Sjournals
Scientific Journals
Scientific Journal of Pure and Applied Sciences (2014) 3(6)
ISSN 2322-2956
doi: 10.14196/sjpas.v3i6.1498

Contents lists available at Sjournals
Scientific Journal of
Pure and Applied Sciences
Journal homepage: www.Sjournals.com

Original article

Effects of elements s, b, zn, and their interaction on agronomic characteristics of rapeseed (brassica napus l.)

M. Hatim[a],*, M. Majidian[b]
[a]*Yung Researchers Club, Arak Branch, Islamic Azad University, Arak, Iran.*
[b]*Department of Agronomy and Plant Breeding, Faculty of Agricultural Sciences, University of Guilan, Rasht, Iran.*

*Corresponding author; Yung Researchers Club, Arak Branch, Islamic Azad University, Arak, Iran.

ARTICLE INFO

Article history,
Received 05 June 2014
Accepted 20 June 2014
Available online 30 June 2014

Keywords,
Grain yield
Protein
Oil yield
Microelements
Sulfur

ABSTRACT

In order to investigate the effects of zinc, boron and sulfur on yield, yield components and comparisom oil and protein in rapeseed var. Hyola 401, an experiment was conducted in Iran, markazi province in 2011. A field experiment with completely randomized block design was performed with eight treatments in three replicates. Treatment consisted control, Zn, B, S, Zn+S, Zn+B, B+S and S+B+Zn. Sulfur treatment was added at the rate 150 kg ha-1 before sowing, and Boron was added as H_3BO_3 at the rate of 9 kg ha−1, $ZnSO_4 \cdot 7H_2O$ at the rate 25 kg ha−1 were foliar applied to the solution equally at three growth stages (three leaves, beginning stem elongation and when first flowers open) of rapeseed. Results showed that there were significant differences among treatments on given traits, grain yield, oil yield, plant height, thousand-grain weight, biological yield. Higher grain yield (1936,05 kg ha-1), oil yield (740,6 kg ha-1), thousand-grain weight (4,3 gr) and biological yield (9835,5 kg ha-1) were obtained from S+B+Zn treatment. Maximum plant height (109,8 cm) was obtained from S+B treatment. So this research showed that application of B, S and Zn fertilizers with basal fertilizer can help to increase quantitative and qualitative yield in rapeseed.

1. Introduction

Corps requires a sufficient, but not excessive, supply of essential mineral elements for optimal productivity. An insufficient supply of mineral elements may lead to limit in plant growth.

Boron (B), sulfur (S) and zinc (Zn) are three essential micronutrients required for the growth and development of higher plants (Cakmak, I. and Romhel, V. 1997). In some agricultural soils, insufficient micronutrients like (B) are often common. Hence, these elements can be supplied as fertilizers in both intensive and extensive agricultural system (Hirel, B., J. Le Goulis, B. Ney and A. Gallais, 2007). Boron plays important roles in cell wall synthesis and structure, and possibly membrane stability (Chen, G., Nian, F.Z., Xu, F.S. and Wang, Y.H. 2005). Boron Deficiency causes abnormal development of reproductive organs and reduces plant yield. However, excess boron can be toxic to both plants and animals. Increased fertilizers use efficiency can be achieved agronomical, through improved fertilizer management practices by cultivating crops that acquire and/or utilize mineral elements more effectively (White, P.J. and J.P. Hammond, 2008). Canola is one of the most sensitive crops to how boron supply, developing characteristic boron deficiency symptoms on leaves, stems and reproductive parts (Asad, A.,F.. Blamey and D.G. Edwards, 2002). Boron Foliar application can increase the seed yield of rape speed and ever improve the seed quality (Xu, F.S., Wang, Y. H. and Meng, J.L. 2001). Adequate levels of sulfur are necessary for maximum production of winter rapeseed. Without adequate (S) the rapeseed will appear light green to yellow. Plants require sulfur to use nitrogen efficiently. Because sulfur is mobile in soils,

It is prone to leaching during winter and early spring. Consequently, soil testing for sulfur is important (Li, C., Chen, J. H. and Shang, W.Y. 1988).

Calcareous soil which are usually located in arid and semi arid regions have low organic matters and consequently These soils are low in organic S. Addition of (S) to a calcareous soil may result in a decline in soil pH and consequently may increase availability of micronutrients like boron . Since canola like other oil seeds have high (B) and (S) requirements and there have been no reports of how interaction between (S) and (B) may affect yield and yield components of canola in calcareous soil (Zhao, F.J., M.J. Hawkesford, A.G.S. Warrilow, S.P. McGrath and D.T. Clarkson, 1996). Zinc is structural component of several enzymes or required for enzyme activation; thus, zinc deficiency also affects carbohydrate metabolism, damages pollen structure, and decrease the yield (Cakmak, I. and Romhel, V. 1997). This research was conducted to evaluate effects of elements S, B and Zn on agronomic characteristics of rapeseed.

2. Material and methods

The field experiment was conducted in Iran, markazi province (34º 05′ 21" N, 49 º 42′ 36" E), during 2011 cropping seasons. A field experiment with completely randomized block design was performed with eight treatments in three replicates. Treatment consisted 1- control, 2- Zn, 3-B 4-S, 5-Zn+S, 6-Zn+B, 7-B+S, 8-S+B+Zn.

A total of 24 plots were divided and dimension of each plot was 8×2 m with 80 plants in each plot. Sulfur treatment was added at the rate 150 kg ha-1 before sowing, and Boron was added as H_3BO_3 at the rate of 9 kg ha−1, $ZnSO_4 \cdot 7H_2O$ at the rate 25 kg ha−1 were foliar applied to the solution equally at three growth stages (three leaves, beginning stem elongation and when first flowers open) of rapeseed.

The statistical analyses of data were performed using analysis of variance and mean comparisons were carried out using SAS program (SAS Institute 1998), for compute correlation coefficients and regression SPSS 11.5 software.

3. Results and discussion

The analysis of variance yield, yield components showed that grain yields, biological yield, 1000 grain weight, oil yield and rate of protein grain have been significant difference at 1% Probability levels. Also the rate of oil grain and plant height has been significant difference at 5% probability levels but protein yield has not been significant (Table 1).

Table 1
analysis of variance for some measurements in this study.

S.O.V	df	MS							
		Grain yield	Biological yield	1000-grain weight	Rate of oil grain	Oil yield	Rate of protein grain	Protein yield	Plant height
Replication	2	268951966979	7.88	0.28	0.96	35704.8	0.01	6168.3	12.02
Treatment	7	375018285658**	1.48 **	0.65**	4.60*	863732.6**	1.30 **	7817.2n.s	93.1*
Error	14	22066100571	1.28	0.01	1.005	4057.1	0.002	3670.2	25.06
Cv (%)	_	10.6	18.3	3.6	2.9	13.1	0.22	22.2	4.8

Ns: no significant
*, **: significant at 5% and 1% probability levels, respectively.

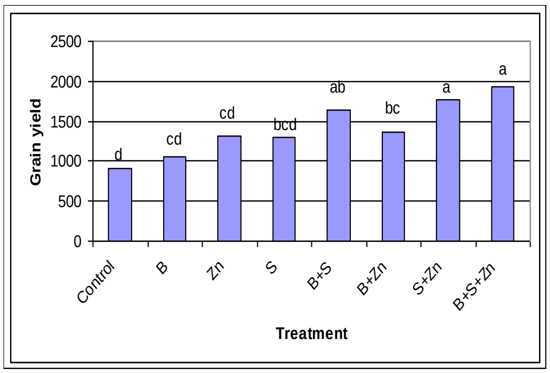

Fig. 1. Grain yield in the S+Zn and S+ B+Zn treatments were significant higher than those in the control.

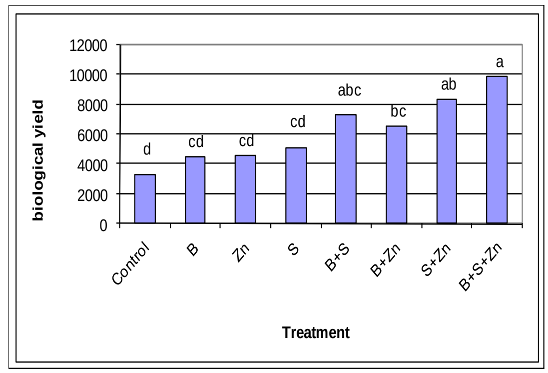

Fig. 2. The biological yield was the highest in S+ B + zn treatments.

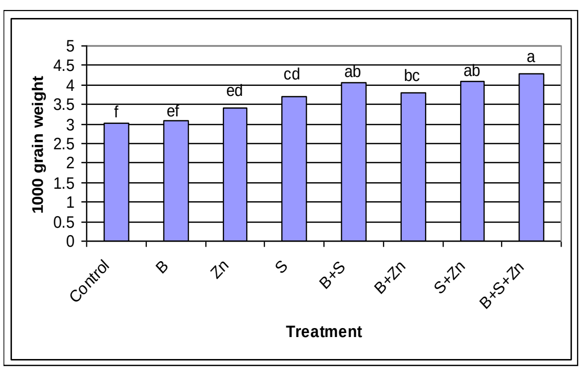

Fig. 3. applying B+ S+ zn fertilizer increased the 1000 grain weight.

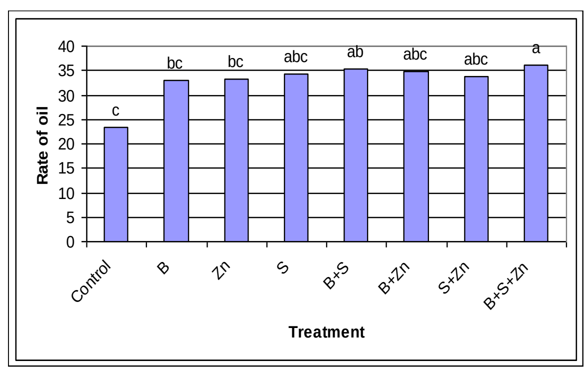

Fig. 4. The graph showed that B+S+ zn treatments were the highest of all treatments.

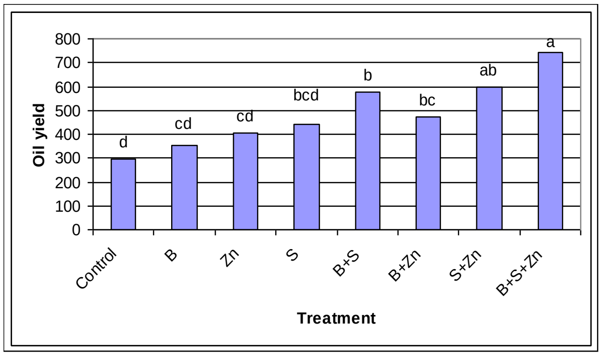

Fig. 5. Also in this graph result showed that S+ B + zn treatments were highest.

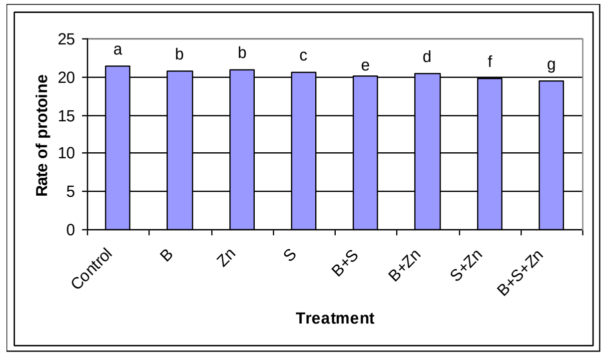

Fig. 6. Rate of protoine the control was significant highest of all treatments.

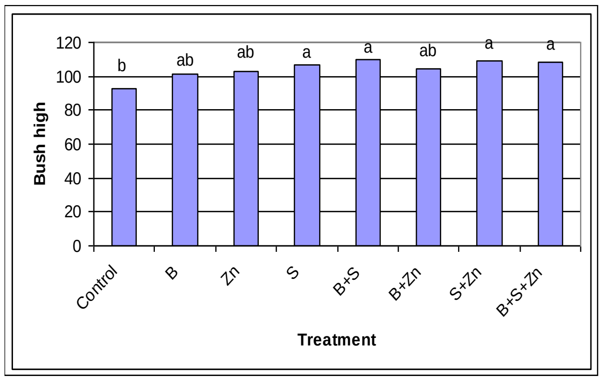

Fig. 7. (S), (B+ S) ,(S+zn)and (B+ S+ zn) extent were more than control.

Changes in seed growth indicate a complex mechanism of dry matter transport and transformation, especially from the pericarp to the developing seed (Li, C., Chen, J. H. and Shang, W.Y. 1988), which may be affected by mineral nutrition. The pericarp plays dual roles in the source- sink relationship during the seed development. The pericarp acts as a sink accumulating nutrients and carbohydrate transported by the xylem and phloem, and then acts as a main source for materials to be transported into the seed (Singal, H. R., Sheoran, I.S. and Singh, R. 1992) .

4. Conclusion

the combined application of three micronutrients S+B+Zn had significant effects on grain yield, biological yield, 1000 grain weight, rate of oil, oil yield and plant height. after that combined application of two micronutrient S+Zn had significant effect on grain yield, biological yield, 1000 grain weight, oil yield and plant height however on the rate of oil B+S application had significant effects after three combined application (Nuttal, W.F., H. Ukrinetz, J.W.B. Stewart and D.T. Spurr, 1987).

There for not only macronutrients but also optimal micronutrient are essential for canola production in soils with low nutrients availability.

References

Asad, A., Blamey, F., Edwards, D.G., 2002. dry matter production and boron concentration of vegetative and re productive tissue of canola and sunflower plants grown in nutrient solution. Plant Soil., 243-252.

Cakmak, I., Romhel, V., 1997. Boron deficiency- induced impairments of cellular functions in plants. Plant Soil., 193, 71-831.

Chen, G., Nian, F.Z., Xu, F.S., Wang, Y.H., 2005. Effect of boron and molybdenum on yield and quality of two rapeseed cultivars. Plant Nutr. Fert. Sci., (In Chinese). 11, 243-247.

Hirel, B., Le Goulis, J., Ney, B., Gallais, A., 2007. The challenge of improving nitrogen use efficiency in crop plants: towards a more central role for genetic variability and quantitative genetics within integrated approaches. J. Exper. Botany., 58, 2369-2387.

Li, C., Chen, J.H., Shang, W.Y., 1988. Study on the processes of the development of pods and seeds in Brassica napus L. Chines J. Oil. Crop. Sci., (In Chinese). 2, 23-26.

Mahler, R.L., 2005. Winter rapeseed . Northern Idaho fertilizer guide. college of Agr. Life Sci.

Nuttal, W.F., Ukrinetz, H., Stewart, J.W.B., Spurr, D.T., 1987. The effect of nitrogen, sulphur and boron on yield and quality of rapeseed. Canadian J. Soil Sci., 67, 545-559.

Singal, H.R., Sheoran, I.S., Singh, R., 1992. Photosnthetic contribution of pods towards seed yield in Brassica. P. Indian Natl. Sci. Acad., 58, 365-370.

White, P.J., Hammond, J.P., 2008. Phosphorus nutrition of terrestrial plants. In: The ecophysiology of plant-phosphorus interactions, White, P.J. and J.P. Hammond, (Eds.). Dordrecht: Springer., pp, 51-81.

Xu, F.S., Wang, Y. H., Meng, J.L., 2001. Mapping boron efficiency gene (s) in Brassica napus using RFLP and AFLP markers. Plant Breed., 120, 319-324.

Zhao, F.J., Hawkesford, M.J., Warrilow, A.G.S., McGrath, S.P., Clarkson, D.T., 1996. Responses of two wheat varieties to sulphur addition and diagnosis of sulphur deficiency. Plant Soil., 181,317-327.