IRS FOR MALARIA CONTROL AND ELIMINATION IN INDIA

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MAJOR DISEASE VECTORS

Malaria

An. culicifacies, An. fluviatilis, An. minimus

An. sundaicus, An. stephensi, An. dirus

Visceral leishmaniasis(Kala-azar)

P.argentipes

Dengue & Chikungunya

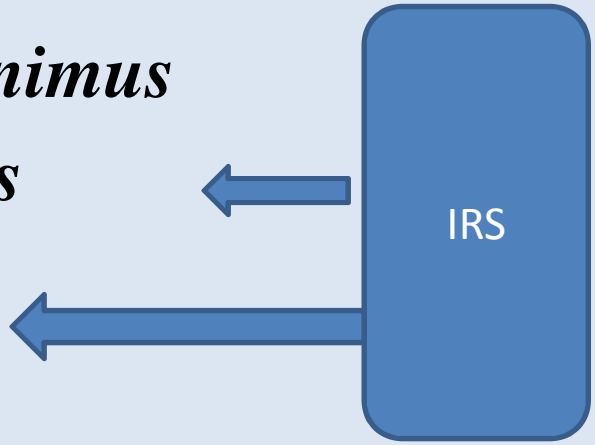
Ae. aegypti, Ae. albopictus

Lymphatic Filariasis

Cx. quinquefasciatus, Ma. annulifera

Japanese Encephalitis

Cx. vishnui, Cx. tritaeniorhyncus



MALARIA VECTORS in india

An. culicifacies	***An. stephensi***	***An. fluviatilis***
An. minimus	***An. dirus***	***An. sundaicus***

An. culicifacies

Monsoon associated species
An. culicifacies
(Epidimic vector)

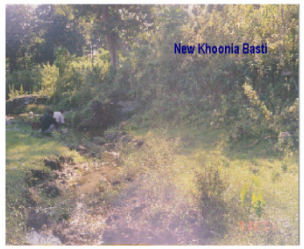
Responsible for 60-70% malaria in India

An. stephensi

Urban malaria

An. dirus and An. sundiacus

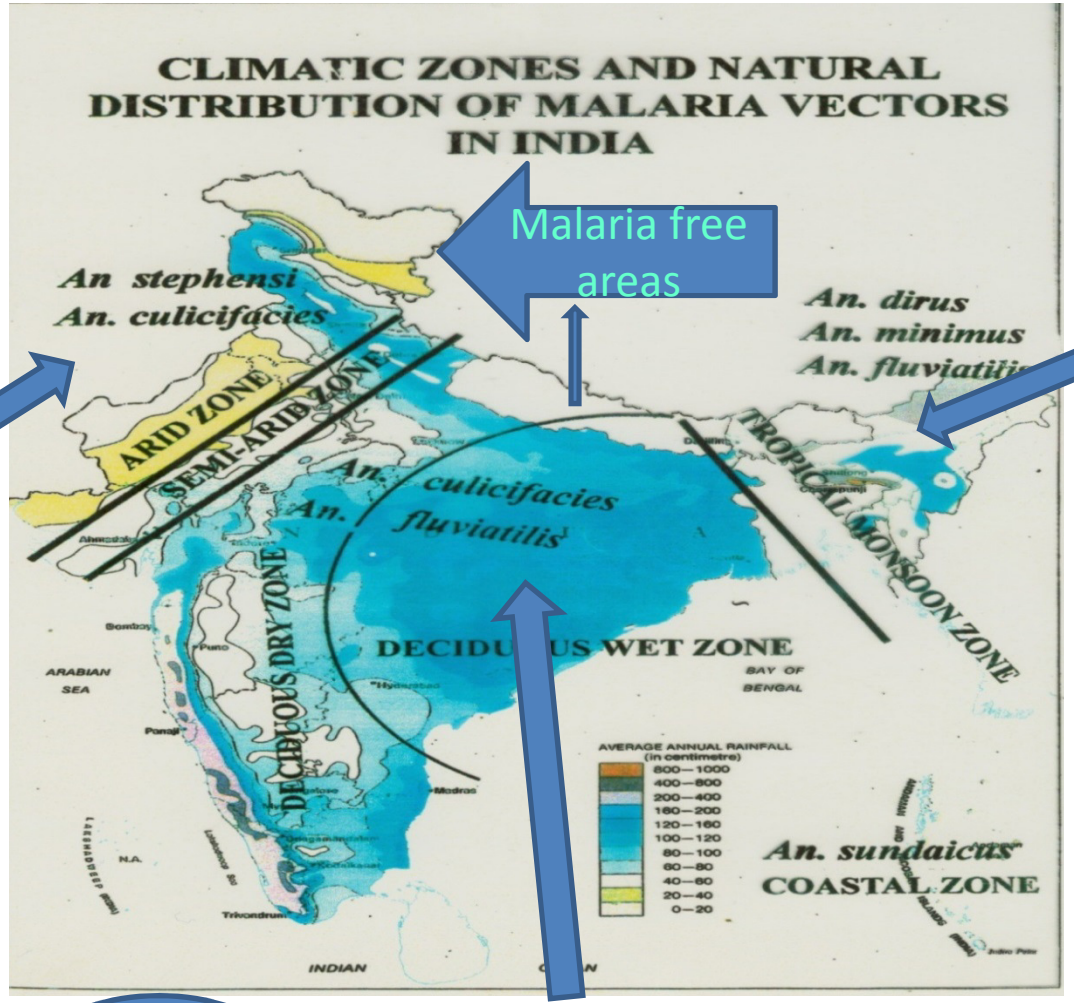
An. fluviatilis and *An. minimus*



Jalpaiguri - breeding sites for An.minimus

Kamrup _ An. minimus breeding palces

Vectors with variable Endemicity



Malaria free areas

Epidemic Prone Unstable malarious areas

Hyper endemic *An. minimus* and *An. dirus* superimposed

1947
75 million cases and 0.8 million deaths

NMEP-**1958**
0.1 million cases and no death.

Variable endemicity Relay transmission

1976
6.4 million cases

2013
0.44 million cases and 519 deaths

Disease distribution

Endemic in eastern States of India namely Bihar, Jharkhand, Uttar Pradesh and West Bengal

•48 districts endemic; sporadic cases reported from a few other districts

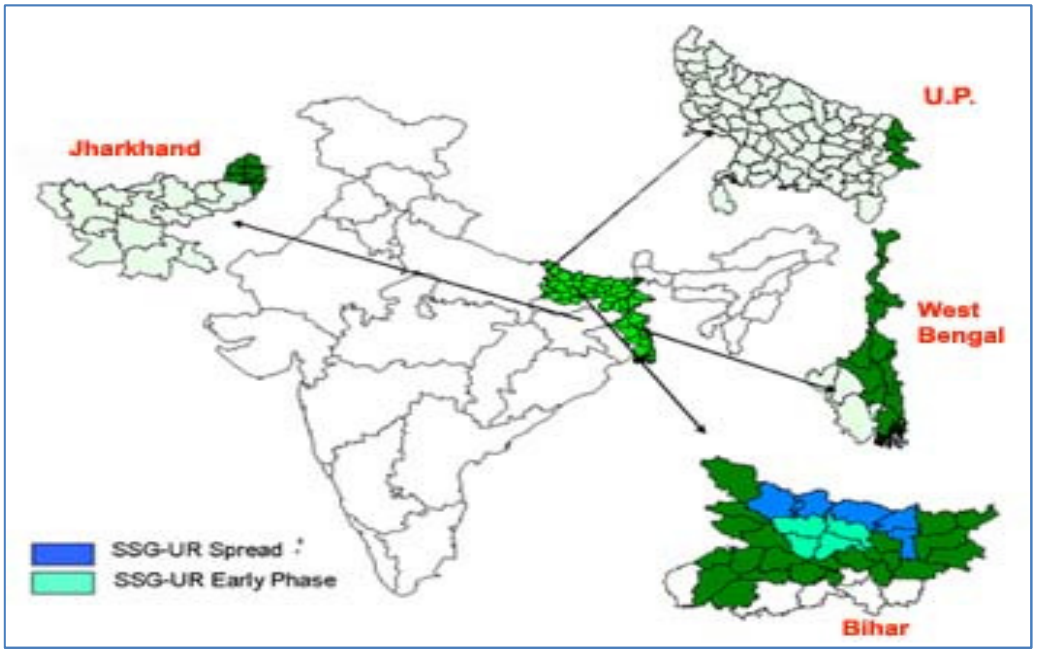
•Estimated 165.4 million population at risk in 4 states

•Mostly poor socio-economic groups of population primarily living in rural areas are affected

•IRS through up to 6 feet

Disease load -KALA-AZAR (VISCERAL LEISHMANIASIS)

Year	Cases	deaths
2007-	44533	203
2008--	33598	151
2009-	24212	93
2010-	29000	105
2011-	33137	80
2012-	20600	29
2013-	13021	19 (up to, Nov.,2013



VECTOR CONTROL STRATEGY

Malaria

Designed on concept of Micro level Epidemiology

- ✓ **IRS in areas with >2 API**
- ✓ **LLIN (Supportive)- 11 million LLINs distributed**
- ✓ **Biological Control (Fish)**
- ✓ **Urban- Anti-larval measures**
- ✓ **Civic Bye-laws**
- ✓ **Legislative measures**
  - Model civic bye-laws: Promulgation and implementation with provisions to prevent/eliminate mosquito breeding
  - Building bye-laws: Provision to prevent mosquitogenic conditions and clauses in the contract to keep curing tanks free of mosquito breeding during construction phase and dismantling of the same before issuance of occupancy certificate

➢ VECTOR CONTROL STRATEGY

➢ Two PRONGED

✓ **Indoor Residual Spraying with DDT from the ground twice annually.** →

✓ **Hygiene and environmental sanitation**

Contd…/-

IRS –Micro Action Plan, INDIA

Planning

Country Targeted Pop (TP)for IRS = 86.3 M (2012) > 2 API

Pop. Covered (PC) = 66.4 M

»	TP	PC	Ins. Cal.
– DDT	40.7 M	24.6 M	@ 150 MT
– Malathion	10.3 M	9.6 M	@ 900 MT
– Synthetic Pyrethroids	35.3 M	32.2 M	@ 60 MT

Spray squads

– IRS Norms - 52 squads per Million pop x TP = 4331.6

– THR for IRS -21658 and other accerries

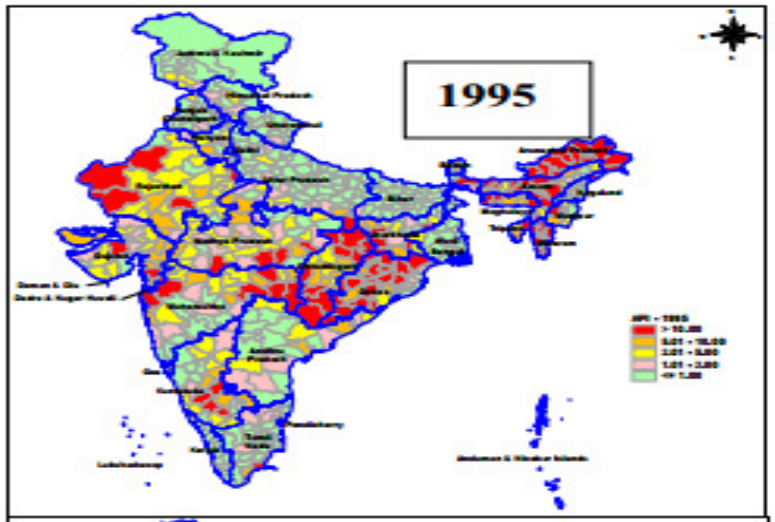
Capacity Building → **Implement ation** → **Monitoring & Supervision** → **Evidence based impact**

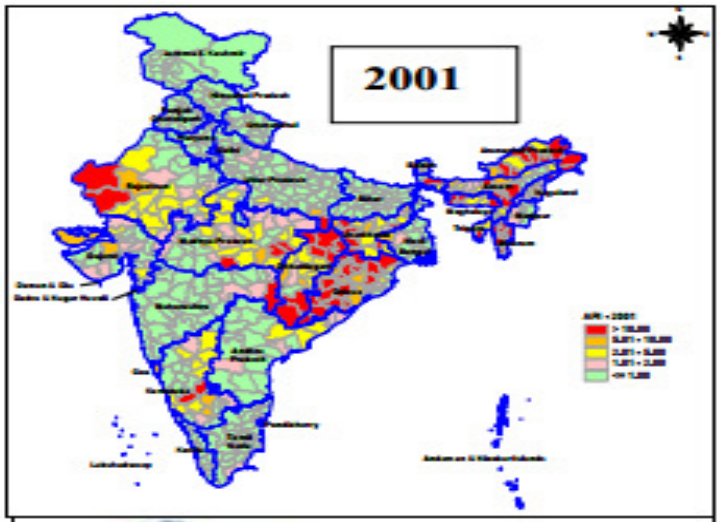
Estimated population projected for IRS 1981 v/s 2012

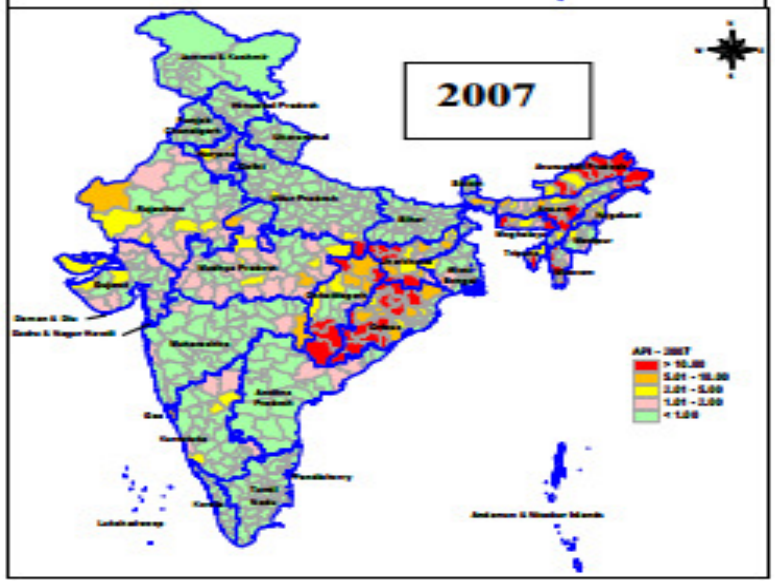
Total population country (1981)	Pop covered under DDT spray	Pop covered under BHC	Pop covered under Malathion spray	Total
685.18 M	197.98 M	114.75 M	19.44 M	332.15M

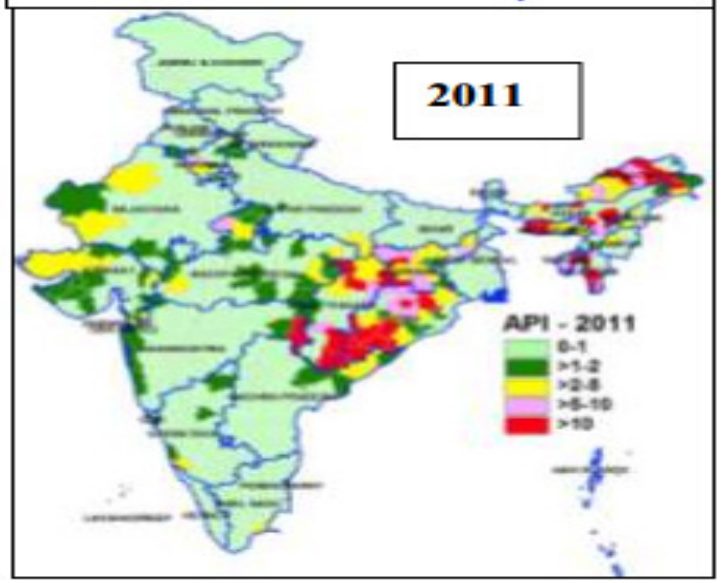
Total population country (2012)	Pop covered under DDT spray	Pop covered under Malathion spray	Pop covered under SP	Total
1210 M	24.6 M	9.6 M	32.2 M	66.4 M

Epidemiological Map for planning of IRS API from 1995 to 2011







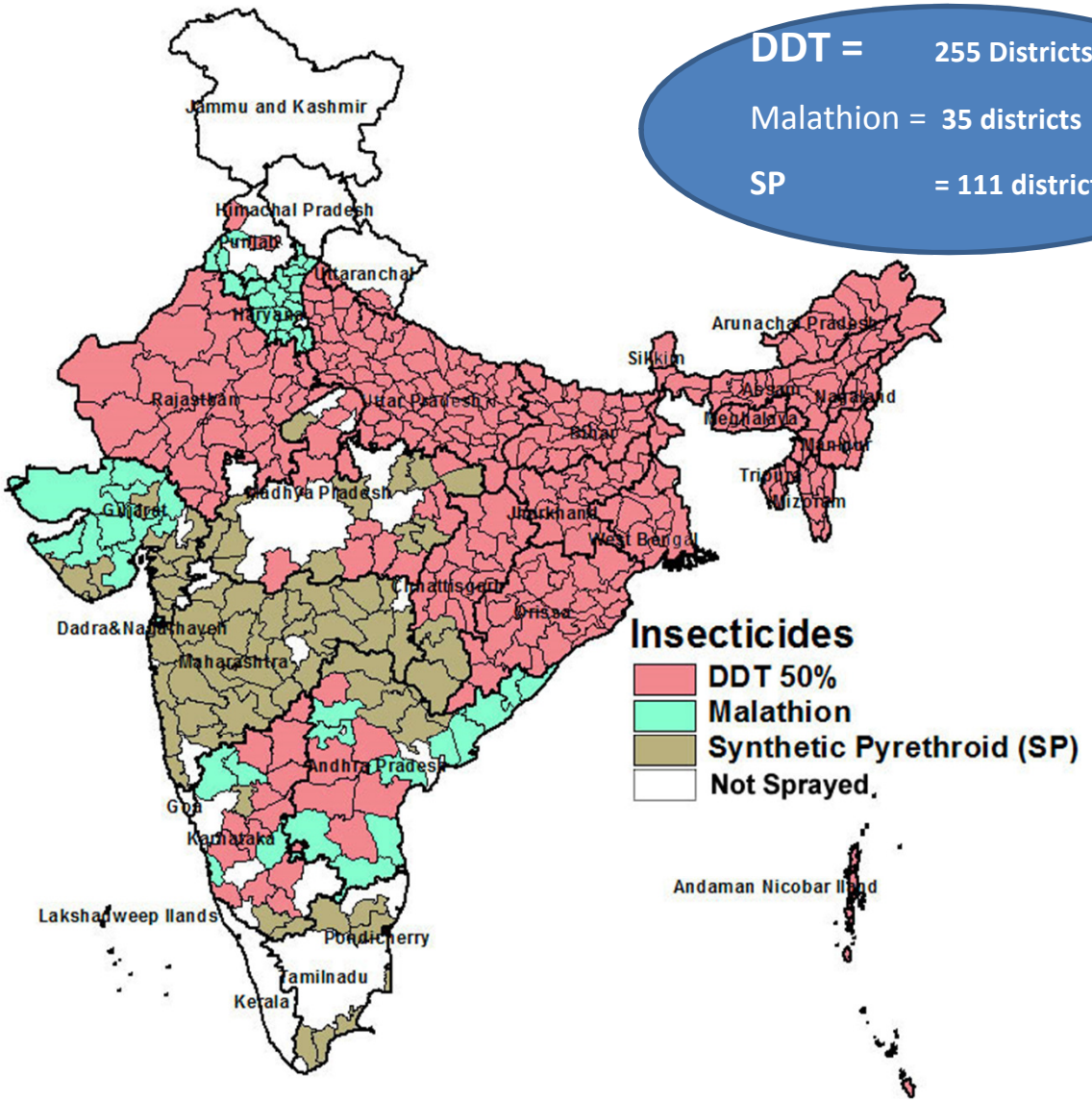


IRS MICRO ACTION PLAN
Delineation of areas for IRS

DDT = **255 Districts**

Malathion = **35 districts**

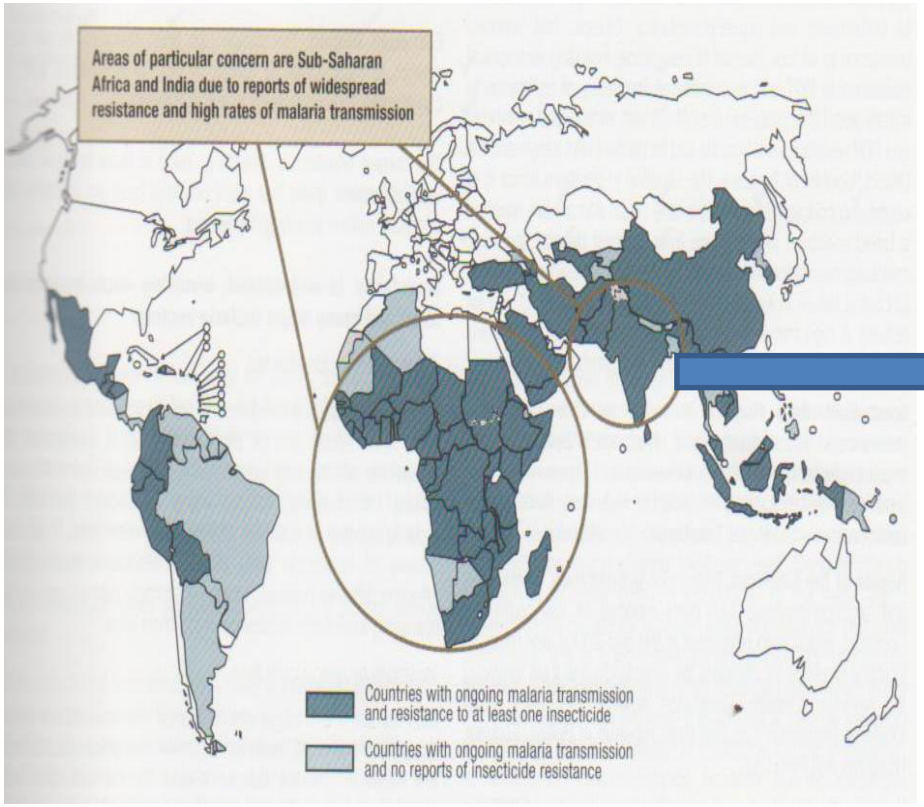
SP **= 111 districts**

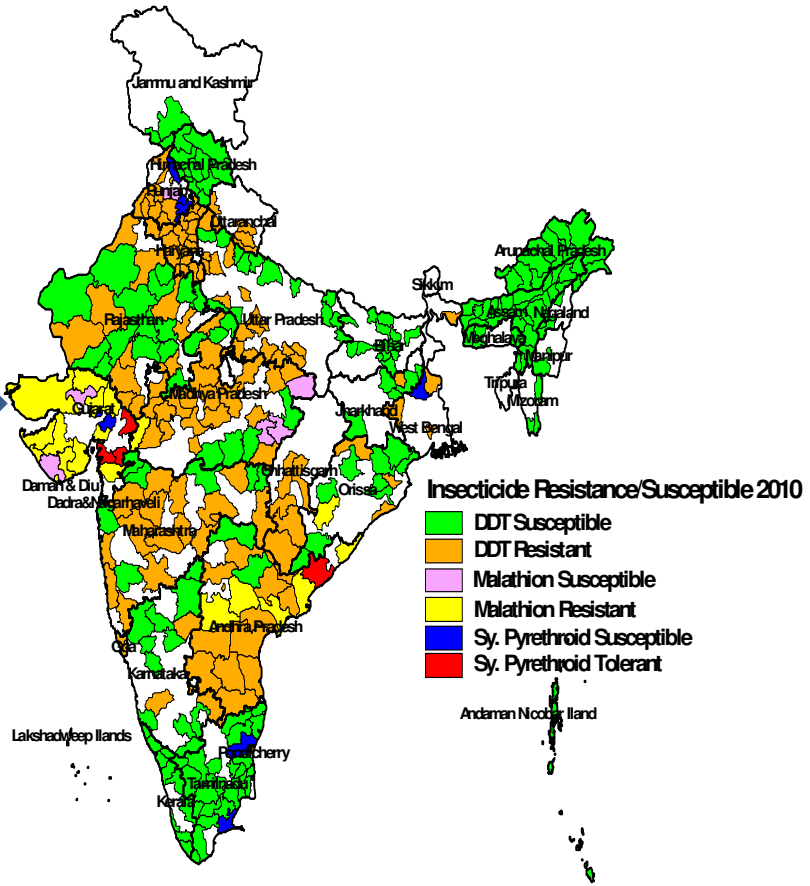


IRS - Insecticide Dosage, Dilution and Requirement

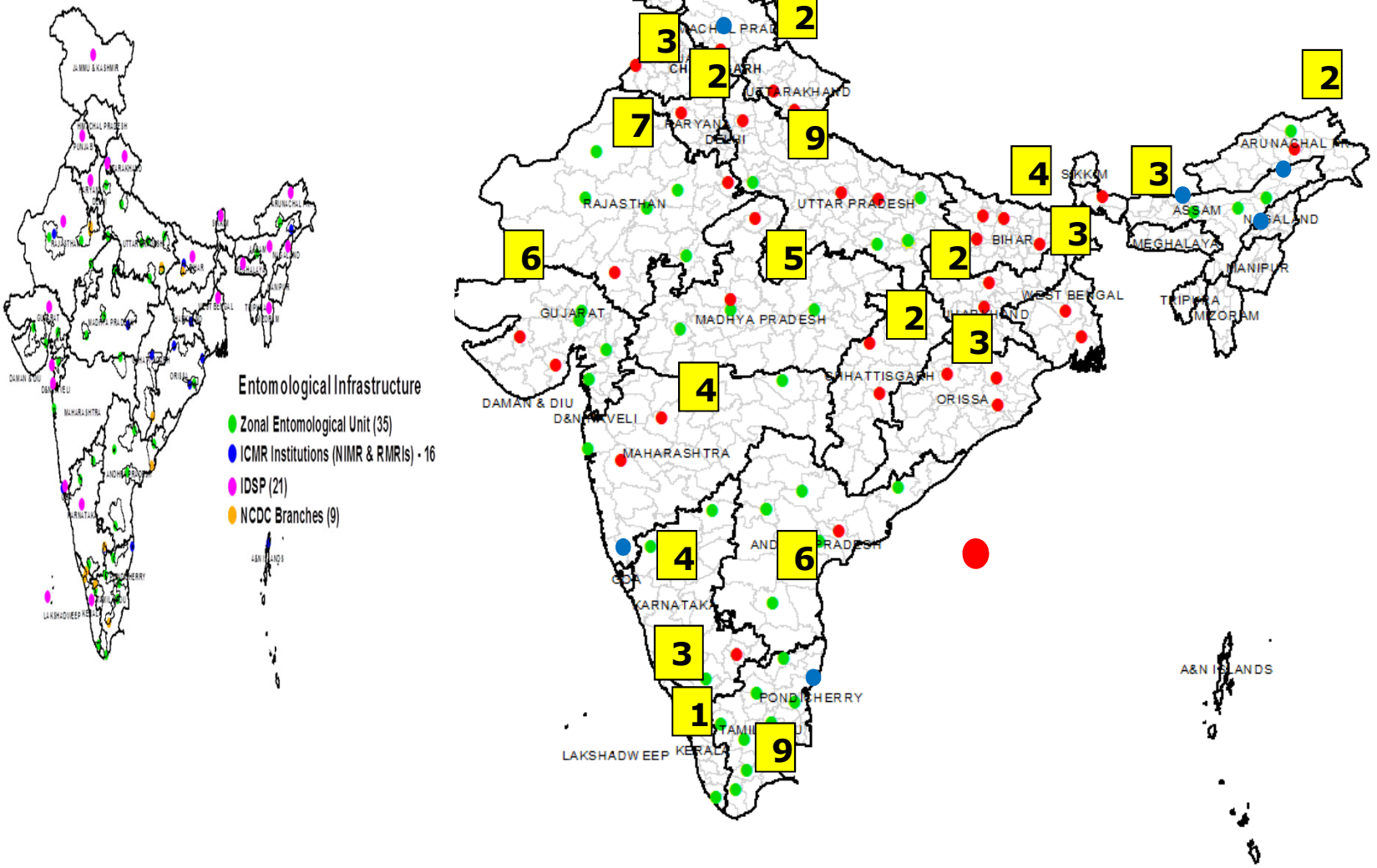
INSECTICIDE	DOSAGE PER Sq. m. (a.i.)	DILLUTION PER 10 LTR. OF WATER (covers 500 sq m area)	INSECTICIDE FORMULATION PER HOUSE (150 Sq. m) PER ROUND	AVERAGE PER 5000 POPU. (or 1000 houses)PER ROUND	TOTAL PER ANNUM
DDT 50%*	1 gm	1 Kg	300 gm	375 Kg	750 Kg
Malathion 25% (2 coats and 3 rounds per annum)	2 gm	2 Kg	1200 gm	1500 Kg	4500 Kg
Deltamethrin 2.5%	20 mg	400 gm	120 gm	50 Kg	300 Kg
Cyfluthrin 10%	25 mg	125 gm	37.5 gm	46.87 Kg	93.75 Kg
Lambdacyhalo-thrin 10%	25 mg	125 gm	37.5 gm	46.87 Kg	93.75 Kg
Alphacyperme-thrin 5%	25 mg	250 gm	75 gm	93.75 Kg	187.50 Kg

IRS MICRO ACTION PLAN
Susceptibility /Resistant status of malaria vectors with insecticides





I Entomological Infrastructure In the country and role in IRS

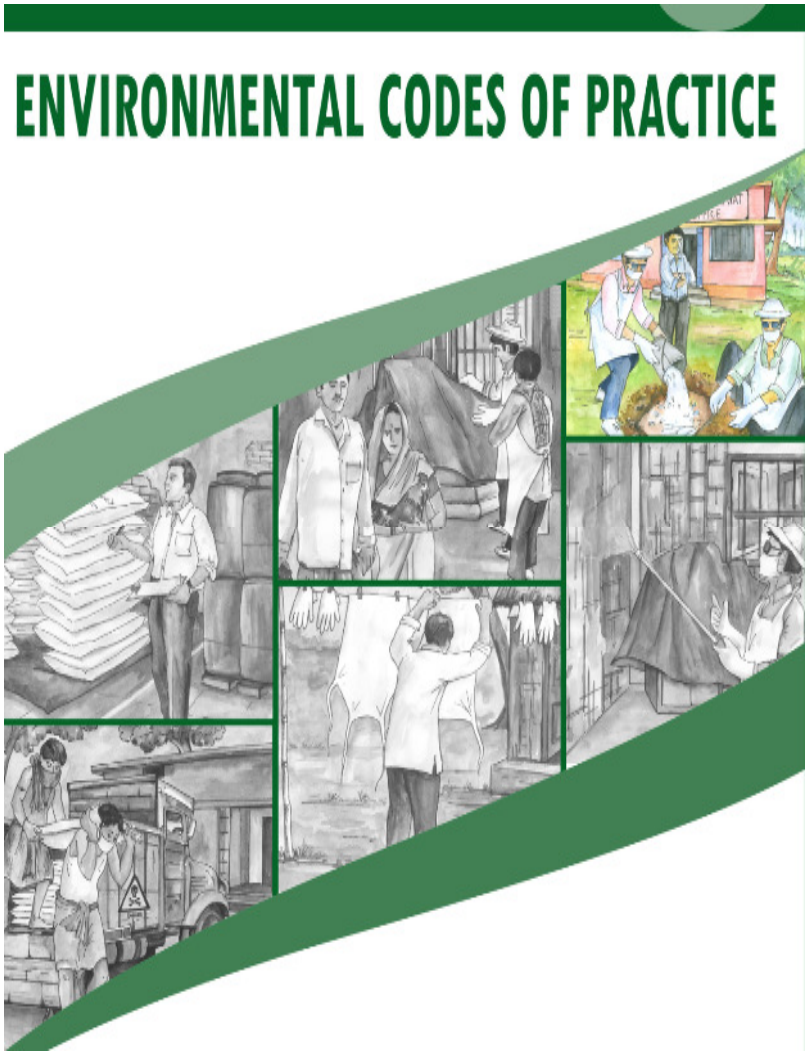


CAPACITY BUILDING FOR IRS

- National Level Workshop conducted on IRS & ECoP

- ECoP accepted by all states with a commitment to implement the same.
- State level training Program :
  - Orissa (for Malaria Program)
  - Bihar (for Kala Azar Program)

ENVIRONMENTAL CODE OF PRACTICE(EMP) FOR IRS



The ECoP series Contain:

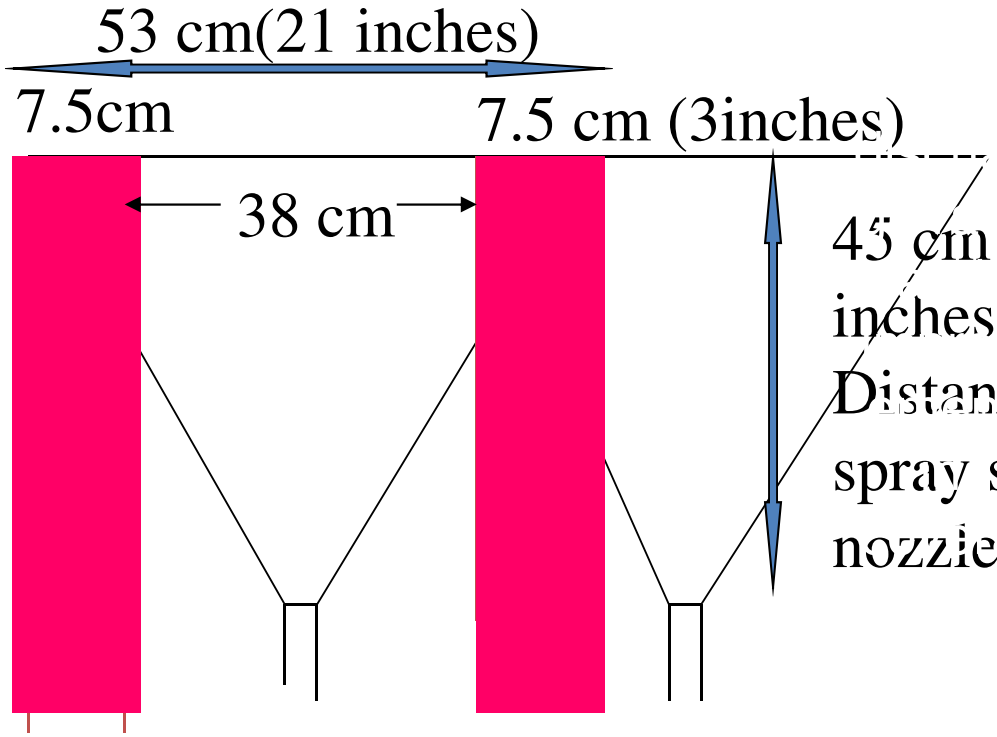
1. Transport of Insecticides for IRS activities
2. Storage and Management of Insecticides Stock
3. Community Responsibility During IRS
4. Use and Maintenance of Personal Protective Equipment (PPE)
5. Indoor Residual Spraying (IRS)
6. Disposal of waste water, empty bags/ Containers and bio-medical wastes

CAPACITY BUILDING FOR IRS
Spray technique

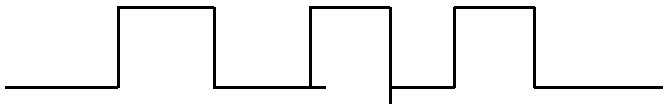
- The discharge rate should be 740 to 850 ml per minute.
- To obtain the above discharge rate, the pump man should give 50 to 120 strokes per minute with 4-5 cms plunger movement at a pressure of 10 PSI (0.7 kg/sq.cm) at the nozzle tip.
- Spraying into a bucket for one minute and measuring the quantity of the suspension in a graduated mug should check the correct discharge rate (740 to 850ml/minute).
- The nozzle tip should be discarded if the discharge rate exceeds 850 ml per minute.
- **It takes about 5 minutes to spray a house with an average surface area of 150 sq. metres.**

Capacity building

Improvement in IRS coverage in high risk areas



Movement during spraying



Swath and overlapping

CAPACITY BUILDING FOR IRS

Training of trainers workshop (for DMO, VBD, MI and KTS) in West Bengal (Koltata), Date-16thJanuary, 2012

Training of trainers workshop in Bihar (for DMO, VBD, MI and KTS), Date-18th-20th January, 2012

Training of trainers workshop (for DMO, VBD, MI and KTS and MTS) in Jharkhand, Date-20th-23rd March, 2012

Training of trainers workshop (for DMO, VBD, MI and MTS) in Ambikapur (Chattishgarh), Date-9-6-2012

CAPACITY BUILDING FOR IRS

Training of trainers workshop (for DMO, VBD, MI and MTS) in Jagdalpur (Chattishgarh), Date-11-6-2012

Training of trainers workshop (for DMO, VBD, MI and MTS) in Raipur (Chattishgarh), Date-7-6-2012

Training of trainers workshop (for DMO, VBD, MI and MTS) in Bilaspur (Chattishgarh), Date-8-6-2012

Handholding trainign for spray worker at Sahasra DMO office, Bihar, Date-9-2-2012

Handholding trainign for spray worker at Madhepura DMO office, Bihar, Date- 11-2-2012

IRS supervision by EMP implementation in Saraikela district of Jharkhand, Date- 6-6-2012

Spray team wearing PPE in East Singhbhum district of Jharkhand, Date-7-6-2012

Insecticide waste disposed at dug-pit in Visakhapatnam district of Andhra Pradesh, Date- 4-5-2012

Spray worker pouring insecticide wastewater in to dug pit at Vishakhapatnam district of Andhra Pradesh, Date- 4-5-2012

Polythene sheet used for covering of furniture before insecticide spray in East Champaran districts of Bihar (1st round IRS), Date-21st February, 2012

Polythene sheet used for staging area (area where insecticide suspention would be prepared) in Darbhanga district of Bihar (1st round IRS), Date-24th February, 2012

Insecticide spension prepared on the polythene sheet (to prevent contamination insecticide with soil) in Darbhanga district of Bihar (2nd round IRS), Date- 27-6-2012

Home take message for spray teams after capacity building

Please remember…….

It is not the insecticide but the supervision and re-supervision of the spray operations, which matter in the control of vector borne diseases. Ensure high coverage of insecticide spray in terms of time & space.

Monitoring and Evaluation indicators-IRS

INPUT INDICATORS

- Capacity Building of Spray Personnel
- Adequacy of PPE
- Safeguards for Staging Area
- Safe Transportation of Insecticides
- Safe Storage of Pesticide

Handholding Training Conducted

PPE Availability/PPE Requirement

Availability of Polythene Sheet

Mode of Transportation of

Location of Storage
Condition of Storage

PROCESS INDICATORS

- Capacity Building of Spray Personnel
- Depth of training
- Community level Planning for IRS
- Safeguards during IRS

Trainers in the Hand holding Training

Trainee in the Hand holding Training

Availability of Prior Information

Food & Household Goods Covered
Presence of Children
Domestic Animals kept of

Output INDICATORS

- Usage of PPE by Spray Personnel
- Safeguards for Staging Area
- Safe Storage of Insecticides
- Involvement & Awareness of Spray Staff
- Awareness of Community
- Penetration of Training
- Usage of PPE by Spray Personnel

Extent of PPE Usage by Solution Prepare
Extent of PPE Usage by Pump man
Usage of Polythene Sheet in Staging Area

Use of staging area during IRS
Non Target areas sprayed
Spillage on Ground

Safeguards for Storage

Output INDICATORS

Awareness of SFW/BHI
Involvement of ASHA

Awareness of Community - Env Safeguards

Personnel's knowledge of Env Aspects
Extent of PPE Usage by Sprayer

MONITORING AND SUPERVISION FROM National level

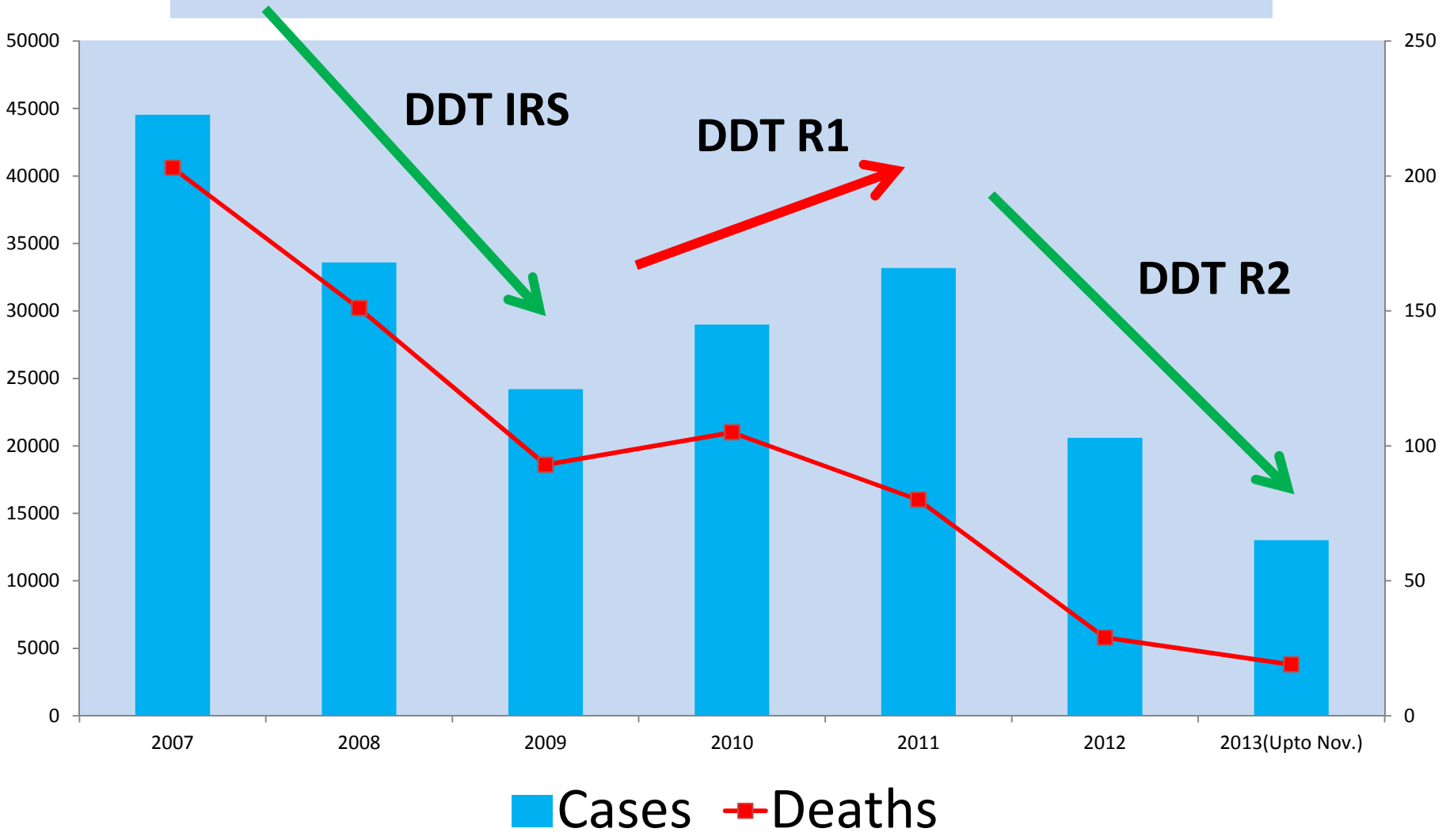
No.	Name of the officer	Designation	State	District Visited	Dates of visit	Purpose
	Mrs Geeta Kumari	Consultant	Jharkhand	Latehar and Chaibasa	03.01.12 to 08.01.12	Monitoring and Supervision of Malaria Control Programme Implementaion
	Dr. G.S. Sonal	Additional Director NVBDCP	Madhya Pradesh	Jabalpur	05.01.12 to 07.01.12	
	Dr. Prabha Arora	Joint Director NVBDCP	Assam	Guwahati	05.01.12 to 07.01.12	
	Dr. S.N. Sharma & Dr. H.G.Thakor	Joint Director NVBDCP & M & E Consultant	Andhra Pradesh	Vishakha Patnam & E. Godawari	Jan 12	
	Dr. S.N. Sharma	Joint Director NVBDCP	Andhra Pradesh	Khamam & Hyderabad	31.01.12 to 04.02.12	
	Mr. J. Nandi	ARO	West Bengal	Kolkata Municipal Corporation	02.02.12 to 09.02.12	
	Dr. K.S. Gill	Joint Director NVBDCP	Bihar	Darbhanga	13.02.12 to 17.02.12	Monitoring and supervision of IRS activities for kala-azar
	Dr. R.S. Sharma	Additional Director NVBDCP	Bihar	Samastipur	13.02.12 to 17.02.12	Monitoring and supervision of IRS activities for kala-azar
	Dr. S. Lyngdoh	Deputy Director	Meghalaya	South & West Garo Hills	13.02.12 to 16.02.12	Monitoring and supervision of Ist Round DDT & Entomological survey of Malaria and Dengue/ Chikungunya
	Miss Suman Khatry	Consultant	Odisha	Sundergarh	13.02.12 to 15.02.12	Death investigation and Monitoring an Evaluation in Sundergarh

Evaluation: Evidence based Impact

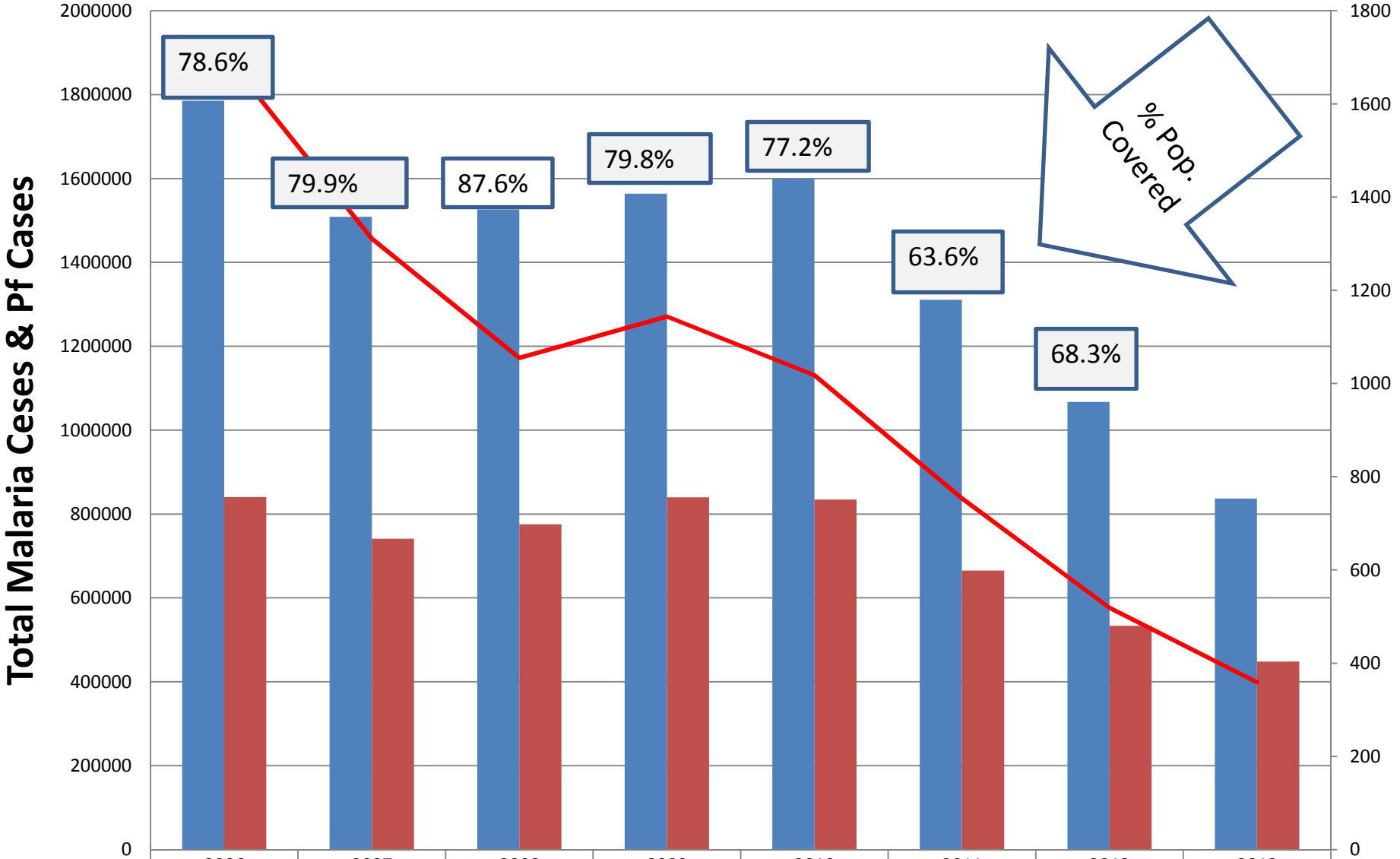
- Entomological:
  - Susceptibility status
  - Cone bioassays: To assess the bio-efficacy
  - Per Man Hour Vector Density in HD & MD:

- Epidemiological : API, SPR, SFR

Impact of IRS on Kala-azar Cases & Deaths in India

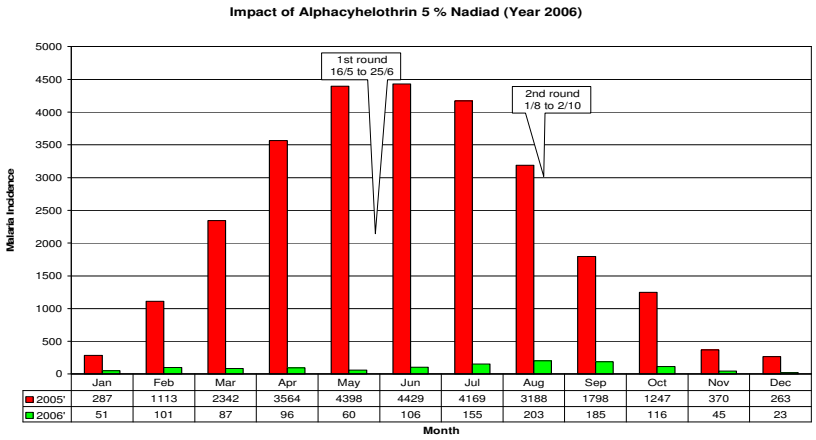


Impact of IRS – Malaria



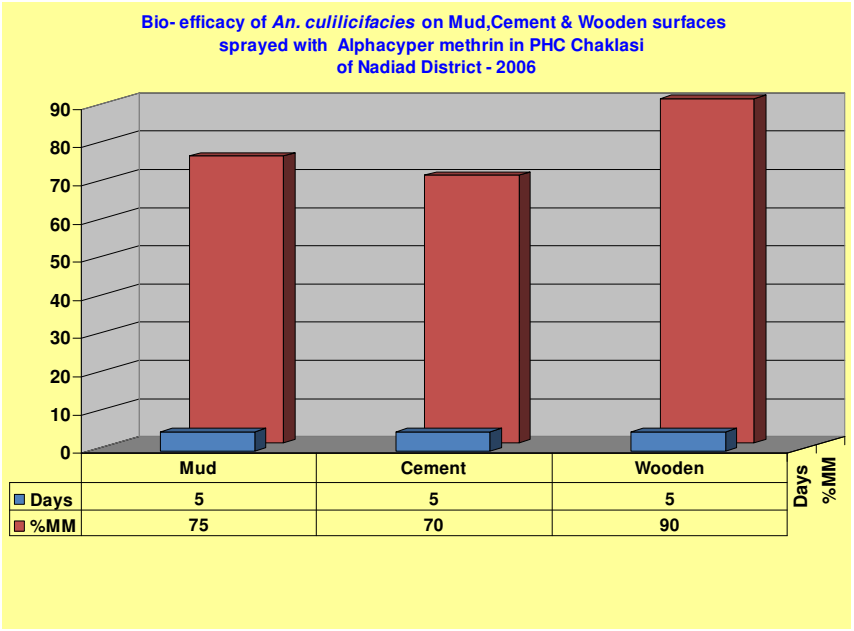
	2006	2007	2008	2009	2010	2011	2012	2013
Total Cases	1785129	1508927	1526210	1563574	1599986	1310656	1066981	836916
Pf Cases	840360	741076	775523	839877	834364	665004	533535	448446
Death	1707	1311	1055	1144	1018	754	519	359

Epidemiological & Entomological Impact of IRS– Nadiad

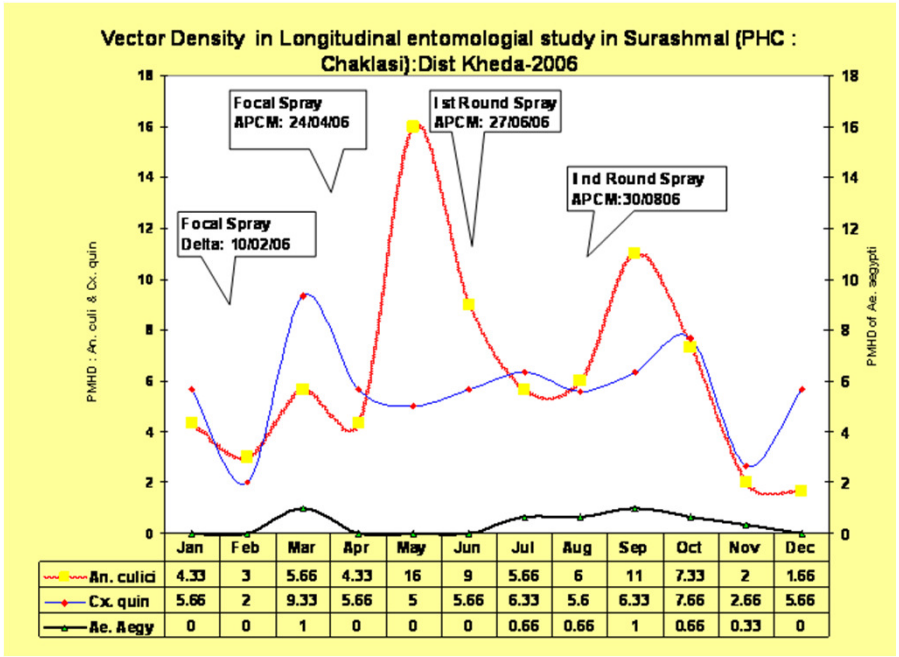


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005'	287	1113	2342	3564	4398	4429	4169	3188	1798	1247	370	263
2006'	51	101	87	96	60	106	155	203	185	116	45	23

- Insecticide – Alphacypermethrin 5%
- Susceptibility status of An.culicifacies :100%(APCM)
- Population Covered – 9.96 lacks
- Villages covered – 315
- No of Regular round – 2
- No of villages covered under focal spray – 41 (Popu. – 1.40 Lacks)
- Room Coverage – 96.24 %

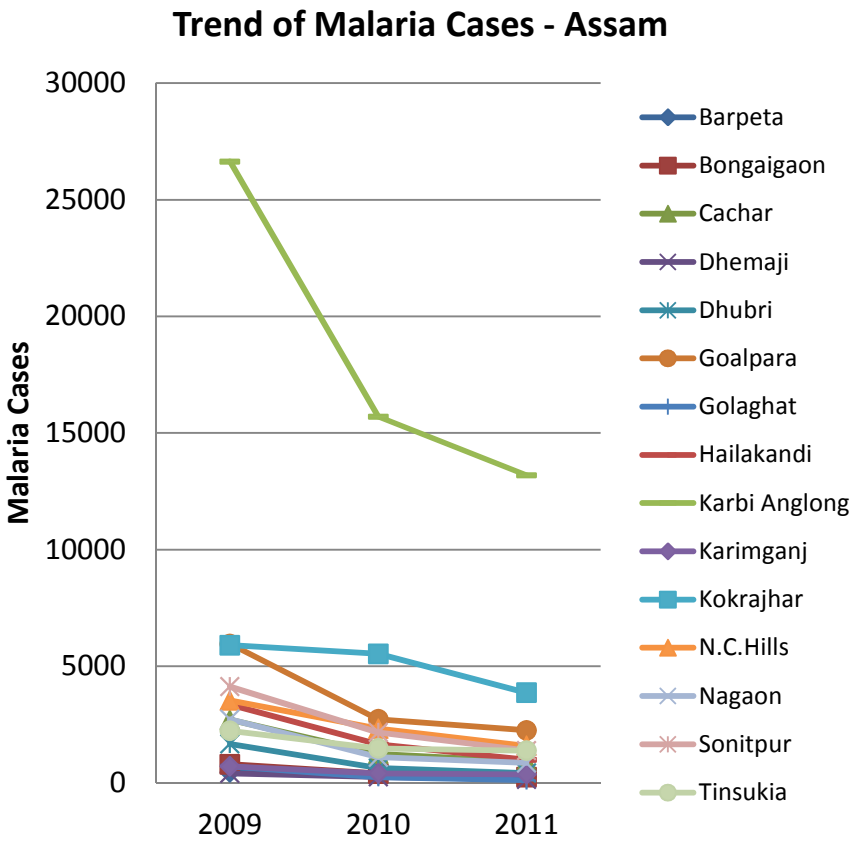


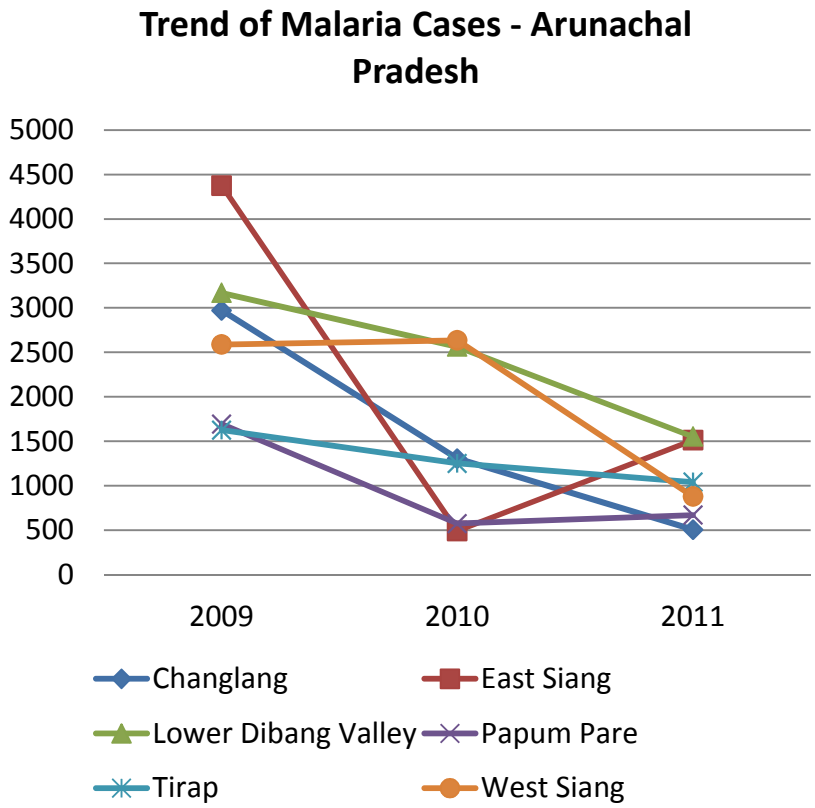
	Mud	Cement	Wooden
Days	5	5	5
%MM	75	70	90



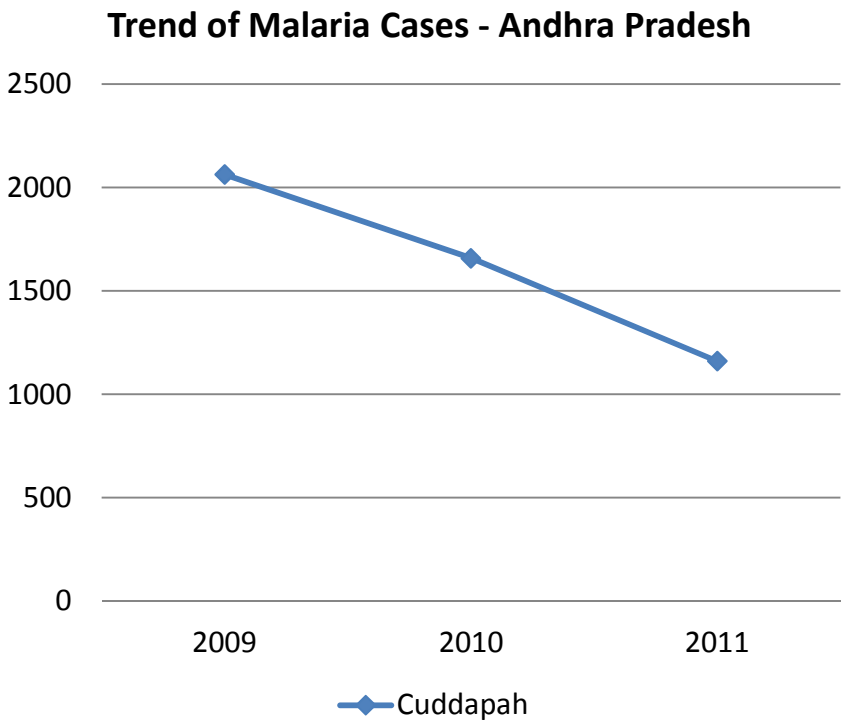
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
An. culici	4.33	3	5.66	4.33	16	9	5.66	6	11	7.33	2	1.66
Cx. quin	5.66	2	9.33	5.66	5	5.66	6.33	5.6	6.33	7.66	2.66	5.66
Ae. Aegy	0	0	1	0	0	0	0.66	0.66	1	0.66	0.33	0

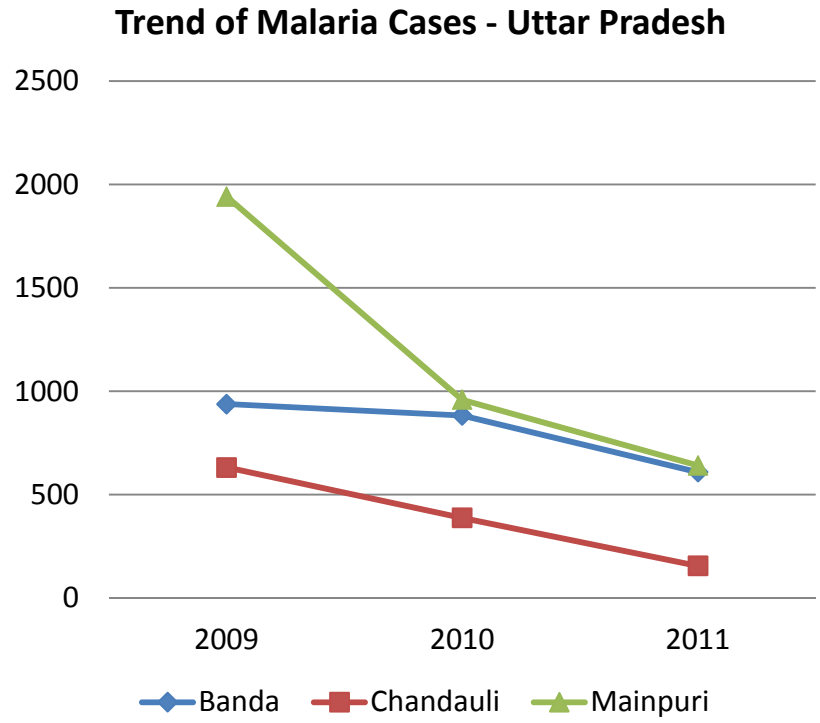
Impact of IRS





IMPACT OF IRS





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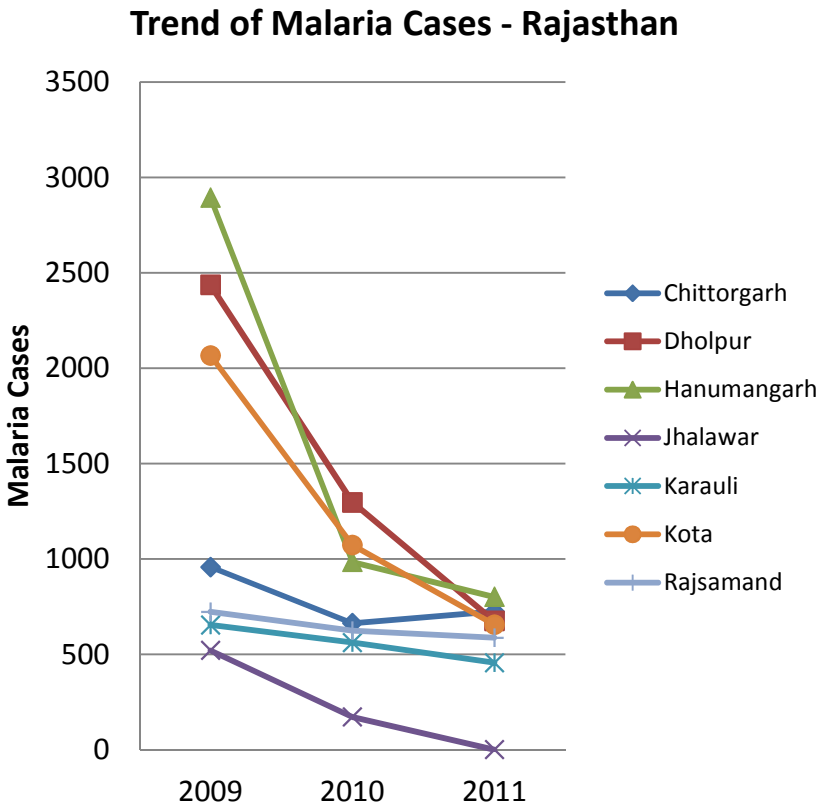

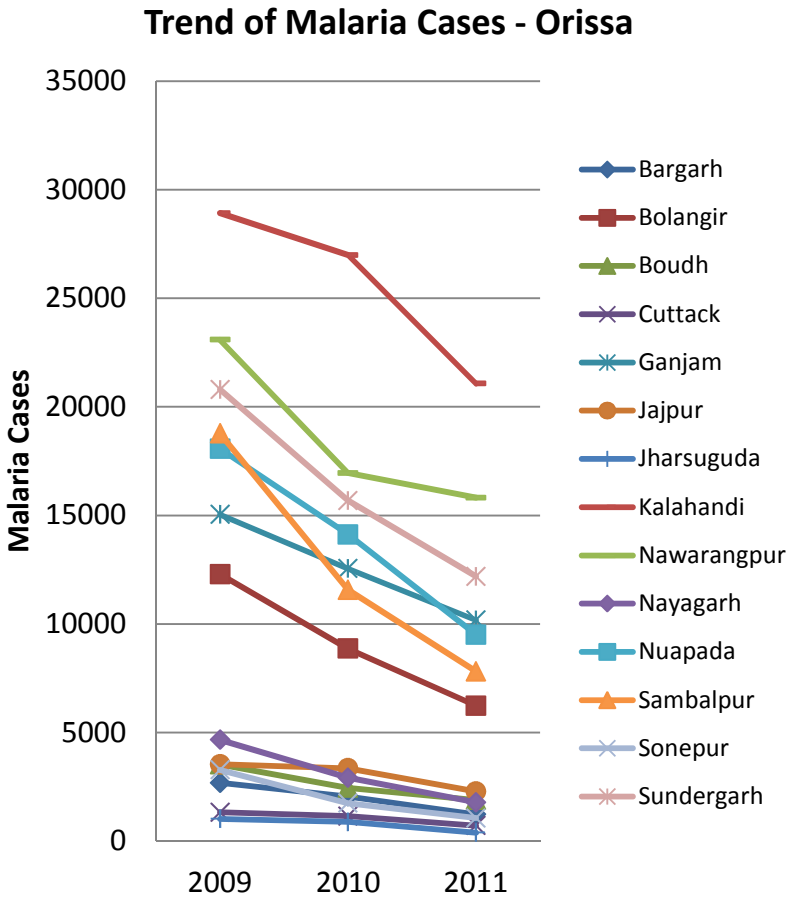

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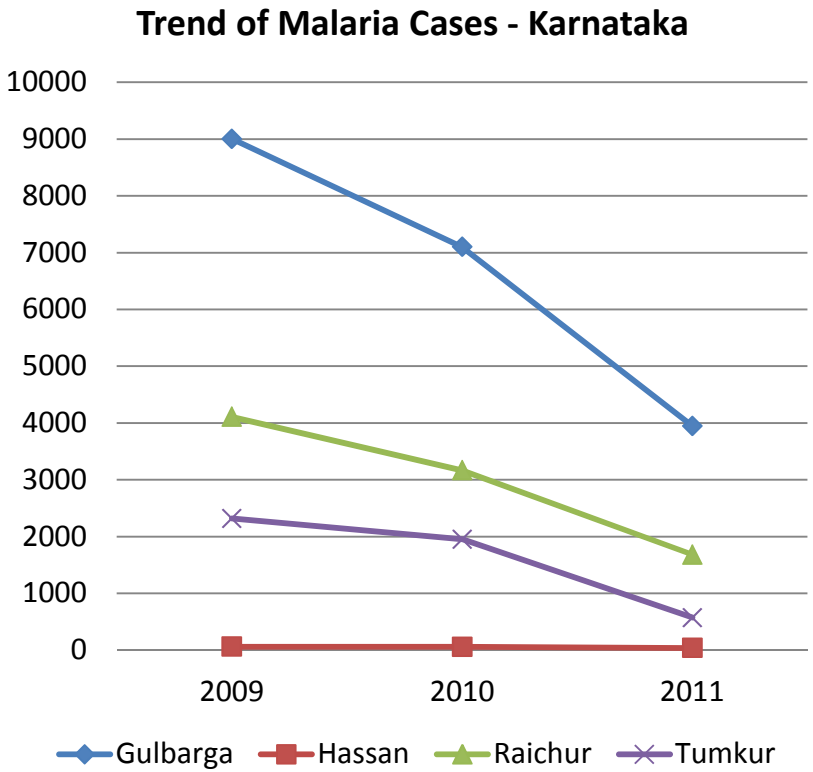
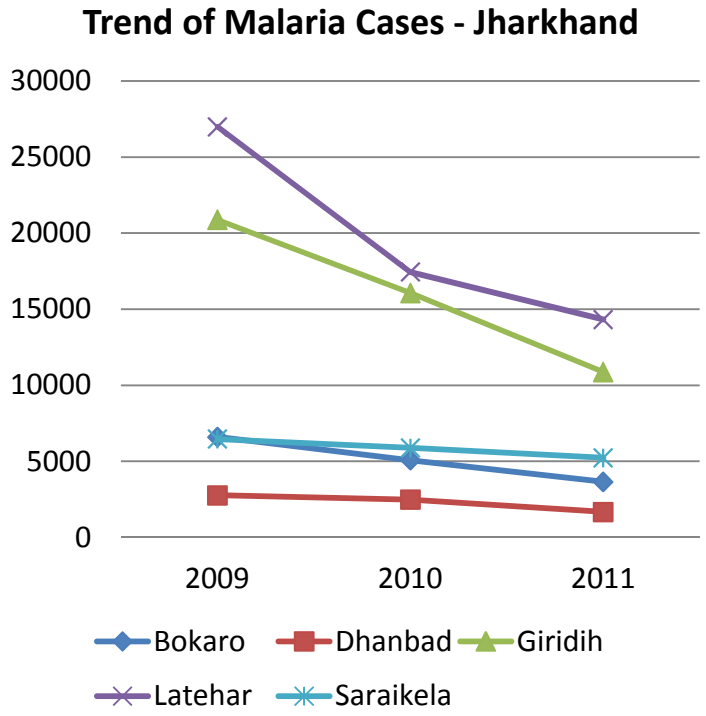
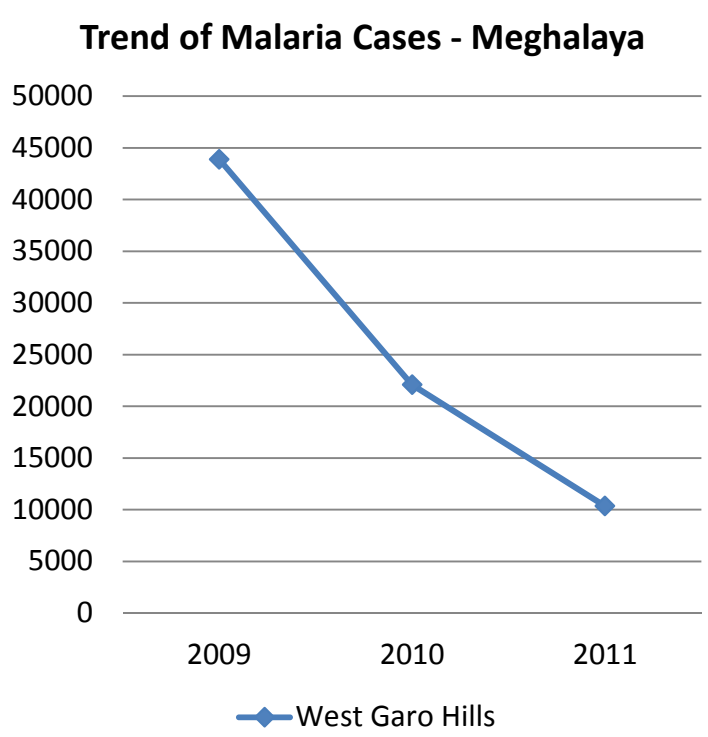
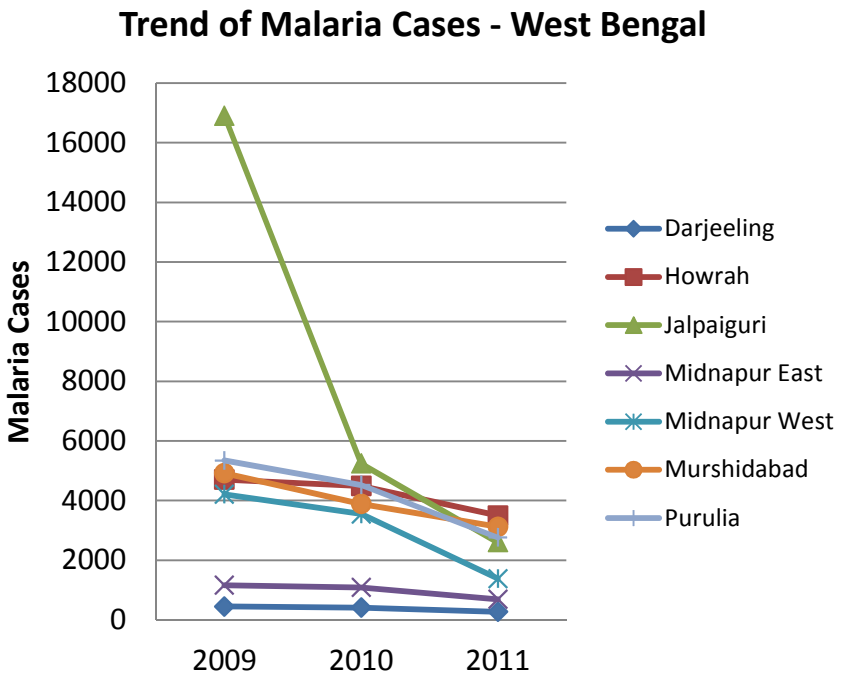




IMPACT OF IRS





interventions for achieving pre-elimination status

S.No.	Category	Definition
1	Category 1	**States** with API **less than one**, and all the **districts** in the state with API **less than one**
2	Category 2	**States** with API **less than one** and few **districts** reporting API **more than one**
3	Category 3	**States** with API **more than one** and either **all the districts** with API **more than one or few districts** with API **less than one** and **few** with API **more than one**

Vector control interventions for achieving pre-elimination status

❖ **Areas having perennial transmission (more than 7 months in a year)**

- 2 rounds of IRS with DDT/ SP or 3 rounds with Malathion, depending on vector susceptibility and priority distribution of LLINs as per the guidelines.

❖ **Areas having seasonal transmission (less than 5 months in a year)**

- 1 round of IRS with DDT/ SP or Malathion before start of transmission, focal spray whenever and wherever needed; priority distribution of LLINs as per the guidelines.

❖ Malaria surveillance; the states which are reporting an API < 1 for three consecutive years will process for declaring Malaria as a notifiable disease in the state.

Category	Strategies
1.	• Case based Quality surveillance with focus on active, passive and sentinel surveillance • Integrated Vector Management (IVM) by involvement of Village Health and Sanitation Committees, other PRIs and MNREGA schemes • Supportive interventions including IEC and BCC activities
2.	• Epidemiological Surveillance and Disease Management (3 Ts—Test, Treat and Track) • Screening of migrants in these areas • Integrated Vector Management (IVM) by source reduction through minor engineering, environmental management and focal spray • Supportive interventions including IEC and BCC activities with the involvement of private health care providers, community involvement and NGOs
3.	• Epidemiological Surveillance and Disease Management: by EDTC • Management of severe malaria cases by strengthening of district and sub-district hospitals and quality referral services • Integrated Vector Management (IVM) by IRS and LLIN distribution so as to saturate the entire high risk population • Supportive interventions.

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GUIDELINES ON
INDOOR RESIDUAL SPRAYING FOR VECTOR CONTRO

- PRE SPRAY ACTIVITIES
- SPRAY OPERATIONS
  - ✓Calculation of insecticides
  - ✓Prepartion of spray suspension
  - ✓Spray technique
- POST SPRAY ACTIVITIES
- -REPORTS AND RECORD Consecutive

Government of India
Dte. National Anti Malaria Programm
(Directorate General of Health Services)
22, Sham Nath Marg, Delhi - 110 054

IRS – CHALLENGE

Vector resistance & loss of Epidemiological impact

National Insecticide Policy

Resistant to	Alternative insecticide
DDT	Malathion
DDT and Malathion	Synthetic Pyrethroids.

CHATTISGARH

- ***An. culicifacies*** **was found tolerant to Alplhacypermethrin (ACM) with 71.9% mortality.**
- **The *An. culicifacies* mortality was found 9.8% with DDT and 55.3% with Malathion.**

Madhya Pradesh

- ***An. culcifacies*** **was found tolerance to ACM (71.9% mortality), and resistance to DDT (9.8% mortality) and MLN (55.3% mortality)**
- **Room Spray coverage was 70% in IR.**
- **Contact bioassays indicated lower mortality with ACM (51.3% -1-day after 1 R), with DDT (10% -1 dqy after IR)**
- **Incidence in all the areas including the control area registered an increase.**

Thank You

In this, O Nature, yield I pray to me.
I pace and pace, and think and think, and take
The fever'd hands, and note down all I see,
That some dim distant light may haply break.
The painful faces ask, can we not cure?
We answer, No, not yet; we seek the laws.
O God, reveal thro' all this thing obscure
The unseen, small, but million-murdering cause.

Dr.Ronald Ross

EPIDEMIOLOGICAL IMPACT

State	S. No.	DISTRICT	Total Positive cases 2009	Total Positive cases 2010	Total Positive cases 2011	2011-12 IRS Targeted Population (for each Rd.)	% Coverage	Qty. of DDT 50% WP Consumed for Two Rds. (MT)
Andhra Pradesh (T/S/G) (7/0/3)	1	Cuddapah	2063	1658	1160	110648	80	13
Arunachal Pradesh (T/S/G) (15/1/7)	2	Changlang	2972	1306	507			
	3	East Siang	4375	492	1512	90819	87	14
	4	Lower Dibang Valley	3168	2564	1552	32375	91	6
	5	Papum Pare	1695	575	671	79253	85	13
	6	Tirap	1626	1252	1041	104586	81	17
	7	West Siang	2588	2635	880	82431	98	16
Assam (T/S/G) (27/1/7)	8	Barpeta	456	353	247	145437	81	17
	9	Bongaigaon	793	399	240	99113	51	7
	10	Cachar	2707	1245	912	273586	87	18
	11	Dhemaji	402	253	151	108157	85	12
	12	Dhubri	1669	633	417	248989	74	18
	13	Goalpara	5957	2727	2250	265498	66	28
	14	Golaghat	710	238	113	238592	77	26
	15	Hailakandi	3346	1650	985	141727	92	10
	16	Karbi Anglong	26639	15701	13188	1001841	30	41
	17	Karimganj	710	404	364	142801	75	15
	18	Kokrajhar	5903	5531	3864	333741	83	26
	19	N.C.Hills	3524	2317	1585	230917	55	8
	20	Nagaon	2725	1098	851	523600	83	59
	21	Sonitpur	4123	2161	1387	256427	85	30
	22	Tinsukia	2230	1473	1382	202345	95	17

EPIDEMILOGICAL IMPACT

State	S. No.	DISTRICT	Total Positive cases 2009	Total Positive cases 2010	Total Positive cases 2011	2011-12 IRS Targeted Population (for each Rd.)	% Coverage	Qty. of DDT 50% WP Consumed for Two Rds. (MT)
Jharkhand (T/S/G) (22/0/1)	31	Bokaro	6600	5069	3648	659097	38	17
	32	Dhanbad	2769	2485	1675	127384	72	6
	33	Giridih	20878	16065	10868	718922	15	12
	34	Latehar	26990	17448	14322	634561	59	32
	38	Saraikela	6462	5886	5230	359920	86	36
Karnataka (T/S/G) (11/0/5)	41	Gulbarga	9001	7100	3948	148242	75	7
	42	Hassan	61	58	41			
	43	Raichur	4108	3166	1682	73758	99	3
	44	Tumkur	2318	1953	572	69804	64	6
Madhya Pradesh (T/S/G) (17/0/7)	45	Harda	267	186	131			
	46	Hoshangabad	2905	2377	2160	204266	96	28
Meghalaya (T/S/G) (7/0/1)	50	West Garo Hills	43890	22087	10356	594827	62	49
Orissa (T/S/G) (23/0/11)	51	Bargarh	2674	2052	1223	68841	97	53
	52	Bolangir	12292	8861	6232	547454	92	66
	53	Boudh	3528	2447	1887	127189	85	2
	54	Cuttack	1323	1140	710			
	56	Ganjam	15040	12551	10176	344666	75	28
	57	Jajpur	3529	3351	2277			
	58	Jharsuguda	1020	877	386	43721	86	5
	59	Kalahandi	28922	26989	21069	603547	79	48
	63	Nawarangpur	23091	16954	15815	708221	85	43
	64	Nayagarh	4662	2916	1775	107358	95	8
	65	Nuapada	18067	14117	9501	437605	91	28
	66	Sambalpur	18770	11565	7811	282872	94	32
	67	Sonepur	3273	1740	1052	134793	95	9
	68	Sundergarh	20796	15685	12188	518205	97	47

EPIDEMILOGICAL IMPACT

State	S. No.	DISTRICT	Total Positive cases 2009	Total Positive cases 2010	Total Positive cases 2011	2011-12 IRS Targeted Population (for each Rd.)	% Coverage	Qty. of DDT 50% WP Consumed for Two Rds. (MT)
Rajasthan (T/S/G) (32/1/14)	71	Chittorgarh	958	664	725	47065	100	6
	72	Dholpur	2437	1297	675	190921	94	27
	73	Hanumangarh	2894	984	801	151288	91	17
	74	Jhalawar	521	172	1			
	75	Karauli	654	562	456	67208	100	10
	76	Kota	2067	1073	656	115593	99	11
	77	Rajsamand	723	624	587	22360	100	3
Uttar Pradesh (T/S/G) (36/2/6)	79	Banda	938	883	609			
	81	Chandauli	632	388	156			
	82	Mainpuri	1941	959	641			
West Bengal (T/S/G) (12/0/2)	83	Darjeeling	445	409	270	227052	82	21
	84	Howrah	4703	4489	3496	14056	66	1
	85	Jalpaiguri	16902	5239	2601			
	86	Midnapur East	1163	1084	691			
	87	Midnapur West	4212	3551	1379			
	88	Murshidabad	4921	3889	3121	109191	36	2
	89	Purulia	5345	4523	2760	194498	93	

FIELD OBSERVATIONS

INDOOR RESIDUAL SPRAY

- Vector control is an important strategy for interrupting the transmission of malaria, especially in areas where the incidence is high.

- The reduction in the density of mosquitoes can be achieved through several methods that include indoor residual spraying.

- The use of insecticide for reducing population of malaria vectors continues to be the mainstay of the malaria control in the country

Effectiveness depends on ....

Anopheline mosquito

- Resting behavior
- Residual efficacy
- Irritability/ excito-repellency
- Human customs/occupation

The effectiveness of IRS depends on

- **Adherence to the specified criteria of the insecticide**
- **Use of well maintained equipment**
- **Correct application procedure**
- **Public acceptance of spraying**
- **Adequately trained personnel**
- **Effective supervision.**
- **Check-list**

INDOOR RESIDUAL SPRAY

- To control malaria vectors, indoor Residual spray (IRS) is being carried out with DDT 50% WP, malathion 25% WP and synthetic Pyrethroid (WP).

- Synthetic Pyrethroids include deltamethrin 2.5% WP, Cyfluthrin 10% WP, lambdacyhalothrin 10% WP, alphacypermethrin 5% WP, Etofenprox 10% WP and Bifenthrin 10% WP.

TECHNICAL ISSUES - IRS

- Advance notification for IRS
- Poor Quality of spray
- Inadequate Spray coverage
- Improper Spray technique
- Odor of insecticide
- Stains of insecticide
- Refusal rate
- Protective equipment
- Transportation of insecticide .
- Spray equipment
- Discharge rate of sprayers.

ADMINISTRATIVE ISSUES ON IRS

- Ineffective monitoring
- Vacancies of supervisory staff
- Community involvement
- Delayed spray wages
- Non Community involvement Apathy of Government efforts
- BCC activities for community may be implemented for the improvement of spray coverage.
- Protective covering should be used during spray operations

EFFECTIVE SUPERVISION

- Supervision of spray operations is a very important activity to ensure that spray operations are carried out according to correct technical procedures, which is essential for taking corrective action, and achieve the programme goals.

- Supervision is carried at all levels of programme implementation. It can be concurrent or consecutive. A stratified sample should be taken up for supervision.

CONCURRENT SUPERVISION

- Date of advance notification and the maintenance of time table for spray operations
- Turn out of spray crew
- Nozzle tip discharge rate
- Conditions of spray pumps
- Preparation of insecticide suspension
- Actual spraying operation including the technique, speed and coverage etc.
- Extent of refusal to accept spray and the numbers and percentage of locked houses

CONCURRENT SUPERVISION

- Maintenance of spray records
- Consumption of insecticide as determined by the quantity issued and stock in hand
- Date and time of checking of the squad by Inspectors/ Supervisors and other supervisory personnel and their remarks, if any
- Arrangements for mopping up
- Future programme and time schedule

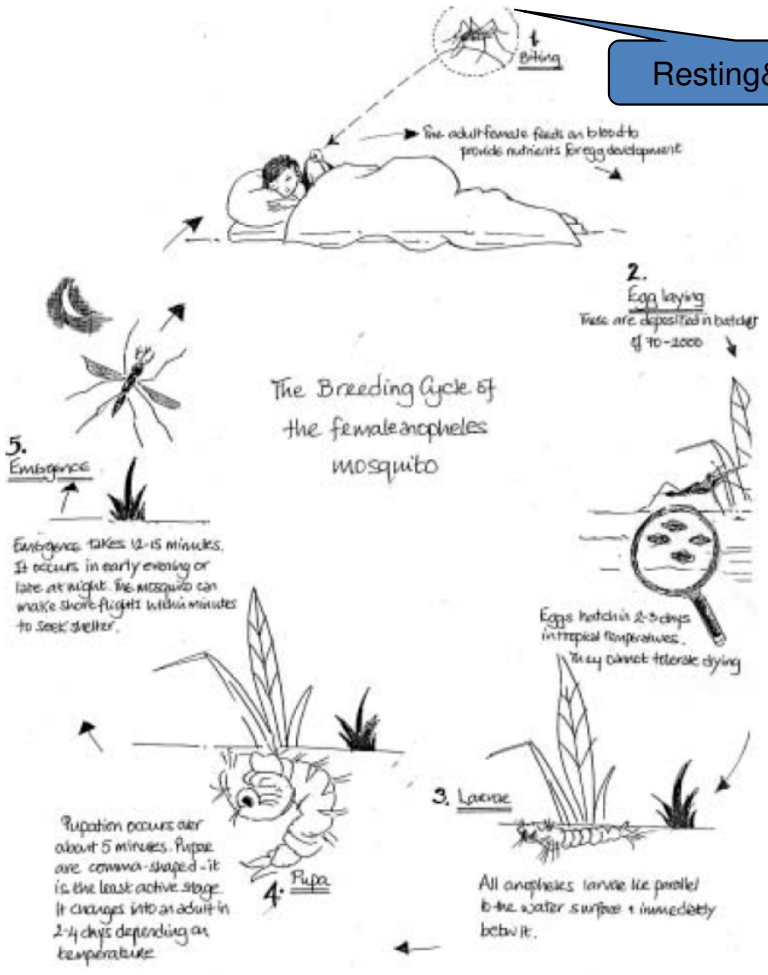
CONSECUTIVE SUPERVISION

- Evidence of insecticide deposit on sprayable surface particularly on the ceiling and wooden material like windows etc.
- Dispersal of the insecticide deposits on the walls to verify uniformity of deposits
- Number of rooms in each house sprayed satisfactorily, partially and not at all
- Percentage of refusals and locked houses
- Factors responsible for not spraying any area as elicited through enquiries from the residents
- Attempts made for mopping up operation in the event of high refusal
- Extent of mud plastering on the walls, if any and other relevant matters.

Indoor Residual spray

The application of an insecticide, having a property of a long residual effect in suspension form which on drying , leaves a crystalline deposit of active ingredient on the sprayed surface.

Principles and importance



- **Mosquito resting places are the primary sites of treatment.(Vector bionomics-Endophillic & Endo phagic)**
- **Mosquitoes rest on these sprayed surfaces.**
- **IRS is most widely used vector control method.**
- **More appropriate method for rural area.**

Effectiveness depends on ....

Anopheline mosquito

- Resting behavior
- Residual efficacy
- Irritability/ excito-repellency
- Human customs/occupation

Identification of high risk areas

High risk villages as per Malaria Action Programme 1995.
Villages identified as per the criteria of TAC

- **To spray on priority basis all areas taking sub-centre as a unit, with more than 5 API with suitable insecticides where ABER is 10% or more.**
- **To spray on priority basis with suitable insecticide all areas reporting more than 5% SPR (based on passive collection of blood slides), if the ABER is below 10%**
- **Due priority be accorded for spray if Pf proportion is more than 50%.**
- **To accord priority for IRS in areas with less than API 5 / SPR 5% in case of drug resistant foci, project areas with population migration and aggregation or other vulnerable factors.**
- **To make provision for insecticidal spraying in epidemic situations.**

Operational planning for IRS and ITNs

- Within the target populations for IRS and ITNs, it is necessary to identify the populations to be covered in the year under planning: the annual-plan target populations.

- Priority should be given to villages with highest burden of malaria (generally, highest API).

- The epidemiological data should be thoroughly analyzed in this process.

- A meeting of MO-PHCs and MPHW supervisors (M) should be convened at district or block level for operational planning target populations and prioritization of villages.

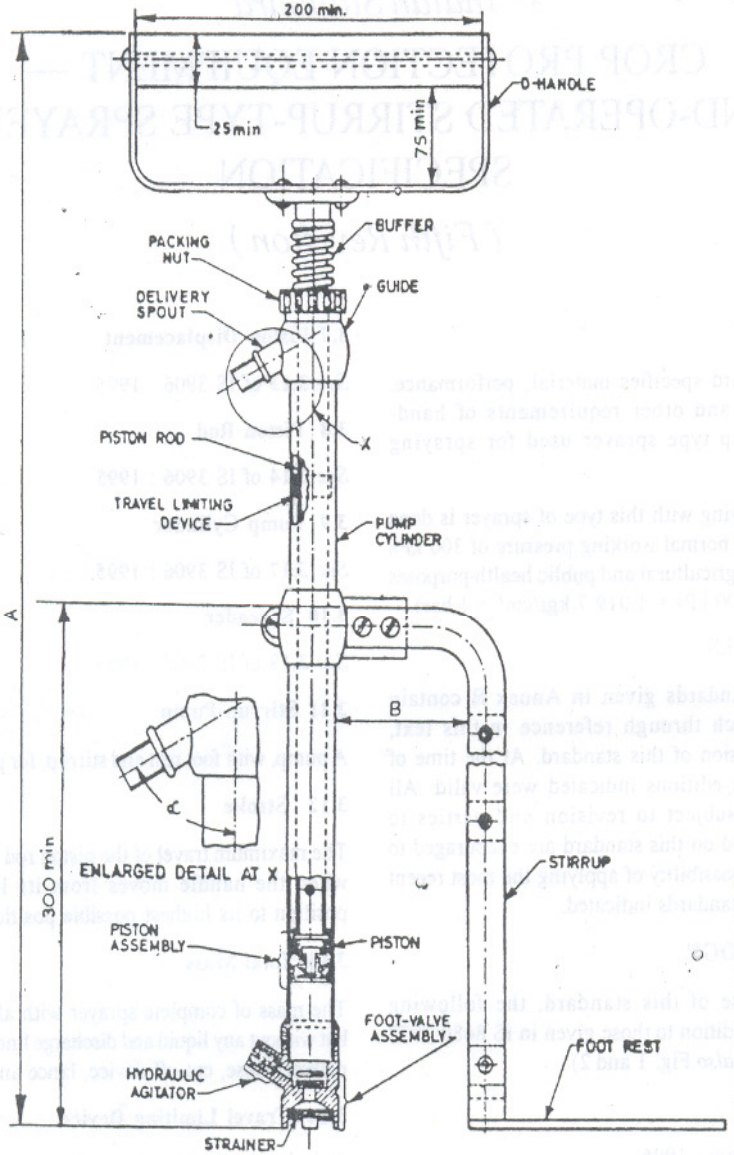
Role of PHC staff in IRS activities

The MO-PHC should plan for IRS activities well in advance and carry out the following:

- Contributing to district level planning by providing relevant village wise micro stratified information to DMO
- Indent for insecticide in time
- Village wise requirement to be identified well in advance and maintenance of records & registers on daily basis.
- Spray equipment to be checked and repaired.- 2 Stirrup pumps/PHC
- Spare nozzle tips, measures, buckets, plastic sheets, etc. to be purchased.
- Manpower for spray to be calculated @ 30 houses in plains or 25 houses in hilly areas per pump per day. Each squad consists of 5 FWs and 1 SFW operating two stirrup pumps.

Requirement of Spray Staff

Period of Round	For 10 Lakh Population		For 1 Lakh Population		For 5000 Population	
	SFW	FW	SFW	F W	SFW	F W
2 ½ Months	44	230	4	23	For Sub center	
2 Months	55	287	5	28		
1 ½ Months	73	375	7	38		
1 Month	115	565	11	57		
15 Days	230	1150	22	115	1	5
7 Days	460	2300	44	230	2	10



All dimensions in millimetres.

FIG. 1 TYPICAL DESIGN OF A HAND - OPERATED STIRRUP - PUMP TYPE SPRAYER

Stirrup pump for IRS

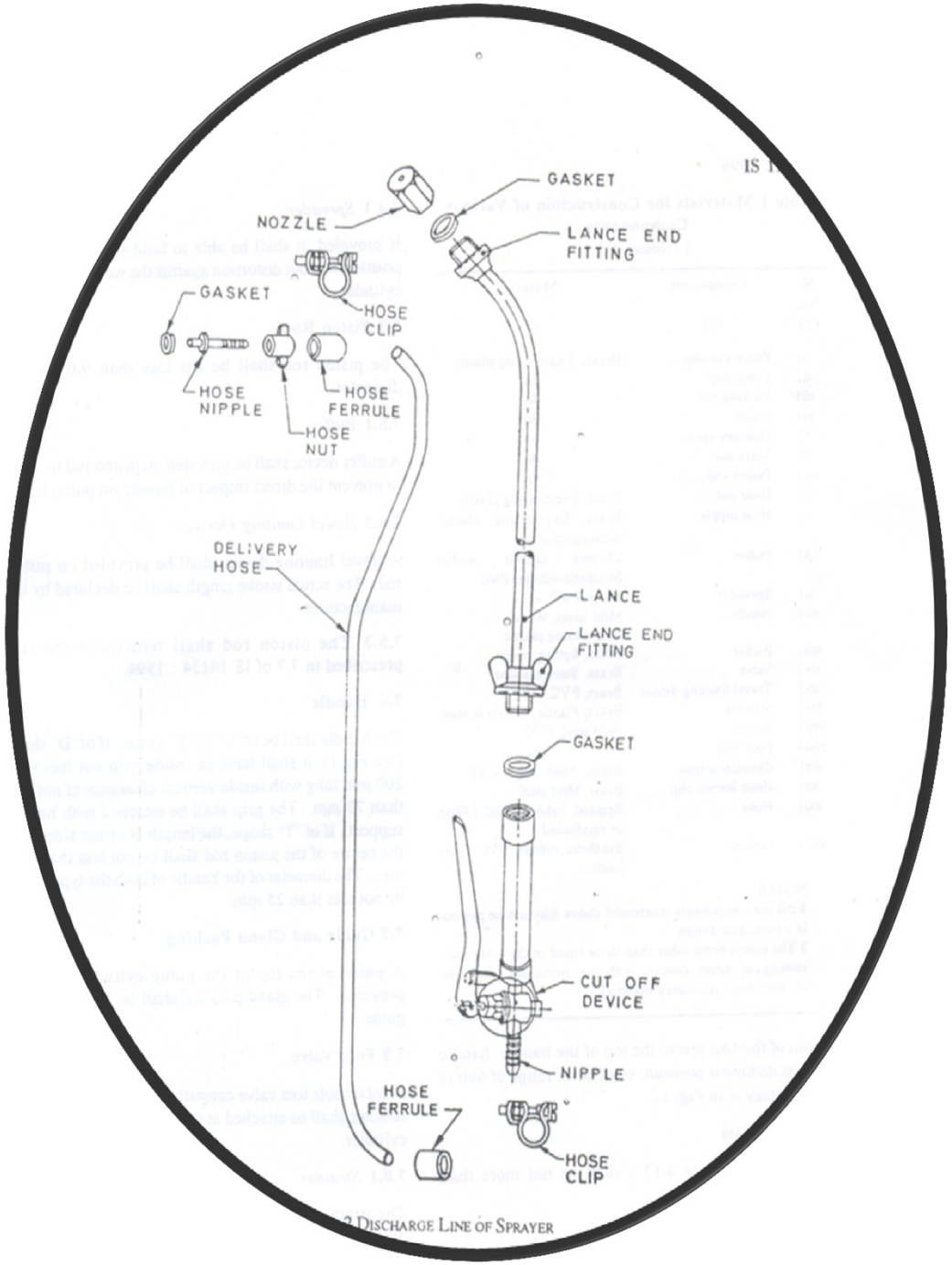
A pump, with foot rest & stirrup, for producing spray.

Stroke

The maximum travel of the piston rod in one direction When the handle moves from its lowest possible position to its highest possible position.

Travel Limiting Device

A device for limiting the stroke



3 Discharge Line of Sprayer

Discharge Line of Sprayer

Delivery hose of suitable Diameter and preferably 5 meters in length.

The hose connected with Delivery spout & the cut- off device & lance through hose connection.

The Nozzle Tip should be of Flat fan type

Spray schedule

- Time of spray should ensure maximum protection.
- Prioritization in case of shortages.
- One round in pre monsoon months followed by further rounds depending on residual efficacy.
- Focal sprays in specialized situation

Advance spray programme

- Involvement of Panchayats is essential for successful IRS.
- Panchayats / village / local bodies / village heads / Taluka Development Officers / Mahila Mandals, religious groups etc., are to be informed about spray schedule at least a month before the spray.
- This is to facilitate the villagers to extend full cooperation in getting the spray inside their dwellings.
- The MPHWs/ASHA/community volunteer should inform the same to the community members 15 days in advance during Gram-shabha and remind them again 3 days before the actual spray date.

Target surfaces

- **All the interior walls and ceilings are to be treated.**
- **In addition to permanent human dwellings, field huts where people sleep during the planting or harvesting season should be sprayed.**
- **The underside of furniture, back of the doors, outside eaves and porches must be treated.**
- **Human dwellings and mixed dwellings should be sprayed.**
- **Cattle sheds are not to be sprayed (with a view to conserve insecticide, improve coverage of human dwellings and prevent diversion of mosquitoes from cattle sheds to human dwellings).**

Spraying should be:

- Total - all the dwellings are sprayed
- Complete - cover all sprayable surfaces
- Sufficient - uniform application of the required dose to all sprayable surfaces
- Regular - repeated at regular intervals to ensure an effective residue is present during the transmission season

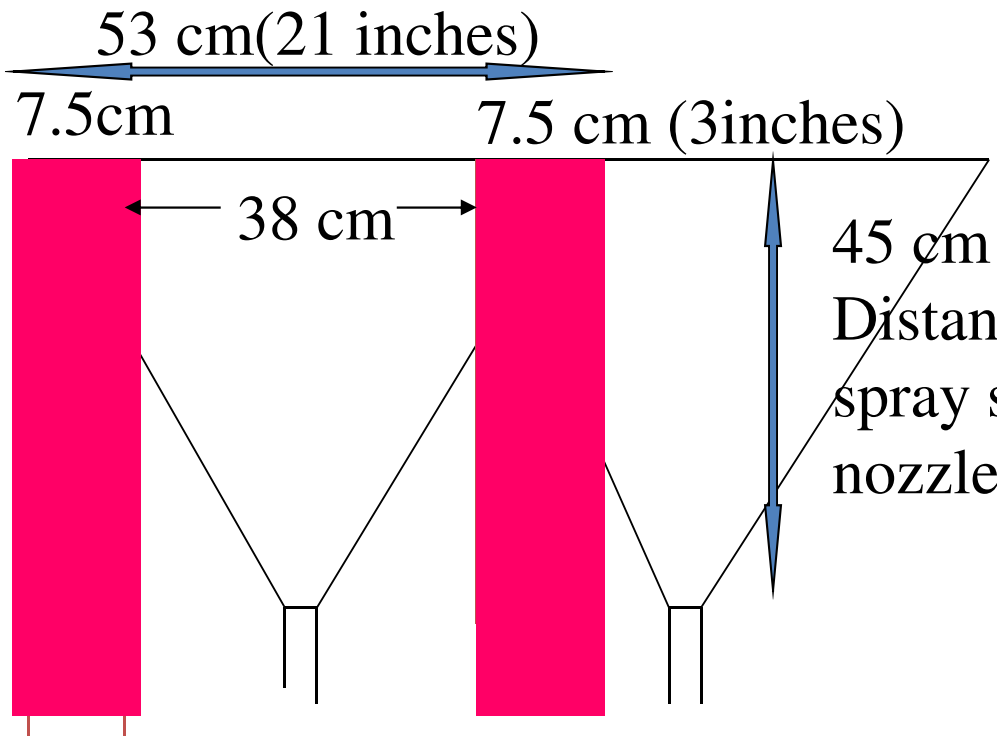
Spray Technique

- Required quantity of insecticide should be issued on a day to day basis after checking balance stocks available from previous day's supplies.
- Spray suspension should be made correctly so that the correct dosage is applied on the sprayed surfaces.
  - **The required quantity of the insecticide is measured with a plastic mug and put inside a 15 litre bucket.**
  - **A paste is made with a small quantity of water.**
  - **The remainder of water is then poured slowly into the bucket and the insecticide water mixture is stirred vigorously to obtain a uniform suspension.**
  - **The suspension is then poured into another bucket through a cloth sieve to remove any particulate matter that might clog the nozzle of the spray pump.**

Spray Technique

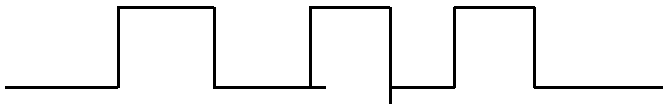
- The barrel of the stirrup pump is put in the bucket containing the spray suspension.
- One man operates the pump and the other man sprays.
- The spray lance should be kept 45 cms (18 inches) away from the wall surface.
- The swath should be parallel.
- Spray is applied in vertical swath of 53 cm (21 inches) wide. Successive swaths should overlap by 7.5 cm (3 inches).
- Spray is done from roof to floor, using downward motion, to complete one swath; then stepping sideways and spraying upwards from floor to roof.
- Do not let the spray drip to the floor.
- Spraying is done on inner surfaces including eaves and roofs.

Spray Technique



Swath and overlapping

Movement during spraying



Spray Technique

- The discharge rate should be 740 to 850 ml per minute.
- To obtain the above discharge rate, the pump man should give 50 to 120 strokes per minute with 4-5 cms plunger movement at a pressure of 10 PSI (0.7 kg/sq.cm) at the nozzle tip.
- Spraying into a bucket for one minute and measuring the quantity of the suspension in a graduated mug should check the correct discharge rate (740 to 850ml/minute).
- The nozzle tip should be discarded if the discharge rate exceeds 850 ml per minute.
- **It takes about 5 minutes to spray a house with an average surface area of 150 sq. metres.**

Salient Reasons for Poor Quality of IRS

Patchy Spray:

- Due to faulty/partially clogged nozzle
- No proper overlapping of spray swath(3 inches)
- Improper Discharge Rate(740 to 850ml/min) of spray suspension due to improper pumping pressure/stokes

Partial Spray:

- Either the ceiling or half room or half of the walls are left unsprayed.
- 3 rooms in a house, 1 or 2 rooms are left unsprayed.
- Mostly due to the lack of pre spray intimation not given to the each house holders/ village community.
- Lack of knowledge about the purpose of spray.
- No mopping up operation is carried out.

Salient Reasons for Poor Quality of IRS

Thick or Thin Spray (Lack of uniform quality of spray):

- Due to the improper distance between the spray surface and nozzle. (Distance is 18 inches)
- Either more or less quantity of insecticide taken for preparing suspension(Deltamethrin 400 gms in 10 ltrs of water)

Spray of Cattle Sheds:

- In majority of the houses only cattle sheds are sprayed resulting in sifting of mosquitoes to human dwellings increasing the chances of man mosquito contact.
- Spray all the sprayable structures in the human dwelling.

Salient Reasons for Poor Quality of IRS

Spray of out side walls:

- Generally out side walls of houses are sprayed, which is a sheer wastage of insecticide, efforts, time and money.

Mud Plastering:

- Most of the houses were found either partially or fully mud plastered after spraying.
- This could be due to post spray information not given to householder/community about purpose of spray and period (2 to 3 months) not to white wash nor mud plastered houses.

Stenciling:

- Either poor or no stenciling found on the sprayed houses.

Salient Reasons for Poor Quality of IRS

Spray in bordering districts:

- Should be synchronization of IRS in the bordering district affected with malaria in respect of their timing and type of insecticide used which should be same in these districts.

Safety measures

- The removal or physical protection of all foodstuffs and cooking or eating utensils is imperative.

- In addition, inhabitants should be advised not to enter a sprayed room until the spray is dry, and to sweep all floors before allowing free entry into the house.

Safety measures

Protective devices:

- Hats/Caps
- Overcoats
- Apron
- Rubber boots
- Goggles
- Gloves
- Mask

Safety measures

- Storage: Store insecticide in a well ventilated room

Disposal

  - Safe disposal of empty containers.
  - Washings of sprayers and the left over insecticides may be poured in to pits.
  - Never pour insecticides in to or near the drinking water source.

Safety measures

Personal hygiene

- Hands and face should be washed after filling each pump charge.
- Eating, drinking and smoking should be forbidden, except after washing and before starting to spray.
- Spray men should not be exposed to insecticide for more than six hours each day.
- Overalls and hats should be washed daily, especially if they have been heavily contaminated.
- Spray men must take a shower at the end of each day’s work.

Antidotes for insecticide poisoning

OP poisoning

(Organo-phosphorous compounds targets nervous system and is esterase inhibitor)

- In case of OP poisoning, the patient should be transported as soon as possible to a doctor to receive an antidote.
- Organophosphate poisoning, 2-4 mg of atropine should be given intravenously (for children 0.5 to 2 mg according to weight).
- Depending on symptoms, further doses of 2 mg should be given every 15 minutes for 2-12 hours in severe cases.

SP poisoning

(Affects nervous system- every part of the nervous system is affected)

- In treating pyrethroid poisoning vitamin E oil preparations can be given for prolonged paraesthesia.
- Only in cases of definite allergic symptoms should corticosteroids be administered. On occurrence of convulsions after sever intoxication, intravenous injection of 5-10 mg Diazepam (or other benzdiazepine derivatives) should be given.

Interpretation - IRS

- Coverage of rooms should not be less than 80 % and spray schedule tailored to curtail the local transmission.
- If first round of IRS not given in time as scheduled or coverage is poor, further the case detection / drug distribution not done for at least 2 to 3 months – the epidemic will be predominantly of ***P. vivax***
- If both the rounds of IRS either not given or coverage is extremely poor and case detection and drug distribution not done at least 4 to 5 months – the epidemic will be predominantly of ***P. falciparum***

Possible ways of avoiding development of insecticide resistance in field

- Avoid indiscriminate use of insecticides
- Avoid use of insecticides that simultaneously select resistance to other chemically related insecticides.
- Avoid use of insecticides that induce development of more than one type of resistance mechanism of broad spectrum of resistance.
- Avoid use of the same insecticide both against adults and larvae.
- Use of non chemical control methods, e.g. biopesticides, larvivorous fish.
- Use of synergist with insecticides to reduce physiological resistance

PROCESS OF CHANGE OF INSECTICIDE

- If the change of insecticide is warranted, the state govt. should support their choice of alternative insecticide by documentation of data on vector resistance studies and field observations on epidemiological impact of spray in respect of insecticide in use.

- The change of insecticide will always be decided in mutual consultation between State Programme Officer for NVBDCP, ROH&FW and the Directorate of NVBDCP with concurrence of State and Central Govts. The proposal should be discussed in the annual action plan meeting in Dte. of NVBDCP.

- State Govt. submits the proposal for change of insecticide to Dte. of NVBDCP in the month of January-February.

- All technical data on vector resistance, epidemiological impact of the current insecticide in use, along with financial outlay, quantity of alternative insecticide chosen, with comparative cost difference for spray operation should be included in the proposal.

- The proposal should be discussed in the annual action plan meeting in Dte. of NVBDCP

SELECTION AND CHANGE OF INSECTICIDES

- Several factors need to be considered in the selection of an insecticide spraying, including availability cost, residual effectiveness, safety, vector susceptibility and excito-repellency.

- Anopheles culicifacies is the main vector of malaria in the country. This species showed resistance to DDT and Malathion in some states. The other main vectors of malaria i.e. *An.fluviatilis, An.minimus and An.dirus* are still susceptible to DDT. The main parameters for switching over to Synthetic Pyrethroids are –

  A. Vector Resistant to DDT and Malathion

  B. Loss of epidemiological impact

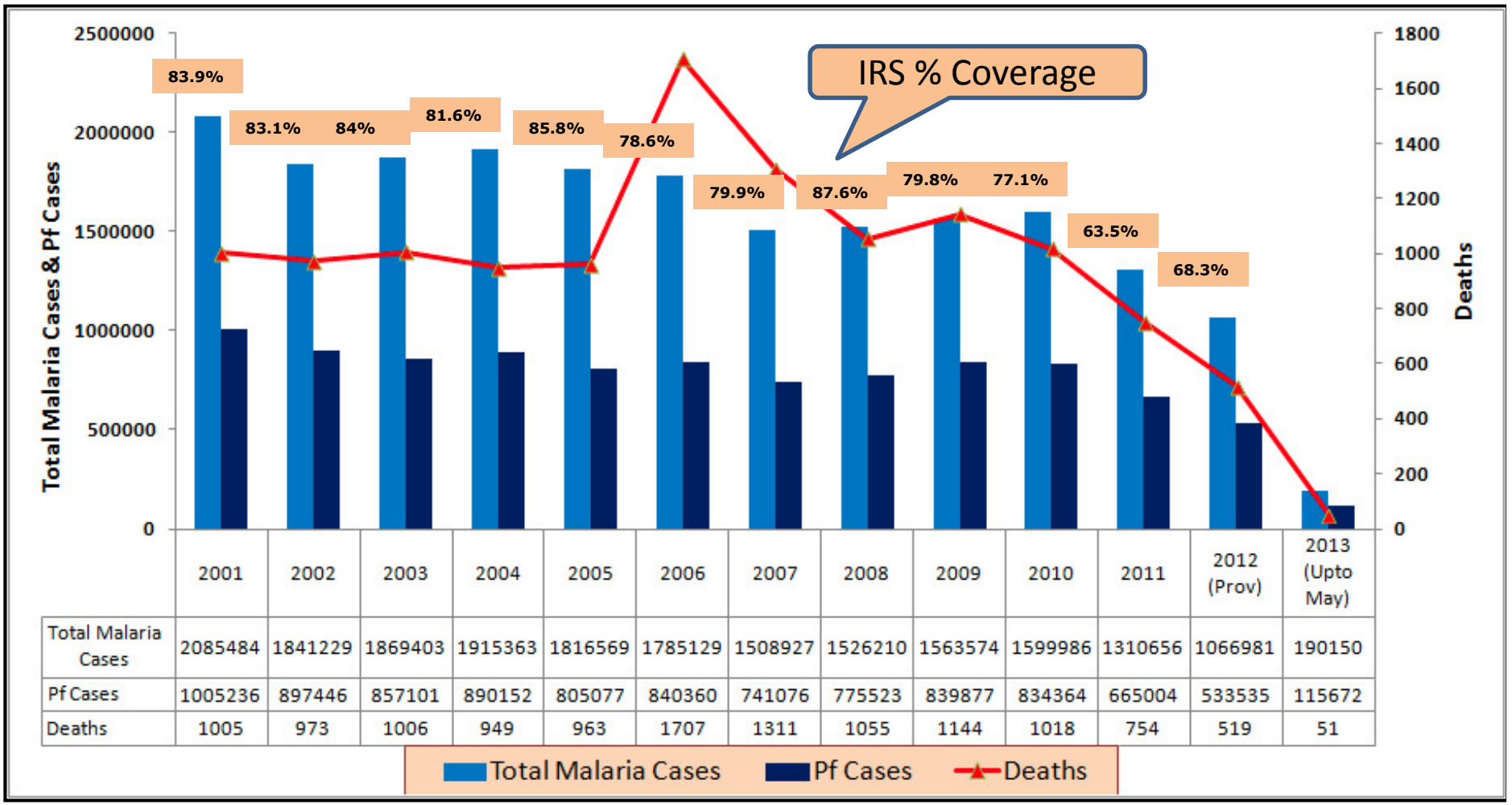
STEPS FOR IMPROVEMENT OF IRS

- The community should be informed well in advance of IRS
- Proper training of spray personnel
- Involvement of Village head/ Panchyat to get the houses sprayed
- Involvement of Mahila mandals for IRS
- Involvement of School teachers for IRS

Please remember…….

It is not the insecticide but the supervision and re-supervision of the spray operations, which matter in the control of vector borne diseases. Ensure high coverage of insecticide spray in terms of time & space.

Impact of IRS (DDT ,Malathion and Synthethic Pyrethroids) on Malaria in India



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012 (Prov)	2013 (Upto May)
Total Malaria Cases	2085484	1841229	1869403	1915363	1816569	1785129	1508927	1526210	1563574	1599986	1310656	1066981	190150
Pf Cases	1005236	897446	857101	890152	805077	840360	741076	775523	839877	834364	665004	533535	115672
Deaths	1005	973	1006	949	963	1707	1311	1055	1144	1018	754	519	51

Thank You

In this, O Nature, yield I pray to me.
I pace and pace, and think and think, and take
The fever'd hands, and note down all I see,
That some dim distant light may haply break.
The painful faces ask, can we not cure?
We answer, No, not yet; we seek the laws.
O God, reveal thro' all this thing obscure
The unseen, small, but million-murdering cause.

Dr.Ronald Ross

Be prepared for Coming
Monsoon
Thank You…..