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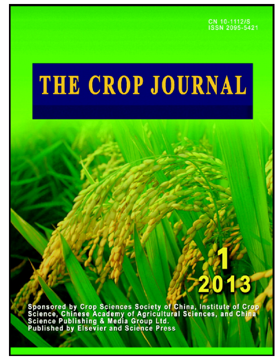

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Mineral concentrations of chickpea and lentil cultivars and breeding lines grown in the U.S. Pacific Northwest

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Abstract: Diseases and health complications caused by mineral deficiencies afflict billions of people globally. Developing pulse crops with elevated seed mineral concentrations can contribute to reducing the incidence of these deficiencies. The objectives of this study were to estimate variance components conditioning seed mineral concentrations of chickpea and lentil grown in Washington and Idaho, determine correlations between different mineral concentrations and between mineral concentrations and yield, 100-seed weight, and days to flowering, and compare seed mineral concentrations between chickpeas and lentils grown in adjacent plots. Genotype effects, although significant in chickpea and lentil for all minerals except selenium, tended to be minimal compared to location, year, and their interaction effects. In both chickpeas and lentils high positive correlations were observed between seed concentrations of phosphorus and potassium, phosphorus and zinc, and potassium and zinc. Correlations between mineral concentration and yield, and mineral concentration and days to 50% flowering were similar for chickpeas and lentils across the majority of minerals. These results may reflect similarities between the two crops in physiological processes for mineral uptake and partitioning. Lentils had higher concentrations of iron and zinc than chickpea when the two crops were grown in adjacent plots, whereas chickpeas had higher concentrations of calcium and manganese. Plant genotypes that are more efficient at obtaining minerals from growing environments will be useful as parental materials to develop improved chickpea and lentil cultivars that have good yield potential coupled with high seed mineral concentrations.

Keywords: Chickpea; Lentil; Mineral; Nutrition; Pulse

1. Introduction

Dietary mineral deficiencies impair the health of over three billion people globally, and are responsible for illnesses and deaths during all stages of development from infancy through adulthood [1]. It is estimated that two billion people globally suffer from iron deficiency [2]. Iron deficiency during pregnancy causes increases in premature deliveries, low birth weights, and maternal deaths, while deficiency during infancy and early childhood can reduce physical growth and development of cognitive functions [1]. Humans also suffer considerably from diseases caused by zinc deficiency. Adequate levels of zinc are essential to fetal development, healthy birth, and subsequent physical growth [3]. Approximately one billion people globally are estimated to be at risk of zinc deficiency [4], primarily in sub-Saharan Africa and southeast Asia [4]. In Bangladesh, over 100 million people are at risk of arsenicosis associated with dietary selenium deficiency [5]. Diets deficient in selenium have been associated with a higher incidence of prostate cancer [6].

Mineral deficiencies can often be treated by dietary consumption of mineral supplements or fortified foods [7]. Unfortunately, in regions such as sub-Saharan Africa and southwest Asia that are strongly affected by mineral deficiencies [8], various socioeconomic constraints can limit availability of mineral supplements and fortified

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