

## **Brassicas in sustainable production and organic farming**

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Brassica plant species show some characteristics in their use of plant nutrients which make them different from most other crops. These characteristics often make brassicas difficult to grow in low-input systems with limited nutrient availability, but at the same time they also make some brassica species valuable tools for reducing nitrate leaching losses and improving N management in farming systems.

Brassicas tend to have high N contents in their leaf tissues compared to most other crop species, and their growth and development can be strongly affected even by moderate N limitation. Therefore brassica crops are fertilized heavily, and often receive more N fertilizer than they are able to take up. After harvest N rich crop residues are often left in the field. Together this leads to a high risk of N leaching loss after harvest of brassica crops.

On the other hand, we have found that brassica species have faster root growth than other crop species. Except for brassica crops with a very short growing period, they can therefore reach greater rooting depths than other crops. We have found that brassica crops with long growing seasons such as winter rape, head cabbages, or curly kale can grow roots to more than 2.5 m depth in the field, and can have a significant N uptake from soil layers below 2 m. Similar results have been found e.g. fodder radish grown as catch crops after harvest of a main crop, in order to reduce nitrate leaching losses. The very deep rooting make these brassicas valuable tools for reducing N leaching loss, as they can take up N which has already been leached to considerable depth in the soil, and which is out of reach of the root systems of most other crops.

The value of brassica species for managing the N cycle in the field is further enhanced by the high N content in their leaf tissue, as it gives them a high total N uptake potential, and allows them to effectively deplete the soil within their root zone of available N. The high leaf N content also leads to fast N release from plant residues when the crop dies, and as mentioned above, this can be a problem as it leads to high N leaching risk after harvest of brassica crops. But when brassicas are grown as catch crops and incorporated into the soil at an optimal time, this leads to a higher and faster release of N for the succeeding crop than when growing most other catch crops. Thereby brassica species are ideal for farmers trying to improve their N management, as they can effectively take up a lot of N from the soil, protect it from leaching loss during winter, and then release much of it to fertilize the next main crop.