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Recent Advances In Biofortification And Potato Tuber Seed Production

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Abstract: Biofortification and potato tuber seed production are two interconnected areas of research that have significant implications for food security and nutritional quality. Biofortification in potatoes involves the enhancement of essential nutrients such as vitamins, minerals, and antioxidants in potato tubers through conventional breeding or genetic engineering. These nutrient-dense potatoes help combat malnutrition and improve overall health outcomes for consumers. In parallel, advancements in potato tuber seed production focus on the development and multiplication of disease-free, high-quality seed tubers through methods such as tissue culture and aeroponics. These methods ensure the production of uniform, healthy planting material, which is essential for achieving optimal yields and maintaining the genetic integrity of potato varieties. The integration of biofortification and improved seed tuber production practices promises to contribute to sustainable potato cultivation and enhanced agricultural productivity. By addressing nutritional deficiencies and providing robust planting materials, these efforts support global food systems and promote resilient, healthy populations.

Keywords: Biofortification, Potato, Tuber Seed Production, Nutritional Enhancement, Genetic Engineering, Tissue Culture, Disease Resistance, Sustainable Agriculture.

1. Introduction

Potato (Solanum tuberosum L.) is one of the world's most important food crops, providing sustenance to millions of people globally. With origins in the Andes region of South America, potatoes have become a staple food in diets worldwide due to their versatility, nutritional value, and adaptability to various growing conditions. The potato plant belongs to the Solanaceae family and produces edible tubers rich in carbohydrates, vitamins, minerals, and antioxidants, making it a valuable source of energy and essential nutrients.

Over centuries of cultivation and breeding, potato varieties have been developed to suit diverse climates, soil types, and culinary preferences. From traditional landraces to modern cultivars, potatoes exhibit remarkable genetic diversity, offering a wide range of flavors, textures, and colors. Additionally, ongoing efforts in potato breeding aim to enhance traits such as disease resistance, yield potential, and nutritional content, addressing challenges posed by climate change, pests, and food security.

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Approximately two billion people suffer from one or more micronutrient deficiencies today. Transdisciplinary strategies are needed to provide micronutrients such as vitamin A, iron, and zinc. Biofortification is the process of adding nutiritional value to the crop, it refers to nutrient enrichment of crops to overcome economic and health consequences of vitamin and mineral deficiencies in humans. Biofortification of crops is an alternative solution to alleviate the burden of malnutrition.

New plant-breeding technologies, including the development of genome-edited and genetically modified crops, are one cost-effective solution to alleviating food insecurity, particularly as a result of climate change (Shoeb *et al.*,2022).

Potato (*Solanum tuberosum* L.) is emerging as one of the important food crops in India accounting for 11.3% of the total global potato area and contributing 12.5% to the global potato production. In 2019-2020, India harvested more than 51.3 million tons of potatoes from 2.16 million hectares of cropped area with an average production of 23.77 tons/ha (Food and Agriculture Organization, 2022).

2. Biofortification

Biofortification in potato refers to the process of enhancing the nutritional content of potatoes through conventional breeding techniques or genetic engineering. The aim is to increase the levels of essential nutrients such as vitamins, minerals, and antioxidants in potato tubers, thereby improving their nutritional value and addressing deficiencies in the human diet.

Iodine deficiency is still a major problem around the world despite widespread preventative efforts. Increasing the iodine content of crops, particularly potatoes, can aid in supplying the dietary component that is required. This study used foliar and soil sprays of iodine compounds to assess the effectiveness of iodine biofortification in potatoes. KI was applied to the soil and KIO_3 was applied topically up to a rate of 2.0 kg I ha^{-1}. The outcomes demonstrated that while yield and dry matter were unaffected, both techniques raised the iodine content of potato tubers. At 2.0 kg I ha^{-1}, foliar spraying with KIO_3 produced the best results. Up to 25% of the Recommended Daily Allowance of iodine may be found in biofortified potatoes, making them an important nutritional source. (Ledwożyw-Smoleń *et.al*., 2020).

Two billion people worldwide suffer from "hidden hunger," or inadequate intake of micronutrients, which can have serious health consequences. One major worry is folate deficiency, which is known to cause birth abnormalities in at least a quarter of a million people each year. Increasing the amount of naturally occurring folates in crops through biofortification is an effective and economical way to address this shortage. While it has been effective to introduce genes for folate biosynthesis in rice and tomatoes, this has not been enough to raise the levels of folate in potatoes. This work shows that including downstream genes involved in mitochondrial folate production increases potato folate levels by a factor of 12 and maintains stability over storage. This strategy can be used as a paradigm to develop potato cultivars high in folate for communities at risk of low folate levels. (De Lepeleire *et.al*., 2018).

2.1 strategies employed in potato biofortification:

1. Increased Vitamin Content: Breeding programs focus on selecting potato varieties with naturally higher levels of key vitamins such as vitamin C, vitamin B6, and provitamin A (beta-carotene). These varieties are then further developed to improve their nutritional profiles through selective breeding.

2. Mineral Enrichment: Efforts are made to breed potatoes with enhanced mineral content, particularly minerals like iron, zinc, and potassium. This is achieved by selecting and breeding varieties with higher uptake and accumulation of these minerals from the soil.

3. Antioxidant Enhancement: Breeding for increased levels of antioxidants such as phenolic compounds and flavonoids in potato tubers aims to improve their health-promoting properties, including their ability to neutralize harmful free radicals in the body.

4. Disease Resistance: In addition to nutritional enhancements, biofortification efforts may also focus on developing potato varieties with improved resistance to diseases and pests. This helps ensure that the nutritional gains achieved through biofortification are sustained in the face of agricultural challenges.

5. Genetic Engineering: Genetic engineering techniques are utilized to introduce specific genes responsible for the synthesis or accumulation of desired nutrients into potato plants. For example, genes encoding enzymes involved in the biosynthesis of provitamin A or iron uptake transporters may be introduced to enhance the nutritional content of potato tubers.

Biofortified potatoes have the potential to play a significant role in addressing malnutrition and improving public health, particularly in regions where potatoes are a dietary staple. By increasing the nutritional value of this important food crop, biofortification contributes to efforts to combat hidden hunger and promote sustainable food systems. However, careful consideration must be given to safety, regulatory, and ethical considerations associated with the use of genetically modified organisms in food production.

2.2 Methods of biofortification

Biofortification involves various methods aimed at enhancing the nutritional content of crops. Here are some key methods used in biofortification:

1. Conventional Breeding: Traditional breeding techniques involve selecting and crossing plants with desirable traits, such as higher nutrient content, to develop new varieties with improved nutritional profiles. This method relies on natural genetic variation within crop populations.

Biofortification enhances the vitamin and mineral content of crops through plant breeding or agronomic practices. In the past 15 years, conventional breeding has led to the development of staple crops rich in zinc, iron, and vitamin A, with over 15 million people in developing countries growing and consuming biofortified crops. Nutrition research supports that biofortified varieties provide essential micronutrients and help reduce deficiencies. Farmers and consumers value the production and consumption qualities of these crops, even without awareness of their nutritional benefits. Further development and distribution of biofortified crops can combat hidden hunger, particularly in rural areas reliant on staple food crops. Future efforts focus on boosting supply and demand for biofortified staples and targeting crop-country combinations with the highest nutritional impact. (Saltzman *et. al.*, 2017).

2. **Genetic Engineering:** Genetic engineering involves the manipulation of an organism's genome to introduce or modify specific genes associated with desired traits. In biofortification, genes encoding enzymes or transporters involved in the synthesis, uptake, or accumulation of nutrients are introduced into crop plants to enhance their nutritional content.

The global food system fails to provide sufficient healthy and nutritionally balanced food to underprivileged populations, leading to micronutrient malnutrition, particularly for minerals like iron and zinc, and vitamin A. In developing countries such as India, cereal-heavy diets and limited food variety result in vitamin A deficiency (VAD), causing child deaths and subclinical VAD in preschoolers and mothers. Although existing nutrition programs offer vitamin A supplementation, they do not reach all affected populations. Biofortification through biotechnology provides a cost-effective, sustainable method for mitigating VAD. Genetic engineering can enhance β-carotene levels in crops, as demonstrated in 'golden rice.' Transgenic crops like maize, tomato, cassava, potato, and mustard with increased provitamin A content have been developed. ICRISAT's transgenic groundnut and pigeonpea, which carry maize and tomato genes, exhibit higher carotenoid and β-carotene levels, potentially benefiting affected populations through improved nutrition. (Bhatnagar *et.al.*, 2011).

3. **Transgenic Approaches**: Transgenic methods involve the insertion of specific genes from unrelated organisms into the genome of the target crop to confer desired traits. For biofortification, genes encoding proteins involved in nutrient synthesis, uptake, or accumulation may be introduced into crop plants to enhance their nutritional content.

Micronutrient malnutrition is a major concern in developing countries, particularly in Asia and Africa, impacting millions of schoolchildren and pregnant women. The reliance on carbohydrate-heavy, nutrient-poor diets increases the risk of malnutrition among the poor. High-yielding but nutrient-deficient crops have exacerbated the issue. While supplementation and fortification can improve nutrition security, they are not always feasible or affordable. Genetic biofortification of crops offers a targeted, one-time solution to combat micronutrient malnutrition. Traditional breeding methods face limitations due to insufficient genetic variation and challenges in regulating gene expression for nutrient accumulation. Biofortification through genetic engineering presents a promising approach to address hidden hunger, especially when traditional breeding is less effective due to limited genetic variability. This technique allows for the swift and precise development of nutrient-rich crops without recurring costs. (Kumar *et. al.,* 2019).

4. **Biofortification Through Agronomic Practices**: Agronomic practices such as soil amendment, fertilizer application, and irrigation management can indirectly influence the nutritional content of crops by affecting nutrient availability and uptake. For example, applying micronutrient-rich fertilizers or utilizing biofertilizers can enhance the nutrient content of crops grown in nutrient-deficient soils.

By employing these methods, researchers and breeders can develop crop varieties with enhanced nutritional profiles, addressing nutrient deficiencies and improving public health outcomes. Each method has its advantages and limitations, and the choice of approach depends on factors such as the target nutrient, crop species, and desired trait outcomes.

Lettuce, often grown in hydroponic systems, can be biofortified with zinc (Zn) to help alleviate nutritional deficiencies in vulnerable populations. A study examined the effects of Zn concentration in nutrient solutions on the growth and biofortification of lettuce cultivars 'Vanda' and 'Saladela,' testing Zn levels of 0.3, 1.0, 1.7, and 2.4 mg/L. Measurements included plant diameter, leaf count, fresh and dry mass, chlorophyll index, Zn content, and Zn accumulation. 'Vanda' exhibited the largest diameter and higher aerial mass, while 'Saladela' had more leaves. At 2.4 mg/L Zn, Zn content in leaves and roots was 733.3 and 2441 mg/kg, respectively, with accumulations of 931.66 and 4890 mg/plant. 'Saladela' showed higher Zn content and accumulation, and increased Zn levels did not affect fresh or dry mass. The study demonstrated the potential for agronomic biofortification of hydroponically grown lettuce using the nutrient film technique. (de Lima *et. al.*,2023).

3. Success of Biofortification

Biofortification in potatoes has shown significant success in enhancing the nutritional content of this important crop. Some key successes include:

1. **Increased Vitamin Content:** Biofortified potato varieties have been developed with higher levels of essential vitamins such as vitamin C, vitamin B6, and provitamin A (beta-carotene). These varieties offer improved nutritional value, addressing deficiencies in these vitamins in the human diet.

2. **Enhanced Mineral Content:** Biofortified potato varieties have been bred to accumulate higher levels of minerals like iron, zinc, and potassium in their tubers. This addresses deficiencies in these essential minerals and contributes to improved overall nutrition.

3. **Disease Resistance:** Some biofortified potato varieties also exhibit improved resistance to diseases and pests, ensuring that the nutritional gains achieved through biofortification are sustained even in challenging agricultural conditions. This helps to maintain the health and productivity of potato crops.

4. **Increased Consumer Acceptance:** Biofortified potatoes have gained acceptance among consumers, who recognize the value of these varieties in improving their nutritional intake and overall health. Increased consumer demand for biofortified potatoes encourages further research and development in this area.

5. **Impact on Public Health:** The adoption of biofortified potato varieties has the potential to have a significant impact on public health, particularly in regions where potatoes are a dietary staple. By addressing nutrient deficiencies, biofortified potatoes contribute to reducing the prevalence of hidden hunger and improving overall nutritional status.

6. **Environmental Sustainability:** Biofortified potato varieties that exhibit traits such as disease resistance and improved nutrient uptake can contribute to sustainable agriculture practices. Reduced reliance on chemical inputs and improved crop resilience can lead to environmental benefits such as reduced pesticide use and enhanced soil health.

Although biofortification in potatoes has seen success, continuous research and development are essential to further improve nutritional content and address regional and population-specific nutrient deficiencies. Factors such as safety, regulatory approval, and consumer acceptance are crucial for the successful introduction of biofortified potato varieties. Iron, a vital nutrient for human and animal health, remains a focus of efforts to enhance plant-based diets, even though outcomes haven't always been optimal. This overview examines current approaches and future plans, emphasizing advancements in iron biofortification across various crops. Overcoming plant morphological, physiological, and metabolic challenges is key to increasing micronutrient levels, while considering environmental factors that may hinder biofortification efforts (Vasconcelos *et.al.*, 2017).

Table 1: Biofortification in vegetable crop

Crop	Biofortified element/ Mineral/ Vitamin	References
Tomato	Carotenoids	Meng *et al.* (2022)
Potato	Iron	Singh *et al.* (2022)
Onion	Selenium	Mobini *et al.* (2019)
Cassava	Iron and zinc	Okwuonu *et al.* (2021)
Sweet potato	Carotene	Pati *et al.* (2021)
Carrot	ß-Carotene	Prasad *et al.*(2020)

4. Recent advances in seed tuber production of potato

4.1 Seed plot technique in potato cultivation has focused on optimizing the production of high-quality seed tubers while minimizing the risk of disease transmission. Seed plot technique involves planting disease-free mini-tubers or small seed tubers in densely spaced plots to produce larger quantities of uniform, healthy seed tubers. Advances in this technique include the use of precision agriculture technologies, such as drone mapping and automated planting, to enhance plot management and tuber uniformity. Researchers have also explored the impact of various agronomic practices, such as nutrient management and irrigation, on seed tuber yield and quality. Additionally, new strategies for disease control, such as the use of biofungicides and genetic resistance, have been investigated to maintain the health of seed plots. These research efforts aim to improve the efficiency, sustainability and scalability of seed plot technique, ultimately contributing to higher productivity and resilience in potato cultivation.

At 27.72 tons/ha, positive selection seed produced the best yield, matching that of certified and SPT seed. On the other hand, farm-saved seed exhibited greater PVY (≥8%), PLRV (7.33%), and PMV (4.17%) infection rates. Potatoes grown using the seed plot approach and positive selection have proven to be the most effective substitutes for certified seed. The study was carried out in 2015–2016 at the Plant Pathology Department's research field and postgraduate laboratory at Hajee Mohammad Danesh Science and Technology University, Dinajpur. Its goal was to determine the best way for farmers to grow seed potatoes that are saved from the farm. The trial contrasted certified, positive selection, seed plot technique (SPT), and TLS seed potatoes with farm-saved seed potatoes. (Hudaa *et.al.*, 2021).

4.2 True potato seed (TPS) technology has shown promise in revolutionizing potato cultivation by offering a more efficient and cost-effective alternative to traditional seed tubers. TPS is the use of botanical seeds for potato propagation, allowing for easier storage, transportation, and handling compared to bulky and perishable seed tubers. Researchers have focused on developing TPS varieties with desirable traits such as disease resistance, high yield potential, and uniformity in tuber size and shape. Advances in breeding techniques, including hybridization and molecular marker-assisted selection, have accelerated the development of superior TPS varieties.

Moreover, TPS technology has the potential to improve the sustainability of potato production by reducing the risk of disease transmission and minimizing the need for chemical treatments. It also offers greater accessibility to smallholder farmers in remote regions, as TPS can be produced locally and more economically. Future research aims to optimize agronomic practices for TPS-based cultivation and enhance the adoption of TPS technology globally. This promising approach may play a key role in ensuring food security and meeting the growing demand for potatoes worldwide.

The study conducted from 1989 to 1991 examined the use of true potato seed (TPS) as a budget-friendly alternative to traditional seed tubers for potato cultivation. High plant density in nursery beds and improved management led to increased seedling tuber yields. The average yield of 10 TPS progenies was 8.1 kg/m2, ranging from 3.9 to 12.6 kg/m2, with an average tuber count of 367/m2 (range: 222 to 533/m2) during the long rain cropping season, with similar results found during the subsequent short rain season. Transplants from 9 TPS progenies produced yields between 18.2 and 95.3 t/ha, with an average yield of 57.0 t/ha. The mean fresh tuber weight ranged from 36 to 90 g, averaging 45 g, akin to conventionally grown improved potato varieties. TPS progenies displayed uniform foliage and tuber traits with minimal genetic variation. Open-pollinated (OP) tuber yields matched those of top hybrid progenies. Seedling tubers from TPS performed as well as traditional tubers, suggesting TPS's potential as a cost-effective, low-risk choice for future potato cultivation (Sikka *et.al.*, 1991).

4.3 Apical rooted cuttings represent a novel approach to potato propagation, offering a viable alternative to traditional seed tubers. This method involves the cultivation of potato plants from the apical tips of potato shoots, which are rooted to produce clonal plants. Research has shown that apical rooted cuttings can yield uniform, disease-free plants, contributing to improved potato production efficiency and quality.

Advantages of this technique include the rapid multiplication of high-quality planting material and reduced risk of transmitting soil-borne pathogens and viruses. Additionally, apical rooted cuttings enable precise genetic control, ensuring the production of plants with desired traits such as disease resistance and yield potential. This method also facilitates the storage and transportation of planting material, making it accessible to a wider range of growers.

Further research focuses on optimizing protocols for apical rooted cuttings, including nutrient management, rooting hormone application, and growing conditions. As the method gains adoption, apical rooted cuttings could play a significant role in sustainable potato production and food security.

Potato yields in Malawi are low due to the lack of high-quality seed tubers and the absence of a potato seed certification program, resulting in farmers achieving yields of less than 7 t/ha compared to the potential 40 t/ha. In response, a study was conducted to evaluate aeroponics for minituber production in Malawi using in vitro plantlets and apical stem cuttings from three clones (CIP381381.13, CIP381381.20, and CIP395016.6) as source materials in a greenhouse aeroponic setup. The experiment was a completely randomized design with two factors and four replicates. Data collection included plant survival rates, root length, plant height, number of minitubers per plant, time to first tuberization, harvest frequency, and tuber weights. First tuberization occurred 28 days post-transplant for both material sources, and the results indicated that in vitro plant material produced significantly more seed potato tubers per plant (24.3) compared to apical stem cuttings (3.4) ($p<0.05$). Among the in vitro clones, CIP381381.13 yielded notably higher tuber counts (30.0 per plant) than the other clones. These findings suggest that in vitro plantlets could be a promising option for seed potato tuber production under aeroponics in Malawi (Nikmatullah *et.al.*, 2018).

5. Conclusion

Biofortification and potato seed tuber production are critical areas of research that contribute significantly to improving the nutritional value, productivity, and sustainability of potato cultivation. Biofortification enhances the nutrient content of potatoes, addressing dietary deficiencies and promoting better health outcomes for consumers. Meanwhile, advances in potato seed tuber production, such as the use of tissue culture and aeroponics, ensure the availability of high-quality, disease-free planting material for growers.

Together, these efforts play a key role in enhancing food security, supporting rural economies, and promoting sustainable agricultural practices. Continued research and collaboration among scientists, policymakers, and industry stakeholders are essential for maximizing the impact of these innovations and meeting the growing global demand for potatoes.

References

Bhatnagar, M., Bhatnagar-Mathur, P., Reddy, D.S., Anjaiah, V. and Sharma, K.K., 2011. Crop biofortification through genetic engineering: present status and future directions.

De Lepeleire, J., Strobbe, S., Verstraete, J., Blancquaert, D., Ambach, L., Visser, R.G., Stove, C. and Van Der Straeten, D., 2018. Folate biofortification of potato by tuber-specific expression of four folate biosynthesis genes. *Molecular Plant*, *11*(1), pp.175-188.

de Lima, B.M., Noboa, C.S., de Lima, F.M., Mello, S.D.C., Purquerio, L.F.V. and Sala, F.C., 2023. Agronomic biofortification with zinc in hydroponically cultivated lettuce. *Australian Journal of Crop Science*, *17*(2), pp.198-205.

Hudaa, M.S., Islamb, M.R., Hannanc, A., Islamd, S. and Hossaind, S.M.M., 2021. Seed quality assessment of farmer’s produced seed potato. *Plant Physiology and Soil Chemistry*, *1*(2), pp.41-44.

Kumar, S., Palve, A., Joshi, C. and Srivastava, R.K., 2019. Crop biofortification for iron (Fe), zinc (Zn) and vitamin A with transgenic approaches. *Heliyon*, *5*(6).

Ledwożyw-Smoleń, I., Smoleń, S., Rożek, S., Sady, W. and Strzetelski, P., 2020. Iodine biofortification of potato (Solanum tuberosum L.) grown in field. *Agronomy*, *10*(12), p.1916.

Meng, F., Li, Y., Li, S., Chen, H., Shao, Z., Jian, Y., Mao, Y., Liu, L. and Wang, Q., 2022. Carotenoid biofortification in tomato products along whole agro-food chain from field to fork. *Trends in Food Science & Technology*, *124*, pp.296-308.

Mobini, M., Khoshgoftarmanesh, A.H. and Ghasemi, S., 2019. Biofortification of onion bulb with selenium at different levels of sulfate. *Journal of plant nutrition*, *42*(3), pp.269-277.

Nikmatullah, A., Ramadhan, I. and Sarjan, M., 2018. Growth and yield of apical stem cuttings of white potato (Solanum tuberosum L.) derived from disease-free G 0 plants. *Journal of Applied Horticulture*, *20*(2).

Okwuonu, I.C., Narayanan, N.N., Egesi, C.N. and Taylor, N.J., 2021. Opportunities and challenges for biofortification of cassava to address iron and zinc deficiency in Nigeria. *Global Food Security*, *28*, p.100478.

Pati, K., Chauhan, V.B.S., Bansode, V.V. and Nedunchezhiyan, M., 2021. Biofortification in sweet potato for health and nutrition security. *Recent Advances in Root and Tuber Crops. Brillion Publishing House, New Delhi*, pp.21-30.

Prasad, R. and Shivay, Y.S., 2020. Agronomic biofortification of plant foods with minerals, vitamins and metabolites with chemical fertilizers and liming. *Journal of Plant Nutrition*, *43*(10), pp.1534-1554.

Saltzman, A., Birol, E., Oparinde, A., Andersson, M.S., Asare-Marfo, D., Diressie, M.T., Gonzalez, C., Lividini, K., Moursi, M. and Zeller, M., 2017. Availability, production, and consumption of crops biofortified by plant breeding: current evidence and future potential. *Annals of the New York Academy of Sciences*, *1390*(1), pp.104-114.

Shoeb, E. and Hefferon, K., 2022. Crop biofortification and food security. In *Plant nutrition and food security in the era of climate change* (pp. 423-436). Academic Press.

Sikka, L.C., Bhagari, A.S., Ssebuliba, J.M. and Kanzikwera, R., 1991, October. Potato production from true potato seed. In *Symposium on Tropical Root Crops in a Developping Economy 380* (pp. 484-489).

Singh, B., Goutam, U., Kukreja, S., Siddappa, S., Sood, S., Sharma, J. and Bhardwaj, V., 2022. Biofortification strategies to improve iron concentrations in potato tubers: lessons and future opportunities. *Potato Research*, *65*(1), pp.51-64.

Tsoka, O., Demo, P., Nyende, A.B. and Ngamau, K., 2012. Potato seed tuber production from in vitro and apical stem cutting under aeroponic system. *African Journal of Biotechnology*.

VanderZaag, P., Pham, T.X., Demonteverde, V.E., Kiswa, C., Parker, M., Nyawade, S., Wauters, P. and Barekye, A., 2021. Apical rooted cuttings revolutionize seed potato production by smallholder farmers in the tropics. *Solanum tuberosum-A Promising Crop for Starvation Problem*, pp.1-19.

Vasconcelos, M.W., Gruissem, W. and Bhullar, N.K., 2017. Iron biofortification in the 21st century: setting realistic targets, overcoming obstacles, and new strategies for healthy nutrition. *Current opinion in biotechnology*, *44*, pp.8-15.

Zaheer, K. and Akhtar, M.H., 2016. Potato production, usage, and nutrition—a review. *Critical reviews in food science and nutrition*, *56*(5), pp.711-721.