SWITCH ON FOUNDATION

OPTIMISING PADDY CULTIVATION:

CHALLENGES AND SUCCESSES IN IMPLEMENTING ALTERNATIVE WET & DRY (AWD) METHOD

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Founded in 2008, the Environment Conservation Society (ECS), also known as SwitchON Foundation, is a nonprofit organisation dedicated to fostering equitable and sustainable development in India. Our vision is to build a sustainable and equitable India, focusing on Clean Energy, Clean Air, Sustainable Mobility, Climate Smart Agriculture, Conservation and Integrated Management of Natural Resources, Just Transition, Skilling, and Sustainable Cities. Our mission is to promote sustainable livelihoods and address environmental challenges through innovative business models and technologies, aiming to create opportunities for 10 million people at the bottom of the pyramid by 2030.

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EXECUTIVE SUMMARY

Project Overview

The Alternate Wetting and Drying (AWD) pilot project, initiated by SwitchON Foundation, was implemented over 100 hectares in West Bengal, Odisha, and Jharkhand. The objective was to demonstrate the feasibility and benefits of AWD practices in paddy cultivation, laying the groundwork for a larger-scale implementation in the future.

Key Achievements

- **Area Coverage:** Successfully implemented AWD practices over the targeted 100 hectares.
- **Water Savings:** Achieved an average water savings of 30%, demonstrating the potential for significant water conservation in paddy cultivation.
- **Yield Improvement:** Recorded an average increase in paddy yield by 10% compared to traditional cultivation methods, showcasing the effectiveness of AWD techniques. Soil aeration (value 2.58) boosts root growth, nutrient absorption, and soil health.
- **Carbon Credits:** Initiated the process for generating carbon credits, establishing a framework for future revenue streams for farmers.

Community Impact

- **Farmer Training:** Provided training to more than 300 farmers, equipping them with the knowledge and skills necessary for implementing AWD techniques.
- **Economic Benefits:** Increased profitability for participating farmers due to reduced water usage and improved crop yields, enhancing their livelihoods.
- **Sustainability:** Promoted sustainable agricultural practices, reducing the environmental impact of paddy cultivation and contributing to long-term resource conservation.

Recommendations

- **Scaling Up:** Expansion of AWD practices to additional regions, leveraging the success and learnings from this pilot project.
- **Policy Advocacy:** Advocate for supportive policies and infrastructure development to facilitate wider adoption of AWD techniques.
- **Partnerships:** Strengthen collaborations with academic institutions, technology providers, and financial organisations to enhance the project's impact and sustainability.

Conclusion

The AWD pilot project by SwitchON Foundation has successfully demonstrated the feasibility and benefits of sustainable paddy cultivation practices. By achieving significant water savings, improving crop yields, and initiating carbon credit generation, the project has made a positive impact on the environment and farmers' livelihoods. Continued efforts and strategic partnerships are essential to scale and sustain these benefits in the long term.

About the AWD project:

The Alternate Wetting and Drying (AWD) project, initiated by SwitchON Foundation, aims to optimise water management practices in paddy cultivation across vulnerable regions in West Bengal, Odisha, and Jharkhand. Targeting an initial 300 acres of paddy fields, the project spans the districts of Nadia, Hooghly, Purba Bardhaman, Purba Medinipur, Bankura, and Purulia in West Bengal, Angul in Odisha, and Bokaro and Pakur in Jharkhand. Over 250 small and marginal farming families, who are particularly susceptible to the adverse effects of climate change and water scarcity, are central to the project.

AWD offers a sustainable alternative to traditional flooding techniques by introducing a controlled irrigation method where paddy fields alternate between wet and dry phases. This technique reduces water consumption, enhances crop yields, and significantly lowers methane emissions, making rice farming more environmentally friendly and efficient.

What is the AWD method?

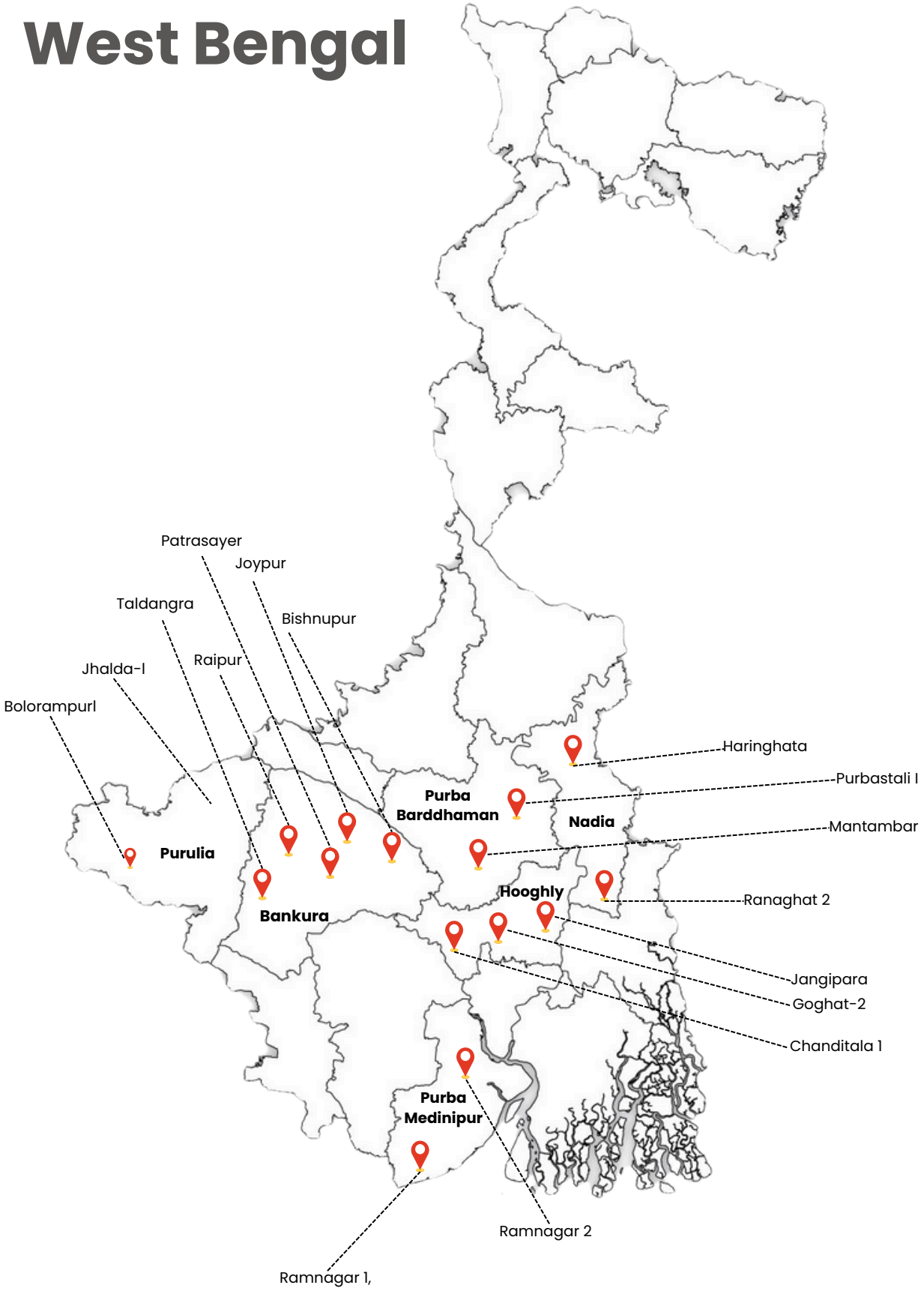
AWD is a water management technique where rice fields are periodically drained and reflooded, effectively reducing both water usage and greenhouse gas emissions (FAO*).

**FAO: Food and Agriculture Association*

Location Details:

State	District	Block	Number of Farmers
Jharkhand	Pakur	Maheshpur, Pakur	50
	Bokaro	Barhagoda	
Odisha	Balangir	Deogoan, Gudbhella	13
West Bengal	Bankura	Bishnupur, Joypur, Patrasayer, Raipur, Taldangra	182
	Hooghly	Chanditala 1, Goghat-2, Jangipara	
	Nadia	Haringhata, Ranaghat 2	
	Purba Barddhaman	Purbastali I, Mantambar	
	Purba Medinipur	Ramnagar 1, Ramnagar 2	
	Purulia	Bolorampur, Jhalda-II	

West Bengal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Nadia
Mantambar
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Bankura
Hooghly
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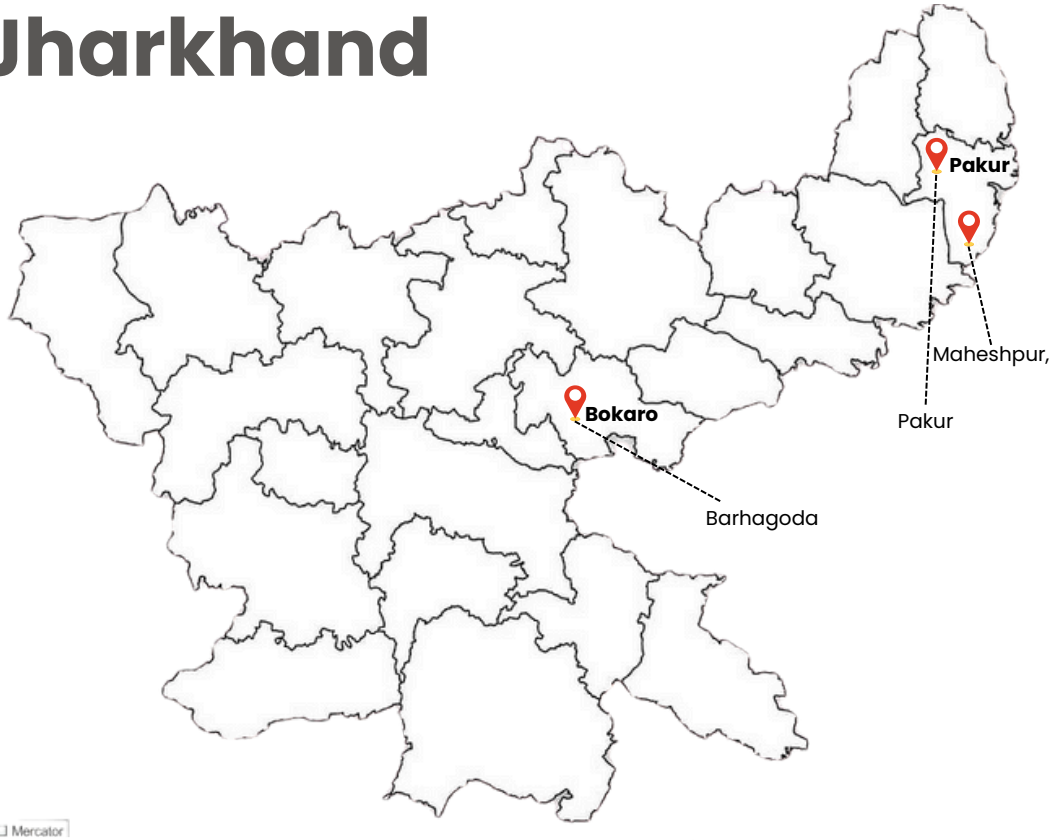
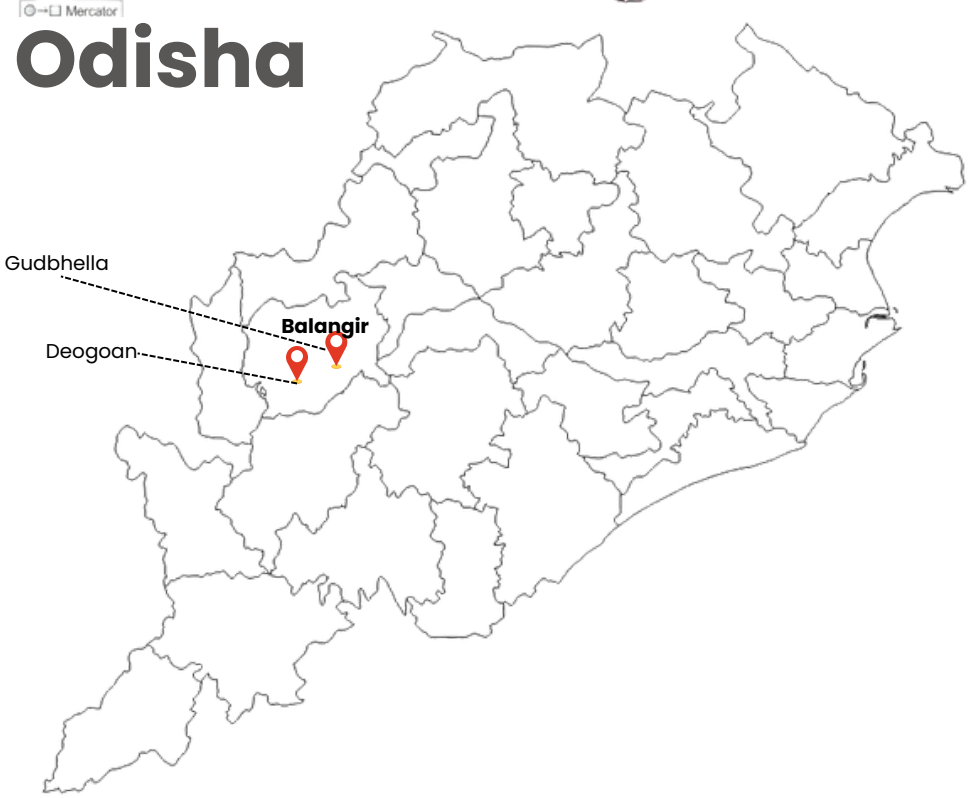
Jharkhand



Odisha



Project Objectives:

1. To introduce AWD practices among paddy farmers on 300 acres.

2.To enhance the technical capacity of farmers for effective AWD implementation.

3.To raise awareness and evaluate the benefits of AWD for water conservation and methane emission reduction.

Literature Review:

Paddy cultivation is a crucial component of agricultural economies, particularly in Asia, where rice is a dietary staple. The Alternate Wetting and Drying (AWD) method has emerged as a promising irrigation strategy designed to optimise water use and enhance crop productivity.

Global Water Conservation and Environmental Impact

Globally, the AWD method has been praised for its ability to conserve water and reduce environmental impact. For instance, in Vietnam's Mekong Delta, AWD implementation led to a 25% reduction in irrigation water use without compromising yield (Kumar et al., 2020). Moreover, AWD has been instrumental in reducing methane emissions by up to 50%, thus contributing significantly to climate change mitigation (Huang et al., 2019).

Despite these successes, the global uptake of AWD is hindered by the variability of its effectiveness, which depends on local climatic conditions, soil types, and water availability. This inconsistency can discourage farmers from adopting the method. Additionally, infrastructure limitations, such as inadequate drainage systems, often prevent effective AWD implementation in many regions (Nguyen et al., 2021).

Reducing Methane Emissions from Paddy Cultivation in Global Context

In the entire paddy cycle, to bring down methane emission significantly the aeration needs to happen at least 3 times. It also enhances microbial activity and nutrient availability, resulting in healthier crops. This benefit has been observed in several regions across Africa and Southeast Asia, where improvements in soil quality have been reported (Nguyen et al., 2021; Parthasarathi et al., 2019).

The method's requirement for continuous monitoring of water levels presents a challenge, especially in regions where farmers lack access to necessary technology and support systems. The need for regular adjustments to irrigation schedules further complicates adoption (Singh et al., 2022).

Global Policy and Institutional Support

Regions with robust water management infrastructure and supportive policies have seen greater success with AWD implementation, achieving significant water savings and environmental benefits (Nguyen et al., 2021).

In contrast, regions lacking proper infrastructure and policy frameworks struggle to adopt AWD effectively. The absence of clear incentives and support structures further impedes the method's broader implementation (Mukherjee et al., 2024).

Water Efficiency and Agricultural Productivity in India

AWD has been recognized as a key strategy for improving water efficiency in paddy cultivation. Government initiatives, particularly those led by the Indian Council of Agricultural Research (ICAR), have successfully promoted AWD through pilot projects in states like Punjab and Haryana. These projects reported water savings of up to 40% and yield increases of 20-30% (Singh et al., 2022).

Despite these initiatives, widespread adoption of AWD faces challenges due to cultural resistance. Many Indian farmers are hesitant to move away from traditional practices, fearing that AWD might not yield immediate economic benefits. This resistance is further exacerbated by the lack of financial resources among smallholder farmers to invest in the necessary infrastructure and training (Sharma et al., 2023).

Soil Health and Input Costs in India

Farmers in India who have adopted AWD report significant reductions in input costs, particularly in fertiliser use, due to the improved health of soils under this method

However, the need for careful monitoring of water levels remains a significant barrier, particularly for resource-constrained farmers who may not have access to the necessary technology or support systems to manage AWD effectively (Singh et al., 2022).

Policy Frameworks and Institutional Support in India

Government-led initiatives have been critical in promoting AWD across India, with varying degrees of success depending on the strength of local policy frameworks and infrastructure support (Singh et al., 2022).

The absence of comprehensive policy frameworks that support AWD adoption is a significant obstacle. In regions where smallholder farmers struggle with resource constraints, effective policies are needed to incentivize adoption and provide the necessary resources for training and infrastructure development (Mukherjee et al., 2024).

Drought Resilience and Water Management in West Bengall

In West Bengal, AWD has shown the potential to enhance the drought resilience of paddy crops. Training programs organised by local agricultural departments and NGOs have been successful in educating farmers about AWD, leading to increased adoption and better water management practices (Chatterjee et al., 2023).

The diverse agro-climatic conditions across West Bengal necessitate tailored approaches to AWD, complicating its widespread implementation. This diversity requires resource-intensive, site-specific management practices, making it challenging for farmers to adopt the method universally (Mukherjee et al., 2024).

Economic Barriers and Smallholder Farmers in West Bengal

Economic barriers remain a significant challenge in West Bengal, where many farmers are smallholders with limited financial capacity to invest in the necessary infrastructure for AWD, such as water storage and distribution systems. These financial constraints make it difficult for smallholder farmers to adopt AWD on a large scale (Mukherjee et al., 2024).

Policy and Institutional Gaps in West Bengal

The lack of coherent policy frameworks supporting AWD in West Bengal has hindered its broader adoption. Effective policies are needed to incentivize farmers and provide the necessary resources for training, infrastructure development, and ongoing support to ensure the success of AWD in the region (Mukherjee et al., 2024).

Thematic review highlights the potential of the AWD method in paddy cultivation, emphasising the importance of tailored, context-specific strategies to overcome the unique challenges faced in different regions. Addressing these challenges, particularly in water conservation, soil health, and policy support, is crucial for enhancing AWD adoption and effectiveness globally, in India, and in West Bengal. Future research and policy development should focus on improving farmer education, fostering collaborations between government bodies and agricultural organisations, and developing context-specific approaches to AWD that account for local conditions and resource availability.

Project Methodology:

The AWD project is designed to assess the feasibility and benefits of AWD practices across 100 hectares in West Bengal, Odisha, and Jharkhand. The project aims to demonstrate water savings, yield improvement, and carbon credit generation potential.

- **Site Selection** involves identifying locations based on water availability, soil type, and farmer willingness to adopt the technique.
- **Farmer Training** is conducted for over 300 farmers, educating them on AWD principles, water management, and technology use. Training covers practical implementation steps, emphasising monitoring and sustainability.
- **Implementation** of AWD involves alternating periods of wetting and drying, with fields flooded to 5 cm and allowed to dry until water drops to 15 cm below the surface before re-flooding. This cycle continues throughout the growing season, except during flowering.
- **Monitoring & Evaluation** is conducted using satellite technology for real-time water level tracking. Regular field visits ensure adherence to AWD practices, and data on water usage and crop yield is systematically collected.
- **Data Analysis** assesses water savings, yield improvements, and environmental impact, while farmer feedback gauges AWD's acceptability.
- **Reporting** documents findings, highlighting successes and challenges, and provides recommendations for project scalability.

State-wise Farmer Details:

West Bengal:

- 63% of the total land in the trial is located here.
- 182 farmers (74.3%) are fully engaged in AWD trial farming.

Jharkhand:

- 50 farmers (20.4%) in Jharkhand are associated with partial AWD trial farming.
- Contributed 17% of the total land area.

Odisha:

- 13 farmers (5.3%) in Odisha are involved in minimal AWD trial farming.
- 19% of the total land in the trial is located here.

Project findings:

Before the implementation of the AWD method of farming, farmers in West Bengal, Jharkhand, and Odisha faced significant challenges in irrigation practices and income levels. Most farmers (33.22%) irrigated their boro paddy fields six to ten times during the cultivation period, with a substantial portion requiring more than twenty cycles, indicating a high demand for water. The income distribution revealed that 42.71% of farmers earned between ₹1001 and ₹5000 per month, reflecting the economic pressures on the farming community.

Irrigation sources heavily relied on groundwater, with 55.59% of farmers depending on it, while canal (8.14%) and other surface water (36.27%) played lesser roles. High irrigation costs were a concern, as 40% of farmers faced expenses exceeding ₹100 per hour per bigha. This financial burden could severely impact their profitability and sustainability. Overall, the situation illustrated diverse irrigation practices, a reliance on groundwater, and considerable economic challenges, highlighting the urgent need for more sustainable and cost-effective farming solutions to support these farmers.

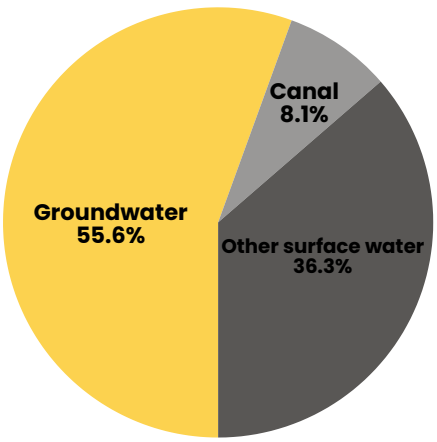


Figure 1: Farmer dependency on Different irrigation practices

At the end of the trial of AWD method by SwitchON, a promising future of AWD method was noticed in the project locations. Farmers across states successfully adopted AWD, with a mere 7.7% facing challenges, while nearly 46% irrigated their fields four times per season, highlighting AWD's effectiveness and the importance of regular irrigation in sustainable farming. Following is the state wise improvement data at the end of the trial.

West Bengal:

In West Bengal, after the AWD trial, irrigation practices and production outcomes showed notable improvements. **78.87% of farmers irrigated their fields only two to eight times**, demonstrating effective water-saving strategies. Higher irrigation is significantly less after AWD implementation. Irrigation duration varied, **4.4% reporting the longest times of 75-84 minutes, while 13.2% had the shortest at 25-34 minutes.**

Table 1: Number of irrigations during the entire season in West Bengal

No. of irrigation	Percentile
2-8	78.87%
9-16	4.23%
16-24	4.23%
25-34	12.68%

Source: Field Survey

In terms of yield, **42.5% of farmers experienced increased yields. Input costs remained stable for 84.9% of farmers**, with 9.6% seeing a decrease. Regarding total production costs, **56% of farmers experienced a decrease**, while **37% experienced no change** from traditional methods. These findings highlight improved water management and potential cost benefits post-AWD implementation.

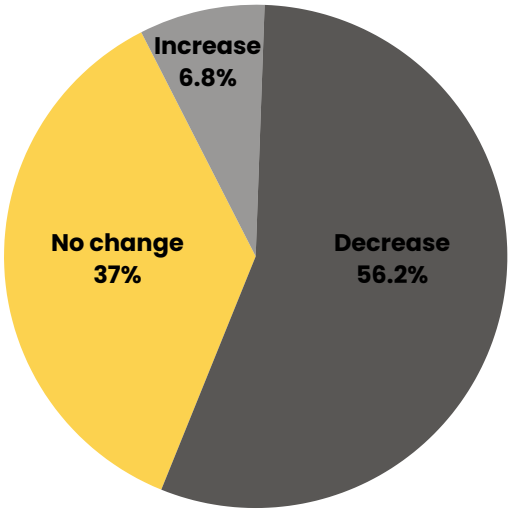


Figure 1: Post-AWD change in total production cost in West Bengal

Source : Field Survey

Jharkhand:

The adoption of the AWD method has led to notable water management practices among farmers. **52% of farmers irrigate 13 times** throughout the season, indicating a clear preference for this frequency. The majority of **farmers (96%) irrigate for 90 minutes**, effectively optimising their water usage. These consistent irrigation practices promote improved water conservation and enhance overall crop management.

While input costs for fertilisers and pesticides remain stable for most (98%), AWD enables farmers to manage their resources more effectively. Ultimately, AWD helps Jharkhand farmers adapt to irregular rainfall and improve resilience, promoting sustainable practices in the region.

Odisha:

In Odisha, the adoption of AWD has shown promising results in optimising irrigation practices. **53.85% of farmers use eight irrigations** during the paddy crop season, which has emerged as the ideal practice, ensuring efficient water use. Additionally, 23.08% use nine irrigations and 15.38% opt for seven irrigations, indicating flexibility in irrigation practices that suit local conditions. In Odisha, all farmers irrigate for an average duration of more than 120 minutes, and the most significant impact of AWD is seen in crop yields, with **69.2% of farmers reporting higher yields** after adopting the method. Moreover, AWD has contributed to cost stability and according to some farmers, major decreases have shown in input cost. These positive outcomes highlight AWD as a key tool for improving productivity, reducing water usage, and stabilising costs in Odisha's rice farming sector.

Viability Of AWD Method:

Adopting the Alternate Wetting and Drying (AWD) technique has led to substantial economic gains for farmers, with over **56% reducing their overall production costs.** By using **25-30% less water** compared to traditional continuous flooding methods, AWD not only conserves water but also cuts operational costs related to pumping and labor. Methane emissions from rice fields have been **reduced by 48%,** contributing to environmental sustainability. Additionally, farmers have seen a **5-8% increase in crop yields,** while maintaining an average soil water level of 11 cm, **ensuring optimal growth.** Soil aeration, with a **value of 2.58**, plays a vital role in **improving root growth, enhancing nutrient absorption, and promoting overall soil health** for sustainable agricultural productivity. These combined benefits make AWD an ideal choice for sustainable farming, leading to enhanced profitability and environmental protection for farming communities across the region.

The AWD method has emerged as a **highly viable and economically beneficial option** for farmers across West Bengal, Jharkhand, and Odisha. In West Bengal, **87.7% of the farmers considered it viable,** with **12.3% finding it highly viable.** In Jharkhand, **all the farmers deemed the method viable,** while in Odisha, farmers rated it as **highly viable.**

a. Successful Irrigation Impacts:

Reduction in Irrigation Frequency: Farmers reduced irrigation cycles by 30–50%, depending on the region, due to more efficient water management under AWD methods.

Improved Water Management: AWD practices allowed farmers to precisely monitor soil moisture through the introduction of a consistent 5-day interval for checking water levels, and optimizing irrigation.

Sustainable Water Usage: AWD enabled a shift towards more sustainable farming, with farmers managing to irrigate paddy fields using less water without compromising crop health. With fewer irrigation cycles, there was less reliance on groundwater, contributing to the conservation of this vital resource.

Prevention of Water Logging: The practice of maintaining alternate wetting and drying cycles reduced instances of waterlogging in paddy fields, leading to healthier plant growth and reducing disease risks.

Uniform Adoption of Water Intervals: The practice of maintaining alternate wetting and drying cycles reduced instances of waterlogging in paddy fields, leading to healthier plant growth and reducing disease risks.

b. Successful Economic Impacts:

Cost Savings in Irrigation: Farmers experienced a 30% reduction in irrigation-related costs, with some saving over ₹5,000 per hectare by using fewer water cycles and lowering fuel or electricity consumption.

Increased Profit Margins: Profit margins grew by an average of 10–15%, as farmers reduced input costs while maintaining or even increasing yields. For example, in Odisha, 69.2% of farmers reported increased yields due to AWD, directly improving their incomes.

Sustainable Water Usage: Farmers adopting AWD noticed long-term financial benefits, including the ability to maintain stable yields and reduce recurring costs, with many projecting these savings to increase their overall profitability by 20% in the coming years.

Issues to be Addressed:

During the AWD method trial, several areas for improvement have been identified to enhance the next phase of the intervention.

- In West Bengal, around 39.7% of farmers are facing some challenges related to **water management**, while 15.1% could benefit from further knowledge and understanding of the method. A smaller group, about 1.4%, have reported labour shortages, and 43.6% of farmers have expressed that they are not encountering major difficulties.
- Soil aeration was impacted due to **untimely rainfall** and **sudden dam water releases** During the trial phase.
- In Odisha, while most farmers have been able to follow the AWD procedure, 76.9% may still need additional knowledge, and 23.1% are experiencing labour shortage

Way Forward:

Awareness Campaigns: Launch targeted awareness campaigns in West Bengal, Jharkhand, and Odisha to improve farmers' understanding of the AWD method and address water management challenges, ensuring wider adoption and effectiveness of the technique.

Skilled Development Training: Organize additional training sessions focused on building practical skills and knowledge in water management and AWD practices, particularly for farmers in Jharkhand and those in Odisha who need further guidance.

Enhanced Monitoring: Increase on-ground monitoring and support to regularly assess farmers' progress, identify areas requiring immediate intervention, and address labor shortages with innovative solutions such as community-based support systems.

Case stories

Adoption of AWD in Bankura District, West Bengal

1

Maya Khan, a farmer from Simulairi village in the Taldangra block of Bankura, faced persistent challenges in managing high irrigation costs and water scarcity on her **2 bigha rice field**. Traditional methods of farming were proving unsustainable due to the **rising expenses of water use** and the increasing **unpredictability of water availability**.

In search of a solution, **Maya adopted the Alternate Wetting and Drying (AWD)** technique, facilitated by the installation of **two water tubes** to monitor water levels. By carefully observing the water needs of her field and allowing it to dry before re-flooding, **she managed to reduce her water usage by 25-30%.** This not only significantly lowered her irrigation costs but also contributed to more sustainable water management.

Beyond the financial benefits, **Maya noticed that her rice crops developed healthier** root systems, which contributed to **better grain quality**. Supported by SwitchON Foundation, her success with AWD has not only improved her own farming outcomes but has also inspired other farmers in Bankura to adopt this method for more efficient and environmentally-friendly rice cultivation.

Promoting Sustainable Rice Farming in Bokaro District,Jharkhand

2

In Bokaro district, Jharkhand, where **irregular rainfall** and **limited irrigation** pose significant challenges to rice farming, Malti Devi, a local farmer, found a sustainable solution through the Alternate Wetting and Drying (AWD) technique. Introduced by the SwitchON Foundation, the AWD project offered **training on simple water management tools,** such as perforated pipes, to **monitor water levels** in her fields. By allowing her rice field to dry between irrigations, Malti achieved a **20% reduction in water usage**—an essential improvement in a region struggling with water scarcity.

The impact of AWD extended beyond water conservation. Malti observed a **noticeable increase in her rice yield** and **greater resistance to pests and diseases**, which **reduced the need for expensive pesticides**. This dual benefit of water savings and **improved crop health** resulted in a **significant boost to her income**, helping to make her farming operations **more profitable** and **sustainable**.

Inspired by Malti's success, many farmers in Bokaro have embraced the AWD technique, recognizing its potential to address the region's water challenges. Her story, alongside similar cases in West Bengal and Odisha, underscores the positive impact of AWD on water conservation, crop yields, and farmer livelihoods, illustrating its potential to drive sustainable agricultural development in rural communities.

Adoption of AWD in Balangir District, Odisha

3

In DesaiMunda village, Balangir district, where **erratic rainfall** and **water scarcity** have long been challenges for rice farmers, Bikram Sahu, a local farmer, initially hesitated to implement the Alternate Wetting and Drying (AWD) technique. With **limited knowledge and uncertainty** about changing traditional practices, he was unsure whether this method would work in his fields. However, **after attending a training session** organized by SwitchON Foundation, Bikram gained **the confidence** to give AWD a try.

Applying the AWD technique on **his 3-acre paddy field**, Bikram installed **seven water tubes** to effectively monitor and manage water levels. He allowed the field to dry periodically before re-flooding it, as recommended. To his surprise, this new approach resulted in an impressive **25% reduction in water usage**, which helped mitigate the impact of water scarcity. Additionally, Bikram saw a **significant improvement in his rice yield**, with **healthier crops and superior grain quality**.

Bikram was able to fetch **better prices** at the market, further **increasing his profits**. He added, "*Thanks to the improved grain quality*". Motivated by his success, he has since become a local advocate for AWD, training other farmers in the village and nearby areas. As more farmers adopt the technique, they are better prepared to manage their water resources and improve productivity, building greater resilience against the challenges posed by water scarcity in the region.

Conclusion:

The Alternate Wetting and Drying (AWD) pilot project implemented by SwitchON Foundation has shown promising results across West Bengal, Odisha, and Jharkhand. With water savings of 30% and a 10% improvement in paddy yield, the project demonstrated AWD's potential as a sustainable solution for paddy cultivation. The successful training of over 300 farmers and the integration of AWD practices across 100 hectares underscore the method's feasibility in promoting water conservation, improving crop productivity, and reducing operational costs.

A notable achievement of the project is the approximately 48% reduction in methane emissions, contributing to a more climate-friendly approach to paddy farming. Additionally, AWD's positive impact on soil health and water efficiency highlights its long-term benefits for sustainable agriculture, particularly in regions facing water scarcity and environmental challenges.

Despite some initial challenges in infrastructure and farmer acceptance, the overall success of the pilot indicates that scaling up AWD practices in these regions could provide substantial economic and environmental benefits. However, continued farmer training, policy support, and investment in water management infrastructure will be essential to ensure the widespread adoption of AWD.

In conclusion, the AWD project offers a viable pathway for sustainable paddy farming, reducing environmental impacts while improving farmer livelihoods. Strategic partnerships, robust policy frameworks, and increased farmer engagement will be crucial for the successful expansion and long-term sustainability of AWD practices in India and beyond.

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