Bangladesh J. Bot. 43(2): 231-233, 2014 (September) **- Short communication**

EFFECTS OF MICRONUTRIENTS ON SEED YIELD AND OIL CONTENT OF *BRASSICA NAPUS* L. CV. TALAYEH

ABDOLLAH BAHRANI* AND JAFAR POURREZA

Department of Agriculture, Ramhormoz Branch, Islamic Azad University, Ramhormoz, Iran

Key words: Canola, Foliar application, Grain yield, Nutrient elements, Oil yield

Abstract

Foliar application of micronutrients like iron, zinc and manganese significantly increased 1000-kernel weight, grain yield, oil content of seed and harvest index of *Brassica napus* L. cv. Talayeh. Changes in grain yield was primarily due to the number of pod per plant and that of oil yield was due to grain yield. In general, applying two parts per thousand of the micronutrient was the best treatment to obtain high qualitative and quantitative yield in cv. Talayeh in this region.

Canola (*Brassica napus* L.) is an important oil crop, ranking third only to soybean and palm oil in global production (Muhammad *et al.* 2007). Recent research has shown that a small amount of nutrients, particularly Zn, Fe and Mn applied by foliar spraying significantly increased the yield of crops (Sarkar *et al.* 2007, Wissuwa *et al.* 2008). Narimani *et al.* (2010) reported that foliar application of microelements improved the effectiveness of macronutrients. Foliar application of microelements is more beneficial than soil application. Since application rates are lesser as compared to soil application, same application could be obtained easily and crop reacts to nutrient application immediately (Zayed *et al.* 2011). Arif *et al.* (2006) found that based on soil properties, foliar spraying could be effective 6 to 20 times as compared to soil application. Resistance to different stresses will be increased by foliar application of micronutrients (Ghasemian *et al.* 2010, Cakmak 2008). Therefore, the objective of this study was to ascertain the optimum level of some micronutrient as foliar application for higher grain yield and oil content of canola.

The studies were conducted in an arid area in west of Iran, at the Islamic Azad University of Ramhormoz, Khuzestan, Iran (31°16´ N, 49°36´ E and 150.5 m above the sea level) during 2012-2013. Iron, zinc and manganese were sprayed on leaves of plants with concentration of two parts per thousand and four parts per thousand. Foliar application of micronutrient was done two times, at first when plants had 6 or 8 leaves and second treatment was applied when these had 10 or 12 leaves (early of flowering stage). To avoid the effect of micronutrient spraying, the plots were separated by borders of 1.5 m in width from all sides. The cv. *Talayeh* of *Brassica napus* used in this experiment. NPK were added at the rate of 150 kg N/ fed as urea 46% N, 70 kg P_2O_5/ fed as simple superphosphate 25% P_2O_5 and 50 kg K_2O/fed as potassium sulphate 48% K_2O before sowing. Plots were sown on 2 November 2012 with a cone seeder, and were 6 m long and 2.4 m wide, with 12 rows 0.2 m apart. At maturity, 10 plants were taken randomly from each sub plot for recording the morphological characteristics, yield components and grain yield. The various parameters within the rapeseed plant that are discussed in this paper were evaluated as follows: Specific seed weight (average weight of 1000 seeds in grams); recorded on ten random samples from each sub-plot. Seed yield: Center eight rows (of 12 rows) of each plot were harvested for grain yield, and converted to grain yield per hectares. Harvest index: [wt. of grain/ (wt. of grain + straw)]. The oil concentration of a sample of whole seeds from each plot was determined by

*Author for correspondence: <abahrani75@yahoo.com>.

Near-infrared reflectance spectroscopy as described by Bhatty (1991). Oil yield (kg/ha); calculated by multiplying seed oil percentage × seed yield per ha. Samples were dried in a forced-air oven at 70ºC for 48 hrs. Data were analyzed by analysis of variance. When significant differences were found ($p = 0.05$) among means, Duncan's multiple range test (DMRT) were applied.

The highest number of pod per plant was related to two parts per thousand Fe, Zn and Mn and the lowest number of pod per plant belonged to the zero micronutrients (Table 1).

Foliar application of Fe, Zn and Mn on number of seed per pod was not significant. However, the highest number of seed per pod was obtained at application of four parts per thousand (Table 1).

Fe, Zn and Mn had significant effect on kernel weight at 5 % probability level. Two and four parts per thousand Fe, Zn and Mn produced the greatest values of kernel weight (Table 1). Narimani *et al.* (2010) indicated that foliar application of Zn, Mg, Mn and Fe significantly increased growth parameters, yield of durum wheat. Zeidan *et al.* (2006) found that foliar spray of micronutrients considerably enhanced the number of pods per plant, 1000-seed weight and seed yield.

Foliar application of four parts per thousand Fe, Zn and Mn produced the highest grain yield (Table 1). SeifiNadergholi *et al.* (2011) stated that foliar application with manganese sulphate increased seed yield of plants.

There was significant difference between foliar application of Fe, Zn and Mn treatments in harvest index. Four parts per thousand Fe, Zn and Mn was more successful than other treatments to produce higher harvest index (Table 1). Ghasemian *et al*. (2010) reported significant positive effect of zinc treatment on dry matter, seed and straw yield of soybean.

Table 1. Foliar effects of Fe, Zn and Mn on grain and oil yield of *Brassica napus* cv. Talayah.

Treatments	No. of pod per plant	No. of seed per pod	1000-kernel weight (g)	Grain yield kg/ha	Biological yield kg/ha	Harvest index (%)	Oil (%)	Oil yield kg/ha
Foliar application of Fe, Zn, Mn part per thousand								
0	80 a	17 a	2.83 b	880 b	6127 b	19 b	19.1 b	176 b
2	83 a	19 a	3.17 a	1224 a	6795a	20 a	23.3 a	238 a
4	86 a	21 a	3.30 a	1532 a	7215 a	21 a	25.7 a	268 a

Same letters in columns are not significantly different at $p \leq 0.05$.

Four parts per thousand of Fe, Zn and Mn produced the highest oil seed and oil seed yield (35 and 51%). Oil content is typically characteristic of species, variety and their genetic make up. Application of Zn or Fe caused significant positive effects, in most cases, on growth measurements and chemical composition (Ghasemian *et al*. 2010, Nasiri *et al.* 2010).

The results of correlation coefficients between traits showed that grain yield had a positive and significant correlation with oil yield and biological yield at 1% probability levels, oil yield also had positive correlation to oil percent. Negative correlation also was observed between number of pod per seed and 1000-kernel weight (Table 2).

Table 2. Simple correlation coefficients between traits.

Factor	1	2	3	4	5	6	7
1-number of pod/plant							
2-number of seeds/pod	–0.023						
3-1000-kernel weight	–0.05	–0.746**					
4-biological yield	0.477	0.078	0.172				
5-grain yield	0.581	0.203	0.082	0.81**			
6-oil per cent	–0.064	–0.087	0.084	0.164	0.102		
7-harvest index	0.521	0.01	0.079	0.015	0.58	–0.073	
8-oil yield	0.484	0.171	0.19	0.238	0.884**	0.637*	0.029

Results of correlation between traits also showed that changes on grain yield and oil yield were primarily due to changes in the number of pod per plant and grain yield, respectively.

Acknowledgment

Funds for this research was provided by the Islamic Azad University of Ramhormoz, Khuzestan, Iran.

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Manuscript received on 25 July, 2013; revised on 16 February, 2014