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PHYSIOLOGICAL STUDIES AS INFLUENCED BY ZINC AND BORON IN HYBRID SUNFLOWER (*HELIANTHUS ANNUUS* L.) LSFH – 171

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ABSTRACT

The field investigation entitled "Physiological studies as influenced by Zinc and Boron in Hybrid Sunflower (Helianthus annuusL.) LSFH – 171" was conducted during late Kharif season of 2013 on experimental farm, Department of Agricultural Botany, College of Agriculture, VNMKV, Parbhani with the objectives to study the effect of zinc and boron on yield and yield contributing characters in sunflower. The experiment was conducted in randomized block design (RBD) with treatments T_1-$ZnSO_4$@ 15 kgha^{-1}, T_2-$ZnSO_4$@ 20 kgha^{-1}, T_3-$ZnSO_4$@ 25 kgha^{-1}, T_4-Borax @ 20 kgha^{-1}, T_5-Borax @ 30 kgha^{-1}, T_6-Borax @ 40 kgha^{-1}, T_7-$ZnSO_4$@ 15 kgha^{-1}+ Borax @ 20 kgha^{-1}, T_8-$ZnSO_4$@ 20 kgha^{-1}+ Borax @ 30 kgha^{-1}, T_9-$ZnSO_4$@ 25 kgha^{-1}+ Borax @ 40 kgha^{-1} and control. Treatments were replicated in thrice. From the result of experiment it can be concluded that, the application of $ZnSO_4$@ 25 kgha^{-1}+ Borax @ 40 kgha^{-1} significantly increased seed yield over control. The increase in yield may be attributed to the increase in harvest index, percentage of filled seeds and total number of seeds and 100- seed weight over control in sunflower.

KEY WORDS : *Zinc, Boron, Harvest index, Test weight.*

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is one of the most popular member of the family Asteraceae and is one of the world's most important source of edible oil. The native of sunflower is reported to be Southern parts of USA and Mexico. It was introduced to Indian during 1960 as a supplement to introduce oilseed crops to bridge the gap of recurring edible oil shortage in the country. Sunflower ranks third next to Groundnut and Soybean in the total production of oilseeds in the world.

In India sunflower is cultivated on an area of 8.97 lakh ha with 6.24 lakh metric tons of production with average productivity of 969 kg ha^{-1} (Anonymous, 2012). However, the productivity of sunflower in India is much less compared to other countries.

In Maharashtra sunflower is cultivated on an area of 33.0 thousand hectare (*Kharif*) and 51.0 thousand hectare (*Rabi*) with the production 23.0 tonnes and 33.0 tonnes, respectively in the year of 2011-2012 (www.indiasta.com)

This crop became very popular in the region of Marathwada due to its high yield potential in dry land agriculture. Sunflower is a profitable oilseed crop due to its desirable characters like short duration, photo and thermo insensitivity i.e. grow in all seasons, water adaptability and comparatively low disease and pest problems. It can be produce better yield on low to high fertile soils.

Sunflower seed also reach in protein and carbohydrates i.e. 20 % and 80 % respectively. The oil content varies from 32 to 48 per cent depending upon cultivar, crop management and season (Mayee and Shelke, 1986). It contains high quality of edible oil with more of polyunsaturated fatty acid having non-cholesterol and anti cholesterol properties. Cholesterol lowering factor constitutes around 80 to 90 percent of total fatty acid (Silver *et. al.* 1984) and therefore it is advised to patients facing heart problems. It also contains 60 to 73 per cent linolenic acid and 32 to 47 per cent oleic acid with sufficient amount of Ca, Fe and vitamins like A, D, E and B complex (Roberston and Russel, 1972).

Sunflower is quite responsive to micronutrients. Among the micronutrients, Zn deficiency is most widespread on a wide range of soils (Graham *et al*. 1992). The micronutrient application has the positive effect on the growth of sunflower, in terms of plant height, number of leaves and dry matter production per plant. These effects can be contributed to enhanced metabolic function of micronutrients in the plant (Amberger, 1980). In the soils of Maharashtra due to widespread deficiency of Zn and B (Malewar and Ismail, 1999) and their responses to sunflower, cotton and groundnut (Malewar *et al*. 2003) importance of both the nutrients in oilseed crops has been increased considerably.

It has a problem of poor seed setting related to unfilled hallow seeds in head. Among many reasons for this, inadequate water supply, lack of photosynthetic activity at the time of seed filling, improper translocation, lack of pollination, boron deficiency are some for overcoming which zinc and boron can be used. Zinc plays important role in formation of chlorophyll and growth hormones and it is associated with water uptake and water relations in the plant. If it is deficient, one of the first adverse effects is on flowering and fruiting and therefore on the yield and quality of produce. Adverse effect on the yield and quality can occur, even though no deficiency symptoms are evident on the foliage. This is known as 'Hidden Hunger' and the boron deficiency is often an unsuspected enemy of crop production.

The experiment was conducted by considering the objective. To study the effect of Zinc and Boron on yield and yield contributing character.

MATERIALS AND METHODS

Treatments details :

T_1-$ZnSO_4$@ 15 $kgha^{-1}$ T_2-$ZnSO_4$@ 20 $kgha^{-1}$ T_3-$ZnSO_4$@ 25 $kgha^{-1}$

T_4- Borax @ 20 $kgha^{-1}$ T_5- Borax @ 30 $kgha^{-1}$ T_6- Borax @ 40 $kgha^{-1}$

T_7-$ZnSO_4$@ 15 $kgha^{-1}$ + Borax @ 20 $kgha^{-1}$

T_8-$ZnSO_4$@ 20 $kgha^{-1}$ + Borax @ 30 $kgha^{-1}$

T_9-$ZnSO_4$@ 25 $kgha^{-1}$ + Borax @ 40 $kgha^{-1}$

T_{10}- Control

The experiment was laid out during late *Kharif* at experimental farm of Department of Agricultural Botany, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in Randomized Block Design (RBD) with three replications with spacing 60 cm x 30 cm. The gross plot size was 4.2 m X 3.0 m (7 rows 3 m long) and net area was 3.0 m X 2.6 m (5 rows 2.4 m long). The treatments and replications were spaced at 1.0 m and 1.5 m apart from each, respectively with recommended dose of fertilizer 60:75:60 kg N, P, K/ha.

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Table 1 : Total number of seeds, number of filled seeds, unfilled seeds, test wt, HI, Seed yield per plot and kg / ha.

Tr.No.	Treatment (kg/ ha $^{-1}$)	Total number of seeds / head	Number of filled seeds / head	Number of unfilled seeds / head	100 seed weight (g)	Harvest index (%)	Seed yield per plot (kg)	Seed yield (Kg ha^{-1})
1	2	3	4	5	6	7	8	9
T_1	$ZnSO_4$@ 15	559.84	417.19	142.65	5.37	33.99	1.16	1486.54
T_2	$ZnSO_4$@ 20	578.17	437.35	140.82	5.12	37.92	1.19	1522.85
T_3	$ZnSO_4$@ 25	576.33	448.64	127.70	5.42	41.89	1.39	1787.25
T_4	$ZnSO_4$@ 15	568.71	438.06	130.66	5.69	41.21	1.38	1773.67
T_5	Borax 20	545.48	408.43	1360.05	5.46	36.22	1.11	1435.78
T_6	Borax 30	560.90	413.49	147.41	5.08	36.60	1.08	1391.26
T_7	Borax 40	567.51	434.39	133.12	5.88	38.37	1.28	1613.69
T_8	$ZnSO_4$@ 15 + Borax 20	586.57	462.26	124.31	6.22	42.31	1.44	1852.42
T_9	$ZnSO_4$@ 20 + Borax 30	596.58	481.45	115.13	6.49	43.98	1.48	1903.10
T_{10}	$ZnSO_4$@ 25 + Borax 40	543.62	399.41	144.21	5.31	34.44	0.99	1277.31
	S. E. ±	8.5817	6.8753	4.0358	0.2142	0.9177	0.0372	47.6181
	C. D. at 5 %	25.4985	20.4283	11.9914	0.6364	2.7267	0.1105	141.4859

RESULT AND DISCUSSION

Total number of seeds, number of filled and unfilled seeds per plant.

Total number of seeds per head and number of filled seeds per head were increased by all the treatments as compared to control. Total number of seeds and number of filled seeds per head were increased with each incremental application of $ZnSO_4$ and decreased with the increment in borax. While number of unfilled seeds per head was decreased by all the treatments except in T_6 (Borax @ 40 kg ha^{-1}). Lowest number of unfilled seeds per head were found in T_9 ($ZnSO_4$@ 25kg ha^{-1} + Borax @ 40 kg ha^{-1}).

The increased total number of seeds and number of filled seeds might be due to direct supply of these nutrients to the crop maintain balanced fertilization as experimental soil was deficient in Zn and B and responses were expected either in terms of seed attributes. Also it might be due to role of boron in proper pollination and seed setting and translocation of sugars and metabolise to the seeds. Similar results in case of total number of seeds were observed by Mina *et al*. (2003) for Zn and by Al-Amery *et al.* (2011), for boron. And in case of filled seeds, findings are similar to those found by Leela Rani and Reddy (1993), Vyakaranahal *et al*. (2001), Renukadevi *et al.* (2003), Ayad*et al*.(2012) and Siddiqui *et al.* (2009) for borax.

100 - seed weight

100 seed weight was increased by all the treatments. Each incremental application of $ZnSO_4$ brought increased 100 seed weight, while levels of borax decreased the same. This increase in 100 seed weight might be due to better translocation of metabolites into head due to these micronutrients.

In case of 100 seed weight the results are similar with the findings of Renukadevi *et al*. (2003) for boron and for zinc Mina *et al.* (2003).

Harvest index

Harvest index gives the idea about partitioning of the dry matter into the plant part of economic interest and rest of the plant. Here the results indicated that all the treatments were found to increase the harvest index and straw yield as compared to control. Harvest index was high, at the highest level of $ZnSO_4$ and the lowest level of borax. The treatment T_9($ZnSO_4$@ 25 kg ha^{-1} + Borax @ 40 kg ha^{-1})was significantly superior over all other treatments in respect of harvest index. The increased plant height, number of leaves due to zinc and boron, might have facilitated more accumulation of dry matter through increased photosynthesis and in turn more allocation of photosynthetic toward seeds. Harvest index as increased with the application of boron was observed by Reddy *et al*. (2002).

Seed yield per plant and seed yield per ha.

Seed yield was high at the highest level of $ZnSO_4$ and lowest level of borax. T_9($ZnSO_4$@ 25 kg ha^{-1} + Borax @ 40 kg ha^{-1}), Treatment T_3($ZnSO_4$@ 25 kg ha^{-1})and T_4 (Borax @ 20 kg ha^{-1}). Boron content of this treatment might have played role in pollen tube growth, fertilization and increase in flowers and seed yield formation and zinc

content might have contributed to the increased yield. These results are in conformation with the findings Maity *et al.* (2003) for zinc and boron the results Marchetti *et al*. (2001).

The synergistic effect of zinc and born combination was also observed by Malewar et al. (2003).

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