

Foliar spray of B+Fe to mitigate the heat and moisture stress

in late sown lentil crop in new alluvial zone of West Bengal

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Lentil is one of the most nutritious cool season food legumes and ranks next only to chickpea in India. The crop is mainly raised during the rabi season. However, delay in the harvest of kharif season crop especially paddy (long duration), sowing often gets delayed which forces the crop to face terminal heat and moisture stress resulting in yield loss. Spraying foliar spray with a combination of boron and iron has resulted in reducing the effect of heat and moisture stress in late sown lentil crops.

Keywords: Foliar Spray of B+Fe, Heat and moisture stress, Lentil, New alluvial zone

RISING temperatures are putting the future global food supply as well as nutritional security at significant risk. More than rising global temperature, increasing local temperature is of much concern as it can drastically affect the crop growth and yield. The prevalence of high temperature is expected to increase in the near future. The sensitivity of crop plants to heat stress will increase by the end of this century with the escalating high temperature variability. Beyond the threshold level, increase in temperature even by a single degree is regarded as heat stress in plants. Elevated temperatures cause various morpho-anatomical, physiological, reproductive and biochemical changes in plants, which can affect plant growth and development and ultimately lead to a reduction in economic yield. The effects of heat stress, mainly at the time of the reproductive stage and seed development of plants, are gaining attention as they are a serious threat to the productivity of leguminous crops by reducing pollen viability,

Table 1. Major pulse crop in West Bengal

Grain legume	Area (000'ha)	Production (000' tonnes)	Productivity (kg ha ⁻¹)	India productivity (kg ha ⁻¹)
Lentil	65.46	62.74	959	797
Blackgram	70.05	48.81	697	555
Lathyrus	30.72	38.13	1,241	742
Greengram	24.90	29.27	1,175	474
Chickpea	22.43	17.00	796	960

Source: IFAD-ICARDA Annual Report 2018-19.

fertilization and pod set.

Lentil, a cool season, nutritious food legume is highly sensitive to high temperature and moisture stress, particularly during reproductive growth, which drastically reduces seed yield. Legume is an important crop in West Bengal (Table 1). The diet of Bengalis is not complete

without the inclusion of this pulse in their diet plan. As Lentil is grown after the monsoon crop, in most of the cases the sowing of the crop gets delayed either due to long duration of the monsoon crop or delay in the preparation of the field. In addition to this, chilling periods are becoming shorter and heat periods are

Table 2. Package of practice

Crop	Lentil
Variety	Moitri (WBL77)
Fertilizer	20:40:40 kg N:P ₂ O ₅ :K ₂ O ha ⁻¹
Spacing	25 cm × 10 cm
Weeding	3 weeks after sowing
Irrigation	Nil
Pesticides	Only for black aphids if it crosses threshold level (Imidachlorpid, 3 mal in 15 litres of water)
Spaying of foliar spray	Pre-flowering and initial pod initiation



Fig. 1. Growth and flowering with foliar spray of B+Fe.

Table 3. Seed and Stover yield

Treatment	Seed yield (kg/ha)	Stover yield (kg/ha)
November first week	1,306.88	2,627.76
December first week	867.25	2,386.46
No spray	748.61	2,241.50
Foliar spray of tap water	830.83	2,441.06
Foliar spray of Zn @ 0.5 %	1,025.14	2,559.63
Foliar Spray of Fe @ 0.5 %	960.14	2,532.29
Foliar spray of B @ 0.2 %	1,099.44	2,617.47
Foliar spray of Zn @ 0.5% + B @ 0.2%	1,187.36	2,392.72
Foliar spray of Zn @ 0.5% + Fe @ 0.5%	1,172.92	2,409.94
Foliar spray of B @ 0.2% + Fe @ 0.5%	1,431.11	2,728.43
Foliar spray of Zn @ 0.5% + Fe @ 0.5% + B@0.2%)	1,328.06	2,640.97

becoming longer in northern parts of India, resulting in the exposure of cool-season crops to heat stress. Long term data analysis of this region shows that the crop would face the adverse effects of heat stress when sown late. Lentil requires low temperatures at the time of vegetative growth but warm temperatures to mature; optimum growth occurs from 18-30 °C. Temperatures above 32/20 °C (max./min.) at the time of flowering and pod filling in lentil can drastically reduce seed yield and quality.

The importance of foliar spray, particularly zinc, iron and boron, especially in reproductive biology, reduction in oxidative stress, membrane stability, and generation of anti-oxidant enzymes has been reported by many researchers. Though agronomists have very

clearly documented the importance of micronutrients in improving the fertility status of soil and improving the yield of many field-crops, their role in mitigating terminal heat and moisture stress is limited to very few crops.

We have tried sowing in two dates (November 1st week and December 1st week) with line and 9 foliar spray (S1: No spray, S2: Foliar spray of tap water, S3: Foliar spray of Zn @ 0.5% (ZnSO₄.7H₂O), S4: Foliar Spray of Fe @ 0.5% (FeSO₄.7H₂O), S5: Foliar spray of B @ 0.2% (Borax 10.5%), S6: Foliar spray of Zn @ 0.5% + B @ 0.2%, S7: Foliar spray of Zn @ 0.5% + Fe @ 0.5%, S8: Foliar spray of B @ 0.2% + Fe @ 0.5% and S9: Foliar spray of Zn @ 0.5% + Fe @ 0.5% + B @ 0.2%) in sub-plots replicated thrice (Table 2).

Lentil sown in November first

week produced the highest seed yield (1,306 kg ha⁻¹), which was 33.65% higher over later sowing (December 1st week). Among the foliar treatments, B + Fe @ 0.5% resulted in the highest yield (1,431.11 kg/ha) followed by B + Zn+Fe @ 0.5% (1,431.11 kg/ha). We would like to mention, that the growth attributes as well as number of flowers were the highest with foliar spray of B + Zn + Fe @ 0.5%. However, high number of flowering also resulted in more flower drops, resulting in lower yield. Stover yield also followed the same trend of seed yield. The highest stover yield (2,627.76 kg/ha) was achieved when sown earlier. The foliar spray with B + Fe @ 0.5% resulted in highest stover yield (2,728.43 kg/ha) when compared to 2,241.50 kg/ha in control (Table 3).

SUMMARY

The study revealed that spraying micronutrients especially a mixture of B + Fe @ 0.5% and B + Zn + Fe @ 0.5% are equally effective in mitigating terminal heat and drought stress. However, the increase in growth and yield attributes might lead to competition among the flowers and thus reduce the pod yield in the case of B + Zn + Fe @ 0.5%.

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