Select microgreens in custom diet may help deliver desired nutrients

August 30 2023, by Jeff Mulhollem

In this study, Francesco Di Gioia, assistant professor of vegetable crop science, and his colleagues at the U.S. Horticultural Research Laboratory looked at the mineral content of different microgreens. Credit: Penn State

A diet including a carefully selected assortment of microgreens may help address an individual's nutritional deficiencies, according to a Penn State researcher who led an international team that evaluated the mineral content in young specimens of many different plant species.

"Under controlled environmental conditions, we grew 17 different species of microgreens—which are simply the young seedlings of edible plants—belonging to seven different botanical families, and we analyzed those for their yield performance," said Francesco Di Gioia, assistant professor of vegetable crop science and lead author on the study. "We determined their nitrate content and the mineral profile, considering both macronutrients and micronutrients, for each species."

He added that macronutrients are the nutrients the body requires in large amounts, such as carbohydrates, proteins and fats, while micronutrients are those required in smaller amounts, such as minerals and vitamins. The researchers recently published their findings in *Frontiers in Plant Science*.

Di Gioia's research group in the College of Agricultural Sciences at Penn State, has studied microgreens for 15 years, evaluating sustainable cultivation techniques of the immature plants and their nutritional value. Lately, Di Gioia's lab has focused on the potential of microgreens as a nutrition security resource in emergency situations and as a strategy for surviving a global catastrophe, such as an all-out nuclear war, large asteroid strike or a supervolcano eruption. Those events would endanger agricultural productivity by reducing sunlight and temperature, disrupting rainfall patterns and contaminating water supplies.

However, in this research, he and his colleagues at the U.S. Horticultural Research Laboratory examined the mineral content of the microgreens, with an eye toward whether microgreens could be used to enrich the diet of people who need high levels of certain minerals to address health

concerns. Microgreens have emerged as a much-loved, tasty garnish at restaurants, grocery stores and farmers markets, but they also can offer high levels of targeted nutrients, Di Gioia noted.

Researchers are shown here seeding microgreens. At harvest—10 to 19 days after sowing, depending on the species—they measured yield components and analyzed dry tissue samples for the concentrations of 13 nutrients. Credit: Penn State

"The idea is that you could choose microgreens based on your need in terms of minerals, or you could mix them to have a good balance

between different minerals," he said. "Microgreens are considered nutrient dense. Many people are willing to pay extra for them because of their nutritional value and their contribution to a particular dietary regime."

In the study, the researchers reported that they tested the following microgreens for minerals: garnet red amaranth, scallion, black oil sunflower, borage, arugula, broccoli, red cabbage, Cressida cress, red Russian kale, mizuna America, garnet giant mustard, red arrow radish, bull's blood beet, dark opal basil, Genovese basil, Britton shiso and lemon balm.

At harvest—10 to 19 days after sowing, depending on the species—the researchers measured yield components and analyzed dry tissue samples for the concentrations of nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, sodium, iron, zinc, manganese, copper, boron and nitrates.

"There is a debate about nitrate because traditionally it has been considered an anti-nutrient due to negative effects it can induce, in children especially," Di Gioia said. "On the other hand, lately, we have seen evidence that nitrates promote blood circulation and are considered beneficial, particularly for athletes."

Variations in plant families were observed for all of the examined parameters, according to the researchers. Nitrogen and potassium were the principal macronutrients found in the microgreens tested, followed in order by calcium, phosphorus, sulfur and magnesium. Except for sunflower, all the tested species accumulated high or very high nitrite levels.

Eight of the studied species had high potassium concentrations and could be considered as a good dietary source of potassium. Another four

species of microgreens—scallion, red cabbage, amaranth and Genovese basil—rated as good sources of calcium. Among microminerals, the most abundant across all microgreens was iron followed by zinc, manganese, boron and copper.

Sunflower, scallion and Britton shiso were found to be good sources of copper. Sunflower was a good source of zinc, whereas none of the other species examined could be considered a good source of iron or zinc. That indicates, the researchers suggested, that supplementary fertilization may be required to biofortify microgreens with essential microminerals. Microminerals are minerals required in the diet in relatively small amounts.

More information: Francesco Di Gioia et al, Yield performance, mineral profile, and nitrate content in a selection of seventeen microgreen species, *Frontiers in Plant Science* (2023). DOI: 10.3389/fpls.2023.1220691

Provided by Pennsylvania State University