

**National Innovations in Climate Resilient Agriculture  
Technology Demonstration Component**

**Annual Report 2025-26**

**(Attached Good quality photographs in jpg format only)**

**Name of KVK: KVK, Kalahandi**

**Nature of Climatic Vulnerability: Drought**

**Name of Adopted Villages: Indramal, Khairbhadi, Pipalpadar**

**Brief description of the villages:**

Under the National Innovations on Climate Resilient Agriculture (NICRA) project by KVK, Kalahandi, three villages—Indramal, Khairbhadi, and Pipalpadar—have been selected for implementing climate-resilient agricultural interventions. Indramal and Khairbhadi have been covered under NICRA since 2021–22, while Pipalpadar was newly included during 2025–26.

The villages are predominantly characterized by rainfed farming systems with limited irrigation facilities. The cultivated area in Indramal, Khairbhadi, and Pipalpadar is 121.4 ha, 97.5 ha, and 72.2 ha respectively, of which the major portion (97.4 ha, 79 ha, and 68 ha respectively) is rainfed. Irrigated areas are relatively small, indicating a high dependence on monsoon rainfall and greater vulnerability to climatic variability.

These villages also experience drought conditions, with about 29 ha in Indramal, 22.6 ha in Khairbhadi, and 21 ha in Pipalpadar categorized as drought-prone areas, while no flood-prone areas have been reported. The villages consist of 71, 62, and 93 households respectively, mainly comprising small and marginal farmers. Considering the climatic risks, location-specific Farming System Technologies (FSTs) have been identified and promoted to strengthen climate resilience and improve the adaptive capacity of the farming systems.

**Name of PI/Co-PI/Associated Scientist/SRF:**

**PI- Dr. Amitabh Panda, Co-PI- Dr. Binod Kumar Jena, SRF- Mr. Swaraj Meher**

**I. Module I: NRM**

**Table. Performances of demonstration of in-situ moisture conservation technologies**

| Technology demonstrated                                      | No. of farmers | Area (ha) | Yield (q/ha)     | Economics of demonstration (Rs/ha) |            |      |
|--------------------------------------------------------------|----------------|-----------|------------------|------------------------------------|------------|------|
|                                                              |                |           |                  | Gross Cost                         | Net Return | BCR  |
| Green manuring (dhaincha) in rice (Swarna Samriddhi)         | 5              | 2         | 42.2             | 52300                              | 44760      | 1.85 |
| Brown manuring in rice                                       |                |           |                  |                                    |            |      |
| Summer Ploughing in rice                                     |                |           |                  |                                    |            |      |
| Azolla in Paddy                                              |                |           |                  |                                    |            |      |
| Zero Tillage in wheat / Maize/ Others crops                  |                |           |                  |                                    |            |      |
| Repair of bund                                               |                |           |                  |                                    |            |      |
| Horticultural production through land embankment development |                |           |                  |                                    |            |      |
| Organic mulching in vegetables                               |                |           |                  |                                    |            |      |
| Mulching in tomato (Arka Apeksha)                            | 5              | 1         | 212.2q/ha tomato | 109605                             | 198145     | 2.8  |
| Any intervention not covered in above                        |                |           |                  |                                    |            |      |
| <b>Total</b>                                                 | <b>10</b>      | <b>3</b>  |                  |                                    |            |      |

**Mention the variety and Enclosed 2/3 photos**



**DEMONSTRATION ON GREEN MANURING WITH DHAINCHA IN RICE CULTIVATION**



**Table. Performances of water harvesting and recycling for supplemental irrigation**

| Technology demonstrated | No. of farmers | Area (ha)/Unit | Output (q/ha) | Economics of demonstration (Rs/ha) |
|-------------------------|----------------|----------------|---------------|------------------------------------|
|-------------------------|----------------|----------------|---------------|------------------------------------|

|                                                       |  |  |  | Gross Cost | Net Return | BCR |
|-------------------------------------------------------|--|--|--|------------|------------|-----|
| Renovation of pond for fish production and irrigation |  |  |  |            |            |     |
| Renovation of canal                                   |  |  |  |            |            |     |
| 5% Model                                              |  |  |  |            |            |     |
| Bora bandh                                            |  |  |  |            |            |     |
| Renovation of Well for irrigation                     |  |  |  |            |            |     |
| Bund making leveling in paddy field                   |  |  |  |            |            |     |
| New water harvesting structure                        |  |  |  |            |            |     |
| Raising of land embankment                            |  |  |  |            |            |     |
| Ground water recharge                                 |  |  |  |            |            |     |
| Desiltation of defunct water harvesting structures    |  |  |  |            |            |     |
| Renovation of irrigation channel                      |  |  |  |            |            |     |
| Newly Check dam                                       |  |  |  |            |            |     |
| Renovation of common pond                             |  |  |  |            |            |     |
| Any intervention not covered in above                 |  |  |  |            |            |     |
| <b>Total</b>                                          |  |  |  |            |            |     |

Enclosed 2/3 photos

**Table. Performance of artificial ground water recharge technologies demonstrated**

| Technology demonstrated                         | No. of farmers | Area (ha) | Output (q/ha) | Economics of demonstration (Rs./ha) |            |     |
|-------------------------------------------------|----------------|-----------|---------------|-------------------------------------|------------|-----|
|                                                 |                |           |               | Gross Cost                          | Net Return | BCR |
| Field bunding for rice                          |                |           |               |                                     |            |     |
| Water management through bunding of rice        |                |           |               |                                     |            |     |
| Ground water recharge through SRI by sub-soiler |                |           |               |                                     |            |     |
| Any intervention not covered in above           |                |           |               |                                     |            |     |
| <b>Total</b>                                    |                |           |               |                                     |            |     |

Enclosed 2/3 Photos

**Table. Performance of different water saving irrigation methods**

| Technology demonstrated                     | No. of farmers | Area (ha) | Output (q/ha) | Economics of demonstration (Rs./ha) |            |     |
|---------------------------------------------|----------------|-----------|---------------|-------------------------------------|------------|-----|
|                                             |                |           |               | Gross Cost                          | Net Return | BCR |
| Irrigation system (micro Irrigation system) |                |           |               |                                     |            |     |
| Application of biofertilizer in rice/crops  |                |           |               |                                     |            |     |
| Vermi-compost from biodegradable wastes     | 4              | 4 beds    | 13.1q/bed/Yr  | 7780                                | 24970      | 4.2 |
| Production of crops on farm bund            |                |           |               |                                     |            |     |
| RBF in crops                                |                |           |               |                                     |            |     |
| LEWA in crops                               |                |           |               |                                     |            |     |
| Sprinkler irrigation in crops               |                |           |               |                                     |            |     |
| Any intervention not covered in above       |                |           |               |                                     |            |     |

|       |  |  |  |  |  |  |
|-------|--|--|--|--|--|--|
| Total |  |  |  |  |  |  |
|-------|--|--|--|--|--|--|

Mention the variety and Enclosed 2/3 photos



### DEMONSTRATION ON VERMI-COMPOST FROM BIODEGRADABLE WASTES

Table. Performance of other demonstrations

| Technology demonstrated | No. of farmers | Area (ha) | Output (q/ha) | Economics of demonstration (Rs./ha) |            |     |
|-------------------------|----------------|-----------|---------------|-------------------------------------|------------|-----|
|                         |                |           |               | Gross Cost                          | Net Return | BCR |
| Demo 1                  |                |           |               |                                     |            |     |
| Demo 2                  |                |           |               |                                     |            |     |
| Demo 3                  |                |           |               |                                     |            |     |
| Others if any           |                |           |               |                                     |            |     |
| Total                   |                |           |               |                                     |            |     |

Enclosed 2/3 photos

Table: KVK wise rainwater harvesting structures developed

| RWH structures | No. | Storage capacity (cu.m) | No. of farmers | Protective irrigation potential (ha) | Increase in cropping intensity (%) |
|----------------|-----|-------------------------|----------------|--------------------------------------|------------------------------------|
|                |     |                         |                |                                      |                                    |

|                                                 |  |  |  |  |  |
|-------------------------------------------------|--|--|--|--|--|
|                                                 |  |  |  |  |  |
| Desilting Pond                                  |  |  |  |  |  |
| New Pond created                                |  |  |  |  |  |
| Pond Renovation                                 |  |  |  |  |  |
| Canal                                           |  |  |  |  |  |
| Checkdam                                        |  |  |  |  |  |
| 5% model                                        |  |  |  |  |  |
| Pyne                                            |  |  |  |  |  |
| Well                                            |  |  |  |  |  |
| Inlet Channel                                   |  |  |  |  |  |
| Desilting drainage channel                      |  |  |  |  |  |
| Bora bandh (Temporary check dam)                |  |  |  |  |  |
| Repaired well                                   |  |  |  |  |  |
| Jalkund                                         |  |  |  |  |  |
| Small ditches for jute retting                  |  |  |  |  |  |
| Landshaping and rain water harvesting structure |  |  |  |  |  |
| Others if any                                   |  |  |  |  |  |
| Total                                           |  |  |  |  |  |

**Enclosed 2/3 photos**

## II. Module II: Crop Production

**Table. Performance of different drought tolerant varieties**

| Technology demonstrated<br>Crops with varieties           | No. of farmers | Area (ha) | Yield(q/ha) |       | % increase | Economics of demonstration (Rs./ha) |            |      |
|-----------------------------------------------------------|----------------|-----------|-------------|-------|------------|-------------------------------------|------------|------|
|                                                           |                |           | Demo        | Local |            | Gross Cost                          | Net Return | BCR  |
| Demonstration on Drought Tolerant Rice (Swarna Samriddhi) | 14             | 14        | 46.1        | 40.9  | 12.71      | 51810                               | 54220      | 2.04 |
| Demonstration on Heat tolerant tomato (Arka Apeksha)      | 11             | 0.51      | 211.5       | 173.2 | 22.11      | 109243                              | 197491     | 2.80 |
| More if any                                               |                |           |             |       |            |                                     |            |      |
| <b>Total</b>                                              |                |           |             |       |            |                                     |            |      |

**Mention the variety and Enclosed 2/3 photos**



**DEMONSTRATION ON DROUGHT TOLERANT RICE (SWARNA SAMRIDDHI)**

**Table. Performance of different salt tolerant paddy varieties**

| Technology demonstrated<br>(Crops with varieties) | No. of farmers | Area (ha) | Yield (q/ha) |       | % increase | Economics of demonstration (Rs./ha) |            |     |
|---------------------------------------------------|----------------|-----------|--------------|-------|------------|-------------------------------------|------------|-----|
|                                                   |                |           | Demo         | Local |            | Gross Cost                          | Net Return | BCR |
| Crop 1                                            |                |           |              |       |            |                                     |            |     |
| Crop 2                                            |                |           |              |       |            |                                     |            |     |
| Crop 3                                            |                |           |              |       |            |                                     |            |     |
| More if any                                       |                |           |              |       |            |                                     |            |     |
| <b>Total</b>                                      |                |           |              |       |            |                                     |            |     |

**Enclosed 2/3 photos**

**Table. Performance of different flood tolerant varieties**

| Technology demonstrated<br>(Crops with varieties) | No. of farmers | Area (ha) | Yield  | % increase | Economics of demonstration (Rs./ha) |
|---------------------------------------------------|----------------|-----------|--------|------------|-------------------------------------|
|                                                   |                |           | (q/ha) |            |                                     |

|             |  |  | Demo | Local |  | Gross Cost | Net Return | BCR |
|-------------|--|--|------|-------|--|------------|------------|-----|
| Crop 1      |  |  |      |       |  |            |            |     |
| Crop 2      |  |  |      |       |  |            |            |     |
| Crop 3      |  |  |      |       |  |            |            |     |
| More if any |  |  |      |       |  |            |            |     |
| Total       |  |  |      |       |  |            |            |     |

Mention the variety and Enclosed 2/3 photos

Table. Performance of advancement of planting dates in different crops

| Technology demonstrated | No. of farmers | Area (ha) | Yield (q/ha) |       | % increase | Economics of demonstration (Rs./ha) |            |     |
|-------------------------|----------------|-----------|--------------|-------|------------|-------------------------------------|------------|-----|
|                         |                |           | Demo         | Local |            | Gross Cost                          | Net Return | BCR |
| Crop 1                  |                |           |              |       |            |                                     |            |     |
| Crop 2                  |                |           |              |       |            |                                     |            |     |
| Crop 3                  |                |           |              |       |            |                                     |            |     |
| More if any             |                |           |              |       |            |                                     |            |     |
| Total                   |                |           |              |       |            |                                     |            |     |

Mention the variety and Enclosed 2/3 photos

Table. Performances of water saving technologies

| Technology demonstrated                         | No. of farmers | Area (ha) | Yield (q/ha) |       | % increase | Economics of demonstration (Rs./ha) |            |     |
|-------------------------------------------------|----------------|-----------|--------------|-------|------------|-------------------------------------|------------|-----|
|                                                 |                |           | Demo         | Local |            | Gross Cost                          | Net Return | BCR |
| Water saving technology through SRI             |                |           |              |       |            |                                     |            |     |
| Aerobic Rice                                    |                |           |              |       |            |                                     |            |     |
| Direct seeded brown manured rice                |                |           |              |       |            |                                     |            |     |
| DSR                                             |                |           |              |       |            |                                     |            |     |
| Sowing of rice / wheat / Maize with ZTD machine |                |           |              |       |            |                                     |            |     |
| Others if any                                   |                |           |              |       |            |                                     |            |     |
| Total                                           |                |           |              |       |            |                                     |            |     |

Mention the variety and Enclosed 2/3 photos

Performance of Community nurseries

| Technology demonstrated | No. of farmers | Area (ha) | Yield (q/ha) | % increase | Economics of demonstration (Rs./ha) |
|-------------------------|----------------|-----------|--------------|------------|-------------------------------------|
|-------------------------|----------------|-----------|--------------|------------|-------------------------------------|

|             |  |  | Demo | Local |  | Gross Cost | Net Return | BCR |
|-------------|--|--|------|-------|--|------------|------------|-----|
| Crop 1      |  |  |      |       |  |            |            |     |
| Crop 2      |  |  |      |       |  |            |            |     |
| Crop 3      |  |  |      |       |  |            |            |     |
| More if any |  |  |      |       |  |            |            |     |
| Total       |  |  |      |       |  |            |            |     |

Mention the variety and Enclosed 2/3 photos

**Table. Performance of different location specific intercropping systems**

| Technology demonstrated | No. of farmers | Area (ha) | Yield (q/ha) |       | % increase | Economics of demonstration (Rs./ha) |            |     |
|-------------------------|----------------|-----------|--------------|-------|------------|-------------------------------------|------------|-----|
|                         |                |           | Demo         | Local |            | Gross Cost                          | Net Return | BCR |
| Crop 1 + Crop 2         |                |           |              |       |            |                                     |            |     |
| Crop 3 + Crop 4         |                |           |              |       |            |                                     |            |     |
| More if any             |                |           |              |       |            |                                     |            |     |
| Total                   |                |           |              |       |            |                                     |            |     |

Mention the variety and Enclosed 2/3 photos

**Table. Performance of different crop diversification in NICRA villages**

| Technology demonstrated | No. of farmers | Area (ha) | Yield (q/ha) |       | % increase | Economics of demonstration (Rs./ha) |            |     |
|-------------------------|----------------|-----------|--------------|-------|------------|-------------------------------------|------------|-----|
|                         |                |           | Demo         | Local |            | Gross Cost                          | Net Return | BCR |
| Crop 1                  |                |           |              |       |            |                                     |            |     |
| Crop 2                  |                |           |              |       |            |                                     |            |     |
| Crop 3                  |                |           |              |       |            |                                     |            |     |
| More if any             |                |           |              |       |            |                                     |            |     |
| Total                   |                |           |              |       |            |                                     |            |     |

Mention the variety and Enclosed 2/3 photos

**Table. Performance of other demonstration under crop production module**

| Technology demonstrated                                                                        | No. of farmers | Area (ha) | Yield(q/ha) |             | % increase | Economics of demonstration (Rs./ha) |            |      |
|------------------------------------------------------------------------------------------------|----------------|-----------|-------------|-------------|------------|-------------------------------------|------------|------|
|                                                                                                |                |           | Demo        | Local       |            | Gross Cost                          | Net Return | BCR  |
| Demonstration on Grafted Tomato for tolerance against moisture stress                          | 21             | 0.18      | 219.8       | 177.6       | 23.76      | 119570                              | 210130     | 2.75 |
| Demonstration on Foliar application of Glycine Betaine on cotton to promote drought resilience | 8              | 2.2       | 16.8        | 14.5        | 15.9       | 46000                               | 71600      | 2.56 |
| Demonstration on cultivation of paddy straw mushroom                                           | 30             | 30 beds   | 3 kg/bed    | 2.17 kg/bed | 38.25      | 100/bed                             | 260/bed    | 3.6  |
| Total                                                                                          |                |           |             |             |            |                                     |            |      |

Mention the variety and Enclosed 2/3 photos



**DEMONSTRATION ON GRAFTED TOMATO FOR TOLERANCE AGAINST MOISTURE STRESS**



**DEMONSTRATION ON FOLIAR APPLICATION OF GLYCINE BETAINE ON COTTON TO PROMOTE DROUGHT RESILIENCE**



**DEMONSTRATION ON CULTIVATION OF PADDY STRAW MUSHROOM**

### III. Module III : Livestocks and Fisheries

**Table. Performance of different fodder demonstration in community lands**

| Technology demonstrated | No. of farmers | Unit/ Area (ha) | Output (q/ha) |       | % increase | Economics of demonstration (Rs/ha) |            |     |
|-------------------------|----------------|-----------------|---------------|-------|------------|------------------------------------|------------|-----|
|                         |                |                 | Demo          | Local |            | Gross Cost                         | Net Return | BCR |
| Fodder 1                |                |                 |               |       |            |                                    |            |     |
| Fodder 2                |                |                 |               |       |            |                                    |            |     |
| <b>Total</b>            |                |                 |               |       |            |                                    |            |     |

Mention the variety and Enclosed 2/3 photos

**Table. Performance of improved fodder**

| Technology demonstrated | No. of farmers | Unit/ Area (ha) | Yield (q/ha) |       | % increase | Economics of demonstration (Rs./ha) |            |     |
|-------------------------|----------------|-----------------|--------------|-------|------------|-------------------------------------|------------|-----|
|                         |                |                 | Demo         | Local |            | Gross Cost                          | Net Return | BCR |
| Fodder 1                |                |                 |              |       |            |                                     |            |     |
| Fodder 2                |                |                 |              |       |            |                                     |            |     |
| <b>Total</b>            |                |                 |              |       |            |                                     |            |     |

Mention the variety and Enclosed 2/3 photos

**Table. Performance of various vaccination camps organized**

| Technology demonstrated                                                           | No. of farmers | Unit/ No./ Area (ha) | Measurable indicators of output* (q/ha) |       | % increase | Economics of demonstration (Rs./ha) |            |     |
|-----------------------------------------------------------------------------------|----------------|----------------------|-----------------------------------------|-------|------------|-------------------------------------|------------|-----|
|                                                                                   |                |                      | Demo                                    | Local |            | Gross Cost                          | Net Return | BCR |
| Vaccination camp against FMD Cattle & PPR against goat, Deworming, other diseases | 50             | -                    | 18                                      | 14.5  | 25         | 4200                                | 12000      | 2.8 |
| Vaccination for PPR in goat and Ranikhet in Poultry.                              |                |                      |                                         |       |            |                                     |            |     |
| Deworming                                                                         |                |                      |                                         |       |            |                                     |            |     |
| Mineral mixture                                                                   |                |                      |                                         |       |            |                                     |            |     |
| Proper De-worming                                                                 |                |                      |                                         |       |            |                                     |            |     |
| Vaccination camp against other diseases                                           |                |                      |                                         |       |            |                                     |            |     |
| Others if any                                                                     |                |                      |                                         |       |            |                                     |            |     |
| <b>Total</b>                                                                      |                |                      |                                         |       |            |                                     |            |     |

Enclosed 2/3 photo



Table. Performance of composite and cat fish in the renovated ponds

| Technology demonstrated | No. of farmers | Unit/<br>No. /<br>Area<br>(ha) | Measurable indicators of output* (q/ha) |       | % increase | Economics of demonstration (Rs./ha) |            |     |
|-------------------------|----------------|--------------------------------|-----------------------------------------|-------|------------|-------------------------------------|------------|-----|
|                         |                |                                | Demo                                    | Local |            | Gross Cost                          | Net Return | BCR |
| Cat Fish 1              |                |                                |                                         |       |            |                                     |            |     |
| Cat Fish 2              |                |                                |                                         |       |            |                                     |            |     |
| More if any             |                |                                |                                         |       |            |                                     |            |     |
| Total                   |                |                                |                                         |       |            |                                     |            |     |

Enclosed 2/3 photo

Table. Performance of livestock demonstration in NICRA adopted villages

| Technology demonstrated                                          | No. of farmers | Unit/ No. / Area (ha) | Measurable indicators of output* (q/ha) |             | % increase | Economics of demonstration (Rs./ha) |            |     |
|------------------------------------------------------------------|----------------|-----------------------|-----------------------------------------|-------------|------------|-------------------------------------|------------|-----|
|                                                                  |                |                       | Demo                                    | Local       |            | Gross Cost                          | Net Return | BCR |
| Demonstration on Backyard rearing of improved poultry bird (RIR) | 40             | 200 chicks            | 1.6 Kg/bird                             | 1.3 kg/bird | 23.08      | 200/bird                            | 680/bird   | 4.4 |
| Breed 2                                                          |                |                       |                                         |             |            |                                     |            |     |
| If any more                                                      |                |                       |                                         |             |            |                                     |            |     |
| Total                                                            |                |                       |                                         |             |            |                                     |            |     |

**Enclosed 2/3 photo**



**Table. Performance of improved shelters for poultry and dairy animals**

[illegible]

|               |  |  |  |  |  |  |  |  |  |
|---------------|--|--|--|--|--|--|--|--|--|
| Shelter 2     |  |  |  |  |  |  |  |  |  |
| Others if any |  |  |  |  |  |  |  |  |  |
| <b>Total</b>  |  |  |  |  |  |  |  |  |  |

Enclosed 2/3 photo

#### IV. Module IV: Institutional Intervention

**Table. Details of the various institutional interventions**

| Intervention s                                           | No. of KVKs | Details of activity                           |                                       |                                                                                                                         | No. of farmer s | Unit/ No. /Area (ha) |
|----------------------------------------------------------|-------------|-----------------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------|
|                                                          |             | Name of crops / Commodity groups / Implements | Quantity(q) / Number / Rent / Charges | Technology used in seed / fodder bank & function of groups                                                              |                 |                      |
| Seed bank                                                |             |                                               |                                       |                                                                                                                         |                 |                      |
| Fodder bank                                              |             |                                               |                                       |                                                                                                                         |                 |                      |
| Commodity groups                                         |             |                                               |                                       |                                                                                                                         |                 |                      |
| Custom hiring centre                                     | 1           | Paddy Transplanter, Reaper, Sprayer, Thresher | Rs. 15750/-                           | Implements hired through rental basis and the amount generated from rent used for maintenance of implements and savings | 31              | -                    |
| Collective marketing                                     |             |                                               |                                       |                                                                                                                         |                 |                      |
| Climate literacy through a village level weather station |             |                                               |                                       |                                                                                                                         |                 |                      |
| More if any                                              |             |                                               |                                       |                                                                                                                         |                 |                      |
| <b>Total</b>                                             |             |                                               |                                       |                                                                                                                         |                 |                      |

Enclosed 2/3 photo



#### V. Village Climate Risk Management Committee (VCRMC)

Under the NICRA-TDC Project, the Village Climate Resilience Management Committee (VCRMC) was duly constituted to strengthen participatory decision-making and ensure effective implementation of climate-resilient interventions at the village level.

During the year 2025–26, a total of seven (07) VCRMC meetings were successfully organized. These meetings witnessed active participation from KVK officials, VCRMC President, VCRMC Secretary, and a large number of farmers, ensuring inclusive and community-driven planning.

The meetings served as a platform for discussion, planning, and execution of various project activities. Key decisions and outcomes of these meetings include:

- Conducting an introductory meeting to deliberate on the annual action plan and overall project objectives.
- Selection of beneficiaries for various demonstrations, ensuring transparency and consensus among stakeholders.
- Finalization of demonstrations such as:

- Green manuring through *Dhaincha*
- Drought-tolerant rice variety (*Swarna Samriddhi*)
- Application of glycine betaine in cotton for drought tolerance
- Cultivation of grafted tomato
- Demonstration on heat-tolerant tomato (Arka Apeksha)
- Paddy straw mushroom cultivation, with priority to farmwomen
- Backyard rearing of improved poultry birds (RIR)
- Planning and operational decisions regarding the Custom Hiring Centre (CHC).
- Organization of animal vaccination camps to improve livestock health.
- Conducting climate resilience awareness programmes to enhance farmers' adaptive capacity.
- Implementation of Farmers & Farm Women (F&FW) trainings and Farmer–Scientist interactions.

The beneficiary selection process was carried out with maximum participation and consensus of the members present, ensuring fairness and transparency. Detailed discussions were held on activity planning, resource allocation, and execution strategies, aligned with the objectives of the NICRA project.

Overall, the VCRMC meetings played a crucial role in strengthening community participation, improving awareness on climate-resilient practices, and ensuring effective implementation of interventions at the grassroots level.



## VI. Custom Hiring Centres:

Photographs of Farm implements and Machinery at NICRA Adopted villages

**Table. Revenue generated through Custom hiring Centres (CHCs) and VCRMC in KVKs**

| Name of KVK    | Revenue generated (Rs.)  |                                         |
|----------------|--------------------------|-----------------------------------------|
|                | From CHC during the year | Total fund under VCRMC as on 31.03.2026 |
| KVK, Kalahandi | 15750/-                  | 21335/-                                 |



## VII. Capacity Building

| Theme                        | Title of training programme                                                                     | No. of Courses | No. of participants |        | Total   |
|------------------------------|-------------------------------------------------------------------------------------------------|----------------|---------------------|--------|---------|
|                              |                                                                                                 |                | Male                | Female |         |
| Crop Production & Management | Integrated Farming System for Resource Optimization                                             | 1              | 26                  | 4      | 30      |
|                              | Farm Mechanization for climate resilience and labour efficiency                                 | 1              | 0                   | 30     | 30      |
|                              | Climate resilient Agronomic practice for rainfed cropping system                                | 1              | 30                  | 0      | 30      |
|                              | Soil Moisture conservation techniques through Mulching and Ridge-Furrow system                  | 1              | 0                   | 30     | 30      |
|                              | Enhancing soil health and productivity through Green manuring with Dhaincha                     | 1              | 0                   | 30     | 30      |
|                              | Seasonal Mushroom Cultivation and Income diversification strategies under climate vulnerability | 1              | 0                   | 30     | 30      |
| Natural Resource Management  | Preparation and use of Organic compost and Vermicompost at Farm level                           | 1              | 0                   | 30     | 30      |
|                              | Soil Health Management and use of organic input                                                 | 1              | 0                   | 30     | 30      |
|                              | Crop residue Management and Soil carbon enhancement technique                                   | 1              | 29                  | 1      | 30      |
| Horticulture                 | Nutritional Kitchen Gardening for Household food security                                       | 1              | 0                   | 30     | 30      |
|                              | Seedling Production techniques and nursery management in vegetables                             | 1              | 23                  | 7      | 30      |
|                              | Water Management and Micro-irrigation in vegetable cultivation                                  | 1              | 26                  | 4      | 30      |
| TOTAL                        |                                                                                                 |                |                     |        | 27000/- |



### VIII. Extension Activities

| Name of the activity | Number of Programmes | No. of beneficiaries |        |       |
|----------------------|----------------------|----------------------|--------|-------|
|                      |                      | Male                 | Female | Total |
| Animal Health Camp   | 1                    | 34                   | 16     | 50    |



### IX. Soil Health Card Prepared and Distributed

Table- SHC card distribution at NICRA adopted villages

| KVK            | Year    | No of soil samples collected | No. of samples analysed | SHC issued | No of Farmers involved |
|----------------|---------|------------------------------|-------------------------|------------|------------------------|
| KVK, Kalahandi | 2025-26 | 15                           | 15                      | 37         | 42                     |

## X. Convergence with Other Ongoing Development Programmes

**Table: Convergence of Ongoing Development Programmes/Schemes in NICRA implementing KVKs**

| KVK            | Technology                                    | Development Scheme/Programme | Nature of work                                                                            | Amount (Rs.) Mobilized |
|----------------|-----------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------|------------------------|
| KVK, Kalahandi | Pond based IFS                                | Tata Steel Foundation        | Construction of farm pond for fishery, irrigation and raising of crops on bunds           | 20000                  |
|                | Backyard rearing of poultry birds             | Dept. of Veterinary          | Improved poultry breed for climate resilience                                             | 20000                  |
|                | Grafted tomato cultivation for wilt tolerance | Dept. of Horticulture        | Implementation and technical supervision of grafted tomato cultivation for wilt tolerance | 20000                  |
|                | Animal Health & Vaccination Camp              | Dept. of Veterinary          | Vaccination and health care support provided to 981 livestock animals                     | 15000                  |



## Pond based IFS in convergence with TATA steel Foundation



Grafted tomato cultivation for wilt tolerance

## XI. Dignitaries visited NICRA Villages during 2025-26

| Name of visitors                                                                      | Date       | Remarks                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Prof. Dr. Rabi Ratna Das, Joint Director (Monitoring), DEE, OUAT, Bhubaneswar, Odisha | 26.12.2025 | Appreciated the climate resilience technologies like, Grafted tomato cultivation in ridge and furrow method with drip irrigation, Polymulch for soil moisture conservation, Vermicomposting and others. Encouraged the team and farmers for upscaling of effective climate-resilient practices. |



Enclosed 2/3 Photographs

## XII. Success stories of NICRA Village Farmers with photographs

KVK, KALAHANDI

Success stories of NICRA Village Farmers  
Year -2025

Name of the State : **Odisha**

Name of the KVK : **KVK, Kalahandi**

Theme : **Drought resilience and stress mitigation in cotton**



|                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name of the farmer                                         | Ratnakara Padhan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Village                                                    | Khairbhadi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Address                                                    | Block-Bhawanipatna, Dist-Kalahandi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Contact details(Phone, mobile, email Id)                   | +91-8260111246                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Education                                                  | Intermediate (+2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Landholding (in acre)                                      | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Irrigated (in acre)                                        | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Un-irrigated (in acre)                                     | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Family size (Number)                                       | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Agricultural and non-agricultural activities of the family | Cotton, paddy & vegetable cultivation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Source of income of the family                             | From Agriculture sector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Daily family expenses for food purpose                     | ₹180/-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Monthly expenses other than food cost                      | ₹5200/-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Background before intervention (not more than 150 words)   | <p>Ratnakara Padhan is a hardworking farmer of Indramal village who primarily cultivates cotton under rainfed conditions. Due to erratic monsoon, long dry spells, and high temperature stress, his cotton yield had significantly declined over the years. The plants frequently showed symptoms of leaf wilting, reduced boll formation, and premature boll drop. His traditional practice involved only basal fertilizer application without any stress-mitigating sprays. During drought periods, his fields suffered heavy moisture stress, leading to 25–30% yield loss, pushing his family toward financial instability.</p> <p>He was selected as a NICRA beneficiary based on his vulnerability to climate-induced drought. Under the project, he was introduced to the foliar application of <b>glycine betaine</b>, a proven osmoprotectant that helps cotton withstand moisture stress. This marked a turning point in improving the health, productivity, and climate resilience of his cotton crop.</p> |

|                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Brief description of technical interventions and justification including innovation, if any (not more than 150 words)</b></p> | <p>Under the NICRA Project, foliar application of <b>glycine betaine @ 2%</b> was demonstrated in Ratnakara's cotton field during critical stress stages (squaring, flowering, and boll formation). Glycine betaine acts as an osmoprotectant, enabling the plant to maintain cellular water balance, reduce heat damage, and sustain physiological activities during moisture stress.</p> <p>The innovation lies in its <b>rapid anti-stress action</b>, which enhances stomatal regulation, chlorophyll stability, and boll retention even during dry spells. After the intervention, his cotton plants exhibited reduced leaf wilting, higher boll number, and uniform growth compared to untreated fields. The technology proved highly effective during intermittent droughts and resulted in higher yield with minimal cost. Overall, the intervention significantly enhanced cotton resilience, stabilized yields, and improved his livelihood under climate-vulnerable conditions.</p> |
| <p><b>Technological benefits after intervention</b></p>                                                                             | <p>After adopting glycine betaine spray, Ratnakara observed notable improvements in his cotton crop. The plants remained visibly greener with delayed leaf senescence, and boll retention increased by 15–20%. Wilting symptoms during dry spells were significantly reduced. The technology enhanced photosynthetic efficiency, resulting in better boll weight and overall yield.</p> <p>Higher drought tolerance also reduced the risk of seasonal crop failure. As a low-cost input, glycine betaine offered high returns by improving plant vigor and reducing dependency on irrigation. This intervention proved valuable for rainfed cotton farmers facing frequent moisture stress.</p>                                                                                                                                                                                                                                                                                                |
| <p><b>Social impact</b></p>                                                                                                         | <p>The successful demonstration motivated several farmers in Indramal and nearby villages to adopt glycine betaine in cotton and other field crops. Ratnakara's improved income strengthened his family's financial security and boosted his confidence. His success created awareness about climate-resilient practices and encouraged peer-to-peer learning. The community now recognizes him as a progressive farmer who adopted scientific solutions to overcome drought stress. This intervention also contributed to wider acceptance of climate-smart agriculture in the village.</p>                                                                                                                                                                                                                                                                                                                                                                                                   |

|                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                             |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Role of KVK in intervention</b>                | KVK, Kalahandi played a key role in implementing this intervention by providing glycine betaine, technical guidance, and regular field monitoring. Scientists trained Ratnakara on the timing, dosage, and preparation of the foliar solution. Field visits were conducted during critical growth stages to assess stress conditions and guide optimal spray application. KVK ensured continuous advisory support and helped him evaluate the impact on crop growth and yield. Through this intervention, KVK strengthened his adaptive capacity to climate-related stress and promoted scientific crop management in the village. |                                                                                                                                                                                                                             |
| <b>Horizontal/Vertical spread</b>                 | Farmers from within and outside the NICRA village visited Ratnakara's field to observe the visible difference between sprayed and unsprayed cotton. Many farmers in Indramal and nearby villages have started using glycine betaine during dry spells, making the technology widely accepted under rainfed cotton systems.                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                             |
| <b>Impact factor</b>                              | <b>Before Adoption</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>After Adoption</b>                                                                                                                                                                                                       |
| <b>Farmer Practice</b>                            | No stress mitigation practice; high risk of yield loss                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Glycine betaine spray @2% improved drought tolerance; ensured stable yield                                                                                                                                                  |
| <b>Yield of Product</b>                           | Cotton suffered severe wilting and flower drop during dry spells; average yield only <b>6.5 q/acre</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Wilting reduced, boll retention increased; yield increased to <b>9.8 q/acre</b>                                                                                                                                             |
| <b>Gross Income</b>                               | ₹32,500/acre                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ₹49,000/acre                                                                                                                                                                                                                |
| <b>Total Expenditure</b>                          | ₹18,000/acre                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ₹20,500/acre                                                                                                                                                                                                                |
| <b>Net Profit</b>                                 | ₹14,500/acre                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ₹28,500/acre                                                                                                                                                                                                                |
| <b>Dissemination of knowledge in the locality</b> | Before the intervention, no farmers practiced anti-stress foliar solutions for cotton.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | After witnessing Ratnakara's success, several farmers adopted glycine betaine spray and other climate-resilient practices. Awareness meetings and farmer-to-farmer interactions facilitated rapid spread of the technology. |
| <b>Knowledge gain based on 1-5 scale*</b>         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 5                                                                                                                                                                                                                           |

|                                                               |   |   |
|---------------------------------------------------------------|---|---|
| Feeling of economic security based on 1-5 scale*              | 1 | 4 |
| Ability to understand and solve problems based on 1- 5 scale* | 2 | 4 |
| Self image in community based on 1-5scale*                    | 1 | 4 |
| Self confidence based on 1-5scale*                            | 2 | 5 |

\*1-5scaleindicates1=lowestand5=highest

## Photographs



Name of the PI: Dr. Amitabh Panda

Name of the Co-PI: Mr. Binod Kumar Jena

Name of the SRF: Mr. Swaraj Meher

### XIII. Newspaper coverage

### XIV. Publication

| Description<br>(nature of<br>publication) | Citation of the publication                                                                                                                                                                                                                                                                                                                                                                                   | Name of the<br>Authors                                                                                                                   |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Original<br>Research<br>Paper             | Enhancing drought tolerance and productivity of Cotton ( <i>Gossypium hirsutum</i> L.) in rainfed ecosystem through foliar application of glycine betaine: A field study in Kalahandi district of Odisha, International Journal of Research in Agronomy 2026; 9(3): 250-255, DOI: <a href="https://www.doi.org/10.33545/2618060X.2026.v9.i3d.5075">https://www.doi.org/10.33545/2618060X.2026.v9.i3d.5075</a> | Swaraj Meher,<br>Amitabh Panda,<br>Binod Kumar Jena,<br>Amit Phonglosa,<br>SK Mondal,<br>Biswaranjan Barik<br>and Prasannajit<br>Mishra  |
| Original<br>Research<br>Paper             | Evaluation of tomato ( <i>Solanum lycopersicum</i> L.) varieties for heat tolerance under high temperature conditions in Kalahandi District of Odisha, India, International Journal of Horticulture and Food Science 2026; 8(3): 61-67, DOI: <a href="https://www.doi.org/10.33545/26631067.2026.v8.i3a.495">https://www.doi.org/10.33545/26631067.2026.v8.i3a.495</a>                                        | Amitabh Panda,<br>Binod Kumar Jena,<br>Swaraj Meher,<br>Biswa Ranjan<br>Barik, Amit<br>Phonglosa, SK<br>Mondal and<br>Prasannajit Mishra |
| Original<br>Research<br>Paper             | Evaluation of Drought-Tolerant Rice Variety (Swarna Samriddhi) under Rainfed Conditions in the Western Undulating Zone of Odisha, International Journal of Agriculture and Food Science 2026; 8(2): 442-449, DOI: <a href="https://www.doi.org/10.33545/2664844X.2026.v8.i3f.1278">https://www.doi.org/10.33545/2664844X.2026.v8.i3f.1278</a>                                                                 | Binod Kumar Jena,<br>Swaraj Meher,<br>Amitabh Panda,<br>Biswaranjan Barik,<br>Prasannajit<br>Mishra, Amit<br>Phonglosa and SK<br>Mondal  |



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## Enhancing drought tolerance and productivity of Cotton (*Gossypium hirsutum* L.) in rainfed ecosystem through foliar application of glycine betaine: A field study in Kalahandi district of Odisha

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### Abstract

Cotton cultivated under rainfed conditions in eastern India frequently experiences intermittent moisture stress, which adversely affects plant growth and yield stability. Application of compatible such as glycine betaine has been reported to improve plant tolerance to drought by maintaining cellular water balance and physiological activity. A field trial was conducted during Kharif 2025 at Kharibadi village of Sadar Block in Kalahandi district, Odisha, under the NICRA project to evaluate the effectiveness of glycine betaine (GB) foliar application in improving the performance of rainfed cotton. Three treatments were assigned, namely T<sub>1</sub> - control (no GB spray), T<sub>2</sub> - glycine betaine at 1.5%, and T<sub>3</sub> - glycine betaine at 2.0%, applied twice during the crop growth period at squaring and early boll development stages. The application of glycine betaine positively influenced crop growth and development, resulting in improved plant height, leaf production, branching pattern, and root growth. These improvements subsequently enhanced yield attributes such as number of bolls per plant and seed cotton yield. The highest seed cotton yield (1558 kg ha<sup>-1</sup>) was recorded with GB 2.0%, followed by GB 1.5% (1404 kg ha<sup>-1</sup>), compared with the control (1225 kg ha<sup>-1</sup>). This corresponded to a yield advantage of 27.18% and 14.61% over the control, respectively. Economic analysis also indicated higher profitability with GB application, as reflected by greater net return and benefit-cost ratio under the 2.0% treatment. The results suggest that foliar application of glycine betaine at 2.0% can serve as an effective and climate-resilient management strategy for improving productivity and economic returns under rainfed conditions of Odisha.

**Keywords:** Cotton, glycine betaine, drought tolerance, osmoprotectant, NICRA, seed cotton yield, economic return

### 1. Introduction

Cotton (*Gossypium hirsutum* L.) is one of the most important commercial fiber crops and plays a vital role in the agricultural economy of India by supporting the textile industry and providing income to millions of farming households. India occupies the largest area under cotton cultivation globally, covering nearly 12-13 million hectares, although productivity remains comparatively lower than that of several other cotton-producing countries due to multiple production constraints (FAR-CR-CR, 2023; FAO, 2023) [1]. A substantial proportion of cotton in India is cultivated under rainfed conditions, where crop performance largely depends on the availability and distribution of monsoon rainfall (Farooq *et al.*, 2017) [2]. Among the various abiotic stresses affecting cotton production, drought or moisture deficit is considered one of the most serious limitations, particularly in semi-arid and rainfed ecosystems (Raza *et al.*, 2022) [3]. In eastern India, especially in Kalahandi district of Odisha, cotton cultivation is predominantly dependent on seasonal rainfall. The district is characterized by undulating terrain and light-textured soils with relatively low water-holding capacity, which often results in soil moisture deficit during the crop growth period. The region frequently experiences delayed onset of

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## Evaluation of tomato (*Solanum lycopersicum* L.) varieties for heat tolerance under high temperature conditions in Kalahandi District of Odisha, India

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### Abstract

Tomato (*Solanum lycopersicum* L.) is one of the most important vegetable crops grown all over the globe, but in present context due to global warming its productivity is highly affected by high temperature stress, particularly in tropical and sub-tropical and regions. The present investigation was performed to evaluate the performance of three tomato varieties Arka Apelsika, Sahoo, and Bahubadi for heat tolerance under high temperature conditions in the Kalahandi District during the summer season. The experiment was conducted in a randomized block design with three replications, and various growth, yield, and economic parameters were recorded. Significant variations were observed among the varieties for most of the traits studied. The investigation revealed tomato variety Arka Apelsika with superior performance in terms of seedling establishment (482 plants), plant height (94.70 cm), leaf area (250 cm<sup>2</sup>), and surface in flowering (154 days). This variety also recorded the highest number of flowers per plant (85), fruit set (72%), fruits per plant (55), and longer fruiting duration (75 days). Consequently, Arka Apelsika produced the highest yield per plant (4.5 kg) and yield per hectare (226.2 q ha<sup>-1</sup>), followed by Sahoo (189.7 q ha<sup>-1</sup>) and Bahubadi (176.3 q ha<sup>-1</sup>). The total soluble solids of tomato as fruit quality ranged from 4.2 to 4.8° Brix for three varieties, with Arka Apelsika exhibiting the highest value. The economic estimate of tomato varieties revealed that Arka Apelsika generated the highest gross return (Rs. 579,500 ha<sup>-1</sup>), net return (Rs. 362,488 ha<sup>-1</sup>), and benefit to cost ratio (2.67). The results clearly indicate that Arka Apelsika possesses better heat tolerance, higher productivity, and greater economic profitability under high temperature conditions. Therefore, this variety can be recommended for commercial cultivation in hot climatic regions of western Odisha.

**Keywords:** Tomato, heat tolerance, variation, vegetative stage, reproductive stage and yield

### 1. Introduction

Tomato (*Solanum lycopersicum*) is considered one of the most important vegetable crops in India and world due to its wide adaptability from temperate to tropic zones on the globe and its importance in food and nutritional security (Ali *et al.*, 2025; Liu *et al.*, 2022) [1-3]. Its nutritional value signs its importance in contributing to human health with high contents of minerals, vitamins, phytochemicals, and life saving antioxidants in plenty (Collins *et al.*, 2022) [4]. In India tomato is widely consumed as fresh vegetables in most of the food preparations and also as processed food items such as soups, sauce, juices, ketchup, dry powder, etc. Tomato cultivation has significant economic importance for rural farm households in Odisha. It is cultivated in a wide range of soil and climatic conditions in Odisha. The tomato growers in Kalahandi district of Odisha typically face problems of elevated temperature during its different growth stages and reproductive period which drastically decreases the total yield, productivity and quality of tomato along with drastic economic loss (Fikre *et al.*, 2022) [5].

In Kalahandi district high temperature stress is one of the most challenging situations affecting production and quality of tomato cultivation as a consequence of global climate change (Panda *et al.*, 2025) [6]. A steady increase in global diurnal temperatures and frequency of heat waves causes continuous threats to productivity of cotton worldwide (Lagarias *et al.*, 2025) [7]. A rise of temperature above the optimum range of a crop that causes irreversible damage in crop biology and inhibits growth and development of both vegetative and reproductive stages of crop is known as heat stress. The optimum range of

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## Evaluation of Drought-Tolerant Rice Variety (Swarna Samridhi) under Rainfed Conditions in the Western Undulating Zone of Odisha

Binod Kumar Jena, Swaraj Meher, Amitabh Panda, Biswanjan Barik, Prasannajit Mishra, Amit Phanglossa and SK Mondal

DOI: <https://www.doi.org/10.33545/264441X.2026.v8i1d.1278>

### Abstract

A field experiment was conducted during Kharif 2025 at Pipaladi village of Nurla block, Kalahandi district under the National Innovation in Climate Resilient Agriculture (NICRA) project to evaluate the drought tolerant rice variety Swarna Samridhi in comparison with Pratiksha and Ranadha under rainfed conditions. The experiment was laid out in Randomized Block Design with three replications. Significant differences were observed among varieties for plant height, maturity duration, effective tillers, panicle length, flag leaf ratio, grains per panicle, test weight and grain yield at 1% probability level. The highest grain yield (44.5 q ha<sup>-1</sup>) was recorded in Swarna Samridhi, representing 15.5% and 20.2% yield advantage over Pratiksha (39.2 q ha<sup>-1</sup>) and Ranadha (37.0 q ha<sup>-1</sup>), respectively. Swarna Samridhi also recorded superior performance in effective tillers (14 till' m<sup>-2</sup>), panicle length (25.3 cm), grains per panicle (159) and test weight (24.36 g). The coefficient of variation (C.V) remained within acceptable limits (6-7%), indicating good experimental precision. Economic analysis revealed maximum gross return (Rs. 1,16,250 ha<sup>-1</sup>), net return (Rs. 54,570 ha<sup>-1</sup>) and B:C ratio (1.89) in Swarna Samridhi, followed by Pratiksha and Ranadha. The findings establish the variety superiority and drought adaptability of Swarna Samridhi under rainfed conditions of Western Odisha.

**Keywords:** Rice, drought tolerance, rainfed ecosystem, yield attributes, climate resilience, B:C ratio, NICRA

### Introduction

Rice is the dominant cereal crop of Odisha and plays a vital role in sustaining rural livelihoods (Nayak *et al.*, 2019) [1]. The state contributes substantially to India's rice production, though productivity remains vulnerable to climate aberrations (Directorate of Rice Research, 2022). In Kalahandi district, rice cultivation is predominantly rainfed, making it highly susceptible to intermittent drought and erratic monsoon distribution (Nayak *et al.*, 2021) [2]. The district lies in the Western Undulating Zone of Odisha, where uneven topography, light-textured soils, and limited irrigation facilities intensify moisture stress during the cropping season. Consequently, yield instability is common, particularly in years of delayed monsoon onset or prolonged dry spells. Rainfed rice ecosystems in this region are largely dependent on seasonal rainfall and low external inputs. Moisture stress during critical stages such as tillering, panicle initiation, and grain filling significantly affects effective tiller number, spikelet fertility, and grain weight (Sakumar *et al.*, 2016) [3]. The fact of predominance of small and marginal farmers with limited adaptive capacity, enhancing varietal resilience remains a practical and cost-effective strategy for stabilizing productivity. Climate-resilient and drought-tolerant rice varieties are increasingly promoted to stabilize production in such fragile ecosystems (Thakur *et al.*, 2017) [4]. Drought-tolerant genotypes maintain better tillering, efficient photosynthesis and improved grain filling under soil moisture deficit (Maiti *et al.*, 2020 and Sharma *et al.*, 2002) [5, 6]. In addition, such varieties often possess adaptive traits like deeper root systems and improved water-use efficiency, enabling them to sustain yield under intermittent moisture stress (Sharma *et al.*, 2023 and Ranjan *et al.*, 2022) [7, 8]. Swarna Samridhi is a drought tolerant rice variety recommended for rainfed ecosystems.

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## XV. Expenditure Statement of NICRA-TDC Budget during 2025-26

| Name of KVK   | FINAL RE      |          |          |           | Expenditure | Closing Balance<br>31.03.2026 |
|---------------|---------------|----------|----------|-----------|-------------|-------------------------------|
|               | Contingencies | SCSP     | NRC      | Total     |             |                               |
| KVK KALAHANDI | 610000/-      | 165000/- | 300000/- | 1075000/- | 1075000/-   | Nil                           |

## XVI. Awards/Recognition etc. (with photos)

## XVII. Any other activities (not covered above) (with photos)