Afghan International Journal of Science (AIJS)

Publisher: Afghan International Islamic University

Website: https://aijs.aiiu.edu.af

e-ISSN: 3134-5859

Deficit Irrigation Effects on Potato Growth, Yield, Quality, and Water Use Efficiency: A Review

Zabihullah Faizi[1*], Hamid Salari [2], Mohammadullah Amin [3] and Nasir Ahmad[4]

[1,4] Mirwais Khan Nika Zabul University, Department of Horticulture, Faculty of Agriculture, Zabul, AF

[2,3] Kabul University, Department of Horticulture, Faculty of Agriculture, Kabul, Afghanistan

Abstract

Global agriculture is the largest consumer of freshwater. Water scarcity, especially in arid and semi-arid regions, is a major constraint to sustainable potato production. Comprehensive scientific evaluation of appropriate levels, timing, and methods of deficit irrigation remains limited. The objective of this review was to evaluate different deficit irrigation strategies. The focus was on potato yield, quality, and water-use efficiency. Relevant studies were collected from reputable scientific journals. These included field experiments, greenhouse studies, models, and meta-analyses. The data were analyzed using comparative and descriptive approaches. The results showed that moderate deficit irrigation reduces water consumption. It increases water-use efficiency. It also maintains or improves yield and quality. These effects are especially evident during the early growth stages. Methods such as PRD, AFI, and SSI are effective in saving water. They also improve production stability. However, the tuber formation and flowering stages are highly sensitive to water deficit. In conclusion, proper scheduling is important. Moderate deficit irrigation is an effective practical strategy. It ensures water saving. It increases economic benefits. It also supports sustainable potato production. These findings provide a scientific basis for decision-making for farmers and water management institutions.

Keywords: Potato; Deficit irrigation; Quality; Water use efficiency; Yield

Article History

Published: June 30, 2026

Accepted: May 17, 2026

Revised: March 29, 2026

Received: February 2, 2026

Cite as: Faizi, Z., Salari, H., Amin, M., & Ahmad, N. (2026). Deficit Irrigation Effects on Potato Growth, Yield, Quality, and Water Use Efficiency: A Review. *Afghan International Journal of Science 2*(2), 227-238. DOI: https://doi.org/10.66546/aijs.v2i2.38

Introduction

Globally, agricultural irrigation is the largest consumer of freshwater; therefore, due to increasing water scarcity, the need for efficient and sustainable irrigation methods has intensified. (Adeyemi et al., 2017).

On the other hand, water shortages, especially in arid and semi-arid regions, are a major constraint on sustainable agriculture, and the growing demand from cities and industry further increases pressure on agricultural water resources. To mitigate the water crisis and increase

*E-mail: zabihullahfaizi078@gmail.com (corresponding author)

Link to this artilce: https://aijs.aiiu.edu.af/index.php/aijs/article/view/38

agricultural production, improving water productivity through better farming practices, improved management, and reduced water consumption is critical. Physical water productivity is an important scientific indicator of optimal water use, playing a fundamental role in water management and agricultural economic planning, and helping to identify appropriate solutions for different regions (Jovzi et al., 2024).

Irrigation is a key factor in agricultural production, especially in arid areas where water resources and annual rainfall are limited (Al-Omran et al., 2020). Moreover, irrigated agriculture is the largest water-consuming sector, accounting for about 70% of total freshwater use, yet it provides nearly 40% of the world's food. Water scarcity and rising energy costs have made improving water use efficiency and adopting effective drought-mitigation measures top priorities in the agricultural sector (Martínez-Romero et al., 2019). The gradual increase in freshwater demand makes it essential to use water efficiently. In this context, irrigation scheduling is needed that maximizes returns from each unit of water. Deficit irrigation is a strategy that allows plants to tolerate a degree of water stress, reducing irrigation costs and potentially increasing profits. The potential benefits of deficit irrigation arise from three factors: increased irrigation efficiency, reduced irrigation costs, and lower water opportunity costs. In deficit irrigation, yield reductions are compensated by cost savings due to water conservation or by the expansion of newly irrigated areas (Kiziloglu et al., 2006).

Potato (*Solanum tuberosum L.*) is one of the world's most important food crops and plays a vital role in food production and economic growth. The diversity of potato cultivars, high yield potential, and strong adaptability to different climates distinguish this crop from other major staples (Chen et al., 2025; Martínez-Romero et al., 2019). From planting to harvest, potato growth passes through five stages: sprouting, seedling establishment, tuber initiation, tuber bulking, and starch accumulation. In general, irrigation demand is low during the sprouting stage, while the highest water requirement occurs during the tuber bulking stage, followed by the tuber initiation and starch accumulation stages (Zhou et al., 2020)

In recent years, due to increasing drought events, water scarcity has become one of the most critical global challenges, clearly observed in many countries, and potato cultivation in arid and semi-arid regions is particularly constrained by limited water availability. Studies conducted on potatoes under deficit irrigation have identified effective deficit irrigation methods and clarified the effects of water stress at different growth stages on plant growth, yield, tuber quality, and water use efficiency. These studies aim to determine optimal irrigation strategies for sustainable, efficient potato production that increase yield and quality, improve water-use efficiency, and provide practical guidance for farmers.

However, a comprehensive synthesis of optimal deficit irrigation strategies across growth stages is lacking. Therefore, this study aims to answer the following research questions:

1. Which deficit irrigation methods improve potato yield and water-use efficiency?
2. Which growth stages are appropriate for water deficit?
3. Which irrigation strategy is most effective in arid regions?

Methods and Materials

This review article was conducted to evaluate the effects of deficit irrigation on the production of potato (*Solanum tuberosum L.*). The data collection process was carried out as follows:

Literature for this review was systematically collected from major academic databases, including Scopus, Web of Science, ScienceDirect, and Google Scholar, to ensure comprehensive coverage of peer-reviewed research.

Study Selection: For this review, most of the selected studies were recent, relevant, and published in peer-reviewed international journals, with the majority published between 2016 and 2025. A total of 36 articles were initially examined in detail. Their results were then compared and interpreted. The included studies comprised field experiments, greenhouse studies, modeling, meta-analyses, and scoping reviews.

Inclusion Criteria

- Studies must evaluate various deficit irrigation methods in potato production, such as RDI, PRD, AFI, Drip, and SSI.
- Studies must provide quantitative or analytical data on water amount, yield, tuber quality, water productivity (WP), and irrigation water use efficiency (IWUE).

Data Extraction and Classification

From each article, the following information was extracted:

- Irrigation method and technique.
- Level of water deficit and growth stage of application.
- Growth stages (e.g., seedling, tuber initiation, tuber bulking).
- Climate and soil type.
- Outcomes related to yield, tuber quality, water productivity (WP), and irrigation water use efficiency (IWUE).
- Economic and agronomic indicators.

Data Analysis

Data analysis was performed using descriptive and comparative methods. The effects of different irrigation methods were compared across growth stages, yield, tuber quality, and water consumption. The main aim of the data analysis was to identify the most effective deficit irrigation strategies and provide practical recommendations for sustainable and efficient potato production.

Findings & Discussion

Deficit Irrigation Effects on Potato Growth and Yield

Although water stress can reduce photosynthesis, transpiration, stomatal conductance, and total water consumption, it can also improve soil hydrothermal conditions. Moderate regulated deficit irrigation applied during the early growth stage and the tuber initiation stage does not negatively affect potato yield; instead, it increases both water productivity and irrigation water

use (Pan et al., 2025). Potatoes respond strongly to proper irrigation management because their shallow root system and high sensitivity to soil moisture fluctuations make irrigation critical to improving yield and quality; therefore, precise irrigation is essential. Advanced irrigation approaches (soil, evapotranspiration, and plant-based scheduling) can enhance water productivity while maintaining yield and quality (Rai & Dong, 2025).

Precision irrigation improves water use efficiency; however, to fully realize its benefits, adaptive decision-support systems, sensors, and model-based predictive control are required. These technologies can increase yield, save water, and enhance agricultural sustainability, especially when deficit irrigation is integrated into overall management strategies (Adeyemi et al., 2017). Deficit irrigation helps maintain potato yield and quality (Chen et al., 2025). Regulated deficit irrigation applied at appropriate timing and moderate levels during the potato growth cycle reduces water consumption, improves water uptake and utilization, increases yield, and enhances tuber quality, making it a useful approach for efficient production management and industry development (Wang et al., 2023)

Applying mild to moderate water deficit during the seedling stage has little negative effect on vegetative growth, and these growth indicators can be compensated for by adequate irrigation in later stages, ultimately resulting in higher yields (Jia et al., 2022; Li et al., 2021). Various methods are available for implementing appropriate deficit irrigation, each being effective when used in suitable conditions. Among these, partial root-zone drying (PRD) can increase water use efficiency, maintain or increase yield, and improve the nutritional and health-related quality of tubers (Jovanovic & Stikic, 2018). Evidence also indicates that PRD can reduce total water consumption compared with full irrigation, with little or no yield reduction (Ahmadi et al., 2010).

Among these methods, the most effective is Controlled Alternate Partial Root-Zone Irrigation (PRD/CAPRI), an advanced form of PRD in which water flow and timing are precisely regulated. This method increases water-use efficiency by reducing evapotranspiration, regulates vegetative growth, and saves water without causing significant yield reductions (Kumar et al., 2019). The use of alternate root-zone irrigation is particularly effective when water savings are below 45%, and appropriate fertilization is applied, indicating that deficit irrigation adapted to local conditions is a practical strategy for water conservation and acceptable yield (Niu et al., 2024). PRD positively influences plant physiological and morphological traits, maintains yield, and enhances water productivity. Especially in arid and semi-arid regions, PRD is a suitable irrigation strategy that achieves high yield while conserving water under limited water availability (Ahmadi et al., 2010).

Moreover, PRD induces partial stomatal closure, which makes water use more efficient, and this partial reduction does not negatively affect yield, leaf dry matter, or total tuber production when compared to full irrigation. Marketable tuber yield is often higher under PRD, which can save up to 30% of irrigation water and increase irrigation water use efficiency (IWUE) by up to 61%, demonstrating that PRD is an effective water-saving strategy for potatoes under limited water conditions (Shahnazari et al., 2008). The tuber bulking stage (from initiation to harvest) is the most sensitive period; thus, deficit irrigation should be avoided during this stage to prevent significant yield losses, although the effect depends on the degree of water deficit

applied (Montoya et al., 2019). Overall, applying mild to moderate water deficit during the seedling stage, without severe stress during tuber initiation and bulking, allows RDI strategies to achieve an optimal balance between potato yield, quality, and water use efficiency (Zhang et al., 2024).

Another deficit irrigation method, Alternate Furrow Irrigation (AFI), reduces seasonal irrigation water by nearly half without significantly affecting tuber yield or total biomass compared with conventional furrow irrigation (Kassaye et al., 2020).

When arable land is limited, it is preferable to apply irrigation at a level that maximizes yield per unit area (Wm), as this also ensures the highest net economic return per unit land (Wl). Under water-limited conditions, however, the optimal irrigation level is that which maximizes economic return per unit of water used (Ww), rather than simply maximizing yield. In this context, applying deficit irrigation for two weeks during the tuber bulking stage is an appropriate strategy for potatoes. Although yield may slightly decrease, the increase in tuber dry matter compensates for the reduction. Under land or water constraints, this approach is effective for maximizing net economic return (Karam et al., 2014).

The mid-growth stage, particularly flowering, is the most sensitive to water stress, and severe deficit should be avoided during this period. For other growth stages, applying 65–85% of crop water requirements throughout the season is an effective water-saving strategy compared with full irrigation. This typically reduces yield by 17.5–23.2%, which remains economically acceptable while providing satisfactory yield (Kifle & Gebretsadikan, 2016; Kifle et al., 2024). When combined with appropriate nitrogen fertilization, this irrigation level further enhances water savings and maintains acceptable yields (Akkamis & Caliskan, 2023).

Moderate deficit irrigation at 75% of full water requirements can reduce seasonal water consumption by approximately 25% without negatively affecting yield or tuber quality. This approach ensures both water savings and the production of commercially acceptable tubers, making it an important strategy for sustainable potato production (Mora-Sanhueza et al., 2025). Using 75% ETC(Crop Evapotranspiration) deficit irrigation through alternate furrow irrigation provides a practical and economic solution, particularly in water-limited regions (Kumilachew et al., 2025). Regulated deficit irrigation, when applied appropriately, can simultaneously reduce water use and increase potato yield, water productivity (WP), and irrigation water productivity (IWP). Deficit irrigation reduces both yield and crop evapotranspiration (ETc) but significantly improves WP and IWP compared with full irrigation. Additionally, combining deficit irrigation with other practices, such as drip or subsurface drip irrigation, proper fertilization, and increased soil organic carbon, further enhances yield and water productivity (Niu et al., 2024). Applying moderate controlled water deficits (e.g., 25% deficit irrigation) is an effective approach for increasing WP and IWP in potato cultivation without significantly reducing yield, and it provides the highest net economic return under conditions of limited land and water (Teshome et al., 2024).

Drip irrigation is an effective method for sustainable potato production in semi-arid regions. To further enhance its efficiency, subsurface drip irrigation (SSI) is considered the optimal approach. Compared with surface drip irrigation (SI), SSI reduces water evaporation by 8–26% during crop growth. Additionally, SSI increases the dry weight of potato roots after tuber

initiation and improves leaf area index (LAI) and total plant dry matter accumulation from tuber bulking to starch accumulation, resulting in higher yields compared with surface drip irrigation (Guan et al., 2025).

Alongside deficit irrigation, applying water according to an appropriate irrigation schedule is essential. Improper scheduling can not only reduce yield but also compromise the sustainable management of water resources (Rai & Dong, 2025). For potato cultivation, different irrigation strategies serve specific purposes: alternate furrow irrigation (AFI) is suitable for simple water savings, partial root-zone drying (PRD) enhances drought tolerance, and controlled alternate partial root-zone irrigation (CAPRI) allows precise water management. The choice of method depends on soil type, water availability, and management capacity.

Deficit Irrigation Effects on Potato Quality

Irrigation levels play a crucial role in both potato yield and tuber quality. Excessive water deficit can reduce yield and increase the proportion of non-marketable or deformed tubers (Sifuentes-Ibarra et al., 2023). To maintain tuber quality, dynamic deficit irrigation is an effective strategy that saves water while protecting tuber weight and nutritional quality, including starch, dry matter, and protein content (Mauro & Ierna, 2025).

The highest potato quality is generally achieved under mild to moderate water deficits applied during the seedling stage. At this stage, slight water stress under regulated deficit irrigation represents the most suitable system (Li et al., 2021). In general, reduced water supply tends to lower tuber sugar and protein content, but under partial root-zone drying (PRD), these quality traits remain higher than under conventional deficit irrigation (DI). Conversely, polyphenol and antioxidant levels increase under water-deficient conditions (Elhani et al., 2019).

PRD enhances tuber quality and improves nutrient use efficiency. This method increases certain nutritional and health-promoting traits in the crop and provides a practical approach for farmers in water-limited regions to produce nutritionally valuable products (Jovanovic & Stikic, 2018; Zhang et al., 2024). Under DI conditions, endogenous gibberellin levels (GA1 and GA3) decrease, while abscisic acid (ABA) concentrations rise from early growth to tuber initiation, even without water deficit. Exogenous ABA application has been shown to enhance tuber dry matter accumulation and uniformity, indicating that ABA, as a key signaling molecule, mediates water stress responses, regulates tuber development, and contributes to higher tuber yield (Jia et al., 2022)

Overall, optimal quality is produced under mild to moderate water deficit during the seedling stage (Li et al., 2021). Properly timed deficit irrigation increases biomass accumulation and maintains or improves tuber quality, supporting efficient industrial potato production (Wang et al., 2023; Yang et al., 2022). Moderate deficit irrigation (approximately 18% reduction in Crop Evapotranspiration (ETc)) preserves or enhances tuber quality parameters such as specific gravity, starch content, and dry matter, whereas severe water deficit reduces quality. Combined management of moderate deficit irrigation and reduced nitrogen application is therefore recommended as an effective approach for resource-efficient, high-quality, and sustainable potato production (Barka et al., 2025; Zhao et al., 2025).

For sustainable potato production and improved quality in semi-arid regions, drip irrigation is an effective method. Within this approach, subsurface drip irrigation (SSI) is particularly efficient, as it increases dry-matter accumulation in the plant after tuber initiation, from tuber bulking to starch accumulation. Compared to surface drip irrigation, SSI significantly enhances tuber expansion and starch accumulation during these critical growth stages (Guan et al., 2025).

Deficit Irrigation Effects on Water Use Efficiency for Potato

In arid and semi-arid regions with severe water scarcity, various irrigation techniques should be employed for potato production, such as deficit irrigation strategies, to mitigate water shortages to some extent. To implement effective deficit irrigation, several studies have investigated and demonstrated the efficiency of different approaches to water-limited irrigation.

Appropriate and timely deficit irrigation throughout the growing season reduces overall water consumption, improves water uptake and utilization, increases biomass yield, and moderately enhances tuber quality, which benefits the efficient development of the potato industry (Wang et al., 2023). Overall, deficit irrigation is an effective water-saving strategy that allows efficient water management without significantly reducing potato yield. However, it has pronounced effects at certain growth stages, particularly during flowering and the mid-growth period. Across the entire season, a 25% deficit irrigation rate is considered optimal for water-use efficiency. Therefore, in water-limited areas, applying 70–85% of ETc as deficit irrigation is recommended (Kifle & Gebretsadikan, 2016; Kifle et al., 2024; Kumilachew et al., 2025).

When ETc is reduced by 24–25% under deficit irrigation, both water productivity (WP) and irrigation water productivity (IWP) increase significantly. This indicates that even limited water under restricted water and land conditions can be effectively managed, providing valuable insights for policy-making and efficient irrigation management (Niu et al., 2024; Teshome et al., 2024; Wale et al., 2022).

Most innovative approaches within deficit irrigation (DI). In the PRD method, alternating irrigation between the sides of the root zone triggers abscisic acid (ABA)-mediated signaling from roots to leaves, regulating plant physiological traits and enhancing water use efficiency (Ahmadi et al., 2010). In practice, implementing PRD can provide farmers in water-limited areas with sustainable production, water savings, and high-quality crops, making it an effective strategy to improve irrigation water-use efficiency (Jovanovic & Stikic, 2018; Zhang et al., 2024).

PRD irrigation can increase water use efficiency (WUE), maintain or even enhance yield, and improve the nutritional and health quality of tubers. Its effectiveness is further supported by water savings, better nutrient utilization, and improved physiological adaptation of the plant (Jovanovic & Stikic, 2018). Among PRD systems, subsurface drip irrigation (SSI) is particularly efficient, reducing evaporation by 26% during the early growth stages of potato and increasing average water productivity (Al-Omran et al., 2020; Guan et al., 2025). Therefore, shallow-buried drip lines are considered a suitable method for efficient water use and sustainable potato production in semi-arid regions.

PRD also positively affects plant physiological and morphological traits, maintains yield, and increases water productivity. In arid and semi-arid regions, PRD is an appropriate irrigation strategy that conserves water while sustaining high yields (Ahmadi et al., 2010). Specifically, PRD partially reduces stomatal activity, leading to up to 30% water savings and a 61% increase in irrigation water use efficiency (IWUE), demonstrating its effectiveness as a water-saving approach under limited water conditions (Shahnazari et al., 2008). Among PRD techniques, Controlled Alternate Partial Root-Zone Irrigation (PRD/CAPRI) maximizes water savings by reducing evaporation and regulating plant growth without causing significant yield loss (Kumar et al., 2019).

Another water-saving approach is Alternate Furrow Irrigation (AFI), in which irrigation water is reduced to approximately half of the furrows at a time. Despite the reduced water application, AFI maintains potato tuber yield and total biomass comparable to full irrigation. Applying AFI with a 25% ETc deficit provides the highest economic benefits while improving water-use efficiency (WUE) and economic returns. Therefore, this method is recommended for sustainable potato production in water-limited regions (Kassaye et al., 2020).

Conclusion

Proper deficit irrigation improves water use efficiency, conserves water, and maintains or enhances potato yield and quality. PRD and its advanced form (PRD/CAPRI) are effective in arid and semi-arid regions as they reduce water loss, regulate plant growth, and improve physiological traits. AFI and subsurface drip irrigation (SSI) also provide high yields with lower water use. During sensitive stages, especially tuber development, these methods create a good balance between yield, quality, and water efficiency. When combined with proper nutrient management and improved soil conditions, deficit irrigation increases economic returns and supports sustainable potato production in semi-arid regions. Most studies are limited; therefore, future research should evaluate these methods across diverse climates, soil types, and long-term systems, and assess their economic and technological impacts.

Acknowledgements

We extend our gratitude to all encouraging and professional colleagues who provided feedback and constructive criticism to motivate and improve our work.

Authors Contributions

- Zabihullah Faizi and Hamid Salari conceptualized the study, designed the framework, and conducted its scientific review.
- Zabihullah Faizi, Mohammadullah Amin, and Nasir Ahmad Zaiarmal prepared the manuscript based on the analysis of previous research.
- All authors reviewed and approved the final version.

References

Adeyemi, O., Grove, I., Peets, S., & Norton, T. (2017). Advanced Monitoring and Management Systems for Improving Sustainability in Precision Irrigation. *In Sustainability*, *9*(3). https://doi.org/10.3390/su9030353

Ahmadi, S. H., Andersen, M. N., Plauborg, F., Poulsen, R. T., Jensen, C. R., Sepaskhah, A. R., & Hansen, S. (2010). Effects of irrigation strategies and soils on field grown potatoes: Yield and water productivity. *Agricultural Water Management*, *97*(11), 1923–1930. https://doi.org/10.1016/j.agwat.2010.07.007

Akkamis, M., & Caliskan, S. (2023). Responses of yield, quality and water use efficiency of potato grown under different drip irrigation and nitrogen levels. *Scientific Reports*, *13*(1), 9911. https://doi.org/10.1038/s41598-023-36934-3

Al-Omran, A., Louki, I., Alkhasha, A., El-Wahed, M. H. A., & Obadi, A. (2020). Water Saving and Yield of Potatoes under Partial Root-Zone Drying Drip Irrigation Technique: Field and Modelling Study Using SALTMED Model in Saudi Arabia. *Agronomy*, *10*(12). https://doi.org/10.3390/agronomy10121997

Barka, A. M. H., Essah, S. Y. C., & Davis, J. G. (2025). Moderate Deficit Irrigation and Reduced Nitrogen Application Maintain Tuber Quality and Improve Nitrogen Use Efficiency of Potato (Solanum tuberosum L.). *Horticulturae*, *11*(10). https://doi.org/10.3390/horticulturae11101159

Chen, X., Zhang, H., & Li, H. (2025). Optimizing Deficit Irrigation Management to Improve Potato Yield, Quality and Water Use Efficiency: A Review | GBP Proceedings Series. *GBP Proceedings Series*, *4*, 39–44. https://doi.org/10.71222/4k6s2x43

Elhani, S., Haddadi, M., Csákvári, E., Zantar, S., Hamim, A., Villányi, V., Douaik, A., & Bánfalvi, Z. (2019). Effects of partial root-zone drying and deficit irrigation on yield, irrigation water-use efficiency and some potato (Solanum tuberosum L.) quality traits under glasshouse conditions. *Agricultural Water Management*, *224*, 105745. https://doi.org/10.1016/j.agwat.2019.105745

Guan, T., Liu, P., Jia, L., Wu, L., Qin, Y., Shi, X., & Fan, M. (2025). Shallow burial of drip irrigation tape improves the water use efficiency of potatoes in semi-arid areas. *Scientific Reports*, *15*(1), 5684. https://doi.org/10.1038/s41598-025-89295-4

Jia, L., Wu, L., Suyala, Q., Shi, X., Qin, Y., & Fan, M. (2022). Promotion of potato yield under moderate water deficiency at the seedling stage by modifying sink-source relationship. *Plant Production Science*, *25*(1), 95–104. https://doi.org/10.1080/1343943X.2021.1963293

Jovanovic, Z., & Stikic, R. (2018). Partial Root-Zone Drying Technique: From Water Saving to the Improvement of a Fruit Quality. *Frontiers in Sustainable Food Systems, Volume 1-2017*. https://doi.org/10.3389/fsufs.2017.00003

Jovzi, M., Ebrahimipak, N., Hamedi, F., & Ebrahimipak, N. (2024). Water Productivity of Potato in Cold, Temperate, and Hot Climates of Kermanshah Province. *Journal of*

Water Research in Agriculture (Soil and Water Sci.), *38*(3), 185–199. https://doi.org/10.22092/jwra.2024.367255.1058

Karam, F., Amacha, N., Fahed, S., EL Asmar, T., & Domínguez, A. (2014). Response of potato to full and deficit irrigation under semi-arid climate: Agronomic and economic implications. *Agricultural Water Management*, *142*, 144–151. https://doi.org/10.1016/j.agwat.2014.05.007

Kassaye, K. T., Yilma, W. A., Fisha, M. H., & Haile, D. H. (2020). Yield and Water Use Efficiency of Potato under Alternate Furrows and Deficit Irrigation. *International Journal of Agronomy*, *2020*(1), 8869098. https://doi.org/10.1155/2020/8869098

Kifle, M., & Gebretsadikan, T. G. (2016). Yield and water use efficiency of furrow irrigated potato under regulated deficit irrigation, Atsibi-Wemberta, North Ethiopia. *Special Issue: Water Management Strategies in Irrigated Areas Overseen by: Dr. Brent Clothier*, *170*, 133–139. https://doi.org/10.1016/j.agwat.2016.01.003

Kifle, T., Nigussie, W., & Deboch, A. (2024). Evaluation of Deficit Irrigation on Potato Yield and Water use Efficiency in Gedeo Zone, South Region. *Middle East Research Journal of Agriculture and Food Science*, *4*(01), 15–19. https://doi.org/10.36348/merjafs.2024.v04i01.002

Kiziloglu, F., Sahin, U., Tunc, T., & Serap, D. (2006). The Effect of Deficit Irrigation on Potato Evapotranspiration and Tuber Yield under Cool Season and Semi-arid Climatic Conditions. *Journal of Agronomy, 5*. https://doi.org/10.3923/ja.2006.284.288

Kumar, S., Bhamini, K., Kumari, P., & Raj, R. (2019). Effect of Partial Root-Zone Drying (PRD) Irrigation in Fruit Crops: A Review. *International Journal of Current Microbiology and Applied Sciences*, *8*, 807–813. https://doi.org/10.20546/ijcmas.2019.811.095

Kumilachew, Y. W., Worku, T. A., Asitatikie, A. N., & Mekonnen, Y. A. (2025). Evaluation of water productivity and yield potential of potato crops. *Journal of Applied Water Engineering and Research*, *13*(4), 315–324. https://doi.org/10.1080/23249676.2025.2506608

Li, F., Deng, H., Wang, Y., Li, X., Chen, X., Liu, L., & Zhang, H. (2021). Potato growth, photosynthesis, yield, and quality response to regulated deficit drip irrigation under film mulching in a cold and arid environment. *Scientific Reports*, *11*(1), 15888. https://doi.org/10.1038/s41598-021-95340-9

Martínez-Romero, A., Domínguez, A., & Landeras, G. (2019). Regulated deficit irrigation strategies for different potato cultivars under continental Mediterranean-Atlantic conditions. *Agricultural Water Management*, *216*, 164–176. https://doi.org/10.1016/j.agwat.2019.01.030

Mauro, R. P., & Ierna, A. (2025). Tuber Growth and Nutritional Traits in Deficit Irrigated Potatoes. *Agronomy*, *15*(5). https://doi.org/10.3390/agronomy15051019

Montoya, F., Camargo, D., Córcoles, J. I., Domínguez, A., & Ortega, J. F. (2019). Analysis of deficit irrigation strategies by using SUBSTOR-Potato model in a semi-arid area. *The Journal of Agricultural Science*, *157*(7–8), 578–591. Cambridge Core. https://doi.org/10.1017/S002185961900090X

Mora-Sanhueza, R., Tighe-Neira, R., López-Olivari, R., & Inostroza-Blancheteau, C. (2025). Assessment of Different Irrigation Thresholds to Optimize the Water Use Efficiency and Yield of Potato (Solanum tuberosum L.) Under Field Conditions. *Plants*, *14*(11), 1734. https://doi.org/10.3390/plants14111734

Niu, Y., Zhang, K., Khan, K. S., Fudjoe, S. K., Li, L., Wang, L., & Luo, Z. (2024). Deficit Irrigation as an Effective Way to Increase Potato Water Use Efficiency in Northern China: A Meta-Analysis. *Agronomy*, *14*(7), 1533. https://doi.org/10.3390/agronomy14071533

Pan, X., Zhang, H., & Li, H. (2025). *A Study of Regulated Deficit Irrigation on Farmland Soil Environment, Yield and Water Productivity of Potato | GBP Proceedings Series*. *4*, 75–78. https://doi.org/10.71222/npxxmb78

Rai, A., & Dong, Y. (2025). A scoping review of irrigation scheduling methods in potato (Solanum tuberosum L.) production. *American Journal of Potato Research*, *102*(4), 348–371. https://doi.org/10.1007/s12230-025-09997-3

Shahnazari, A., Andersen, M. N., Liu, F., Jacobsen, S.-E., & Jensen, C. R. (2008). PARTIAL ROOT ZONE DRYING (PRD) SUSTAINS YIELD OF POTATOES (SOLANUM TUBEROSUM L.) AT REDUCED WATER SUPPLY. *Acta Horticulturae*, (792), 581–586. https://doi.org/10.17660/ActaHortic.2008.792.68

Sifuentes-Ibarra, E., Ojeda-Bustamante, W., Macías-Cervantes, J., Merino-Leyva, R. I., Preciado-Rangel, P., & Ruelas-Islas, J. del R. (2023). Déficit hídrico controlado y su efecto en el rendimiento y calidad de tres variedades de papa. *Revista Mexicana de Ciencias Agrícolas*, *14*(8), e3202. https://doi.org/10.29312/remexca.v14i8.3202

Teshome, A. W., Wosenie, M. D., & Addis, H. K. (2024). Effects of deficit irrigation on potato yield and water productivity in northern Ethiopia. *PLOS Water*, *3*(9), 1–16. https://doi.org/10.1371/journal.pwat.0000266

Wale, A., Dessie, M., & Kendie, H. (2022). Evaluating the Performance of AquaCrop Model for Potato Production Under Deficit Irrigation. *Air, Soil and Water Research*, *15*, 11786221221108216. https://doi.org/10.1177/11786221221108216

Wang, Y., Yu, S., & Zhang, H. (2023). Review of study on the effects of regulated deficit irrigation on potato yield, quality, and water use efficiency. In *Water Conservancy and Civil Construction Volume 1*. CRC Press.

Yang, B., Fu, P., Lu, J., Ma, F., Sun, X., & Fang, Y. (2022). Regulated deficit irrigation: An effective way to solve the shortage of agricultural water for horticulture. *Stress Biology*, *2*(1), 28. https://doi.org/10.1007/s44154-022-00050-5

Zhang, H., Chen, X., Xue, D., Zhang, W., Li, F., Teng, A., Zhang, C., Lei, L., & Ba, Y. (2024). Dry Matter Accumulation, Water Productivity and Quality of Potato in Response to Regulated Deficit Irrigation in a Desert Oasis Region. *Plants*, *13*(14). https://doi.org/https://doi.org/10.3390/plants13141927

Zhao, J., Zhang, H., & Li, H. (2025). Effects of Water Deficit on Water and Nitrogen Coupling Management of Potato | GBP Proceedings Series. *GBP Proceedings Series*, *4*, 23–28. https://doi.org/10.71222/gdxhgq77

Zhou, S., Li, F., & Zhang, H. (2020). Effect of Regulated Deficit Irrigation on Potato under-Mulched Drip Irrigation. *IOP Conference Series: Earth and Environmental Science*, *615*(1), 012104. https://doi.org/10.1088/1755-1315/615/1/012104