

# #088

## Microbes for mitigating drought and temperature stress and enhancing yield in rapeseed mustard

**Pushp Sharma<sup>1</sup>**

Virender Sardana<sup>1</sup>  
Parmod Kumar Rai<sup>2</sup>

<sup>1</sup> Punjab Agricultural University, Ludhiana, India

<sup>2</sup> Directorate of Rapeseed-Mustard Research, Bharatpur, India

### Background:

With the erratic changes in global climate incidences of drought and heat stresses will limit rapeseed-mustard productivity worldwide. These stresses affect various physiological, biochemical and morphological traits and consequently the productivity either individually or in combination with other abiotic stresses at different crop growth stages. Microbes play an important role in improving nutrient availability particularly in legumes, soil health and biodiversity.

### Objective:

To test the efficacy of microbial inoculants in non-leguminous crop/rapeseed mustard under two environments, water stress and irrigated modules for stress mitigation and enhancing productivity.

### Methods:

Two independent field experiments were conducted to evaluate the impact of microbes for 3 years (2020-21 to 2022-23). Drought mitigation study was in split plot design with six microbial seed inoculation (Biophos & Biophos +, CRIDA MI-I, CRIDA M-II, MRD 17, MKS 6 and without inoculation) in the main plots and three irrigation modules: no irrigation, 50% deficit (35 DAS) and normal irrigations (35 and 65 DAS) in the sub plots. Photosynthetic pigments, SPAD, RWC, osmoprotectants (total sugars and proline) were recorded at 70 DAS in PBR357.

For study on terminal heat stress mitigation, three varieties (PBR 357, RH 725 and Giriraj) were sown at optimum time and late sowing by one month comprised the main plots, whereas seed dressing with microbial formulation as bio stimulant (MFs) and stress adaptive consortium (Pusa Sanjeevani) comprised the sub plots. Chlorophyll content, carotenoids, membrane stability, RWC (70 DAS) and CTDoC (90 DAS) were investigated. Yield and yield components were recorded at harvest in both the trials.

### Results:

Water stress impeded the studied physiological traits. However, the different microbes improved them to variable extent. Maximum increase in RWC and SPAD was recorded with MKS 6. Increase in chlorophyll 'a' varied from 1.62-2.13, chlorophyll 'b' from 0.53-0.70, total chlorophyll from 2.09-2.55 and carotenoids from 0.411-0.469 mg g<sup>-1</sup> FW over control. However, increase in total chlorophyll was comparable in CRIDA M-II and Biophos (2.09 mg g<sup>-1</sup> FW). RWC improved by 14.1% with CRIDA M-II inoculation and by 11.2% with Biophos over control under water stress. Osmoprotectants improved with microbial inoculations. Maximum proline content was recorded with CRIDA M-II and total sugars with Biophos & Biophos+. Seed yield increased by 14.8% with Biophos & Biophos+ and by 13.8% with CRIDA M-II.

Microbial formulations and Pusa Sanjeevani inoculated varieties registered higher chlorophyll, carotenoids and maintained cooler canopies under late sown condition. However, membrane stability was improved by 9.5% with MFs and 19.3% with Pusa Sanjeevani over control in PBR 357 only. Microbial seed treatments improved seed yield (7.9 - 10.7%) under heat stress caused by late sowing.

### Conclusions:

Physiological traits, osmoprotectants and yield improved with the microbial treatments under moisture and temperature stress. Maximum increase in RWC and SPAD was recorded with MKS 6, total chlorophyll and proline with CRIDA M-II and total sugars with Biophos & Biophos+. Variations existed in *B. juncea* varieties for the physiological and yield traits with microbial formulation and stress adaptive consortium under normal and late sown conditions.