

EFFECTS OF SULFUR FERTILIZER IN COMBINATION WITH THIOPHOSPHATE ON YIELD AND YIELD COMPONENTS OF CANOLA (*BRASSICA NAPUS L.*)Alireza jahany^{*1}, javad vafabakhsh², [saeid bakhtiari](#)³^{*1,3} Department of agriculture science, Nyshabour Branch, Islamic Azad University

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E-mail: alirezajahany62@yahoo.com**Introduction**

According to the importance of oilseeds, especially rapeseed, high oil level among others oilseed (about 40-45%), also the lack of information around sulfur with Thiobacillus bacteria effect on the growth and yield of rapeseed, this research with aim of the application of sulfur with Thiobacillus bacteria on yield, yield components and some morphological traits in rapeseed took place. Sulfur is the fourth major element for canola. Canola plant and its seeds have lots of protein. Rapeseed protein is made of Sulfurous simple amino acid and is produced by plants when nitrogen to sulfur ratio of 8 to 1. The sulfur also is required in the formation of chlorophyll for photosynthesis. Canola requires more sulfur and this is due to the protein content of the grains. However, to produce 3 tons of wheat only requires 12 kg of sulfur for rapeseed production about 3 times the same amount (30 kg) of sulfur is needed (Malakouti et al, 2001). Samavat (2000) announced a high sulfur requirements of canola and depending on soil type and soil sulfur status, consumption of 20 kg ha⁻¹, grain yield increased from 120 to 600 kg ha⁻¹. Sparks & Huang (2001) reported by doing experiments that the use of 50 kg ha⁻¹ sulfur can increase crop yields by up to 150 percent. The average, using of sulfur can increase content of the oil to be 3.6% (Samavat, 2000). In another study in China, Zhi-Hui et al (2010) found that the use of sulfur, bacteria Thiobacillus population increased from 2.8×10^5 to 4×10^8 within 14 days after the start of the experiment. Thiobacillus number decreased later and then to zero after 56 days. Sepahvand(2004) by studying the effect of different amounts of sulfur in soil on yield and quality of soybean concluded that consumption of 100 kg per hectare sulfur than control, increased soybean yield by about 650 kg ha⁻¹ and amount of oil and protein separated was significance on the 1% level.

Materials and Methods

This field research was performed for 2010 in Research Field of Agriculture and Natural Resources Research station of Mashhad. The average annual rainfall is 286 mm and the average annual temperature 14/5 ° C, respectively. The experiment was conducted on 2011 in Research Field of Agriculture and Natural Resources Research station of Mashhad. The experimental design was Factorial experiment in a randomized complete block design with 16 treatments and 3 replications. Treatments included 1- cultivar at two levels c1 (Modena) and c2 (Regent) 2- Sulfur at four levels of S0 (without sulfur), S1 (300 kg ha⁻¹), S2 (400 kg ha⁻¹) and s3 (500 kg ha⁻¹) and 3- Thiobacillus Bacteria at four levels of T0 (non-inoculated) and T1 (inoculation), respectively. To measure the height, two plants per plot at maturity choosed and plant height measured from crown to stem end and the average was calculated for each plant. Plant dry matter measurements did from 0.25 square meter each plot at flowering stage. Samples dried at 70 ° C for 48 h and then were weighed. At the time of maturity, the Pod weight, Pod number per plant, 1000 seed weight, Total dry matter and seed yield was measured. To determine the amount of seed oil and protein yield of each treatment, 200 g of grain were sent to the Department of Oilseeds Research. For data analysis, statistical software SAS, MSTAT-C and EXCEL software was used. Also for mean comparison Duncan test was performed.

RESULTS AND CONCLUSION

Analysis of variance results revealed significant differences among cultivars in terms of yield, plant height, pod weight, pods per plant, 1000 seed weight, total dry matter and oil yield (table 1).

In this experiment, Modena cultivar with an average yield of 3735/2 kg ha⁻¹ produce further more yield than Regent cultivar, with an average yield of 2732/3 kg ha⁻¹. Average number of pods per plant in Regent and Modena cultivars were 188/1 and 164, 1000 Seed weight were 6/08 and 7/13 gr, Maximum

total dry matter were 29/48 and 39/53 gr m⁻², the amount of oil were 1031/74 and 1433/5 kg ha⁻¹ respectively (Table 2).

Except of plant height, other treats values in Modena cultivar were higher than Regent. In study of sulfur fertilizer levels on all the indicators, no significant difference was observed. The treat with 500 kg ha⁻¹ sulfur fertilizer was at the highest levels on all traits were measured. Also different characteristics in terms of Thiobacillus bacteria appeared. Apart from seed yield, total dry matter, oil yield and protein percentage, among other traits, there was no significant difference in the effect of Thiobacillus bacteria. In study of interaction effects, only plant height was affected with interaction effect between cultivar and sulfur fertilizer in the level of one percent.

Based on survey results, the average yield per hectare in Modena was 27 percent more than the Zarfam. On the other traits except plant height, others values measured in Modena were more than Zarfam. Also, sulfur fertilizer treatment of 500 kg ha, had the highest values in the among all properties were measured. In terms of the Thiobacillus bacteria effect, except for grain yield, total dry matter yield, oil yield and protein percentage, significant differences were not showed between the other. In general, the use of sulfur and sulfur oxidizing bacteria (Thiobacillus) to improve the nutrient absorption related to various factors such as the kind and amount of sulfur used, the initial population of bacteria and soil characteristics (important of all). So before making any decision and recommendation, must be investigated its efficacy and relative benefit to take appropriate decision.

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