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Combined Effect of Pesticides, Sulphur and Boron on Yield of Sesame in Alluvial Soil of West Bengal

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ABSTRACT
An experiment was conducted in five different adapted villages of Krishi Vigyan Kendra, Ashokenagar, West Bengal, India to study the combined effect of pesticides, sulphur and boron on yield of sesame in alluvial soil during two consecutive summer seasons of 2016 and 2017. The results clearly indicated positive response of pesticides along with boron and sulphur to sesame. Timely application of pendimethalin @ 750 g ai ha^{-1} as PE; mencozeb @ 2 gm lit^{-1} and imidachlorprid @ 0.5 ml lit^{-1} at active growth stage and fruiting stage and Boron @ 10 kg ha^{-1} with Sulphur @ 30 kg ha^{-1} recorded maximum plant height (187.5cm), no. of capsules plant^{-1} (70.50), seed index (4.41 g) and yield (1188.25 kg ha^{-1}) but this treatment was differed significantly from farmer's practice. Combined application of pendimethalin, mencozeb and imidachlorprid without sulphur and boron plot showed significant reduction in growth attributes. But the extent of reduction was higher with application of pendimethalin and mencozeb only.
Key words: *Sesame, pendimethalin, pesticides, sulphur and boron*

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INTRODUCTION

India is the world's largest producer of sesame accounting nearly 35 % of the total production but its productivity is extremely low (368 kg ha^{-1}). The acreage and production of sesame is declining in the traditional sesame growing areas due to several yield limiting factors like biotic and abiotic stresses [1]. Inadequate pest (weed, insect and diseases) management appears to be one of the major constraints for such low productivity of sesame. Being a slow growing crop during seedling phase, weeds affect the growth of sesame and reduced the yield [2].The period from 15 and 30 DAS is the most critical period of crop weed competition in sesame. Yield losses due to crop weed competition in sesame have been estimated to be 50-75 % [11]. Like weeds, damage caused by insect pests and diseases also major yield limiting of sesame. Twenty nine insect-pests have been reported infesting this crop at various stages of plant growth [9]. Among the 29 insect species, sesame shoot and leaf webber, *Antigastra catalaunalis* (Duponchel) is considered a serious pest [13]. While, sesame is susceptible to diseases like Alternaria and Cercospora leaf spots, powdery mildew and phyllody due to phytoplasma etc. Seed borne mycoflora are carried over by infected seeds and they cause deterioration in seed, in soil affecting germination, causing seedling mortality and further infection of foliage is observed at adult stage, development of visible moldiness, discoloration, bad odour, loss of dry matter, heating, chemical and nutritional changes, loss of quality and the production of mycotoxins [3], which are hazardous to animal being. Apart from pest management practices, sulphur and boron are two essential nutrients regarded as inevitable in the production phenology of oil seed crops. Sulphur is needed for the synthesis of other metabolites, including coenzyme A, biotin, thiamin or vitamin B1 and glutathione. Coenzyme A is involved in the oxidation and synthesis of amino acids. Additional sulphur application increased the seed and oil content of the sesame. Sesame has a high requirement for sulphur [12]. On the other hand, boron deficiency is one of the most wide spread micronutrient deficiency in India. Plants require boron for a number of growth processes like development of meristematic tissue, proper pollination and seed set, translocation of sugars, starches, nitrogen and phosphorus, synthesis of amino acids and proteins etc. It has been reported that boron is required for pollen germination and pollen tube growth [5].

Keeping all the above facts into consideration, present investigation has been undertaken to study the effect of pesticides, sulphur and boron on growth and yield of sesame crop.

MATERIALS AND METHODS

The experiment was conducted during two consecutive *summer* seasons of 2016 and 2017 in five different adapted villages namely Ichhapur, Mena, Galdaha, Beraberi and Janaful of Krishi Vigyan Kendra, Ashokenagar,West Bengal, India. The soil was medium in organic carbon content (0.67%) and the available nutrient status was low in nitrogen, medium range of phosphorus and the potassium status was high with neutral soil reaction. The variety used in this experiment was "Savitree". The experiment was laid out in randomized block design with six treatments, *viz.* T1: Farmer's Practices (Mencozeb @ 2 gm lit^{-1} at active growth stage and fruiting stage and Imidachlorprid @ 0.5 ml lit^{-1} at flowering and pod development stage); T2: Pendimethalin @ 750 g ai ha^{-1} as PE and Mencozeb @ 2 gm lit^{-1} at active growth stage and fruiting stage; T3: Pendimethalin @ 750 g ai ha^{-1} as PE ; Mencozeb @ 2 gm lit^{-1} at active growth stage and fruiting stage and Imidachlorprid @ 0.5 ml lit^{-1} at flowering and pod development stage; T4: T3 + Boron @ 10 kg ha^{-1}; T5: T3 + Sulfer @ 30 kg ha^{-1} and T6: T3 + Boron @ 10 kg ha^{-1} + Sulfer @ 30 kg ha^{-1}. All total 113 numbers of farmers with an area of 23.31 ha was covered under the experiment. In the treatment farmer's practice, the variety was "Roma" and the experiment was conducted in five numbers of farmer's field from each villages. All the other recommended agronomic and plant protection measures were adopted to raise the crop and the intercultural practices were taken as need based. The data were analyzed following analysis of variance (ANOVA) technique and mean differences were adjusted by the multiple comparison test [7].

RESULTS AND DISCUSSIONS

The experimental results distinctly revealed that plant height of sesame was influenced to a considerable extent under different treatment combinations (Table 1). Among the treatments, treatment T6 (T3 + Boron @ 10 kg ha^{-1}+ Sulfer @ 30 kg ha^{-1}) recorded maximum plant height (187.50 cm) which was significantly differ from other treatments and the treatment T1 (Farmer's Practices) performed lowest plant height (140.5 cm). The increase in plant height from different treatments (T2 to T6) might be due to the application of pre emergence herbicide, Pendimethalin. As because weeds are serious pest, damages most of the crops by competition on light, nutrients, moisture and space, and this lead to enormous reduction in crop growth and yield [10 and 22]. Sasikumar and Kumar [18] reported highest control of sesame shoot and leaf webber by application of Imidachlorprid @ 0.5 ml lit^{-1} at flowering and pod development stage. While increase in plant height with Sulfer @ 30 kg ha^{-1} might be resulted from synthesis of sulphur containing amino acids, proteins and activity of proteolytic enzymes [16]. Application of boron @ 10 kg ha^{-1} might have increased the plant height due to role of boron in cell elongation, photosynthesis and transpiration [20 and 21].

Table 1: Effect of pesticides, sulphur and boron on growth and yield of sesame

Treatment	Plant height (cm)	No. of capsules $plant^{-1}$	Seed index (g)	Yield (kg/ha)	Oil (%)
T1	140.5	54.45	3.54	855.0	46.90
T2	159.7	60.75	4.06	997.03	48.59
T3	163.8	63.35	4.19	1024.44	48.88
T4	167.3	66.39	4.25	1092.08	49.09
T5	181.8	68.77	4.37	1139.48	49.93
T6	187.5	70.50	4.41	1188.25	50.61
LSD at @ 0.05	**1.71**	**1.45**	**0.56**	**56.76**	**0.48**

The highest number of capsule per plant (70.50) was observed in the treatment T6 (T3 + Boron @ 10 kg ha^{-1}+ Sulfer @ 30 kg ha^{-1}) followed by (68.77) in T5 (T3 + Sulfer @ 30 kg ha^{-1}) and the minimum number of capsule per plant obtained in the treatment T1 (Farmer's Practices -Mencozeb @ 2 gm lit^{-1} at active growth stage and fruiting stage and Imidachlorprid @ 0.5 ml lit^{-1} at flowering and pod development stage) (54.45). The increase in number of capsules $plant^{-1}$with application of Boron @ 10 kg ha^{-1} and Sulfer @ 30 kg ha^{-1} might be due to better availability, fertility improvement and translocation of photosynthates. These results were corroborated with Rana *et al*. [17], Nagavani *et al.* [12] and Duary and Mondal [4].

The maximum seed index of 4.4 g was obtained in T6 (T3 + Boron @ 10 kg ha^{-1} + Sulfer @ 30 kg ha^{-1}) followed by treatment T5 (T3 + Sulfer @ 30 kg ha^{-1}), which was (4.37 g) in seed index. The minimum of (3.54 g) was observed in T1 (Farmer's Practices - Mencozeb @ 2 gm lit^{-1} at active growth stage and fruiting stage and Imidachlorprid @ 0.5ml lit^{-1} at flowering and pod development stage). These results are agreement with Sasikumar and Kumar [18].

Among the different treatment the highest yield was obtained from (1188.25 kg) in treatment of T6-(T3 + Boron @ 10 kg ha^{-1}+ Sulfer @ 30 kg ha^{-1}) followed by T5. The sulphur fertilization played a vital role in improving the three major aspects of yield determination *i.e.* formation of vegetative structure, reproductive structure and production of assimilates to fill economically important sink. Thus cumulative influence of S application maintained balance source-sink relationship and ultimately resulted in increased seed yield. The results were in close conformity with the findings of Ganeshmurthy [6] and Hussain *et al*. [8]. Application of boron 10 kg ha^{-1} along with sulphur and pesticides owing to availability of more nutrients for plant growth parameters and higher yield [14 and 15]. The lowest yield of 855 kg ha^{-1} was recorded from the treatment T1 where no herbicide, sulphur and micronutrient were used.

Sulphur as a plant nutrient can play a key role in augmenting the production and productivity of oilseeds and it has a significant influence on quality. An assessment of data indicated that application of sulphur and boron had significant influence on oil % (Table-1). Among the treatments, T6 (T3 + Boron @ 10 kg ha^{-1}+ Sulfer @ 30 kg ha^{-1}) recorded maximum oil percentage (50.61 %) followed by treatment T5 (49.93 %) which was significantly differ from other treatments and the treatment T1 performed lowest oil percentage (46.90 %). Similar results were obtained by Nagavani *et al.* [12]. The treatment fertilized with 10 kg B ha^{-1} along with sulphur helped to gain higher oil yield by improving fertility and high number of capsules $plant^{-1}$and number of seeds $capsule^{-1}$ ultimately seed yield of sesame crop [19].

CONCLUSION

It may be concluded from this study that application of pendimethalin @ 750 g ai ha^{-1} as PE; mencozeb @ 2 gm lit^{-1} and imidachlorprid @ 0.5 ml lit^{-1} at active growth stage and fruiting stage and Boron @ 10 kg ha^{-1} with Sulphur @ 30 kg ha^{-1} could be adopted for effective management of pests and higher production of sesame in the region.

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