



Improvement of nutritional quality of food crops with fertilizer: a global meta-analysis

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Abstract

Providing the world's population with sufficient and nutritious food through sustainable food systems is a major challenge of the twenty-first century. Fertilizer use is a major driver of crop yield, but a comprehensive synthesis of the effect of fertilizer on the nutritional quality of food crops is lacking. Here we performed a comprehensive global meta-analysis using 7859 data pairs from 551 field experiment-based articles published between 1972 and 2022, assessing the contribution of fertilization with a wide set of plant nutrients to the nutritional quality of food crops (i.e., fruits, vegetables, cereals, pulses/oil crops, and sugar crops). On average, fertilizer application improved crop yield by 30.9% (CI: 28.2–33.7%) and nutritional quality (referring to all nutritionally relevant components assessed: carbohydrates, proteins, oil, vitamin C, representative mineral nutrients, and total soluble solids) by 11.9% (CI: 10.7–12.1%). The improvements were largely nutrient- and crop species dependent, with vegetables being the most responsive. Potassium, magnesium, and micronutrients played important roles in promoting crop nutritional quality, whereas the combined application of inorganic and organic source(s) had the greatest impact on quality. Desirable climatic conditions and soil properties (i.e., silt loam, soil organic matter 2.5–5.0%, and pH 4.5–8.5) supported further enhancements. Considering cross-continent responsiveness, the increase in the nutritional quality of food crops with fertilizer application was greatest in Africa. In a nutshell, our findings pave the way towards a quantitative understanding of nutrient management programs and responsible plant nutrition solutions that foster the sustainable production of nutritious and healthy food crops for human consumption.

Keywords Soil and environmental conditions · Soil fertility and plant nutrition · Agriculture production · Biofortification · Human health · Food security

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Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper

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Table of Contents Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper

1. Understanding the eBook Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - The Rise of Digital Reading Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - Advantages of eBooks Over Traditional Books
2. Identifying Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - User-Friendly Interface
4. Exploring eBook Recommendations from Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - Personalized Recommendations
 - Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper User Reviews and

Ratings

- Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper and Bestseller Lists

5. Accessing Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper Free and Paid eBooks

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- Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper eBook Subscription Services
- Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper Budget-Friendly Options

6. Navigating Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper eBook Formats

- ePub, PDF, MOBI, and More
- Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper Compatibility with Devices
- Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper Enhanced eBook Features

7. Enhancing Your Reading Experience

- Adjustable Fonts and Text Sizes of Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
- Highlighting and Note-Taking Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
- Interactive Elements Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper

8. Staying Engaged with Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper

- Joining Online Reading Communities
- Participating in Virtual Book Clubs
- Following Authors and Publishers Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper

9. Balancing eBooks and Physical Books Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - Setting Reading Goals Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - Fact-Checking eBook Content of Improvement Of Nutritional Quality Of Food Crops Fao Plant Production And Protection Paper
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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