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**Barsabindu Roul**
SRF-NRRI, Cuttack, Odisha, India

**BK Mishra**
Associate Professor, OUAT, Bhubaneswar, Odisha, India

**Nibedita Prusty**
SRF-NRRI, Cuttack, Odisha, India

**Correspondence**
**Barsha Bindu Roul**
SRF-NRRI, Cuttack, Odisha, India

# Physiological effect of micronutrient on yield and yield attributes of sesame crops of coastal Odisha condition

**Barsabindu Roul, BK Mishra and Nibedita Prusty**

**Abstract**
A Research and Field Experiment was undertaken at Department of Plant Physiology, College Of Agriculture, OUAT, Bhubaneswar in the year 2014 in order to know the Physiological Effect of Micronutrient on Yield and Yield Attributes of Sesame Crops in Coastal Odisha Climatic situation. 3 Researchers were involved in this Research to get concrete conclusion regarding this. So that farmers can use the latest technology. The research was conducted during Kharif Season. Various Micronutrient Tests had been made for getting suitable result by using AAS machine and Spectrophotometer.

**Keywords:** Micronutrient, Physiological Effect, Yield

## Introduction
Sesame is a flowering plant and called as "Queen of all Oilseeds" In Odisha, the deficiency of micronutrients has been observed in light –textured red and lateritic acid soils. The situation has been aggravated with the introduction of high yielding crop varieties and intensive cropping system. As the demands of nutrients for higher yields increase and plant requirements for major nutrients are only met micronutrient deficiencies are likely to become acute. In Odisha soil, the deficiency of micronutrients like Zn, B, and Mo have been reported both by farmers, extension and research workers. Low seed yield, due to deficiency of above micronutrients, have been well recognized due to several reasons such as flower and fruit drop, low harvest index and poor vegetative growth. Keeping all the above facts into consideration, present investigation has been undertaken to study the effect of micronutrients applied as foliar spray, on metabolism, growth and yield of sesame crop.

## Material and Methodology
Randomized Block Design was used in this experiment to get the concrete results. Field Level Experiment was executed carefully under the guidance of a Plant Physiologist. The experiment was carried out in randomized block design with 10 treatments and replicated thrice. Field Level Intercultural operations was made with proper care. The application of various Micronutrients in field time to time in order to observe the real result.
The Modus Operandi of Field Preparation is as per the following Calendar prepared by the Researchers.

### Calendar of field operation

| Date | Field preparation |
|---|---|
| 11.06. 2014 | Collection of soil sample |
| 14.06.2014 | Ploughing |
| 16.06.2014 | application of FYM and fertilizer |
| 17.06.2014 | Lay out and leveling |
| 18.06.2014 | Sowing |
| 19.06.2014 | Irrigation |
| 02.07.2014 | 2nd irrigation |
| 07.07.2014 | Thinning |
| O8.07.2014 | Hoeing and weeding |
| 09.07.2014 | Top dressing |
| 10.07.2014 | Earthling up |
| 12.07.2014 | 3rd irrigation |
| 22.07.2014 | 4th irrigation |
| 03.08.2014 | 1st Foliar application |
| 08.08.2014 | Sampling of plant |
| 11.08.2014 | 5th irrigation |
| 18.08.2014 | 2nd Foliar application |
| 25.08.2014 | Sample collection |
| 26.09.2014 | 6th irrigation |
| 27.09.2014 | Harvesting |

**Sampling techniques**
Plants were sampled from a unit area of 0.30m$^2$5 no. of plants at random from each plot leaving sufficient border rows around it. The plant parts were separated and sun dried. Then dried in a hot air oven at 80$^0$ for 72 hrs. Till constant weight. The dry weight of different plant parts were recorded.

**Growth observations**
The following observations were recorded at 45, 60 and 90 DAS.

**Results and Discussion**
After the Critical observation and enthusiastic Field experiment was conducted at central farm OUAT, BBSR, during Kharif 2014 with 10 treatments replicated thrice in a Randomized Block Design to study the response of sesame to foliar application of micronutrients. The morphological, physiological and biochemical observations taken at various growth stages during the course of investigation were recorded, statistically analyzed and presented in this chapter with appropriate tables and figures in following heads and subheads.

**Dry matter accumulation and its partitioning**
Dry matter accumulation and its partitioning in to different plant partswere recorded at 45, 60, and 90 DAS were presented in table 5. Data revealed that there was concomitant increase in total dry matter (TDM) accumulation till 90 DAS but it's partitioning to different parts like leaf, stem and pod increased up to 60 DAS but at 90 DAS partitioning of TDM was less to the leaf compared to stem and pod.
Foliar application of all the micronutrients and their combination significantly increased leaf dry matter (LDM), stem dry matter (SDM), pod dry matter (PDM) and total dry matter (TDM) of the plant recorded at 45, 60 and 90 DAS over control except foliar application of Cu ($T_5$), Fe ($T_6$) which found at par with control with respect to (TDM) and its partitioning to different plant parts at various growth stages. Significantly the highest accumulation of dry matter in leaf , stem, pod as well as in whole plant recorded at all the growth stages in plant applied with foliar spray of micronutrients in combination ($T_9$) followed by foliar application of Zn ($T_3$) and B ($T_2$). The pattern of partitioning of TDM at 45 and 60 DAS are same i.e. stem > leaf > pod whereas pattern of partitioning of TDM was in a sequence of pod > stem > leaf at 90 DAS.

**Physiological Traits**
**LAI, SLA, SLW and LAR**
Growth parameters like LAI, SLA, SLW and LAR determined at 45 and 60 DAS were presented in table-6. Data indicated that higher value of LAI and SLW were found at 60 DAS where as higher value of SLA and LAR were noticed at 45 DAS in all the treatments.
Leaf area index (LAI) increased significantly due to foliar application of micronutrients which was ranged a minimum of 0.91 ($T_1$) to a maximum of 1.35 ($T_9$) at 45 DAS and 1.08 ($T_1$) to 2.24 ($T_9$) at 60 DAS. In both the stages (45 and 60 DAS) significantly the highest LAI was recorded in plants sprayed with combined micronutrients ($T_9$) followed by application of Zn ($T_3$), B($T_2$), Mo ($T_4$) and commercial mixture ($T_{10}$).

**Table 1:** Effect of different micronutrients on Dry matter accumulation (g/plant) and its partitioning.

| Treatments | 45DAS | | | | 60 DAS | | | | 90DAS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LDM | SDM | PDM | TDM | LDM | SDM | PDM | TDM | LDM | SDM | PDM | TDM |
| $T_1$ | 0.95 | 0.90 | 0.08 | 1.95 | 1.93 | 3.08 | 2.80 | 7.81 | 1.71 | 4.31 | 4.42 | 10.44 |
| $T_2$ | 1.51 | 1.68 | 0.32 | 3.52 | 3.27 | 5.50 | 5.50 | 14.27 | 2.95 | 7.01 | 10.27 | 20.23 |
| $T_3$ | 1.59 | 1.69 | 0.25 | 3.54 | 3.90 | 5.56 | 5.30 | 14.76 | 3.73 | 7.63 | 10.14 | 21.50 |
| $T_4$ | 1.49 | 1.64 | 0.22 | 3.37 | 3.12 | 4.57 | 4.40 | 12.09 | 2.83 | 5.88 | 8.21 | 16.92 |
| $T_5$ | 1.09 | 1.11 | 0.10 | 2.30 | 2.11 | 3.97 | 3.30 | 9.38 | 1.96 | 4.37 | 5.90 | 12.23 |
| $T_6$ | 1.27 | 1.23 | 0.11 | 2.62 | 2.67 | 4.13 | 3.50 | 10.30 | 1.77 | 4.79 | 6.59 | 13.15 |
| $T_7$ | 1.33 | 1.50 | 0.19 | 3.03 | 2.83 | 4.31 | 3.60 | 10.74 | 2.56 | 5.50 | 7.63 | 15.69 |
| $T_8$ | 1.32 | 1.48 | 0.12 | 2.93 | 2.80 | 4.29 | 3.50 | 10.59 | 2.64 | 5.18 | 7.14 | 14.96 |
| $T_9$ | 1.92 | 1.72 | 0.36 | 4.01 | 4.26 | 7.16 | 6.90 | 18.32 | 4.09 | 8.40 | 13.40 | 25.89 |
| $T_{10}$ | 1.49 | 1.55 | 0.20 | 3.24 | 2.88 | 4.34 | 4.30 | 11.52 | 2.77 | 5.85 | 7.59 | 16.21 |
| SE(m)± | 0.014 | 0.003 | 0.015 | 0.183 | 0.171 | 0.268 | 0.303 | 0.690 | 0.158 | 0.341 | 0.479 | 0.979 |
| C.D(0.5) | 0.04 | 0.008 | 0.04 | 0.54 | 0.50 | 0.79 | 0.90 | 2.05 | 0.47 | 1.01 | 1.42 | 2.90 |

**Table 2:** Effect of different micronutrients on LAI, SLA, SLW, LAR at different growth stages

| Treatments | LAI | | SLA (cm$^2$/g) | | SLW (mg/cm$^2$) | | LAR (cm$^2$/g) | |
|---|---|---|---|---|---|---|---|---|
| | 45DAS | 60 DAS | 45 DAS | 60 DAS | 45 DAS | 60 DAS | 45 DAS | 60 DAS |
| $T_1$ | 0.91 | 1.08 | 428.8 | 252.8 | 2.33 | 3.95 | 210.4 | 62.4 |
| $T_2$ | 1.08 | 1.77 | 324.2 | 244.4 | 3.08 | 4.09 | 139.0 | 56.0 |
| $T_3$ | 1.13 | 2.10 | 319.0 | 243.2 | 3.13 | 4.11 | 143.7 | 64.2 |
| $T_4$ | 1.09 | 1.65 | 329.2 | 239.1 | 3.03 | 4.18 | 146.4 | 61.7 |
| $T_5$ | 0.98 | 1.33 | 405.0 | 284.3 | 2.46 | 3.51 | 191.6 | 63.9 |
| $T_6$ | 1.00 | 1.38 | 353.6 | 233.6 | 2.82 | 4.28 | 171.7 | 60.5 |
| $T_7$ | 1.06 | 1.63 | 360.1 | 259.7 | 2.77 | 3.84 | 158.3 | 68.4 |
| $T_8$ | 0.98 | 1.32 | 335.3 | 213.0 | 2.98 | 4.69 | 151.7 | 56.3 |
| $T_9$ | 1.35 | 2.24 | 317.3 | 237.4 | 3.15 | 4.21 | 151.9 | 55.2 |
| $T_{10}$ | 1.07 | 1.64 | 321.9 | 257.0 | 3.10 | 3.89 | 148.2 | 64.2 |
| SE (m)± | 0.052 | 0.053 | 0.641 | 0.606 | 0.082 | 0.001 | 0.475 | 3.382 |
| C.D (0.5) | 0.15 | 0.15 | 1.90 | 1.79 | 0.24 | 0.002 | 1.41 | NS |

Specific leaf area (SLA) was recorded at 45 and 60 DAS differed significantly among the treatments. At 45 DAS the highest SLA 428.8 cm$^2$/g was recorded in control ($T_1$) and lowest 317.3 cm$^2$/g in $T_9$where as at 60 DAS the SLA was highest 284.3 cm$^2$/g in $T_5$ and the lowest 213 cm$^2$/g recorded in $T_8$. Though significant difference in SLA was observed

among the treatments in both the stages but no definite trend in influence of micronutrient spray on SLA was observed at both stages.

Specific leaf weight (SLW) recorded at 45 and 60 DAS differed significantly among the treatments. Foliar application of most of the micronutrients alone or in combination significantly increased SLW over control. At 45 DAS the maximum SLW 3.15 mg/cm$^2$ recorded in plants applied with foliar spray of combined micronutrients ($T_9$) followed by Zn ($T_3$), commercial mixture ($T_{10}$) and B ($T_2$) where as at 60 DAS, the highest SLW 4.69 mg/cm$^2$ was recorded in Co ($T_8$) followed by Fe ($T_6$) and $T_9$. The lowest value of SLW was recorded in control ($T_1$) at 45 DAS and in Fe ($T_5$) at 60 DAS.

Leaf area ratio (LAR) recorded at 45 and 60 DAS varied among the treatments. The highest LAR 210.4 and the lowest 139 cm$^2$/g were recorded in $T_1$ and $T_2$ respectively at 45 DAS. Whereas highest LAR 68.4 and lowest 55.2 cm$^2$/g were recorded in foliar spray of Mn ($T_7$) and combined micronutrients ($T_9$) respectively at 60 DAS. Though LAR differed among the treatments recorded at both the stages, but no definite influence of micronutrient spray on LAR was observed.

**RGR, NAR, CGR and LAD**

RGR, NAR, CGR and LAD determined between 45 and 60 DAS were depicted in table-7.

Relative growth rate (RGR) increased with foliar spray of most of the micronutrients over control but significant increase was recorded (101.3 mg/g/day) in combined micronutrients sprayed ($T_9$) followed by Zn ($T_3$).

Net assimilation rate (NAR) significantly influenced by foliar application of micronutrients. The significant increase in NAR over control was observed in case of foliar spray of all the micronutrients except Mn ($T_7$) which was at par with control. The highest NAR 1.2 mg/cm$^2$/day was recorded in $T_9$ followed by B ($T_2$) and Zn ($T_3$).

**Table 3:** Effect of different micronutrients on RGR, NAR, CGR and LAD at different growth period

| Treatments | RGR(mg/gm/day) | NAR(mg/cm$^2$/day) | CGR(g/m$^2$/day) | LAD |
|---|---|---|---|---|
| | 45-60 DAS | 45-60 DAS | 45-60 DAS | 45-60 DAS |
| $T_1$ | 92.5 | 0.87 | 8.7 | 14.97 |
| $T_2$ | 93.2 | 1.13 | 15.9 | 21.49 |
| $T_3$ | 95.0 | 1.05 | 16.6 | 24.31 |
| $T_4$ | 85.2 | 0.95 | 12.9 | 20.66 |
| $T_5$ | 93.5 | 0.91 | 10.5 | 17.37 |
| $T_6$ | 91.2 | 0.96 | 11.4 | 17.90 |
| $T_7$ | 84.4 | 0.85 | 11.4 | 20.24 |
| $T_8$ | 85.5 | 0.98 | 11.3 | 17.36 |
| $T_9$ | 101.3 | 1.20 | 21.1 | 27.01 |
| $T_{10}$ | 84.4 | 0.91 | 12.2 | 20.36 |
| SE(m)± | 0.763 | 0.001 | 0.760 | 0.596 |
| C.D(0.5) | 2.26 | 0.002 | 2.58 | 1.77 |

Crop growth rate (CGR) was significantly increased by application of different micronutrients as foliar spray. Among the treatments the maximum CGR 21.1 g/m$^2$/day was registered in plants applied with combined micronutrients ($T_9$) followed by Zn ($T_3$), B ($T_2$) and Mo($T_4$). The lowest CGR was recorded in control plant ($T_1$) where no micronutrient was applied.

Leaf area duration (LAD) was influenced significantly by foliar application of micronutrients. Among the treatments the highest LAD 27.01 was registered in $T_9$ followed by application of Zn (24.31), B (21.49), and Mo (20.66). The lowest LAD was recorded in control plant without micronutrients ($T_1$).

## Conclusion

Here the Researchers are able to get the research on effect of micronutrient on growth of Sesame crop and able to recommend the latest technology for poor farmers.In the present investigation, it was very clear that foliar application of different micronutrients either alone or their combination enhanced most of the morpho- physiological traits (plant height, number of branches, capsules per plant, RGR, NAR, CGR and total dry matter accumulation per plant) as well as bio chemical attributes (chlorophyll content, N, P and K uptake and oil content), seed yield and yield attributes over control. Application of micronutrients in combination ($T_9$) excelled over rest of the treatments in respect of seed yield and oil content. Further application of individual micronutrients like B, Zn and Mo also performed well for increasing seed yield and oil content in sesamum next to combined micronutrient treatment. Keeping in view of the above beneficial effect of micronutrient application, from the present endeavor, it was concluded that foliar spray of individual micronutrients like B, Zn, Mo, Fe, Mn, Cu and Co or their combination can be used as supplementary application along with the normal dose of N, P and K in order to improve the productivity of oil seed crop in general and sesamum in particular.

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