

## **Abstract**

To investigate the effect of biological and chemical phosphorus fertilizers on the quantitative and qualitative characteristics of black cumin under drought stress in 2016, an experiment was conducted as split plot randomized complete block with three replications in University of Zabol research farm. Main plot was drought stress including: full irrigation, stop irrigation from stem elongation to the start of flowering, stop irrigation of flowering stage until seed filling and stop irrigation at the filling stage until the end of grain filling and sub factor were phosphorus fertilizers in four levels including: control (no fertilizer), phosphate-e-barvar 1, phosphate-e-barvar 2 and triple super phosphate. The results of this experiment showed that plant height, number of follicule per plant, number of seed per follicule, 1000 seed weight, grain yield, biological yield, harvest index, number of branch per plant, percentage of empty follicule per plant, chlorophyll a, chlorophyll b, total chlorophyll, carotenoids, proline, carbohydrate, Nitrogen, potassium, phosphorous, protein, percentage of oil, percentage of essential oil, essential oil yield, drought stress and fertilizer were significant. The highest grain yield is obtained in control (378.53kg/ha) and stop irrigation at flowering stage, while least grain yield was observed at stop irrigation at seed full stage. Plant grown under cutting irrigation at flowering stage had the highest percentage of essential oil, and it was 47.59% more than the control treatment. The results of fertilizer treatment showed that the highest grain yield and percentage of essential oil from biological fertilizer (phosphate B-1) were 320/47kg/h. Interaction of phosphorous fertilizer and drought stress in most traits were significant. In our studies the greatest amount of traits were related to irrigated control and biological fertilizer.

**Key words:** Phosphorous solubilizing bacteria, Essential oil, Partial irrigation, Soil applied



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**Title**

**Effects of biological and chemical phosphorus fertilizers  
on quantitative and qualitative traits of *Nigella sativa*  
under drought stress conditions**

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