

Abstract

Endive (*Cichorium endivia* L.) is a leafy vegetable mainly used in ready-to use salads. Nitrate accumulation, is a serious problem in this type of vegetables, because when ingested, nitrate has toxic effects in the human health. Solar radiation, nitrogen fertilization and temperature are some factors that affect nitrate concentration in leaves. 'Tipburn', bolting and 'glassines' are some physiological disorders that appears in endives and impairs their marketable quality. 'Tipburn' is characterized by necrosis on the outside of leaves, and 'glassines' is associated with oil spots on leaves.

In this thesis have been studied the influence of different environmental factors (temperature, relative humidity), nitrogen fertilization and cultivar in the nitrate accumulation, the incidence of physiological disorders and marketable production. Also, we studied the correlations between different parameters in order to know, with some of this, if the chlorophyll meters SPAD-502 and the colorimeter could be useful for estimating indirectly nitrate and nitrogen content in endives.

Different experiments were realized using broad-leaved endive cultivars ('Cuartana', 'Natacha', 'Santel') that were cultivated in open-field and in greenhouse with different humidity levels in different seasons.

Regarding nitrogen fertilization, the experiments were separated in two groups. In the first group the $\text{NH}_4^+/\text{NO}_3^-$ ratio was modified, increasing the percentage of nitrogen applied in ammonium form (0, 5, 10, 20%). In the second, three nutrient solutions were applied. In these solutions, a part of the nitrates were replaced by chloride (0, 20, 40% of total nitrogen).

Periodically, the chlorophyll content (extracted by acetone and measured with a chlorophyll meter SPAD-502), color parameters, nitrate concentration (reflectometry), total nitrogen (Kjeldahl) and phosphorus were determined. Also nitrate reductase activity was measured. At the end of each cycle the production and the incidence of physiological disorders were determined.

Results showed that cv. 'Cuartana' was more resistant to 'tipburn'. The hottest cycles and greenhouse favored the incidence of 'tipburn', but increasing the relative humidity we achieved reduced it. Cv. 'Santel' presented the highest susceptibility to bolting in conditions of short photoperiod. 'Glassines' was favored by low relative humidity, and cv. 'Cuartana' was the most susceptible.

Nitrate accumulation was higher in spring-summer cycles and in greenhouse. Applying a 10-20% of ammonium with the nutrient solution and replacing part of the nitrates by chloride, nitrate concentration in endive leaves was reduced, maintaining the quality of the plants.

In the other hand, in our conditions, the chlorophyll meter SPAD-502 and the colorimeter wouldn't be useful for estimate indirectly the nitrate and nitrogen content in plants.