Asian Journal of Research in Agriculture and Forestry

Volume 11, Issue 1, Page 17-30, 2025; Article no.AJRAF.129051
ISSN: 2581-7418

Assessing the Influence of Water Supply Schemes on Agriculture: A Case Study of Unnichchai Irrigation Scheme in Batticaloa, Sri Lanka

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ajraf/2025/v11i1359

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/129051

Original Research Article

Received: 02/11/2024
Accepted: 06/01/2025
Published: 10/01/2025

ABSTRACT

The allocation of water from irrigation reservoirs to urban drinking supplies directly reduces the quantity available for agricultural use. Understanding this impact is crucial for evaluating changes in agricultural performance and crop yields. This study aimed to assess the effects on agricultural performance of Unnichchai irrigation scheme by assessing water availability and comparing key performance indicators before and after the implementation of the drinking water initiative. Results indicate that average output per crop area, output per unit command area, output per unit irrigation supply, and output per unit water consumed increased after the introduction of the drinking water scheme. During *Maha* season, these values improved from Rs.107,340/ha, Rs.92,674/ha, Rs.80.05/m^3 and Rs.11.60/m^3 before implementation, to Rs.239,081/ha, Rs.248,930/ha, Rs.117.17/m^3 and Rs.25.84/m^3, respectively after implementation. Similarly, for *Yala* season, values increased from Rs.108,457/ha, Rs.66,195/ha, Rs.7.04/m^3 and Rs.7.57/m^3,to Rs.358,558/ha,

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Cite as: *Sumaiya, A.M.F., and M. Rajendran. 2025. "Assessing the Influence of Water Supply Schemes on Agriculture: A Case Study of Unnichchai Irrigation Scheme in Batticaloa, Sri Lanka". Asian Journal of Research in Agriculture and Forestry 11 (1):17-30. https://doi.org/10.9734/ajraf/2025/v11i1359.*

Rs.330,580/ha, Rs.29.45/m^3 and Rs.25.02/m^3, respectively. Water performance indicators also showed variation. Average relative water supply for the *Maha* season increased from 0.54 (2000–2011) to 1.36 (2012–2019), while for the *Yala* season, it improved slightly from 0.72 to 0.74. However, the relative irrigation supply decreased for the *Maha* season from 0.31 to 0.25 during the same periods, whereas it increased in *Yala* from 0.72 to 0.78. Average cropping intensity improved from 1.83 to 1.91 between the two periods. The average irrigation ratio during the *Maha* season was 0.78 for the period 2000–2011, but it increased to 1.0 for the period 2012–2019. For *Yala* season it increased from 0.47 (2000–2011) to 0.92 (2012–2019). Despite concerns, the study concludes that the overall performance of the Unnichchai irrigation scheme improved even after the implementation of the drinking water supply project, suggesting effective management of competing water demands. However, the system's performance remains lower compared to other major irrigation schemes in Sri Lanka, necessitating targeted interventions to achieve further improvements.

Keywords: Agricultural performance; irrigation systems; water deficit, water diversion; water productivity.

1. INTRODUCTION

Batticaloa stands as a key rice-producing region in Sri Lanka, holding the sixth position nationally and contributing 4.9% to the country's total output. The local economy in this district is primarily centered around agriculture and fishing, with rice farming being the principal source of income for most agricultural households. The upland areas also support a range of farming activities, including secondary food crops, tree crops such as coconut and cashew, and vegetable cultivation. Although the region boasts diverse soil types suitable for varied agriculture, water scarcity during critical growth periods continues to impede economic and social progress.

The extensive irrigation network in Sri Lanka, while primarily designed for agricultural use, often serves multiple purposes, including providing water for washing, bathing, and drinking. In many locations, these systems are the sole water source for such domestic activities. However, older irrigation projects have often fallen short of their intended objectives, particularly in terms of productivity and efficient water management. This issue is particularly pronounced in areas with limited access to fresh groundwater or dedicated household water supply systems, compelling residents to rely on alternative sources. The problem is further exacerbated by poor coordination between agricultural and domestic water supply institutions, as both sectors frequently compete for the same scarce water resources without effective collaboration.

In the years following Sri Lanka's independence, the government initiated various programs to enhance drinking water facilities. Initially, local authorities developed shared dug wells and small-scale piped water systems. A more substantial push for rural water supply occurred after the announcement of the "Global Water Decade" in 1980, leading to significant improvements in rural water infrastructure by the National Water Supply and Drainage Board (NWSDB), along with governmental and non-governmental organizations (Fan, 2015).

In 2009, to address groundwater contamination in Batticaloa town, the government initiated a project to supply treated water from the Unnichchai tank. As part of this drinking water scheme, jointly managed by the Irrigation Department and the NWSDB, the tank's height was increased by five feet. While the project aimed to resolve the town's water supply issues, it faced considerable opposition from farmers who relied on the tank for irrigation. Previous studies indicated that many farmers under the Unnichchai irrigation scheme resisted the diversion of water to Batticaloa town, fearing a reduction in irrigation supply. However, the long-term effects of this drinking water scheme on agricultural productivity remain undocumented.

Assessing the effectiveness of irrigation and drainage systems requires systematic observation, documentation, and interpretation for continuous improvement (Bos et al., 2005). According to Clemmens & Molden (2007), there are two primary methods for evaluating performance: assessing the quality of service delivery and examining the results of irrigation in terms of resource utilization efficiency and productivity. Numerous indicators have been developed to evaluate the performance of agricultural systems (Bos et al., 2005; Lorite et al., 2004). The International Water Management Institute (IWMI) has developed key indicators for comparative analysis of the performance of irrigation schemes, focusing on water usage, land use, and crop production. This analysis helps determine which irrigation schemes best optimize limited water and land resources (Molden et al., 1998).

Given this context, the current study evaluates the performance of the Unnichchai irrigation scheme and investigates the impact of the drinking water supply project on agricultural practices using selected performance indicators. The hypothesis suggests that the introduction of the drinking water supply project has led to substantial improvements in agricultural outcomes, as evidenced by enhanced water use efficiency, land utilization, and crop yields through improved water management practices.

2. MATERIALS AND METHODS

2.1 Location of the Study Area

This study was conducted in the Unnichchai irrigation scheme in Batticaloa (Fig. 1). The Unnichchai tank is located in the Unnichchai village in Manmunai West Division in the Batticaloa District, Sri Lanka. Unnichchai tank is constructed across Magilavettuvan Aru and its geographical Coordinates are 7◦37’0” N, 81◦33’0” E. This area belongs to DL2b agro-ecological region of Sri Lanka. The mean annual temperature varies from 25ºC to 35ºC. Annual average rainfall is 1,650 mm whereas mean annual average evaporation is about 1150 mm. The major soil types include sandy and gravel.

The Unnichchai tank with the catchment area of 67,840 acres has the full capacity of 67.84 MCM and supplying water to the irrigable extent of 6228 hectares through left bank (LB) and right bank (RB) canals. The length of LB and RB canals are 13.2 km and 23 km, respectively. In this irrigation scheme, farmers mainly cultivate rice as the main crop in both *Maha* and *Yala* seasons. Substantial part of crop water requirement is met by rainfall in *Maha* season whereas *Yala* season depends mainly on irrigation water supply from the tank.

2.2 Data Collection

The data were collected from both primary and secondary sources. Primary data were gathered through a structured questionnaire survey, while secondary data were collected from Irrigation Department (Rugam Division, Chenkalady, Batticaloa) and the National Water Supply and Drainage Board, Batticaloa. Due to time and financial constraints, a total of 100 farmers representing the entire irrigation scheme were randomly selected for the survey.

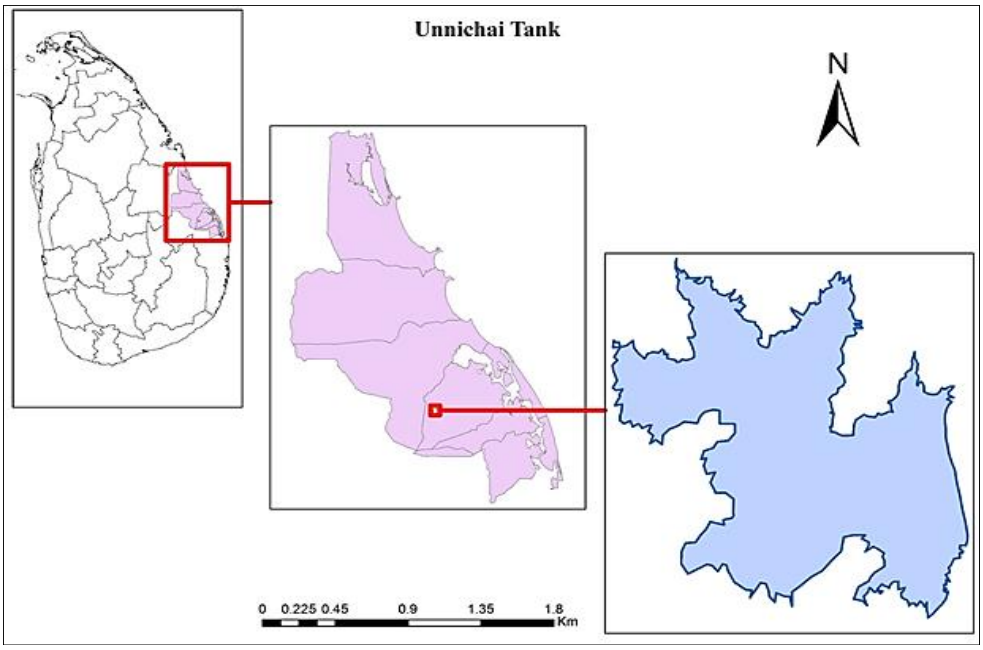


Fig. 1. Location of Unnichchai tank

2.3 Estimation of Water Demand

In this study, seasonal water demand was assessed for the last twenty years (2000-2019). Crop water requirement (CWR) was estimated for 105 days rice variety. Paddy irrigation water requirement (IWRpaddy) was estimated using Eq.(1).

$$IWR_{paddy} = ET_{Crop} + Wl_p + W_{ps} + Wl - P_e \quad \text{Eq. (1)}$$

Where, IWR_{paddy} is the irrigation water requirement of paddy; ET_{crop} is the crop evaporation; Wl_p is the water required for land preparation; W_{ps} is the percolation and seepage losses; W*l* is the water required to establish standing water layer for paddy; P_e is the effective rainfall. For this study W_{lp}, W_{ps}, Wl and P_e for Unnichchai irrigation scheme were collected from Irrigation Department, while the ET_o was calculated using CROPWAT software based on Penman Monteith formula (Indraja et al., 2024; Gaddikeri et al., 2024), and ET_{crop} was estimated using single crop coefficient (Kc) method. Seasonal water demand was estimated based on CWR, extend of cultivation, effective rainfall (ER). Overall irrigation efficiency was assumed to be 45%, based on discussions with the Irrigation Department.

2.4 Evaluation of Impacts of Drinking Water Supply Scheme on Agricultural Productivity

Impact of drinking water supply scheme was assessed based on performance indicators. Performance of agricultural system was assessed before and after establishment of drinking water supply scheme. In this study, performance of the irrigated agriculture system was evaluated using three selected comparative indicators viz. (1) agricultural, (2) water-use and (3) physical performance.

2.4.1 Agricultural performance

The following four indicators related to the output of different units were used to assess the agricultural performance (Molden et al., 1998).

$$Output\ per\ cropped\ area\ (Rs/ha) = \frac{Production\ (Rs)}{Irrigated\ cropped\ area\ (ha)} \quad \text{Eq. (2)}$$

$$Output\ per\ unit\ command\ (Rs/ha) = \frac{Production\ (Rs)}{Command\ area\ (ha)} \quad \text{Eq. (3)}$$

$$Output\ per\ unit\ irrigation\ supply\ (Rs/m^3) = \frac{Production\ (Rs)}{Diverted\ irrigation\ supply\ (m^3)} \quad \text{Eq. (4)}$$

$$Output\ per\ unit\ water\ consumed\ (Rs/m^3) = \frac{Production\ (Rs)}{Volume\ of\ water\ consumed\ by\ ET\ (m^3)} \quad \text{Eq. (5)}$$

Where,

- Production- Output of the irrigated area in terms of gross or net value, measured at local prices.
- Irrigated cropped area- The sum of the areas under crops during the time period of analysis.
- Command area- The nominal or design area to be irrigated.
- Diverted irrigation supply- The volume of surface irrigation water diverted to the command area, plus net removals from groundwater.
- Volume of water consumed by ET- The actual evapotranspiration of crops.

2.4.2 Water use performance

The following two types of indicators were used to assess the water use performance of selected irrigation schemes (Levine, 1982; Perry, 1996).

$$Relative\ water\ supply = \frac{Total\ water\ supply}{Crop\ water\ demand} \quad \text{Eq. (6)}$$

$$Relative\ irrigation\ supply = \frac{Irrigation\ suppy}{Irrigation\ demand} \quad \text{Eq. (7)}$$

Where, Total water supply is the surface diversions plus net groundwater draft plus rainfall. Crop demand is the Potential crop ET, or the ET under well-watered conditions. When rice is considered, deep percolation and seepage losses are added to crop demand. Irrigation supply is the only the surface diversions and net groundwater draft for irrigation. Irrigation demand is the crop ET minus effective rainfall.

2.4.3 Physical performance

Physical indicators are related with the changing or losing irrigated land in the command area by different reasons. It was calculated using the following equations (Vermillion, 2000):

$$Cropping\ intensity = \frac{annually\ cropped\ area}{cultivable\ area} \quad \text{Eq. (8)}$$

$$Irrigation\ ratio = \frac{Irrigated\ land}{Irrigable\ land} \quad \text{Eq. (9)}$$

Where, irrigated land (ha) refers to the portion of the actually irrigated land (ha) in any given irrigation season. Irrigable land (ha) is the potential scheme command area.

3. RESULTS AND DISCUSSION

3.1 Present Status of Unnichchai Irrigation Scheme

3.1.1 Water demand and supply deficit

In irrigated agricultural systems, water utilized for irrigation constitutes the primary resource in crop production. Therefore, evaluating the water demand and supply deficit of an irrigation scheme is essential for project planning, design and management. The total water requirement is primarily determined by the cultivated area, evapotranspiration, crop type, and system efficiency. In the study area, crop water requirement of 105 days paddy are 925.18 mm in *Maha* season and 1433.14 mm in *Yala* season. Water demand was not calculated for non-cultivated periods.

The *Maha* season exhibited the highest water demand of 93.29 MCM in 2018/2019, while the lowest was 33.43 MCM in 2007/2008 (Fig.1). For *Yala* season, the maximum water demand over the past two decades was 110.28 MCM in 2012, with the lowest of 8.93 MCM in 2007. The fluctuation in water demand is primarily influenced by the extent of cultivation, which is determined based on the water availability in the tank and anticipated or historically observed rainfall pattern.

The maximum water supply of 371.88 MCM was observed in 2015/2016, while the minimum of 18.62 MCM was recorded during the 2007/2008 *Maha* season. A substantial increase in water supply occurred subsequent to 2010. Due to high effective rainfall in the *Maha* seasons of 2014/15, 2015/16, and 2016/17, the water supply exceeded demand for those periods. Conversely, the *Yala* season experienced its peak water supply of 130.14 MCM in 2016, with the lowest value of 7.41 MCM documented in 2007.

Supply deficit is the difference between water demand and water supply. Estimation of water supply deficit of an irrigation scheme is useful information to take appropriate management decision on water diversion and crop diversification (Rajendran et al., 2017). In Fig. 2, positive values reveal excess water supply while negative values show water shortage. The Unnichchai irrigation scheme is a water deficit system, where unmet demand is significant except 2014/15, 2015/16 and 2016/17 *Maha* and 2016 and 2017 *Yala*. Highest water shortage of 55.46 MCM was observed in 2014 *Yala* season. In 2019, nearly 53.94 MCM and 49.46 MCM supply deficit was observed in *Maha* and *Yala* season, respectively. Some of the Unnichchai scheme farmers believe that this deficit is due to water diversion for drinking water supply. However, water shortage was observed in many seasons even before the implementation of drinking water supply scheme in this system.

3.2 Impact of Drinking Water Scheme on Agriculture Productivity

3.2.1 Farmers' perspective on drinking water supply scheme and crop production

Nearly 85% of farmers believe that the drinking water supply scheme doesn't affect their farming activities. They continue to practice farming at the same level, and there is no noticeable negative impact on crop yield. However, many farmers discontented with strict water management mechanism introduced under the rotation water supply system and the level of water distributed, following the implementation of the scheme.

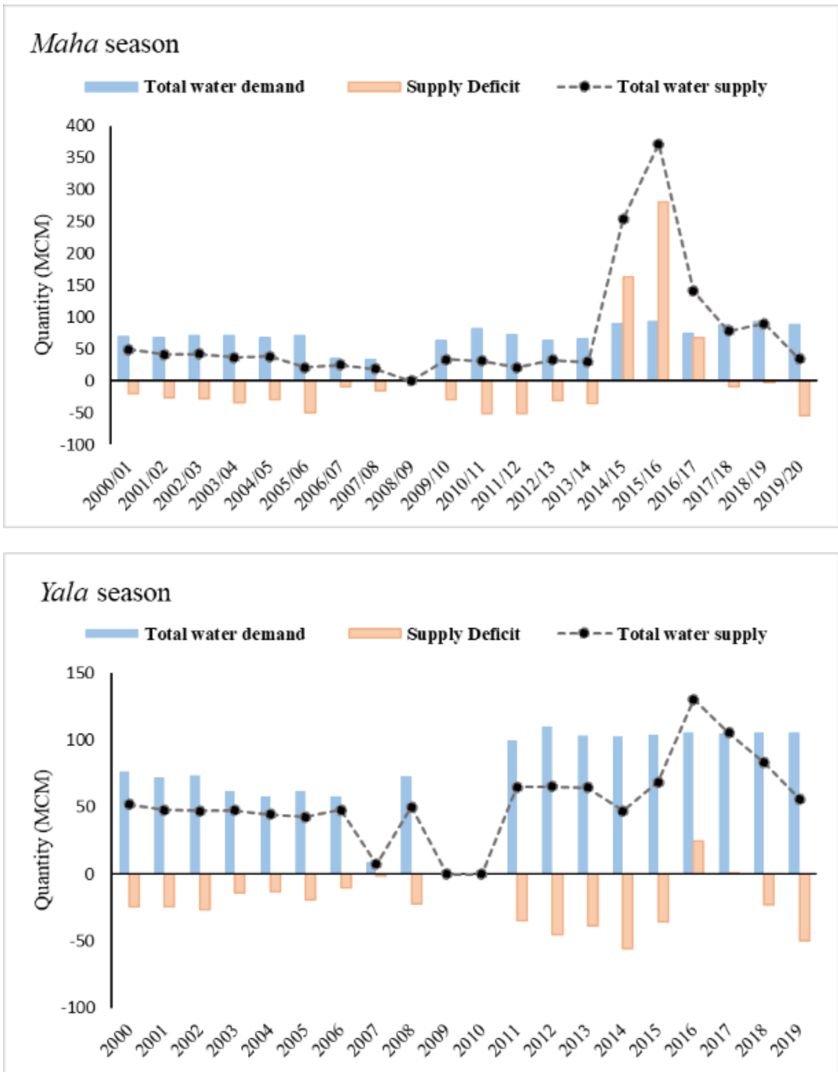


Fig. 2. Total water supply, water demand and supply deficit in *Maha* and *Yala* seasons in Unnichchai irrigation scheme over the period 2000-2019

An additional issue that farmers now face is the prohibition of upland farming, which requires pumping water from the canal. Prior to the water supply scheme's implementation, this was not considered as a problem by the irrigation department. However, the pumping of water from the canal is now seen as an offensive practice, as the department seeks to conserve water for drinking purposes. As a result, some farmers have lost their main source of income. This issue also affects vegetable farmers.

Vegetable farming is a secondary income source for Unnichchai farmers. They engage in upland cultivation and home gardening, with vegetable farming typically practiced only during the *Maha* season. Nearly 92% of farmers were dissatisfied with the amount of water allocated by the irrigation department for vegetable farming, as priority is given to paddy cultivation. Consequently, farmers rely on their own water sources for vegetable farming during the *Maha* season and refrain from growing vegetables in the *Yala* season due to water shortages.

In addition, most farmers in this system also raise livestock for additional income. They face significant water shortages, especially during the off-seasons and prolonged dry periods. Before the drinking water scheme was implemented, the irrigation department supplied water for livestock once every 15 days upon farmers' requests. However, due to the need to conserve water for drinking purposes, the irrigation department now denies water supply for livestock, particularly during dry seasons. As a result, the drinking water supply scheme indirectly affects livestock farming in this system.

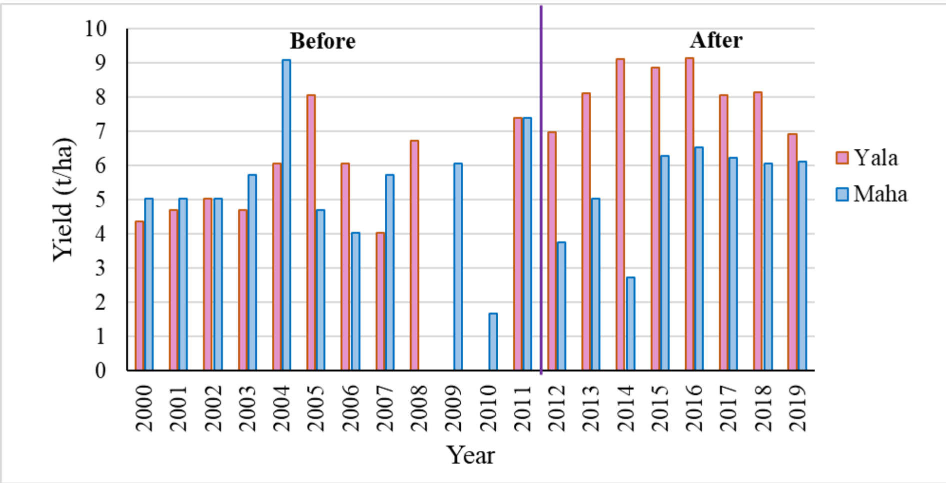


Fig. 3. Seasonal paddy yield in the study area from 2000 to 2019

3.2.2 Paddy yield of Unnichchai irrigation scheme

The agriculture department has introduced different high yielding varieties to suit different environmental conditions of the country. Thus, one can expect that with the existing technology a grain yield of about 7 t/ha is attainable in well managed irrigated paddy land in the dry zone (Bandara, 2006). Fig. 3 shows that the most variation of grain yield in both *Maha* and *Yala* seasons. The paddy yield was below the attainable level in most of the years. However, it has been increased substantially after 2011 and exceeded 7 t/ha, especially in *Yala* season.

3.3 Assessing the Effect of Drinking Water Scheme on Agricultural Productivity Using Comparative Performance Indicators

Due to high variation in the extent of cultivation, command area and water diversion across different years, the use of comparative indicators is essential to accurately assess the impacts of drinking water scheme on the performance of this system. In this study, selected indices were used to compare the agricultural system's performance before and after the implementation of the drinking water scheme.

3.3.1 Agricultural performance

Agriculture productivity is the expected output of the system by utilizing irrigation water. After extensive literature review, 4 indicators were selected for assessing the productivity in irrigated agriculture such as output per cropped area, output per unit command area, output per unit irrigation supply and output per unit water consumed. The results are given in Figs. 4 & Fig. 5. Average paddy yield reflects the productivity of land and this particular indicator depends on the scarcity of land resource (Rao, 1993). As an indicator, it gives the information on yield per unit area per season and shows the potential of that land for paddy production under set of environmental and other supplementary input services (Takeuchi & Murty, 1994).

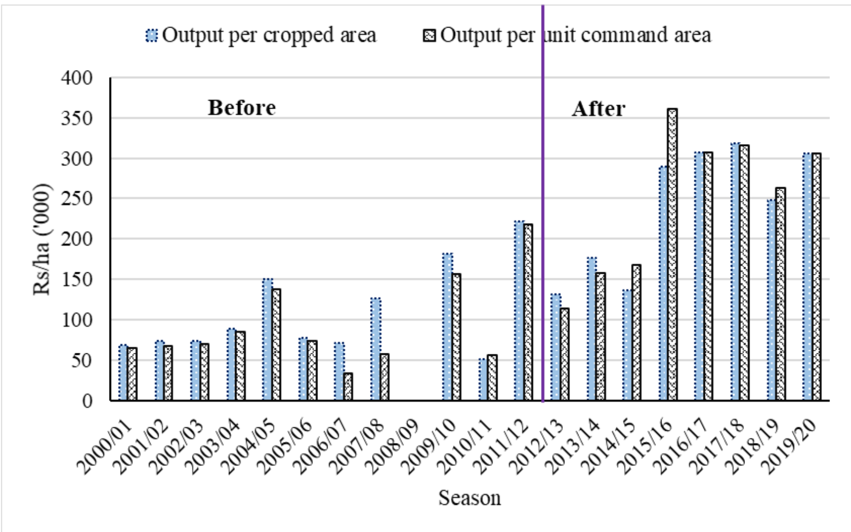
Unnichchai irrigation scheme shows remarkable increase in agricultural productivity since 2008. Average output per crop area, output per unit command area, output per unit irrigation supply and output per unit water consumed were Rs. 107,340/ha, Rs.92,674/ha, Rs.80.05/m^3 and Rs.11.60/m^3 in *Maha* before drinking water supply scheme introduced. However, it has been increased to Rs.239,081/ha, Rs.248,930/ha, Rs.117.17/m^3 and Rs.25.84/m^3, respectively after the implementation of water supply scheme. The corresponding figures for the *Yala* season before drinking water scheme were Rs.108,457/ha, Rs.66,195/ha, Rs.7.04/m^3 and Rs.7.57/m^3. The values increased to Rs.358,558/ha, Rs.330,580/ha, Rs.29.45/m^3 and Rs.25.02/m^3, respectively after implementation of drinking water scheme.

In this system, farmers had restrictions on visiting their farms and carrying out the farming activities on time during the ethnic war. However, they were granted unrestricted access to their farms after the ethnic war ended. In addition, the introduction of high-yielding paddy varieties, the adoption of new technologies in farming, proper land preparation methods, and the use of effective biochemicals for pest and disease control may have contributed to the improved performance of this system. Notably, better paddy production was reported under the Unnichchai irrigation scheme, even though cultivation was carried out with a limited water supply. However, this system shows low output per unit irrigation supply compared to other systems such as Parakrama Samudraya, Girithale, Minneriya and Kaudulla in Polonnaruwa district (Nilakshi & Rajendran, 2023).

3.3.2 Water use performance

Water delivery and supply indicators are essential for evaluating the efficiency of the services provided by the system. In the context of irrigation schemes, irrigation water serves as the primary input for crop production. Hence, the water supply performance of an irrigation scheme can be assessed by computing input-supply indicators for agriculture.

The water use performance of selected irrigation scheme was assessed using two indicators: relative water supply and relative irrigation supply. The indicator of irrigation contribution shows the percentage of water requirement of the crop met by irrigation water. Meanwhile, the relative water supply indicator assess the adequacy of water provided by both irrigation and rainfall to meet the crop water demand (potential crop evapotranspiration plus deep percolation and seepage losses), as defined by (Molden et al., 1998).



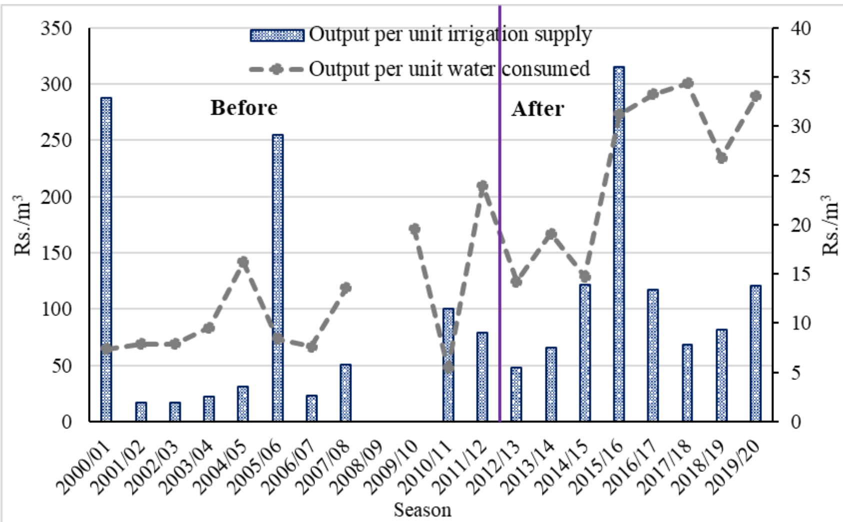


Fig. 4. Agricultural performance of Unnichchai irrigation scheme in *Maha* season before and after implementation of drinking water supply

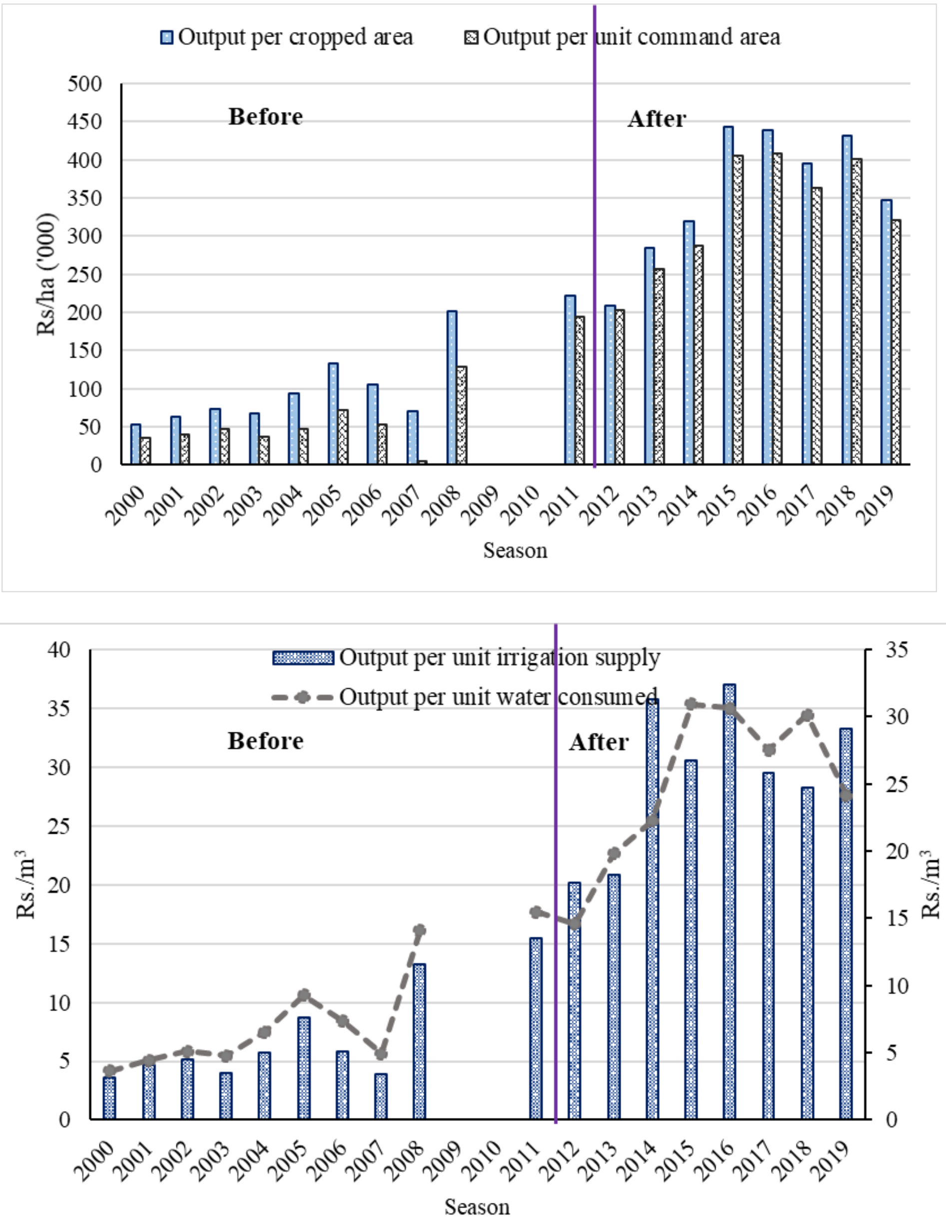
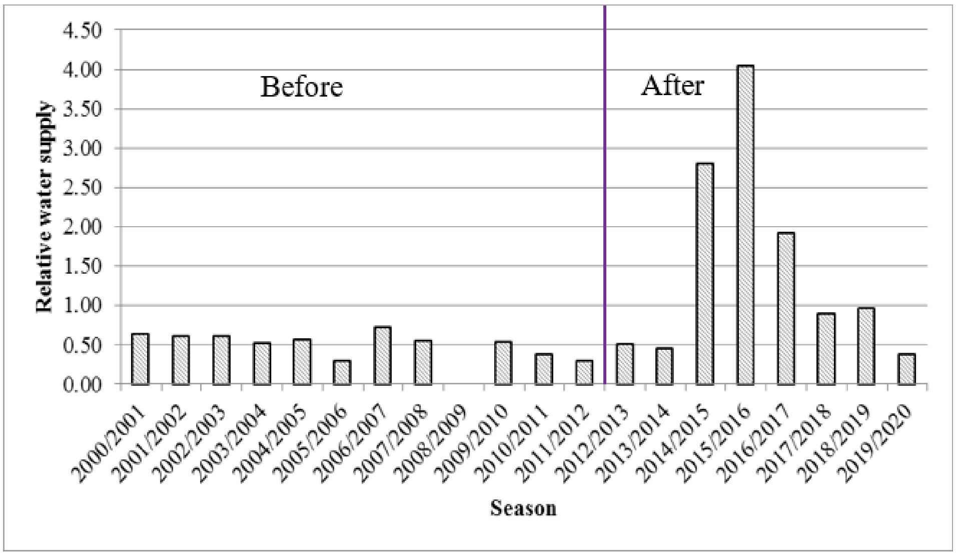


Fig. 5. Agricultural performance of Unnichchai irrigation scheme in *Yala* season before and after implementation of drinking water supply scheme

Relative water supply: Relative water supply relates water supply to demand and indicates the condition of water abundance or scarcity and how tightly supply and demand is matched. Relative water supply more than 1 indicates excess water supply while less than 1 indicates water shortage (Degirmenci, 2003). Average relative water supply was found to be 0.54 for the period 2000-2011 *Maha* whereas, for the period of 2012-2019 it was found to be as 1.36 (Fig. 6).

This indicates that the average relative water supply increased during the 2012-2019 period compared to 2000-2011. Similarly, in *Yala* season, the average relative water supply increased from 0.72 to 0.74 during 2000-2011 to 2012-2019. Excess water supply was observed in 2014/15, 2015/16 and 2016/17 *Maha* season. However, a water deficit was observed in all *Yala* seasons except for 2016 and 2017. This indicates that crops in this system were not irrigated with the required amount of water, particularly when compared to other irrigation systems such as *Hakwatuna Oya* and *Kimbulwana Oya* in Sri Lanka (Lakmali et al., 2015).



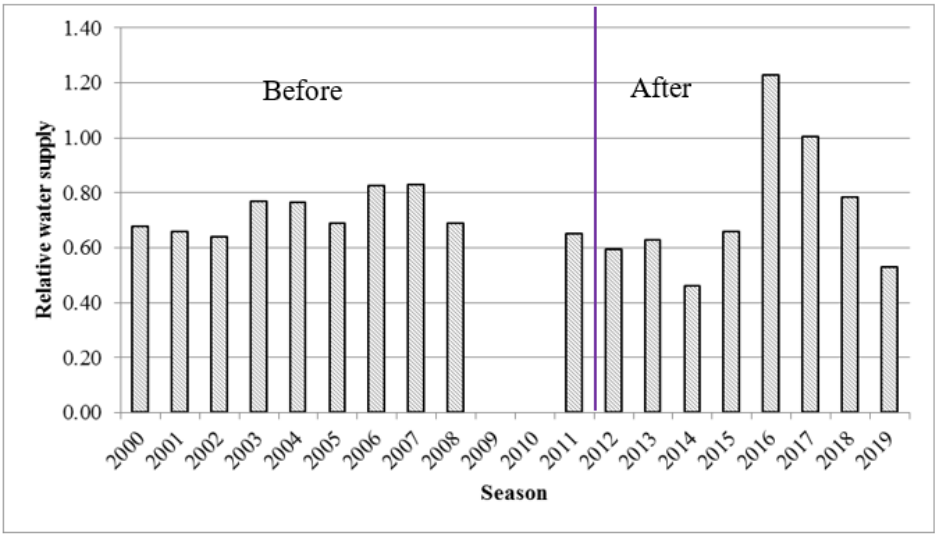


Fig. 6. Relative water supply of Unnichchai irrigation scheme in *Maha* and *Yala* seasons before and after implementation of drinking water supply scheme

Relative irrigation supply: Relative irrigation supply varies across seasons. The average relative irrigation supply was found to be 0.31 for the period 2000-2011 *Maha* seasons, whereas it decreased to 0.25 during 2012-2019 period (Fig. 6). This indicates that the average relative irrigation ratio was decreased during the 2012-2019 period. However, in *Yala* season, the average relative irrigation supply increased from 0.72-0.78 for the period 2000-2011 and 2012-2019, respectively (Fig. 7).

Relative irrigation supply was very low during the *Maha* season, except in 2004/2005, 2017/2018 and 2018/2019 *Maha* seasons. Overall, relative irrigation supply remained below 1 across all years. Heavy rainfall during the 2014/15, 2015/16 and 2016/17 *Maha* seasons exceeded the irrigation demand of paddy, while excess water supply was observed in 2016 *Yala* season. However, in all other seasons, relative irrigation supply was below 1. Overall, both relative water supply and relative irrigation supply remained below 1 in both seasons.

3.3.3 Physical performance of Unnichchai irrigation scheme

Cropping intensity and irrigation ratio are widely used indicators to assess the physical performance of an irrigation scheme. The following section describes the performance of

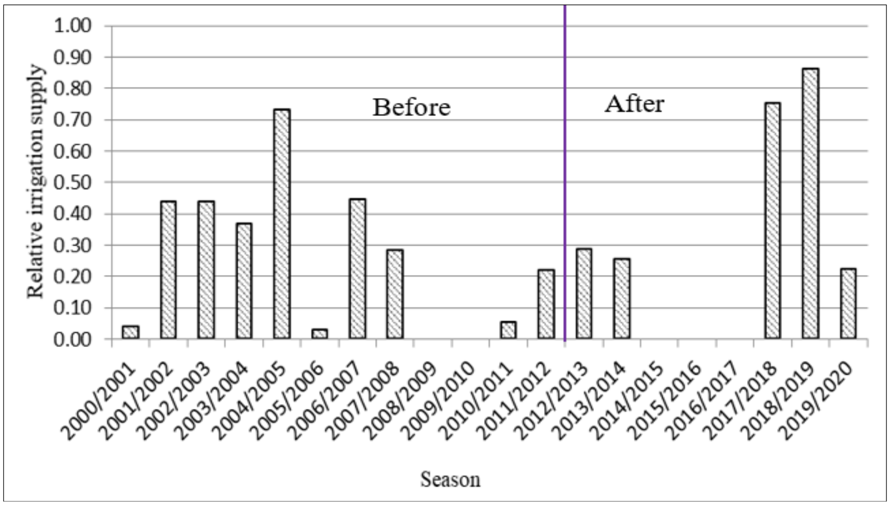
Unnichchai irrigation scheme based on these two indicators.

Cropping Intensity: The cropping intensity (CI) is commonly used to indicate the extent of irrigation (Degirmenci, 2003). It is the primary and essential criteria for measuring irrigation service performance (Rajendran et al., 2017). Over the past 20 years, CI has varied from year to year. Fig. 8 shows the CI of the Unnichchai irrigation scheme over this period.

The CI was less than 2 in most years, except 2014 and 2015. This reveals that famers in this system do not cultivate entire command area during both seasons. However, in 2014 and 2015, the CI exceeded 2, indicating farmers cultivated more than the designated command area during these years.

This is because the actual cultivated area was higher than the specified irrigable area. In *Maha* seasons, higher rainfall allow farmers to cultivate a larger extent than the designated command area. From 2006 to 2009, CI was observed less than 1, as farmers cultivated only during *Maha* season due to construction work.

The average CI during 2000-2011 period was 1.83, which increased to 1.91 during 2012-2019. In the original designs of most of these schemes a cropping intensity of 1.5 was anticipated. Accordingly, the average CI of this system is higher than the expected value.



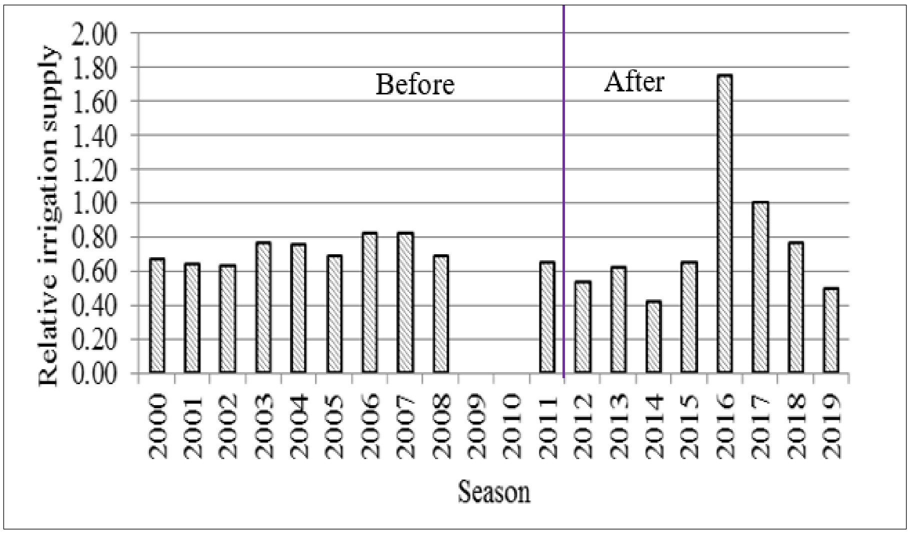


Fig. 7. Relative irrigation supply of Unnichchai irrigation scheme in *Maha* and *Yala* season before and after implementation of drinking water supply scheme

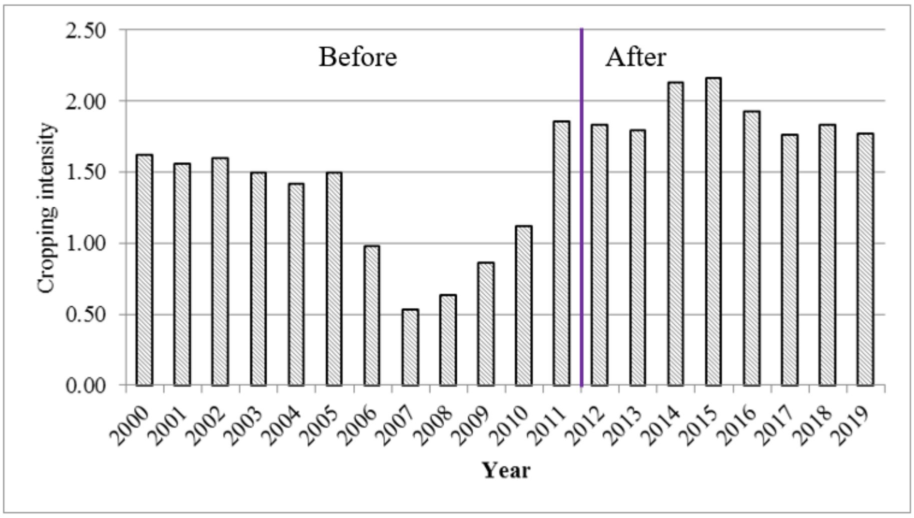


Fig. 8. Cropping intensity of Unnichchai irrigation scheme

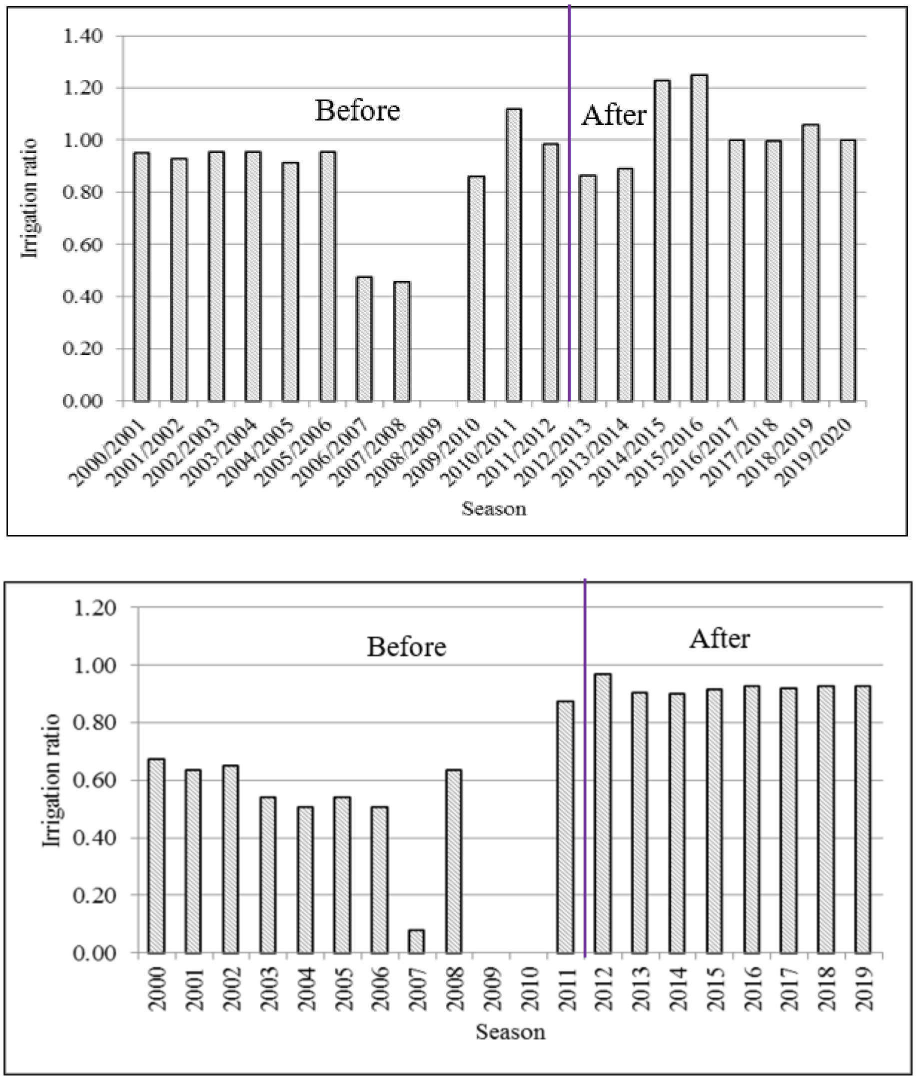


Fig. 9. Irrigation ratio of Unnichchai irrigation scheme in *Maha* and *Yala* seasons

Irrigation ratio: Among agricultural indicators, this measure becomes particularly crucial in areas where water availability limits the expansion of irrigation systems (Kuşçu et al., 2008). It also shows system's ability to supply water to entire irrigable area. The irrigation ratio varied year to year in both *Maha* and *Yala* seasons.

An irrigation ratio of 1 reveals that irrigation water was supplied to the entire irrigable area. In certain *Maha* seasons such as 2010/11, 2014/15, 2015/16 and 2018/19, the irrigation ration exceeded 1, indicating that water was supplied to more than the designated irrigable extent (Fig. 9).

As mentioned in the preceding section, the irrigation department extends irrigable extent during *Maha* seasons. The higher irrigation ratios observed in 2014/15 and 2015/16 *Maha* seasons were due to higher effective rainfall. However, there was significant uncertainty in irrigation water supply during *Yala* seasons. Water supply was restricted to portions of the irrigable area every year, resulting in an overall irrigation ratio of less than 1 during *Yala* seasons in this irrigation scheme.

In *Maha* season, farmers do not fully rely on the irrigation department for their water needs. However, in *Yala* season, farmers depend on irrigation water for their cultivation. Compared to the past, substantial increase in irrigation ratio during *Yala* seasons was observed from 2011 in this system. Average irrigation ratio was found to be as 0.78 for the period 2000-2011 in *Maha* season. However, during the 2012-2019 period, it increased to 1. Similarly, in the *Yala* season, the average irrigation ratio increased from 0.47 in 2000-2011 to 0.92 in 2012-2019.

4. CONCLUSION

This study assessed the impact of a drinking water supply scheme on agricultural performance in the Unnichchai irrigation scheme. Despite the diversion of water from irrigation reservoirs for urban drinking supplies, agricultural performance showed overall improvement. Key indicators, such as crop yield per unit area, irrigation efficiency, and water use efficiency, all increased following the implementation of the scheme in both *Maha* and *Yala* seasons. Additionally, water management indicators like relative water supply and irrigation ratio showed positive trends. These findings indicate that the Unnichchai irrigation system has successfully balanced competing water demands, enhancing agricultural productivity while meeting urban water needs through effective management strategies after implementation of drinking water supply scheme. However, the performance of this system remains comparatively lower than other major irrigation systems particularly in Kurunagela and Polannaruwa districts. Therefore, targeted interventions are recommended to further improve its efficiency and outcomes.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

ACKNOWLEDGEMENT

We are sincerely grateful to Eng.S.M.B.M. Azhar, Director of Irrigation Department, Batticaloa, and Mr. M. Firthous, Engineer of the National Water Supply and Drainage Board, Batticaloa, for their valuable support and granting permission to collect the necessary data.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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