0 किग्रा./हे. के हिसाब से डालने पर खरपतवारों की संख्या में कमी दर्ज की गई, साथ ही साथ खरीफ मौसम में 15.3 एवं रबी मौसम में 16.5 प्रतिशत तक उपज बढ़ाने में सहायक हुयें।

मटर : मटर की किस्मों के खरपतवारों के साथ प्रतिस्पर्धिक आचरण को ज्ञात करने के लिए एक परीक्षण किया गया जिसमें यह देखा गया कि जे. पी. – 885 नामक किस्म की 60 दिन एवं कटाई पर खरपतवारों के शुष्क पदार्थ को कम करने में काफी सिद्ध हुई। खरपतवारीय प्रबंधन प्रणालियों से मटर की उपज में बढ़ोत्तरी दर्ज की गई। मटर की उपज खरपतवार रहित क्षेत्र में (28 क्वि./हे.) में फ्लूक्लोरेलिन 1.0 किग्रा/हे. (26 क्वि./हे.) तथा निदाई 30 दिन (25.8 क्वि./हे.) नामक उपचारें की तुलना में ज्यादा प्राप्त हुई।

राजमा : राजमा की फसल में खरपतवारीय नियंत्रण एवं नाइट्रोजन का खरपतवारों के

उगने पर प्रभाव का अध्ययन किया गया। इस परीक्षण के परिणामों से यह ज्ञात होता है कि जैसे-जैसे नाइट्रोजन की दर से 0 से 80 किग्रा. तक बढ़ाते है वैसे ही खरपतवार संख्या बढ़ती है परंतु जब दर को और 120 किग्रा. तक बढ़ाते है, तो खरपतवार की संख्या कम होने के साथ-साथ फसल की उपज 10.15 क्वि./हे. प्राप्त हुई जो कि अन्य उपचारों से ज्यादा पाई गई। पेन्डीमिथालिन 1.0 किग्रा. एवं निंदाई 30 दिन पर उपचार करने में भी खरपतवारीय शुष्क पदार्थ में कमी आई। खरपतवार -फसल प्रतिस्पर्धिक अध्ययन से यह ज्ञात होता है कि फसल को इसकी प्रारंभिक अवस्था के 60 दिन तक खरपतवार रहित रखने से फसल की उपज ज्यादा प्राप्त होती है।

पार्थेनियम हिस्टेरोफोरस (गाजर घास) : अकृषित क्षेत्र में गाजर घास नामक खरपतवार को उसके रसायनिक नियंत्रण वाबत् एक परीक्षण किया गया। जिससे यह ज्ञात होता है कि सभी शाकनाशियों जैसे मेटसल्फ्यूरान (3.5 एवं 4.5 ग्रा./हे.), क्लोरीमुरान (20 ग्रा./हे.), 2,4 - डी (2.0 किग्रा. /हे.) तथा ग्लाईफोसेट (1.5 किग्रा./हे.) को बुआई के बाद 15 वें दिन पर डालने से पार्थेनियम के नियंत्रण में क्रमशः 67, 91, 47 एवं 97 प्रतिशत तक की कमी दर्ज की गई।

गाजर घास की जीवविधा हेतु गमले में एक परीक्षण किया गया। इस परिक्षण से यह हुआ कि अगस्त एवं सितम्बर माह में बोई गई गाजर घास का सबसे ज्यादा अंकुरित हुये तथा अंकुरण में अक्टूबर से जनवरी माह तक अंकुरण में देरी दर्ज की गई। फरवरी -मार्च में बोई गई गाजर घास के अंकुरण में कमी आई। तथा अप्रैल के बाद बोई गई गाजर घास का अंकुरण नहीं हुआ।

विसीया सटाईवा (अकरी) : अकरी की जीवविधा के अध्ययन हेतु एक परीक्षण गमले में किया गया। इस खरपतवार के अंकुरण क्रम को जानने हेतु 15 दिन के अंतर पर सितम्बर से दिसम्बर तक बोआई की गई। यह ज्ञात हुआ कि अकरी के कम पौधों के अंकुरण एवं उसके सबसे ज्यादा शुष्क पदार्थ 15 सितम्बर की बोआई से प्राप्त हुआ।

मसूर की फसल में अकरी के प्रतिस्पर्धा हेतु एक अध्ययन किया गया जिससे यह ज्ञात हुआ कि अकरी की सघनता 0 से 180 /वर्ग मीटर बढ़ाने से मसूर की उपज में कमी आई। अकरी की सघनता 30/वर्ग मीटर करने से मसूर की उपज में अर्थपूर्ण कमी पाई गई।

फसलीय पद्धति : धान-गेहूं फसलीय चक्र में, खरपतवारों के वितरण एवं नत्रजन उपयोग क्षमता पर नत्रजन के विभिन्न मूलों के प्रभाव का अध्ययन किया गया। परिणामों का अध्ययन करने से यह ज्ञात हुआ कि 120 किलो नत्रजन को यूरिया से डालने पर खरपतवार के शुष्क पदार्थ में अन्य उपचारों जैसे गौबर की खाद एवं ढेइचा की तुलना में अर्थपूर्ण बढ़ोत्तरी देखी गई। इसी चक्र में, शाकनाशियों में ऐनीलोफोस नामक शाकनाशी से खरपतवार के शुष्क पदार्थ में कमी आई।

नत्रजन को फसल के पृथक-पृथक समय पर डालने से फसल की उपज में काफी

बढ़ोत्तरी दर्ज की गई।

वानस्पतिक प्रबंधन : केन्द्र के प्रक्षेत्र एवं जबलपुर के नजदीकी जिलों में गाजर घास, साइप्रस, चिरईया बाजरा एवं जलकुम्भी पर रोगों व कीड़ों का पता लगाने हेतु सर्वेक्षण किया गया। इसके दौरान इन रोगयुक्त पौधों को एकत्र कर प्रयोगशाला में इनमें विद्यमान रोग मूलकों को रोगयुक्त पौधों से प्रथक किया गया। गाजर घास के पौधे से फ्यूजेरियम स्पी, स्केलोरेशियम रोल्फसाई एवं कर्वूलेरिया स्पी नामक फफूंद, साइप्रस से फ्येजूरियम स्पी एवं पक्सीनिया रस्ट तथा जलकुम्भी से एक्रोमोनियम स्पी एवं आल्टरनेरिया आल्टरनाटा आदि फफूंद अलग किये गये।

परीक्षण के एक अध्ययन में, फ्यूजेरियम स्पी नामक फपूंद का गाजर घास पर उसकी खरपतवार नाशक क्षमता की जांच करने से यह पाया गया कि फ्यूजेरियम स्पी के घोल को 8 से 30 दिन तक छिड़कने से गाजर घास के पौधे की लम्बाई, शाखाओं एवं फूलों की संख्या में भारी कमी दर्ज की गई। 60 से 75 दिन के बीज इस फफूंद के छिड़कने से गाजर घास पर कोई खास असर नहीं देखा गया।

इस परीक्षण से यह पाया गया कि गाजर घास की वृद्धि रोकने के लिए फ्यूजेरियम स्पी के घोल का 150 से 200 ग्राम प्रति लिटर तक का छिड़काव गाजर घास की शुरू की स्थिति में करने से अच्छे परिणाम प्राप्त होते हैं।

गाजर घास, चिरैया बाजरा एवं जलकुम्भी पर स्कलेरोशियम रोलफसाई नामक फफूंद का प्रभाव देखने हेतु परीक्षण किया गया। इस के परिणामों से यह ज्ञात हुआ कि गाजर घास एवं जलकुम्भी के नियंत्रण के लिए यह फफूंद 35 दिन में काफी विषमय साबित हुई परंतु चिरैया बाजरा (फेलेरिस माइजर) की पत्तियां बहुत कम प्रभावित हुई। ट्राइकोडरमा नामक फफूंद के छिड़काव का गाजर घास एवं जलकुम्भी दोनों पर प्रभाव देखा गया जिससे यह ज्ञात हुआ कि इस फफूंद ने भी इन दोनों खरपतवारों को नष्ट कर दिया। बिना विषयक रसायनों का जलकुम्भी पर असर जानने हेतु भी एक अध्ययन किया गया। इस परीक्षण से यह ज्ञात हुआ कि नमक के घोल का (एन. ए. सी. एल.) जलकुम्भी की पत्तियों पर काफी नकारात्मक असर देखा गया।

ट्राइकोडरमा, फ्यूजोरियम एवं स्केलेरोशियम नामक फफूंदों को एक साथ उगाकर उनका एक दूसरे पर प्रभाव देखा गया जिसमें इस बात का पता चला कि ट्राइकोडरमा से बाकी दोनों फफूंदों की वृद्धि रुक जाती है। एक अन्य परीक्षण में, फ्यूजेरियम एं स्केलोरोशियम को विभिन्न माध्यमों में उगाकर देखा एवं पाया गया कि फ्यूजेरियम आलू के डेक्ट्रोस अगर एवं ब्राथ माध्यमों में ज्यादा अच्छे वृद्धि करते है बल्कि स्केलेरोशियम रोलफसाई एक ही माध्यम जैसे आलू के डेक्ट्रोस ब्राथ माध्यम में सफलता पूर्वक उगा।

कीड़ों द्वारा जलकुम्भी के जैविक नियंत्रण बावत् एक परीक्षण किया गया। इस हेतु

अगस्त 94 के दौरान कई तालाबों का जलकुम्भी तथा उससे होने वाली समस्या को जानने के लिए एक सर्वेक्षण किया गया। एक तालाब में यह पाया गया कि जलकुम्भी उगे तालाब आधे से ज्यादा क्षेत्र एक कीड़े (वीबिल) से नष्ट पाया गया। यह कीड़ी (वीबिल) नियोकेटिना स्पी के रूप में पहचाना गया। सीधी जिले में एक सर्वेक्षण परीक्षण के दौरान लेन्टाना कमारा नामक खरपतवार पर एक कीड़े (टेलेम्रिया स्कपूलोया) के आक्रमण को नोट किया गया। ज्ञात हुआ है कि इस खरपतवार की कुछ शाखायें छः महिने के अंदर सूखी पाई गई।

खरपतवारकार्यिकी :- वृद्धि प्रतिरोधकों का गेहूं एवं उसमें उगने वाले खरपतवारों पर के प्रभाव का अध्ययन किया गया। जिससे यह पाया गया कि पेक्लोब्यूट्राजोल या कोलतार को 30 वे दिन उपयोग करने से चिरैया बाजरा (फेलेरिस माइनर) के शुष्क पदार्थ में कमी तथा फसल की उपज में बढ़ोत्तरी दर्ज की गई। इथेफोन एवं कोलतार नामक वृद्धिप्रतिरोधकों के डालने से सिचोरियम इनटाईवस खरपतवार की वृद्धि में भी कमी पाई गई।

धान पर आधारित फसलीय चक्र एवं शाकनाशी अनुक्रम का खरपतवारों के उगने पर प्रभाव देखा गया। इस परीक्षण में पाया गया कि धान में कामेलिना कम्यूनिस का वृतान्त व्यूटाक्लोर /आइसोप्रोट्रान शाकनाशी अनुक्रम उपचार वाले प्लाट में सबसे कम पाया गया। खरपतवार रहित क्षेत्र में दर्ज की गई। सबसे कम खरपतवारीय शुष्क पदार्थ एवं सबसे ज्यादा उपज ब्यूटाक्लोर/आइसोप्रोट्रान नामक शाकनाशी अनुक्रम में भी लगभग यही स्थिति पाई गई।

गेहूं की फसल में, चिरैया बाजरा का वृतान्त व्यूटाक्लोर/आइसोप्रोट्रान उपचारित वाले शाकनाशी अनुक्रम में तथा सी. फिसीफोलियम का वृतान्त ब्यूटाक्लोर, 2,4 - डी उपचारित वाले क्षेत्र में सबसे कम पाया गया। शाकनाशी अनुक्रम में, चिरैया बाजरा की संख्या आइसोप्रोट्रान उपचारित वाले क्षेत्र में सबसे कम पाई गई।

धान एवं उसमें आने वाले खरपतवारों पर रबी फसलों के अवशेषों के प्रभाव का अध्ययन किया गया इस परीक्षण से यह ज्ञात हुआ कि मटर, सरसों एवं अलसी भूसा से धान की फसल में वृद्धि एवं उपज में बढ़ोत्तरी प्राप्त हुई। धान की उपज मटर के अवशेषों (46.4 क्वि. /हे.) की तुलना में सबसे ज्यादा खरपतवार रहित क्षेत्र (46.81 क्वि. /हे.) से प्राप्त हुई। मटर के अवशेषों से धान की फसल में खरपतवार शुष्क पदार्थ 60 दिन पर काफी कम हुआ।

जलीय खरपतवारों पर गाजर घास के अवशेषों से लेमना एवं सिरेटोफाइलम नामक जलीय खरपतवारों की वृद्धि कम होने के साथ -साथ 10-15 दिनों के भीतर ही नष्ट हो गये।

केसीथा एवं कसक्यूटा का जल खरपतवारों पर असर देखने हेतु परीक्षण किया गया। इस परीक्षण से ज्ञात हुआ कि केसिथा 0.75 प्रतिशत (पर एवं ज्यादा) एक कसक्यूटा 1 प्रतिशत के उपयोग से पर जलीय खरपतवारों को नष्ट करने में सहायक सिध्द हुये।

जलीय खरपतवारों पर ऐलीलोकेमिकलस् जैसे पी – हाइड्रॉक्सीबेन्जोइक अम्ल, एनीसीक अम्ल एवं पार्थेनिन का प्रभाव देखा गया। पी–हाइड्रोक्सीबेन्जोइक अम्ल 50–100 पी पी एम पर सभी जलीय खरपतवारों के लिए नष्ट कारक पाया गया जबकि एनीसिक अम्ल 100 पीपीएम पर उपयोग करने से हाइड्रीला एवं नाजस खरपतवारों के लिए एवं 50 पी पी एम पर स्पायरोडिला एवं लेम्ना खरपतवारों के लिए नष्टकारक सिद्ध हुआ। जलकुम्भी पर पार्थेनिन के प्रभाव से यह पाया गया कि पार्थेनिन डालने पर जलकुम्भी की वृद्धि उसकी जड़ीय कार्यकलापों को रोककर दोनों झिल्लीयों एवं क्लोरोफिल को कम नष्ट करने में सहायक होती है और जलकुम्भी अन्ततः मर जाती है। यूरिया के 0.04 प्रतिशत घोल को उपयोग करने से सभी जलीय खरपतवारों की कोशकीय झिल्लियों नष्ट हो जाती हैं।

धान पर एवं उसमें उगने वाले खरपतवारों पर गाजरघास के अवशेषों का प्रभाव देखा गया। यह ज्ञात हुआ कि गाजरघास के अवशेष के 1 प्रतिशत घोल के उपयोग से स्पायरोडेला एवं लेम्ना को छोड़कर सभी जलीय खरपतवार नष्ट हो गये। यह भी पाया गया कि इस अवशेषों से धान की फसल में दाने / बाली में बढ़ोत्तरी प्राप्त हुई।

कृषि अभियांत्रिकी : खरीफ एवं रबी फसलों में उन्नत यांत्रिक वीडर का खरपतवार नियंत्रण हेतु प्रदर्शनी मूल्यांकन किया गया। रबी मौसम में गेहूं की फसल में 25 व 35 दिन पर सिंगल ग्राइन्ड ग्रबर चलाने से क्रमशः 90 एवं 78 प्रतिशत खरपतवार नियंत्रण क्षमता प्राप्त हुई। चने की फसल में बड़े चके वाले हो के प्रयोग से क्रमशः 70 एवं 71 प्रतिशत क्षमता 25 एवं 35 वें दिन चलाने से प्राप्त हुई।

तकनीकी स्थानांतरण : इस केन्द्र में जनवरी माह की 16–23 तारीख 1995 को ''खरपतवार प्रबंधन – एक फसल उत्पादन बढ़ाने का औजार'' पर राज्यों के कृषि विभाग मे कार्यरत 15 विषय वस्तु विशेषज्ञ तथा आफीसरों को एक प्रशिक्षण दिया गया। जिसके तहत् उन्हें खरपतवार की तत्कालीक तकनीकी से अवगत कराया गया। प्रशिक्षण के दौरान प्रशिक्षार्थियों को समय–समय पर अनुसंधान स्थल पर भी ले जाया गया।

ANNEXURE -I

Total strength of the staff in the centre is 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 31.03.95)

Sl. No.	Designation	Name	Joining	Date of selection, promotion if any
RESEARCH MANAGEMENT PERSONNEL				
1.	Director	Dr. V.M. Bhan	22.04.89	
2.	Project Coordinator	Dr. K.C. Gautam	03.02.94	
SCIENTIFIC PERSONNEL				
3.	Sr. Scientist	Dr. L.P. Kauraw	10.07.91	
4.	Sr. Scientist (Ag. Engg.)	Sh. H.S. Bisen	01.01.92	
5.	Scientist (Pl. Physio.)	Dr. D. Swain	25.02.91	
6.	Scientist (Pl. Physio.)	Sh. D.K. Pandey	29.11.91	
7.	Scientist (Agronomy)	Dr. Sahadeva Singh	20.11.90	
8.	Scientist (Agronomy)	Dr. A.N. Singh	01.04.91	
9.	Scientist (Agronomy)	Dr. V.P. Singh	28.05.92	
10.	Scientist (Agromomy)	Sh. J.S. Mishra	24.07.92	
11.	Scientist (Soil Sci.)	Dr. Khajanchilal	30.08.93	
12.	Scientist (Entomo.)	Dr. Sushilkumar	11.04.94	New Scientists
13.	Scientist (Agro.)	Dr. Anil Dixit	11.08.94	
TECHNICAL PERSONNEL				
14.	T-5 (Technical Officer)	Dr. M.S. Raghuwanshi	24.08.92	
15.	T-5 (Farm Manager)	Sh. R.S. Upadhyay	17.03.90	Selected on 29.01.94
16.	T-4 (Librarian)	Sh. M.N. Jadhav	08.07.91	
17.	T-4 (Sr. Stat. Asstt.)	Sh. R.R. Saxena	18.12.91	

Sl. No.	Designation	Name	Joining	Date of selection, promotion if any
-				
18.	T-4 (Sr. Photographer)	Sh. Basant Mishra	19.12.91	
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.	T-1 (Field Assistant)	Sh. S.K. Parey	15.03.90	
26.	T-1 (Field Assistant)	Sh. K.K. Tiwari	14.01.92	
27.	T-1 (Field Assistant)	Sh. S.K. Tiwari	14.01.92	
28.	T-1 (Field Assistant)	Sh. Somitra Bose	14.01.92	
29.	T-1 (Field Assistant)	Sh. G. Vishwakarma	28.03.92	
30.	T-1 (Field Assistant)	Sh. Ajay Pal Singh	28.03.92	
31.	T-1 (Field Assistant)	Sh. Man Singh	08.02.94	
32.	T-1 (Field Assistant)	Sh. R.K. Meena	11.02.94	
33.	T-1 (Field Assistant)	Sh. Mukesh Meena	22.02.94	
ADMINISTRATIVE				
34.	Asstt. Admn. Officer	Sh. Balwant Rai	21.08.89	
35.	Office Assistant	Sh. S.C. Sharma	19.03.90	Deputation
36.	Sr. Clerk	Sh. S.K. Sharma	02.12.89	
37.	Jr. Stenographer	Ku. Nidhi Kaushik	28.11.89	
38.	Jr. stenographer	Sh. Ajay Bhowal	24.10.92	
39.	Jr. Clerk	Sh. J.P. Kori	21.05.90	
40.	Jr. Clerk	Sh. R.K. Hadge	26.11.90	
41.	Jr. Clerk	Sh. T. Lakhera	26.11.90	
42.	Jr. Clerk	Sh. Sunil Gupta	17.02.90	
43.	Jr. Clerk	Sh. Manoj Gupta	24.05.91	
44.	Jr. Clerk	Sh. Beni Pd. Uriya	25.03.92	

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

ANNEXURE - II

The expenditure (In rupees) for the year 1994-95 under different heads is as follows:

Statement of expenditure during the year 1994-95

Sl. No.	Name of Heads	Plan (Rs.)	Non-Plan (Rs.)	Total (Rs.)
1.	Establishment charge	23,80,215	6,42,999	30,23,214
2.	Travelling Expenses	1,10,000	16,000	1,26,000
3.	Expenditure acquiring assets :			
a.	Land	-	-	-
b.	Building & other original works	55,07,645	-	55,07,645
c.	Tools and Plants	25,11,234	-	25,11,234
d.	Furniture & other office equipment	95,044	-	95,044
e.	Typerwriters & Accounting Machines	-	-	-
f.	Vehicles	-	-	-
g.	Live stock	-	-	-
h.	Library Books & Journals	1,65,911	-	1,65,911
4.	Other contingent expenditure	12,20,603	13,40,507	25,61,170
5.	Additional expenditure :			
	a. Pension & Gratuity	-	-	-
	b. P-Loans2,80,600	1,39,300	4,19,900	
	c. Q-funded Debts	4,14,000	62,570	4,76,570
	d. R-Deposits	51,869	-	51,869
	i. D.B.T.	8,29,672	-	8,29,672
	e. S-Advances	18,600	6,600	25,200
	f. T-Suspense	-	-	-
	g. Remittance	1,49,391	68,156	2,17,547
	h. Closing Balanace :			
	a. Cash in hand	-	-	-
	b. Cash in Bank	13,17,875	-	13,17,875
GRAND TOTAL		**1,50,52,659**	**22,76,192 1,**	**73,28,851**

ANNEXURE - III

A. Visits in Symposium/Seminar/Conference/Meeting etc.

Dr. V.M. Bhan, Director

- Participated in VI Biennial Conference of Indian Society of Weed Science, held from Feb. 9-10, 1995. at Annamalai Univ., Annamalai.
- Attended Seminar on Nutrition Management in Soybean based Cropping Systems in India held on 22.9.94. at Indian Instt. of Soil Science, Bhopal
- Attended the Technology Mission on Oilseed & Pulses held on 5.1.95. at Kanpur
- Attended Fact Finding Committee committee on Parthenium held from 27-29 December, 1994 at Bangalore.
- Attended ICAR Regional Committee No. 5th & 7 th meeting on 8.7.94 at Bhopal.
- Participated in National Seminar on Weed Management in Hill Agriculture held on 16.04.94 at Palampur.
- AttendedInternational Symposium on Pulses held on 2.4.94 at New Delhi.

Dr. L.P.Kauraw, Sr. Scientist

- Attended third Biocontrol Workers Group Meeting held from October, 17-18, 1994 at UAS Banglore.
- Participated in VI Biennial Conference of Indian Society of Weed Science, held from Feb. 9-10, 1995. at Annamalai Univ., Annamalai.

Shri D.K. Pandey, Scientist (Physiology)

- Participated in International Symposium on Allelopathy in Sustainable Agriculture, Forestry and Environment held from September 6-8, 1994 at New Delhi and also participated in International Conference on Gerontology held from November 14-16, 1994 at AIIMS, New Delhi.
- Participated in VI Biennial Conference of Indian Society of Weed Science, held from Feb. 9-10, 1995. at Annamalai Univ., Annamalai.

Dr. D. Swain, Scientist (Physiology)

- Attended Indian Science Congress, 1995 held from January, 3-8, 1995 at Jadhavpur Univ. Calcutta.
- Participated in VI Biennial Conference of Indian Society of Weed Science, held from Feb. 9-10, 1995. at Annamalai Univ., Annamalai.

Dr. S. Singh, Scientist

- Attended National Symposium on Agriculture in relation to Environment held from January 16-18, 1995, at IARI, New Delhi.

Dr. A.N. Singh, Scientist

- Participated in VI Biennial Conference of Indian Society of Weed Science, held from Feb. 9-10, 1995. at Annamalai Univ., Annamalai.

Dr. V.P. Singh, Scientist

- Participated in VI Biennial Conference of Indian Society of Weed Science, held from Feb. 9-10, 1995. at Annamalai Univ., Annamalai.

Shri J.S. Mishra, Scientist

- Participated in National Seminor on Weed Management in Hill Agriculture held on 16.04.94 at Palampur and attended International Symposium on pulses held on 2.4.94 at New Delhi.
- Participated in VI Biennial Conference of Indian Society of Weed Science, held from Feb. 9-10, 1995. at Annamalai Univ., Annamalai.

Dr. Khajanchilal, Scientist

- Participated in VI Biennial Conference of Indian Society of Weed Science, held from Feb. 9-10, 1995. at Annamalai Univ., Annamalai.

Dr. Sushilkumar, Scientist

- Attended Seminor on Pest Management in June 28-30, 1994, at Solan.
- Attended third Biocontrol Workers Group Meeting held from October, 17-18, 1994 at UAS Banglore.

Dr.Anil Dixit, Scientist

- Participated in VI Biennial Conference of Indian Society of Weed Science, held from Feb. 9-10, 1995. at Annamalai Univ., Annamalai.

B. Honours and Awards

Dr. V.M. Bhan, Director, has been elected as a President of Indian Society of Weed Science (I.S.W.S.) for the year 1994-96. During Silver Jublee of ISWS, the society has honoured Dr. V.M. Bhan, Director, for his meritorious service to Weed Science discipline by conferring fellowship of the society.

He was awarded "1995 Outstanding International Achievement Award-Developing Countries" by International Weed Science Society, United State of America for his important contribution in research and extension worksin the line of Weed Science.

In addition to this, he was also awarded "Hexamar Foundation Award" by Plant Protection Association of India, Hyderabad on 2nd Feb.,1995 for his meritorious contribution in weed control in Soybean.

Acknowledgement

The Director acknowledges with thanks to Vice Chancellor, Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV) for providing the assistance of staff members in various selection committees, purchase committees and other advisory committees.

The thanks are due to Dr. R. S. Paroda, DG; Dr. I. P. Abrol, DDG (S); Dr. P. C. Bhatia, ADG (Agri) for their constant encouragement in carrying out the various programmes; Shri N. Parthsarthy, Financial Advisor, Shri G.S. Sahni, IAS, Secretary, ICAR; Mrs. Vibha Pandey, Director (finance); Dr. Rana, Director (Personal) and their team of persons who helped in various matters pertaining to NRCWS. Shri Jagdish Chander, Under Secretary of the IA II section also deserve thanks for assisting in day to day activities.

The help rendered by the scientists, officers and staff members of the NRCWS is also gratefully acknowledged.

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