

Technology Options for Enhancing Climate Resilience in PM Dhan Dhanya Krishi Yojana Districts Learnings from NICRA



ICAR-Central Research Institute for Dryland Agriculture

Santhoshnagar, Hyderabad - 500 059

Technology Options for Enhancing Climate Resilience in PM Dhan Dhanya Krishi Yojana Districts Learnings from NICRA

**VK Singh, G Pratibha, Adul Islam, PK Pankaj, V Visha Kumari, M Prabhakar, Rakesh Kumar,
AK Nayak, Ranjay Kumar Singh, Rajbir Singh, ML Jat**



**ICAR-Central Research Institute for Dryland Agriculture,
Santoshnagar, Hyderabad – 500059**

Citation:

Singh, V. K., Pratibha, G., Adlul Islam, Pankaj, P. K., Visha Kumari, V., Prabhakar, M., Rakesh Kumar, Nayak, A. K., Ranjay Kumar Singh, Rajbir Singh, Jat, M. L., 2026, Technology Options for Enhancing Climate Resilience in PM Dhan Dhanya Krishi Yojana Districts Learnings from NICRA. ICAR-Central Research Institute for Dryland Agriculture, Hyderabad. P154.

Copies: 200

© Copyright 2026 ICAR – Central Research Institute for Dryland Agriculture, Hyderabad, All rights reserved

Facilitated by

Agricultural Technology Application Research Institute

Editorial assistance (Research Associates/fellow)

ICAR-CRIDA: Prabhamani, P.S., Adilakshmi, K., Shiva Kumar, A., Prasanna

Published by

The Director

ICAR-Central Research Institute for Dryland Agriculture (CRIDA)

Santoshnagar, Hyderabad-500 059. Ph: 040-24530177 Fax: 040-24531802

E-mail: director.crida@icar.gov.in

<http://www.icar-crida.res.in/>; <http://www.nicra-icar.in>

Cover design

AVM Subba Rao (Principal Scientist)

Designed and Printed at:

PRINTOGRAPHY, M.G. Road, Ranigunj,

Hyderabad - 500003. Mobile : 98489 24254

E-mail : info@printography.co

PREFACE

In the face of increasing climate vulnerabilities, the adoption of innovative climate-resilient technologies is essential to minimize risks and sustain agricultural productivity. The National Innovations on Climate Resilient Agriculture (NICRA), implemented by the ICAR -CRIDA , promotes climate-resilient agriculture by enabling farmers to adapt to droughts, floods, heat and cold stress, and other extreme weather events. Its key interventions were natural resource management (soil and water), crop management, and livestock-based practices. Crop and livestock enterprises in India are closely interlinked, particularly within smallholder systems. The promotion of Farming Systems (IFS)—combining crops, livestock, horticulture, fisheries, and allied enterprises—enhances resource-use efficiency through optimal use of land, water, and labour, while reducing production risks. These interventions contribute to higher productivity, stable farm income, improved resilience to climatic uncertainties, sustainable natural resource management and environmentally sustainable agriculture, These contribute to stable incomes, reduced risks, improved food and nutritional security,

The Pradhan Mantri Dhan-Dhaanya Krishi Yojana (PMDDKY) is a flagship initiative of the Government of India aimed at improving productivity, resource-use efficiency, and farmers' income through targeted interventions in selected districts. In this context, NICRA aligns closely with the objectives of PMDDKY by promoting climate-resilient technologies, through efficient natural resource management, complements PMDDKY by ensuring that productivity gains are sustainable under changing climatic conditions, while supporting rural livelihoods and national food security. The compilation of technologies and their economic performance under both normal and stress conditions provides a practical framework for scaling up climate-resilient interventions through ongoing development programmes.

This publication, “Technology Options for Enhancing Climate Resilience in PM Dhan-Dhaanya Krishi Yojana Districts: Learnings from NICRA,” documents district-wise climate resilient technologies across selected regions. It presents improved resource management and crop strategies, along with successful farming system models, highlighting their advantages in productivity, profitability, and sustainability across 50 climate-vulnerable districts. The inclusion of case studies further illustrates field-level adoption and tangible benefits for farmers, offering valuable insights for researchers, policymakers, and practitioners.

We express our sincere appreciation to the Zonal Monitoring Committees, Directors of Extension, State Agricultural Line Departments, ATARIs, and Krishi Vigyan Kendras (KVKs) for their support and contributions. We are especially grateful to the farmers and all project stakeholders, whose participation has been instrumental in shaping this work.

We hope this publication will serve as a useful reference for strengthening PMDDKY implementation and for promoting climate-resilient, practices across the identified districts.

Authors

CONTRIBUTORS

State	Director	Nodal Scientist (PI)	Nodal Scientist (CRIDA)
Himachal Pradesh	Parvender Sheoran.	Ashish Murari	J.V.N.S Prasad
Rajasthan	J.P. Mishra	PP Rohilla	A.K. Indooria
Uttar Pradesh	Raghavender Singh		I. Srinivas
Bihar, Jharkhand	Anjani Kumar	Amarender Kumar	P.K. Pankaj
WB and Odisha	Pradeep Dey	S.K. Mohanty	S. Kundu
Meghalaya, Nagaland	A K. Mohanty.	Prashanth Kumar Pathak	T.V. Prasad
Maharashtra, Gujarat	S.K. Roy	Tushar Atare	A.V.M. Subba Rao
Madhya Pradesh, Chhattisgarh	S.R.K. Singh	Harish Kumar	B. Sanjeev Reddy
Andhra Pradesh, Tamil Nadu	Sheik Meera	T.V. Prasad	K. Nagashree
Karnataka, Kerala	V. Venkatasubramanian	B.T. Rayudu	G. Venkatesh

CONTENTS

Sr. No.	State	District	Page No.
1		Introduction	1
2	Andhra Pradesh	Anantapuram	3
3	Bihar	Darbhang	7
4		Kishanganj	10
5		Madhubani	12
6		Siwan	14
7	Chhattisgarh	Jashpur	16
8		Korba	19
9	Gujrat	Dahod	22
10		Kachhh	25
11		Panch Mahal	28
12	Himachal Pradesh	Bilaspur	31
13	Jharkhand	West Singhbhum	34
14	Karnataka	Chikkaballapura	37
15		Chitradurga	41
16		Gadag	44
17		Haveri	48
18		Koppal	51
19		Tumakur	53
20	Kerala	Kannur	56
21		Kasargod	59
22		Kozhikode	61
23	Madhya Pradesh	Dindori	64
24		Shahdol	67
25		Sidhi	71
26		Tikamgarh	74
27	Maharashtra	Beed	78
28		Nanded	82
29	Meghalaya	West Jaintia Hills	85
30	Nagaland	Mon	88
31	Odisha	Nuapada	91
32	Rajasthan	Barmer	94
33		Bikaner	97
34		Churu	100
35		Jaisalmer	103
36		Jalore	106
37		Jodhpur	109
38		Nagaur	113
39		Pali	116
40	Tamil Nadu	Ramanathapuram	119
41	Uttar Pradesh	Banda	123
42		Chitrakoot	126
43		Hamirpur	129
44		Jalaun	132
45		Jhansi	135
46		Pratapgarh	138
47		Shravasti	140
48		Sonbhadra	143
49		Unnao	145
50	West Bengal	Darjeeling	147
51		Purulia	150

Introduction

The Pradhan Mantri Dhan-Dhaanya Krishi Yojana (PMDDKY) is a major initiative of the Government of India aimed at transforming the agricultural sector through integrated development, improved infrastructure, and enhanced support to farmers. Announced as part of recent national agricultural reforms, the programme focuses on strengthening productivity, sustainability, and income generation in selected agricultural districts across the country. With a significant financial outlay and convergence of multiple agricultural schemes, PMDDKY is designed to address key challenges such as low crop productivity, inadequate irrigation facilities, poor access to credit, and post-harvest losses.

The programme adopts a comprehensive and district-focused approach by integrating several existing schemes related to irrigation, crop insurance, agricultural credit, and market linkages. By converging resources and interventions from different ministries, PMDDKY aims to ensure better coordination and efficient utilization of funds. The scheme primarily targets districts with low agricultural productivity, limited cropping intensity, and inadequate infrastructure, thereby promoting balanced agricultural development and reducing regional disparities.

The major objective of PMDDKY is to enhance farmers' income through the adoption of modern technologies, climate-resilient farming practices, and improved agricultural infrastructure. The programme emphasizes the expansion of irrigation facilities, promotion of sustainable farming systems, strengthening of storage and processing infrastructure, and facilitation of easy access to institutional credit. It also encourages diversification of agriculture and the adoption of advanced tools such as mechanization and digital agriculture platforms to improve efficiency and productivity.

Another important aspect of PMDDKY is its focus on small and marginal farmers, women farmers, and rural youth engaged in agriculture and allied sectors. By promoting farmer producer organizations, capacity building, and skill development, the scheme aims to empower farming communities and create new opportunities in agriculture-based enterprises. The programme also supports climate-smart agriculture and resource-efficient technologies, which are essential for ensuring long-term sustainability and resilience in the face of climate change.

The implementation of PMDDKY is planned through coordinated efforts at the national, state, and district levels, with strong monitoring and evaluation mechanisms. Special emphasis is placed on participatory planning, involving local institutions, agricultural experts, and farmers in decision-making processes. The scheme is expected to contribute significantly to strengthening India's agricultural economy, improving food security, and promoting inclusive rural development.

Overall, the PMDDKY programme represents a holistic and strategic initiative to modernize agriculture in India. By integrating multiple development components and focusing on targeted districts, the scheme aims to create a more productive, sustainable, and resilient agricultural system while enhancing the livelihoods of farmers across the country.

1. Andhra Pradesh

District 1: Ananthapuramu

Climate vulnerability: Dry spells, poor soil fertility

A. Introduction/ Background

- Ananthapuramu district is located in the southwestern part of Andhra Pradesh with an altitude of 335 m above MSL. The district experiences frequent dry spells
- The district receives an average annual rainfall of 606 mm, and temperatures ranging from 20 °C to 32 °C.
- Soils are predominantly red and black soils, characterized by poor fertility
- The rainfed and irrigated area are 68 and 32% respectively.
- The major source of irrigation in the district are tanks, bore wells and canals.
- Major field crops: Groundnut, redgram and bengal gram; Plantations: Sweet orange, banana and mango.
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in Chamaluru, Peravali, Sodanapalli, East Narsapuram and Pothurajukaluva climate smart villages The major outcomes were as follows

B. Impact of Interventions

Module 1: NRM based Interventions

Sub-soiling: Sub-soiling with a chisel plough is practiced to break hard pans formed due to prolonged continuous tillage under low rainfall conditions. This intervention reduces runoff, higher soil moisture. Increase in crop yield: 10-20%, net returns: ₹ 19,000-20,000 ha⁻¹, additional cost of cultivation: ₹ 1,300-1,500 ha⁻¹.

Additional net returns:

NRM based interventions

Sub-soiling:	₹ 4,000 - 5,000 ha ⁻¹
Conservation furrows:	₹ 20,000 - 22,500 ha ⁻¹
Green manuring:	₹ 20,000 - 21,000 ha ⁻¹

Conservation furrows: Furrows of 30 cm depth were made with wooden plough at 35 DAS (at 2 m distance). This helps in *in-situ* moisture conservation in the crops.

Opportunity crops: Redgram, groundnut. Increase in crop yield: 30-50%, net returns: ₹ 40,000-45,000 ha⁻¹, cost of cultivation: ₹ 30,000-35,000 ha⁻¹

Green manuring in mangos: Green manuring is a practice of ploughing *in-situ* or turning into soil undecomposed green plant material to improve physical structure and fertility of the soil.

Increase in crop yield: 12-14%, cost of cultivation: ₹ 40,000-45,000 ha⁻¹, net returns: ₹ 1,35,000-1,40,000 ha⁻¹

Rainwater harvesting: Water harvesting was done through construction of new ponds, desilting of community ponds, deepening of drainage channels, recharging of bore wells.

New farm ponds : 1 (20 × 13 × 2.5 m) Renovated :3 check dams, Borewells :9. This increased water storage capacity enhanced irrigated area to 59 ha.

Crop diversification with vegetables like tomato,

pumpkin, ladies finger, fruit crops like mango, papaya, sweet orange, banana, and flowers crops like lily, jasmine, as high-value crops.

Supplemental irrigation through harvested water: Before the intervention only groundnut was cultivated, after water harvesting and supplemental irrigation groundnut, paddy and green gram were cultivated.

Increase in crop yield: 45-60%, crop damage reduction: 20%, net returns: ₹ 65,000-80,000 ha⁻¹, cost of cultivation: ₹ 40,000-45,000 ha⁻¹, additional net returns: ₹ 25,000-30,000 ha⁻¹,

Rain water harvesting

Check dams: Volume of water harvested: 9,01,005 m³

Farm pond: Capacity: 6,50,000 litres

Renovation of farm ponds: 2,09,046 litres

Open wells recharged: 18, Bore wells recharged: 9

Improvement in groundwater levels: 15 to 20"

Increase in access to irrigation to 82 ha in kharif + 50 ha in rabi - 25 % total cultivated area in the village

Module 2: Crop based Interventions

Dharani groundnut variety: This is short duration, drought tolerant and leaf spot tolerant variety. Can withstand 35 days dry spell. net returns: ₹ 40,000 ha⁻¹, increase in crop yield: 12-15%, cost of cultivation: ₹ 48,000 ha⁻¹

Additional net returns:

Crop based interventions

Improved groundnut varieties

Dharani and K-Lepakshi: ₹ 6,000 -15,000 ha⁻¹

K-Lepakshi groundnut variety: This variety is resistant to both drought and also water stagnation. This variety is tolerant to early leaf spot, thrips, collar rot, jassids. Increase in crop yield: 14-30%, net returns: ₹ 90,000-95,000 ha⁻¹, cost of cultivation: ₹ 47,000-49,000 ha⁻¹

Intercropping: Redgram and setaria (1:5): Increase in crop yield:35-40%, net returns: ₹ 60,000 ha⁻¹, cost of cultivation: ₹ 49,360 ha⁻¹, Opportunity crops: Millet+ Pulses (Groundnut / Redgram/ Castor +

Additional net returns:

Intercropping and crop diversification

Redgram + setaria (1:5) intercropping: ₹ 35000 - 50000 ha⁻¹

Castor (ICH-66) as an alternative: ₹ 6,000 - 10,000 ha⁻¹

Foliar spray of KNO₃: ₹ 20,000 - 25,000

Bajra/ Foxtail millet, Redgram + Bajra /Foxtail millet, Maize + Green gram / Cowpea, Foxtail millet- Bengal gram)

Castor ICH-66 as an alternative to groundnut (K-6): Castor hybrid ICH-66 a high-yielding, resilient variety was introduced to replace groundnut (K-6). The crop was given supplemental irrigations from harvested water with drip during primary spike and secondary spike initiation.

Increase in crop yield: 25%, cost of cultivation: ₹ 27,550 ha⁻¹, net returns: ₹ 35,000 ha⁻¹,

Foliar spray of KNO₃: Application of foliar spray of KNO₃ in redgram variety PRG 176 at vegetative and flowering stage during stress. Increase in crop yield: 25-30%, cost of cultivation: ₹ 37,000 ha⁻¹, net returns: ₹ 51,000 ha⁻¹

High density planting of cotton : Rasi Swift, is planted at a spacing of 90 × 15 cm for better boll development over farmers practice (120 × 30 cm). Additional net returns: ₹ 20,000-40,000 ha⁻¹, increase in crop yield: 35-40%, cost of cultivation: ₹ 65,000-75, 000 ha⁻¹, net returns: ₹ 1,00,000-1,10,000 ha⁻¹

WGG-42 greengram variety: A short duration drought tolerant variety, net returns: ₹ 35,000 ha⁻¹, additional net returns: ₹ 7,500-16,000 ha⁻¹, cost of cultivation: ₹ 24,000 ha⁻¹, increase in crop yield: 20-40%

NTJ-5 (Nandyal Tella Jonna-5): A contingent crop for late onset of monsoon dry conditions and prolonged dry spells. Increase in yield: 25%, cost of cultivation: ₹ 36,000 ha⁻¹, net returns: ₹ 45,000 ha⁻¹, additional net returns: ₹ 13,000-15,000 ha⁻¹

Fruit crops: Improved fruit crop varieties like banana (Grandnaine), sweet orange (Satgudi), mango (Baneshan, Mallika, Kesar, Amrapali), papaya (Red lady, Surya), pomegranate (Mrudula, Bhagwa, Ganesh), onion (Nasik red, N-53) and tomato (Arka abhinav, Arka rakshak)

Module 3: Livestock based interventions

Super Napier for year-round fodder availability:

First cut is at 60 DAS and subsequent cuts every 40-45 days. Increase in net returns: ₹ 13,292 animal⁻¹, crop yield: 186 t/ha (7-8 cuts), cost of cultivation: ₹ 15,000-20,000 ha⁻¹

Additional net returns:

Livestock based interventions

Super Napier production: ₹ 16,000 - 17,000 ha⁻¹
Mineral mixtures: ₹ 4,000 - 5,000 animal⁻¹

CO-4 Napier: Increase in milk yield: 1-2 liter animal⁻¹ day⁻¹, increase in fodder yield : 18.2%, cost of cultivation: ₹ 15,000-20,000 ha⁻¹

Area specific mineral mixture for improving livestock productivity

Milk productivity: 90-95 %, net returns: ₹ 7,000-7,500 /month/ animal, cost: ₹ 7,000/month/animal

Integrated Farming Systems (IFS): In IFS systems crop and animals can be taken up by recycling of by products of one enterprise to other. Additional cost of cultivation: Rainfed: ₹ 1,000-3,000; Irrigated: ₹ 10,000-20,000

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Intervention	Individual/ community participation	Cost (₹ ha ⁻¹)
Sub-soiling	Individual	1,300 -1,500
Conservation furrow	Individual	1,000 - 1,500
Check dams	Community	25,000 - 45,000
Farm pond	Community/ Individual	20,000 - 25,000

Module 2a: Crop based interventions

Crop	Variety	Method
Groundnut	Dharani	Seed bank
Groundnut	K-Lepakshi	Seed bank
Red gram	PRG 176	Seed bank
Cotton	Rasi Swift	Seed bank
Sorghum	NTJ-5 (Nandyal Tella Jonna-5)	Seed bank
Castor	ICH-66	Individual

Module 2b: System based interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Redgram and setaria intercropping (1:5)	50,000	60,000
Rainfed integrated farming systems: Crop + livestock	50,000 - 55,000	10,000 - 15,000
Irrigated crop +livestock	60,000 - 65,000	30,000 - 35,000
Groundnut crop alone	40,000	10,000
Groundnut + fodder + livestock	55,000	38,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Cost (₹ ha ⁻¹)
Super Napier for year-round fodder	CoFS-31 and 32	15,000 - 20,000
Improved Hybrid Napier	Co-4	15,000 - 20,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups for post-harvest value addition and promotion of natural and organic farm farming.	Community	Women empowerment

2. Bihar

District 1: Darbhanga

Climate vulnerability: Flood, moisture stress

A. Introduction/ Background

- Darbhanga district is located with an altitude of 48 m above mean sea level.
- The district receives an average annual rainfall of 1103 mm, with temperatures ranging from 8°C to 43°C. Soils are predominantly alluvial, sandy loam and loamy.
- The rainfed and irrigated areas are 29 and 71% respectively. The major source of irrigation is bore well.
- Major field crops: Paddy, wheat, maize, moong, mustard; Horticultural crops: Mango, litchi
- Livestock plays a key role in nutritional security, supplying milk, eggs, and animal protein.
- In Darbhanga district, livestock plays a vital role in stabilizing farm income, enhancing climate resilience, and supporting crop-based farming systems, especially under frequent flood stress conditions.
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in Chandauna, Jogiara and Muraitha villages.

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

DSR paddy followed by zero tillage wheat, mustard, lentil, potato, and greengram cultivation with the introduction of mulching saved >35% labour. Increase in crop yield: 35-47%, cost of cultivation: ₹ 32,580-49,850 ha⁻¹, net returns: ₹ 77,400-81,500 ha⁻¹

Additional net returns:

NRM based interventions

Direct seeded rice:	₹ 4,500 - 5,000 ha ⁻¹
Zero till wheat:	₹ 4,000 - 5,000 ha ⁻¹
Zero till summer moong:	₹ 4,000 - 5,000 ha ⁻¹
Zero till mustard:	₹ 11,000- 12,000 ha ⁻¹
Zero till lentil:	₹ 7,000 - 8,000 ha ⁻¹

Zero tillage wheat: Increase in crop yield: 22-35%, net returns: ₹ 47,700-51,030 ha⁻¹, cost of cultivation: ₹ 25,600-34,890 ha⁻¹

Zero tillage summer moong: Increase in crop yield: 58-89%, net returns: ₹ 76,500-81,240 ha⁻¹, cost of cultivation: ₹ 24,685-31,890 ha⁻¹

Zero tillage mustard: Increase in crop yield: 32-35%, net returns: ₹ 56,000-67,200 ha⁻¹, cost of cultivation: ₹ 25,680-33,900 ha⁻¹

Zero tillage lentil: Increase in crop yield: 26-30%, net returns: ₹ 83,800-91,065 ha⁻¹, cost of cultivation: ₹ 26,855-32,600 ha⁻¹

Module 2: Crop based Interventions

Makhana seed production: Makhana seed production proved to be a highly climate-resilient and remunerative technology. Increase in makhana yield: 37-45%, cost of cultivation: ₹ 1,30,980-1,49,800 ha⁻¹, net returns: ₹ 3,60,200-4,76,390 ha⁻¹

Additional net returns: Crop based interventions

Makhana seed production:	₹ 1,16,000 - 1,17,000 ha ⁻¹
Paddy-wheat-moong bean:	₹ 50,000 - 60,000 ha ⁻¹
Paddy-wheat-mustard:	₹ 50,000 - 60,000 ha ⁻¹
Paddy-wheat-fodder:	₹ 30,000 - 50,000 ha ⁻¹

Paddy-wheat-moong bean cropping system: net returns: ₹ 2,13,800-2,14,000 ha⁻¹, increase in crop yield: 15-20%, cost of cultivation: ₹ 80,000-85,000 ha⁻¹

Paddy-wheat-mustard cropping system: net returns: ₹ 1,99,700-2,00,000 ha⁻¹, increase in crop yield: 15-20%, cost of cultivation: ₹ 80,000-85,000 ha⁻¹

Paddy –wheat-fodder cropping system: net returns: ₹ 4,54,099-4,56,000 ha⁻¹, increase in crop yield: 12-15%, cost of cultivation: ₹ 86,600-87,000 ha⁻¹

Module 3: Livestock based Interventions

Pusa mineral mixture for cows:

Increase in milk yield: 30-35%,
net returns: ₹ 27,700-37,600 animal⁻¹,
cost of production: ₹ 48,560-61,500 animal⁻¹

Additional net returns: Livestock based interventions

Mineral mixture for cows:	₹ 10,000 - 20,000 animal ⁻¹
Mineral mixture for goats:	₹ 1,400 - 1,500 animal ⁻¹
Vanraja poultry breed:	₹ 190 - 200 bird ⁻¹
Makhana+Amur carp:	₹ 30,000 - 50,000 ha ⁻¹

Pusa mineral mixture for goats:

net returns: ₹ 4,110- 5,550 animal⁻¹, cost of production: ₹ 8,850-11,890 animal⁻¹,
increase in yield: 16-21%

Makhana+Amur carp (fast growing fish species):

net returns: ₹ 9,00,000-10,00,000 ha⁻¹, increase in crop yield: 20-25%,
cost of production: ₹ 2,65,100-2,65,500 ha⁻¹

Backyard poultry Vanraja -10 chicks: net returns: ₹ 9,040-9,230 unit⁻¹,
increase in eggs yield: 55-56%, cost of production: ₹ 4,460-5,870 unit⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Intervention	Individual/ community participation	Cost (₹)
Desilting of check dam and community ponds	Community	Depend on the size of the pond
Conservation Agriculture	Individual	35,000-55,000 ha ⁻¹

2a: Crop based Interventions

Crop	Variety	Method
Makhana	Swarna Vaidehi	Seed bank
Paddy	R. Mahsuri	Seed bank
Wheat	HD 2967	Seed bank

Module 2b: System based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Paddy-Wheat-Moong Bean	82,865	2,13,834
Paddy-Wheat-Mustard	83,860	1,99,739
Paddy-Lentil-Moong Bean	88,955	2,18,534
Paddy-Wheat-Fodder	86,680	4,54,099
Makhana + Amur carp	2,65,100	9,94,900
Paddy-Wheat- Moong + Vanraja Chicks (10)	87,525	2,23,065
Paddy-Wheat-Pusa Mineral Mixture (Cow)	1,18,970	1,70,209
Multicut fodder Sorghum CoFS-31 with irrigation	39,470	63,570
Multicut fodder Sorghum CoFS-31 + Cross breed cow under irrigation	82,340	2,36,692

Module 3: Livestock based Interventions

Livestock	Breed / variety	Method	Cost (₹)
Pusa mineral mixture	Cow	Individual	48,560-61,500
Pusa mineral mixture	Goat	Individual	8,850-11,890
Poultry	Vanraja	Backyard poultry	4,460-5,870

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring Centers with need-based machinery	Community, local youth	Provide essential machinery
VCRMC	Community, committee: 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centers, and guide seasonal action plans

District 2: Kishanganj

Climate Vulnerability: Flood

A. Introduction/ Background

- Kishanganj is the easternmost district of Bihar, India, located in the Purnia Division, bordering West Bengal to the east and Nepal to the north, experiencing heavy floods
- The district receives an average annual rainfall of 2418 mm, with temperatures of 3 °C to 45 °C
- Soils are predominantly loamy, sandy, calcareous and clayey
- The rainfed and irrigated area are 46 and 54 % respectively. The major source of irrigation in the district is tube well/ bore well
- Major crops: Rice, maize, wheat, millets, pulses and oilseeds; Horticultural crops: Pineapple, banana, litchi, guava, mango, makhana and tea
- Livestock integration played a crucial role in Kishanganj district by enhancing farm resilience and stabilizing income under climate stress. Crop–livestock systems showed much higher resilience (up to ~99%) compared to crop-only systems, especially during floods and heat stress.
- Livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in Khanabari and Kharsel villages. Livestock interventions such as dairy, backyard poultry, duckery, and fishery provided regular income, nutrition, and employment even when crops were affected. Recycling of crop residues as fodder and animal waste as compost improved soil health, reduced input costs, and strengthened overall system sustainability. The major out comes were

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Raised bed in maize: Increase in crop yield: 16-17.5%,
net returns: ₹ 1,22,000-1,65,000 ha⁻¹,
cost of cultivation: ₹ 48,565-56,940 ha⁻¹

Additional net returns:

NRM based interventions

Raised bed in maize: ₹ 28,000-45,000 ha⁻¹

Module 2: Crop based Interventions

JRO 204/JBO 2003H-Improved jute varieties:

Increase in crop yield: 21-36%,
cost of cultivation: ₹49,034-59,244 ha⁻¹,
net returns: ₹ 55,000-70,000 ha⁻¹

Additional net returns:

Crop based interventions

Jute (JRO 204/JBO 2003H): ₹ 19,000 - 21,000 ha⁻¹
Makhana: Sabour Makhan-1 : ₹ 97,000 - 1,50,000 ha⁻¹
Swarna Sub-1: ₹ 8,500 - 14,000 ha⁻¹
Sabour sampan: ₹ 10,000 - 12,000 ha⁻¹
Banana+ Potato intercropping : ₹ 53,000 - 75,000 ha⁻¹

Introduction of makhana to low land:

Increase in crop yield: 21-34%,
net returns: ₹ 2,00,000-4,00,000 ha⁻¹, cost of cultivation: ₹ 1,05,968-1,10,045 ha⁻¹

Swarna Sub-1 paddy variety: Increase in crop yield: 8-17%, net returns: ₹ 52,000-67,000 ha⁻¹,
cost of cultivation: ₹ 36,000-37,000 ha⁻¹

Sabour sampann paddy variety: Increase in crop yield: 9-11%, net returns: ₹ 49,000-60,000 ha⁻¹, cost of cultivation: ₹ 30,000-37,000 ha⁻¹

Banana+ Potato intercropping: Increase in crop yield: 2.5-7.5%, cost of cultivation: ₹ 1,34,000-4,32,000 ha⁻¹, net returns: ₹ 3,00,000-5,00,000 ha⁻¹,

Module 3: Livestock based Interventions

Area specific mineral mixture (cows):

net returns: ₹ 19,000-23,000 animal⁻¹ year⁻¹, cost of production: ₹ 27,000-29,000 animal⁻¹ year⁻¹, increase in milk yield: 9-10%

Kadakhnath and Vanraja poultry

breeds: Tolerant to heat stress.

Increase in bird weight: 89-113%,

increase in egg production: 96-166%

net returns: ₹ 300-600 bird⁻¹, cost of production: ₹ 190-320 animal⁻¹

Additional net returns:

Livestock based interventions

Kadakhnath and Vanraja breeds: ₹ 217 - 313 bird⁻¹

Mineral mixture: ₹ 2,000 - 4,000 animal⁻¹ year⁻¹

Seed bank initiatives (paddy, banana and fish): Seed banks of rice (Swarna Sub-1), banana (G9) and fish (Amur carp) were established. Swarna Sub-1 seed was spread over 8 ha benefitted 60 farmers, and generated ₹ 2.5 lakh. Banana G9 seed bank supplied 8 t of seed, while Amur carp fish production generated ₹ 40,000 revenue.

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Intervention	Individual/ community participation	Cost (₹ ha ⁻¹)
Raised bed in maize	Individual	48,565-56,940

Module 2: Crop based Interventions

Crop	Variety	Method
Rice	Swarna Sub-1, Sabour sampann	Seed bank
Jute	JRO 204, JBO 2003H	Seed bank
Banana	G-9	Seed bank
Potato	Kufri pukhraj	Seed bank
Makhana	Sabour Makhan-1	Seed bank

Module 3: Livestock based Interventions

Livestock	Breed/variety	Method	Cost (₹)
Area specific mineral mixture	Cow	Individual	27,000-29,000 animal ⁻¹ year ⁻¹
Poultry	Kadakhnath, Vanraja	Back yard poultry	190-320 bird ⁻¹

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring Centers with need-based machinery	Community, local youth	Provide essential machinery
VCRMC	Community, committee: 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centers, and guide seasonal action plans

District 3: Madhubani

Climate vulnerability: Flood, moisture stress

A. Introduction/ Background

- Madhubani district is situated in northern Bihar, bordering Nepal, experience flood and moisture stress.
- The district receives an average annual rainfall of 1202 mm, with temperatures ranging from 10°C to 43°C. Soils are predominantly alluvial, silty to sandy loam soils.
- The rainfed and irrigated areas are 61 and 39%, respectively. The major source of irrigation in the district is bore well and canals.
- Field Crops: Rice, wheat, lentil and green gram; Horticultural crops: Banana, guava and litchi

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Zero till wheat, mustard, lentil, potato, and greengram cultivation with the introduction of mulching: Labour cost reduction: >35%, land preparation cost reduction: >55%, irrigation water saving: >30%, increase in crop yield: 3-5%

Zero tillage + DBW-187 + residue retention

Increase in crop yield: 5-10%,
net returns: ₹ 60,000-69,000 ha⁻¹,
additional net returns: ₹ 10,000-15,000 ha⁻¹
cost of cultivation: ₹ 32,500-36,500 ha⁻¹

Additional net returns:

NRM based interventions

Zero till summer moong:	₹ 6,000 - 13,000 ha ⁻¹
Zero till mustard:	₹ 4,000 - 5,000 ha ⁻¹

Zero tillage in summer moong Increase in crop yield: 25-30%, net returns: ₹ 33,250-46,250 ha⁻¹, cost of cultivation: ₹ 14,500-17,500 ha⁻¹

Zero till mustard: Increase in crop yield: 25-30%, net returns: ₹ 37,518-41,994 ha⁻¹, cost of cultivation: ₹ 19,500-21,500 ha⁻¹

Makhana Seed Production (*Euryale Ferox*) in deep rice field: net returns: ₹ 50,000 ha⁻¹

Module 2: Crop based Interventions

Rice-wheat-moong cropping system with flood tolerant rice variety Swarna sub-1:

Increase in crop yield: 17-25%,
net returns: ₹ 61,479-1,39,288 ha⁻¹,
cost of cultivation: ₹ 1,02,810-1,13,965 ha⁻¹

Additional net returns:

Crop based interventions

Rice-linseed-jute cropping system:	₹ 25,679 - 31,324 ha ⁻¹
Rice-wheat-moong system:	₹ 36,598 - 58,681 ha ⁻¹
Rice-linseed-jute system:	₹ 25,679 - 31,324 ha ⁻¹
Rice-wheat-mustard system	₹ 50,000 - 60,000 ha ⁻¹
Rice-wheat-fodder system:	₹ 30,000 - 50,000 ha ⁻¹

Rice-linseed-jute cropping system with

flood tolerant rice variety SS-1 and paira cropping of linseed:

net returns: ₹ 1,01,974-1,60,144 ha⁻¹,
cost of cultivation: ₹ 98,000-1,04,640 ha⁻¹, increase in crop yield: 10-12%

Rice-wheat-mustard cropping system Increase in crop yield: 15-20%,
net returns: ₹ 1,99,700-2,00,000 ha⁻¹, cost of cultivation: ₹ 80,000-85,000 ha⁻¹

Rice-wheat-fodder system: Increase in crop yield: 12-15%, net returns: ₹ 4,54,099-4,56,000 ha⁻¹, cost of cultivation: ₹ 86,600-87,000 ha⁻¹

DSR with climate resilient varieties (Rajendra, Mahsuri, Rajendra, Sweta):

Water saving: 20-25%. Labour cost, time, energy, and cultivation cost also reduces

Rajendra Mashuri variety: Increase in crop yield: 15-20%, additional net returns: ₹ 20,000-25,000 ha⁻¹

Module 3: Livestock based Interventions

Vanraja poultry breed: Increase in egg yield: 19-26%, net returns: ₹ 189-362 bird⁻¹ year⁻¹, cost of production: ₹ 591-658 bird⁻¹

Nutrition with chelated mineral mixture, immuno syrup and ectoparasite in one cow:

net returns: ₹ 37,520-84,548 animal⁻¹ year⁻¹,

cost of production: ₹ 17,600-19,943 animal⁻¹, increase in milk yield: 13-41%

Additional net returns:

Livestock based interventions

Poultry breed Vanraja: ₹ 83 - 143 bird⁻¹ year⁻¹

Nutrition: ₹ 8,713 - 55,563 animal⁻¹ year⁻¹

Fodder production to increase the milk production in milch cattle: Climate resilient fodder jowar variety (UPML-530) and berseem

Site specific mineral mixture for increase milk production and health of milch animals

Supplementation with Pusa mineral mixtures: Cows: Increase in milk yield: 1-1.5 liters/day, additional net returns: ₹ 10,000; **Goat:** Enhanced body weight at 9th month: 2 kg, net income: ₹ 1,500-2,000 animal⁻¹

Backyard poultry (Vanraja): net income: ₹ 10,000 for a flock of 25 birds, Yield: 230 eggs /bird/year

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Intervention	Individual/ community participation	Cost (₹ ha ⁻¹)
Wheat zero tillage	Individual	25,000-34,000
Summer moong zero tillage	Individual	24,000-31,000
Mustard zero tillage	Individual	25,000-34,000
Lentil zero tillage	Individual	26,000-32,000

Module 2: Crop based Interventions

Crop	Variety	Method
Rice	SS1, R. Mahsuri, R. Sweta	Seed bank
Wheat	HD 2967, DBW 187	Seed bank
Potato	Kufri Pukhraj	Seed bank

Module 3: Livestock based Interventions

Livestock	Breed/ variety	Method	Cost (₹)
Poultry	Vanraja	Backyard poultry	591-658 bird ⁻¹
Nutrition	Cow	Individual	17,600-19,943 animal ⁻¹

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring Centers with need-based machinery	Community, local youth	Provide essential machinery
VCRMC	Community, committee: 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centers, and guide seasonal action plans

District 4: Siwan

Climate vulnerability: Flood, moisture stress, terminal heat

A. Introduction/ Background

- Siwan district is in the north-western part of Bihar, situated near the border with Uttar Pradesh, along the eastern bank of the Dahanu river. The district experiences heavy floods, moisture stress and terminal heat
- The district receives an average annual rainfall of 997 mm, with temperatures ranging from 4°C to 46°C.
- Soils are predominantly black, sandy, sandy loam and alkali with the characteristic presence of diara lands
- The rainfed and irrigated areas are 38 and 62%, respectively. The major source of irrigation in the district is bore well.
- Field crops: Rice, maize, wheat, sugarcane and mustard; Horticultural crops: Mango, jackfruit, litchi, banana and guava
- Livestock integration played a crucial role in siwan district by enhancing farm resilience and stabilizing income under climate stress. Crop–livestock systems showed much higher resilience (up to ~99%) compared to crop-only systems, especially during floods and heat stress. Livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in villages Mirjumla, Shankarpur, Mahamadpur.

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Zero tillage wheat + DBW-187: Zero tillage wheat, mustard, lentil, potato, and greengram cultivation with the introduction of mulching. Labour cost reduction: >35%, land preparation cost reduction: >55%, increase in crop yield: 4-6%, net returns: ₹ 60,000-69,000 ha⁻¹, cost of cultivation: ₹ 32,500-36,500 ha⁻¹

Additional net returns:

NRM based interventions

Zero tillage wheat + DBW-187: ₹ 10,000 ha⁻¹

Community nursery: ₹ 10,000 ha⁻¹

Community nursery: Paddy (Kharif): Increase in crop yield: 8-15%, net returns: ₹ 28,000-43,400 ha⁻¹, cost of cultivation: ₹ 44,000-51,000 ha⁻¹

Module 2: Crop based Interventions

Mustard variety for drought stress (RH 761): Low water consuming variety. Increase in crop yield: 1-2%, net returns: ₹ 37,518-41,994 ha⁻¹, cost of cultivation: ₹ 19,500-21,500 ha⁻¹

Additional net returns:

Crop based interventions

Mustard (RH 761): ₹ 4,000 - 5,000 ha⁻¹

Summer moong (Virat): ₹ 6,000 - 13,000 ha⁻¹

Summer moong for drought (Virat): Increase in crop yield: 22-24%, net returns: ₹ 33,250-46,250 ha⁻¹, cost of cultivation: ₹ 14,500-17,500 ha⁻¹

Module 3: Livestock based Interventions

Mineral mix + Napier fodder (Buffalo):

Increase in milk yield: 30%-32%,
net returns: ₹ 50,000-67,650 animal⁻¹ year⁻¹,
cost of production: ₹ 10,500-12,000 animal⁻¹ year⁻¹

Additional net returns:

Livestock based interventions

Mineral mix + Napier fodder: ₹ 17,650 animal⁻¹
Silage: ₹ 17,500 animal⁻¹

Silage + Mineral mix (Buffalo): Increase in milk yield: 34.5%,
net returns: ₹ 44,500-62,000 animal⁻¹ year⁻¹, cost of production: ₹ 10,500-12,000 animal⁻¹ year⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Zero tillage + DBW-187 (wheat)	Individual	32,500-36,500
Community nursery (Paddy)	Community	44,000-51,000

Module 2: Crop based Interventions

Crop	Variety	Method
Wheat	DBW-187	Seed bank
Paddy	S. Samparna, R. Neelam	Seed bank
Summer Moong	Virat	Seed bank
Mustard	RH 761	Seed bank

Module 2b: System based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Crop alone	30,000 -32,000	25,000 -30,000
Crop livestock	45,000 -48,000	90,000 - 95,000

Module 3: Livestock based Interventions

Livestock	Breed/variety	Method	Cost (₹)
Mineral mix + Napier fodder	Buffalo	Individual	10,500-12,000
Silage + Mineral mix	Buffalo	Individual	10,500-12,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring Centers with need-based machinery	Community, local youth	Provide essential machinery
VCRMC	Community, committee: 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centers, and guide seasonal action plans

3. Chhattisgarh

District 1: Jashpur

Climate vulnerability: Hail storm, Frost & Heavy rain

A. Introduction/ Background

- Jashpur district, located in the Northern Hills agro-climatic zone of Chhattisgarh, is predominantly tribal and characterized by undulating topography, high rainfall variability, and frequent intra-seasonal dry spells, which pose significant risks to rainfed agriculture and livelihood security.
- The district receives an average annual rainfall of about 1,200–1,400 mm, mainly during the southwest monsoon, with temperatures ranging from 6–8 °C during winter to 38–40 °C in summer.
- Soils are largely light-textured sandy loam soils, low in organic carbon and available nutrients, resulting in poor moisture retention.
- Agriculture in the district is predominantly rainfed (around 90–95%), with very limited assured irrigation; hence, rainwater harvesting, *in-situ* moisture conservation, and soil fertility improvement are critical for sustaining crop productivity and reducing climate risk.
- Major field crops: Paddy, maize, blackgram, redgram, niger and mustard; Vegetables: Tomato, potato, onion, okra etc. are cultivated on a limited scale.
- Livestock plays an important role in household livelihoods, mainly comprising indigenous cattle, goats, and backyard poultry; however, productivity remains low due to fodder scarcity, poor-quality feed resources, limited veterinary outreach, and weak market linkages.

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Renovation of open well: Renovation and maintenance of open well and cultivation of low water requiring mustard crop variety RH-725. net returns: ₹ 35,000-45,000 ha⁻¹
Increase in mustard crop yield: 25-35%,
cost of cultivation: ₹ 30,000-35,000 ha⁻¹.

Additional net returns

NRM based interventions

Supplemental irrigation in mustard:	₹ 10,000 -15,000 ha ⁻¹
Mulching in tomato:	₹ 12,000 -15,000 ha ⁻¹
DSR with Vikram TCR :	₹ 7,000 -10,000 ha ⁻¹
Ridge and furrow in chilli:	₹ 50,000 -65,000 ha ⁻¹
SRI:	₹ 8,500 -12,000 ha ⁻¹
Raised bed in cauliflower production:	₹ 46,000 -47,000 ha ⁻¹
Line sowing of aerobic rice-1:	₹ 35,000 -40,000 ha ⁻¹

Crop diversification and mulching:

Increase in yield: tomato :18-20%,
cost of cultivation: ₹ 20,000-22,000 ha⁻¹, net returns: ₹ 40,000-42,000 ha⁻¹

DSR: Vikram TCR with drought tolerant paddy variety. Increase in crop yield: 8-12%,
cost of cultivation: ₹ 40,000-45,000 ha⁻¹, net returns: ₹ 85,000-90,000 ha⁻¹

Ridge and furrow method in chilli: Reduces root rot and wilt. Increase in crop yield: 60-65%, cost of cultivation: ₹ 68,000 ha⁻¹ (3% higher), net returns: ₹ 1,00,000-1,25,000 ha⁻¹, water saving: 25-30%

System of Rice Intensification (SRI) - A tool to save water and reduce methane emission from rice field. Increase in crop yield: 10-25%, net returns: ₹ 55,000-75,000 ha⁻¹, cost of cultivation: ₹ 30,000-40,000 ha⁻¹

Raised bed for vegetable seedling production: Increase in cauliflower yield: 30-32%

Line sowing of aerobic rice-1: Increase in crop yield: 50-55%

Module 2: Crop based interventions

Indira Barani Dhan 1 rice variety: Drought tolerant suited for rainfed upland and medium land.

Duration :110-115 days.

Increase in crop yield: 25-30%,

net returns: ₹ 35,000-45,000 ha⁻¹,

cost of cultivation: ₹ 23,000-25,000 ha⁻¹

(4-6% higher)

Additional net returns

Improved crop varieties

Dhan 1 Indira Barani rice : ₹ 10,000- 15,000 ha⁻¹

MTU 7029 Paddy variety: ₹ 7000 - 13000 ha⁻¹

Aerobic rice 1: ₹ 10,000- 20,000 ha⁻¹

CG-1029 Wheat variety: ₹ 10000 - 15000 ha⁻¹

MTU 7029 rice variety: Lodging resistant. Duration: 135–140 days. Suited for rainfed low land and medium low land. Increase in crop yield: 5-10%, cost of cultivation: ₹ 27,000-29,000 ha⁻¹, net returns: ₹ 40,000 -55,000 ha⁻¹

Aerobic rice 1: Drought tolerant rice variety: Duration: 110-115 days, Water requirement: 35-40% lesser, increase in crop yield: 15 -25%, cost of cultivation: ₹ 20,000–22,000 ha⁻¹ (7-9% lower), net returns: ₹ 38,000-40,000 ha⁻¹,

CG 1029 wheat variety: Tolerant to terminal heat stress. It is suitable for timely sown irrigated conditions, resistant to lodging and major diseases. Increase in crop yield: 15-20%, net returns: ₹ 35,000-45,000 ha⁻¹

Module 3: Livestock based interventions

Area specific mineral mixture:

Nutrient supplementation for high milk production in cattle.

Dose: 50g/day.

Increase in milk yield: 10-20%,

conception rate: 15-20%,

cost of mineral mixture: ₹ 80-100

Additional net returns

Livestock based interventions

Area specific mineral mixture in cattle: ₹ 3,000 - 4,500 animal⁻¹

Breed upgradation through Sirohi buck: ₹ 1,000 - 1,500 animal⁻¹

Kadaknath and Sonali: ₹ 50 - 100 bird⁻¹

Azolla supplementation: ₹ 10,000- 15,000 animal⁻¹

Oyster mushroom cultivation: ₹ 24,000- 25,000 per 1000 kg

Sirohi breed + mineral mixture supplementation: This breed is well suited to rainfed situations tolerant to heat stress. Increase in body weight: 10-15%, net returns: ₹ 3,500 - 4,000 animal⁻¹, cost of rearing: ₹ 1,500- 2,000 animal⁻¹

Kadaknath and Sonali poultry: Require low feed costs and high quality of meat and eggs than the existing normal local birds. Increase in body weight: 15-18%, cost of production: ₹ 250-280 bird⁻¹, net returns: ₹ 200-250 bird⁻¹

Azolla-feed supplementation: *Azolla pinnata* is an alternative to green fodder and a supplementary protein diet due to its high palatability. Increase in milk yield: 25-35%, cost of production: ₹ 33,000-34,000 animal⁻¹, net returns: ₹ 30,000-40,000 animal⁻¹

Oyster mushroom cultivation: Crop residue recycling, paddy straw, wheat straw and cotton residues make a good substrate material for mushroom cultivation and can be used as a primary raw material. cost of production: ₹ 30,000 per 1000 kg mushroom, net returns: ₹ 1,70,000 - 2,00,000 per 1,000 kg mushroom

Lac cultivation: Lac is a natural resin obtained in the form of resinous substance in secretory glands present in the body for its protection from small insects. The lac insect cultivation through Semialata host plantations cultivation. net returns: ₹ 39000-40000 ha⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Renovation of open well	Community	
Polythene mulching	Individual	2,800-3,000
DSR	Individual	40,000-50,000
Ridges and furrows	Individual	2,500-3,200
SRI	Individual	35,000-40,000
Raised bed	Individual	3,200-4,000

Module 2: Crop based interventions

Crop	Variety	Method
Paddy	Indira Barani Dhan-1, MTU-7029, Vikram TCR	Individual
Mustard	RH-725	Individual
Wheat	CG-1029	Individual

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Area specific mineral mixture	Cattle	Individual	350-400 animal ⁻¹
Goat	Sirohi	Individual	1800-2000 animal ⁻¹
Poultry	Kadaknath and Sonali	Individual	550-600 bird ⁻¹
Mushroom	Oyster	Individual	30 / kg mushroom
Lac cultivation	Rangeeni on butea/ber	Individual	1,50,000-2,00,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 2: Korba

Climate vulnerability: Droughts, Dry spells, erratic rainfall

A. Introduction/ Background

- Korba district, in the central–northern part of Chhattisgarh under the Chhattisgarh Plains agro-climatic zone, is characterized by undulating to gently rolling topography, high monsoonal rainfall variability, and intermittent dry spells
- The district receives an average annual rainfall of about 1,200–1,300 mm, mainly during the southwest monsoon, with temperatures ranging from 10°C in winter to 41°C during peak summer.
- Soils are predominantly red and lateritic to mixed alluvial soils, shallow to medium in depth, low in organic carbon and available nutrients, leading to moderate moisture-holding capacity.
- Agriculture in Korba is largely rainfed (around 85–90%), with limited assured irrigation. Hence, *in-situ* moisture conservation, rainwater harvesting, and soil fertility enhancement are essential for sustaining crop yields and reducing climate-related risks.
- Field crops: Paddy, maize, wheat, pigeon pea, blackgram, lathyrus and mustard; Plantations: Mango, banana, guava, papaya, and custard apple are cultivated on a restricted scale.
- Livestock is an important livelihood component, dominated by indigenous cattle, goats, and backyard poultry; however, productivity remains low due to fodder shortages and low genetic potential.
- The district has significant potential for improving farm productivity and household incomes through convergence-based, climate-resilient interventions, focusing on integrated crop–livestock systems, sustainable natural resource management, and millet-based nutrition-sensitive farming.

B. Impact of interventions: Key evidences

Module A: NRM based interventions:

Supplemental irrigation in paddy through harvested water from the community farm pond: Channelling of excess rainwater into harvesting structures and reuse for irrigation during dry spells at critical stages.

Additional net returns:

NRM based interventions

Supplemental irrigation in paddy:	₹ 16,000 - 23,500 ha ⁻¹
Green manuring in paddy:	₹ 19,500 - 20,000 ha ⁻¹
Improved banana plantation :	₹ 85,000 - 1,10,000 ha ⁻¹
DSR paddy-Zero tillage wheat:	₹ 25,000 - 35,000 ha ⁻¹

Increase in crop yield: 25-35%, cost of cultivation: ₹ 30,000 ha⁻¹ (15% higher), net returns: ₹ 50,000-55,000 ha⁻¹,

DSR paddy followed by zero till wheat: Early sowing, tolerant to terminal heat stress, In total system water saving : 30-35%, Increase in yield: 30-35%, cost of cultivation: ₹ 45,000-47,000 ha⁻¹, net returns : ₹ 1,00,000-1,15,000 ha⁻¹

Green manuring in paddy: Cultivation and incorporation of leguminous green manure crop daincha in the paddy fields. Increase in crop yield: 32%, net returns: ₹ 1,20,000 - 1,25,000 ha⁻¹, cost of green manuring: ₹ 40,000-50,000 ha⁻¹

Banana plantation with tractor ridger: Drip irrigation system was used for irrigation. net returns: 140%, cost of cultivation: ₹ 1,35,000 (12% higher), increase in crop yield: 25-30%

Zero tillage in wheat: It is resource conservation technique. Increase in crop yield: 20%, no. of irrigations saved: 2-3 irrigations, cost of cultivation: ₹ 20,000 -25,000 ha⁻¹, net returns: ₹ 3,65,000 - 4,00,000 ha⁻¹, reduction in cost of cultivation: 4%,

Module 2: Crop based Interventions

MTU 1010 rice: Short duration, fine variety of rice tolerant to leaf blast, bacterial leaf blight and sheath blight.

Duration: 112-115 days. Increase in crop yield: 25-30 %, net returns: ₹ 40,000 -45,000 ha⁻¹, cost of cultivation: ₹ 27,000 ha⁻¹

Additional net returns:

Crop based interventions

Rice variety MTU 1010: ₹ 18,000-20,000 ha⁻¹
Crop diversification with coriander: ₹ 40,000-45000 ha⁻¹

Crop diversification with coriander (Rice -wheat): variety: Delite, can be cultivated on residual soil moisture in *rabi* in rice fallows or maize. Increase in yield: 50%, cost of cultivation: ₹15,000 -18,000 ha⁻¹ (3% lower than rice -wheat), net returns: ₹ 65,000 - 85,000 ha⁻¹, water saving :30-40%

Module 3: Livestock based interventions

Vermicomposting: Crop residue recycling using cow dung. Time taken for harvesting one cycle of compost: 3 months Average compost quantity/cycle: 620 kg

Additional net returns:

Livestock based interventions

Berseem production for cattle: ₹ 20,000 animal⁻¹

Berseem green fodder: Improved berseem variety Mescavi as feed to cattle. Increase in milk yield: 300 l /lactating period, cost of fodder production: ₹ 22,000 -25,000 ha⁻¹, net returns: ₹ 35,000–50,000 ha⁻¹

Oyster mushroom cultivation: Crop residue recycling, paddy straw, wheat straw and cotton residues make a good substrate material for mushroom cultivation and can be used as a primary raw material. cost of production: ₹ 30,000 per 1,000 kg mushroom, net returns: ₹ 1,70,000 - 2,00,000 per 1,000 kg mushroom

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Community farm pond	Community	Depends on size of farm pond Lined pond :1,20,000 -1,50,000 / 1,000–1,500 m ³
DSR	Individual	25,000 ha ⁻¹
Zero tillage	Individual	20,000-22,000 ha ⁻¹
Green manuring	Individual	4,000-5,000 ha ⁻¹

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	MTU1010	Individual
Banana	G-9	Individual
Coriander	Delite	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Rice + Dairy	70,000–80,000	90,000–1,20,000
Rice + Goatery (10 does + 1 buck)	45,000–55,000	80,000–1,00,000
Rice + Fish (farm pond)	12,000–15,000	15,000–30,000
Rice + Poultry (backyard, 50 birds)	18,000–22,000	35,000–45,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Berseem	Mescavi	Individual	25,000-30,000
Mushroom	Oyster	Individual	5,000-8,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

4. Gujarat

District 1: Dahod

Climate vulnerability: Erratic rainfall, Heatwave

A. Introduction/ Background

- Dahod district, located in the eastern tribal belt of Gujarat along the Madhya Pradesh border, falls under the Middle Gujarat–Eastern Hills agro-climatic region, erratic rainfall, undulating terrain, and limited irrigation infrastructure, making farming systems vulnerable to climatic variability.
- The district receives an average annual rainfall of about 910 mm, concentrated mainly during the monsoon season, with temperature ranging from 13-40 °C, hot summers and mild winters.
- Soils are predominantly alluvial and black, generally low in organic carbon, nutrient status, and have moderate moisture-holding capacity.
- Field crops: Maize, paddy, black gram, green gram, and soybean during the *kharif* season, while wheat and chickpea are grown in *rabi*; Plantations: mango and citrus fruits are grown in limited scale.
- Livestock and allied activities are integral to rural livelihoods, with cattle, buffaloes, goats, and backyard poultry commonly reared, however, productivity remains constrained due to seasonal fodder shortages and low genetic potential of animals.
- Dahod district has considerable potential for improving agricultural productivity and household incomes through convergence-based, climate-resilient interventions, focusing on integrated crop-livestock systems, sustainable water and soil management, adoption of stress-tolerant technologies, and diversification into horticulture and allied enterprises. Implementation of such interventions was done in selected villages Moti Handi and Dageria. The major outcomes were

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Revival of village pond: Initial pond area: 4,468 m² with an average depth of 2 m

**Additional net returns:
NRM based interventions**
Green gram: ₹ 10,000 ha⁻¹

New excavated pond: ~5,000 m² with a depth of 4 m. Average depth after renovation: 4 m. Summer crops were introduced with supplemental irrigation as third crops.

Green gram: Increase in crop yield: 28-32%, net returns: 88-92%, cost of cultivation: ₹ 27,000-28,000 ha⁻¹

Module 2: Crop based Interventions

Improved varieties:

NRC 37 Soybean: Increase in crop yield: 17-25%, net returns: ₹ 30,000 -50,000 ha⁻¹, cost of cultivation: ₹ 25,000 -27,000 ha⁻¹

GAYMH 3 Maize: short duration variety.

Increase in crop yield: 20-40%,

net returns: ₹ 20,000-25,000 ha⁻¹,

cost of cultivation: ₹ 25,000-30,000 ha⁻¹

GJG-6 Chickpea: Increase in crop yield: 20-23%,

net returns: ₹ 45,000-47,000 ha⁻¹,

cost of cultivation: ₹ 28,000-30,000 ha⁻¹,

net returns: ₹ 45,000-55,000 ha⁻¹, cost of cultivation: ₹ 25,000-30,000 ha⁻¹

GAM 8 Green gram: Increase in crop yield: 25-30%, cost of cultivation: ₹ 25,000-28,000 ha⁻¹,

net returns: ₹ 50,000 ha⁻¹

Additional net returns:

Crop based Interventions

Improved crop varieties:

NRC 37 soybean: ₹ 8,000 - 9,000 ha⁻¹

GJG 6 chickpea: ₹ 10,000 - 12,000 ha⁻¹

GAYMH 3 maize: ₹ 7,000 - 14,000 ha⁻¹

GGW 451 wheat: ₹ 8,000 - 10,000 ha⁻¹

GAM 8 greengram: ₹ 8,000 - 10,000 ha⁻¹

Module 3: Livestock based interventions

Backyard poultry with Ankaleshwar breed:

Dual-purpose backyard poultry, hardy, disease tolerant, suitable for low-input and free-range

rearing systems. Increase in body weight: 14%, cost of rearing: ₹ 3,000 -3,500,

net returns: 1,200 bird⁻¹

Additional net returns:

Livestock based interventions

Backyard poultry with Ankaleshwar: ₹ 450 - 480/bird

Scientific feed management: ₹ 10,000 - 15,000

Scientific feed management in buffaloes: Balanced rations, proper nutrient planning, quality fodder, and mineral supplementation. Increase in milk yield: 20-30%,

net returns: ₹30,000 - 45,000 animal⁻¹, cost of production: ₹30,000 - 35,000 animal⁻¹ year⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Water harvesting structures (Revival through desilting of farm ponds and water harvesting structures)	Community Convergence with irrigation department	Depends on the size For size 20×20×3: 50,000
Drip irrigation	Individual	55,000-60,000

Module 2a: Crop based intervention

Crop	Variety	Method
Soybean	NRC 37	Individual/Seed bank
Maize	GAYMH 3	Individual/ Seed bank
Chickpea	GJG-6	Individual/ Seed bank
Wheat	GW 451	Individual/ Seed bank
Green gram	GAM 8	Individual/ Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Soybean alone	23,654	47,062
Soybean +Poultry	27,269	48,249
Wheat alone	29,119	68,327
Wheat + Lactating Buffalo	71,319	1,15,331

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Poultry	Ankaleshwar	Individual	400- 450 /bird
Scientific feed management	Buffaloes	Individual	30,000-40,000/animal

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 2: Kachchh

Climate vulnerability: Drought, salinity, heat waves, erratic rainfall

A. Introduction/ Background

- Kachchh district, is in the westernmost part of Gujarat, represents one of the most arid and ecologically fragile regions of India, extreme climatic variability and vast stretches of saline and desert landscapes,
- The district receives an average annual rainfall of about 500 mm, largely confined to a short southwest monsoon period, with very hot summers (up to 42 °C) and mild winters (11°C).
- Soils are predominantly shallow sandy and loamy, saline, and alkaline, with low organic carbon, poor nutrient status, and very low moisture-holding capacity, severely limiting crop productivity under rainfed conditions.
- Field crops: Castor, cotton, groundnut, sesame, rapeseed mustard, and cumin; Plantations: Date palm, pomegranate, ber and mango.
- Livestock is the backbone of rural livelihoods in Kachchh, with cattle, buffaloes, sheep, goats, and camels playing a central role, however, productivity is constrained by chronic fodder scarcity, degradation of grazing lands, and lack of improved breeds.
- Kachchh district has immense potential for livelihood enhancement through convergence-based, climate-resilient interventions, focusing on integrated crop-livestock-pasture systems, rangeland development, efficient water harvesting, promotion of drought and saline tolerant crops, and diversification into allied activities. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Rain water harvesting and Ground water recharge:

New: 3 farm ponds, 1 community pond, 5 percolation tanks, 8 check dams, 11 open wells, were constructed.

Desilting and widening of catchment channel of 2.1 km

-3 Nos, Repaired/renovated: 16 ponds, 1 percolation tank, 19 check dams, 209 bore wells. These helped in improving ground water. Water level in open wells raised by 2.0 to 5.5 m, number of open wells increased from 130 to 209 in 8 years. After eight years, the number increased to 79 open wells and 11 borewells.

Area under double cropping increased to 77 ha Increase in crop yield: Bt cotton: 29%, castor: 85%

Increase in area under irrigation: *Kharif*: 150 ha (107%), *rabi*: 85 ha (130%), summer :30 ha

Drip irrigation through harvested water:

Bt. Cotton: Increase in crop yield: 7-54%, net returns: ₹55,000 – 60,000 ha⁻¹, cost of installation of drip system: ₹75,000 -80,000 ha⁻¹

Castor: Increase in crop yield: 20-45%, net returns: ₹ 40,000-45,000 ha⁻¹,

Additional net returns:

NRM based interventions

Drip irrigation in cotton: ₹ 15,000 - 30,000 ha⁻¹

Drip irrigation in castor: ₹ 10,000 - 20,000 ha⁻¹

Module 2: Crop based Interventions

Improved varieties of various crops

GTHH-49 Bt. Cotton: Increase in crop yield: 12 %, net returns: ₹ 75,000-80,000 ha⁻¹, cost of cultivation: ₹ 70,000 -75,000 ha⁻¹

GCH-2 Castor:

net returns: ₹ 75,000 -80,000 ha⁻¹,

cost of cultivation: ₹29,000 -35,000 ha⁻¹, Increase in crop yield: 24 %

GT-3 Sesame: Increase in crop yield: 50-55%, net returns: ₹ 34,000 -35,000 ha⁻¹,

cost of cultivation: ₹ 20,000 -25,000 ha⁻¹

Cumin: GC-4, increase in crop yield: 32-35%, net returns: ₹ 69,000 -70,000 ha⁻¹,

cost of cultivation: ₹50,000-55,000 ha⁻¹

Sesame + cotton intercropping system (1:1): (Cotton variety BG-2 and sesame variety GT-4):

Increase in crop yield: 10-15%, cost of cultivation: ₹50,000 -55,000 ha⁻¹,

net returns: ₹ 1,10,500-1,25,000 ha⁻¹

Crop diversification with salinity tolerant fruit crop: Pomegranate, Area brought under pomegranate cultivation: 68 ha, fruit yield: 18 to 20 t ha⁻¹, net returns: ₹ 4,50,000-5,00,000 ha⁻¹

Additional net returns:

Crop based Interventions

Improved varieties:

GTHH-49 Bt.Cotton :	₹ 7,000 - 10,000 ha ⁻¹
GCH-2 castor:	₹ 20,000 - 25,000 ha ⁻¹
GT3 sesame:	₹ 20,000 - 25,000 ha ⁻¹
GC 4 cumin:	₹ 24,000 - 30,000 ha ⁻¹
Sesame + Cotton intercropping:	₹ 35,000 - 40,000 ha ⁻¹

Module 3: Livestock based interventions

Shelter management with mineral mixture and green

fodder to cow: Mineral mixture @ 40 gm⁻¹ day⁻¹ animal⁻¹.

Increase in milk yield: 23%, net returns: ₹ 100 day⁻¹,

cost: ₹ 130-140 animal⁻¹ day⁻¹

Fodder sorghum (Gundri): Increase in fodder yield: 16-20%, net returns: ₹ 40,000-45,000 ha⁻¹

Additional net returns:

Livestock based interventions

Pucca shed:	₹ 22 day ⁻¹ animal ⁻¹
Gundri fodder sorghum:	₹ 7,400 - 7,600 ha ⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Farm ponds	Community	Depends on the size of the pond 10×10×3: 45,000
Community pond	Community	75,000 /pond
Check dams	Community	3,00,000 / check dam
Drip irrigation	Individual	45,000 ha ⁻¹

Module 2a: Crop based interventions

Crop	Variety	Method
Bt. Cotton	GTHH-49	Individual/seed bank
Castor	GCH-2	Individual/ seed bank
Sesame	GT-3 and GT-4	Individual/ seed bank
Cumin	GC-4	Individual /seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Cotton sole	42,653	1,10,500
Sesame + cotton	49,500	67,361

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Mineral mixture	Cow	Individual	136 /day/animal
Fodder sorghum	Gundri	Fodder bank	16,000 ha ⁻¹

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 3: Panchmahal

Climate vulnerability: Drought, flood, high temperature

A. Introduction/ Background

- Panchmahal district, is in the central-eastern part of Gujarat, is characterized by undulating topography, tribal-dominated farming systems, and high dependence on monsoon rainfall.
- The district receives an average annual rainfall of about 900–950 mm, mainly during the southwest monsoon, with 14–42 °C temperature, hot summers and mild winters.
- Soils are predominantly light to medium-textured loamy and sandy loam soils, generally low in organic carbon and available nutrients.
- Agriculture in Panchmahal is largely rainfed (around 74%), with 26% under irrigation, therefore, rainwater harvesting, *in-situ* moisture conservation, and soil fertility management are crucial for sustaining crop productivity and reducing climate-induced risks.
- Major crops: Maize, paddy, redgram, cotton, and soybean during the *kharif* season, while wheat and chickpea are cultivated in *rabi*. Plantations: Mango, banana, papaya, and citrus fruits.
- Livestock and allied enterprises play an important role in rural livelihoods, with cattle, buffaloes, goats, and backyard poultry commonly reared
- Panchmahal district has substantial scope for enhancing agricultural productivity and household income through convergence-based, climate-resilient interventions, focusing on integrated crop-livestock systems, sustainable water and soil management, adoption of stress-tolerant crop varieties, and diversification into horticulture and allied activities. Implementation of such interventions was done in selected villages Nesda and Bedhiya. The major outcomes were

B. Impact of Interventions: Key Evidences

Module 1: NRM based interventions

Revival of open wells: Increasing well depth from 30 ft to 51 ft and expanding the diameter from 3 ft to 16.5 ft. The intervention was implemented through NICRA–ISSWC convergence. cost of renovation: ₹10,000-15,000

Additional net returns: NRM based interventions

Revival of open wells: ₹ 40,000 - 50,000 ha⁻¹
Paddy straw mulching: ₹ 18,000 - 19,000 ha⁻¹

/well, increase in irrigated area: 60-80%, crop diversification with horticultural and vegetable crops such as tomato and brinjal during *rabi*.

Increase in crop yields: Wheat (*Rabi*): 1.5-2.0 t ha⁻¹, maize: 1.0-1.5 t ha⁻¹, chick pea: 0.5-0.8 t ha⁻¹

Paddy straw mulching in redgram: reduces evapotranspiration, conservation of soil moisture, and suppression of weed growth. Increase in crop yield: 14-17%, cost: ₹ 8,000-12,000 ha⁻¹ (for mulching)

Module 2: Crop based Interventions

Improved varieties

GAWMH-2 maize variety: Increase in crop yield: 88%, net returns: ₹ 47,400-47,800 ha⁻¹

GR-21 paddy variety: Increase in crop yield: 60%, net returns: 58%

GT-106 pigeon pea variety:

Increase in crop yield: 14-17%,
net returns: ₹ 93,000 ha⁻¹

GUG-3 chick pea variety:

Increase in crop yield: 30%,
net returns: ₹ 30,000-35,000 ha⁻¹

GG-37 groundnut variety:

Increase in crop yield: 35%,
net returns: ₹ 52,000-55,000 ha⁻¹

RAJ-1111 bajra variety:

Increase in crop yield: 35%,
net returns: ₹ 31,000-31,600 ha⁻¹, cost of cultivation: ₹ 24,000-30,000 ha⁻¹

GAM-5 greengram variety: Increase in crop yield: 35%, cost of cultivation: ₹ 24,000 ha⁻¹,
net returns: ₹ 24,000 ha⁻¹

GG-34 Groundnut: Increase in yield: 7-10% , net returns: ₹ 1,17,400-1,17,800 ha⁻¹,
cost of cultivation: ₹ 40,000-50,000 ha⁻¹

Crop diversification of paddy with short duration variety of soybean NRC-37:

Increase in crop yield: 13-16%, net returns: ₹ 58,000 - 60,000 ha⁻¹,
cost of cultivation: ₹ 26,500-27,000 ha⁻¹

Module 3: Livestock based interventions**Year-round fodder production: Napier grass (APBN-1), multi cut sorghum (CoFS-31) and Azolla:**

Increase in milk yield: 58-62% (Cow), 38-43% (Buffalo)

net returns: ₹ 34,000-35,000/animal (Cow),

₹ 1,20,000-1,22,000 /animal (Buffalo)

Additional returns: ₹ 20,000-23,000 (Cow), ₹ 40,000-41,000 (Buffalo)

cost: ₹ 35,000-40,500

Additional net returns:**Livestock based interventions**

Year-round fodder production

Cow : ₹ 20,000- 23,000

Buffalo: ₹ 40,000- 41,000

C. Strategic Interventions Recommended for PMDDKY**Module 1: NRM based Interventions**

Interventions	Individual/ community participation	Cost ₹
Revival of open well	Individual	10,000–15,000 /well
Paddy straw mulching	Individual	8,000-12,000 ha ⁻¹

Module 2a: Crop based interventions

Crop	Variety	Method
Maize	GAWMH-2	Individual
Paddy	GR-21	Individual
Redgram	GT-106	Individual
Chickpea	GG-3	Individual
Groundnut	GG-37	Individual
Bajra	RAJ-1111	Individual
Greengram	GAM-5	Individual
Soybean	NRC-37	Individual

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹)
Crop + Livestock	2,57,625-2,58,000	5,57,276-5,60,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Napier grass	APBN-1	Individual	35,000-40,500
Fodder sorghum	COFS-31 (For cow & buffalo)	Individual	35,000-40,500

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

Himachal Pradesh

District 1: Bilaspur

Climate vulnerability: Drought, water scarcity, heat waves

A. Introduction/ Background

- Bilaspur district, located in the south-western part of Himachal Pradesh falls under the Shivalik hill range, experiences drought, water scarcity, and heat waves
- The district receives an average annual rainfall of 1202 mm, with temperature ranging from 14-27 °C.
- The rainfed and irrigated area of the district were 12 and 88% respectively
- Soils are predominantly alluvial and non-calci brown soils
- Field crops: Wheat, maize, and rice. Plantations: Mango, pomegranate, and citrus
- Livestock is a key livelihood, but milk productivity remains low due to poor feeding practices, the unavailability of fodder round the year during prolonged dry spells, the inaccessibility of improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based-climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Bari Majherwan and Chuwari. The major outcomes were as follows

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Water harvesting structures (farm pond):

Collecting surplus runoff in dug out farm pond and reusing the same for critical irrigation during *Kharif* season or as pre-sowing irrigation to *rabi* crops

Additional net returns:	
NRM based interventions:	
Supplemental irrigation to wheat:	₹ 20,000 - 25,000 ha ⁻¹
Micro irrigation + plastic mulching in cauliflower:	₹ 20,000 - 25,000 ha ⁻¹
Plastic mulching in garden pea:	₹ 15,000 - 20,000 ha ⁻¹

enhance productivity. cost of construction: ₹ 25,000 - 30,000 per structure

Supplemental irrigation to wheat with harvested water: Supplemental irrigation at critical stages booting and flowering stage enhanced yield and returns of the crop. Increase in crop yield: 60-70%, cost of cultivation: ₹ 26,800 -33,000 ha⁻¹, net returns: ₹ 30,000-35,000 ha⁻¹

Micro irrigation + plastic mulching: Cauliflower Cv Megha: Increase in cauliflower yield: 5-10%, cost of cultivation: ₹ 1,92,000 -2,02,000 ha⁻¹, net returns : ₹ 2,50,000-2,85,000 ha⁻¹

Plastic mulching garden pea: Increase in crop yield in garden pea: 20 -25%, cost of cultivation: ₹ 1,30,000 -1,42,000 ha⁻¹, net returns : ₹ 80,000- 85,000 ha⁻¹

Module 2: Crop based interventions

Maize – wheat cropping system:

Maize: Kanchan variety with IPM for fall army worm in *kharif*. Increase in crop yield: 20-25%, cost of cultivation: ₹33,000 -34,000 ha⁻¹ net returns : ₹30,000 - 35,000 ha⁻¹

Wheat: Drought tolerant variety of wheat

(HPW-368) + foliar application of potassium nitrate (2%) at booting and grain filling stage in wheat. Increase in crop yield: 40-50 %, cost of cultivation: ₹ 31,000 -32,000 ha⁻¹ , net returns : ₹30,000 -35,000 ha⁻¹

Additional net returns

Crop based interventions:

Maize-wheat cropping system

Maize: ₹ 10,000 - 15,000 ha⁻¹

Wheat: ₹ 20,000 - 25,000 ha⁻¹

Blackgram-chickpea system: ₹ 20,000 - 25,000 ha⁻¹

Gajendra variety: ₹ 1,30,000- 1,35,000 ha⁻¹

Crop diversification with Elephant foot yam Gajendra variety: Planting on raised bed, the furrow, and foliar application of Mancozeb + Carbendazim (2g/L). Reduction in collar rot: 35%, increase in crop yield: 20-25%, cost of cultivation: ₹ 1,96,000 -2,25,000 ha⁻¹, net returns : ₹ 3,00,000 -3,50,000 ha⁻¹

Blackgram (Him Mash-1) - Chickpea (Him Chana-1) cropping system:

Increase in crop yield: 65-75%, cost of cultivation: ₹ 25,000 -33,000 ha⁻¹

Module 3: Livestock based interventions

Improved fodder and nutritional supplementation for lactating animals:

Fodder of chari (Him Palam Chari-1) + azolla feed and supplementation of UMMB mixture for lactating animals.

Additional net returns:

Livestock based interventions

Improved fodder and nutritional supplementation : ₹ 25,000-30,000 ha⁻¹

Him Samridhi + Mushroom cultivation: ₹ 15,000-16,000

Button mushroom: ₹ 2,000 -4,000

Increase in milk yield in cow: 50-55 %, cost of production: ₹ 18,000 -22,000 animal⁻¹

Him Samridhi + Mushroom cultivation:

net returns: ₹ 15,000- 16,000, cost of production: ₹ 150- 200 animal⁻¹

Button mushroom cultivation on crop residues: Increase in yield: 55%-58%, cost of cultivation: ₹ 120 unit⁻¹, net returns: ₹ 620 unit⁻¹

Module 4: Integrated farming systems: Combination of livestock with crop, horticulture crops, etc., by recycling one by-product to another by-product. Eg: crop residues, etc., can be fed to cattle, and cattle dung can be used for crops, enhance the opportunity for organic farming.

net returns: ₹ 4,66,000-4,66,500, additional cost of cultivation: ₹ 21,000-22,000, cost of production: ₹ 2,79,000-2,80,000 ha⁻¹

C. Strategic Interventions Recommended for PMDDY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Water harvesting structures (farm pond)	Community	Size of the farm pond (10mx10mx3m): 25,000 to 30,000 Quantity of water harvested: 10,000 L No. of irrigations/hectare with harvested water: 12
Supplemental irrigation in wheat	Individual	Diesel pump 1,200 ha ⁻¹
Micro irrigation	Individual	Installation cost: 65,000 - 70,000
Plastic mulching	Individual	Cost of mulching: 3,000 - 4,000

Module 2a: Crop based interventions

Crop	Variety	Method
Wheat	HPW-368	Seed bank
Elephant foot yam	Gajendra	Seed bank
Chickpea	Him Palam Chana-1	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Improved maize (Kanchan)-wheat (HPW-368) + foliar application of potassium nitrate (2%)	66,200-66,500	61,000- 61,200
Blackgram (Him Mash-1) - Chickpea (Him Palam Chana-1)	32,000- 32,200	35,500- 36,000
Crop alone (Wheat + elephant foot yam)	2,57,500-2,58,000	3,48,000-3,48,200
Crop (wheat + elephant foot yam) + cows+ poultry	2,79,400- 2,79,700	4,66,200-4,66,400

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Improved fodder of Chari	Him Palam Chari-1	Individual	18,000 -22,000 ha ⁻¹
Backyard Poultry	Him Palam Samridhi	Individual	150-200

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

Jharkhand

District 1: West Singhbhum

Climate vulnerability: Moisture stress

A. Introduction/ Background

- West Singhbhum district is located in the southern part of Jharkhand and falls under the Eastern Plateau and Hill agro-climatic region, is characterized by undulating to hilly terrain, forest-dominated landscapes, with a predominantly tribal farming population. Agriculture is largely dependent on monsoon rainfall and is vulnerable to rainfall variability and intermittent dry spells.
- The district receives an average annual rainfall of about 1,200–1,400 mm, mostly during the southwest monsoon, with temperatures ranging from 8–10 °C in winter to 40–43 °C in summer.
- Soils are mainly red, lateritic, sandy loams and clay loams, shallow to medium in depth, low in organic carbon and nutrient availability, resulting in moderate to poor moisture-holding capacity under rainfed conditions.
- Agriculture in West Singhbhum is predominantly rainfed (around 85%), with limited irrigation (15%), therefore, rainwater harvesting, in-situ moisture conservation, and soil fertility improvement are crucial for sustainable crop production.
- Major crops: Paddy, wheat, maize, mustard, small millets, pigeon pea, green gram, lentil and niger. Plantations: Mango, guava, jackfruit are grown on a limited scale.
- Livestock and allied activities are integral to rural livelihoods, with indigenous cattle, goats, pigs, and backyard poultry commonly reared. However, productivity remains low due to fodder scarcity and low genetic potential.
- West Singhbhum district has considerable scope for enhancing agricultural productivity and household incomes through convergence-based, climate-resilient interventions, focusing on integrated crop-livestock systems, sustainable natural resource management, promotion of millets, and nutrition-sensitive farming.

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions:

Strawberry farming: Raised beds, drip irrigation, mulching

Field bunding/ Artificial ground water recharge: This is called as Medh Bandi in local. Ground water was maintained at 12-15 feet in wells and 130-140 feet in bore wells which was 4-5 feet in wells and 180-200 feet in bore wells earlier.

Mulching: Use of paddy straw and local available plant leaves as mulching material in ginger and turmeric field. Reduction in irrigation water: 42% in 17 days interval (11 days interval in without mulching), reduction in wilt: 63%, reduction in weed population: 63%, increase in crop yield: 33%, net returns: 62%.

DSR: Increase in crop yield: 11-21%, net returns: ₹ 30,000-40,000 ha⁻¹

**Additional net returns:
NRM based interventions
DSR: ₹ 20,000 to 30,000 ha⁻¹**

Zero till wheat: Zero tillage wheat, mustard, and lentil, labour cost saving: >35%, land preparation cost saving: >55%, irrigation water saving: >30%.

Increase in crop yield: 10-12% (wheat), 25-30% (mustard), 10% (lentil)

net returns: ₹ 25,000-30,000 ha⁻¹ (wheat), ₹ 15,000-20,000 ha⁻¹ (mustard), ₹ 20,000-25,000 (lentil)

Module 2: Crop based interventions

**Additional net returns:
Crop based interventions
Swarna shreya CR-320: ₹ 20000-25000 ha⁻¹**

Community rice nursery: Improved varieties Sahbhagi Dhan and Abhishek were used in drought prone regions,.

Increase in crop yield: 52% (2 t ha⁻¹), net returns: ₹ 15,000-20,000 ha⁻¹

Swarna Shreya, CR-320 rice varieties: Drought tolerant rice varieties.

Increase in crop yield: 15-20%, net returns: ₹ 40,000-45,000 ha⁻¹

K 1812 groundnut variety: Drought tolerant, suitable for rainfed and semi-arid conditions. Seed treatment with carbendazim 50% @ 2.5 g kg⁻¹ and chlorpyrifos 20EC @ 6 ml kg⁻¹, fertilizer 25:50:20:20 kg ha⁻¹ N:P:K:Zn was done. Increase in crop yield: 30%, net returns: ₹ 15,000-20,000 ha⁻¹

Birsa Niger 3 niger variety: Fertilizer 20:80:40:40 kg ha⁻¹ N:P:K:Zn, application of micro nutrients. Increase in crop yield: 14%, net returns: ₹ 3,000-5,000 ha⁻¹

Groundnut + Redgram intercropping system (4:1) Groundnut variety TG-51+Redgram Rajeev lochan were sown in 4:1 row ratio:

Increase in crop yield: 10%, net returns: ₹ 30,000-35,000 ha⁻¹

Module 3: Livestock based interventions

**Additional net returns:
Livestock based interventions
Pig breed (Jharshuk): ₹ 25,000-30,000 animal⁻¹**

Fodder Cultivation: Hybrid Napier and fodder maize

Improved Feed management: Area specific mineral mixture supplementation, increase in milk yield: 1-1.5 L animal⁻¹, net returns: ₹ 10,000 animal⁻¹

Cage aqua culture: Repurpose major reservoirs and abandoned mines for cage aquaculture. Fish species stocked: Pangas and Mono-sex Tilapia (Fast growing fish species).

net returns: ₹ 2,20,000/farmer

Composite fish farming: net returns: ₹ 1,00,000 acre⁻¹

Improved backyard poultry breeds: Sonali and improved duck breed Khaki Campbell: Egg production: 180 eggs /bird/annum, net returns: ₹ 8,000 for a flock of 25 birds

Improved Goat and Pig breed: Black Bengal and Jharshuk: increase in body weight: 1.3 kg animal⁻¹, net returns: ₹40,000-45,000 animal⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Field bunding	Individual	1,500-2,000
Mulching	Individual	3,000-4,000
DSR	Individual	38,000
Zero tillage	Individual	25,000-35,000

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	Swarna Shreya, CR-320	Individual
Groundnut	K 1812	Individual
Niger	Birsa Niger 3	Individual
Wheat	Birsa Gehu-4 and Sabour Nirjal	Individual
Lentil	IPL-220	Individual
Mustard	PM-30 and BBM-1	Individual
Green gram	IPM 2-3 and Virat	Individual
Blackgram	PU-31	Individual
Finger millet	BM-3	Individual
Redgram	Rajeev Lochan	Individual
Groundnut	TG-51 and K-1812	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Rice + fallow	62,671	28,629
Rice + Black BengalGoat	67,171	32,029
Rice + fallow	59,670	54,630
Rice + backyard poultry	60,185	55,865

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Napier	Hybrid Napier	Fodder bank	35,000-45,000
Goat	Black Bengal	Individual	4,000 /animal
Pig	Jharshuk	Individual	500/piglet
Poultry	Sonali	Individual	500 /bird
Duck	Khaki Campbell	Individual	50-100/duckling
Fish	Pangas and Tilapia	Individual	70-150/kg

Module 4: Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centers with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

Karnataka

District: Chikkaballapura

Climate vulnerability: Drought-prone climate

A. Introduction/ Background

- Chikkaballapura district is in the southeastern part of Karnataka
- The district receives an average annual rainfall of 687 mm, with temperature ranging from 22-43 °C.
- The rainfed and irrigated area of the district were 72% and 28% respectively
- Soils are predominantly red loamy and red sandy loam soils. These soils have low to moderate water-holding capacity, poor in organic matter and major nutrients. Hence rain water harvesting and recycling of harvested water and in-situ moisture conservation measures are crucial to increase crop productivity.
- Field crops: Ragi, maize, groundnut, redgram. Plantation: Mango and grapes.
- Livestock in the district is central to livelihood security, climate resilience and sustainability of dryland agriculture. It provides regular and assured source of income especially when crops fail due to drought. Water scarcity and fodder shortages leads to reduced milk yield, growth, and reproductive efficiency.
- The district has significant scope for improving agricultural productivity and rural livelihood through convergence, climate resilient interventions that emphasize integrated crop-livestock systems and sustainable natural resource management with need-based and outcome-oriented implementation in climate-smart villages S Raguttahalli, Madamangala, Hanumaigarahalli and Somakalahalli. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Water harvesting structures: New farm ponds :8, New check dams :5, Desilting of check dam: 2, village tanks :2, mini dam (2 ha), percolation ponds :13, nala bunds :2, recharge of bore well 3. Total farmers benefitted: 344, average increase in depth of water level: 24 ft, Artificial recharge of ground water structures increased the groundwater level by 20 to 25ft . This created supplemental irrigation potential: 42.5 + 32.5 ha (*kharif* + *rabi*)

Water storage created

Total water harvested: 5.26 crore litres

Recharged :15 open wells and 18 defunct bore wells

Supplemental irrigation: 1-3 supplemental irrigation through harvested water from various sources was given at critical stages during dry spells. This enhanced grain yields and net returns in finger millet

Farm ponds: cost of construction (10×10×3): ₹ 45,000, Increase in finger millet yield: 30-33%, net returns: ₹ 19,000-19,600 ha⁻¹,

Percolation tanks: Increase in finger millet yield: 32-37%, cost of cultivation: ₹ 15,000-18,000 ha⁻¹, net returns: ₹ 22,000-22,500 ha⁻¹, additional returns: ₹ 8,000- 8,350 ha⁻¹

Desilted nala bunds:

Increase in finger millet yield: 32-37%,
net returns: ₹ 22,000-22,300 ha⁻¹,
additional returns: ₹ 8,000- 8,200 ha⁻¹

Additional net returns

Supplemental irrigation: ₹ 5,200 - 5,500 ha⁻¹
Drip irrigation to vegetables: ₹ 45,500- 46,000 ha⁻¹
Tank silt application in intercropping: ₹ 20,000- 25,000 ha⁻¹

Micro irrigation for vegetables: Drip irrigation in vegetables. Increase in crop yield: 22%, Water saved through Drip irrigation: 30-50%. Increase in Tomato yield: 22%. net returns : ₹ 2,36,000 ha⁻¹, cost of installation: ₹65,000 -70,000 ha⁻¹

Tank silt application: The desilted tank silt was applied to different crops. Increase in yield in finger millet + red gram and groundnut + red gram intercropping system: 25-35%,
net returns: Finger millet + redgram : ₹40,000-45,000 ha⁻¹,
Groundnut+ redgram : ₹ 60,000 -65,000 ha⁻¹

Trench-cum-Bunds (TCB): Trenches of 5 m x1 m x0.5 m length, width and height, by leaving one-meter berm between each trench were made. Crops : Groundnut, pigeonpea and fruit trees. Increase in pigeonpea yield: 20-25%, net returns: ₹ 48000-48700 ha⁻¹

Broad Bed Furrow (BBF) system in intercropping: Bed width of 150 cm, furrow width and depth of 45 cm and 20 cm respectively can be made.

Additional net returns:**NRM interventions**

In situ moisture conservation

Trench cum bunding in pigeonpea: ₹ 22,200 -22,600 ha⁻¹
BBF in groundnut + redgram (10:2): ₹ 5,500 -5,600 ha⁻¹

Crops: Groundnut and pigeonpea. Rain Water Use Efficiency: 18-19%.

Increase in crop yield: 20-25%, net returns: ₹ 12,000-12,300 ha⁻¹

Polythene mulching in vegetables along with biofertilizers: Conserves soil moisture and suppress weed growth. Tomato yield: 15 - 20 %, net returns: ₹48,000- 46,000 ha⁻¹,
cost of cultivation: ₹1,98,000-2,06,000 ha⁻¹ Brinjal yield: 12- 30 %, net returns: ₹48,000- 46,000 ha⁻¹, cost of cultivation: ₹84,000-97,000 ha⁻¹

Module 2: Crop based Interventions**GPU-48 Finger millet variety:**

Early-maturing drought-escaping variety.
Increase in yield: 20-25%,
net returns: ₹ 28,000 - 28,500 ha⁻¹,
cost of cultivation: ₹20,000-20,500 ha⁻¹.

Additional net returns:**Intercropping systems**

GPU 48 Finger millet variety : ₹ 8,000 - 8,200 ha⁻¹
Finger millet + redgram (4: 1): ₹ 20,000 - 25,000 ha⁻¹
Groundnut + redgram (10:2): ₹ 6,500 - 7,000 ha⁻¹

Nipping in pigeonpea: Nipping at 45 days after sowing in improved pigeonpea variety BRG-1 and BRG-5 for better development of auxiliary branches. Increase in yield: 10-15%,
net returns: ₹ 48,000 - 48,700 ha⁻¹, cost of cultivation: ₹ 41,000-41,500 ha⁻¹

Redgram-based intercropping: Finger millet + redgram (8:1) and groundnut + redgram (10:2) intercropping systems. Increase in yield: 25-30%, net returns: ₹ 44,000-71,000 ha⁻¹,
cost of cultivation: ₹ 42,000-58,000 ha⁻¹

Diversification with dry land horticulture : Mixed fruit orchards (mango, cashew, tamarind, custard apple, jamun, lemon and drumstick), and in-situ green manuring with horse gram and sun hemp introduced in mango and cashew orchards improved the soil fertility.
net returns: ₹ 75,000-3,50,000 ha⁻¹.

Module 3: Livestock based interventions

Azolla + Silage feed + Lucerne fodder production for cows:

Increase in milk yield: 3-5%,
net returns: ₹ 80,000-84,000
cost of cultivation: ₹ 92,000- 95,000

Additional net returns:

Livestock based interventions

Azolla and Silage feed +

Lucerne cows: ₹ 5,000 - 8,000 /animal/year

Stall feeding of sheep: ₹10,000 - 20,000 animal⁻¹

Kadaknath and Grama Priya: ₹ 300 - 500 bird⁻¹

Stall feeding of sheep: Feeding with Azolla, silage and fodder like Lucerne.

Gain in body weight: 13-17%, net returns: ₹ 71,000-74,500, cost of cultivation: ₹ 14,5000-15,3000

Year-round fodder supply: *kharif* (rainy season): Kharif : Sorghum, maize (African tall), cowpea, hybrid napier (DHN 10) Rabi (Post-rainy season): lucerne, horsegram, maize (irrigated). Summer: Multicut sorghum, perennial grasses, fodder trees (subabul, gliricidia). Azolla cultivation Silvi-pastoral systems (grasses + fodder trees). Increase in fodder yield: 18%.

Backyard poultry: Backyard poultry with Kadaknath and Grama Priya breeds. Increase in egg productivity Kadaknath: 30-35%: and Grama Priya: 110-130%. net returns: ₹ 650 - 700 bird⁻¹
Kadaknath ₹600- 700 bird⁻¹ Grama Priya.

Breed upgradation: Breed upgradation with NARI Suwarna sheep to increase the twinning and litter size in sheep. Flock size increase: 52 to 94 lambs (78-83%), net returns: ₹ 2,53,500 - 2,54,500

Composite fish culture in Farm ponds: Jayanthi Rohu can be raised in the farm pond with harvested water. net returns: ₹ 20,100

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Water harvesting through pond, check dams, borewell recharging <i>etc.</i>	Community convergence with MGNREGA	Depends on the size of the pond 10×10×3: 45,000
Supplemental irrigation with harvested water	Community	Diesel pump ₹ 1200 ha ⁻¹
Trench cum bunding	Individual	25,000 ha ⁻¹
Broad bed and furrow	Individual	1,500-2,000 ha ⁻¹
Polythene mulching	Individual	3,000-4,000

Module 2a: Crop based interventions

Crop	Variety	Method
Finger millet	GPU-48	Seed bank
Pigeonpea	BRG-4	Seed bank
Groundnut	K-6, KCG-6, K-1812	Seed bank
Cashew	Chinthamani-1/V-4	Seed bank
Mango	Mallika, Totapuri	Nursery
Tamarind	GKVK-17/PKM-1	Nursery
Jamun	Dhupdal/Bardoli, GKVK-1	Nursery

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Groundnut + redgram alone	68,200	1,00,000
Groundnut + redgram + azolla + silage + 20 sheep	2,20,000	1,80,000
Finger millet + redgram intercropping alone	44,530	70,000
Finger millet + redgram + azolla + silage + 1 HF cow	1,35,000	1,55,000
Polythene mulching in tomato alone	2,05,600	2,39,200
Polythene mulching in tomato + Napier grass + 1 HF cow	2,75,000	3,45,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹ ha ⁻¹)
Fodder sorghum	CoFS-29	Fodder bank	40,000
Fodder maize	African Tall	Fodder bank	25,000
Lucerne	RL-88	Fodder bank	54,000
Hybrid Napier	DHN-10	Fodder bank	72,560
Backyard poultry	Kadaknath and Gram Priya	Individual	30-35 per chick
Sheep	NARI Suwarna	Individual	7,000-10,000 per adult sheep

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 2: Chitradurga

Climate vulnerability: Drought

A. Introduction/ Background:

- Chitradurga district, located in the Central Dry Zone of Karnataka, is highly drought-prone and frequently experiences dry spells, erratic rainfall, and prolonged moisture stress.
- The district receives an average annual rainfall of about 564 mm, mostly concentrated during the southwest monsoon, with temperatures ranging from 15–38 °C.
- Agriculture in the district is predominantly rainfed. Around 73% and 27 % of the cultivated area are rainfed and irrigated area.
- Soils are mainly medium to deep black soils and red sandy loam to red sandy clay loam soils.
- Field crops: Finger millet, maize, redgram, chickpea and groundnut. Plantations: Arecanut, coconut, mango and banana.
- Livestock plays a major role in livelihood security and climate resilience rather than being a supplementary activity. Livestock provide regular income, risk buffering during crop failure, and support mixed farming systems. However, water scarcity and fodder scarcity during drought years result in reduced milk yield, poor growth, and lowered reproductive performance.
- The district has considerable potential for enhancing agricultural productivity and rural livelihoods through convergence-based, climate-resilient interventions focusing on integrated farming systems, fodder security, water harvesting, and sustainable natural resource management. Need-based and outcome-oriented interventions were implemented in climate-smart village Yalagatta. The major outcomes were.

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Trench cum bunding in pulses, groundnut, fruit trees and vegetables:

Trenches of 2x0.91x1.25 m. at 3-6 m

spacing were made depending on slope and soil characters.

Water stored: 989 L/m³. Total no of trenches: 230 ha⁻¹. Increase in crop yield: 15–25%, net returns: ₹ 45,000-50,000 ha⁻¹, cost of trench bunding: ₹ 25,000 ha⁻¹.

Water harvesting through farm ponds /desilting of farm ponds/ checkdams : Water is harvested in ponds during the monsoon and stored it for use during dry periods as supplemental irrigation and livestock

Supplemental irrigation through harvested water with micro irrigation system (Drip):

Supplemental irrigation to groundnut, at peg initiation and flowering stage in groundnut, grand growth stage and flowering in redgram, germination in green gram and flowering stage of cashew and mango.

Water saving: 30-50 %. Increase in fodder sorghum (CoFS-31) yield: 34-38%, cost of cultivation: ₹ 35,000 ha⁻¹, net returns: ₹ 60,000-70,000 ha⁻¹

Additional net returns: NRM based interventions	
Trench cum bunding:	₹ 26,500 - 27,000 ha ⁻¹
Supplemental irrigation through drip:	₹ 9,600 - 9,850 ha ⁻¹

Vermicomposting of crop residues and application to the crops: Groundnut and redgram stalks were used for compost preparation. net returns: ₹ 20,000

Module 2: Crop based Interventions

Crop diversification with short duration crops

Green gram: BGS-9 : A short-duration variety suitable for double cropping in monocropping of groundnut. Yield increase: 5-10%.

net returns: ₹ 18,000 - 22,000 ha⁻¹, additional returns: ₹ 2,500 - 3,500 ha⁻¹.

Additional net returns:

Groundnut based intercropping systems

Groundnut + redgram (8:1): ₹ 15,000 - 18,000 ha⁻¹

Groundnut + castor (8:1): ₹ 18,000 - 20,000 ha⁻¹

Groundnut based intercropping systems:

Groundnut + redgram (8:1): Increase in yield: 12-18%, cost of cultivation: ₹ 25,000-28,000 ha⁻¹ net returns: ₹ 1,19,000-1,20,000 ha⁻¹, Groundnut + castor (8:1): Increase in yield: 14-18 %, cost of cultivation: ₹ 24,000-26,000 ha⁻¹, net returns: ₹ 1,12,000-1,13,000 ha⁻¹

Dryland horticulture with drought tolerant varieties of various crops: Drumstick : PKM-1, cashew Vengurla 4 and 7, onion : Bhima Super (early to mid-duration), mango Mallika and jackfruit Siddhu. Increase in crop yield: Drumstick: 22-25%, Cashew 40-45% and Onion: 15-19%.

net returns: Drumstick: ₹ 2,00,000- 2,22,000 ha⁻¹,

Cashew: ₹ 60,000- 65,000 ha⁻¹ and onion: ₹ 2,00,000- 2,30,000 ha⁻¹.

Module 3: Livestock based interventions

Perennial fodder production: For year-round green fodder availability. Multi cut fodder sorghum (CoFS-31) and Super Napier. Increase in yield multi cut sorghum fodder (CoFS-31)

Irrigated: 18-20% and Rainfed: 18-36%;

net Returns Irrigated: ₹ 50,000-60,000

Rainfed: ₹ 10,000- 12,000.

cost of cultivation: Irrigated: ₹ 15,000-20,000, Rainfed: ₹ 10,000-15,000.

Super Napier: 27-30%. cost of cultivation: ₹ 20,000 ha⁻¹, net returns: ₹ 65,000-66,000 ha⁻¹,

Additional net returns:

Multi cut fodder Sorghum:

Irrigated: ₹ 50,000 - 60,000 ha⁻¹

Rainfed: ₹ 10,000 - 12,000 ha⁻¹

CoFS-31: ₹ 10,000 - 12,000 ha⁻¹

Super Napier: ₹ 70,000 - 85,000 ha⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/community participation	Cost (₹)
Water harvesting through farm pond	Community convergence with MGNREGA	Depends on the size of the pond 10×10×3: 45,000
Supplemental irrigation with harvested water	Individual	Diesel pump 1,200 ha ⁻¹
Trench cum bunding	Individual	25,000 ha ⁻¹

Module 2a: Crop based interventions

Crop	Variety	Method
Redgram	BRG-5, TS- 3R	Seed bank
Green gram	BGS-9	Seed bank
Groundnut	K6	Individual
Horse gram	PHG-9	Seed bank
Castor	ICH-66	Individual
Drumstick	PKM-1	Nursery
Cashew	Vengurla 4 and 7	Nursery
Onion	Bhima Super	Nursery
Mango	Mallika	Nursery
Jackfruit	Siddhu	Nursery

Module 2b: Systems based Interventions

System	Net returns (₹ ha ⁻¹)
Intercropping system	66,000-1,10,000
Agroforestry systems with dryland horticulture	50,000-2,20,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹ ha ⁻¹)
Fodder sorghum	CoFS-31	Fodder bank	35,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment
Vermicomposting for recycling of crop residues	Individual	To improve the soil fertility and resilience

District 3: Gadag

Climate vulnerability: Drought, dry spells

A. Introduction/ Background:

- Gadag district, located in northern dry zone of Karnataka experiences drought and dry spells, erratic due to low rainfall. The district has a history of frequent droughts with a high probability (>70 % of years) of rainfall failure. The district receives an average annual rainfall of 663 mm, with temperature ranging from 16-37 °C.
- The rainfed and irrigated area of the district were 92% and 8% respectively
- Soils are predominantly shallow to deep black soil and red sandy clay loamy soils.
- Field crops: Chickpea, maize, groundnut, rabi sorghum, sunflower.
- Plantations: Pomegranate, mango, banana, cashew.
- Livestock in the district is central to livelihood security, climate resilience and sustainability of dryland agriculture. It is regular and assured source of income Water scarcity and fodder shortages leads to reduced milk yield, growth, and reproductive efficiency.
- The district has significant scope for improving agricultural productivity and rural livelihood through convergence, climate resilient interventions that emphasize integrated crop-livestock systems and sustainable natural resource management with need-based and outcome-oriented implementation carried out in climate-smart villages Shingatarayanakeri and Shingatarayanakeri Tanda. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Water harvesting structures: Renovation of farm ponds, check dams, and community ponds, through desilting. Harvested water supported supplemental irrigation for 24-27 ha, Increase in the cropping intensity to 175%. Rise in ground water level by 20-25 ft, Farmers benefitted :146

Artificial recharge of borewell. Ground water table increase: 3 to 5 m. Farmers benefitted: 188. recharge bore well: 17 Nos. Increase in crop yield: 50-60% additional net returns: ₹ 20,000-25,000 ha⁻¹

Water harvesting structures

Total harvested water: 3.8 crore litres.
Area increased in irrigation: 26.6 ha,
cropping intensity: 175%

Additional net returns:

Supplemental irrigation

Groundnut: ₹12,000-14,000 ha⁻¹
Maize: ₹10,000-12,000 ha⁻¹
Onion: ₹13,000-15,000 ha⁻¹
Greengram: ₹ 20,000-25,000 ha⁻¹

Supplemental irrigation: Lifesaving irrigation through harvested water from the farm pond to different crops during dry spells at critical stages. Increase in crop yield: 40-60%.

Compartmental bunding: The specifications of compartmental bunding were 5 m×5 m or 10 m×10 m, with a bund height of **30 cm**. The animal drawn equipment was used for formation of bunds.

Increase in sorghum crop yield: 10 -25%, net returns: ₹ 20000-25000 ha⁻¹, cost of cultivation: ₹ 19000-20500 ha⁻¹

Conservation furrows: The conservation furrows of 40 cm width, 20 cm depth were opened between the crop rows at 40 DAS during the interculture operations with the bullock-drawn ridge plough. This can be adopted in all crops, including intercropping systems. Increase in crop yield: 25-38%.

Module 2: Crop based Interventions

JAKI-9218 bengalgram variety: Short duration drought tolerant variety escapes from terminal moisture stress (112 days).

Increase in crop yield: 30-45 %,

net returns: ₹ 10,000-13,000 ha⁻¹, cost of cultivation: ₹ 17,000-24,000 ha⁻¹.

Additional net returns:

Improved varieties

JAKI-9218 Bengalgram: ₹ 3,000 - 6,000 ha⁻¹

SPV-2217 *Rabi Sorghum*: ₹ 7,000 - 10,000 ha⁻¹

VPMV-9 Bajra: ₹ 8,000 - 10,000 ha⁻¹

Redgram based intercropping:

Greengram + redgram (2:1) and maize + redgram (6:1). Greengram + redgram (2:1):

Increase in crop yield: 30-50%,

net returns: ₹ 23,000-24,000 ha⁻¹

cost of cultivation: ₹ 27,000-40,000 ha⁻¹. Maize + redgram (6:1): Increase in yield: 25-35%,

net returns: ₹ 70,000-80,500 ha⁻¹, cost of cultivation: ₹ 47,500-49,000 ha⁻¹.

Additional net returns:

Pigeonpea based intercropping system:

Greengram + redgram (2:1) : ₹ 7,000 - 12,000 ha⁻¹

Maize + redgram (6:1) : ₹ 12,000- 25,000 ha⁻¹

SPV-2217 *Rabi Sorghum* var.: Drought tolerant and resistant to charcoal stem rot. The crop is sown with wider row spacing. Increase in crop yield: 30-40%, net returns: ₹ 18000-21000 ha⁻¹, cost of cultivation: ₹ 17000-19000 ha⁻¹.

Seed hardening in redgram: 2% CaCl₂ seed treatment is done before sowing: This practice enhances germination %, improves the vigor of the plant to withstand the moisture stress conditions. Increase in crop yield: 15-20 %

Crop diversification with millets:

Foxtail millet DHft-109 and HN-46:

Increase in crop yield: 40-60%,

net returns: ₹ 7,000-8,000 ha⁻¹,

cost of cultivation: ₹ 15,000-16,000 ha⁻¹, additional cost of cultivation: ₹1,000-1,500 ha⁻¹.

Additional net returns:

Seed hardening: ₹ 4,000-5,000 ha⁻¹.

Crop diversification with millets: ₹ 13000-15000 ha⁻¹

Bajra: Drought tolerant and high yielding VPMV-9 variety for rainfed regions. Increase in yield :45-50%, net returns: ₹ 15,000-22,500 ha⁻¹, cost of cultivation: ₹ 16,000-18,500 ha⁻¹

Crop diversification with Agri horticulture systems in rainfed systems: Mango, cashewnut, tamarind and intercropping of field crops under dryland conditions. Planting of teak and melia on field bunds.

Crop diversification with Agri horti systems in irrigated conditions: Mango, cashew nut, custard apple, jamun, curry leaf, drumstick, papaya, guava and citrus.

Module 3: Livestock based interventions

Cage system of poultry rearing: To reduce the risk from the predators and provide shelter during extreme weather condition, cage system of rearing was introduced. Increase in body weight in the

Grama Priya poultry breed: 82%,
egg production: 65-70%,
net returns: ₹ 6,500-7,500/unit,
cost of rearing: ₹ 5,500-6,500/unit

Silage preparation: Silage preparation is the process of preserving green fodder

such as maize, sorghum, or other nutritious grasses through controlled fermentation.

Increase in milk yield: 10-15%, net returns: ₹ 18,000-18,500/cow/ 60days,
cost of rearing: ₹ 3,000-4,000 cow/60 days.

Additional net returns:

Livestock based interventions

Cage system of rearing:	₹ 1,500 - 2,000 unit ⁻¹
Drought-tolerant perennial fodders:	₹ 15,000-16,000 animal ⁻¹
Year-round fodder production:	₹ 19,000 /unit/year
Silage preparation:	₹ 1,500 cow/60 days

Drought-tolerant perennial fodders: Guinea grass, rhodes grass, signal grass, hedge lucerne and *Stylosanthes heamata* are cultivated under rainfed to provide year-round green fodder to livestock. Increase in milk yield: 10-15%, net returns: ₹49,500-50,500/animal/year, cost of cultivation: ₹ 30,000-30,500 animal⁻¹ year⁻¹

Year-round fodder production: Planting of super Napier, guinea grass, hybrid napier and hedge lucerne with supplemental irrigation. Increase in milk yield: 10-15% in cows, net returns: ₹ 49,500-50,500 animal⁻¹ year⁻¹, cost of cultivation: ₹ 30,000-30,500/ animal⁻¹ year⁻¹

Sheep breed upgradation: NARI Suwarna sheep was introduced to increase the twinning and litter size in sheep. This breed ewes produce milk for raising twin lambs to a weaning weight of 13-15 kg each in 3-4 months with little supplementary feeding. Flock size gain: 15-25 lambs year⁻¹ (60-70%), net returns: ₹20,000-50,000 unit⁻¹ year⁻¹.

Module 4: Integrated farming systems

Combination of small ruminants/livestock with crop, horticulture crops etc. Eg: crop straw can be fed to cattle and cattle dung can be used for crops. additional cost of cultivation: ₹ 70,000-75,000 ha⁻¹, net Returns: ₹ 1,00,000 - 1,15,000 ha⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Water harvesting through farm ponds, check dams, artificial recharging of borewell etc.	Community convergence	Depends on the size of the pond 10×10×3: 45,000
Supplemental irrigation with harvested water	Community	Diesel pump :1,200 ha ⁻¹
Compartmental bunding and conservation furrows for <i>in-situ</i> moisture conservation	Individual	Additional cost: : 2,000 ha ⁻¹

Module 2a: Crop based interventions

Crop	Variety	Method
Bengalgram	JAKI-9218	Seed bank
Greengram	DGGV-2	Seed bank
Maize	DHARMA-150125	Seed bank
Redgram	TS-3R and GRG-152	Seed bank
Rabi Sorghum	SPV-2217	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Rabi sorghum alone	18,000-19,000	20,000-21,000
Rabi sorghum + 1 cross breed cow + 10 sheep	92,000-94,000	1,20,000-1,40,000
Maize + redgram intercropping alone	45,000-47,000	75,000-85,000
Maize + redgram intercropping + Drought tolerant grass species, silage enrichment + 1 cross breed cow + 10 sheep	1,20,000-1,22,000	1,85,000-1,90,000
Improved greengram var. DGGV-2	30,000-31,000	55,000-65,000
Improved greengram var. DGGV-2 + Drought tolerant grass, silage enrichment + 1 cross breed cow	60,000-64,000	1,00,000-1,15,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Silage preparation	Fodder maize	Individual	2,500-3,000 t ⁻¹
Cage system of poultry	Swarnadhara	Back yard poultry	12,000-15,000
Perennial fodders	Guinea grass, Rhodes grass, Signal grass, Hedge Lucerne		30,000 ha ⁻¹
Sheep	NARI Suwarna (10 sheep+1 cow)	Improved breed	44,800/ unit

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 4: Haveri

Climate vulnerability: Drought

A. Introduction/ Background

- Haveri district, situated in the Transitional Zone of Karnataka, experiences high rainfall variability, intermittent dry spells, and increasing incidence of drought particularly during critical crop growth stages.
- The district receives an average annual rainfall of about 800–850 mm, with temperature ranging between 18–36 °C.
- Agriculture in Haveri is predominantly rainfed, covering approximately 85–88% of the net sown area, while irrigation accounts for only about 12–15%.
- Soils in the district are mainly black soils along with red loam and red sandy loam soils.
- Field crops: Maize, jowar, rice, chickpea. Plantations: Arecanut, banana, mango
- Livestock constitutes a key component of the farming system, contributing significantly to income diversification, nutritional security, and resilience against climate stress.
- The district offers substantial scope for improving farm productivity and livelihoods through convergence-based, climate-resilient strategies emphasizing integrated crop–livestock systems, improved fodder production, rainwater harvesting, and sustainable natural resource management. Need-based, outcome-oriented interventions implemented in climate-smart village Rahutanakatti. The major outcomes were.

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Trench-cum-bund: In-situ moisture conservation.

TCB of $5 \times 1.2 \times 0.6$ m L×W×D were formed in the summer before the onset of monsoon.

Increase in yield: 15-30 %,

net returns: ₹ 35,000 - 40,000 ha⁻¹

Crops: Maize + redgram intercropping system, maize, redgram, foxtail millet, *rabi* sorghum, guava, mango, drumstick, curry leaf

Compartmental Bunding: Compartmental bunds of 5 m × 5 m or 10 m × 10 m, with a bund height of 30 cm were formed depending on the slope with a bund former. Crops: *Rabi* sorghum, chickpea

Increase in crop yield: 25-50%, net returns: ₹ 20,000-23,000 ha⁻¹,

cost of cultivation: ₹ 47,000-48,000 ha⁻¹

Conservation furrows: Conservation furrows of 40 cm width and 20 cm depth were formed between the crop rows at 40 days after sowing (DAS) during interculture operations using a bullock-drawn ridge plough. This practice was followed for all crops, maize + redgram intercropping system, maize, redgram, foxtail millet, *rabi* sorghum. cost of preparation: ₹ 2,200 ha⁻¹. Increase in crop yield: 11- 17%. Seed priming with Calcium Chloride @ 2% to enhance germination percentage, KNO₃ spray @ 0.5%

Additional net returns:

NRM based interventions

Trench cum bunding: ₹12,000- 20,000 ha⁻¹

Compartmental bunding: ₹ 5,000 - 30,000 ha⁻¹

Conservation furrows in

Cereals and pulses: ₹ 9,000 - 10,000 ha⁻¹

at 30 and 60 DAS during, flowering and grain development stages helps to sustain moisture stress during drought.

Module 2: Crop based interventions

Crop diversification with millets: Finger millet variety KMR-630 is a short-duration, drought-tolerant and seed treatment with *Azospirillum*

and line sowing with seed drill. Increase in yield: 25-30%, net returns: ₹ 43,000-44,000 ha⁻¹, cost of cultivation: ₹ 38,000-39,000 ha⁻¹.

Foxtail millet- DHFT-109-3: Drought-tolerant and high-yielding variety + seed treatment with *Azospirillum* and line sowing with seed drill. Increase in yield over finger millet: 10-25%, net returns: ₹ 52,000-53,000 ha⁻¹, cost of cultivation: ₹ 26,000-27,000 ha⁻¹.

Maize + redgram intercropping (5:1): TS-3R redgram variety (medium duration), seed treatment in redgram with *Trichoderma* @ 10 g kg⁻¹ seeds, PSB and *Rhizobium* @

20 g kg⁻¹ seeds + Foliar application of 19:19:19 and pulse booster @ 1% during vegetative and flowering stage to enhance pod setting. 1% KNO₃ foliar spray to impart drought tolerance. Increase in yield: 40-45%, net returns: ₹ 15,000-25,000 ha⁻¹, cost of cultivation: ₹ 53,000-54,000 ha⁻¹.

DGGV-2: Greengram var. Non-shattering high yielding variety and seed treatment with *Trichoderma* @ 10 g kg⁻¹ seeds, PSB and *Rhizobium* @ 20 g kg⁻¹ seeds.

Increase in yield: 30-35%, net returns: ₹ 20,000-25,000 ha⁻¹

Promotion of dryland horticulture: Crop diversification with drumstick variety Bhagya instead of sorghum crop. cost of cultivation: ₹ 1,20,000 - 1,45,000 ha⁻¹.

Additional net returns:

Crop diversification with millets

Finger millet - KMR 630: ₹ 4,000 - 5,000 ha⁻¹

Foxtail millet -DHFT -109-3: ₹ 10,000 - 13,000 ha⁻¹

Additional net returns:

Maize + redgram (5:1) intercropping: ₹ 10,000-12,000 ha⁻¹

Additional net returns:

Improved varieties

DGGV-2: ₹15,000 -16,000 ha⁻¹

Dryland horticulture: ₹1,50,000-1,90,000 ha⁻¹

Module 3: Livestock based interventions

Year-round green fodder production:

Multi-cut fodder sorghum (CoFS-31) and Fodder tree (*Sesbania grandiflora*).

Cow increase in milk yield: 25-35%, net returns: ₹ 44,000 - 56,000 animal⁻¹, cost of production: ₹35,000 - 36,000 ha⁻¹.

Additional net returns:

Livestock based interventions

Year-round green fodder production: ₹ 18,000- 20,000 animal⁻¹ year⁻¹

Supplementation with vitamins and area specific mineral mixture to sheep: ₹ 5,000 - 7,000 animal⁻¹ year⁻¹

Supplementation with vitamins and area specific mineral mixture to sheep: Feeding of sheep with vitamins and area specific mineral mixture. Increase in body weight: 10-15%, net returns: ₹ 66,000-67,000 animal⁻¹ year⁻¹, cost of rearing: ₹ 21,000-22,000 animal⁻¹ year⁻¹

Module 4: Integrated farming systems

Combination of livestock with crop, horticulture crops etc. by recycling one by product to other by product. Eg: crop residues etc. can be fed to cattle and cattle dung can be used for crops. Can enhance opportunity for organic farming.

Rainfed with animal: cost of cultivation: ₹1,40,000 -1,45,000 (64%) ha⁻¹,
net Returns: ₹ 3,10,000 -3,16,000 ha⁻¹ (70%-75%).

Irrigated with animal: cost of cultivation: ₹ 1,50,000 -1,55,000 ha⁻¹ (57 %),
net returns: ₹ 3,50,000 -3,90,000 ha⁻¹ (75 -80%)

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Trench cum bunding	Individual	4,500
Compartmental Bunding	Individual	5,750 (for compartmental bunds) 49,500
Conservation furrows	Individual	2,200

Module 2a: Crop based interventions

Crop	Variety	Method
Finger millet	KMR-630	Individual
Foxtail millet	DHFT-109-3	Individual
Redgram	TS-3R	Individual
Maize	Private hybrid	Individual
Greengram	DGGV-2	Individual
Drumstick	Bhagya	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Integrated farming systems	Rainfed: 1,40,000 -1,50,000 (60-65% higher than crop alone) Irrigated: 1,50,000 -1,60,000 (50% higher than crop alone)	Rainfed: 3,10,821 (70-75% higher than crop alone) Irrigated: 3,94,339 (75-80% higher than sole crop alone)
Maize + Redgram Intercropping system with ICM practices	50,000-55,000 (8% higher than sole without ICM)	88,039

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Fodder sorghum and <i>Sesbania grandiflora</i>	CoFS-31, <i>Sesbania grandiflora</i> on bunds to cows	Individual	Rainfed: 30,000 -35,000 ((2-5% higher than dry fodder -farmers practice) Irrigated 40,000-45,000
Mineral mixture to sheep	Vitamin and Mineral feed supplements to sheep.	Individual	20,000- 25,000 (5-7% higher than farmers practice)

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 5: Koppal

Climate vulnerability: Erratic rainfall, High Temperature

A. Introduction/ Background

- Koppal district, located in the Northern Dry Zone of Karnataka, is highly vulnerable to recurrent droughts, erratic rainfall, and prolonged dry spells.
- The district receives an average annual rainfall of about 550–600 mm, with temperatures ranging from 17–39 ° C, often experiencing heat stress during summer.
- The rainfed and irrigated area are 65%, 35% respectively. Primarily dependent on canals from the Tungabhadra command, tanks, and groundwater.
- Soils are predominantly medium to deep black soils and red sandy loam soils.
- Crops: Paddy (command areas), maize, chickpea, mungbean and sorghum. Plantations: Coconut, potato, tapioca and ginger.
- Livestock forms a core component of livelihoods, providing income stability during crop failure. However, water scarcity and fodder shortages during drought years result in declining milk yield, growth, and reproductive performance.
- The district has strong potential for enhancing productivity and livelihoods through convergence, climate-resilient interventions focusing on integrated crop livestock systems, fodder security, water harvesting, and sustainable natural resource management, with need-based, outcome-oriented implementation leading to improved resilience and farm incomes.

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Direct seeded rice(DSR): DSR is an alternate method for puddled rice cultivation. Labour saving: 40–45%, Irrigation water saving: 50-60%, Crop maturity: 7–10 days earlier than transplanted rice, Increase in yield: 8-10%, net returns: ₹ 1,10,500- 1,11,000 ha⁻¹

Additional net returns:

NRM based interventions

DSR:	₹ 20,000 -25,000 ha ⁻¹
Ridge and furrow method:	₹17,000 - 18,000 ha ⁻¹
Supplemental irrigation:	₹ 20,000 -21,000 ha ⁻¹

Ridge and furrow method: The rainfall was stored in the furrow, and this moisture is stored for 5-7 days. Increase in yield: 18-23%

Supplemental irrigation: Lifesaving irrigation was given from harvested water through drip irrigation at critical stages during dry spells of different crops. Increase in yield: 60-65 %

Module 2: Crop based Interventions

Saline tolerant paddy: Paddy variety GNV-1109 is a salt tolerant, medium duration (125-130 days), non-shattering and moderately resistant to leaf blast disease. Increase in crop yield: 8-12%,

Improved varieties of millets: Finger millet variety HR-13 and foxtail millet variety HN-46 are drought tolerant and short duration varieties. Increase in finger millet yield: 10-15%, net returns: ₹ 55,600- 55,900 ha⁻¹

Increase in foxtail millet yield: 30-35%, net returns: ₹ 35,200 - 35,500 ha⁻¹

VPMH-14 Biofortified short duration pearl millet: Increase in crop yield: 28-32%, net returns: ₹ 32,100- 32,350 ha⁻¹

CRHG-19 Improved horse gram variety: is a drought tolerant variety. Increase in yield: 2-5%

Maize + Pigeon pea (6:1) intercropping: Increase in yield: 25-30 %,

Module 3: Livestock based Interventions

Area specific mineral mixture: Nutrient supplementation to milch animals to mitigate the climate stress. Increase in milk yield: 5-10%, net returns: 8-10%

Additional net returns:

Livestock based Interventions

Area specific mineral mixture ₹ 5,000-6,000 animal⁻¹ year⁻¹

Module 4: Integrated farming systems

Combination of small ruminants/livestock with crop, horticulture crops etc. by recycling one by product to other by product. Eg: crop straw etc. can be fed to cattle and cattle dung can be used for crops. Can enhance opportunity for organic farming.

additional cost of cultivation: ₹ 75,217ha⁻¹, net returns: ₹ 1,18,163 ha⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
DSR (Direct seeded rice)	Individual	38,000
Drip irrigation	Individual	65,000 -70,000
Ridges and furrows	Individual	2,000-2,500

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	GNV-1109	Seed bank
Finger millet	HR-13	Seed bank
Foxtail millet	HN-46	Seed bank
Pearl millet	VPMH-14	Seed bank
Horse gram	CRHG-19	Seed bank
groundnut	G 2-52	Seed bank

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹ ha ⁻¹)
Fodder sorghum	CoFS-31	Fodder bank	20,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centers with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centers, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 6: Tumkur

Climate vulnerability: Drought

A. Introduction/ Background

- Tumakur district, located in the Central Dry Zone of Karnataka, experiences high climatic variability and recurrent droughts, with frequent dry spells and terminal droughts.
- The district receives an average annual rainfall of 669 mm, with temperatures ranging from 20 to 32 ° C.
- Soils are predominantly red sandy loam and red soils, characterized by low organic carbon and poor moisture-holding capacity, leading to moisture stress under rainfed conditions.
- The irrigated and rainfed area were 52% and 48% respectively. Hence efficient water and soil management is critical.
- Field crops: Finger millet, groundnut and maize. Plantations: Coconut, arecanut. Vegetables: Tomato, chillies
- Livestock is a key livelihood, but milk productivity remains low due to fodder scarcity, poor-quality feed, limited veterinary services, and weak market linkages.
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages D. Nagenahalli, Tanganahalli and Chikkadoddavadi, Koratagere Taluk. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Water harvesting structures: New: 81 new farm ponds, 5 new check dams, Renovation through desilting: 15 farm ponds, 3 community tanks and

13 percolation ponds. Desilting and widening of catchment channel for 2.1 km length. Size of farm ponds depend on the size of catchment area. Farmers benefitted: 200

Supplemental irrigation: Harvested rainwater from water harvesting structures was used for life saving supplemental irrigation during prolonged dry spells (> 20 days) coinciding with the tillering stage and flowering stages in finger millet to reduce the impact of drought.

Water harvesting structures

Total rain water harvested: 44.2 crore L
Increase in irrigated area: 25%

Additional net returns:

Supplemental irrigation

Finger millet:	₹9,000 - 10,000 ha ⁻¹
Groundnut:	₹ 20,000 - 25,000 ha ⁻¹
Tomato:	₹ 49,000 - 50,000 ha ⁻¹
Pigeonpea:	₹ 10,000 - 11,000 ha ⁻¹

Increase in finger millet yield: 55-60%, net returns: ₹ 22,500 - 23,000 ha⁻¹

Increase in groundnut yield: 30-35%, net returns: ₹ 21,500 - 22,000 ha⁻¹

Increase in tomato yield: 35-40%, net returns: ₹ 1,94,000 - 1,95,000 ha⁻¹

Increase in pigeonpea yield: 35-40%, net returns: ₹ 27,000 - 27,600 ha⁻¹

In-situ moisture conservation through Trench cum bunding (Trenches: 5 m length, 1 m width and 0.5 m height, by leaving one-meter berm between each trench) Trenches were made across the slope. Crops: groundnut, redgram and fruit trees. Increase in groundnut yield: 20-30%, net returns: ₹ 33,500-34,000 ha⁻¹

Micro-irrigation:

Drip irrigation in vegetables such as tomato and brinjal. Row to Row spacing: 30-90 cm and plant to plant spacing of 10 to 30 cm. Increase in yield: 35-40% water saving: 30-50%

Additional net returns:

NRM based interventions

Micro irrigation Drip: ₹ 35,000- 40,000 ha⁻¹
Sprinkler: ₹ 15,000- 20,000 ha⁻¹

Sprinkler Irrigation: Groundnut the increase in yields: 35-40 %, water saving: 30- 50%, cost of installation: ₹ 30,000 ha⁻¹

Application of tank silt: Increases moisture holding capacity of soil, and improved the moisture availability for longer duration. Tank silt was applied at the rate of 20 t ha⁻¹ with 3 years interval. The rate of application depends on clay content of soil. Increase in finger millet yield: 25-28 %, net returns: ₹ 20,000-21,000 ha⁻¹, cost of application: ₹ 6,000-6,500 ha⁻¹

Module 2: Crop based interventions

ML 365, ML 322, Indaf -7 finger millet:

short duration drought tolerant varieties.

Increase in yields: 20-35%,

net returns: ₹ 16,310-16,310 ha⁻¹, cost of cultivation : ₹ 22,000-24,000 ha⁻¹

Additional net returns:

Crop based interventions

Improved varieties: ₹10,000 - 15,000 ha⁻¹
Fingermillet + redgram intercrop: ₹ 25,000-30,000 ha⁻¹

Redgram based intercropping: Finger millet + redgram (4:1) and groundnut +pigeon pea (8:2). Increase in yield :30-40% and net returns: ₹ 16,000-17,000 ha⁻¹

Aerobic paddy KMP-175: Water saving: 50%. Increase in yield: 26 - 51%, net returns: ₹ 31,000-32,000 ha⁻¹, cost of cultivation: ₹ 24,000-25,000 ha⁻¹

Crop diversification with Dryland Horticulture high value crops like floriculture, vegetables:

Tamarind, Mango, Anola, Cashew, Jamun trees are planted in a pit size of 2 × 2 ft. at 7 m × 7 m spacing for along with drip irrigation. Increase in the annual net income by 338% saving of two irrigations due to drip irrigation.

Module 3: Livestock based interventions

Multi-cut fodder sorghum: Sorghum var. CoFS-

29 and CoFS-31 for year-round green fodder availability Increase in. milk yield: 18-20 %

net returns: ₹ 55000-56000 animal⁻¹, cost of cultivation: ₹ 39000-39500 animal⁻¹

Additional net returns:

Livestock based interventions

Multi-cut fodder sorghum: ₹ 42,000-43,000 animal⁻¹

Giriraj breed as backyard Poultry: Heat stress management. Egg laying :170 days, 200 eggs /bird/ annum. cost of rearing: ₹ 586 / bird (45% over local bird). net returns: ₹ 600-650 bird⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Water harvesting through pond, check dams etc	Community convergence with MGNREGA	Depends on the size of the pond 10×10×3: 45,000
Supplemental irrigation with harvested water	Community	Diesel pump: 1,200
Application of desilted tank silt	Community/Individual	20,000
Drip irrigation (Vegetables)	Individual	Installation: 65,000 - 70,000 Cost of each irrigation: 250- 350
Sprinkler irrigation	Community/Individual	Installation : 25,000 - 30,000 Cost of each irrigation: 1,500
Trench cum bunding	Individual	20,000

Module 2a: Crop based interventions

Crop	Variety	Method
Finger millet	ML 365, ML 322, Indaf -7	Seed bank
Redgram	BRG-2	Seed bank
Tamarind	Gottipura/PKM1	Nursery
Mango	Alphonso	Nursery
Amla	NA5/7/Krishna/ Kanchana	Nursery
Cashew	Ullal-3/5	Nursery

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Dual purpose maize (MAH-14-5) alone under rainfed	25,353	19,752
Dual purpose maize (MAH-14-5) + Indigenous cow under rainfed	37,263	38,825
Multicut fodder Sorghum CoFS-31 under irrigation	39,470	63,570
Multicut fodder Sorghum CoFS-31 + Cross breed cow under irrigation	82,340	2,36,692

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Multi-cut fodder sorghum	CoFS-29 and 31	Fodder bank	36,000-39,000 ha ⁻¹
Poultry	Giriraj	Backyard poultry	150/ bird

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring Centers with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee: 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition. (Amla processing unit)	Community	Women empowerment

Kerala

District 1: Kannur

Climate vulnerability: Heavy monsoon rainfall

A. Introduction/ Background

- Kannur district is in the Northern part of Kerala, experiencing heavy monsoon.
- The district receives an average annual rainfall of 2832 mm, with temperatures ranging from 20 °C to 35 °C.
- Soils are predominantly red laterite, riverine alluvium, forest and alluvial soils.
- The rainfed and irrigated area are 93 and 7% respectively. The major source of irrigation in the district is open wells and bore wells (85%).
- Field crops: Autumn rice, winter rice, gram Plantation crops: Coconut, cashewnut, arecanut, black pepper.
- Livestock is a key livelihood, but milk productivity remains low due to fodder scarcity, poor-quality feed, limited veterinary services, and weak market linkages.
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart village ‘Chengalayi’. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Husk burial as a soil and water conservation measure in coconut garden: Husk burial in coconut gardens effectively conserves soil moisture, increase in soil potash during decomposition, Increase in coconut yield: 25- 35%, cost of cultivation: ₹ 1,25,000 ha⁻¹, net returns: ₹ 25,000 -75,000 ha⁻¹

Mulching and soil test based nutrient management: Mulching along with soil test based nutrient management is effective for heat stress tolerance.

Panniyur 1 Pepper var.: Increase in yield: 30%-40%, cost of cultivation: ₹ 2,55,000-2,55,000 ha⁻¹, net returns: ₹ 2,19,000 - 4,41,000 ha⁻¹

Ginger var. Varada: Increase in yield: 28-36%, cost of cultivation: ₹ 3,95,000 ha⁻¹, net returns: ₹ 1,09,000 - 2,44,000 ha⁻¹

Additional net returns: NRM based Interventions		
Husk burial:	₹30,000	- 50,000 ha ⁻¹
Enhanced water storage in check dam:	₹ 20,000	- 25,000 ha ⁻¹
Mulching:		
Pepper:	₹ 1,03,000	- 1,95,000 ha ⁻¹
Ginger:	₹ 1,71,000	ha ⁻¹
Turmeric:	₹ 4,65,000	ha ⁻¹
Drip irrigation in banana:	₹ 1,00,000	ha ⁻¹
Field bunds in rice:	₹20,000	ha ⁻¹

Turmeric var. Pratibha: Increase in yield: 35-46%, cost of cultivation: ₹ 3,00,000 ha⁻¹, net returns: ₹ 5,60,000 - 6,60,000 ha⁻¹

Drip irrigation and scientific soil health management in banana var. Nendran: Application of lime to correct soil acidity helps to improve the nutrient absorption and overall plant health in banana var. Nendran. Increase in banana yield: 20%, cost of cultivation: ₹ 4,50,000 ha⁻¹, net returns: ₹ 4,25,000 ha⁻¹

Field bunds for effective management of rice: Field bunds helps to reduce runoff velocity and prevent erosion, cost of construction: ₹ 4,54,000 ha⁻¹. The rice area increased from 5.6 ha to 8.4 ha. Increase in rice yield: 15-20%, net returns: ₹ 62,000 ha⁻¹

Enhance water storage in the existing check dams through installation of wooden planks: Wooden planks in the existing check dam improved water regulation in Chengalayi, enabling second-season rice cultivation. Rice area increased from 2 to 10 ha, and a third short-duration black gram was also cultivated, Increase in rice yield: 20-23%, cost of cultivation: ₹ 75,000 ha⁻¹, net returns: ₹ 40,000- 55,000 ha⁻¹

Module 2: Crop based interventions

Tray nursery preparation and mechanical transplanting in rice: Mechanical transplanting of rice using mat or tray nurseries (seeded 15–20 days earlier) reduces time and labour in transplanting.

Increase in rice yield: 10%-20%,

cost of cultivation: ₹ 75,000 ha⁻¹, net returns: ₹ 15,000 -18,000 ha⁻¹

Additional net returns:

Crop based Interventions

Mechanical transplantation:	₹19,000 - 25,000 ha ⁻¹
Gajendra Amorphophallus variety:	₹45,000 - 60,000 ha ⁻¹
Rice -Amaranthus system:	₹50,000 - 60,000 ha ⁻¹
Rice-blackgram system:	₹ 25,000 - 30,000 ha ⁻¹
Sampoorna KAU multimix spray:	₹20,000 - 25,000 ha ⁻¹

Gajendra Amorphophallus variety in homesteads: Increase in crop yield: 8-15%, cost of cultivation: ₹ 1,65,000 ha⁻¹, net returns: ₹ 2,90,000 - 3,60,000 ha⁻¹

Rice - Amaranthus (Arun) cropping system with improved varieties:

Increase in system yield:22-25%, cost of cultivation: ₹ 1,75,000 ha⁻¹,

net returns: ₹ 1,40,000 - 1,45,000 ha⁻¹

Rice - blackgram system: Increase in system yield: 22-25%, net returns: ₹ 55,000 - 75,000 ha⁻¹ cost of cultivation: ₹ 1,10,000 ha⁻¹,

Sampoorna KAU multi mix micronutrient spray in paddy with drone for higher nutrient use efficiency: Sampoorna KAU multi mix, containing essential micronutrients is applied at 5 g L⁻¹ before transplanting and 10 g L⁻¹ at 30 and 50 DAT is sprayed with drone. Increase in crop yield: 18-20%, cost of cultivation: ₹ 77,000 ha⁻¹, net returns: ₹ 50,000-55,500 ha⁻¹

Module 3: Livestock based Interventions

Susthira Hybrid Napier: For year-round supply of the fodder. cost of cultivation: ₹ 1,50,000 ha⁻¹.

Increase in fodder yield: 53%, net returns: ₹ 2,70,000 ha⁻¹,

increase in milk yield: 5-8%, cost of production: ₹ 98,000 animal⁻¹, net returns: ₹ 1,68,000 animal⁻¹

Additional net returns:

Livestock based Interventions

Fodder grass hybrid Napier var. Susthira:
Fodder: ₹80,000 ha ⁻¹ , Milk: ₹5,500 animal ⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Husk burial as a soil and water conservation measure in coconut garden	Individual	1,25,000
Mulching and soil test based nutrient management for heat stress tolerance	Individual	2,45,000 - 2,55,000
Drip irrigation and scientific soil health management in banana <i>var.</i> Nendran	Individual	4,50,000
Field bunds for effective management of rice	Individual	1,500-2,000
Enhance water storage in the existing check dams through Installation of wooden planks:	Community	75,000

Module 2: Crop based Interventions

Crop	Variety	Method
Pepper	Panniyur 1	Seed bank
Banana	Nendran	Nursery
Rice	Manuratna	Seed bank
Amaranthus	Arun	Seed bank
Amorphophallus	Gajendra	Seed bank

Module 3: Livestock based Interventions

Livestock	Breed/ variety	Method	Cost (₹ ha ⁻¹)
Napier	Susthira	Fodder bank	1,50,000

Institutional Interventions

Intervention	Management	Purpose
Custom Hiring Centers with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee 12-20 members	Coordinates activities such as seed banks, fodder banks, custom hiring centers and guide seasonal action plans

District 2: Kasaragod

Climate vulnerability: Drought, Flooding in river banks, wind damages, Sea erosion

A. Introduction

- Kasargod district is in the northern part of Kerala, is increasingly affected by climate extremes like drought, flooding along river banks, wind damages and sea erosion.
- The district receives an annual rainfall of 3980 mm, with temperatures ranging from 23°C to 31°C.
- Soils are predominantly gravelly laterite, forest and loamy soils.
- The rainfed and irrigated area are 62 and 38% respectively.
- The major source of irrigation in the district are wells and tanks (96%).
- Field Crops: Rice, chickpea Plantations: Coconut, arecanut, cashewnut and black pepper.

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Contour Trenching in coconut garden: Contour trenches (40 × 0.8 × 0.8 m) helps in *in-situ* moisture conservation to reduce runoff and enhance infiltration into the root zone. Water saving : 25-30%.

Increase in coconut yield: 28 -33%, net returns: ₹ 70,000 -80,000 ha⁻¹

Additional net returns:

NRM based Interventions

Contour Trenching in coconut garden:	₹ 42,000-45,000 ha ⁻¹
Husk burial in coconut garden:	₹ 30,000-50,000 ha ⁻¹
Drip irrigation in Banana:	₹10,000 -15,000 ha ⁻¹

Inter cultivation and coconut husk burial in coconut garden using garden tiller:

Increase in crop yield: 25-35%, net returns : ₹ 80,000-85,000 ha⁻¹, cost of cultivation: ₹ 1,25,000 ha⁻¹

Micro-irrigation (Vegetables and Banana): Increase in crop yield :30–50%, net returns: ₹40,000 -45,000 ha⁻¹, cost of cultivation : ₹45,000 ha⁻¹ water saving 30%

Integrated Farming (Crops + Livestock/Fish): Increase in yield: 20-30%, net returns: 40-70%, cost of cultivation: 10-15%

Windbreaks and Shelterbelts (Coastal areas) with Casurina /Glyricidia:

Increase in yield: 10-15%, net returns: 15-20%, cost of cultivation: 5-8%

Module 2: Crop based Interventions

Introduction of salt tolerant rice: Ezhom-4, a salt-tolerant improved rice variety was introduced in the Kaipad coastal ecosystem to replace traditional rice.

Increase in crop yield: 40-45%, net returns: ₹ 26,400-26,800 ha⁻¹, cost of cultivation: ₹ 74,380 ha⁻¹

Additional net returns:

Crop based Interventions

Rice variety Ezhom-4:	₹ 30,000-50,000 ha ⁻¹
Manuratna, rice variety:	₹ 20,000-25,000 ha ⁻¹

Micronutrient application in rice field with drone: Drone-assisted micronutrient spraying in rice reduces labour and time. Time taken for drone spray: 0.25 h ha⁻¹; Manual spray: 7.4 h ha⁻¹, labour and time saving: 95%, net returns: ₹ 6,000-6,600 ha⁻¹ (85-90% higher), cost of cultivation: ₹ 65,000 ha⁻¹

Manuratna, Flood-tolerant short-duration rice varieties: Manuratna, Increase in yield: 15-25%, net returns: ₹50,000 -₹55,000 cost of cultivation: ₹ 75,000 ha⁻¹

Module 3: Livestock based Interventions

Susthira hybrid Napier fodder grass.: Fodder production through improved fodder hybrid Napier var. Susthira Increase in productivity: 50-55%, cost of cultivation: ₹1,30,000 -1,50,000 ha⁻¹ net returns: ₹1,20,000 -1,30,000 ha⁻¹

Additional net returns:

Livestock based Interventions

Susthira:Hybrid Napier : ₹ 50,000-55,000 ha⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Contour Trenching in coconut garden	Individual	25,000

Module 2: Crop based Interventions

Crop	Variety	Method
Rice	Ezhom-4	Seed bank/ Community Nursery

Module 3: Livestock based Interventions

Livestock	Breed/variety	Method	Cost (₹)
Hybrid Napier	Susthira	Fodder bank	25,000 ha ⁻¹
Mineral mixture	Area specific	50-60 gm in cows and 20-30 gm in goat/ sheep per day	3.0 per day per cow and 1.5 per day per goat

Institutional Intervention

Intervention	Management	Purpose
Custom hiring centre	Community	Provide essential machinery
Women empowerment	Community	Post-harvest value addition
VCRMC	Community, committee: 12-20 members	Coordinates activities such as seed banks, fodder banks, custom hiring centres and guide seasonal action plans
Vermicomposting of crop residues	Individual/ community	Recycling of crop residues and to increase soil fertility

District 3: Kozhikode

Climate vulnerability: high intense rainfall during monsoon and prolonged dryspell during summer

A. Introduction

- Kozhikode district, located in the south-western Malabar coast of Kerala, experiences high intense rainfall during monsoon and prolonged dry spells during summer.
- The district receives an average annual rainfall of 2588 mm, with temperatures ranging from 23°C to 34 °C.
- Soils are predominantly coastal/river alluvium and laterite soils.
- The rainfed and irrigated area are 97 and 3%, respectively. The major source of irrigation in the district is wells and tanks (96%).
- Field crops: Summer rice, winter rice Plantation: Coconut, arecanut, black pepper
- Livestock and fishery is a key livelihood, but milk productivity remains low due to fodder scarcity, poor-quality feed, poor scientific management of fish farming.
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart village ‘Maruthomkara’. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Scientific Kuttiady method of coconut cultivation: This method involves pit modification using native topsoil, FYM (25–30 kg), and organic residues, followed by formation of circular basins filled with coconut husk and coir pith compost to enhance moisture retention. Lime application along with compost corrects soil acidity and improves nutrient availability. Raising cowpea as a cover crop provides ground cover, reduces evaporation, controls weeds and minimizes soil erosion, resulting in improved soil health and enhanced coconut productivity. Increase in crop yields: 8-11%, cost of cultivation: ₹ 65,000-70,000 (3% higher over farmers practice), net returns: ₹ 20,000-25,000 ha⁻¹.

Additional net returns:

NRM based Interventions

Scientific Kuttiady in coconut: ₹ 20,000-25,000 ha⁻¹

Farm pond: The flood water can be collected in a pond. A pond of 20.8 m³ (5 m × 3.2 m × 1.3 m; 20,800 litres capacity) supports small-scale aquaculture, including air-breathing fish culture, as an integrated and sustainable farming solution. The fish can be introduced. Increase in fish yield: 1-1.85 kg/m². Increase in net returns: ₹ 130-240 m²

Module 2: Crop based Interventions

IISR Varada early sowing variety of Ginger: Increase in crop yield: 30-35%, cost of cultivation: ₹ 8,00,000-8,20,000 ha⁻¹, net returns: ₹ 10,05,715 – 12,10,715 ha⁻¹

IISR Pragati Short duration turmeric

variety: Increase in crop yields: 13-25%,
cost of cultivation: ₹ 3,65,000-4,14,300 ha⁻¹
(1-5 % higher),
net returns: ₹ 3,31,000-4,45,000 ha⁻¹

CO-8 and KKM-3 are short duration green gram varieties for rice fallows:

Perform well
in summer rice fallows utilizing the residual moisture in the field.

Increase in crop yields: 34-56%, cost of cultivation: ₹15,000-20,000 ha⁻¹ (35-57 % less),
net returns: ₹ 23,000- 40,000 ha⁻¹

Sree Padma drought tolerant elephant foot yam variety: Increase in crop yields: 7-10%,
net returns: ₹ 8,00,000- ₹10,00,000 ha⁻¹, cost of cultivation: ₹ 9,30,000-9,450,000 ha⁻¹

CO-8 Green gram variety + Foliar application of Pulse Wonder through Drone:

Increase in crop yields: 60-65%, net returns: ₹ 20,000- 22,000 ha⁻¹
cost of cultivation: ₹ 15,000-22,000 ha⁻¹ (35-40 % higher),

Cultivation of improved varieties of vegetables tolerant to high rainfall: Improved Amaranthus
var. Vlathankara cheera): Increase in crop yields: 25-30%, net returns: ₹ 3,60,000-3,65,000 ha⁻¹,
cost of cultivation: ₹ 2,70,000-2,80,000 ha⁻¹. Salkeerthi Improved variety of Okra:

Increase in crop yields: 10-20%, cost of cultivation: ₹ 20,000-2,50,000 ha⁻¹,
net returns: ₹ 2,50,000 – 3,00,000 ha⁻¹

Module 3: Livestock based Interventions**Perennial fodder production along with**

mineral feed supplementation: Introduction
of improved varieties of Hybrid Napier, Super
Napier and KAU Susthira along with mineral

feed supplementation to cows enhance milk yield. Increase in milk yield: 2-10%,
net returns: ₹ 70,000-80,000 animal⁻¹, cost of cultivation: ₹ 69,000-80,000 animal⁻¹

Culture of air breathing fishes to tide over water scarce situations: Air-breathing murrel
culture helps to manage water scarcity, as hardy species tolerate low oxygen and minimal water,
sustaining aquaculture. Increase in yield: 1-1.85 kg m⁻², increase in net returns: ₹130-240 m⁻²,
rearing cost: ₹ 250-300 m⁻²

Integrated fish farming in weed infested coconut palm channels: Introducing murrel fish culture
in Salvinia-infested coconut channels converts unused waterways into productive systems, enhancing
overall farm income. Increase in yield: 175-200%, increase in net returns: ₹ 25,00,000-30,00,000 ha⁻¹,
rearing cost: ₹ 41,00,00-43,00,000 ha⁻¹

Additional net returns:		
Crop based Interventions		
Improved varieties		
IISR Varada Ginger:	₹ 90,000	- 1,00,000 ha ⁻¹
IISR Pragati turmeric:	₹ 38,500	- 39,000 ha ⁻¹
CO-8 and KKM-3 green gram:	₹ 15,000	- 16,000 ha ⁻¹
Sree Padma elephant foot yam:	₹ 3,30,000-	3,50,000 ha ⁻¹

Additional net returns:	
Livestock based Interventions	
Perennial fodder production:	₹ 13,000-15,000 animal ⁻¹

C. Strategic Interventions for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Scientific Kuttiady method of coconut cultivation	Individual	61,600 -62,600
Farm pond	Community/Individual	25,000 (5 m × 3.2 m × 1.3 m)
Raised bed cultivation of vegetables	Individual	80,000 - 85,000

Module 2a: Crop based Interventions

Crop	Variety	Method
Turmeric	IISR Pragati	Seed bank
Green gram	KKM-3 and CO-8	Seed bank
Amaranth	Vlathankara cheera	Seed bank
Elephant foot yam	Sree padma, Gajedra	Seed bank

Module 2b: System based interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Integrated fish farming in weed infested coconut palm channels and rain water harvesting	41,00000	30,00,000
Coconut based system (Intercropping of pepper/pineapple)	70,000-80,000	1,30,000-2,00,000

Module 3: Livestock/Aquaculture based Interventions

Livestock/Aquaculture	Breed/variety	Method	Cost (₹)
Perennial fodder production along with mineral feed supplementation	Hybrid Napier, Super Napier and KAU Susthira	Fodder bank	76,650 ha ⁻¹
Culture of air breathing fish for water scarce conditions	Murrel	Individual	250-300 m ⁻²

Institutional Interventions

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

Madhya Pradesh

District 1: Dindori

Climate vulnerability: Drought, dry spells

A. Introduction/ Background

- Dindori district, situated in the eastern part of Madhya Pradesh, is characterized by high rainfall variability, undulating terrain, and frequent dry spells during the cropping season.
- The district receives an average annual rainfall of about 1200 mm, largely concentrated during the southwest monsoon, with temperatures ranging from 18-32 °C. Soils are mainly red sandy loam soils, low in organic carbon and available nutrients.
- Agriculture in the district is predominantly rainfed (around 93%), with very limited irrigated area (8%).
- Field crops: Paddy, maize, masoor and small millets (kodo and kutki), Plantations: Mango, papaya, and vegetables are grown on a limited scale.
- Livestock forms an integral component of the farming system, particularly indigenous cattle and goats; however, productivity remains low due to inadequate fodder availability and poor genetic potential
- The district offers considerable scope for enhancing farm productivity and household income through convergence-based, climate-resilient interventions, emphasizing integrated crop–livestock systems, natural resource management, and millet-based nutrition security. These interventions were implemented in selected climate-smart villages Padariya and Dhanauli. The major outcomes were

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Desilting of community ponds

Supplemental irrigation with harvested water:

Increase in paddy yield: 33%, Maize: 23%,
net returns in rice ₹45,000-50,000 ha⁻¹,
net returns in maize ₹34,000-40,000 ha⁻¹,

Additional net returns:

NRM based interventions

Supplemental irrigation	
Paddy and maize:	₹ 7,000 - 11,000 ha ⁻¹
Minimum /conservation tillage	
Mustard:	₹10,000 - 12,000 ha ⁻¹
Linseed and Chick pea:	₹12,000 - 14,000 ha ⁻¹
Drip irrigation	
Brinjal and Tomato:	₹ 25,000 - 26,000 ha ⁻¹
Sprinkler in Wheat:	₹ 20,000 - 22,000 ha ⁻¹

SRI: System of Rice Intensification (SRI) with improved variety JR-206. Seed saving: 55%,
Increase in crop yield: 40–45%, net returns: ₹15,000-20,000 ha⁻¹,
cost of cultivation: ₹ 20,000-25,000 ha⁻¹

Minimum tillage in *rabi* crops: *Rabi* mustard (var RH 761) can be sown with zero/minimum tillage after harvest of maize, Increase in crop yield: Mustard: 60 %, net returns: ₹ 20,000-30,000 ha⁻¹,
cost of cultivation: Mustard: ₹ 34,000 -35,000 ha⁻¹,

In rice fallows after paddy harvest Linseed (var JLS -67)/chick pea (JG 36) with minimum tillage can be sown. Saving in seed: 40-50%, Saving in labor: 2-3 man days, Productivity : linseed: 55%

chickpea :40-45%, cost of cultivation : Linseed: ₹37,000-40,000, chickpea: ₹ 40,000 -45,000
net returns : Linseed: ₹ 30,000 -34,000 ha⁻¹, Chickpea: ₹ 25,000 -30,000 ha⁻¹

Broad Bed and Furrow: Beds of 90-95 cm wide and furrows of 15 cm deep. Increase in crop yield
Maize: 20 - 27 %, Water use efficiency: 25-30% ,cost of the intervention: ₹4,000 -5,000 ha⁻¹

Micro irrigation system (MIS): MIS deliver water directly to the root zone of crops through drip, ensuring precise and efficient water use.

Drip Irrigation: In vegetables like brinjal and tomato drip irrigation can be practiced. Increase in crop yield: 33- 42%, cost of installation of drip system: ₹ 75,000 ha⁻¹, water saving: 30-50%
net returns: ₹1,88,000 -₹ 1,90,000, ha⁻¹

Sprinkler irrigation: Increase in maize yield: 30 %. Water saving in wheat: 25- 45%.
net returns: ₹60,000 - 65,000 ha⁻¹, sprinkler installation cost: ₹ 35,000 ha⁻¹.

Module 2: Crop based Interventions

JR 206 and JR 21 paddy suitable for fully irrigated / limited irrigation conditions.

Increase in crop yield: 20-40%,
cost of cultivation: ₹ 20,000-23,000 ha⁻¹,
net returns: ₹ 35,000- 40,000 ha⁻¹

Additional net returns: Crop based interventions

Improved varieties	
JR 206 and JR 21 Rice:	₹ 17,000 - 17,500 ha ⁻¹
JK-137 kodo Millet:	₹ 7,000 - 8,000 ha ⁻¹
MPO 1255 and MP 3465 Wheat:	₹ 15,000 - 15,500 ha ⁻¹
JNS- 30 Niger:	₹ 6,000 - 6,500 ha ⁻¹

JK-137, kodo millet: drought tolerant, suitable for rainfed condition, increase in crop yield: 80 – 85%,
cost of cultivation: ₹ 5000 - 5500 ha⁻¹, net returns: ₹14,000 - 15,000 ha⁻¹

MPO 1255 and MP 3465 wheat: suitable for rainfed conditions and resistant to diseases.
Increase in crop yield: 25%,

JNS- 30 Niger: Increase in crop yield: 18-20%,

Crop diversification with Dryland Horticulture: Agri Horti models of Amla NA-7, Kanchan, and Chakiya for standard plantation at 6×6 m spacing, high density plantation 3×3 m spacing, mango and guava with kodo–kutki millets and niger and lentil as intercrops along with drip irrigation through supplemental irrigation from farm pond and *in-situ* moisture conservation (TCB). net income > 200%

Module 3: Livestock based interventions

Composite fish farming: Stocking rate: Fingerlings of Rohu, Katla, Mrigal @ 10,000 quality fingerlings per pond (0.8 ha area). **Nutrient management:** Application of liquid micronutrient premix: 6% zinc, 2% magnesium and manganese, 1% boron, and trace molybdenum at a rate of 2.5 L/ ha⁻¹, month, applied for four months from the last week of August. Increase in fish yield: 35-40%,
cost of production: ₹ 85,000-90,000 ha⁻¹, net returns: ₹ 90,000-1,00,000 ha⁻¹

Additional net returns:

Livestock based interventions

Rohu, Katla, Mrigal: ₹ 40,000-42,000 ha ⁻¹	
Multi cut sorghum ;	
Kadaknath :	₹ 150 -200 bird ⁻¹

Improved multi-cut fodder: Multi-cut sorghum variety CSV 33 during *kharif*,
increase in milk yield: 15-17 %, net returns: ₹35,000 -40,000 ha⁻¹.
cost of cultivation: ₹16,000 - 20,000 ha⁻¹

kadaknath: A heat stress (>38°C) tolerant poultry breed. Egg laying: About 170 days, 200 eggs / bird/annum. cost of rearing: ₹ 500 / bird (45% higher over local bird), net Returns: ₹300 -400 bird⁻¹.

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
SRI	Individual	20,000-23,000
BBF	Individual	2,000-2,500
Drip Irrigation	Individual	85,000
Sprinkler irrigation	Individual	65,000

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	JR 206 and JR 21	Seed bank
Kodo millet	JK-137	Individual
Wheat	MPO 1255 and MP 3465	Individual
Niger	JNS- 30	Individual
Pigeon pea	Rajeshwari	Seed bank
Linseed	JLS-67	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹ ha ⁻¹)
Crop+ Fish culture in harvested water	65,000 -70,000	1,54,634

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Fish farming	Rohu, Katla, Mrigal	Individual	75,000-85,000
Multi-cut fodder sorghum	CSV 33	Individual	16,000 ha ⁻¹
Poultry	Giriraj	Individual	500 / bird

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 2: Shahdol

Climate vulnerability : Erratic rainfall and high temperature

A. Introduction/ Background:

- Shahdol district, located in the north-eastern part of M.P, is characterized by undulating terrain, high dependence on monsoon rainfall, and frequent intra-seasonal dry spells.
- The district receives an average annual rainfall of about 1000-1200 mm, with temperatures range from 18–32 °C.
- Soils are mainly shallow to medium-depth red sandy loam soils, generally low in organic carbon
- Agriculture in the district is predominantly rainfed (around 92%), with restricted irrigation coverage (8%), therefore, rainwater harvesting, in-situ moisture conservation, and soil health management are critical for stabilizing crop productivity.
- Field crops: Paddy, wheat, maize, kodo millet, kutki (Little millet) pigeonpea, urdbean (Black gram), soybean (in selected pockets), Sesame (Til). Plantations: Mango, guava, papaya are grown in small scale.
- Livestock contributes significantly to household income, with indigenous cattle, goat, and backyard poultry forming the main components, however, animal productivity remains low due to inadequate fodder resources and low genetic potential.
- Shahdol district presents considerable opportunities for enhancing farm productivity and rural incomes through convergence-based, climate-resilient interventions, emphasizing integrated crop–livestock systems, sustainable natural resource management, and millet-based nutrition security. Implementation of these interventions in selected climate-smart villages resulted in improved system resilience, better resource-use efficiency.

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Desilting of check dam and community ponds: Desilting of ponds can be done in convergence. Increased recharge of groundwater in surrounding wells, increased the storage capacity up to 50,000 to 1,00,500 m³, increased the groundwater level by 3 to 5 m.

Desilting of farm ponds: Desilting of community pond increases the water level and water retention capacity.

Desilting of check dams
NRM based interventions
Water storage: 50,000 - 1,00,500 m ³
Groundwater level increased: 3 - 5 m

Silt application: Tank silt can be applied to fields in the range of 20-50 tonnes, but the quantity of tank silt depend on soil type and properties. This practice can be followed at every 3 years interval. cost of application: ₹ 30,000 ha⁻¹.

DSR paddy - Zero-till *rabi* crops: Direct Seeded Rice (DSR) in *kharif* and sowing of wheat and chickpea in *rabi*. Super seeder reduces crop residue burning and greenhouse gas emission through lower diesel consumption.

Paddy – wheat system: Increase in crop yield: paddy: 30-35%, wheat: 25-30% ,
net returns : ₹ 25,000–35,000 ha⁻¹ System cost of cultivation : ₹ 42,000-45,000 ha⁻¹
(10-15% lower cost),

Paddy-chickpea system: Increase in crop yield: paddy: 30-35%, chickpea: 30-40%,
net returns: ₹ 95,000-1,05,000 ha⁻¹ System cost of cultivation: ₹ 35,000-40,000 ha⁻¹
(5-10% lower cost),

Broad bed and furrow in soybean: Raised beds of 90-95 cm wide, with 45-55 cm wide and 15 cm deep, can with stand dry spells up to 20 days, saving in seed rate: 25%. Increase in crop yield: 55-65%, water use efficiency: 41%, net returns: ₹ 40,000 -45,000 ha⁻¹, cost of intervention: ₹ 2,500 -3,000 ha⁻¹

Additional net returns	
DSR -wheat:	₹ 25,000- 35,000 ha ⁻¹
DSR -chickpea system:	₹ 20,000- 25,000ha ⁻¹
BBF:	₹ 12,000- 15,000 ha ⁻¹
Conservation furrows: maize:	₹ 6,000 - 12,000 ha ⁻¹
Drip irrigation:	₹ 25,000- 35,000 ha ⁻¹

Conservation furrows in maize: Increase in crop yield: 15- 25%,
net returns : ₹ 30,000 -35,000 ha⁻¹, cost of intervention ₹ 800 -1,000 ha⁻¹

Drip irrigation + mulching: Water saving: 30-45%, increase in yield: 25-30%

Module 2: Crop based Interventions

DSR paddy with drought tolerant paddy variety (JR 206) JR 206 variety seeds are directly drilled into the fields with a seed drill or drum seeder at optimum moisture level to a depth of 2 to 3 cm. Stomp 30 EC (pre-emergence weedicide) is sprayed @ 2.5 L ha⁻¹ dissolved in 370 L of water after sowing on moist soil. Increase in cop yield: 5% lower, duration: 15 days earlier. cost of cultivation: ₹ 23,000-25,000 ha⁻¹ (4-6% lower), net returns: ₹45,000 - 47,000 ha⁻¹

Additional net returns:	
Crop based Interventions	
Improved crop varieties	
JR 206 Paddy variety:	₹18,000 - 22,000
JS 9560 Soybean variety:	₹ 20,000 - 25,000 ha ⁻¹
DRR 42 Paddy variety:	₹ 25,500 - 30,000 ha ⁻¹
CR Dhan 802 Paddy variety:	₹ 20,000 - 25,000 ha ⁻¹
MPO 1255 Wheat variety:	₹7,000 - 9,000 ha ⁻¹
Aerobic rice:	₹15,000 - 20,000 ha ⁻¹
JR-206, JR-201 SRI varities :	₹ 20,000 - 25,000 ha ⁻¹
Intercropping systems	
Soybean + Pigeonpea (4:2/ 6:2):	₹ 20,000 - 30,000 ha ⁻¹
Maize + Pigeonpea (2:1):	₹ 25,000 - 35,000 ha ⁻¹
Maize + Soybean (2:2):	₹15,000 - 22,000 ha ⁻¹

JS 9560- : Duration: 80-85 days, tolerant to 10 days of dry spell and low-rainfall conditions, during the cropping season. Increase in crop yield: 30-35%, net returns: ₹ 50,000 - 55,000 ha⁻¹, cost of cultivation: ₹ 22,000 - 23,000 ha⁻¹,

SRI with drought tolerant paddy varieties JR-206 and JR-201: Suitable for rainfed and moisture-stress conditions. Increase in crop yield: 40-45%, cost of cultivation: ₹ 23,000 -24,000 ha⁻¹, net returns: ₹ 50,000-60,000 ha⁻¹

DRR 42 paddy variety: Drought-tolerant, suitable for rainfed and direct-seeded rice systems, early vigour, moderate duration. Increase in crop yield: 1,000 -1,500 kg ha⁻¹, net returns: ₹ 55,000 - 65,000 ha⁻¹, cost of cultivation: ₹ 23,000 - 24,000 ha⁻¹

CR Dhan 802 paddy: Tolerant to drought and intermittent moisture stress, early to medium maturing, suitable for both DSR and transplanting. cost of cultivation: ₹ 20,000 - 22,000 ha⁻¹
Increase in crop yield: 20-25%, net returns: ₹46,000 - 55,000 ha⁻¹

MPO 1255 wheat variety: Suitable for timely sown irrigated conditions, good tolerance to lodging and major diseases. Increase in crop yield: 14-18 %, net returns: ₹ 46,000 - 55,000 ha⁻¹
cost of cultivation: ₹ 21,000 - 22,000 ha⁻¹,

Promotion of aerobic paddy cultivation: CR Dhan 200; CR Dhan 201 and CR Dhan 202 varieties can be adopted, 50% water saving. Increase in crop yield: 20-30%, net returns: ₹ 39,000 - 45,000 ha⁻¹

Intercropping systems: For sustainable crop yields under rainfed system.

Soybean + Pigeonpea (4:2/ 6:2): Increase in crop yield: 20-35%, , net returns: ₹ 55,000 - 65,000 ha⁻¹
cost of cultivation: ₹ 24,000–25,000 ha⁻¹

Maize + Pigeonpea (2:1): Increase in crop yield: 25-40% , net returns: ₹ 55,000 65,000 ha⁻¹,
cost of cultivation: ₹ 26,000 - 27,000 ha⁻¹

Maize + Soybean (2:2): Increase in yield: 20-25%, cost of cultivation: ₹ 26,000 - 27,000 ha⁻¹,
net returns: ₹ 55,000 - 65,000 ha⁻¹

Kodo/Kutki + Pigeonpea (6:1): Increase in yield: 25-30% , net returns: ₹ 38,000 - 47,000 ha⁻¹
cost of cultivation: ₹ 16,000 -18,000 ha⁻¹

Black gram + Pigeonpea: (4:2): Increase in yield: 15-30%, net returns: ₹ 45,000–₹55,000 ha⁻¹
cost of cultivation: ₹ 20,000 - 25,000 ha⁻¹

Crop diversification with Dryland Horticulture: Amla NA-7, Kanchan, and Chakiya at 6 × 6 m spacing for standard plantation, at 3 × 3 m spacing for high density plantation can be taken up. Another option of horticulture crop is mango along with pulse crops with supplemental irrigation through farm pond and *in-situ* moisture conservation (TCB) increases the annual net income of farmers.

Module 3: Livestock based interventions

CSV 33 Multi-cut sorghum variety during *kharif*, increase in milk yield: 15-17 %, net returns: ₹ 35,000 - 40,000 ha⁻¹,
cost of cultivation: ₹ 16,000 - 20,000 ha⁻¹

**Additional net returns:
Livestock based interventions**
Composite fish culture of Rohu,
Kadakhnath: 150-200 bird⁻¹

Hybrid Napier Grass (CO4): An option, where farmers are able to provide irrigations. This is a high-yielding perennial grass that is widely used for fodder for commercial dairy farming.
net returns: ₹ 1,45,000 - 2,20,000 ha⁻¹ year⁻¹

Tree fodders: Planting of Melia and Sesbania for small ruminants on field borders supply, year-round continuous green fodder to lactating animals, Feed cost reduction: 25–30%

Kadakhnath Backyard Poultry: Heat stress (>38°C) tolerant poultry breed.

Egg laying: About 170 days, 200 eggs/bird/annum. cost of rearing: ₹ 500 / bird (45% higher over local bird), net returns: ₹ 300 -400 birds⁻¹.

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	(₹ ha ⁻¹)
Desilting of check dam and community ponds	Community	Depend on the size of the pond
Tank silt application	Community	30,000
DSR	Individual	5,000-6,000
Broad bed and furrow	Individual	2,500-3,500
Conservation furrow	Individual	2,500-3,000
Zero tillage	Individual	5,000-6,000
Drip irrigation	Individual	80,000-85,000

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	JR 206 and JR-201, DRR 42, CR Dhan 802,	Individual
Soybean	JS 9560	Individual
Wheat	MPO 1255	Individual
Amla	NA-7, Kanchan, and Chakiya	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Rice-wheat fodder +animals	1,26,000	1,40,000
Rice + Fish + Goatery	99,000	1,20,000
Rice + Vegetables + Mushroom	79,000	1,90,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Multicut fodder of sorghum	CSV 33	Individual	20,000-22,000 ha ⁻¹
Hybrid Napier	CO4	Individual	20,000-22,000 ha ⁻¹
Poultry	Giriraj	Individual	500 /bird

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 3: Sidhi

Climate vulnerability: Heat waves, Extreme rainfall

A. Introduction/ Background

- Sidhi district, in the north-eastern part of Madhya Pradesh, is characterized by undulating landscapes, forest fringes, and high dependence on monsoon rainfall.
- The district receives an average annual rainfall of about 1100 mm, mostly during the southwest monsoon, while temperatures vary from 18-32 °C.
- Soils are predominantly red, lateritic, and alluvial soils, shallow to medium deep, generally low in organic carbon and plant-available nutrients.
- Farming in Sidhi is largely rainfed (around 75%), irrigated is about 25%. therefore, rainwater harvesting, *in-situ* moisture conservation, and soil health improvement measures are essential to stabilize crop yields and reduce climate-related risks.
- Field crops: Paddy, wheat, gram, pigeonpea, rapeseed and mustard *etc.*
- Livestock plays a supportive role in farm livelihoods, with indigenous cattle, goats, and backyard poultry being predominant; however, animal productivity remains low due to scarcity of quality fodder and low genetic potential.
- Sidhi district holds substantial potential for improving agricultural productivity and household incomes through convergence-based, climate-resilient interventions, with emphasis on integrated crop–livestock systems, sustainable natural resource management, and millet-based nutrition-sensitive farming. Implementation of these interventions in selected climate-smart villages has contributed to enhanced resilience, improved resource-use efficiency, and greater livelihood stability

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Broad bed and Furrow: (BBF): In BBF system raised beds of 90-95 cm wide, with 45-55 cm wide and 15 cm deep furrows. soybean is sown on beds

Reduction in seed rate: 25%, Water use efficiency: 41%,

Increase in soybean yield: 55-65%,

net returns: ₹ 40,000 - 45,000 ha⁻¹, cost of intervention: ₹ 25,00 -3,000 ha⁻¹,

Additional net returns:

NRM based interventions

BBF in soybean: ₹ 15,000 -20,000 ha⁻¹

Drip irrigation + mulching in

vegetables: ₹ 25,000 -35,000 ha⁻¹

Zero tillage: ₹ 8,000 - 15,000 ha⁻¹

BBF: ₹ 12,000 - 15,000 ha⁻¹

Drip irrigation + mulching in vegetables: For higher moisture efficiency and planting vegetables (Onion, potato and Tomato) on raised beds for good drainage in high rainfall area. Water saving: 30-40%, increase in crop yield: 25-30%.

Zero tillage of wheat /gram sowing after paddy/soybean crop with super seeder: Super Seeder implement cuts, lifts, and mulches paddy residues helps in simultaneously sowing of wheat and chickpea in a single pass after harvesting of paddy or soybean, without land preparation. Reduces cultivation cost (saves 2–3 tillage operations). Field capacity: 2-3 ha/day, operating cost: ₹ 3,500 ha⁻¹ (on custom hiring). Increase in crop yield: 20-30%.

Paddy wheat system: Increase in crop yield: Paddy: 30-35%, wheat :25-30% ,
net returns : ₹ 25,000–35,000 ha⁻¹. System cost of cultivation: ₹ 42,000–45,000 ha⁻¹
(10–15% lower cost),

Paddy – chickpea system: Increase in crop yield: Paddy: 30-35%, chickpea: 30-40% ,
net returns: ₹ 95,000-1,05,000 ha⁻¹, System cost of cultivation: ₹ 35,000-40,000 ha⁻¹
(5–10% lower cost),

Desilting of check dam and community ponds: Community ponds become defunct due to silting up and non- maintenance, leading to less storage of water during monsoon. This leads to reduced recharge of ground water in surrounding wells. This desilting of ponds can be done in convergence with line departments.

Module 2: Crop based Interventions

Direct Seeded Rice: JR 206 variety seeds are directly drilled into the fields with a seed drill or drum seeder at optimum moisture level to a depth of 2 to 3 cm. Stomp 30 EC (pre-emergence weedicide) is sprayed @ 2.5 L ha⁻¹ dissolved in 370 L of water after sowing on moist soil. Increase in cop yield: 5%, Shorter duration: 15 days earlier.
net returns: ₹ 45,000 - 47,000 ha⁻¹,
cost of cultivation: ₹ 23,000 - 25,000 ha⁻¹

Additional net returns: Crop based Interventions	
Improved varieties JS-95-60, MAUS-71, JS-20-34 Soybean:	₹ 5,000 - 10,000 ha ⁻¹
JAKI-9218, ICCV-2	
Chickpea :	₹ 18,000 - 21,000 ha ⁻¹
GNG-1581Wheat variety:	₹ 18,000 - 25,000
GJT-5 Sesame variety:	₹ 20,000 - 25,000 ha ⁻¹
Kufri Jyoti, Kufri Chandramukhi,	
Kufri Pukhraj Potato varieties:	₹ 60,000 - 1,10,000 ha ⁻¹
Pusa Ruby, Pusa Sheetal,	
Arka Rakshak:	₹ 70000 - 1,14,000 ha ⁻¹

(4-6% lower), labour saving :43 man-days ha⁻¹, water saving: 1,400 m³ ha⁻¹ (15-18%)

JS-95-60, MAUS-71, JS-20-34 soybean varieties : Duration 80-85 days, tolerant to about 10 days of dry spell during the cropping season. Performs better in early cessation of rainfall. Increase in crop yield: 30-35%, cost of cultivation: ₹ 22,000-23,000 ha⁻¹, net returns: ₹ 50,000-55,000 ha⁻¹

JAKI-9218, ICCV-2 drought tolerant chickpea varieties: Increase in crop yield: 40-50%,
cost of cultivation: ₹ 23,000–24,000 ha⁻¹, net returns : ₹ 60,000 - 72,000 ha⁻¹

GJT-5 sesame variety: Early maturing, exhibits tolerance to drought and shattering. Increase in crop yield: 40-60%, net returns: ₹ 42,000–54,000 ha⁻¹, cost of cultivation: ₹18,000 - 20,000 ha⁻¹,

GNG-1581 wheat variety: Increase in crop yield: 40-50%, cost of cultivation: ₹30,000-32,000 ha⁻¹,
net returns: ₹ 55,000-65,000 ha⁻¹

Kufri Jyoti, Kufri Chandramukhi, Kufri Pukhraj potato varieties: High-yielding varieties, suitable for irrigated and rainfed conditions. Increase in crop yield: 40-50%,
cost of cultivation: ₹ 1,20,000 -1,25,000 ha⁻¹, net returns: ₹ 1,70,000 -2,50,000 ha⁻¹

Pusa Ruby, Pusa Sheetal, Arka Rakshak: High-yielding variety, heat-tolerant and disease resistant varieties. Increase in crop yield: 30-40%. net returns: ₹ 1,70,000 -2,50,000 ha⁻¹
cost of cultivation: ₹1,80,000 - 3,00,000 ha⁻¹,

Module C: Livestock based interventions

Breed Upgradation: Introduction of high-yielding cattle and buffalo breeds like jersey cross, Holstein Friesian crosses. Increase in milk yield in cattle breeds: Jersey cross: 120-150%, Holstein Friesian: 250-300%, Gir: 80-100%

net returns: Jersey cross: ₹ 40,000-60,000 animal⁻¹,
Holstein Friesian: ₹ 50,000-90,000 animal⁻¹,
Gir: ₹ 30,000-50,000 animal⁻¹

Goat breeds: Jamunapuri cross, Black Bengal, Sirohi. net returns: ₹ 9,682 animal⁻¹, cost of rearing: ₹ 1,640 animal⁻¹

Additional returns:

Livestock based interventions

Breed upgradation Gir:	₹ 15,000- 30,000 animal ⁻¹ year ⁻¹
Jersey cross:	₹ 20,000- 40,000 animal ⁻¹ year ⁻¹
Goat breeds:	₹ 15,000- 20,000
Backyard poultry:	₹ 8,000 - 15,000/100 birds year ⁻¹
Pig breeds:	₹ 15,000- 25,000 animal ⁻¹

Kadaknath Heat stress (>38°C) tolerant poultry breed can be introduced. Egg laying: About 170 days, 200 eggs /bird/annum. cost of rearing: ₹ 500 / bird (45% higher over local bird), net returns: ₹ 300 -400 bird⁻¹.

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Desilting of check dam and community ponds	Community	Depends on the size of the water harvesting structure
Broad bed and furrow	Individual	4,000 -5,000 ha ⁻¹
Drip irrigation	Individual	Installation: 70,000 -75,000 ha ⁻¹

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	JR 206	Individual/Seed bank
Soybean	JS-95-60, MAUS-71, JS-20-34	Individual/Seed bank
Chickpea	JAKI-9218, GNG-1581, ICCV-2	Individual/Seed bank
Sesame	GJT-5	Individual/Seed bank
Potato	Kufri Jyoti, Kufri Chandramukhi, Kufri Pukhraj	Individual/Seed bank
Tomato	Pusa Ruby, Pusa Sheetal, Arka Rakshak	Individual/Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Crop + Livestock + Fish + Horticulture	2,31,000	5,15,000
Crop + Vegetable + Mushroom + Dairy	1,39,000	3,10,00

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Cattle	Jersey, Holstein Friesian, Gir	Individual	45,000 -70,000 depends on the breed
Goat	Jamunapuri, Black Bengal, Sirohi	Individual	1,640
Poultry	Vanaraja, Gramapriya, Broilers	Individual	400-500 bird
Year round fodder	Multicut sorghum/ Hybrid Napier	Individual	30,000-35,000 ha ⁻¹
Silage Preparation	Plant residues	Individual	900-1,200

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District: Tikamgarh

Climate vulnerability: Drought, dry spells, heat and cold waves, fog, frost

A. Introduction/ Background

- Tikamgarh district, located in the Bundelkhand region of Madhya Pradesh, is highly prone to climatic extremes, particularly recurrent droughts, erratic rainfall, and prolonged dry spells.
- The district receives an average annual rainfall of about 850-870 mm, largely confined to the southwest monsoon, with temperatures ranging from 19-33 °C.
- Soils are predominantly mixed red soils, low in organic carbon and prone to surface crusting, resulting in poor infiltration and frequent moisture stress.
- Agriculture in Tikamgarh is predominantly rainfed (around 90-95%), with limited irrigated area (5%) therefore, efficient rainwater harvesting, *in-situ* moisture conservation, and soil health management are essential for sustaining crop productivity.
- Field crops: Wheat, black gram, groundnut, chickpea, lentil, pigeon pea, sesame. Plantations: Guava, aonla and seasonal vegetables are cultivated on a smaller scale.
- Livestock constitutes a vital component of the farming system, mainly indigenous cattle, buffaloes, and goats; however, productivity remains low due to chronic fodder shortages and low genetic potential
- To address these challenges, convergence-based, climate-resilient interventions emphasizing integrated crop–livestock systems, water and soil conservation, and climate-smart agronomic practices were implemented in climate-smart villages Kodiya and Nanhi-Tehri. The major outcomes were

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Rain water harvesting: New water harvesting structures constructed: 7 new farm ponds, 4 new community ponds, renovated/ desilting: 11 percolation tanks open/ tube wells recharged with silt trap : 15.

Water storage created: 1,88,240 m³, Increased Irrigation access *khari*f: 106 ha and *rabi*: 55 ha crop diversification, with vegetables, spices, and fruits. Farm ponds (98), community ponds (31), percolation tanks (16), recharging wells (496), and check dams (18) were created.

Rain water harvesting NRM based interventions
Total water harvested: 5,05,100 m ³
Farmers benefitted : 15
Potential irrigation created: 502 ha
Surplus water irrigated: 266 ha

Bori bandhans: Constructed 4 poly bag sand check dams. Temporary sandbag check dams were constructed by using low-cost polythene bags filled with sand from stream beds. The gap between two rows was filled with clay to check water leakage.

De-silting of open wells and recharging of borewells: Irrigated area increase: 50%, Increase in well depth: 23%, Increase in water table: 12 ft.

Silt Management: 4714 m³ excavated, applied to 10 acres for 10 farmers, used for cotton cultivation. Increase in yield 15-18% due to high silt fertility.

Lifesaving irrigation: Irrigation is given to the crops at critical crop growth stages if dry spells occur. Usually 1-2 irrigations were applied. Increase in crop yield: Soybean: 128 %, blackgram: 40-60%, sesame: 25%, wheat 25 -50%, chickpea: 29% -36%, mustard: 69% tomato: 26%, chilli: 27%

Increase in net returns: Soybean: ₹ 29,000 - 30,000 ha⁻¹
blackgram: ₹ 24,000 - 25,000 ha⁻¹,
sesame: ₹ 21000 - 22,000ha⁻¹, wheat: ₹ 65,000 ha⁻¹,
chickpea: ₹ 59,000-60,000 ha⁻¹, mustard: ₹ 65,000 ha⁻¹

Broad bed and furrow: In BBF system raised beds of 90-95 cm wide, with 45-55 cm wide and 15 cm deep furrows. BBF in soybean with stand dry spells for 20 days, Seed rate: 25% , lower, increase in yield: 55-65%, water use efficiency: 41%.

cost of intervention : ₹ 4,000 - 5,000 ha⁻¹, net returns: ₹ 20,600 ha⁻¹

Zero tillage in wheat: To reduce the impact of terminal heat stress during flowering and grain filling in wheat. Wheat sown with zero till drill. The field capacity: 2-3 ha/day operating cost of operation ₹ 3,500/ha (on custom hiring). Reduction in cost of cultivation: ₹ 2,500 - 3,000 ha⁻¹, Diesel consumption: 50-60 L ha⁻¹, increase in crop yield: 35-40%, net returns : ₹ 57,000 ha⁻¹

Sprinkler Irrigation in wheat: 40–50% water saving, increase in crop yield: 35-45 %, net returns : ₹ 64,000 ha⁻¹ cost of intervention: ₹ 30,000-35,000 ha⁻¹,

Furrow irrigated raised bed (FIRB): FIRB planting in wheat and blackgram for minimizing the risk of crop failure. Increase in crop yield: blackgram 79%, wheat: 38%. net returns: blackgram: ₹ 24,000 ha⁻¹, wheat : ₹ 1,01,680 ha⁻¹. cost of intervention: blackgram: ₹ 25,000 ha⁻¹, wheat: ₹ 45,000 ha⁻¹

Module 2: Crop based interventions

JS 9560- soybean variety: Duration 80-85 days, can withstand for about 10 days of dry spell. Increase in crop yield: 25-40%, net returns: ₹ 6,000-18,000 ha⁻¹, cost of cultivation : ₹ 17,000 - 20,000 ha⁻¹

TKG 308- sesame variety: It is 95% biotic stress tolerant. Increase in crop yield: 40-60%, net returns: ₹ 18,000 - 19,000 ha⁻¹, cost of cultivation: ₹ 8,000 -9,000 ha⁻¹

Additional net returns : Crop based interventions

Improved varieties	
JS 9560 Soybean:	₹ 5,000 - 13,000 ha ⁻¹
TKG-308 sesame:	₹ 5,000 - 10,000 ha ⁻¹
Pusa Bold, Pusa Tarak, and	
Giriraj Mustard varieties:	₹ 10,000 - 20,000 ha ⁻¹
Shekhar-2, Pant Urd-31,	
IPU 94-1, Pratap Urd-1 Blackgram:	₹ 10,000 - 15,000 ha ⁻¹
Pusa 1509 Rice variety:	₹ 8,500 - 9,500 ha ⁻¹
RVG 201 Chick pea variety:	₹ 10,000 - 20,000 ha ⁻¹

Pusa Bold, Pusa Tarak, and Giriraj- : Low water requiring Mustard varieties:: These are well-suited to light and medium soils and can produce optimum yields even with 2-3 irrigations. Increase in crop yield: 20-40% , net returns : ₹ 30,000-50,000 ha⁻¹, cost of cultivation: ₹ 20,000 - 25,000 ha⁻¹

Shekhar-2, Pant Urd-31, IPU 94-1, Pratap Urd-1 Blackgram varieties.

Increase in crop yield: 35-40%, net returns: ₹ 22,000-22,500 ha⁻¹,
cost of cultivation: ₹ 19,000-20,000 ha⁻¹

Improved chick pea variety RVG 201: Short duration (100-110 days) variety.

Increase in crop yield: 25-35% net returns : ₹40,000-65,000 ha⁻¹,
cost of cultivation: ₹ 18,000 - 20,000 ha⁻¹

Module 3: Livestock based interventions

Breed upgradation with Murrah buffaloes:

Murrah buffaloes have higher milk yield.

Calves were sold @ ₹ 5,000 calf¹.

Increase in milk yield: 35-45%, }

cost of rearing: ₹ 45,000-60,000 animal⁻¹,

net returns: ₹ 45,000-55,000 animal⁻¹

Additional net returns:

Livestock based interventions

Breed upgradation with Murrah

buffaloes: ₹ 20,000 - 30,000 animal⁻¹

Jamunapuri goats: ₹ 1,600 - 1,700 animal⁻¹

Kadaknath: ₹150 - 200 bird⁻¹

Jamunapuri goats for breed upgradation Increase in body weight: 32% in one year. Kids were sold @ ₹ 3000 kid⁻¹ 45 bucks distributed in three villages over 10 years, resulted in 90 kids. Increase in milk yield: 200%, net returns: ₹ 10,000-11,000 animal⁻¹, cost of rearing: ₹ 1,600 goat⁻¹

Kadaknath as backyard poultry: This breed is climate resilient and tolerant to heat stress.

Increase in body weight: 3-6 %. cost of rearing: ₹ 300-400 bird⁻¹, net returns: ₹ 300 - 400 bird⁻¹

Feed supplementation using UMMB: Urea molasses mineral blocks in cows for nutrient supplementation help to improve the digestibility of fodder and reduces the stress impact. Increase in milk yield: 10%.

Year round fodder production: *Kharif*: sorghum, cowpea, hybrid Napier, fodder sorghum (MP Chari), Maize (J-1006) can be sown immediately after the rains during *kharif* season. *Rabi*: Berseem (JB-1 and BB- 3) and Oat (JHO-851) and lucerne. Increase in milk yield: 11-12%. net returns: ₹ 6,000 -7,000 animal⁻¹

Module 4: Integrated farming system for rainfed conditions

An Integrated Farming System (IFS) model was developed with a farm pond for rainwater harvesting. Harvested water was utilized for supplemental irrigation to field crops, vegetables, dairy, and fish production.

- Fingerlings of Catla, Rohu, Mrigal, and Grass carp were stocked in the pond for fish production.
- Crop residues and dairy dung were used for composting and biogas preparation.
- Biogas slurry was applied to field and vegetable crops as organic manure.
- Pond water was used for providing critical irrigation during crop growth stages.
- The IFS model generated net returns of ₹ 1,54,634 with a B:C ratio of 3.30.
- About 50% of the farm pond construction cost was recovered in the first year itself.
- Pond construction raised the borewell water level, enabling expansion of *rabi* cropping area.

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Rain water harvesting	Community	14,00,000
Bori bandhans	Community	27,000
De-silting of open wells and recharging of borewells	Community	4,00,000
Broad bed and furrow	Individual	2,500
Zero tillage	Individual	2,500
Sprinkler irrigation	Individual	7,900
Furrow irrigated raised bed system	Individual	2,500

Module 2a: Crop based interventions

Crop	Variety	Method
Soybean	JS 9560	Seed bank
Sesame	TKG-308	Seed bank
Mustard	Pusa Bold, Pusa Tarak, and Giriraj	Seed bank
Black gram	Shekhar-2, Pant Urd-31, IPU 94-1, Pratap Urd-1	Seed bank
Rice	Pusa-1509	Individual
Chick pea	RVG 201	Seed bank
Wheat	HI-1544 and SR-1-14	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
BBF + rainfed Soybean	32,300	24,936
BBF + rainfed Soybean + Murrah buffalo	32,000	29,339
Heat tolerant wheat alone	42,700	60,363
Heat tolerant wheat + Murrah buffalo	42,200	67,410

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Buffaloes	Murrah	Individual	40,000-60,000 animal ⁻¹
Goat	Jamunapuri	Individual	7,500 animal ⁻¹
Poultry	Kadaknath	Individual	500 bird ⁻¹
Urea molasses mineral blocks	Cows	Individual	230-280 kg ⁻¹
Year-round fodder	<i>Kharif</i> : fodder sorghum (MP Chari), cowpea, hybrid Napier, Maize (J-1006) <i>Rabi</i> : Berseem (JB-1 and BB- 3) and Oat (JHO-851) and lucerne	Seed bank and individual	20,000-23,000 ha ⁻¹

Module 4: Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centers with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centers, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

Maharashtra

District 1: Beed

Climate vulnerability: Drought, dry spells, heat waves, erratic rainfall

A. Introduction/ Background

- Beed district, located in the Marathwada region of Maharashtra, lies in a semi-arid, drought-prone agro-climatic zone, where agriculture is heavily dependent on erratic monsoon rains.
- The district receives an average annual rainfall of about 670–750 mm, mostly during the southwest monsoon, temperature ranging from 12–42 °C with hot and dry summers and mild winters.
- Soils are light to medium and some heavy black soils, generally low in organic carbon.
- Agriculture in Beed is predominantly rainfed (about 75–80%), with only around 20–25% of the area under irrigation, making soil moisture conservation, farm ponds, and watershed management critical for sustaining yields and reducing climate risks.
- Field crops: Kharif season : Sorghum, bajra, cotton, soybean, pulses such as redgram and black gram. Rabi : chickpea, rabi sorghum, wheat, and maize. Plantations: mango, banana, pomegranate, custard apple (GI-tagged), and citrus fruits.
- Livestock and allied activities form an important part of the rural economy, with cattle, buffaloes, goats, sheep, and poultry widely reared; however, productivity challenges persist due to fodder scarcity and low genetic potential.
- Beed district offers scope for enhancing agricultural productivity and rural incomes through convergence-based, climate-resilient interventions, focusing on integrated crop–livestock systems, water conservation, drought-tolerant technologies, and diversification into high-value horticulture and allied enterprises. Implementation of such interventions was done in selected villages Rakshaswadi, Rajewadi/ Bhavthana, Gondanpatti Tanda/ Mandva (P.), Kolhewadi (Kaij), Morphadi (Dharur). The major outcomes were

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Ferro-cement water tank: A eco friendly, durable water storage tank a solution suitable for dryland conditions. Two models were designed

1. Model–I: Ferro-Cement Tank: Materials Used: Weld chicken mesh, bricks, sand mixture, and cement were used, Total cost: ₹30,000, Capacity: 10,000 litres, Cost per litre: ~₹3.0
2. Model–II: Eco-Friendly Tank: Materials Used: Coconut coir, bricks, sand mixture, cement, Total cost: ₹25,000, Capacity: 10,000 litres, Cost per litre: ~ ₹ 2.5

Improved water availability Helped in providing irrigation to vegetables and fruit plants and life-saving irrigation to field crops, drinking water for livestock, reduced dependency on erratic electricity supply and borewell discharge.

Farm pond: The approx. dimensions of the farm pond were 20 m × 20 m × 3 m.

cost of construction: ₹50,000 -55,000

Desilting of check dam and community ponds, tank silt application: Desilting has increased the storage capacity of village ponds. cost of de silting ₹9,000 -12,000

Supplemental irrigation: Irrigation through harvested water from farm ponds, desilting of farm ponds, check dams etc. during dry spells at critical stages to soybean, chickpea and cotton.

Increase in crop yield soybean: 26-35% cotton: 36-45%,
chickpea: 18-22% net returns: soybean: ₹ 65,000 -75,000 ha⁻¹,
cotton: ₹ 25,000 -40,000 ha⁻¹, chick pea: ₹ 60,000 -70,000 ha⁻¹

Additional net returns: NRM based interventions	
Supplemental irrigations	
Soybean :	₹10,000 - 15,000 ha ⁻¹
Cotton :	₹11,000 - 15,000 ha ⁻¹
Chickpea :	₹11,000 ha ⁻¹

Broad Bed and Furrow (BBF): Broad raised beds (1.2-1.5 m width) separated by furrows (30-45 cm width and 20 cm depth) are formed using BBF planters or ridge formers. Protects the crops from both drought and waterlogging stress. Crops: Soybean, cotton, redgram, and chickpea.

Increase in crop yield: soybean: 20–30%, cotton: 15–25%, pigeonpea: 20%, chickpea: 15–20%.

Cost of broad bed preparation : ₹4,000 -5,000 ha⁻¹, net returns : soybean : ₹ 45,000-50,000 ha⁻¹,
cotton: ₹55,000–65,000 ha⁻¹, pigeonpea : ₹38,000–45,000 ha⁻¹, chick pea : ₹ 45,000–55,000 ha⁻¹

Conservation furrows: Furrows of about 45 cm width, 20 cm depth, spaced at 100 cm, are commonly made after 40 to 50 days of sowing using a tractor-drawn ridge plough/ Animal ridger plough.

cost of intervention: ₹ 2,500 - 3,000 ha⁻¹, increase in crop yield: 40 - 45 %,
net returns: ₹ 20,000 -25,000 ha⁻¹, Crops: Soybean, pigeonpea, cotton

Micro irrigation system (MIS): Drip Irrigation: In crops like pomegranate drip irrigation can be practiced. Increase in crop yield: 18- 20 %, Fertilizer saving: 25-30%

Drip irrigation +Mulching: Cotton,
Increase in yield: 25-30%, water saving: 55%,
cost of cultivation: ₹65,000 -75,000 ha⁻¹,
net returns: ₹ 1,00,000 -1,20,000 ha⁻¹
cost of installation: ₹75,000 -80,000 ha⁻¹
Chick pea: Yield advantage: 45%

Additional net returns: NRM based interventions	
Conservation furrow :	
Micro irrigation	₹ 8,000-10,000 ha ⁻¹
Cotton: Drip +mulching:	₹25,000- 40,000 ha ⁻¹
Opening conservation furrow at 35-45 DAS:	
Cotton:	₹13,000- 14,000 ha ⁻¹
Pigeonpea:	₹ 6,000 - 6,500 ha ⁻¹

Module 2: Crop-based Interventions

Phule Suchitra and Phule Sangam (KDS-726) Rabi sorghum: Early to medium duration drought-tolerant high-yielding dual-purpose sorghum variety suitable for rainfed and semi-arid conditions.

Increase in crop yield: 20-25 %, net returns: ₹25,000 -37,000 ha⁻¹,
cost of cultivation: ₹33,600-37,620 ha⁻¹

Drought-tolerant rabi Pigeonpea: BDN-2013-41 variety, drought tolerant, resistant to major diseases such as wilt and sterility mosaic disease (SMD), recommended for both irrigated and rainfed. Increase in crop yield: 36%, cost of cultivation: ₹ 25,000-27,000 ha⁻¹, net returns: ₹ 80,000-85,000 ha⁻¹

Phule Vikram Chickpea variety: Wilt resistance,

Duration: 105–110 days

Increase in crop yield: 22-30%,

net returns: ₹55,000 -70,000 ha⁻¹,

cost of cultivation: ₹24,000-25,000 ha⁻¹

MAUS-612 Soybean: Semi-determinate

type 90–98 days, good resistance to pod

shattering. Increase in crop yield: 18-20%, cost of cultivation: ₹45,000-50,000 ha⁻¹,

net returns: ₹ 20,000 -75,000 ha⁻¹

Soybean based intercropping systems:

Soybean + pigeonpea (6:1):

Increase in crop yield: 18-20%,

net returns: ₹ 10,000 -85,000 ha⁻¹, cost of cultivation: ₹44,000 -48 000 ha⁻¹

Additional net returns:

Crop-based Interventions

Improved crop varieties:

Phule Suchitra Rabi sorghum: ₹ 6,000 - 8,000 ha⁻¹

Phule Vikram Chickpea: ₹ 16,000 - 18,000 ha⁻¹

MAUS-612 Soybean: ₹ 15,000 - 25,000 ha⁻¹

BDN-2013-41 Pigeonpea: ₹ 30,000 - 35,000 ha⁻¹

Additional net returns:

Crop-based Interventions

Soybean intercropping systems:

Soybean + pigeonpea: ₹ 15,000 -35,000 ha⁻¹

Module 3: Livestock based interventions

Mineral mixture supplementation in cows and buffaloes:

Increase in milk yield: 40-50%,

cost: ₹25,000-₹30,000 animal/year

net returns: ₹ 30,000- ₹ 38,000 animal⁻¹ yr⁻¹

Additional net returns:

Livestock based interventions

Mineral mixture: ₹12,000 - 15,000 animal⁻¹ yr⁻¹

Mineral lick brick goats: ₹1,500 -3,000 animal⁻¹ yr⁻¹

Kaveri breed Backyard poultry: ₹ 400 - 500 bird⁻¹

Mineral Lick-brick feeding to goats: To supply essential minerals and to increase the immunity power of ruminates. Increase in body weight: 20-25%, net returns: ₹40,000 -₹45,000 /animal, cost of mineral lick bricks: ₹ 1,690-1,850 /animal

Kaveri breed Backyard poultry: Suitable for low-input poultry farming in India. Increase in egg production: 135-165% (100-125 eggs/bird), increase in meat yield: 90-110%, cost of rearing: ₹510 bird⁻¹, year net returns: 600 -650 birds⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Water harvesting structures (Farm ponds, desilting of farm ponds)	20m× 20m × 3m	50,000
Desilting of farm ponds	Community	9,000
Eco friendly water storage structures (Ferro-cement water tank, Eco-Friendly Tank)	Individual	30,000
Broad Bed and Furrow	Individual	4,000-4500 ha ⁻¹
Conservation furrows	Individual	2,500 -1,650 ha ⁻¹
Drip Irrigation	Individual	Installation: 60,000 -70,000 ha ⁻¹

Module 2a: Crop based interventions

Crop	Variety	Method
Rabi sorghum	Phule Suchitra and Phule Sangam	Seed bank
Pigeonpea	BDN-2013-41	Seed bank
Soybean	MAUS-612	Seed bank
Chickpea	Phule Vikram	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹ ha ⁻¹)
Soybean sole	40,000 ha ⁻¹	55,000-75,000
Soybean + pigeonpea (6:1)	40,000-45,000 ha ⁻¹	65,000-1,20,000
Crops (<i>Rabi</i> Jowar + Chickpea)	55,000	94,400
Crop +livestock (<i>Rabi</i> Jowar + Chickpea+ Livestock (Mineral mix + Poultry integration)	1,05,500	1,64,690
Crop (Soyabean)	55,000 -60,000	1,00,000 -1,10,000
Crop +Livestock (Mineral mix + Lick brick integration)	70,000-75,000	1,50,000 -1,60,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Mineral mixture	Cows and buffaloes	Individual	21,000-28,000 animal ⁻¹ year ⁻¹
Mineral Lick-brick	Goat	Individual	1600-1800 animal ⁻¹
Poultry	Kaveri	Individual	510-550 bird ⁻¹

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 2: Nanded

Climate vulnerability: Drought, dry spells

A. Introduction/ Background

- Nanded district, is in the Marathwada region of Maharashtra, is highly vulnerable to climatic variability, characterized by frequent droughts, erratic monsoon rainfall, intermittent dry spells, and occasional floods due to intense rainfall events.
- The district receives an average annual rainfall of about 900–950 mm, most of which is concentrated during the southwest monsoon (June–September). Temperatures typically range from 12–15 °C in winter to 40–42 °C during peak summer.
- Predominant soil are medium to deep black cotton soils (Vertisols), with pockets of shallow soils.
- Agriculture in Nanded is largely rainfed (around 82%), with limited irrigation (18%). Rainwater harvesting, *in-situ* moisture conservation, efficient water-use practices, and soil health improvement are critical for sustaining agricultural productivity.
- Field crops: Soybean, cotton, sorghum, pearl millet, pigeon pea, chickpea, green gram, sugarcane and wheat. Plantations: Banana, sweet orange, pomegranate, mango etc. are cultivated on a limited scale.
- Livestock forms an integral component of the farming system, dominated by indigenous cattle, buffaloes, sheep, and goats. However, overall productivity remains low due to seasonal fodder scarcity, poor quality feed resources, and limited adoption of improved breeding and health management practices.
- To mitigate these challenges, convergence-based climate-resilient interventions focusing on integrated crop–livestock systems, soil and water conservation measures, diversification of cropping systems.

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Farm pond: The approx. dimensions of the farm pond were 20 m × 20 m × 3 m. cost of construction: ₹50,000 -55,000 per pond

Desilting of check dam and community ponds, tank silt

application: Desilting has increased the storage capacity of village ponds. cost of de silting ₹9,000 -12,000

Supplemental irrigation: Irrigation through harvested water from farm ponds, desilting of farm ponds, check dams etc during dry spells at critical stages to soybean, chickpea and cotton.

Increase in crop yield Soybean: 26-35% cotton :30-35%, chickpea: 18-22%, sorghum :25-30%
net returns: soybean: ₹50,000 -50,000 ha⁻¹, cotton: ₹25,000 -40,000 ha⁻¹, chick pea ₹55,000 -70,000 ha⁻¹,
sorghum: ₹32,000–38,000 ha⁻¹

Additional Net Returns: NRM based interventions

Supplemental irrigations

Soybean : ₹10,000 - 15,000 ha⁻¹

Cotton : ₹11,000 - 15,000 ha⁻¹

Chick pea: ₹18,000 - 25,000 ha⁻¹

Sorghum : ₹8,000 - 12,000 ha⁻¹

Chickpea : ₹11,000 ha⁻¹

Broad Bed and Furrow (BBF) in soybean:

cost of operation : ₹4000 -5000 ha⁻¹

Increase in crop yield: Soybean :15-30 %, cotton :20-30%.

pigeonpea: 20-25% chickpea :25-30%

net returns: Soyabean ₹45,000 -50,000 ha⁻¹,

chickpea: ₹48,000 -53,000 ha⁻¹, cotton: ₹60,000 -70,000 ha⁻¹,

pigeon pea: ₹44,000 -46,000 ha⁻¹

Additional Net Returns:

NRM based interventions

Broad bed and furrow

Soybean: ₹ 17,000 - 23,000 ha⁻¹

Cotton: ₹ 15,000 - 22,000 ha⁻¹

Pigeonpea: ₹ 22,000 - 25,000 ha⁻¹

Module 2: Crop based interventions

Improved varieties of various crops

KDS-753/ MAUS 158 Soybean: ,

Increase in crop yield: 15-25%,

cost of cultivation : Soybean: ₹ 5,000-6,000 ha⁻¹

cotton: ₹15,000 -22,000 ha⁻¹

pigeonpea: ₹ 22,000-25,000 ha⁻¹

(13% higher over local variety), net returns: ₹ 38,000-45,000 ha⁻¹,

Additional Net Returns:

Crop based interventions

Improved varieties

KDS-753/ MAUS Soybean : ₹15,000 -25,000 ha⁻¹

Phule Vikrant Chickpea: ₹ 18,000-25,000 ha⁻¹

Sorghum: ₹ 8,000 -12,000 ha⁻¹

Chickpea : ₹ 10,000-13,000 ha⁻¹

Phule Vikrant Chickpea: increase in crop yield: 15-30%, net returns: ₹ 85,000-90,000 ha⁻¹,

Crop diversification: Pulses, oilseeds, fodder crops instead of monocropping Intercropping systems:

Soybean + pigeon pea, cotton + green gram

Module 3: Livestock interventions

Kaveri and Grama Priya Dual-purpose poultry breed: Kaveri breed is known for their dual purpose of egg and meat production.

Increase in egg production: 190-220%, Egg laying capacity: 148 eggs/year/bird, increase in meat yield: 75-85%, net returns: ₹ 1,200-1,600 /bird

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Water harvesting structures (Farm ponds, desilting of farm ponds)	20×20×3	50,000
Desilting of farm ponds	Community	9,000
Eco friendly water storage structures (Ferro-cement water tank, Eco-Friendly Tank)	Individual	30,000
Broad Bed and Furrow	Individual	4,000-4500 148 ha ⁻¹
Conservation furrows	Individual	2,500 -1,650 ha ⁻¹
Drip Irrigation	Individual	Installation: 60,000 -70,000 ha ⁻¹

Module 2a: Crop based interventions

Crop	Variety	Method
Rabi sorghum	Phule Suchitra and Phule Sangam	Seed bank
Pigeonpea	BDN-2013-41	Seed bank
Soybean	MAUS-612	Seed bank
Chickpea	Phule Vikram	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Crop (Soyabean)	55,000 -60,000	1,00,000 -1,10,000
Crop +Livestock (Mineral mix + Lick brick integration)	70,000-75,000	1,50,000 -1,60,000
Soybean +pigeonpea intercropping system	40,000-45,000	65,000-1,20,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Poultry	Kaveri/Gramapriya	Individual	400-500 bird ⁻¹
Osmanabad and Sangamneri	Goat	Individual	4,000 -5,000 animal ⁻¹
Mineral mixture	Cows and buffaloes	Individual	21,000-28,000 animal ⁻¹ year ⁻¹
Mineral Lick-brick	Goat	Individual	1,600-1,800 animal ⁻¹

Module 4: Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centers with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centers, and guide seasonal action plans
FPO and women self-help groups for post-harvest value addition	Community	Women empowerment

Meghalaya

District 1: West Jaintia Hills

Climate vulnerability: Erratic rainfall, dry spells, Flash floods, Hail storm and frost

A. Introduction/ Background:

- West Jaintia Hills is in the North-Eastern Hills (Purvanchal) and the Eastern Himalayan Agro-Climatic Zone. This region experiences wide range of climate variabilities like erratic rainfall, dry spells, flash floods, hail storm and frost. The district receives an average annual rainfall of 2060 mm, with temperatures ranging from 6°C to 28 °C.
- Soils are predominantly black, red and alluvial.
- The rainfed and irrigated area are 80 and 20% respectively, hence efficient water management is essential.
- Field Crops: Rice, maize, soybean and sweet potato. Horticultural crops: Banana, oranges and pineapple
- Livestock forms an integral component of the farming system, dominated by indigenous cattle, buffaloes, sheep, and goats. However, overall productivity remains low due to seasonal fodder scarcity, poor quality feed resources, and limited adoption of improved breeding and health management practices. To mitigate these challenges, convergence-based climate-resilient interventions focusing on integrated crop–livestock systems, soil and water conservation measures, diversification of cropping systems, and climate-smart agronomic practices were implemented in Umjalisiaw, Mukhnang, Namdong, Wahiajer, Niriang climate-smart villages of west Jaintia hills district. The major outcomes were,

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions Hills with slopes

Jalkund: Jalkund of $5 \times 4 \times 1.5$ m pit lined with silpaulin over a clay–cow dung plaster and cushioning layer, with storage capacity ~30,000 L is made.

Life saving irrigation: The harvested water of Jalkund

is used to irrigate three crops tomato, cabbage and bracoli were cultivated whereas before formation of Jalkund only tomato was cultivated. cost of cultivation for 3 crops: ₹ 3,70,000 (Additional cost: 2,48,900), net returns: ₹ 12,00,000 - 1,20,50,000 ha⁻¹

Paddy Straw mulching: Mulching in broccoli with paddy straw

Increase in crop yield: 5-20 %,

net returns: ₹3,20,000 -3,20,500 ha⁻¹,

cost of cultivation: ₹1,00,200-1,05,000 ha⁻¹

(20% lower cost of cultivation),

Water saving: 5 irrigations

Additional net returns:

NRM based Interventions

Hills with slopes

Life saving irrigation: ₹ 6,00,000 ha⁻¹

Paddy straw Mulch: ₹45,000 - 90,000 ha⁻¹

Poly house: ₹7,00,600- 8,30,000 ha⁻¹

Additional net returns:

NRM based Interventions

Plains in the valley : Rice based systems

Potato on ridge and furrows: ₹ 2,06,000- 3,10,000 ha⁻¹

Cabbage: ₹ 2,49,600-3,10,350 ha⁻¹

Protected cultivation for year-round vegetable cultivation: A walk-in tunnel of polythene with a semicircular structure of 6ft height, 2m width and 15m long was constructed

net returns: ₹ 10,00,600 -12,10,000 ha⁻¹

cost of cultivation: ₹ 5,08,000- 5,50, 000 ha⁻¹

Plains in the valley

Ridge and Furrow in potato in Rice fallow: Potato (Kufri Pukhraj) is planted after harvest of rice (CAU R1) with ridge and furrow method. The ridges are 1 m wide and with height of 20 cm.

net returns: ₹ 2,35,000 - 3,60,000 ha⁻¹, cost of cultivation: ₹1,94,500- 1,80,000 ha⁻¹,

Cabbage in rice fallows: net returns: ₹ 2,16,000-2,79,000 ha⁻¹,

cost of cultivation: ₹1,23,000 -1,36,000 ha⁻¹

Module 2: Crop based Interventions

Hills with mild slopes

Maize+ French bean intercropping system: Increase in crop yield: 90-95%,

net returns: ₹75,000 -85,000 ha⁻¹, cost of cultivation: ₹ 66,000- 68,900 ha⁻¹,

additional net returns: ₹ 42,000- 50,000 ha⁻¹

Crop diversification with Finger millet V.L. Mandua 352: net returns: 9,000 -9,500 ha⁻¹,

cost of cultivation: ₹ 12,000 - ₹ 13,000 ha⁻¹

Module 3: Livestock based Interventions

Low-cost pig-pen model Lumsniang: Increase in pig production: 55-60%,

net returns: ₹1,20,000 - 1,60,000, cost of production : ₹ 1,50,000 -1,60,000 unit⁻¹

Silage for year-round supply of feed to Pig: Locally available green fodder and vegetable waste is used for pig feeding during lean season. Increase in gain in body weight with silage: 12-22 %, net returns: ₹8,000-₹ 9,000, cost of production: ₹11630 animal⁻¹

Aquaculture in mid-hill altitude: Fish sp.: Amur common carp and Labeo gonius (cold stress tolerant), Stocking density-8,000 nos./ha, Species ratio:1:1, net returns: ₹ 22,350

Paddy straw for Oyster Mushroom cultivation Productivity Normal year: 0.11-0.2 t /unit (30 bags/unit), net returns: ₹8,000-15,000

Integrated farming system

Paddy-cum fish (Integrated farming system): An integrated paddy–fish farming system was established in a 500 m² low-lying mid-hill field with 4-6 months of water retention, incorporating a peripheral refuge canal (1.0 m wide, 0.5 m deep). Local paddy was transplanted in mid-July, and after

21 days, Amur common carp and local common carp were stocked in a 1:1 ratio at 4,000 fingerlings ha⁻¹ (200 fingerlings total). Fish were reared within the paddy field and harvested together with the rice crop in November. System productivity: 6.7-7.2 t ha⁻¹year⁻¹, net returns: ₹1,04,600 - 1,33,000, cost of production: ₹80,000-1,00,000 ha⁻¹

Additional net returns:

Livestock based Interventions

Integrated farming system

Paddy-cum fish: ₹ 90,00,000 -1,00,000

Pig-fish-horticulture: ₹ 6,50,000

Pig-fish-horticulture (Integrated farming system): In 1 hectare integrated system, 30–40 pigs are reared and six carp species are cultured in the pond, with pig dung serving as fish feed and manure for crops. Vegetables such as cabbage and capsicum are grown on pond embankments twice a year, while pineapple is planted along pond sides in double rows at 60 × 30 cm spacing.

Pork-3.5 t, capsicum-5.8 t ha⁻¹, cabbage-24.8 t ha⁻¹, pineapple-45.2 t ha⁻¹, fish-1.9.8 t ha⁻¹

net Returns: ₹ 7,050,000 -7,10,000 ha⁻¹, cost of cultivation: ₹6,99,000 ha⁻¹

Pig-fish-horticulture (Integrated farming system): Vegetables such as tomato, cabbage, broccoli
net returns: ₹ 2,00,000-2,10,000, cost of cultivation: ₹1,55,000 -1,60,000, additional returns: ₹1,90,000

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Jalkund	Community	1,25,800-1,26,500
Paddy Straw mulching	Individual	1,04,200
Protected cultivation for year-round vegetable cultivation	Individual	4,98,700- 5,28,900
Ridge and Furrow for potato in Rice fallow	Individual	63,850-1,19,500

Module 2a: Crop based Interventions

Crop	Variety	Method
Potato	Kufri Pukhraj	Seed bank
Rice	CAU R1	Seed bank
Tomato	Rocky	Nursery
Cabbage	Wonder ball	Nursery
Broccoli	Ashwarya	Nursery

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹ ha ⁻¹)
Paddy cum fish	80,000-1,00,000 ha ⁻¹	1,00,000 -1,33,000
Paddy -fish -Horticulture	6,99,000	7,05,900

Module 3: Livestock based Interventions

Livestock	Breed/ variety	Cost (₹)
Pig	Lumsniang	1,29,528-1,31,976
Fish	Fish sp.: Amur common carp and Labeo gonius	15,000 -16,000

Institutional Intervention

Intervention	Management	Purpose
Custom hiring centre	Community	Provide essential machinery
Women empowerment	Community	Post-harvest value addition
VCRMC	Community, committee:12-20 members	Coordinates activities such as seed banks, fodder banks, custom hiring centres and guide seasonal action plans

Nagaland

District 1: Mon

Climate vulnerability: Moisture stress

A. Introduction/ Background:

- Mon district is located in the North eastern part of Nagaland, experiences high moisture stress.
- The district receives an average annual rainfall of 2121 mm, with temperatures ranging from 12°C to 27°C
- Soils are predominantly red sandy, deep to very deep.
- The rainfed and irrigated area are 86 and 14% respectively
- The major source of irrigation in the district is surface water bodies like streams, spring and rivulets.
- Field Crops: Jhum paddy, maize, small millets, soybean and rapeseed mustard. Horticultural crops: Passion fruit, pineapple, banana and kinnow/mandarin/orange
- Livestock forms an integral component of the farming system, dominated by indigenous cattle, buffaloes, sheep, and goats. However, overall productivity remains low due to seasonal fodder scarcity, poor quality feed resources, and limited adoption of improved breeding and health management practices. To mitigate these challenges, convergence-based climate-resilient interventions focusing on integrated crop–livestock systems, soil and water conservation measures, diversification of cropping systems, and climate-smart agronomic practices were implemented in Ngangching, Sowa Changle Langmeing, Tolok Chingha climate-smart villages of Mon district. The major outcomes were,

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Jalkund and supplemental irrigation (Hills with mild slope): New jalkund- A $5 \times 4 \times 5$ m³ jalkund with a 30,000–35,000 L capacity was constructed. The pond was lined with 250-micron silpaulin, The stored water was used for 3-4 supplemental irrigations.

Crop diversification with cabbage.

Crop yield: 14,000-16,000 kg ha⁻¹, net returns: ₹2,00,000-2,35,000 ha⁻¹

Garlic: Increase in crop yield: 30-45%, net returns: ₹4,00,000 - ₹ 5,00,000 ha⁻¹

Zero till Toria: zero-till toria cultivation conserves soil moisture, saves time, and the crop escape terminal heat stress. Increase in crop yield: 70-75%, net returns: ₹23,000-25,000 ha⁻¹

Hills with steep slope

Paddy straw mulch: In garlic and pea the chopped paddy straw was uniformly spread over the field surface for a thickness of 3-5 inches for effective moisture conservation and weed suppression.

Additional net returns:

NRM based interventions

Jalkund: Garlic :	₹2,45,000 ha ⁻¹
Zero till Toria:	₹13,000 - 14,000 ha ⁻¹
Paddy straw mulch pea:	₹1,00,000 ha ⁻¹
Garlic:	₹2,80,000 - 2,92,000 ha ⁻¹
Potato:	₹70,000 ha ⁻¹

Increase in pea yield: 45 -60%, cost of cultivation: ₹33,000 ha⁻¹ (₹7,000 ha⁻¹ additional cost for mulching) net returns: ₹2,00,000 -2,00,000 ha⁻¹, Increase in garlic yield: 50 -60%, net returns: ₹5,90,000 -6,30,000 ha⁻¹

Crop diversification with potato Var Kufri Jyothi: After rice harvest, the cut tubers are planted at 5–7 cm depth and uniformly mulched with paddy straw, which improves germination, growth, soil moisture conservation, weed control and yield. Increase in crop yield: 17- 19%, net returns: ₹ 1,90,000-2,05,000 ha⁻¹, cost of cultivation: ₹1,10,000-1,12,000 ha⁻¹

Module 2: Crop based Interventions

Predominant varieties and yield: Tahnyu, Nyamshang, Phohhah, Wongshao, Yam, Shiha with 100% crop intensity and productivity of 2 t/ha.

Additional net returns:

Crop based Interventions

Direct seeded rice: ₹30,000 - 45,000 ha⁻¹

Arka Rakshak tomato: ₹2,00,000 - 2,20,000 ha⁻¹

RC Maniphou-14 Direct Seeded Rice variety :

Short-duration rice varieties were directly sown instead of transplanting 25–30-day-old seedlings as in farmers' practice.

Increase in crop yield: 25 -40%, cost of cultivation: ₹50,000 ha⁻¹ (₹5,000 ha⁻¹ higher than local variety), net returns: ₹85,000 - 95,000 ha⁻¹

Crop diversification with potato and tomato Arka Rakshak

Potato: net returns ₹1,80,000 – 1,99,000 ha⁻¹; Tomato Arka Rakshak: Increase in crop yield: 75-80%, net returns: ₹2,00,000-2,20,000 ha⁻¹

Module 3: Livestock-based Interventions

Poultry: Vanaraja

cost of production: ₹24,00-3,000 /10 birds

net returns ₹10,000 -11,000 /10 birds

Additional Net Returns:

Livestock-based Interventions

Rainbow Rooster: ₹7,000 - 7,500 /10 birds

Vanaraja: ₹ 8,000 - 10,000 /10 birds

Rainbow Rooster: net returns: ₹10,000 -12,000 /10 birds cost of production: ₹ 2,400- 3,000 /10 birds

Oyster mushroom: The rice straw can be recycled for oyster mushroom cultivation, thereby reducing pollution from residue burning. Mushroom yield: 460-480 kg /100- cylinder bags, net returns: ₹50,000-55,000/ 100- cylinder bags,

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Jalkund and supplemental irrigation (Hills with mild slope)	Community	14,000-19,000/Jalkund
Zero tillage Toria	Individual	11,000-15,000 ha ⁻¹
Paddy straw mulching	Individual	9,000-11,000 ha ⁻¹

Module 2: Crop based Interventions

Crop	Variety	Method
Garlic	Yamuna Purple-10	Seed bank
Pea	Arka Apoorva, Aman	Seed bank
Toria	TS-38, TS-67	Seed bank
Rice	RC-Maniphou-14, RC-Maniphou-15	Seed bank
Potato	Kufri Jyothi	Seed bank

System based

System	Cost (₹)	Net returns (₹)
Rainfed with livestock, Hills with steep slope		
Crop alone	1,14,200 ha ⁻¹	2,85,800 ha ⁻¹
Crop +livestock (1 unit=10 birds)	1,17,200 ha ⁻¹	2,96,960 ha ⁻¹
Rainfed with livestock, Hills with steep slope		
Crop alone	1,80,000 ha ⁻¹	4,30,000 ha ⁻¹
Crop +livestock (1 unit=10 birds)	1,84,000 ha ⁻¹	4,40,960 ha ⁻¹

Module 3: Livestock based Interventions

Livestock	Breed / variety	Method	Cost (₹)
Poultry	Vanaraja	Backyard poultry	3,000 /10 birds
Poultry	Rainbow rooster	Backyard poultry	3,000 /10 birds (₹ 600 higher)
Mushroom	Oyster	Individual	Spawn cost: 60/100 kg

Institutional Intervention

Intervention	Management	Purpose
VCRMC	Community, committee: 12-20 members	Coordinates activities such as seed banks, fodder banks, custom hiring centers and guide seasonal action plans
Custom Hiring Canters with need-based machinery	Community, local youth	Provide essential Machinery
FPO and women self-help groups. For post-harvest value addition. (Mushroom production and value addition)	Community	Women empowerment

Odisha

District 1: Nuapada

Climate vulnerability: Drought

A. Introduction/ Background

- Nuapada district, located in the western part of Odisha on the border with Chhattisgarh, is highly vulnerable to climatic extremes, especially erratic monsoon rainfall, recurrent droughts, prolonged dry spells, and moisture stress, severely affecting agricultural production and rural livelihoods.
- The district receives its rainfall mainly from the southwest monsoon, with an average annual rainfall of about 1233 mm. Temperatures range from around 12 °C in winter to over 38 °C in summer.
- Soils are predominantly medium to deep red and mixed red–lateritic soils with low organic carbon and fertility, often found on upland and undulating terrain with limited natural moisture retention.
- Agriculture in Nuapada is predominantly rainfed (81%), cultivation depends on monsoon rains, making water conservation, rainwater harvesting, and soil health management critical for sustaining crop productivity.
- Field crops: Paddy, maize, pulses, groundnut, cotton, and oilseeds. Plantations: Mango, guava, papaya, banana *etc.*
- Livestock and allied sectors (cattle, goats, and poultry) are vital components of the rural farming system, but productivity is constrained by fodder shortages, limited input access, and dependence on traditional practices.
- To cope with the climate challenges, climate-resilient interventions focusing on integrated crop-livestock systems, water and soil conservation, efficient rainwater use and moisture conservation, along with improvements in crop diversification and livelihood options are recommended.

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Crop diversification through Integrated farming Systems: Cultivation of improved paddy, groundnut and potato varieties (8 ha paddy, 0.2 ha each groundnut and potato), drought tolerant kodo millet (2 ha), introduction of horticulture crop (Mango in 0.4 ha, dragon fruit and marigold in 1 ha), introduction of fishery in farm pond along with livestock (2 cows). Before intervention farmer income: ₹ 3,00,000-3,50,000 ha⁻¹, after crop diversification farmer income: ₹ 6,00,000 ha⁻¹.

Additional net returns:

NRM based interventions

Crop Diversification through

Integrated farming system: ₹ 3,00,000 ha⁻¹

Drip irrigation + mulching: ₹ 25,000-30,000 ha⁻¹

Mushroom production and post harvest value addition: Oyster mushroom cultivation using paddy straw, The mushroom waste was vermicomposted. Women SHGs produce over 100 mushroom beds per day, Monthly income: ₹18,000-20,000, additional income from vermicomposting: ₹ 12,000 /year, additional earnings through post-harvest value addition (pickles, papad, powders)

Micro irrigation system (MIS):

Drip irrigation + mulching: Better root aeration and drainage in raised beds, water saving: 30–45%, increase in crop yield: 25-30%,

Ridge and Furrow System in maize: Furrows of 15 cm deep were made, increase in crop yield: 20-27 %, Water use efficiency was 25-30%

Sprinkler irrigation for Greengram: Increase in crop yield: 30 %, water saving: 25- 45%, cost of installation: ₹ 35,000 ha⁻¹

Module 2: Crop based interventions

System of Rice Intensification: The seed rate is 3.75 -5 kg ha⁻¹. Single seedling of 8-12 days old or three leaf stage seedlings were transplanted at a spacing of 25 × 25 cm spacing. After 8/10 lines of transplanting one line is skipped. Increase in crop yield: 20–25%, net returns: ₹ 59,377 ha⁻¹

Additional Net Returns:

Crop based interventions

CR Dhan-800 paddy: ₹ 35,000- 40,000 ha⁻¹

DSR method: ₹ 15,000- 20,000 ha⁻¹

Direct seeding of rice with Sahabhazi Dhan: Sowing of rice directly in the field with tractor drawn implement at a spacing of 20 × 20 cm, placed at 2.5 cm to depth, Sahabhazi dhan variety, 100-105 days duration, drought tolerant, increase in crop yield: 15-20%

CR Dhan-800 paddy variety: Resistant to bacterial leaf blight and suitable for rainfed shallow lowland ecosystems. Increase in crop yield: 35-40%,

Suggested management intervention

Zero till sowing of greengram: Sowing of the crop directly into the residual soil moisture immediately after harvesting paddy or soybean without ploughing or land preparation. Increase in crop yield: 15-20%, additional returns: ₹10,000 - 15,000 ha⁻¹

Residue recycling through Mushroom cultivation and use mushroom waste for vermicomposting
Introduction of millets like finger millet

Module 3: Livestock based interventions

Improved goat breeds (Black Bengal / Ganjam):

Increase in net returns: 30-40%

Vanaraja poultry breed: Improved dual-purpose breed,
140–180 eggs/hen/year

Additional Net Returns:

Livestock based interventions

Vanaraja poultry breed ₹ 8,000 - 10,000

Fishery: Maintenance of proper pH of water using lime, application of cow dung along with different cakes like groundnut, mustard cake for enhancing the Plankton and proper maintenance of stock density of major Carps

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Drip irrigation	Individual	65,000 -70,000 ha ⁻¹
Ridge and furrow system	Individual	2,000 ha ⁻¹
Sprinkler irrigation	Individual	35,000 ha ⁻¹
Mushroom production	Community	10,000-13,000
Vermicomposting	Individual	3,900 /unit

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	Sahabhagi Dhan, CR Dhan-800	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Paddy sole cropping	45,000	43,000
Paddy + mushroom cultivation + vermicomposting	55,000	75,000
Paddy sole cropping	47,600	29,,450
Paddy + Pallishree poultry bird	52,040	34,070

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Goat	Black Bengal / Ganjam	Individual	3,000 /animal
Poultry	Vanaraja	Individual	75 /bird for 2 months

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

Rajasthan

District 1: Barmer

Climate vulnerability: Drought, heat wave, erratic rainfall

A. Introduction/ Background

- Barmer district, located in the south-west region of Rajasthan experiences droughts, heat stress, and erratic rainfall
- The district receives an average annual rainfall of 343 mm, with temperatures ranging from 4-50 °C.
- The irrigated and rainfed areas was 28% and 72%, respectively.
- Soils are predominantly sandy to sandy loam soils, which influence crop choice and water-holding capacity
- Field Crops: Bajra, moth bean, castor, greengram, rapeseed and mustard. Plantations: Pomegranate and ber
- Livestock is a key livelihood, but milk productivity remains low due to fodder scarcity, poor-quality feed, unavailability of improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Junapatrasar, Sujan Nagar, and Punro Ki Basti. The major outcomes were as follows

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Supplemental irrigation through Drip and Sprinkler from harvested water: Water saving through Drip and Sprinkler: 30-50%.

Additional net returns:

NRM based interventions

Micro irrigation in pearl millet: ₹ 3,000- 5,000 ha⁻¹

Mungbean: ₹ 7,000- 10,000 ha⁻¹

Increase in crop yield in pearl millet: 23-32%, cost of cultivation: ₹ 17,000-18,000 ha⁻¹, net returns: ₹ 7,000-10,000 ha⁻¹,

Increase in crop yield in mung bean: 22-52%, cost of cultivation: ₹ 19,000-20,000 ha⁻¹, net returns: ₹ 17,000-25,000 ha⁻¹,

Module 2: Crop based interventions

MPMH-17 , pearl millet variety: Short-duration drought tolerant variety

Increase in crop yield: 23-32%, cost of cultivation: ₹ 17,500 (3-4 % higher over farmers practice) net returns ₹10,000 -20,000 ha⁻¹

MH 1142 and GM-4: The duration of MH 1142 is 60-70 days, Increase in crop yield: 22-52%, cost of cultivation: 19,800 ha⁻¹ (3-5% higher over traditional varieties), net returns: ₹ 15,000-35,000 ha⁻¹

GC-4 drought tolerant cumin variety: is a short duration variety with 105-110 days duration. Increase in crop yield: 22-48%, net returns: ₹60,000-95,000 ha⁻¹

Additional net returns:

Crop based interventions:

Improved varieties:

MPMH-17 Pearl millet: ₹ 10,500- 68,000 ha⁻¹

MH 1142 Mung bean: ₹ 9,200 - 15,450 ha⁻¹

GC-4 Cumin: ₹ 26,300- 38,200 ha⁻¹

RMO-435 Moth bean: ₹ 2,800 - 3,200 ha⁻¹

RI-1 Isabgol: ₹ 20,000- 20,200 ha⁻¹

RMO-435 Drought tolerant moth bean variety: an early-maturing with 62-65 days duration, ideal for arid/semi-arid regions and escapes from terminal drought. Increase in crop yield: 38-42%, net returns: ₹ 4,000-5,000 ha⁻¹

RI-1 Drought tolerant Isabgol variety: Matures 20 to 25 days earlier than local varieties, which helps to escape late-season environmental stresses. Increase in crop yield: 25-30 %, net returns: ₹ 60,000 -65,000 ha⁻¹

Module 3: Livestock based interventions

Balance feeding in dairy animals through mineral mixture supplementation: More nutritious feed is fed to the animals. This resulted in higher returns to the farmers as it could mitigate cold stress. Increase in milk yield: 5-22%, cost of the mineral mixture: ₹2,000 -25,00 /animal, net returns: ₹ 3,000-5,000 animal⁻¹

Additional net returns:

Livestock based interventions

Balanced feeding: ₹ 5,200 - 5,800 ha⁻¹

Multicut fodder : ₹ 5,000 - 6,000 ha⁻¹

Breed upgradation:

Goats: ₹ 6,500 - 6,800 goat⁻¹,

Cows: ₹ 5,000 - 10,000 animal⁻¹

Improved perennial fodder production: Multi cut cultivars of fodder crops like Napier grass (Co-5), has the ability to withstand drought conditions and gives more returns Increase in milk yield: 20-25%, net Returns: ₹20,000,

Breed upgradation to increase productivity and profitability: Goats Sirohi bucks: Increase in yield: 95-100%, cost of rearing goats: ₹4,000 (50% higher over farmers practice), net returns: ₹ 9,500-10,000 goat⁻¹.

Tharparkar cross cows: Increase in milk yield: 15-20%, net returns: ₹5,000-10,000 animal⁻¹

Module 4: Integrated farming systems Combination of livestock with crop, horticulture crops etc. by recycling one by product to other by product. Eg: crop residues etc can be fed to cattle and cattle dung can be used for crops. Can enhance opportunity for organic farming. Reduction in cost of cultivation: ₹ 400- 600, additional net returns: ₹ 19,000- 20,000

B. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Drip irrigation Sprinkler irrigation	Individual Community/Individual	Installation Cost Drip irrigation: 65,000 -70,000 Sprinkler irrigation: 50,000- 55,000
Water harvesting through new ponds/ desilting	Community	Depends on the size of the pond 10×10×3: 45,000
Field bunding	Individual	1,500-2,000

Module 2a: Crop based interventions

Crop	Variety	Method
Pearl millet	MPMH-17	Individual
Mung bean	MH 1142 and GM-4	Individual
Cumin	GC-4	Individual
mothbean	RMO-435	Individual
Isabgol	RI-1	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns(₹ ha ⁻¹)
Pearl millet and mungbean alone under rainfed	23,000-23,150	14,600-14,800
Pearl millet and mungbean alone under rainfed + Live stock	22,300-23600	34,300-34,400

Module 3: Livestock based interventions

Intervention	Breed / variety	Method	Cost (₹)
Perennial fodder (Multi cut napier grass) production	Co-5	Individual	23,580-39,600 ha ⁻¹
Breed upgradation	Goats: Sirohi bucks Cows: Tharparkar bulls	Individual	52/buck 20,000/bull

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring Canters with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee: 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 2: Bikaner

Climate vulnerability: Drought, heat wave, cold wave,

A. Introduction/ Background

- Bikaner district, is in the northwest of Rajasthan experiences droughts, heat waves, cold waves, and extreme temperature variations.
- The district receives an average annual rainfall of 283 mm, with temperature ranging from 19-33 °C.
- The rainfed and irrigated area of the district were 60% and 40% respectively.
- Soils are predominantly desert soils, sandy, loamy coarse-textured, and calcareous soils.
- Field crops: Rapeseed and mustard, moth bean, groundnut, bajra, chick pea and wheat. Plantations: Pomegranate, citrus, ber and date palm.
- Livestock is a key livelihood, but milk productivity remains low due to poor-quality feed, unavailability of improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Kansara and Himtasar. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Green manuring in mustard: Green manuring in mustard involves growing and incorporating a green manure crop into the soil before sowing mustard to

Additional net returns:

NRM based interventions

Green manuring in mustard: ₹ 25,400- 32,200 ha⁻¹

Supplemental irrigation through sprinkler: ₹ 33,000- 33,200 ha⁻¹

improve soil fertility, organic matter content, and overall crop productivity. Increase in crop yield in mustard: 70-75%, net returns: ₹40,000 -45,000 ha⁻¹

Supplemental irrigation through sprinkler in field crops: Adoption of efficient irrigation methods like sprinkler irrigation in field crops improves productivity, profitability of field crops. Water saving: 30-40%. Increase in crop yield in chick pea: 27-30%, net returns: ₹ 60,000-63,200 ha⁻¹

Laser Land levelling coupled with sprinkler irrigation in wheat: Adoption of laser land levelling along with sprinkler irrigation and improved irrigation scheduling increased the productivity of crops like wheat (RAJ-4238). Increase in crop yield: 10-18%

Module 2: Crop based Interventions

RMO 2251-Drought tolerant moth bean variety: Duration :

63 - 67 days: Increase in crop yield: 54-82%,

net returns: ₹ 30,000 -35,000 ha⁻¹,

cost of cultivation: ₹ 9,000-9,450 ha⁻¹

RGC 1033-Cluster bean variety: Drought tolerant and has early

flowering (around 16-17 days). net returns: ₹ 31,000 -32,000 ha⁻¹

Increase in crop yield: 65-89%, cost of cultivation: ₹ 11,000-11,500 ha⁻¹

Radhika -Heat-tolerant mustard variety: is suitable for late-sown irrigated conditions.

Increase in crop yield: 70-75%, net returns: ₹ 55,000 -60,000 ha⁻¹

cost of cultivation: ₹ 24,000-24,500 ha⁻¹

GNG 2207- Heat-tolerant chickpea variety: is moderately resistant to Fusarium wilt disease.

Increase in crop yield: 28-35%, net returns: ₹ 17,000-18,000 ha⁻¹,

cost of cultivation: ₹ 34,000-38,000 ha⁻¹

Additional net returns:

Crop based Interventions

Improved varieties

RMO-2251: ₹ 14,000 - 15,000 ha⁻¹

RGC-1033: ₹ 14,500 - 16,000 ha⁻¹

Radhika: ₹ 25,400 - 32,200 ha⁻¹

GNG-2207: ₹ 6,550 - 17,800 ha⁻¹

Module 3: Livestock based interventions

Breed upgradation in goats to increase meat production

Sirohi goat has conception rates and twinning in goats,

buck breed, well-suited for commercial meat goat

farming in India. It shows remarkable adaptability

to diverse climates, possess resistance to common goat diseases, and thrive in hot and arid

environments. Increase over local breeds in yield: 52-55%, net returns: ₹ 3,46,800- 3,47,300 goat⁻¹

cost of production: ₹ 71,000-76,000 animal⁻¹

Additional net returns:

Livestock based Interventions

Breed upgradation: ₹ 2,41,000 - 2,52,200 goat⁻¹

Supplementation with mineral mixtures: Supplementation of dairy animals like cows with mineral mixtures improved the productivity of cows. Increase in milk yield: 10-20% cost: ₹ 235-250 day⁻¹

Module 4: Integrated farming systems:

Combination of small ruminants/livestock with crop, horticulture crops etc. Eg: crop straw can

be fed to cattle and cattle dung can be used for crops. net returns: ₹ 4,27,800-4,94,000 ha⁻¹,

additional cost of cultivation: ₹ 70,000-72,000 ha⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Green manuring	Individual	3,000 - 3,500
Sprinkler irrigation	Individual	50,000 -55,000

Module 2a: Crop based interventions

Crop	Variety	Method
Moth bean	RMO-2251	Seed bank
Cluster bean	RGC-1033	Individual
Mustard	Radhika	Seed bank
Chickpea	GNG-2207	Individual

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹ ha ⁻¹)
Crop alone	Rainfed: 42,000-42,500 Irrigated: 60,000 - 65,000	1,45,000 -1,50,000 80,851
Crop + Goat	Rain fed: 1,13,000-1,14,500 Irrigated: 1,33,040- 1,43,040	4,90,000 - 4,94,000 4,27,800 – 4,30,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹ ha ⁻¹)
Goat	Sirohi buck	Individual	20,000 - 30,000

Institutional Interventions

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 3: Churu

Climate vulnerability: Heat wave, cold wave, frost, erratic rainfall , frequent drought and temperature extremes

A. Introduction/ Background

- Churu district, is in the northern part of Rajasthan experiences heat waves, cold waves, frost, erratic rainfall, frequent droughts, and extreme temperature variations.
- The district receives an average annual rainfall of 377 mm, with temperature ranging from 19-33 °C.
- The rainfed and irrigated area of the district were 76% and 24% respectively.
- Soils are predominantly sandy in nature
- Field Crops: Green gram, bengal gram, moth bean, bajra, rapeseed and mustard.
- Plantations: Pomegranate, ber and date palm.
- Livestock is key livelihood, but milk productivity remains low due to poor-quality feed, unavailability of fodder, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Mitasar and Nainasar. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Efficient irrigation through Drip: Irrigation through Drip enhanced the productivity and profitability of crops like mustard and fenugreek. Water saving through Drip: 30-40%. Increase in mustard crop yield: 18-36%,

**Additional net returns:
NRM based interventions**
Drip in mustard:
₹ 9,700 - 16,300 ha⁻¹

net returns: ₹ 49,500-49,700 ha⁻¹, cost of cultivation: ₹ 33,900-34,200 ha⁻¹. Increase in fenugreek crop yield: 12 - 30%, net returns: ₹ 43,000-49,500 ha⁻¹, cost of cultivation: ₹ 37,000-37,300 ha⁻¹

Module 2: Crop based Interventions

MH 1142 mung bean variety: A short-duration variety with 60-70 days duration. Increase in crop yield: 13-45%, net returns: ₹ 24,000-24,300 ha⁻¹, cost of cultivation: ₹20,000- 20,500 ha⁻¹

RGC-936 cluster bean variety: 85-95 days duration with drought tolerance. Increase in crop yield: 26-30%, net returns: ₹10,000-17,000 ha⁻¹, cost of cultivation: ₹24,000-25,000 ha⁻¹

**Additional net returns:
Crop based Interventions**
Improved varieties
MH 1142 Mung bean variety: ₹ 9,000 - 11,000 ha⁻¹
RGC-936 Cluster bean variety: ₹ 8,000 - 8,300 ha⁻¹
CS-60 Mustard variety: ₹ 9,700 - 16,300 ha⁻¹
GJG 19 Groundnut variety: ₹40,000 - 45,000 ha⁻¹
AFG-5 Fennel variety: ₹ 10,000 - 12,000 ha⁻¹

CS-60 + Spray of DMSO@ 0.38 %Salinity tolerant mustard var.: Spray of DMSO@ 0.38 % was done to avoid damage due to cold wave and frost in saline tolerant mustard var. CS-60. Increase in crop yield: 18-36%, net returns: ₹ 49,500-49,700 ha⁻¹, cost of cultivation: ₹ 33,900-34,200 ha⁻¹

GJG 19 Groundnut: Short duration of 120 days. Increase in crop yield 24-25%, net returns: ₹1,40,000 -1,60,000 ha⁻¹, cost of cultivation: ₹ 50,000-60,000 ha⁻¹

AFG -5 Fennel under limited irrigation: Increase in crop yield: 25-40%, net returns: ₹ 40,000 -45,000 ha⁻¹, cost of cultivation: ₹ 35,000 - 40,000 ha⁻¹

Module 3: Livestock based interventions

Balance feeding using mineral mixtures

along with cow mats: Balanced feeding of dairy animals using mineral mixtures along with cow mats for improved comfort and productivity: Rainfed: Increase in milk yield: 6-9%, net returns: ₹ 8,000 -10,000
Irrigated: 8-12%,
net returns: ₹ 14,000 -15,000

Additional net returns:

Livestock based interventions

Balance feeding through mineral mixture supplementation	
Rainfed:	₹ 1,500 - 2,000 animal ⁻¹
Irrigated:	₹ 1,700 - 2,000 animal ⁻¹
Year-round fodder production	
Irrigated:	₹ 1,700 - 2,500 animal ⁻¹
MFSH 4 Sorghum:	₹ 20,000 - 25,000
Increase in milk yield: 13-30%,	
additional net returns:	₹ 1,700 - 2,500 animal ⁻¹

Year-round fodder production through improved multi-cut green bajra (Raj Bajra Chari -2) in irrigated conditions: Increase in milk yield: 14-20%,

net returns: ₹ 12,000 -15,000 ha⁻¹, cost of cultivation: ₹ 15,000 -16,000 ha⁻¹

Napier Co4 Green fodder under assured irrigation

MFSH 4 Fodder sorghum: Increase in fodder yield: 30%, Increase in milk yield: 8-10%, net returns: ₹ 70,000 -75,000 ha⁻¹ cost of cultivation: ₹ 30,000-32,000 ha⁻¹

Module 4: Integrated farming systems: Combination of small ruminants/livestock with crop, horticulture crops etc. Eg: crop residues can be fed to cattle and cattle dung can be used for crops.

Rainfed with animal: net returns: ₹ 29,000-29,500

Irrigated with animal: net returns: ₹ 11,500-12,000

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Drip irrigation (mustard and fenugreek)	Individual	Installation: 45,000 -50,000

Module 2a: Crop based interventions

Crop	Variety	Method
Mung bean	MH 1142	Individual
Cluster bean	RGC-936	Individual
Mustard	CS-60	Individual
Fenugreek	AFG 5	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Crop alone	Rainfed: 24,000-24,200 Irrigated: 36,000-36,400	Rainfed: 12,000-12,300 Irrigated: 13,800-14,000
Crop with dairy animals	Rainfed: 23,700-24,000 Irrigated: 25,800-26,000	Rainfed: 29000-29500 Irrigated: 11,500-12,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹ ha ⁻¹)
Balanced feed with mineral mixtures	Dairy animals	Individual	20,700-22,200
Year-round fodder production with improved multi-cut green bajra	Raj bajra chari -2	Individual	11,500-13,600
Napier (Irrigated)	Co4	Individual	36,000-50,000
Sorghum (Rainfed)	MSFH 4	Individual	30,000

Institutional Interventions

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 4: Jaisalmer

Climate vulnerability: Heat wave, drought and dry spell

A. Introduction/ Background

- Jaisalmer district, is in the western part of Rajasthan Experiences heat waves, droughts, and prolonged dry spells.
- The district receives an average annual rainfall of 227 mm, with temperature ranging from 9-47 °C.
- The rainfed and irrigated area of the district were 76% and 24% respectively.
- Soils are predominantly sandy loamy in texture
- Field crops: Bengal gram, bajra, cluster bean, rapeseed and mustard. Vegetables: Onion.
- Livestock is a key livelihood, but milk productivity remains low due to unavailability improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart village Jogidas ka gaon. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Life saving irrigation in cluster bean:

Life saving irrigation during prolonged dry spells (> 20 days) at flowering stage in cluster bean to reduce the impact of drought. Increase in crop yield: 12-18% net returns : ₹34,000 -35,000 ha⁻¹

Additional net returns:
NRM based interventions
Efficient irrigation through Drip
In mustard: ₹ 9700 -16300 ha⁻¹

Module 2: Crop based Interventions

RGC-936 cluster bean variety: Duration: 85 to 95 days is an early-maturing cultivar.

Increase in crop yield: 12-15%,
net returns: ₹15,000 -16,000 ha⁻¹
cost of cultivation: ₹ 21,000 -23,000 ha⁻¹

Additional net returns:

Crop based Interventions

Improved varieties

MH 1142 Mung bean variety: ₹ 9,000 - 11,000 ha⁻¹

RGC-936 Cluster bean variety: ₹ 8,000 - 8,300 ha⁻¹

CS-60 Mustard variety: ₹ 9,700 - 16,300 ha⁻¹

GJG 19 Groundnut variety: ₹40,000 - 45,000 ha⁻¹

GC-4 cumin variety: is drought tolerant and fusarium wilt resistant variety. Increase in crop yield: 8-10%, cost of cultivation: ₹35,000 -40,000 ha⁻¹ (2% higher than traditional variety), net returns: ₹10,0000 -12,0000 ha⁻¹

RMO 257 moth bean variety: short duration variety of 65 to 75 days escapes terminal droughts and suitable for late-season planting. Increase in crop yield: 18-48%, net returns: ₹16,000 -18,000 ha⁻¹ cost of cultivation: ₹9,000 -10,000 ha⁻¹

RI-1 (Rajasthan Isabgol-1) is a short duration drought tolerant variety and matures 20 to 25 days earlier than traditional local varieties. Increase in crop yield: 7-15%, cost of cultivation: ₹ 30,000 -35,000 ha⁻¹, net returns: ₹55,000 - 65,000 ha⁻¹

Module 3: Livestock based interventions

Sirohi bucks for Breed upgradation in

goats: The local non-descriptive goat breed has low productivity. To address this issue, the Sirohi bucks breed is well-suited due to its adaptability and resistance to common goat diseases, and thrives in hot and arid environments.

Increase in milk yield: 8-15%, cost of production: ₹8,000 -10,000

net returns: ₹ 10,000-12,000 goat⁻¹

Additional net returns:

Livestock based interventions

Balanced feeding through mineral mixture supplementation

Rainfed: ₹ 1,500 - 2,000 animal⁻¹

Irrigated: ₹ 1,700 - 2,000 animal⁻¹

Year-round fodder production

Irrigated: ₹ 1,700 - 2,500 animal⁻¹

MFSH 4 Sorghum: ₹ 20,000- 25,000

Module 4: Integrated farming systems (IFS) : Combination of small ruminants/livestock with crop, horticulture crops etc. Eg: crop residues can be fed to cattle and cattle dung can be used for crops.

Rainfed with animal: net returns: ₹ 50,000-55,000

Irrigated with animal: net returns: ₹ 2,08,200-2,08,600

Rainfed IFS: additional cost of cultivation: ₹ 17,100- 17,350

Irrigated IFS: additional cost of cultivation: ₹ 20,800-21,300 (25-28% higher over only crop),

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Lifesaving irrigation in cluster bean through harvested rain water from farm ponds	Individual	5,00,000

Module 2a: Crop based interventions

Crop	Variety	Method
Cluster bean	RGC-936	Individual
Cumin	GC-4	Individual
Moth bean	RMO 257	Individual
Isabgol	RI-1	Individual

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹ ha ⁻¹)
Crop alone	Rainfed: 24,00-25,000	Rainfed: 27,000 -28,000
	Irrigated: 75,000 -79,000	Irrigated: 1,90,000 -1,95,000
Crop with Goat	Rainfed: 42,000-43,000	Rainfed: 52,000-53,000
	Irrigated: 1,00,000 - 1,10,000	Irrigated: 2,00,000 -2,00,847

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹ ha ⁻¹)
Breed upgradation in goats through Sirohi bucks	Sirohi	Individual	9,560-11,255

Institutional Interventions

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 5: Jalore

Climate vulnerability: Heat wave, drought, erratic rainfall

A. Introduction/ Background

- Jalore district, located in the south west part of Rajasthan experiences heat wave, drought, erratic rainfall
- The district receives an average annual rainfall of 483 mm, with temperatures ranging from 20-33 °C.
- The rainfed and irrigated area of the district were 38 and 62% respectively.
- Soils are predominantly alkaline and sandy loamy soils in nature
- Field crops: Bajra, green gram, castor, cluster bean, rapeseed and mustard. Vegetables: Onion
- Livestock is key livelihood, but milk productivity remains low due to unavailability of fodder, poor shelter management, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource.

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Mulching: Mulching can be either poly mulching or crop residue. It also can be recommended for vegetable crops like onion. Increase in crop yield: pearl millet: 20-50%, net returns: ₹30,000 -35,000 ha⁻¹

Additional net returns:	
NRM based interventions Mulching	
Pearl millet:	₹ 8,000 - 10,000 ha ⁻¹
Ridge and furrow planting	
Field crops:	₹ 8,000 - 12,000 ha ⁻¹
Vegetables:	₹ 30,000- 50,000 ha ⁻¹

In situ moisture conservation: Ridge and furrow planting: The furrows are opened between the crop rows either at the time of sowing or at the time of first interculture operations. The water is conserved in the furrows and this moisture available for longer periods. Due to conservation furrows, crops can survive during dry spells. The furrow spacing is 40 cm in field crops and 90-120 cm in vegetables and 15 cm depth, ridges of 15 cm height can be made. Crops: Groundnut, castor, cotton, cumin, pulses, vegetables

Increase in crop yield: 15-20 %, net returns: Crops: ₹ 25,000-35,000, Vegetables: ₹ 1,20,000- 1,50,000

Drip irrigation: Efficient method of irrigation for pomegranate, ber date palm and vegetable crops (Onion and Tomato) Water saving 25-30%. Increase in crop yield: 25-40%, cost of installation: ₹ 55,000 - 60,000

Sprinkler irrigation can be used for: Groundnut, cumin, wheat, barley, mung bean, moth bean
Water saving: 30–40%, Installation cost: ₹ 30,000 - 40,000 ha⁻¹,
additional net returns: ₹ 10,000 - 20,000 ha⁻¹

Module 2: Crop based Interventions

RMG-501, RMG 492: Greengram with duration of 60-65 days is drought tolerant and fits well in rainfed and summer cropping systems due to short duration. Both varieties were resistant to the Yellow Mosaic Virus (YMV). Increase in crop yield: 25-30%, cost of cultivation: ₹16,000-18,000 ha⁻¹, net returns: ₹ 25,000 -30,000 ha⁻¹

Additional net returns: Crop based Interventions

Improved varieties

RMG-501, RMG 492 Green gram: ₹ 2,900 - 5,300 ha⁻¹

DRMR-1165-40 Mustard: ₹ 8,600 - 11,000 ha⁻¹

RHB-177 Bajra: ₹ 8,000 - 10,000 ha⁻¹

RGC 936 Cluster bean: ₹ 8,000 - 10,000 ha⁻¹

Mustard DRMR-1165-40 (Bharat Sarson-8 or Rukmini,) Drought tolerant and is suitable for both irrigated and rainfed (unirrigated) conditions.

Increase in crop yield: 15-25%, cost of cultivation: Rainfed ₹18,000-20,000 ha⁻¹,
Irrigated: ₹ 35,000 -40,000 ha⁻¹ net returns: Rainfed ₹18,000-20,000 ha⁻¹
Irrigated: ₹ 75,000 -80,000 ha⁻¹

RHB-177 drought tolerant bajra, variety: Resistance to ergot. Increase in yield: 20-25%, cost of cultivation: ₹15,000-16,000 ha⁻¹ net returns: ₹ 30,000 -35,000 ha⁻¹

Cluster bean RGC 936: Drought tolerant and early maturing (85-90 days) variety. Increase in crop yield: 20-25%, cost of cultivation: ₹10,000-12,000 ha⁻¹

Line sowing in crops: Line sowing in crops over traditional broadcasting reduces weed infestation and an increase in crop yields can be 25-30%

Intercropping systems: Intercropping systems like bajra + moong 2:1, bajra + guar 2:1, castor+ moong bean, mustard+ gram for better drought resilience and moisture use, reduced crop failure risk under erratic rainfall conditions. Increase in crop yield: 20-30%, additional net returns: ₹ 15,000-20,000 ha⁻¹

Agri -horticulture and Agroforestry system with in situ moisture conservation

Increase in crop yield: 59-66%, net returns: ₹ 1,18,300- 1,18,600 ha⁻¹, additional net returns: ₹ 23,600- 52,300 ha⁻¹.

Module 3: Livestock based interventions

Improved housing for small runinants (Goat and sheep)

The house is in east -west direction with manger and water at one side of the corner

Increase in milk yield: 14-24%, cost of construction: ₹ 20,000-21,000

Additional net returns:

Livestock based interventions

Shelter management ₹ 16,400- 23,550 animal⁻¹

Perennial fodder production ₹ 10,600- 13,800 ha⁻¹

Perennial fodder production: Availability of fodder is very important for sustainable dairy farming. Hybrid Napier grass, Cenchrus, Bajra, cowpea, silage and hay making. Increase in yield: 57-65%

Breed upgradation in goats: Improved goat breeds include Sirohi, Marwari, Barbari,

Sheep Rearing: Marwari, Magra, **Poultry:** Vanaraja, Pratapdhan, Gramapriya

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Mulching in cluster bean	Individual	Cost of mulching: 3,000-4,000

Module 2a: Crop based interventions

Crop	Variety	Method
Green gram	RMG-501, RMG-492	Individual
Mustard	DRMR-1165-40	Individual
Bajra	RHB-177	Individual
Castor	GCH-7, GCH-5	Individual
Cluster bean	RGC 936	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Agri -horti systems	67,400-1,16,500	62,500- 1,18,600
Integrated farming systems (crop + small ruminants)	50,000-60,000	40,000- 50,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Shelter management (E-W direction)	Sheep and goat	Individual	20,000- 21,000
Fodder production	Napier grass, Cenchrus, bajra, cowpea	Individual	14,500-18,900

Institutional Interventions

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 6: Jodhpur

Climate vulnerability: Drought, high intensity rainfall, frost, cold waves, heat waves

A. Introduction/ Background

- Jodhpur district, in the western region of Rajasthan experiences drought, high intensity rainfall, frost, cold waves, heat waves
- The district receives an average annual rainfall of 332 mm, with temperature ranging from 10-43 °C.
- The rainfed and irrigated area of the district were 73 and 27% respectively
- Soils are predominantly sandy and sandy loam in nature
- Field crops: Bajra, green gram, rapeseed and mustard, ground nut and cluster bean. Vegetables: Onion and garlic
- Livestock is a key livelihood, but milk productivity remains low due to poor-quality feed, poor shelter management, unavailability of improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Lawari (P.S. Bhopalgarh) and Nandiya kalla (P.S. Bawadi). The major outcomes were as follows

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Desilting and renovation of water harvesting

structures: This increases the storage capacity of the

structures and water can be used for lifesaving irrigation. Size of the water harvesting structure was 100'x100'x19'. Improved water level in the wells: 5'-10', Additional water storage: 4,200 m³

Tank silt application in bajra: The desilted tank silt is applied to the field. The rate of tank silt depends on the clay content of the soil. Increase in crop yield in bajra: 46-50%, net returns: ₹ 8,000- 9,000 ha⁻¹

Compost application in bajra: The crop residues can be used for compost preparation. The size of the compost pit was 3 m x 1.5 m x 1m. The compost pit is filled layer by layer, each layer being 15 cm thick, the first layer is a green manure crop, the second layer is a straw mixture, third layer is animal dung. These layers are alternated until the pit is full. Increase in bajra yield: 28-30%, net returns: ₹ 7,400-7,500 ha⁻¹

Additional net returns:

NRM based interventions

Tank silt application in bajra: ₹ 5,000 - 6,000 ha⁻¹

Compost application in bajra: ₹3,500 - 4,000 ha⁻¹

Module 2: Crop based interventions

GAM-5 and GAM 4 (60-65 days), MH-421 (60-65 days) : and IPM 205-7 (52-55 days), IPM-2-3:

Short duration gre gram varieties Increase in crop yield: GAM-5: 25-26%, MH-421 and IPM 205-7: 26-30%, and IPM-2-3: 14-18%;

cost of cultivation: ₹ 16,000 -18,000 ha⁻¹,
net returns: ₹15,000-16,000 ha⁻¹

Giriraj and RH-725 Mustard variety:

Increase in crop yield: 20-25%,
net returns: ₹ 65,000-68,000 ha⁻¹,
cost of cultivation: ₹ 30,000 -34,000 ha⁻¹

HHB 299, MPMH-17 drought tolerant pearl

millet varieties: Highly resistant to major diseases such as downy mildew and blast. HHB 299 is a biofortified pearl millet hybrid known for its high iron (around 73 ppm) and zinc (around 41 ppm) content, making it a nutritious choice for combating micronutrient deficiencies. Increase in crop yield: 28-32%,
net returns: ₹ 25,000- 30,000 ha⁻¹, cost of cultivation: ₹ 15,000-16,000 ha⁻¹

GC-4 drought tolerant Cumin variety: A fusarium wilt resistant variety. Increase in crop yield: 7-22%, net returns: ₹ 35,000- 36,000 ha⁻¹, cost of cultivation: ₹ 40,000-42,000 ha⁻¹

Additional net returns:

Crop based interventions

Improved varieties:

RH 725 Mustard: ₹ 17,000- 18,000 ha⁻¹

MPMH: ₹ 5,600 - 10,600 ha⁻¹

HHB 299, MPMH-17: ₹8,000 - 16,000 ha⁻¹

GC 4 Cumin variety: ₹ 6,000 - 8,000 ha⁻¹

Additional net returns:

Crop based interventions

Improved varieties

GAM-5: ₹ 14,700 - 15,000 ha⁻¹

MH-421, IPM 205-7: ₹ 13,500 - 13,850 ha⁻¹

IPM-2-3: ₹ 2,800 - 3,100 ha⁻¹

Module 3: Livestock based interventions

E-W housing, usage of cow mats and balanced feeding through mineral mixtures (MM) and multinutrient feed

blocks in cows: E-W housing protects cows from extreme heat and cold, while mineral mixtures (MM) and multi nutrient feed blocks (MNFB) ensure balanced nutrition. **Rainfed:**

Increase in milk yield: 22-25%,
cost of cultivation: ₹ 25,000 -30,000 animal⁻¹ year⁻¹, net returns: ₹ 30,000- 40,000 animal⁻¹ year⁻¹

Irrigated: Increase in milk yield: 15-20%, cost of cultivation: ₹ 37,000-39,000 animal⁻¹ year⁻¹,
net returns: ₹ 61,000-62,000 animal⁻¹ year⁻¹,

Urea molasses blocks supplementary feed to cows and buffaloes: Increase in milk yield in cows: 22-25%, net returns: ₹ 1,600 animal⁻¹, Increase in milk yield in buffaloes: 20-24%,
net returns: ₹ 1,400 animal⁻¹

Area specific mineral mixtures @ 50-80 g/day: Increase in milk yield: 500 ml to 1 liter higher milk yield.

Breed upgradation in various animals

Sirohi goats for breed upgradation: Breed upgradation using Sirohi bucks was undertaken to improve productivity, conception rates, and twinning in low-producing local goats

Increase in yield: 18-48%, net returns: ₹ 8,000-9,000 animal⁻¹ year⁻¹,

Additional net returns:

Livestock based interventions

E-W housing, and supplementation through mineral mixtures (MM) and multinutrient feed blocks:

Rainfed: ₹ 20,000- 20,300 animal⁻¹

Irrigated: ₹ 46,000- 47,000 animal⁻¹

Area specific mineral mixtures: ₹ 3,000 - 4,500 year⁻¹

Breed upgradation

Sirohi goats: ₹ 73,400- 1,21,200 goat⁻¹

Tharparkar cows: ₹ 5,000 - 10,000 cow⁻¹

Tharparkar cows for breed upgradation to enhance productivity: Breed upgradation of cows using Tharparkar bulls has enhanced productivity. Increase in milk yield: 48-52%

Murrah Breed upgradation of buffaloes for enhancing milk production: To enhance milk production and ensure sustainable income, native non-descript buffaloes are upgraded with the high-yielding Murrah breed, which is well adapted to hot and arid climatic conditions. Increase in milk yield: 58-62%

Module 4: Integrated farming systems:

Combination of livestock with crop, horticulture crops, etc., by recycling one by-product to another by-product. Eg: crop residues, etc., can be fed to cattle, and cattle dung can be used for crops. Can enhance the opportunity for organic farming.

Rainfed with animal: additional cost of cultivation: ₹ 85,000-85,300,
net returns: ₹ 3,05,500-3,05,700

Irrigated with animal: additional cost of cultivation: ₹ 1,34,300-1,34,500,
net returns: ₹ 2,20,500-2,21,000

C. Strategic Interventions Recommended for PMDDY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Water harvesting structures (desilted)	Community	1,50,000
Application of desilted tank silt	Community	2,200
Compost (crop residue recycling) application	Individual	5,300
Drip/sprinkler irrigation	Individual	Drip installation: 65,000 - 70,000 Sprinkler installation: 25,000 - 30,000

Module 2a: Crop based interventions

Crop	Variety	Method
Greengram	Short duration greengram (GAM-5, MH-421 and IPM 205-7) and Drought tolerant greengram (IPM-2-3)	Seed bank
Mustard	Drought tolerant mustard (Giriraj, RH-725)	Individual
Cumin	Drought tolerant and fusarium wilt resistant cumin (GC-4)	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns ((₹ ha ⁻¹))
Crop alone	Rainfed: 34,700-35,000 Irrigated: 76,600-77,000	Rainfed: 83,000-84,000 Irrigated: 1,04,000-1,04,200
Crop with cow and goats	Rainfed: 1,20,000-1,20,200 Irrigated: 2,11,000-2,11,200	Rainfed: 3,05,500-3,05,700 Irrigated: 2,20,500-2,21,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
E-W housing	Dairy animals	Individual	20,345
Breed upgradation in various animals (goat, cow and buffalo)	Goats: Sirohi bucks Cows: Tharparkar bulls Buffalos: Murrah buffaloes	Individual	Sirohi: 10,000-40,000 buck ⁻¹ Tharparkar: 30,000-80,000 bull ⁻¹ Murrah buffaloes: 50,000-1,20,000
Pearl millet	HHB 299, MPMH-17	Fodder bank	15,000
Year round fodder production through multi-cut fodder sorghum	CoFS-29 and 31	Individual	36,000- 39,000 ha ⁻¹

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 7: Nagaur

Climate vulnerability: Drought, heat wave and cold wave

A. Introduction/ Background

- Nagaur district, located in center of Rajasthan, experiences drought, heat waves and cold waves
- The district receives an average annual rainfall of 418 mm, with temperatures ranging from 19-33 °C.
- The rainfed and irrigated area of the district were 68 and 32% respectively
- Soils are predominantly sandy to sandy loam in nature
- Field Crops: Green gram, bajra, cotton, wheat, rapeseed and mustard. Plantations: Lemon and ber
- Livestock is a key livelihood, but milk productivity remains low due to imbalanced feeding, unavailability of improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management need based outcome-oriented implementation was done in climate smart villages Deshwal and Amarpura. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Water harvesting structures: Farm ponds were dug. The HDPE lining was encouraged to reduce seepage losses. Area covered: 150 ha, Farmers benefitted :30 farmers

Drip irrigation from harvested water of farm pond: Drip irrigation enhanced yield and returns of the crops like wheat, green gram and cluster bean.

Additional net returns:

NRM based interventions

Drip irrigation:

Wheat: ₹ 15,300 - 15,700 ha⁻¹

Green gram: ₹ 11,400 - 18,800 ha⁻¹

Cluster bean: ₹ 6,600 - 13,400 ha⁻¹

Water saving in Drip: 30-50%. Increase in yield: wheat 17-20%, net returns: ₹61,500-64,000 ha⁻¹, cost of cultivation: ₹39,000-40,500 ha⁻¹.

Increase in green gram yield: 25 - 33%, net returns: ₹62,000-63,000 ha⁻¹, cost of cultivation: ₹26,000-27,000 ha⁻¹, Increase in cluster bean yield: 24 - 38%, net returns: ₹ 30,000-32,000 ha⁻¹, cost of cultivation: ₹22,000-23,500 ha⁻¹

Composting/ Vermicomposting: The animal dung was recycled to crops by converting to compost or vermicompost. Increase in crop productivity 25-28%

Module 2: Crop based Interventions

HHB-299 pearl millet variety: Drought tolerant and biofortified pearl millet rich in iron (73 ppm), zinc (41 ppm), protein, and healthy fats. Increase in crop yield: 20-34%, net returns: ₹ 17,000-25,000 ha⁻¹, cost of cultivation: ₹ 22,000- 25,000 ha⁻¹.

MH-421 and GM-7 green gram varieties: Drought tolerant early-maturing variety, matures in 60–61 days and resistant to yellow mosaic virus (MYMV) and powdery mildew), GM-7 (resistant to mosaic virus and leaf spot), and MH1142 7 (resistant to mosaic virus and anthracnose).

Additional net returns:

Crop based Interventions

Improved varieties:

HHB 299 Pearl millet variety: ₹ 6,000-12,000 ha⁻¹

MH-421 and GM-7 Green gram varieties: ₹11,000- 18,000 ha⁻¹

RGC 1033 Cluster bean variety: ₹ 7,000- 13,000 ha⁻¹

Increase in crop yield: 25-33%, net returns: ₹ 40,000- 60,000 ha⁻¹,
cost of cultivation: ₹ 22,000- 25,000 ha⁻¹

RGC-1033 cluster bean variety: Early-maturing, drought tolerant, and resistant to alternaria blight, Bacterial Leaf Blight (BLB), and root rot. Increase in yield: 24-38%, net returns: ₹16,000 -30,000 ha⁻¹, cost of cultivation: ₹ 22,000-23,000 ha⁻¹.

DHM 121 Maize variety: A short duration drought tolerant variety. Increase in crop yield: 18-20%, net returns: ₹40,000 -41,000 ha⁻¹, cost of cultivation: ₹ 18,000-23,000 ha⁻¹.

GC-4 Cumin variety: is drought tolerant and resistant to fusarium wilt.

Increase in crop yield: 19-26%, additional net returns: ₹ 51,000- 1,95,000 ha⁻¹,
net returns: ₹1,90,000 - 2,10,000, cost of cultivation: ₹ 42,000- 43,000 ha⁻¹.

DRMR 2017-15/Radhika mustard

variety: Heat stress tolerant mustard variety, specifically recommended for late- sown irrigated conditions.

Increase in crop yield: 22-28%,
net returns: ₹30,000 -32,000 ha⁻¹,
cost of cultivation: ₹31,500 -33,000 ha⁻¹.

Additional net returns:

Crop based Interventions

Improved varieties

GC-4 Cumin variety: ₹ 36,000- 50,000 ha⁻¹

DRMR 2017-15/Radhika Mustard: ₹12,650 - 16,700 ha⁻¹

Wheat variety DBW 303: ₹ 15,000- 16,000 ha⁻¹

DBW-303 wheat variety: It is a high yielding, rust and blast resistant variety. Increase in crop yield: 18-20%, net returns: ₹60,000 -62,000 ha⁻¹, cost of cultivation ₹39,500 -40,000 ha⁻¹.

Module 3: Livestock based interventions

Supplementation with mineral mixture in buffaloes: Supplementation of milch animals like buffaloes with mineral mixtures helps in enhancing the returns of the farmer by increasing the milk yield.

Additional net returns:

Livestock based interventions

Supplementation with mineral mixture

Buffaloes: ₹ 6,500 -7,200 animal⁻¹ year⁻¹

Sirohi breed upgradation: ₹ 62,500 -1,20,000 year⁻¹

Increase in milk yield: 8-12%, net returns: ₹60,000- ₹69,000 animal⁻¹ year⁻¹,
cost of production: ₹60,000 -₹65,000 animal⁻¹ year⁻¹

Sirohi buck for breed upgradation in goats: Sirohi breed goats were dual purpose breed goats to the farmer. Increase in flock size: 28-70%, Increase in production year⁻¹ 28-60%
cost of production: ₹1,90,000 - 2,80,000, net returns: ₹1,04,400 -1,62,000

Module 4: Integrated farming systems

Combination of small ruminants/livestock with crop, horticulture crops etc. by recycling one by product to another by product. Eg: crop straw can be fed to cattle and cattle dung can be used for crops. net returns: ₹ 1,80,000, cost of production: ₹1,42,000 -1,45,000 additional returns: ₹1,40,000

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Water harvesting through farm pond	Community	Depends on the size of the pond Size: 100×100×10 Cost: 3,50,000 ha ⁻¹
Drip from harvested water in farm pond	Individual	Installation cost: 55,000-60,000 ha ⁻¹
Composting	Individual	75,000 (1.5 tons)

Module 2a: Crop based interventions

Crop	Variety	Method
Pearl millet	HHB-299	Individual
Greengram	MH-421, GM-7, and MH1142	Individual
Cluster bean	RGC-1033	Individual
Cumin	GC-4	Individual
Mustard	DRMR 2017-15/Radhika	Individual

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹ ha ⁻¹)
Rainfed: Crop alone	Rainfed: 24,400- 24,600	Rainfed: 1,20,000-1,20,600
Irrigated: Crop alone	Irrigated: 32,650-32,700	Irrigated: 48,000-49,000
Rainfed: Crop + Buffalo+ Goat	Rainfed: 1,42,700-1,43,000	Rainfed: 3,52,000-3,52,600
Irrigated: Crop + Buffalo	Irrigated: 95,150-95,500	Irrigated: 1,25,000-1,26,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Breed upgradation in goats	Sirohi	Individual	10,000-35,000 per buck
Area specific mixture supplementation	Buffaloes	Individual	60,000-65,000 animal ⁻¹ year ⁻¹

Institutional Interventions

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 8: Pali

Climate vulnerability: High temperature, uneven rainfall, dry spells and hot winds

A. Introduction/ Background

I. Introduction/Background

- Pali district, in the southwest region of Rajasthan experiences high temperatures, uneven rainfall, dry spells and hot winds
- The district receives an average annual rainfall of 526 mm, with temperature ranging from 6-46 °C.
- The rainfed and irrigated area of the district were 73 and 27% respectively.
- Soils are predominantly sandy and loamy in nature
- Field Crops: Green gram, jowar, bengal gram, sesame, wheat, rapeseed and mustard. Vegetables: Cluster bean and onion.
- Livestock is a key livelihood, but milk productivity remains low due to unavailability of fodder, poor shelter management, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Gajangarh and Sajjanpura. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Crop residue mulching for moisture conservation through: crop residues as mulch improved the productivity and profitability of bengal gram.

Increase in crop yield: 16-21%, net returns: ₹ 55,000-60,000 ha⁻¹,
cost of cultivation: ₹ 30,000-43,500 ha⁻¹

Additional net returns:

NRM based interventions:

Crop residue mulching in bengal gram: ₹ 7,500 - 9,500 ha⁻¹

Field Bunding for *in situ* moisture conservation: Bunding minimizes runoff and soil erosion, allowing better rainwater retention in the field.

Module 2: Crop based Interventions

MH-1142 green gram variety: 60-70 days short duration variety and performs well under both rainfed and irrigated conditions. This is drought tolerant, Increase in crop yield: 26-29 %, net returns: ₹ 14,000 - 24,000 ha⁻¹, cost of cultivation: ₹ 10,500-16,500 ha⁻¹

Crop based Interventions

Additional returns

MH1142 Green gram: ₹ 3,000 - 5,500 ha⁻¹

DRMR-1165-40 mustard: ₹ 8,000 - 10,000 ha⁻¹

RTM-314 tarameera: ₹ 2,000 - 3,000 ha⁻¹

Agri-Horti system: ₹ 23,600 - 52,300 ha⁻¹

DRMR-1165-40 mustard variety: Drought tolerant variety has oil content of 40-42% and tolerant to heat/moisture stress, Increase in crop yield: 16-25 %, net returns: ₹40,000 -55,000 ha⁻¹, cost of cultivation: ₹ 27,000-37,000 ha⁻¹.

RTM-314 (Karan Tara tarameera variety): A high yielding, inherently powdery mildew resistant rainfed oilseed crop. Increase in crop yield: 20-24%, net returns: ₹13,000-15,000 ha⁻¹, cost of cultivation: ₹ 4,000-5,600 ha⁻¹.

Agri -horticulture and Agroforestry systems with rainwater harvesting:

Cultivation of horticultural crops like Ber (Fruit) and Khejri (Agroforestry Plants) with *in situ* moisture conservation and drip irrigation to stabilize the income of farmers. Increase in crop yield: 59-66%, net returns: ₹ 65,000 -1,10,000 ha⁻¹, cost of cultivation: ₹ 67,000-1,16,500 ha⁻¹.

Module 3: Livestock based interventions

Shelter management: Shelter management in buffalo helped to combat high temperatures.

Increase in milk yield: 14-24%,

net returns: ₹ 55,000 -75,000 animal⁻¹, cost of cultivation: ₹ 53,000-55,500

Additional net returns:

Livestock based interventions

Shelter management: ₹ 16,400 - 23,550 animal⁻¹

Napier grass-Perennial fodder: ₹ 10,600 - 13,800 ha⁻¹

Perennial fodder Napier grass production: This grass provides year-round fodder. Increase in fodder yield: 55-65%, net returns: ₹ 1,35,000-1,40,000 ha⁻¹, cost of cultivation: ₹ 14,000-19,000 ha⁻¹

Kadaknath Backyard poultry: Kadaknath birds thrive in temperatures ranging from 12° to 42°C with higher feed conversion ratio. Increase in egg production: 70-80%, net returns: ₹ 15,700 per 20 birds

Module 4: Integrated farming systems

Combination of small ruminants/livestock with crop, horticulture crops etc. by recycling one byproduct to another by product. Eg: crop straw can be fed to cattle and cattle dung can be used for crops.

additional cost of cultivation: ₹ 84,300-84,600, net returns: ₹ 1,89,000-1,89,600

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Crop residue mulching in bengal gram	Individual	35,000 -45,000
Field Bunding	Individual	1,500-2,000

Module 2a: Crop based interventions

Crop	Variety	Method
Green gram	MH-1142	Individual
Mustard	DRMR-1165-40	Seed bank
Tarameera	RTM-314	Individual
Bengalgram	Karnal chenna	Seed bank
Ber	Sev, Gola	Community nursery
Khejri	Thar Sobha	Community nursery

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Agri horticultural (Ber fruit) and agroforestry system (Khejri)	67,400-1,16,500	62,500- 1,18,600
Crop alone	58,600-58,800	92,500-92,700
Crop with two cows	1,43,000-1,43,300	1,89,000-1,89,600

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Fodder production	Napier grass	Individual/fodder bank	14,500-18,900 ha ⁻¹
Poultry	Kadakhnath	Women	500-600

Institutional Interventions

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

Tamil Nadu

District 1: Ramanathapuram

Climate vulnerability: Drought

A. Introduction/ Background

- Ramanathapuram district, situated in the south-eastern part of Tamil Nadu, experiences drought.
- Agriculture in the district is predominantly rainfed, making it highly vulnerable to rainfall variability.
- The district receives an average rainfall of 878 mm, with temperatures ranging from 22.7 °C to 34.7 °C.
- Soils are predominantly red loam, black soil, sandy coastal alluvium and red sandy soil.
- The irrigated and rainfed area were 36% and 64% respectively, hence proper water conservation and mangement practices are necessary
- Crops: Paddy, Cotton, Plantations: Coconut, Vegetables: Chilli, Coriander
- Livestock is a key livelihood, but milk productivity remains low due to imbalanced feeding, unavailability of improved breeds, limited veterinary services and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Kombuthi, Karukathi, Manjakollai, Malankudi. The major outcomes were

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Ridge and furrow: In ridge and furrow system, soil is raised to form ridges, while the spaces between them act as furrows (45–60 cm). These furrows increase moisture availability. Opportunity crops sorghum and maize. Increase in crop yield: 18-20%, net returns: ₹ 35,000-40,000 ha⁻¹, cost of cultivation: ₹20,000-27,000 ha⁻¹

Additional net returns:

NRM based Interventions

Water Harvesting

Cotton: ₹35,000 - 40,000 ha⁻¹

Rice fallow pulses: ₹ 25,000- 30,000 ha⁻¹

Cumulative benefit of ₹ 6,60,000/village

Supplemental irrigation to 75 ha
(40% increase in irrigated area)

Rain hose irrigation: ₹ 30,000- 35,000 ha⁻¹

Efficient water harvesting and recycling:

124 lakh litres water storage created; HDPE lining extended availability by 30–90 days. Cropping intensity increased from 103 to 132 %.

Renovation of existing farm ponds :20 no,

Desilting of check dam and community ponds: Increased storage capacity (54,064 m³). Enabled supplemental irrigation during dry spells in paddy and cultivation of rabi crops in rice fallows.

Increase in cotton yield :60-75%, net returns: ₹ 50,000 - 60,000 ha⁻¹, cost: ₹60,00,000-75,00,000 ha⁻¹

Rain hose irrigation technology: An innovative, low-cost irrigation system for efficient recycling of harvested water. Increase in crop yield: 70-80%, cost of cultivation: ₹ 32,123 ha⁻¹, net returns: ₹60,000 -65,000 ha⁻¹

Field water pipeline along with water lifting devices: Increase in yield: 30-35%, water saving: 30% net returns: ₹48,000-50,000 ha⁻¹, additional net returns: ₹15,000 - 20,000 ha⁻¹, cost: ₹ 65,000-70,000 ha⁻¹

Module 2: Crop based Interventions:

Improved paddy varieties

TRY5: Saline tolerant: Increase in yield: 26%, net returns: ₹ 48,000- 49,000 ha⁻¹, cost of cultivation: ₹40,000-45,000 ha⁻¹

ADT53: Drought tolerant: Increase in yield :20%, net returns: ₹ 48000- 50,000 ha⁻¹, cost of cultivation: ₹38,000-44,000 ha⁻¹

ADT 55: Drought tolerant Paddy variety:

Increase in yield:36%, net returns: ₹ 47,000 ha⁻¹ -48,000 ha⁻¹, cost of cultivation: ₹ 36,000-40,000 ha⁻¹

VBN 11: A Short duration blackgram variety and MYMV disease resistant. Increase in yield: 20-22% net returns: ₹ 30,000 -35,000 ha⁻¹, cost of cultivation: ₹18,000-25,000 ha⁻¹

Cotton: High-density planting system (HDPS) of cotton in rice fallows and spraying of Cotton Plus (2.5 kg acre⁻¹ in 200 L) reduces flower and square shedding, improves boll bursting. Increase in crop yield: 25-30%, cost of cultivation: ₹ 40,000-55,000 ha⁻¹, net income: ₹ 40,000 -45,000 ha⁻¹

Groundnut + pigeonpea intercropping: Groundnut CO 6 intercropped with short-duration red gram CO7 under rainfed conditions (120–125 days) with assured moisture, optimum plant population, soil test–based fertilization, gypsum @ 400 kg ha⁻¹ for salinity management, and groundnut-rich booster @ 5 kg ha⁻¹ enhances crop performance through complementary interactions. net income: ₹60,000 -65,000 ha⁻¹, cost of cultivation: ₹ 13,000-13,500 ha⁻¹

Drum seeded direct sown rice: Direct-seeded rice, compared to conventional puddled transplanting, 7-10 days early, conserves water, improves labour efficiency, reduces costs and greenhouse gas emissions. Increase in crop yield: 15-20%, net returns: ₹ 40,000-45,000 ha⁻¹, cost of cultivation: ₹ 31,000-38,000 ha⁻¹

Crop diversification with arid fruit crops: Growing arid-zone trees such as Manila tamarind (PKM 1), amla (NA 6) and pomegranate (Bagwan), enables efficient land use and higher net income. Increase in net income: Manila Tamarind: ₹ 8,00,000 -10,50,000 ha⁻¹; Pomegranate: ₹10,00,000 -12,00,000 ha⁻¹; Amla (NA6): ₹ 1,60,000-1,70,000 ha⁻¹ cost of cultivation: Pomegranate (Bagawan): ₹ 3,30,000 - 3,40,000 ha⁻¹; Amla (NA6): ₹1,05,000 -1,10,000 ha⁻¹; Manila Tamarind (PKM 1): ₹350000- 3,75,000 ha⁻¹

Additional net returns: Crop based Intervention	
Paddy varieties	
TRY 5:	₹ 19,000 - 20,000 ha ⁻¹
ADT53:	₹ 25,000 - 27,000 ha ⁻¹
ADT 55:	₹ 21,000 - 23,000 ha ⁻¹
Drum seeded direct sown rice:	₹10,000 - 12,000 ha ⁻¹
Groundnut+ pigeonpea intercropping:	₹20,000 ha ⁻¹

Sesbania + Chilli intercropping system:

Sesbania is planted along chili rows.

This has the advantage of providing shade, organic mulch and nitrogen fixation, provides green fodder of 9,000 kg ha⁻¹ for the animals.

Increase in crop yield: 20-30 %, net returns: ₹90,000 -95,000 ha⁻¹,
cost of cultivation: ₹70,000-80,000 ha⁻¹

Additional net returns:

intercropping system

Sesbania + Chilli: ₹15,000 - 20,000 ha⁻¹

Integrated Farming systems: ₹50,000 - 55,000 ha⁻¹

Integrated Farming systems: Crop + Live stock Total cost of production: ₹ 90,000-95,000 ha⁻¹,
net returns: ₹ 1,27,000- 1,30,000 ha⁻¹

Module 3: Livestock Interventions**Introduction of fish in farm ponds:**

Fish can be introduced in to the farm pond. cost of production: ₹10,000-12,000,
net returns: ₹ 15,000 -20,000

Area specific mineral mixture: This mixture supplies essential minerals, improves immunity, and stress tolerance in animals, fed at 20 g per animal per day with feed. Cost of rearing: Cow: ₹1,000-1,200; Goat: ₹ 100-200, net returns: Cow: ₹20,000 -21,000;
Goat: ₹5,000-6,000

Additional Net Returns:**Livestock Interventions**

Poultry: ASEEL ₹ 16,440-17,000/unit

Poultry: ASEEL breed of poultry: cost of production/unit (25 birds): ₹10,000-12,000,
net returns: 10,000 -12,000/unit

C. Strategic Interventions Recommended for PMDDKY**Module 1: NRM based Interventions**

Interventions	Individual/community participation	Cost (₹)
Ridge and furrow	Individual	2,500 ha ⁻¹
Water harvesting through new structures and renovation	Community/ Individual	32,123
Desilting of check dam and community ponds	Community	1,50,000 /pond
Drip irrigation	Individual	20,000 -25,000
Field water tube	Individual	85,000 ha ⁻¹

Module 2a: Crop based Interventions

Crop	Variety	Method
Paddy	TRY5, ADT53, ADT 55, CO55	Seed bank
Black gram	VBN 11	Seed bank
Manila tamarind	PKM 1	Nursery
Pomegranate	Bagawan	Nursery
Amla	NA6	Nursery

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Intercropping of groundnut + pigeonpea	13,000- 13,500	60,000 -65,000
Intercropping of sesbania + chilli	70,000-80,000	90,000 -95,000
Integrated farming system	90,000-95,000	1,27,000- 1,30,000

Module 3: Livestock based Interventions

Livestock	Breed/variety	Method	Additional Cost (₹ animal ⁻¹ year ⁻¹)
Area specific mineral mixture	Cattle	Individual	2,000
	Goat		1,000
Poultry	Aseel	Backyard poultry	10,000 -12,000/unit (25 birds)

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring Centers with need-based Machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee: 12-20 members	Coordinates activities such as seed banks, fodder banks, custom hiring centers and guide seasonal action plans
FPO and women self-help groups for value addition	Community	Women empowerment

Uttar Pradesh

District 1: Banda

Climate vulnerability: Drought, heat

A. Introduction/ Background

- Banda district, located in the Bundelkhand region of southern Uttar Pradesh, experiences drought and heat
- The district receives an average annual rainfall of 834 mm, with temperature ranging from 6-47 °C.
- The rainfed and irrigated area of the district were 54 and 46% respectively
- Soils are predominantly gravelly, desert sandy, sandy loam, and clayey soils
- Field Crops: Wheat, bengal gram and chilli. Vegetables: Onion and potato
- Livestock is key livelihood, but milk productivity remains low due to poor-quality feed, unavailability of improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Chaudhary dera and Nibaich. The major outcomes were as follows

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Leveling and bunding in improved varieties of field pea (IPFD12-2) and linseed

(BUAT Alsi-4): Proper leveling and bunding minimizes runoff and soil erosion, helps in better rainwater retention in the field.

Field pea: Increase in crop yield in field pea: 15-18%; net returns: ₹ 34,500-34,700 ha⁻¹, cost of cultivation: ₹ 25,900-26,200 ha⁻¹; linseed Increase in crop yield: 18-22%, net returns: ₹ 30,800- 31,000 ha⁻¹, cost of cultivation: ₹ 23,600-23,800 ha⁻¹.

Additional net returns:

NRM based Interventions

Leveling and bunding

Field pea: ₹ 9,000 - 9,200 ha⁻¹

Linseed: ₹ 9,400 - 9,600 ha⁻¹

Green manuring and : ₹ 19,000 - 19,300 ha⁻¹
irrigation with sprinkler
in improved wheat (K-1317)

Green manuring and irrigation through the sprinkler system in improved wheat (K-1317):

The adoption of sprinkler irrigation along with the improved wheat variety K-1317 brought a shift toward more efficient wheat cultivation. Sprinkler irrigation ensured timely and uniform water application, reduced water stress and saving in irrigation water, while K-1317 showed good responsiveness with strong tillering and better grain filling. Increase in crop yield: 20-23%, net returns: ₹ 81,200- 81,400 ha⁻¹, cost of cultivation: ₹ 28,600-28,800 ha⁻¹.

Module 2: Crop based interventions

BUAT Alsi 4- Improved linseed variety: Medium duration variety matures between 130 to 135 days Increase in crop yield:18-22%, net returns: ₹33,500-33,700 ha⁻¹, cost of cultivation: ₹ 23,900-24,200 ha⁻¹.

K 1317-Drought and heat tolerant wheat variety followed by seed treatment with Phosphate Solubilizing

Bacteria (PSB) culture: K 1317 is resistant to yellow rust (Pila Ratuwa) and aphids (Mahu). Furthermore, seed

treatment with Phosphate Solubilizing Bacteria (PSB) culture also done, which enhanced phosphorus solubilization in the soil, leading to better root development, stronger tillering, and healthier crop growth. Increase in crop yield: 8-12%, net returns: ₹ 75,000-75,200 ha⁻¹, cost of cultivation: ₹ 29,900- 30,200 ha⁻¹.

Additional net returns:

Crop based interventions

BUAT Alsi 4 Linseed variety:	₹ 10,200 - 10,500 ha ⁻¹
K 1317 Wheat variety + Seed treatment with PSB culture:	₹ 11,100 - 11,400 ha ⁻¹
Dhanshakti Pearl millet variety:	₹ 10,300 - 10,600 ha ⁻¹
Wheat + Mustard (9:1) intercropping:	₹ 24,000 - 24,300 ha ⁻¹

Dhanshakti pearl millet variety: It is an early maturing and biofortified variety with crop duration 80-90 days, rich in iron and zin. Increase in crop yield: 16-20%, net returns: ₹ 39,000- 39,300 ha⁻¹, cost of cultivation: ₹ 24,000-24,300 ha⁻¹.

Shikha green gram variety: A short duration, variety highly resistant to Yellow Mosaic Virus (MYMV) and powdery mildew. Matures in about 65-70 days. Increase in crop yield: 10-30%.

IPL-316 lentil variety: An early-maturing variety and typically ready for harvest in about 102 to 116 days, making it suitable for shorter *Rabi* seasons and rice fallows, and it's known for resistance to wilt and rust. Increase in crop yield: 15-35%.

Wheat (K-1317) + Mustard (RH-749) (9:1): Intercropping of wheat with mustard in place of fallow land improved land utilization, conserved soil moisture, reduced weed pressure, ensured better yield stability, provided additional mustard along with wheat, and enhanced overall farm income. Increase in crop yield: 23-26%, net returns: ₹ 86,900-87,200 ha⁻¹, cost of cultivation: ₹ 31,000-31,300 ha⁻¹.

Module 3: Livestock based interventions

Mineral mixture supplementation to buffaloes: Regular supplementation of the mineral mixtures

to buffaloes helped to maintain better body condition, improved feed intake, and enhanced metabolic efficiency, which are commonly affected during hot months. Rainfed: Increase in milk yield: 15-18%,

net returns: ₹ 77,200- 77,400 animal⁻¹ year⁻¹,

cost of cultivation: ₹ 45,600- 45,800 animal⁻¹ year⁻¹. Irrigated: Increase in milk yield: 20-23%,

net returns: ₹ 83,000- 83,200 animal⁻¹ year⁻¹, cost of cultivation: ₹ 46,700-46,900 animal⁻¹ year⁻¹.

Additional net returns:

Livestock based interventions

Mineral mixture supplementation to buffaloes:	
Rainfed:	₹ 21,000 - 21,300 animal ⁻¹ year ⁻¹
Irrigated:	₹ 22,000 - 22,200 animal ⁻¹ year ⁻¹
Improved fodder oat variety Kent:	₹ 23,000 - 23,200 ha ⁻¹

Kent- Improved fodder oat variety: This is known for its suitability for early grazing, and also grown for grain, offering good resistance to diseases like rust and lodging. Increase in fodder yield: 40-45%, net returns: ₹ 45,500-45,700 ha⁻¹, cost of cultivation: ₹ 27,400- 27,600 ha⁻¹.

Kadaknath-Improved poultry breed: It is a dual-purpose breed, valued for both its meat and

eggs. These birds are known for their disease resistance and ability to adapt to local environmental conditions, making them suitable for free-range and backyard farming. Increase in yield: 40-55% net returns: ₹ 1,800-2,100 bird⁻¹, cost of cultivation: ₹ 28,700-28,900.

Module 4: Integrated farming systems:

Combination of livestock with crop, horticulture crops, etc., by recycling one by-product to another by-product. Eg: crop residues, etc., can be fed to cattle, and cattle dung can be used for crops.

Can enhance the opportunity for organic farming.

Rainfed with animal: Additional cost of cultivation: ₹ 45,400-45,700 ha⁻¹,

net returns: ₹ 1,16,500-11,700 ha⁻¹. Irrigated with animal:

additional cost of cultivation: ₹ 51,200-51,400 ha⁻¹, net returns: ₹ 2,19,700-2,19,900 ha⁻¹

C. Strategic Interventions Recommended for PMDDY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Levelling and bunding	Individual	8,000-10,000
Green manuring	Individual	3,500-4,000
Sprinkler system	Individual	Cost of installation: 25,000 -30,000 Cost of each irrigation: 1,500

Module 2a: Crop based interventions

Crop	Variety	Method
Linseed	BUAT Alsi-4	Individual
Wheat	K-1317	Seed bank
Pearl millet	Dhanshakti	Fodder bank
Green gram	IPM 410-3	Individual
Lentil	IPL-316	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Intercropping of Wheat (K-1317) + Mustard (RH-749) with row ratio (9:1)	31,000-31,300	87,000-87,200
Crop alone	Rainfed: 24,000-24,300 Irrigated: 26,800-27,000	Rainfed: 39,000-39,300 Irrigated: 36,800-37,000
Crop with buffaloes	Rainfed: 70,000-70,200 Irrigated: 78,000-78,300	Rainfed: 1,16,500-1,16,700 Irrigated: 2,19,700-2,19,900

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Mineral mixture supplementation	buffaloes	Individual	25,000-30,000
Improved fodder oat variety	Kent	Individual	27,400-27,600
Improved poultry breed Kadaknath	Kadaknath	Individual	500-600/ bird

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 2: Chitrakoot

Climate vulnerability: Drought, heat wave

A. Introduction/ Background

- Chitrakoot district, located in southern part of Uttar Pradesh, experiences drought and heat wave
- The district receives an average annual rainfall of 849 mm, with temperature ranging from 19-32 °C.
- The district has rainfed and irrigated areas of 55 and 45% respectively
- Soils are predominantly Alfisols (hilly soils), Vertisols (black soils) and Entisols (alluvial soils)
- Field Crops: Wheat, chick pea, red gram and cluster bean. Vegetables: Onion and potato
- Livestock is a key livelihood, but milk productivity remains low due to the unavailability of improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Titihara, Rampurva, Baihar and Hariharpur. The major outcomes were as follows

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

***In-situ* moisture conservation through farm**

bunding in chick pea: Bunding minimizes runoff and soil erosion, allows better rainwater retention in the field. Increase in crop yield: 25-30%, net returns: ₹ 28,000-28,600 ha⁻¹, cost of cultivation: ₹ 23,500-24,000 ha⁻¹.

Construction of permanent check dams for rain

water harvesting and crop diversification with harvested water: The permanent check dams of 45×4×2m were constructed. Farmers cultivated crops such as toria and wheat during the *rabi* season instead of keeping them fallow, rise in groundwater levels by up to 5 feet. Crop diversification with green gram and sesame instead of pigeon pea and jowar.

***Kharif* crops:**

Green gram crop yield: 1,100-1,300 kg ha⁻¹, net returns: ₹ 53,500 - 54,000 ha⁻¹

Sesame crop yield: 1,200-1,500 kg ha⁻¹, net returns: ₹ 51,000- 52,000 ha⁻¹

***Rabi* crops**

Toria crop yield: 1,400-1,600 kg ha⁻¹, net returns: ₹ 24,500-25,500 ha⁻¹

Wheat crop yield: 1,200-1,500 kg ha⁻¹, net returns: ₹ 23,500-24,500 ha⁻¹

Additional net returns:

NRM based Interventions

Farm Bunding in Chick pea : ₹ 14,000 -14,300 ha⁻¹

Construction of permanent check dams and crop diversification with harvested water

Green gram: ₹ 38,000 -40,000 ha⁻¹

Sesame: ₹ 47,500 -48,500 ha⁻¹

***Rabi* crops**

Toria: ₹ 24,500 -25,500 ha⁻¹

Wheat: ₹ 23,500 -24,500 ha⁻¹

Module 2: Crop based interventions

Sahbhagi Dhan -Drought tolerant rice variety:

Duration is 105 days, enables farmers to take a second crop during the same season.

Increase in crop yield: 35-40%,
net returns: ₹ 18,500-19,000 ha⁻¹,
cost of cultivation: ₹ 26,500-27,500 ha⁻¹.

Urvasi- Mustard variety : Both heat and salt tolerant mustard variety:

Increase in crop yield: 60-65%,
net returns: ₹ 40,000-40,500 ha⁻¹, cost of cultivation: ₹ 20,000-22,000 ha⁻¹.

JKM 189- pigeon pea variety: It is drought tolerant resistant to fusarium wilt, sterility mosaic, phytophthora blight, and root-knot nematodes. Increase in crop yield: 35-40%,
net returns: ₹ 28,500-29,500 ha⁻¹, cost of cultivation: ₹ 15,500-16,000 ha⁻¹.

JG 14- chickpea variety: JG-14 (Jawahar Gram 14) : Short-duration variety matures in 100-105 days. Suitable for late sowing, heat tolerant, moderate resistance to diseases like wilt and pod borer. Increase in crop yield: 25-30%, net returns: ₹ 28,000-28,600 ha⁻¹, cost of cultivation: ₹ 23,500-24,000 ha⁻¹.

K 1317 wheat variety: K-1317 is heat tolerant brown rust and leaf blight resistant variety. Increase in crop yield: 10-15%, net returns: ₹ 1,23,500-1,24,000 ha⁻¹, cost of cultivation: ₹ 67,500-68,500 ha⁻¹.

Pigeon pea (IPA 201) + Pearl millet Dhanshakti (1:1) intercropping: Increase in crop yield: 5-10%, net returns: ₹ 89,000-90,000 ha⁻¹, cost of cultivation: ₹ 31,000-31,500 ha⁻¹.

Additional net returns:

Crop based interventions

Improved varieties

Sahbhagi Dhan Paddy: ₹ 10,000 - 10,500 ha⁻¹

Urvasi Mustard: ₹ 19,500 - 20,500 ha⁻¹

JKM 189 Pigeon pea variety: ₹ 9,000 - 10,000 ha⁻¹

JG 14 Chickpea variety: ₹ 14,000 - 14,300 ha⁻¹

K1317 Wheat variety: ₹ 20,500 - 21,000 ha⁻¹

Pigeon pea (IPA 201) + Pearl millet

Dhanshakti (1:1) intercropping: ₹ 5,000 - 5,500 ha⁻¹

Module 3: Livestock based interventions

Breed upgradation in goats with Lalitpuri bucks under rainfed conditions:

The limited availability of high-quality breeding bucks led to reduced goat productivity, negatively impacting farmers' income., Lalitpuri breed

Additional net returns:

Livestock based interventions

Breed upgradation in goats

through Lalitpuri bucks: ₹ 8,000 - 10,000 goat⁻¹

Mineral mixture

supplementation to buffaloes: ₹ 10,500 - 11,000 animal⁻¹ year⁻¹

bucks were introduced as high quality bucks through demonstrations. Gain in body weight: 25-30%,
net returns: ₹ 15,000-16,000 / goat, cost of rearing: ₹6,500-7,000 / goat.

Supplementation with mineral mixtures to buffaloes: Increase in milk yield: 45-50%,
net returns: ₹16,000- 17,000 /animal /year, cost of rearing: ₹28,000-28,500 /animal /year.

Module 4: Integrated farming systems: Combination of livestock with crop, horticulture crops, etc., by recycling one by-product to another. Eg: Crop residues, etc., can be fed to cattle, and cattle dung can be used for crops.

Rainfed with animal: additional cost of cultivation: ₹ 3500-4000, net returns: ₹ 67000-68000

Irrigated with animal: additional cost of cultivation: ₹ 28000-29000, net returns: ₹ 234500-235000

C. Strategic Interventions Recommended for PMDDY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Farm bunding	Individual	2,000-3,000
Rainwater harvesting through the construction of permanent check dams	Individual	2,00,000-3,00,000

Module 2a: Crop based interventions

Crop	Variety	Method
Rice	Sahbhagi Dhan	Individual
Mustard	Urvasi	Individual
Pigeon pea	JKM 189	Individual
Chick pea	JG 14	Seed bank
Wheat	K-1317	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Crop alone	Rainfed: 31,000 - 31,500	Rainfed: 64,000 - 64,500
	Irrigated: 1,57,000 - 1,57,500	Irrigated: 2,22,000 - 2,23,000
Rainfed: Crop with goat	Rainfed: 35,000 - 35,500	Rainfed: 67,000 - 68,000
Irrigated: Crop with buffaloes	Irrigated: 1,85,500 - 1,86,000	Irrigated: 2,34,500 - 2,35,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Supplementation with mineral mixtures	Buffaloes	Individual	25,000-35,000
Improved goat breed	Lalitpuri	Individual	3,000-6,000/unit

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 3: Hamirpur

Climate vulnerability: Drought, heat wave

A. Introduction/ Background

- Hamirpur district is situated in the south-central part of Uttar Pradesh within the Bundelkhand agro-climatic region. The district's terrain consists of alluvial plains interspersed with undulating tracts along the Yamuna and Betwa river systems, influencing soil and water availability for farming.
- The district receives a moderate annual rainfall of about 700-750 mm, predominantly during the southwest monsoon, with long, hot summers (45 °C) and cool winters (19 °C).
- Soils include alluvial and Bundelkhand varieties (Mar, Kabar, Parua, and Rakar), which vary from light sandy to clayey textured soils, generally low in organic carbon and moisture retention under rainfed conditions.
- Agriculture is the principal livelihood, with about 61 % and 39% of the area under irrigated, and rainfed respectively. The irrigated areas rely on surface water and groundwater sources and 39% under rainfed.
- Major crops: Wheat, gram, pigeonpea, sesamum, rape seed and mustard, jowar. Plantations: Grown in pockets with irrigation support.
- Livestock rearing complements agriculture, with rural households commonly keeping cattle, buffaloes, goats, sheep, and poultry, contributing to household incomes. However, productivity constraints persist due to seasonal fodder scarcity and lack of improved breeds.
- Hamirpur district presents significant scope for improving agricultural productivity and rural livelihoods through climate-resilient, convergence-based interventions, such as water management (farm ponds, micro-irrigation), integrated crop-livestock systems, adoption of stress-tolerant crop varieties, and diversification into horticulture and allied enterprises. These need based climate resilient interventions were demonstrated in the climate smart villages, Manki Khurd, Pachkhura Khurd and Kanauta Danda of Hamirpur district. the major out comes were,

B. Impact of Interventions: Key evidences

Module 1: NRM based interventions

Sprinkler irrigation system in field pea and chickpea: For drought and heat wave management, chickpea Increase in crop yield: 50-60%, Field pea:55-80%, cost of cultivation: ₹25,000-27,000 ha⁻¹, chickpea net returns: ₹ 55,000-70,000 ha⁻¹ and ₹ filed pea : 45,000-75,000 ha⁻¹, Desilting of check dam and community ponds

Farm pond for combating climate change and improved cropping intensity

Additional net returns:

NRM based interventions

Sprinkler irrigation

Chickpea : ₹ 30,000-38,000 ha⁻¹

Field pea : ₹ 30,000-45,000 ha⁻¹

Module 2: Crop based Interventions

GT-6 drought tolerant short duration

sesame variety: Early to medium maturing, shows good tolerance to drought, suitable for rainfed and irrigated conditions. Increase in crop yield: 20–30%, cost of cultivation: ₹ 20,000-25,000 ha⁻¹ in both chickpea and field pea. net returns: ₹ 20,000-30,000 ha⁻¹,

Additional net returns:

Crop based Interventions

GT 6 sesame :	₹ 2,000 - 4,000 ha ⁻¹
JG-36 Chickpea :	₹ 15,000- 18,000 ha ⁻¹
Raj 4120 wheat variety :	₹ 18,000 ha ⁻¹
RVG-202, RVG-203 and JAKI-9218 :	₹ 10,000- 15,000 ha ⁻¹
Sikha greengram :	₹ 15,000- 30,000 ha ⁻¹
DRMR1165-40 Mustard:	₹ 20,000- 25,000 ha ⁻¹

JG-36 heat tolerant chickpea variety: Heat-tolerant, short-duration variety (100–105 days). Increase in crop yield: 15–20%, cost of cultivation: ₹ 20,000-25,000 ha⁻¹, net returns: ₹ 75,000-80,000 ha⁻¹,

Raj 4120 Heat tolerant wheat: Suitable for early planting with ZT technology. Increase in crop yield: 20-22%, cost of cultivation: ₹ 22,000 ha⁻¹, net returns: ₹ 58,000 ha⁻¹,

Short duration and late sown chickpea varieties RVG-202, RVG-203 and JAKI-9218: Short-duration and drought-escaping varieties, mature early, avoid terminal heat stress. Increase in crop yield: 19-25%, cost of cultivation: ₹ 25,000-35,000 ha⁻¹, net returns: ₹30,000-40,000 ha⁻¹,

Sikha short duration green gram variety: Suitable for rainfed conditions and crop diversification. It performs well under low-input systems. Increase in crop yield: 8-10 %, cost of cultivation: ₹ 18,000-20,000 ha⁻¹, net returns: ₹ 25,000-30,000 ha⁻¹,

DRMR 1165-40 Mustard variety: Salt-tolerant, suitable for saline and sodic soils, good adaptability under irrigated and partially rainfed conditions. Increase in crop yield: 20-25 %, cost of cultivation: ₹ 24,000-25,000 ha⁻¹, net returns: ₹ 90,000-10,0000 ha⁻¹,

L-4717 Lentil variety: Suitable for timely sowing under irrigated and rainfed areas. Increase in crop yield: 10-12 %, cost of cultivation: ₹ 18,000-20,000 ha⁻¹, net returns: ₹ 50,000-60,000 ha⁻¹, additional returns: ₹ 6,000-7,000 ha⁻¹

Module 3: Livestock based interventions

Breed improvement: Jakhrana goat breed, high milk-producing indigenous goat breed, suitable for arid and semi-arid regions. Increase in body weight: 78% in six months, twining: 80-90%, cost of rearing: ₹ 6,500 /animal, net returns: ₹ 7,900 /animal, additional net returns: ₹ 1,400 /animal

Post-deworming and area specific mineral mixture: Mineral and vitamin blend liquid mixture as nutrient supplementation to lactating animals.

Increase in milk yield: 8-10%, cost of rearing: ₹ 60,000-70,000 animal⁻¹, net returns: ₹ 17,000 animal⁻¹, additional net returns: ₹ 7,000 animal⁻¹

Year round fodder production: Improved varieties of maize (African tall) and sorghum (RC-23) during *kharif*, berseem (Vardhan, JHB-146) and oat (JHO-822) during *rabi*. Increase in fodder production: 35-85% (120-430 t ha⁻¹), increase in milk yield: 20-25%, cost of cultivation: ₹ 2,000-4,000 ha⁻¹, additional net returns: ₹ 8,000 /animal

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Sprinkler irrigation	Individual	80,000-85,0000

Module 2a: Crop based interventions

Crop	Variety	Method
Sesame	GT-6	Seed bank
Chickpea	JG-36, RVG-202, RVG-203 and JAKI-9218	Seed bank
Greengram	Sikha	Seed bank
Mustard	DRMR 1165-40	Seed bank
Lentil	L-4717	Seed bank
Wheat	Raj 4120, DBW-187	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ha ⁻¹)
Chickpea crop alone under rainfed	20,000-22,000	70,000-72,000
Chickpea + mineral mixture to livestock under rainfed	68,000-72,000	1,25,000-1,35,000
Field pea alone under irrigated	25,000-27,000	48,000-53,000
Field pea + mineral mixture to livestock under irrigated	73,000-76,000	1,15,000-1,20,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Area specific mineral mixture	Cow and buffalo	Individual	60,000-70,000
Goat	Jakhrana	Individual	6,500 /animal
Green fodder	maize (African tall), sorghum (RC-23), berseem (Vardhan, JHB-146) and oat (JHO-822)	Individual	2,000-4,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 4: Jalaun

Climate vulnerability: Drought, heat

A. Introduction/ Background

- Jalaun district, located in southwestern part of Uttar Pradesh within Bundelkhand region, experiences drought and heat
- The district receives an average annual rainfall of 604 mm, with temperature ranging from 19-33 °C.
- The rainfed and irrigated area of the district were 55 and 45% respectively
- Soils are predominantly desert sandy, sandy loam, gravelly, and clayey soils
- Field Crops: Wheat, peas, beans, chick pea and cluster bean. Vegetables: Onion and potato
- Livestock is a key livelihood, but milk productivity remains low due unavailability of fodder throughout the year as well as improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Piyaniranjanpur and Sadhara. The major outcomes were as follows

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Leveling and bunding in sesame: Proper leveling and bunding minimizes runoff and soil erosion, allowing better rainwater retention in the field. Increase in crop yield: 40-80%, net returns: ₹ 30,000-33,500 ha⁻¹, cost of cultivation: ₹ 20,700-24,500 ha⁻¹.

Additional net returns:

NRM based Interventions

Leveling and bunding in sesame:	₹22,900 - 23,600 ha ⁻¹
Sprinkler irrigation: Field pea:	₹ 16,000- 21,500 ha ⁻¹
Wheat:	₹ 15,500- 16,200 ha ⁻¹
Mulching in bottle gourd sponge gourd:	
Bottle gourd:	₹ 60,000- 95,000 ha ⁻¹
Sponge gourd:	₹ 60,000- 65,000 ha ⁻¹

Sprinkler irrigation in field pea and wheat:

The adoption of sprinkler irrigation ensured timely and uniform water application, reduced water stress and saved irrigation water up to 50%.

Increase in crop yield field pea: 20-30%, net returns: ₹ 31,500-52,500 ha⁻¹, cost of cultivation: ₹ 47,000-49,000 ha⁻¹; Increase in crop yield in wheat: 10-20%, net returns: ₹ 59,500-63,200 ha⁻¹, cost of cultivation: ₹ 52,500-54,000 ha⁻¹.

Mulching in bottle gourd and sponge gourd: Plastic mulching in bottle gourd encouraged moisture conservation by reducing evaporation losses and controlling weed infestation. Increase in crop yield in bottle gourd: 75-85%, net returns: ₹ 1,65,000-1,65,400 ha⁻¹, cost of cultivation: ₹ 1,34,600-1,34,800 ha⁻¹; Increase in crop yield in sponge gourd: 60-70%, net returns: ₹ 1,41,000-1,41,400 ha⁻¹.

Module 2: Crop based interventions

K1317 -Heat tolerant wheat variety: K-1317

is brown rust and leaf blight resistant variety.

Increase in crop yield: 10-20%,

net returns: ₹ 59,500-63,200 ha⁻¹,

cost of cultivation: ₹ 52,500-54,000 ha⁻¹.

IPFD 13-2 Short duration field pea variety:

IPFD 13-2 (Anant) , is an early maturing

variety and takes 100 to 138 days to reach full

maturity. Resistance to powdery mildew, downy mildew, rust diseases and moderately resistant to the

Pod Borer. Increase in crop yield: 20-30%, net returns: ₹ 31,500-52,500 ha⁻¹,

cost of cultivation: ₹ 47,000-49,000 ha⁻¹.

Shikha-Short duration green gram variety (IPM 410-3): . Highly resistant to Yellow Mosaic

Virus (MYMV) and powdery mildew. Matures in about 65-70 days. Increase in crop yield: 15-35%,

net returns: ₹ 26,000-42,200 ha⁻¹, cost of cultivation: ₹ 24,500-28,000 ha⁻¹.

Dhanshakti-Short duration pearl millet variety: Dhanshakti biofortified variety with crop duration

80-90 days, rich in iron and zinc. Increase in crop yield: 15-25%, net returns: ₹ 11,000-22,000 ha⁻¹,

cost of cultivation: ₹ 28,000-28,300 ha⁻¹.

JG 36-Short to medium duration chick pea variety: JG-36 is suitable for both rainfed,

irrigated conditions and also for late sown conditions. Increase in crop yield: 25-35%,

net returns: ₹ 31,000-71,000 ha⁻¹, cost of cultivation: ₹ 39,000-44,400 ha⁻¹.

KLB 345-Short-duration lentil variety: KLB-345 is an early-maturing variety, matures

in around 110-111 days, and resistant to wilt and rust. Increase in crop yield: 20-25%,

net returns: ₹ 21,000-56,800 ha⁻¹, cost of cultivation: ₹ 41,500-43,700 ha⁻¹.

Module 3: Livestock based interventions

Balance feeding and perennial fodder production through multi cut variety of chari (BB-2)

for buffaloes: Balanced feeding along with perennial fodder production, ensures improved health,

productivity, and sustainability in buffaloes. Increase in milk yield: 35-40%,

net returns: ₹ 33,300-33,600 animal⁻¹ year⁻¹, cost of cultivation: ₹ 28,700-29,000 animal⁻¹ year⁻¹.

Kadaknath: It is a dual-purpose breed, valued for both its meat and eggs. These birds are known for their disease resistance and ability to adapt to local environmental conditions, making them suitable for

free-range and backyard farming. Increase in yield: 40-55%,

net returns: ₹ 1,800- 2,100 bird⁻¹, cost of cultivation: ₹ 28,700-28,900.

Additional net returns:

Crop based interventions

Improved varieties

K-1317 Wheat variety: ₹ 15,500 - 16,200 ha⁻¹

IPFD 13-2 Field pea variety: ₹ 16,000 - 21,500 ha⁻¹

Shikha Green gram variety: ₹ 12,500 - 17,700 ha⁻¹

Dhanshakti Pearl millet variety: ₹ 6,000 - 11,200 ha⁻¹

JG-36 Chick pea variety: ₹ 29,500 - 30,000 ha⁻¹

KLB-345 Lentil variety: ₹ 20,000 - 20,500 ha⁻¹

Additional net returns:

Livestock based interventions

Multicut variety of chari

₹ 13,300-13,600 animal⁻¹ year⁻¹

Module 4: Integrated farming systems:

Combination of livestock with crop, horticulture crops, etc., by recycling one by-product to another by-product. Eg: crop residues, etc., can be fed to cattle, and cattle dung can be used for crops.

Enhance the opportunity for organic farming.

net returns : Rainfed with animal: ₹ 1,22,000- 1,22,200 ha⁻¹

Irrigated with animal: ₹ 2,20,400-₹ 2,20,600 ha⁻¹

C. Strategic Interventions Recommended for PMDDY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Levelling and bunding	Individual	8,000-10,000
Sprinkler sysrem	Individual	Installation: 25,000 -30,000 Cost of each irrigation: 1,500
Mulching	Individual	3,000-4,000

Module 2a: Crop based interventions

Crop	Variety	Method
Wheat	K-1317	Seed bank
Field pea	IPFD 13-2	Seed bank
Green gram	(Shikha) IPM 410-3	Seed bank
Pearl millet	Dhanshakti	Individual
Bengal gram	JG-36	Seed bank
Lentil	KLB-345	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹ ha ⁻¹)
Crop alone	Rainfed: ₹96,300-96,500	Rainfed: 1,19,800-1,20,000
	Irrigated: ₹1,62,800-1,63,000	Irrigated: 1,87,000-1,87,200
Rainfed: Crop with poultry	Rainfed: ₹96,500-96,800	Rainfed: 1,22,000-1,22,200
Irrigated: Crop with buffaloes	Irrigated: ₹1,91,600-1,91,800	Irrigated: 2,20,400-2,20,600

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Balanced feeding and perennial fodder production through multicut variety of chari (BB-2)	Buffaloes	Individual	28,700-28,900
Improved poultry breed	Kadaknath	Individual	600-700/bird

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 5: Jhansi

Climate vulnerability: Heat, drought

A. Introduction/ Background

- Jhansi district, located in the southwestern part of Uttar Pradesh, experiences heat and drought
- The district receives an average annual rainfall of 767 mm, with temperature ranging from 19-33 °C.
- The rainfed and irrigated areas of the district were 70 and 30% respectively
- Soils are predominantly red and black soils
- Field Crops: Wheat, and pulses like gram, peas and beans. Vegetables: Potato, onion and ginger
- Livestock is a key livelihood, but milk productivity remains low due to the lack of fodder throughout the year, unavailability of improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Gandhinagar, Birgua, Bawaltanda, and Pathakarka. The major outcomes were as follows

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Desilting of check dams and sprinkler irrigation in field pea

Water storage structures such as check dams

are very important in drought-prone areas as they help in collecting rainwater and recharging groundwater. Stored water can be used to cultivate kharif and rabi crops such as field pea with the help of sprinkler irrigation, Water saving through sprinkler: 60-65%, Increase in crop yield: 10-15%, net returns: ₹ 64,000-66,000 ha⁻¹

Additional net returns:

NRM based Interventions

Sprinkler irrigation in field pea: ₹ 7,000 - 8,000 ha⁻¹

Crop intensification : ₹ 53,000- 54,000 ha⁻¹

Cropping intensification with harvested water: Renovation of borewells increased water storage by 37%, enabling its efficient use through micro-irrigation during stress periods. This facilitated the introduction of rabi crops such as field pea, replacing fallow lands after the kharif season.

Field pea crop yield: 1,200-1,400 kg ha⁻¹, net returns: ₹ 53,000- 54,000 ha⁻¹

Module 2: Crop based interventions

Raj 4120-Heat tolerant wheat variety: Increase in crop yield: 20-25%, net returns: ₹ 28,500-29,500 ha⁻¹, cost of cultivation: ₹ 15,500-16,000 ha⁻¹.

Azad Urd 3 and Shekar 2 - drought resistant short duration black gram varieties: Duration : 70-80 days. Increase in crop yield Azad Urd 3 :10-15%, net returns: ₹ 33,000-35,000 ha⁻¹, cost of cultivation: ₹ 12,000-13,000 ha⁻¹; Increase in crop yield : Shekar 2: 10-15%, net returns: ₹ 38,000-39,000 ha⁻¹, cost of cultivation: ₹ 8,000-9,000 ha⁻¹

IPU-13-1: Short duration black gram along with application of soil test-based rhizobium cultures@ 20g/kg: Duration : 70-82 days, when combined with soil test-based Rhizobium culture @20 g/kg, enhanced early plant growth and nitrogen fixation, improved soil fertility, and delivered higher, stable yields. Increase in crop yield: 90-95%, net returns: ₹ 29,000-30,000 ha⁻¹, cost of cultivation: ₹ 14,000-15,000 ha⁻¹.

Additional net returns: Crop based interventions

Improved varieties

Raj 4120 Wheat variety:	₹ 18,000 - 19,000 ha ⁻¹
Black gram varieties	
Azad Urd 3:	₹ 3,000 - 4,000 ha ⁻¹ ;
Shekar 2:	₹ 4,500 - 5,000 ha ⁻¹ ,
IPU-13-1:	₹ 11,000 - 12,000 ha ⁻¹
Sesame variety Sekhar:	₹ 6,000 - 7,000 ha ⁻¹
JG 14 Chickpea variety:	₹ 23,000 - 24,000 ha ⁻¹
RH-406 Mustard variety:	₹ 22,000 - 23,000 ha ⁻¹
RG 425 Groundnut variety:	₹ 18,500 - 19,000 ha ⁻¹

Sekhar-Short duration sesame variety: Duration :

80 to 90 days. Tolerant to leaf curl, powdery mildew, macrophomina, and phytophthora blight. Increase in crop yield: 30-35%, net returns: ₹ 15,000-16,000 ha⁻¹, cost of cultivation: ₹ 10,000-11,000 ha⁻¹ G 14-Heat tolerant chickpea variety: It is a short-duration variety that matures in 100-105 days. Known for moderate resistance to diseases like wilt and pod borer, and suitable for late sowing. Increase in crop yield: 40-50%, net returns: ₹ 58,000-59,000 ha⁻¹, cost of cultivation: ₹ 19,000-20,000 ha⁻¹.

RH-406 heat tolerant mustard variety + Sulphur application (40 kg/ha): Traditional mustard varieties often suffered from flower drop, low seed weight, and low oil content due to terminal heat stress. To overcome these problems, the heat-tolerant mustard variety RH-406 combined with sulphur application is recommended. Increase in crop yield: 25-30%, net returns: ₹ 87,000- 88,000 ha⁻¹, cost of cultivation: ₹ 15,000-16,000 ha⁻¹.

RG 425-drought tolerant groundnut variety + Seed treatment with Tebuconazole @2gm/seed: The RG-425 combined with Tebuconazole seed treatment enhanced crop performance under moisture stress conditions, while timely irrigation improved water-use efficiency. Increase in crop yield: 20-25%, net returns: ₹ 79,000-80,000 ha⁻¹, cost of cultivation: ₹ 25,000-26,000 ha⁻¹.

Module 3: Livestock based interventions

Round year green fodder production and mineral mixture supplementation to buffaloes: Round-the-year green fodder production, along with mineral mixture supplementation, ensured continuous availability of quality feed for dairy animals.

Additional net returns:

Livestock based interventions

Round year green fodder production:

Rainfed:	₹ 20,000 - 21,000 animal ⁻¹
Irrigated:	₹ 22,000 - 23,000 animal ⁻¹
multi coloured broiler Chabro:	₹ 50 - 60 bird ⁻¹

This reduced seasonal fodder scarcity and improved the nutritional balance of the ration, thereby increased the income of the farmer.

Rainfed: Increase in milk yield: 20-25%, net returns: ₹69,000, cost of rearing: ₹ 45,000- 46,000 animal⁻¹, Irrigated: Increase in milk yield: 20-25%, net returns: ₹ 75,000-76,000 animal⁻¹, cost of rearing: ₹ 46,000-47,000 animal⁻¹

Multi coloured broiler Chabro as backyard poultry: Chabro are well adapted to backyard poultry in tropical and harsh climate, grow faster than desi birds. Gain in body weight: 95-98%, net returns: ₹ 150-160 bird⁻¹, cost of rearing: ₹ 150 bird⁻¹.

Module 4: Integrated farming systems: Combination of livestock with crop, horticulture crops, etc., by recycling one by-product to another by-product. Eg: crop residues, etc., can be fed to cattle, and cattle dung can be used for crops. Can enhance the opportunity for organic farming.

Rainfed with animal: Additional cost of cultivation: ₹ 45,000-46,000, net returns: ₹ 1,88,000-1,89,000

Irrigated with animal: Additional cost of cultivation: ₹ 45,500-47,500, net returns: ₹ 2,32,000-2,32,500

C. Strategic Interventions Recommended for PMDDY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Desilting of check dams	Individual	30,000-50,000 (1,000-2,500 m ³ silt accumulation)
Irrigation through sprinkler system	Individual	Installation 25,000 -30,000 Cost of each irrigation: 1,500

Module 2a: Crop based interventions

Crop	Variety	Method
Wheat	Raj 4120	Individual
Black gram	Azad Urd 3, Shekar 2, IPU-13-1	Individual
Sesame	Sekhar	Individual
Chickpea	JG 14	Individual
Mustard	RH-406	Seed bank
Groundnut	RG 425	Individual

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹ ha ⁻¹)
Crop alone	Rainfed: 30,000-31,000	Rainfed: 1,19,000-1,19,500
	Irrigated: 52,000-52,500	Irrigated: 1,56,000-1,57,000
Crop with buffaloes	Rainfed: 76,000-76,500	Rainfed: 1,88,000-1,89,000
	Irrigated: 99,000-99,500	Irrigated: 2,32,000-2,32,500

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹ ha ⁻¹)
Round year green fodder production along with mineral mixture supplementation	Buffaloes	Individual	26,000-30,000
Backyard poultry	Chabro	Individual	250-350/bird

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 6: Pratapgarh

Climate vulnerability: Drought, salinity stress

A. Introduction/ Background

- Pratapgarh district, located in the eastern part of Uttar Pradesh within the Purvanchal agro-climatic region. In this region agriculture is predominant with fertile alluvial plains along the Ganga and Sai rivers. Periodic rainfall variability and dry spells influence crop cycles and farming decisions.
- The district receives an average annual rainfall of about 740–800 mm, mainly during the southwest monsoon, with hot, dry summers often exceeding 40 °C and cool, dry winters favorable for *Rabi* crops.
- Soils are largely fertile alluvial soils derived from river deposits, supporting high productivity for staple crops under irrigated conditions.
- Agriculture in Pratapgarh is largely supported by irrigation (>85 %) through tube wells, borewells, and minor canal systems, enabling intensive cultivation of rice, wheat, pulses, and other crops
- Field crops: Paddy and wheat as dominant staples, along with maize, pulses (such as black gram, pigeonpea and green gram), and oilseeds. Plantations: Amla orchards, which contribute significantly to fruit production and diversified incomes.
- Livestock and allied activities play a crucial role in rural livelihoods, with cattle, buffaloes, goat, sheep, and poultry widely reared, despite high animal populations, productivity constraints persist due to fodder shortages, and lack of improved breeds.
- Pratapgarh district has considerable potential for enhancing farm productivity and rural income through climate-resilient, convergence-based interventions, such as improved water management (farm ponds and micro-irrigation), integrated crop-livestock systems, and diversification into horticulture and high-value crops. Implementation of such measures was done in climate smart villages Chhachhamau, Ainthu and Baliyapur of Pratapgarh. The major outcomes were,

B. Impact of Interventions: Key Evidences

Module 1: NRM based interventions

Laser land levelling in wheat: Increase in crop yield: 8%, net returns: ₹ 23,000 ha⁻¹,

Crop residue management in wheat: Crop residue mulching conserves soil moisture, and salinity build-up. Increase in crop yield: 21%, net returns: ₹ 41,000 ha⁻¹.

Additional net returns:

NRM based interventions

Laser land levelling: ₹ 2,500 ha⁻¹

Crop residue management : ₹ 9,000 ha⁻¹

Dhaincha green manuring : ₹13,000 ha⁻¹

Dhaincha green manuring in paddy: Incorporation of dhaincha 30–45 days after sowing adds substantial organic matter and nutrients, increase in crop yield: 22 %, cost of cultivation: ₹ 25,000 ha⁻¹,

Module 2: Crop based Interventions

Crop diversification in salt affected soils: Paddy variety CSR-60: Medium duration, salt-tolerant,

high-yielding paddy variety developed for sodic and saline soils. Increase in crop yield: 8-12%, cost of cultivation: ₹ 30,000-35,000 ha⁻¹, net returns: ₹ 15,000-20,000 ha⁻¹,

Wheat variety KRL-283: Medium duration, salt-tolerant, high-yielding wheat variety. Increase in crop yield: 7-14%, cost of cultivation: ₹ 25,000-35,000 ha⁻¹, net returns: ₹ 20,000-23,000 ha⁻¹.

Mustard variety CS-58/60: Medium duration, salt-tolerant varieties, well adapted to problem-soil areas under irrigated and partially rainfed conditions. Increase in crop yield: 20-30%, cost of cultivation: ₹ 14,000-19,000 ha⁻¹, net returns: ₹ 30,000-45,000 ha⁻¹,

Additional net returns:

Crop based Interventions

Salinity tolerant varieties

CSR-60 Paddy variety: ₹ 2,000 - 5,000 ha⁻¹

KRL-283 Wheat variety: ₹ 2,000 - 7,000 ha⁻¹

CS-58/60 Mustard variety: ₹ 4,000 - 8,000 ha⁻¹

Module 3: Livestock based interventions

Copper concentrated mineral mixture: To mitigate impact of sodicity (High pH), **Cow:** Increase in milk yield: 15-25%, cost of production: ₹ 30,000-35,000 animal⁻¹, net returns: ₹ 35,000-64,000 animal⁻¹, additional net returns: ₹ 4,000-10,000 /animal

Buffalo: Increase in milk yield: 16-18%, cost of production: ₹ 24,000-27,000 /animal, net returns: ₹ 50,000-75,000 /animal, additional net returns: ₹ 9,000-13,000 /animal

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Laser land levelling	Individual	8,000-10,000
Dhaincha green manuring	Individual	3,800-4,000

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	CSR-60	Seed bank
Wheat	KRL-283	Seed bank
Mustard	CS-58/60	Seed bank

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Paddy followed by wheat/mustard	90,000	1,00,000
Paddy followed by wheat/mustard + cow + buffalo	15,2000	2,17,000

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹ animal ⁻¹)
Copper mineral mixture	Cow and buffalo	Individual	25,000-35,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 7: Shravasti

Climate vulnerability:

A. Introduction/ Background

- Shravasti district, located in the northeastern part of Uttar Pradesh.
- The district receives an average annual rainfall of 1070 mm, with temperatures ranging from 19-32 °C.
- The rainfed and irrigated area of the district were 21 and 79% respectively
- Soils are predominantly alluvial soils
- Crops: Wheat, rice, and lentil. Vegetables: Onion and potato
- Livestock is a key livelihood, but milk productivity remains low due to poor-quality feed, unavailability of improved breeds, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done.

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Direct Seeded Rice: The rice seeds are directly drilled into the fields with a seed drill or drum seeder at optimum moisture level to a depth of 2 to 3 cm in contrast to the traditional water-intensive method of transplanting rice seedlings to waterlogged puddle fields. It can

Additional net returns:

NRM based Interventions

Direct Seeded Rice: ₹10,000 - 11,000 ha⁻¹

Zero tillage in wheat: ₹ 25,000 - 35,000 ha⁻¹

Ridge sowing in maize: ₹ 12,000 - 14,000 ha⁻¹

be done with varieties such as Narendra 97, Narendra 118, Narendra 80 and NDR 359. Additional advantage of this technology is early sowing of wheat can be done. Increase in crop yield: 10-15%, net returns: ₹ 12,000-13,300 ha⁻¹, cost of cultivation: ₹ 22,000-23,000 ha⁻¹, water saving : 1,400 m³ of irrigation water ha⁻¹ (15-18%)

Zero Tillage (ZT):

ZT is a direct drilling of wheat in an unploughed rice field immediately after harvest of kharif crop using zero till ferti seed drill or happy seeder. This is a tractor-mounted machine (45-55 HP with double clutch), enables direct sowing of wheat into standing crop residues without residue burning. It chops and spreads residues uniformly as surface mulch. The crop can be sown at a row spacing of 20 cm at an optimum sowing depth of 3.5-5.0 cm. The field capacity: 2-3 ha day⁻¹ operating cost ₹ 3,500 ha⁻¹ (on custom hiring). Zero till helps in timely sowing and immediate sowing of wheat crop after the kharif crop harvest. Increase in crop yield: 40-45%, net returns: ₹ 44,000-45,000 ha⁻¹, cost of cultivation: ₹ 30,000-32,000 ha⁻¹.

Ridge sowing in Maize: Maize seeds are sown on raised ridges 50–60 cm apart, with seeds placed at recommended spacing along the ridges. Improves drainage in flood-prone areas. Reduces water

stagnation around roots. Enhances root aeration and nutrient uptake. Helps in early crop establishment and uniform germination, Improved crop growth and yield stability under erratic rainfall. Reduces risk of fungal diseases and root rot. Gain over flat sowing :10-25%, net returns: ₹ 26,000-26,500 ha⁻¹, cost of cultivation: ₹ 24,000-25,000 ha⁻¹.

Module 2: Crop based interventions

Rice: Submergence tolerant varieties with tolerance up to 10–14 days, Varieties includes Swarna Sub1, Swarna-Sub1 MTU 1010. Increase in crop yield: 10-15%

HD 3271 wheat variety: It is ideal for very late sown irrigated conditions and resistant to rust. Increase in crop yield:15-30%

Pant Sweta mustard variety: Suitable for late sowing and moisture-stress conditions. Increase in crop yield: 15-25%

Introduction of horticulture crop like Dragon fruit: It has yield potential of 8-10 t/ha from 3rd Year onwards. Performs better in erratic rainfall and flood-prone conditions. Economic yield begins 16–18 months after planting.

Improved chickpea variety GJG-6 can be cultivated.

Module 3: Livestock based interventions

Mineral mixture supplementation to buffaloes to enhance milk yield: Regular supplementation of the mineral mixtures to buffaloes helped to maintain better body condition, improved feed intake, and enhanced metabolic efficiency, which are commonly affected during hot months.

Increase in milk yield: 20-25%

Year round fodder production: It can be done through sorghum (MP Chari), maize (African Tall / HQPM fodder types), Bajra–Napier hybrid (CO-4 / CO-5) for continuous fodder availability and yield improvement

Silage making: It can be done with maize, sorghum for lean periods and flood emergencies

Crop residue enrichment: Urea treatment of wheat/paddy straw to get more profits

C. Strategic Interventions Recommended for PMDDY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Direct Seeded Rice	Individual	38,000
Zero Tillage	Individual	25,000-35,000
Ridge sowing in Maize	Individual	1,500-2,500

Module 2a: Crop based interventions

Crop	Variety	Method
Rice	Swarna Sub1, Swarna-Sub1 MTU 1010	Individual/Seed bank
Wheat	HD 3271	Individual/Seed bank
Mustard	Pant Sweta	Individual/Seed bank
Chick pea	GJG-6	Individual/Seed bank

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Mineral mixture supplementation	buffaloes	Individual	25,000-30,000
Year round fodder production	Sorghum: MP Chari Maize: African Tall Bajra–Napier hybridS: CO-4 / CO-5	Individual	40,000-50,000 ha ⁻¹
Silage making	Maize/Sorghum	Individual	6-12/kg
Crop residue enrichment	Urea treatment	Individual	10,000-20,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 8: Sonbhadra

Climate vulnerability: Drought, heat wave and soil erosion

A. Introduction/ Background

- Sonbhadra district, located in the southeast of Uttar Pradesh, experiences drought and heat wave and soil erosion
- The district receives an average annual rainfall of 921 mm, with temperature ranging from 19-32 °C.
- The rainfed and irrigated area of the district were 66 and 34% respectively
- Soils are predominantly alluvial, sandy loam, and lateritic
- Field Crops: Wheat, rice, maize, lentil, chick pea, red gram, and chilli. Vegetables: Onion and potato
- Livestock is a key livelihood, but milk productivity remains low due unavailability of fodder throughout the year, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done in climate smart villages Dorihar and Bahuar. The major outcomes were as follows

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Raised bed pigeon pea: Raised bed planting helps in conserving the rain water and the furrows contribute towards safe disposal of excess water during intense rainfall events. Bed dimensions

were width 30 cm, height 15 cm with 60 x 60cm row spacing and 30 x 30cm plant spacing with manual sowing. Increase in crop yield: 30-35%, net returns: ₹ 52,000- 52,300 ha⁻¹

Additional net returns: NRM based Interventions

Bed and furrow pigeon pea: ₹19,700 - 20,000 ha⁻¹

Direct seeded rice : ₹14,200 - 14,400 ha⁻¹

Direct seeded rice with Shusk Samrat : Direct seeded rice cultivation with short duration rice variety Shusk Samrat found better adoption under delayed sowings minimizes the climate variability. Increase in crop yield: 27-30%, net returns: ₹ 18,000- ₹ 18,300 ha⁻¹, cost of cultivation: ₹ 23,000- 23,300 ha⁻¹

Module 2: Crop based interventions

T 78- Short duration sesame variety: Duration: 85–90 days, making it ideal for intensive cropping systems or late-sown conditions. Known for its resistance to lodging and leaf curl disease. Increase in crop yield: 40-45%, net returns: ₹ 31,400-31,600 ha⁻¹, cost of cultivation: ₹ 25,200-25,400 ha⁻¹.

Additional net returns:

Crop based interventions

Improved crop varieties

T 78 Sesame variety: ₹ 24,400 - 24,600 ha⁻¹

JG 36 Chick pea variety: ₹ 29,800 - 30,000 ha⁻¹

RH 725 Mustard variety: ₹ 20,600 - 20,800 ha⁻¹

K 1317 Wheat variety: ₹ 16,000 - 16,200 ha⁻¹

JG 36- Drought tolerant chick pea variety:

Increase in crop yield: 30-35%, net returns: ₹ 70,900-71,200 ha⁻¹,
cost of cultivation: ₹ 44,300-44,500 ha⁻¹.

RH 725-Drought and heat tolerant mustard variety: It is suitable for late sown conditions, resistant to lodging. Increase in crop yield: 15-20%,
net returns: ₹ 61,288-61,288 ha⁻¹, cost of cultivation: ₹ 35,300-35,500 ha⁻¹.

K 1317-Drought and heat tolerant wheat variety: It is resistance to rusts and leaf blight.
Increase in crop yield: 10-15%, net returns: ₹ 63,000- 63,300 ha⁻¹,
cost of cultivation: ₹ 52,700- 52,900 ha⁻¹.

Module 3: Livestock based interventions

Mineral mixture supplementation to Kaveri cows: A combination of feeding with fodder and mineral mixture enhanced the milk yield in Kaveri cows. Increase in milk yield: 33-36% animal⁻¹.
additional net returns: ₹ 15,250 animal⁻¹

C. Strategic Interventions Recommended for PMDDY**Module 1: NRM based Interventions**

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Raised bed sowing	Individual	40,000-50,000
Direct seeding of rice with short duration rice (Shusk Samrat)	Individual	23,000-23,300

Module 2: Crop based interventions

Crop	Variety	Method
Sesame	T 78	Individual
Chick pea	JG 36	Individual
Mustard	RH 725	Individual
Wheat	K 1317	Individual

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹ animal ⁻¹)
Mineral mixture supplementation	Kaveri cows	Individual	25,000-35,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 9: Unnao

Climate vulnerability: Floods and dry spells

A. Introduction/ Background

- Unnao district, located in the central part of Uttar Pradesh, experiences floods and dry spells
- The district receives an average annual rainfall of 698 mm, with temperature ranging from 19-32 °C.
- The rainfed and irrigated area of the district were 32 and 68% respectively
- Soils are predominantly alluvial soils
- Field Crops: Wheat, rice, black gram, maize and chilli. Vegetables: Potato, onion and sweet potato
- Livestock is a key livelihood, but milk productivity remains low due to poor-quality feed, unavailability of improved fodder, limited veterinary services, and weak market linkages
- The district has significant potential for productivity and livelihood enhancement through convergence-based, climate-resilient interventions focusing on integrated crop, livestock systems and sustainable natural resource management and need based outcome-oriented implementation was done.

B. Impact of Interventions: Key evidences

Module 1: NRM based Interventions

Green manuring in paddy: Green manuring with *Sesbania* before paddy sowing helps in increasing productivity and profitability of crops.

Increase in crop yield: 15-20%,
net returns: ₹ 30,000-40,000 ha⁻¹.

Additional net returns:

NRM based Interventions

Green manuring in paddy	₹17,000 - 20,000 ha ⁻¹
Crop residues in wheat	₹ 17,000 - 20,000 ha ⁻¹
Laser land levelling	
Rice:	₹ 13,500 - 15,000 ha ⁻¹
Wheat:	₹ 9,500 - 11,000 ha ⁻¹

Crop residue management in wheat: Conversion of paddy residues into quality compost through the application of Halo-CRD (Crop residue decomposer) before wheat sowing Increase in crop yield: 15-20%, net returns: ₹ 30,000-40,000 ha⁻¹

Laser land levelling with Laser Land Leveler (LLL) in rice and wheat: Laser land levelling is a process, where levelling of undulated land can be done with laser land leveller, a precision tool that levels agricultural fields using a laser-guided system. It gives uniform crop stand, and higher yields immediately after laser levelling. Saving in Irrigation water: 27–29% in rice and wheat due to the adoption of this technology. efficient use of nutrients, germination of seed and crop yield,

Increase in crop yield in rice: 15-20%, net returns: ₹ 30,000-40,000 ha⁻¹

Increase in crop yield in wheat: 8-12%, net returns: ₹ 30,000-40,000 ha⁻¹

Module 2: Crop based interventions :Improved varieties of various crops

CSR 30- Salt tolerant rice variety: It is moderately resistant Rice Tungro Virus (RTV) and white-backed Plant Hopper (WBPH). Increase in crop yield: 10-15%,
net returns: ₹ 21,000-35,500 ha⁻¹

KRL 210-Salt and Sodi city tolerant wheat variety:

It is suitable for normal fields too, but in salt-affected areas records higher yields, providing diversification for cropping systems. Increase in crop yield: 5-15%, net returns: ₹ 27,000-36,000 ha⁻¹

Additional net returns:**Crop based interventions**

CSR 30 Rice variety: ₹ 6,000 - 10,000 ha⁻¹
KRL 210Wheat variety: ₹ 5,000 - 8,000 ha⁻¹
Mustard variety Surekha: ₹ 10,000 - 14,000 ha⁻¹

Surekha- Heat tolerant mustard variety: Short duration variety (120-125 days). Highly resistant to Alternaria blight and White rust. Increase in crop yield: 15-20%, net returns: ₹ 38,000-55,000 ha⁻¹

Module 3: Livestock based interventions**Improved fodder grass production along with mineral mixture**

supplementation to dairy animals: In dairy animals feeding with Napier fodder grass along with mineral mixture supplementation helps in increasing the income of the farmers.

Increase in milk yield: 10-20%, net returns: ₹ 90,000- 1,09,000 animal⁻¹

Additional net returns:**Livestock based interventions :**

Napier Fodder+ mineral mixture:
₹20,000-23,000 animal⁻¹

C. Strategic Interventions Recommended for PMDDY**Module 1: NRM based Interventions**

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Green manuring	Individual	3,500-40,000
Crop residue management through crop residue decomposer	Individual	1,500-2,000
Laser land levelling with Laser Land Leveler	Individual	8,000-10,000

Module 2a: Crop based interventions

Crop	Variety	Method
Rice	CSR-30	Individual
Wheat	KRL-210	Individual
Mustard	Surekha	Individual

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Improved fodder grass production along with mineral mixture supplementation	Dairy animals	Individual	53,000-54,000

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

West Bengal

District 1: Darjeeling

Climate vulnerability: Drought

A. Introduction/ Background:

- Darjeeling district, located in the northernmost part of West Bengal in the Eastern Himalayan foothills, experiences a sub-tropical humid climate with heavy and uneven rainfall, marked temperature gradients by altitude, and landslides.
- The district receives very high average annual rainfall (about 3400–mm), mostly during the monsoon (June–September), temperatures vary widely with elevation ~35–37 °C in summer and ~12 °C in winter in hill areas.
- Soils in the district are red soil, red and yellow soil, mixed, red and black
- Agriculture here is constrained by terrain, small and fragmented holdings, and soil erosion, with cultivation largely on terraces or in the limited plains.
- Field crops: Paddy, maize, wheat, millets, jute, potato. Plantations: Tea, cardamom, ginger.
- Livestock and allied activities such as cattle, goats and poultry complement farming, while in higher elevations yak and chauri herding persists however, productivity is limited by pasture constraints and rugged terrain.
- Climate-resilient interventions emphasizing soil and water conservation on slopes, improved terrace farming, crop diversification and integrated crop-livestock systems are demonstrated in the selected climate smart villages Paiyong and Dalapchand to enhance resilience, stabilize yields and support rural livelihoods in the district.

B. Impact of interventions: Key evidences

Module 1: NRM based interventions:

Rain water harvesting with concrete and poly tanks: Jalkund of 18 ft × 10 ft × 5 ft with water storage capacity of more than 18,000 liter was constructed. Increase the cropping intensity by 15–18%. Crops: Tomato, Dalley Chilli, Cole crops, Beans etc. Number of farmers benefited: 10.

Additional net returns:

NRM based interventions

Raised bed and Poly mulching:

Chilli: ₹ 1,20,000 - 1,25,000 ha⁻¹

Ginger: ₹ 2,70,000 - 3,00,000 ha⁻¹

Mulching in vegetables:

Crop residues or polythene: ₹ 30,000 - 35,000 ha⁻¹

Raised bed and Poly mulching: Black or silver–black polyethylene sheets (20–25 microns) laid over raised beds. Dalley chilli and ginger crops were cultivated. Increase in crop yield: Chilli: 60–65%, Ginger: 65–70%; Cost of cultivation: Chilli: ₹ 1,00,000 -1,10,000 ha⁻¹, Ginger: ₹ 3,50,000 -3,53,000 ha⁻¹; Increase in net returns: Chilli: ₹ 1,20,000 -1,25,000 ha⁻¹, Ginger: ₹ 2,60,000-3,10,000 ha⁻¹

Crop residues mulching in Cole crops:

Increase in crop yield: 50–55%, cost of cultivation: ₹ 70,000–75,000 ha⁻¹, net returns: ₹ 55,000–60,000 ha⁻¹

Ridge and furrow System: Furrows of 15 cm deep were made. Crops: Maize, Potato. Increase in crop yield: 20 -27 %, water use efficiency: 25-30%

Micro irrigation system (MIS): In vegetables like potato, cabbage, drip irrigation can be practiced. Increase in crop yield: 33- 42 %, cost of installation of drip irrigation system: ₹ 75,000 ha⁻¹, net returns: ₹ 35,000-40,000 ha⁻¹, water saving: 30-50 %.

Additional net returns:

Drip irrigation: ₹ 25,500 ha⁻¹
Sprinkler irrigation: ₹ 19,000 ha⁻¹

Sprinkler irrigation: For maize, wheat, mustard crops sprinkler irrigation can be practiced. Increase in crop yield: 25-30 %, water saving in wheat: 25- 45%. net returns: ₹ 18,000-20,000 ha⁻¹
cost of installation: ₹ 35,000 ha⁻¹,

Module 2: Crop based Interventions

Intercropping systems: Cabbage + field pea, increase in crop yield: 15-18%, cost of cultivation: ₹ 60,000-63,000 ha⁻¹, net returns: ₹ 70,000-80,000 ha⁻¹

Additional net returns:

Crop based Interventions

Intercropping: ₹ 50,000 - 55,000 ha⁻¹
DSR: ₹ 15,000 - 20,000 ha⁻¹
Sahabhagi dhan: ₹ 15,000 - 20,000 ha⁻¹
Kufri Jyoti, Kufri Himalini: ₹ 30,000 - 50,000 ha⁻¹

Direct seeding of rice with Sahabhagi Dhan:

Sowing of rice directly in the field with tractor drawn implement at a spacing of 20 × 20 cm, placed at 2.5 cm to depth. This variety matures in 100-105 days duration, drought tolerant. Increase in crop yield: 15-20%, net returns: ₹ 20,000-30,000 ha⁻¹

Kufri Jyoti, Kufri Himalini potato varieties: Medium duration and late-blight resistant potato varieties suitable for hill ecosystems. Increase in crop yield: 20-30%, net returns: ₹ 50,000-60,000 ha⁻¹.

Module 3: Livestock based interventions

Area-Specific mineral mixture: 50g/day/animal once in a day along with the animal feed. Increase in milk yield: 25%, cost of production: ₹ 109 /day/animal, net returns: 36%

Additional net returns:

Livestock based interventions

Area-specific mixtures: ₹ 40.5 /animal/day
Shelter management and improved breed: ₹18,000-22,000
Green fodder: ₹ 35-40 /animal/day
Mushroom cultivation: ₹ 14,000 for 200 barrels

Scientific shelter for pig and improved

breed: Ghungroo pig breed, (1 gilt + 1 boar), 16 piglets per year, increase in litter size: 150-160%, Low mortality rate (5%) cost of production: ₹ 40,000-45,000, net returns: ₹ 30,000-35,000

Green fodder for cows: Hybrid Napier grass, increase in milk yield: 40%, cost of production: ₹95 / animal, net returns: ₹ 120-140/animal/day

Scientific mushroom cultivation with paddy straw / maize residues:

cost of production: ₹4,500–5,500, net returns: ₹7,000–10,000 cycle⁻¹ (45-60 days), Yield: 80-100 kg mushrooms

Vermicompost production: Vermicompost from biodegradable wastes. Compost yield: 50%-60% (700–900 kg/cycle), cost of production: ₹ 3,500–4,000 /cycle, net returns: ₹3,500–6,500 cycle⁻¹ (Cycle: 60-75 days)

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹)
Concrete and poly tanks	Community convergence with MGNREGA	14,000-20,000/unit
Raised bed and polythene mulching	Individual	50,000 ha ⁻¹
Ridge and furrow	Individual	2,000-2,500
Micro irrigation system	Individual	75,000 ha ⁻¹
Sprinkler irrigation	Individual	35,000 ha ⁻¹

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	Sahabhagi Dhan	Individual
Potato	Kufri Jyoti, Kufri Himalini	Individual

Module 2b: Systems based Interventions

System	Cost (₹)	Net returns (₹ ha ⁻¹)
Cabbage + Field pea intercropping alone	62,000 ha ⁻¹	81,515
Cabbage + Field + 16 piglets	10,000	1,16,515

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost (₹)
Area-Specific mineral mixture	Cow	Individual	109 /day/animal
Shelter for pig	Ghungroo pig	Individual	40,000-45,000
Green fodder	Cow	Individual	95 /animal
Mushroom		Individual	20,000-23,000 for 200 barrels
Vermicompost		Individual	3,900 /unit

Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centres with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centres, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

District 2: Purulia

Climate vulnerability: Moisture stress

A. Introduction/ Background

- Purulia district, located in the westernmost part of West Bengal (Rarh region), is highly prone to climatic extremes, particularly recurrent droughts, erratic and uneven monsoon rainfall, intense heat waves in summer, and intermittent dry spells.
- The district receives most of its rainfall from the southwest monsoon, with average annual rainfall of 1387 mm. Temperatures range from around 3.8-7 °C in winter to extreme highs of 45–48 °C in summer.
- Soils in Purulia are predominantly red lateritic and laterite-derived soils on undulating terrain, generally low in organic carbon and essential nutrients, acidic, and have poor moisture retention.
- Agriculture in Purulia is predominantly rainfed, with a significant share of upland and lateritic terrain limiting irrigation potential.
- Field crops: Paddy, maize, pulses (such as arhar, gram and moong), and minor oilseeds (e.g., mustard and groundnut). Plantations: mango, guava, lime are grown.
- Livestock constitutes a vital component of the rural farming system in Purulia, contributing to both livelihoods and nutritional security. The district has a substantial population of cattle, buffaloes, sheep, goats, pigs, and poultry. Productivity remains constrained by feed and fodder shortages typical of dryland zones.
- To address the challenges, climate-resilient, convergence-based interventions emphasizing integrated crop-livestock systems, water and soil conservation, moisture augmentation, and climate-smart agronomic practices have been promoted under various government and development initiatives in climate smart villages of Haramjanga, Purulia district. The major outcomes were,

B. Impact of interventions: Key evidences

Module 1: NRM based interventions

Scientifically designed dug well:

Diameter: 12 ft, Depth: 15 ft, Total Volume: 1,695 cubic feet, Equivalent Water Storage: 48,000 litres, Average daily recharge in summer months: 400–

550 litres/day, Summer crops: Introduced vegetables (Ridge gourd, Bottle gourd, Okra, pumpkin, Cucumber, Cowpea, spinach, amaranthus, coriander), Cropping intensity: Doubled

Supplemental irrigation: In tomato variety RCDTH-22 increase in crop yield: 15-20%, net returns: ₹80,000 -120000 ha⁻¹, cost of cultivation: ₹ 80,000 -85,000 ha⁻¹

Line sowing of maize (P-3535) with multi crop 4-row planter: The crop can be sown in line at a spacing of 90 X 25 cm between rows and plants respectively. Increase in crop yield: 90-95%,

Additional net returns:	
NRM based interventions	
Scientifically dug well:	₹28,000 - 35,000
Supplemental irrigation to tomato:	₹ 70,000- 1,00,000 ha ⁻¹

net returns: ₹ 30,000 -33,000 ha⁻¹, cost of cultivation: ₹ 55,000 -57,000 ha⁻¹

Farm ponds: They ensure a source of supplemental irrigation for crops during dry spells and re-charge groundwater, helping farmers cope with erratic rainfall and drought

Community nurseries: It ensures timely availability of robust planting material, which is critical for contingency cropping (planting an alternative crop when the main crop fails due to weather).

Module 2: Crop based interventions

System of Rice Intensification: Single seedling of 8-12 days old or three leaf stage seedlings were transplanted at a spacing of 25 x 25 cm spacing. After 8/10 lines of transplanting one line is skipped.

Seed rate in traditional method: 50-60 kg ha⁻¹; SRI: 3.5-5 kg ha⁻¹.

Increase in crop yield: 20–25%,

net returns: ₹ 55,000 -60,000 ha⁻¹, cost of cultivation: ₹ 60,000 -62,000 ha⁻¹

Additional net returns:

Crop based interventions

Sahabhagi dhan paddy: ₹ 15,000 - 20,000 ha⁻¹

Improved crop varieties

CR Dhan-800 paddy: ₹35,000 - 40,000 ha⁻¹

Groundnut: Narayani: ₹ 12,000 - 20,000 ha⁻¹

IPU-11-02 Black gram: ₹ 20,000 - 40,000 ha⁻¹

CFL-1522 Cauliflower: ₹1,20,000 - 1,40,000 ha⁻¹

Direct seeding of rice: Sowing of rice directly in the field. Suitable variety: Sahabhagi Dhan. Direct sowing of rice was done with tractor drawn implement at a spacing of 20cm × 20 cm. The rice seed should not be placed deeper than 2.5 cm for good and uniform crop establishment. Increase in crop yield: 15-20%, net returns: ₹ 28,000 -29,000 ha⁻¹, cost of cultivation: ₹ 59,000 -60,000 ha⁻¹

Sahabhagi dhan paddy: Drought tolerant variety with 100-105 days duration. Increase in crop yield: 14-18%, net returns: ₹ 30,000 -35,000 ha⁻¹, cost of cultivation: ₹ 60,000 -63,000 ha⁻¹

CR Dhan-800 paddy: High-yielding, semi-dwarf variety suitable for rainfed shallow lowlands. Increase in crop yield: 30-35%, net returns: ₹55,000 -60,000 ha⁻¹

Narayani variety Groundnut: Drought tolerant and 100-105 days duration. Increase in crop yield: 15-18%, net returns: ₹ 50,000-55,000 ha⁻¹

IPU-11-02 Black gram: High-yielding, early-maturing cultivar, adaptable to rainfed and irrigated conditions. Increase in crop yield: 15-20%, net returns: ₹ 40,000-50,000 ha⁻¹

Green Express Cabbage variety: An early-maturing, high-yielding hybrid with compact heads and excellent green colour, pest control using pheromone traps, trap crops and other biological pesticides. Increase in crop yield: 50-60%, net returns: ₹2,00,000 -2,50,000 ha⁻¹

CFL-1522 Cauliflower: High-yielding, early to mid-season variety with uniform curd quality, tolerance to environmental stresses. Increase in crop yield: 30-35 %, net returns: ₹2,20,000-2,40,000 ha⁻¹

Introduction of Finger millet: Indravathi variety: Grown in un-irrigated and unfertile land, 25-30 days old seedlings were transplanted into the main field at a spacing of 20 × 10 cm. 75 kg ha⁻¹ of urea 10:26:26 complex fertilizer was applied as basal followed by 40 kg ha⁻¹ urea was applied at 25 DAT. Increase in crop yield: 40-45%, net returns: ₹ 30,000-40,000 ha⁻¹

Module 3: Livestock based interventions:

Silvi-pastoral system: Tree component *Acacia auriculiformis*, at 2.5 × 2.5 m, intercropped with *Stylo hemata fodder*. Milk yield: Cow: 3.5 - 5.0 litres/day; Buffalo: 3.5 - 6.0 litres/day

Black Bengal goat breed and scientific

management: A native, heat-tolerant and drought-resilient breed. Adoption of scientific breeding practices to enhance the kidding rate and kid survival, elevated concrete platforms to prevent foot rot, perimeter fencing shade, vaccination, and seasonal fodder for feed. Increase in body weight: 7-14%, net returns: ₹2,500 -3,000 goat⁻¹, Increase in kids number: 14-16 /year

Year-round fodder and nutrient supplementation: In zebu cattle, an increase in milk yield: 25-30%, net returns: ₹3,000-4,000 animal⁻¹

Pig: Entrepreneurship development through Piggery (breed: T&D) farming, vaccination against Swine Fever & time bound deworming, proper feeding of milk along with iron solution to piglet to check piglet anaemia, introduction of boiled Tamarind seed in feed to reduce the cost. Average litter size: 8–10 piglets per farrowing, Farrowing frequency: 1.5 litters /sow/year, Annual piglet production per sow: 12–15 piglets/year, Body weight gain: At birth: 0.9–1.2 kg

Backyard poultry: Vanaraja breed, adapted to low-input conditions, Time bound vaccination against Ranikhet and Fowl Pox, deworming throughout the year. Egg yield: 150-180 eggs bird⁻¹ year⁻¹, net returns: ₹ 1,200 -1,400 bird⁻¹ year⁻¹, cost of production: ₹ 500 bird⁻¹ year⁻¹

Duck: Time bound vaccination against Duck plague & deworming throughout the year, women empowerment through climate resilience breeds of duck like Khaki Campbell, promotion of Azolla feeding for enhancing the quality of yolk and low-cost feed. Egg productivity: 150–200 eggs/duck/year, typical mature weights: 2.0-2.2 kg

Fishery: Excavation of the top soil of the pond during the summer season, maintenance of proper pH of water using lime, application of cow dung along with different cakes like groundnut, mustard cake for enhancing the plankton, and proper maintenance of stock density of major Carps. Fish yield: 2-3 tonnes/ha/year

Additional net returns:

Livestock based interventions

Black Bengal goat: ₹ 500 - 1,000 animal⁻¹

Backyard poultry : ₹ 500 - 1,000 bird⁻¹

Year-round fodder and

nutrient supplementation: ₹ 3,000 - 3,500 animal⁻¹

C. Strategic Interventions Recommended for PMDDKY

Module 1: NRM based Interventions

Interventions	Individual/ community participation	Cost (₹ ha ⁻¹)
Water harvesting structures like farm ponds and dug wells	Individual	50,000-60,000
Multi crop 4-row planter	Individual	55,000
SRI	Individual	60,503

Module 2a: Crop based interventions

Crop	Variety	Method
Paddy	Sahabhagi Dhan, CR Dhan-800	Seed bank
Groundnut	Narayani	Seed bank
Black gram	IPU-11-02	Seed bank
Finger millet	Indravathi	Seed bank
Cabbage	Green Express	Individual
Cauliflower	CFL-1522	Individual
Tomato	RCDTH-22	Individual

Module 2b: Systems based Interventions

System	Cost (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)
Rice + fallow	62,671	28,629
Rice + Black Bengal goat	67,171	32,029
Rice + fallow	61,288	73,712
Rice + Zebu cattle + year-round fodder + nutrition	70,288	86,212
Rice + fallow	59,670	54,630
Rice + backyard poultry	60,185	55,865

Module 3: Livestock based interventions

Livestock	Breed / variety	Method	Cost
Fodder sorghum	MP Chari	Fodder bank	25,000-35,000/ha
Napier	Hybrid Napier	Fodder bank	35,000-45,000
Cattle	Zebu	Individual	9,000 /animal
Goat	Black Bengal	Individual	4,000 /animal
Pig	T&D	Individual	500/piglet
Poultry	Vanaraja	Individual	500 /bird
Duck	Khaki Campbell	Individual	50-100/duckling
Fish	Carps	Individual	70-150/kg

Module 4: Institutional Intervention

Intervention	Management	Purpose
Custom Hiring centers with need-based machinery	Community, local youth	Provide essential Machinery
VCRMC	Community, committee has 12-20 members	Coordinate activities such as seed banks, fodder banks, custom hiring centers, and guide seasonal action plans
FPO and women self-help groups. For post-harvest value addition	Community	Women empowerment

PMDDKY CONTRIBUTORS LIST

Sl. No.	State	District	PI	CO-PI
1	Andhra Pradesh	Anantapur	S. N. Malleswari Sadhineni	G. Sashikala
2	Bihar	Darbhanga	Dibyanshu Shekhar	Pradeep Kumar Vishwakarma
3		Kishanganj	Kanhaiya Lal	Rajeev singh
4		Siwan	Jitendra Prasad	Kishan Bahadur chatri
5	Gujrat	Dahod	G. K. Bhabhor	R.Radha Rani
6		Kutch	U.N.Tank	Nilesh N Patel
7		Panchmahal	Kanak Lata	Jayapalsinh K Jadav
8	Himachal Pradesh	Bilaspur	Seema Shah	Manpreet Kaur
9	Karnataka	Chikkaballapura	M. Papireddy	Vishwanatha
10		Chitradurga	Parashurama Chandravamshi	Mahantesh.P.S
11		Gadag	L.G. Hiregoudar	N. H. Bhandi
12		Haveri	A. H. Biradar	Siddagangamma. K.R
13		Tumakur	N. Loganandhan	P.R. Ramesh
14	Kerala	Kannur	Meera Manjusha A V	Parvathy A
15		Kozhikode	P. Ratha Krishnan	P S Manoj
16	Madhya Pradesh	Dindori	P. L. Ambulkar	Geeta Singh
17		Tikamgarh	B. S. Kirar	R.K. Prajapati
18	Maharashtra	Beed	Vasant Deshmukh	Krushna Kardile
19	Meghalaya	West Jaintia Hills	Dodo Pasweth	Banylla Kharbamon
20	Nagaland	Mon	V. Akashe Zhimomi	Bendangjungla.l
21	Rajasthan	Barmer	Vinay Kumar	Shyam Das
22		Bikaner	Durga singh	Madan Lal Reager
23		Churu	Vinod Kumar Saini	Harphool Sharan
24		Jaisalmer	Deepak Chaturvedi	Charu Sharma
25		Jodhpur	Bhagwat Singh Rathore	Chandana
26		Nagaur	Gopichand Singh	Bhawana
27		Pali	Manoj Kumar	Arvind tetarwal
28	Tamil Nadu	Ramanathapuram	S.Vallal Kannan	M.Jagadeesan
29	Uttar Pradesh	Banda	Shyam Singh	B.K.Gupta
30		Chitrakoot	Manoj Kumar	Deepesh Mishra
31		Hamirpur	N. K. Yadav	SP Sonkar, Chanchal Singh
32		Jalaun	Mohd. Mustafa	Rajkumari
33		Jhansi	Nishi Roy	Vimal Raj Yadav
34		Pratapgarh	AK Srivastava	Naveen Kumar Singh
35		Sonbhadra	PK Singh	Sanjeev Rao
36	West Bengal	Darjeeling	Mendel Wanchuk Moktan	Pranab Barma
37		Purulia	Anirban Chakraborty	Sanjib Bhattacharya



ICAR-Central Research Institute for Dryland Agriculture
Santhoshnagar, Hyderabad - 500 059