

## Investigating the Effects of Density and Different Nitrogen Nutritional Systems on Yield, Yield Components and Essential Oil of Fennel (*Foeniculum Vulgare Mill.*)

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**Abstract :** Fennel is of most important medicinal plants which is widely used in food and pharmaceutical industries. In order to investigate the effect of different nitrogen nutritional systems including chemical, organic and biologic ones at different plant densities on yield, yield components and seed essential oil content and yield of this valuable medicinal plant, a field experiment was carried out in 2013-2014 agricultural season at Islamic Azad University of Shoushtar agricultural college in split plot design with 18 treatments and based on completely randomized blocks design. Different nitrogen system treatments consisting of: 1. N1 or control (Uniformly spreading urea fertilizer in the plot, 50% at planting time and 50% at stem elongation), 2. N2 (Uniformly spreading 50% of urea fertilizer in the plot at planting time and spraying the other 50% of urea fertilizer at stem elongation on fennel foliage), 3. N3 or cow manure, 4. N4 or biofertilizer (Inoculation of fennel seeds with *Azotobacter* and *Azospirillum*), 5. N5 or Integrated-1 (Cow manure + uniformly spreading urea fertilizer in the plot at stem elongation), 6. N6 or Integrated-2 (Cow manure + Inoculation of fennel seeds with *Azotobacter* and *Azospirillum*) were applied to the main plots. Three fennel densities consisting of: 1. FD1 (60 plant/m<sup>2</sup>), 2. FD2 (80 plant/m<sup>2</sup>) and 3. FD3 (100 plant/m<sup>2</sup>) were applied to subplots. Results showed that all of the traits were significantly affected by applied treatments (P 0.01). The interaction between treatments also were significant at 5 percent level for shoot dry weight and at 1 percent level for other traits. Based on the results, using the Integrated-1 treatment at 100 plant per m<sup>2</sup> produced 94.575 g/m<sup>2</sup> seed yield containing 3.375 percent of essential oil. Utilization of such combination not only could lead to a desirable fennel quantity and quality, but also is more consistent with environment.

**Keywords :** fennel (*foeniculum vulgare mill.*), nutritional system, nitrogen, biofertilizer, organic fertilizer, chemical fertilizer, density

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