

**ANNUAL REPORT 2015-16**  
**(वार्षिक प्रतिवेदन २०१५-१६)**  
**ALL INDIA COORDINATED RESEARCH**  
**PROJECT on WEED MANAGEMENT,**  
**PASIGHAT CENTRE**



**COLLEGE OF HORTICULTURE AND FORESTRY**  
**CENTRAL AGRICULTURAL UNIVERSITY**  
**PASIGHAT-791102, ARUNACHAL PRADESH**



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ALL INDIA COORDINATED RESEARCH PROJECT ON WEED  
MANAGEMENT, PASIGHAT CENTRE

**College of Horticulture and Forestry, Central Agricultural University  
Pasighat -791102, East Siang District, Arunachal Pradesh**

**ANNUAL REPORT (2015-2016)**

**I. Introduction of the centre**

1. Project Title : AICRP on Weed Management
  
2. Name and Address of the Centre : AICRP-WM, Pasighat Centre,  
Department of Natural Resource Management  
College of Horticulture and Forestry,  
Central Agricultural University,  
Pasighat, Arunachal Pradesh

**A brief write up about organization/institution:**

The College of Horticulture and Forestry was established under the umbrella of Central Agricultural University (Act 1992 of Parliament, Act No. 40 of 1992) through the first ordinance issued on 31<sup>st</sup> January, 1996 and is located at Pasighat in Arunachal Pradesh keeping in view the rich natural biodiversity and agro ecological conditions favourable for large scale production of a wide range of horticultural crops and flower species. The following are the objectives of the College:

- To impart education in different branches of horticulture and forestry and its allied sciences.
- To further the advancement of learning and protection of research in horticulture and forestry and its allied sciences.
- To undertake the programmes of extension education in the states under the jurisdiction, and
- To undertake such other activities as it may deem fit from time to time.

## II. Weather conditions during the year and deviation from the normal

MONTH & YEAR	Av. Max. Temp (°C)	Relative Humidity (%)		Rainfall (mm)	No of rainy days	Evaporation Av. (mm)
		0700hrs	1400hrs			
JANUARY, 2015	22.6	70.2	61.6	45.5	3	4.6
FEBRUARY, 2015	22.5	75.7	68.7	125.8	6	3.64
MARCH, 2015	23.09	78.0	72.0	107.0	7	3.5
APRIL, 2015	28.5	78.0	72.0	29.0	13	4.0
MAY, 2015	28.1	79.9	78.0	267.0	10	3.2
JUNE, 2015	28.9	87.5	83.6	1037.0	21	3.8
JULY, 2015	28.8	77.4	67.8	613.7	13	4.9
AUGUST, 2015	28.9	87.4	86.4	1262.2	15	3.6
SEPTEMBER, 2015	30.0	83.8	75.5	514.6	20	4.0
OCTOBER, 2015	31.5	69.8	63.2	12.35	2	4.7
NOVEMBER, 2015	28.2	73.2	65.6	46.1	3	4.1
DECEMBER, 2015	23.0	76.5	71.6	46.3	3	3.7
TOTAL RAINFALL DURING THE PERIOD(mm): 4373.5						

\*Agro-meteorological observations recorded at weather station CHF, Pasighat, Latitude 28°4'N, Longitude 95°22'E and Altitude 152 m MSL.

The average annual rainfall of Pasighat is about 3715 mm. During the year 2015 Pasighat received 4373.5 mm rainfall which was 658 mm more from normal and 1676 mm more than previous year (2014) rainfall. At Pasighat about 70 to 80 % of the annual rainfall is occurred between June to September. The crop in its life cycle experienced 2640.85 mm rainfall, 741 mm evaporation, relative humidity 63.2 to 87.5 % and the maximum temperature in the range of 23 to 31.5 °C.

### III. Staff position and Expenditure statement

**Table: 1. Staff position**

Name	Designation	Pay Band	Grade Pay	Date of Joining	Date of leaving
Dr. Dinesh Sah	Principal Investigator	---	---	---	--
Vacant Post	Agronomist	37400	9000	--	--
Vacant Post	Assistant Agronomist	15600	6000	--	--
Vacant Post	Steno Typist	5200	2400	--	--
Vacant Post	Technical Assistant	5200	2400	--	--
Vacant Post	Laboratory Attendant	5200	1800	--	--

**Table: 2. Expenditure statement**

Gants released under head for FY 2015-16	Amount released (Rs. in lakh)	Amount utilized (Rs. in lakh)	Balance (Rs. in lakh)
Pay and Allowances	4.64	00.00	4.64
TA	0.22	0.218	0.002
Recurring Contingency	1.50	0.82	0.68
Total	6.36	1.038	5.322

#### IV. Executive Summary (English & Hindi)

Among several types of weeds, population of grassy weeds were higher in the experimental field. All the weed control treatments proved effective in significantly reducing the number and dry weight of weeds as compared to weedy check. Hand weeded treatment recorded the lowest weed number (48.40/m<sup>2</sup>) and weed dry matter accumulation (6.8 g/m<sup>2</sup>) as well as the highest weed control efficiency (75.2%) at 75 DAP. It likewise produced the maximum number of tillers/plant (3.2), fingers/plant (3.4), longest rhizome (8.4 cm) and highest fresh rhizome yield (9.4 t/ha). The application of pendimethalin @1.5 kg/ha as pre emergence coupled with slashed grass mulch significantly increased rhizome yield over un-weeded control. In un-weeded plots rhizome yield was reduced by 34.04 % compared with hand weeded plot twice (30 and 60 DAP). Among all weed control treatments hand weeding twice at 30 and 60 DAP seems to be the viable option to realize higher crop yield and more net return (Rs/ha).

खरपतवारों के परिक्षण प्रक्षेत्र में पाये जाने वाले कई प्रकार के खरपतवारों में घासकुल के खरपतवारों की संख्या अधिक आंकी गयी। खरपतवारों की संख्या एवं शुष्क भार कम करने में खरपतवार सहित उपचार की तुलना में सभी खरपतवार नियंत्रण के उपचार सार्थक साबित हुए। दो बार हाथ द्वारा खरपतवार नियंत्रण वाले भूखंड में खरपतवारों की संख्या (४८.४/ वर्ग मीटर) एवं शुष्क भार (६.८ ग्रा./ वर्ग मीटर) कम आँका गया साथ ही साथ ७५ दिन की अवस्था पर अधिकतम खरपतवार नियंत्रण क्षमता (७५.२%) भी आंकी गयी। इसी तरह प्रति पौध अधिकतम कल्लों की संख्या (३.२), ४.४ फिंगर/ पौध, अत्यधिक लम्बा कंद (८.४ सेमी) तथा अधिकतम कंद उपज (९.४ टन/ हेक्टेयर ) प्राप्त हुआ। तृण सहित नियंत्रण उपचार (un-weeded control) की तुलना में पेंडीमेथालिन की १.५ किग्रा मात्रा का घास आवरण के साथ प्रयोग से उपज में सार्थक बढ़ोतरी आंकी गयी। दो बार हाथ द्वारा खरपतवार नियंत्रण वाले भूखंड की तुलना में तृण सहित नियंत्रण उपचार (un-weeded control) वाले भूखंड से ३४.०४ % कम कंद उपज प्राप्त हुआ। बुवाई के ३० और ६० दिन बाद हाथ द्वारा निराई गुड़ाई सभी खरपतवार नियंत्रण के उपचार की तुलना में अधिक उपज और अधिक शुद्ध आय का एहसास करने के लिए व्यवहार्य विकल्प हो रहा है।

#### V. Results of practical utility

Based on observations under high rainfall areas of Arunachal Pradesh, it can be concluded that hand weeding twice at 30 and 60 DAP is more efficient, practically convenient and economically feasible method for weed management in ginger.

#### VI. Recommendations passed on to state package of practices

For effective management of weeds in ginger crop under high rainfall areas of Arunachal Pradesh hand weeding at 30 and 60 days after planting (DAP) is more efficient and economically viable.

## VII. Research achievements

### A. Network trials

No any network trial conducted during *kharif* 2015.

### B. Station trials

#### *WS<sub>3</sub>: Weed management in crops and cropping systems*

##### 3.3.3: Integrated weed management in ginger (*Kharif* 2015)

#### Objectives:

- To study the effect of integrated weed control measures against weeds and on growth and yield of ginger
- To study the phytotoxic effects on the crop, if any

**Table 3. Treatments detail**

	<b>Herbicides</b>	<b>Dose</b>	<b>Application time</b>
T <sub>1</sub>	Pendimethalin	1.5 kg/ha	After planting but before mulching
T <sub>2</sub>	Oxyfluorfen	0.20 kg/ha	After planting but before mulching
T <sub>3</sub>	Pendimethalin <i>fb</i> hand weeding	1.5 kg/ha	After planting but before mulching <i>fb</i> 30-35 DAP
T <sub>4</sub>	Oxyfluorfen <i>fb</i> hand weeding	0.20 kg/ha	After planting but before mulching <i>fb</i> 30-35 DAP
T <sub>5</sub>	Glyphosate	0.80 kg/ha	Just before emergence of sprouts of ginger
T <sub>6</sub>	Glyphosate+ pendimethalin	0.80 +1.5 kg/ha	Just before emergence of sprouts of ginger
T <sub>7</sub>	Glyphosate + oxyfluorfen	0.80 + 0.2 kg/ha	Just before emergence of sprouts of ginger
T <sub>8</sub>	Hand weeding (2)	---	30 and 60 DAP
T <sub>9</sub>	Un-weeded control	---	--

### Methodology

A field experiment was conducted at College of Horticulture and Forestry, CAU, Pasighat, Arunachal Pradesh during cropping season of 2015. The experiment was laid out following a randomized block design (RBD), with nine treatments (Table 3) and three replications in 12 m<sup>2</sup> plots (Raised bed of 1.2 m x 10 m). The ginger (var. Nadia) was sown on 30<sup>th</sup> June, 2015 with recommended package of practices and harvested on 24<sup>th</sup> December 2015. Recommended dose of fertilizers (60 kg N, 90 kg P<sub>2</sub>O<sub>5</sub> and 60 kg K<sub>2</sub>O /ha) were applied to crop at the time of sowing. The weed population, dry matter of weed, crop growth parameter, yield attributes and yield and phyto-toxicity on crop were recorded as per standard protocol. Economic analysis was done by following the methods as suggested by DWR, Jabalpur. The weed number and weed dry weight were analyzed after transforming the actual data (X) to square root (X+0.5). The data for different parameters were statistically analyzed by following the standard methods.

## **Observations recorded:**

- i. Weed population (no./m<sup>2</sup>) and dry matter (g/m<sup>2</sup>) at 75 DAS.
- ii. Weed control efficiency (%) at 75 DAS
- iii. Crop growth parameters
- iv. Yield attributes and yield.
- v. Phytotoxicity on crop, if any
- vi. Economics analysis

## **RESULTS:**

### **A) Observation on weed:**

#### **Weed and weed population**

The major weeds observed in experimental field were *Cynodon dactylon*, *Digitaria sanguinalis*, *Panicum sp.*, *Echinochloa spp.*, *Eleusine indica*, *Cyperus spp.*, *Commelina benghalensis*, *Murdania kiosak*, *Urena lobata*, *Ageratum conyzoids*, *Spilanthes acmella*, *Sida acuta*, etc.

Data on weed population revealed that population of grassy weeds were higher in the experimental field and it was observed that maximum weed population recorded in the un-weeded control plots. Keeping the plots weed free upto 60 days after planting (DAP) significantly reduced the weed population than others. Application of oxyfluorfen supplemented with hand weeding at 30 days after planting (DAP) *fb* mulching also found effective treatment for controlling weeds (Table 4).

#### **Weed dry matter and weed control efficiency**

Data recorded on weed dry matter production revealed that hand weeding at 30 and 60 DAP reduced dry matter production and increases weed control efficiency (WCE). Application of oxyfluorfen supplemented with hand weeding at 30 DAP *fb* mulching showed a reduction in weed dry weight and increased WCE (59.4%). The highest weed dry weight was recorded under un-weeded control. All weed control treatments exert significant effect on weed dry weight and weed control efficiency (Table 5).

### **B) Observation on crops:**

#### **Crop growth parameters**

The maximum number of tillers per plant and taller plant were recorded in hand weeded plots twice at 30 DAP and 60 DAP. Un-weeded control plot gave lowest number of tillers per plant and minimum plant height followed by glyphosate alone and glyphosate + oxyfluorfen. All weed control measures exhibited higher number of tillers and plant height than un-weeded control (Table 6).

#### **Yield attributes and yields of ginger**

Hand weeding twice at 30 DAP and 60 DAP resulted in significantly higher rhizome length, rhizome width and number of rhizomes per finger which was at par with treatment application of pendimethalin supplemented with one hand weeding at 30 DAP *fb* mulching. Rhizome width recorded in oxyfluorfen treated plot was also at par with hand weeded treatment. Hand weeding twice at 30 DAP and 60 DAP resulted in significantly higher number of fingers per rhizome which was at par with application of oxyfluorfen alone *fb* mulching, application of pendimethalin supplemented with one hand weeding at 30 DAP *fb*



mulching, application of oxyfluorfen supplemented with one hand weeding at 30 DAP *fb* mulching and application of glyphosate + pendimethalin. Hand weeding twice at 30 DAP and 60 DAP recorded significantly higher fresh rhizome yield (9.4 t/ha) than un-weeded control and application of pendimethalin alone *fb* mulching. It was statistically at par with remaining other weed control treatments (Table 7). Ginger crop perform well under Arunachal Pradesh conditions if planting completed by mid May. Due to late planting crop produced low yield than average yield (8.4 t/ha) of the state.

**Visual toxicity on crop:** No any visual toxicity was observed.

### **Observations on economic analysis**

All the weed control treatments gave considerably higher net return over un-weeded control (Table 8). Higher net return of Rs 58700 was recorded in plot hand weeded twice at 30 DAP and 60 DAP followed by pendimethalin + hand weeding *fb* mulching and oxyfluorfen *fb* mulching. Higher benefit cost ratio (BCR) of 1.7 was recorded with all weed control treatments except pendimethalin alone *fb* mulching and oxyfluorfen supplemented with one hand weeding *fb* mulching.

**Table: 4.** Effect of integrated weed management practices on weed population (no./m<sup>2</sup>)

Treatments	Grassy and sedge weeds (no./m <sup>2</sup> )	Broad leaved weeds(no./m <sup>2</sup> )	Total weeds (no./m <sup>2</sup> )
T <sub>1</sub>	8.9 (80.3)	6.1(36.73)	10.8 (117.1)
T <sub>2</sub>	8.6 (73.2)	5.8 (33.8)	10.3 (107)
T <sub>3</sub>	7.8 (61.3)	5.2 (27.7)	9.4 (88.9)
T <sub>4</sub>	7.2 (51.3)	4.4 (19.2)	8.4 (70.5)
T <sub>5</sub>	8.4 (71.2)	6.4 (41.1)	10.6 (112.3)
T <sub>6</sub>	8.3 (68.3)	6 (35.6)	10.2 (104)
T <sub>7</sub>	7 (59.2)	5 (25)	9.2 (84.2)
T <sub>8</sub>	5.5 (30.1)	4.3 (18.2)	6.9 (48.4)
T <sub>9</sub>	9.7 (93.3)	6.8 (46.4)	11.8 (139.7)
SD	0.18	0.17	0.17
SEm±	0.11	0.10	0.10
LSD (P=0.05)	0.32	0.31	0.30

Figures in the parentheses indicate the actual values  
 Transformed value =  $\sqrt{(x + 0.5)}$

**Table: 5.** Effect of integrated weed management practices on weed dry matter (g/m<sup>2</sup>) and Weed Control Efficiency (WCE) (%) at 75 DAS

Treatments	Weed dry matter (g/m <sup>2</sup> )	WCE (%)
T <sub>1</sub>	4.5 (19.7)	27.9
T <sub>2</sub>	4.2 (16.9)	38.2
T <sub>3</sub>	3.8 (14.3)	47.8
T <sub>4</sub>	3.4 (11.1)	59.4
T <sub>5</sub>	4.1 (16.1)	41.2
T <sub>6</sub>	4 (15.5)	43.4
T <sub>7</sub>	3.7 (13.2)	51.6
T <sub>8</sub>	2.7 (6.8)	75.2
T <sub>9</sub>	5.3 (27.4)	00
SD	0.06	0.96
SEm±	0.03	0.55
LSD(P=0.05)	0.10	1.66

Figures in the parentheses indicate the actual values  
 Transformed value =  $\sqrt{(x + 0.5)}$

**Table: 6.** Effect of integrated weed management practices on ginger crop growth parameters.

Treatments	No. of tillers/ plant	Plant height (cm)
T <sub>1</sub>	1.9	51.7
T <sub>2</sub>	2.8	50.2
T <sub>3</sub>	2.9	53.5
T <sub>4</sub>	2.6	48.2
T <sub>5</sub>	2.2	51.2
T <sub>6</sub>	2.5	52.5
T <sub>7</sub>	2.3	47.5
T <sub>8</sub>	3.2	56.2
T <sub>9</sub>	1.5	44.7
SD	0.07	3.1
SEm±	0.04	1.80
LSD(P=0.05)	0.13	5.38

**Table: 7.** Effect of integrated weed management practices on yield attributes and yields of ginger.

Treatments	Rhizome length (cm)	Rhizome width (cm)	No. of fingers/ rhizome	Fresh rhizome yield (t/ha)
T <sub>1</sub>	6.1	4.3	2.4	8.1
T <sub>2</sub>	7.2	4.9	3.0	8.9
T <sub>3</sub>	7.9	5.2	3.2	9.2
T <sub>4</sub>	6.6	4.7	2.9	8.8
T <sub>5</sub>	6.4	4.6	2.5	8.7
T <sub>6</sub>	6.5	4.7	2.8	8.7
T <sub>7</sub>	6.6	4.7	2.7	8.7
T <sub>8</sub>	8.4	5.5	3.4	9.4
T <sub>9</sub>	5.7	3.9	2.1	6.2
SD	0.54	0.41	0.33	0.44
SEm±	0.31	0.24	0.19	0.25
LSD(P=0.05)	0.94	0.71	0.57	0.76

**Table: 8.** Effect of integrated weed management practices on economics of ginger production.

Treatments	Fresh rhizome yield (t/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	BCR
T1	8.1	122300.0	45300.0	1.6
T2	8.9	133050.0	56050.0	1.7
T3	9.2	137400.0	56400.0	1.7
T4	8.8	131850.0	50850.0	1.6
T5	8.7	129900.0	54100.0	1.7
T6	8.7	130950.0	53150.0	1.7
T7	8.7	130500.0	52700.0	1.7
T8	9.4	140700.0	58700.0	1.7
T9	6.2	92400.0	18400.0	1.2
SD	0.44	6633.5	6633.5	0.09
SEm±	0.25	3829.8	3829.8	0.051
LSD(P=0.05)	0.76	11480.6	11480.6	0.152

General cost of cultivation Rs. 74000/ha, Cost of weed management practises is additional

## **VIII. TSP programme**

Currently there is no any TSP programme with AICRP-WM, Pasighat centre.

## **IX. List of publications (research, abstract of seminar/symposia/conference, technical/ extension bulletins, popular articles, books/book chapter, radio/TV talks etc. (from the project work)**

Published 01 Abstract on “Effect of Mulching and Herbicides on growth and Fresh Rhizome Yield of Ginger” published in “National Conference on Horticulture for North Eastern region” during 16-18 January, 2016 at College of Horticulture and Forestry, Central Agricultural University, Pasighat.

04 numbers of folders on weed management in different horticultural crops and weed utilization prepared and distributed among farmers during Arunachal Agri Expo 2016 at College of Horticulture and Forestry, Pasighat.

Participated in “National Conference on Horticulture for North Eastern region” during 16-18 January, 2016 at College of Horticulture and Forestry, Central Agricultural University, Pasighat.

## **X. List of trainings/awareness campaign**

The AICRP-WM Pasighat centre conducted 03 number of Parthenium awareness programme with under graduate students of agriculture and horticulture courses as well as in collaboration with NSS unit of College of Horticulture and Forestry, Pasighat during last week of August and first week of September, 2015.

## **XI. Awards/recognitions/students guided**

Secured 3<sup>rd</sup> position during poster presentation session of National conference on “Horticulture for North East Region” during 16-18 January, 2016 at College of Horticulture and Forestry, Pasighat.

## **XII. Linkages and collaboration**

The centre has linkage with KVK East Siang, Pasighat and Department of Agriculture and Horticulture, Pasighat.

**(Dinesh Sah)**  
**Principal Investigator**  
**AICRP-WM, Pasighat Centre**