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بلاگ مرکز اطلاعات علمی



عضویت در خبرنامه



فیلم های آموزشی

## کارگاه های آموزشی مرکز اطلاعات علمی جهاد دانشگاهی



آموزش آنلاین ابزار پژوهش کمی (کاربره نرم افزار SPSS)

کارگاه آنلاین کاربرد نرم افزار SPSS در پژوهش



مباحث پیشرفته یادگیری عمیق شبکه های توجه گرافی (GAN)

مباحث پیشرفته یادگیری عمیق؛ شبکه های توجه گرافی (Graph Attention Networks)



مقاله نویسی ISI (روزه ای مهندسی)

کارگاه آنلاین مقاله نویسی ISI و IEEE و ویژه فنی و مهندسی

## The Effect of Foliar Application of Humic Acid and Nano Fertilizer (Pharmks®) on Morphological Traits, Yield, Essential Oil Content and Yield of Black Cumin (*Nigella sativa* L.)

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**Introduction:** The ever-increasing tendency to the use of medicinal plants in the world has grown concerns about their cultivation and production processes. As medicinal plants are more compatible with the nature, special interest and attention have recently been given to herb therapy, and use of medicinal plants, being limited by the rise of pharmaceutical drugs, has become again common and widespread due to a number of reasons. In a sustainable agriculture system, application of the fertilizers which are nature friendly and suitable for plants is essential. This becomes more important when dealing with medicinal plants. Doing studies over the effect of nanopharmax and humic acid fertilizer on the plant, no research findings were obtained. So, in order to use less chemical fertilizers to prevent environmental pollution and encourage farmers to use more organic fertilizer, the present study was carried out to evaluate the effect of foliar application of humic acid and nanopharmax fertilizer on the growth index, yield, yield components, essential oil content of *N. sativa*.

**Materials and Methods:** The experiment was conducted at Research Station, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran, in 2012-2013. Land preparation was done in October. The land area was 80 square meters in which three blocks were designed. Eight plots were prepared within each block and each plot was planted with 4 lines. Furrow sowing operations were carried out on October 29. The plants were thinned in 4-6 leaf stage. First irrigation after planting, and subsequent ones were done every 7 days until the end of the growing season. No herbicides were applied in this plan and weeding was done by hand. The test treatments included humic acid and nanopharmax fertilizer with the levels of 0, 1, 3 and 6 mg per liter and 0 and 1 ml per liter, respectively. Fertilizer treatments was applied at the 8-10 leaf stage and continued once every two weeks, three times until after flowering. Foliar application continued until the plants were well treated with the solution. Plant height, leaf area index, dry weight, the number of branches, and the number of capsules per plant, the number of seeds per capsule, seed weight, seed yield, biological yield, essential oil content and yield were measured. The factorial experiment was conducted in a completely randomized block design with three replications. For the variance analysis of test data and drawing graphs, Excel and *Minitab-16* software was used. All the averages data were compared at the 5 and 1% level, according to LSD test.

**Results and Discussion:** Different levels of humic acid imposed a significant effect on plant height, leaf area index, dry weight, the number of branches, and the number of capsules per plant, the number of seeds per capsule, seed weight, seed yield, biological yield, essential oil content and yield. Nano fertilizer application significantly increased the yield and essential oil content of *Nigella sativa*. Combined treatment at various levels had significant effect on dry weight, seed weight, biological yield and essential oil content and yield. According to the results, it can be concluded that the levels of 6 mg.l<sup>-1</sup> of humic acid and Nano fertilizer (Farmks®) application the treatments were more effective in the increase of growth index, yield, yield components, essential oil content on other traits. The increased seed yield affected by humic acid and nano fertilizer can be attributed to the better vegetative growth, canopy development and consequently, more appropriate use of solar radiation and high photosynthesis. Using nano fertilizer, the time and speed of nutrients dispersion is coordinated by food requirements of the plant and thus, the plant will be able to absorb the maximum amount of nutrients and therefore, while reducing the leaching of nutrients and the crop yield increases.

**Conclusion:** The results showed that the use of nano fertilizer and humic acid can have positive effects on yield components and yield of *N. sativa*. Application of nano fertilizer and humic acid concentrations of 6 mg/l showed higher yield than other treatments. Intensifying the vegetative growth, these treatments increased the yield in *N. sativa* species. The combined treatments significantly increased the seed weight, growth index, seed yield, biological yield essential oil content and yield. Therefore, on the basis of the results of current study, it sounds like that nano fertilizer and humic acid can reduce the use of chemical fertilizers and environmental

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pollution. They also play an important role in achieving the goals of sustainable agriculture.

**Keywords:** Active Substances, Medicinal Plants, Nano fertilizers, Organic Culture, Organic Fertilizers

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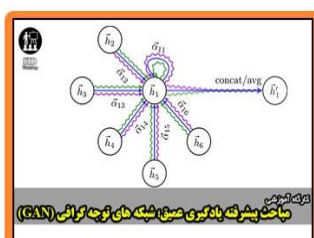
فیلم های آموزشی

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