गेहूं में बढ़ती हुई कार्बन डाइआक्साइड गैस, उच्च तापमान एवं फास्फोरस का पौधों की वृद्धि, उपज और पोषण गुणवत्ता पर परस्पर प्रभाव

INTERACTIVE EFFECTS OF ELEVATED CO_2, HIGHTEMPERATUREANDPHOSPHORUSONPLANTGROWTH,GRAINYIELDANDNUTRITIONALQUALITY INWHEAT

ALIASHOUR SHAABAN

DIVISIONOFPLANTPHYSIOLOGY
ICAR-INDIANAGRICULTURALRESEARCHINSTITUTE
NEWDELHI-110 012

2022

Interactive Effects Of Elevated Co_2, High temperature and phosphorus on plantgrowth,Grainyieldandnutritionalqualityinwheat

A

ThesisB

y

ALIASHOUR SHAABAN

Submitted to the Faculty of Post-Graduate School,IndianAgriculturalResearchInstitute,New Delhi
Inpartialfulfillmentofrequirementsfortheawardofthedegreeof

DOCTOROFPHILOSOPHY

IN

PLANT

PHYSIOLOGYNEWDE

LHI

2022

Approvedby:

Chairman : Dr.MadanPalSingh _____

Co-chairperson : Dr.RenuPandey _____

Member : Dr.ArchanaWatts _____

Member : Dr.AnilDahuja _____

Member : Dr.AnshulWatts _____

Interactive effects of elevated CO_2, high temperature and phosphorus on plant growth, grain yield and nutritional quality in wheat

ABSTRACT

In India, wheat (*Triticum aestivum* L.) is the second most important cereal crop and it plays vital role in food and nutritional security.Atmospheric CO_2 concentration has been increasing since pre-industrial period and is predicted to reach 550 µmol mol^{-1} by 2050. It can increase photosynthesis rates in C_3 plants and enhance their growth and productivity. However, concurrent increase in global air temperature may negate above beneficial effects of elevated $CO_2$for carbon assimilation. A study was conducted to analyse the response of two contrasting wheat genotypes (C-306, high temperature tolerant and HD-2781, high temperature sensitive) under elevated CO_2 and low and optimum-P supply on plant growth and yield, P uptake and its utilization protein, macro and micro nutrients concentration in grain. Both the genotypes were grown in the pots under low-P (0%) vs. optimum-P (100% of recommended dose) and exposed to ambient (415 µmol mol-1) andelevated CO_2 (550 ± 50 µmol mol^{-1})] concentrations using open-top chambers (OTC). In general, both genotypes showed increased growth and biomass of all plant parts and yield traits. Similarly phosphorus content in all plant parts as well as specific phosphorus use efficiency (SPUE) increased under e[CO_2]even with low-P compared to a[CO_2].Genotype C-306 performed better as compared to HD-2781 with respect to growth and yield and P acquisition parameters. Phosphorus use efficiency (PUE grains and biomass), physiological phosphorus efficiency (PPE) and phosphorus utilization efficiency (PUtE) increased in both genotypes under a[CO_2] with low-P compared to e[CO_2]. All gas exchange traits including rate of photosynthesis decreased under low P and high temperature in both the genotypes and reductions were higher in HD-2781. On the other hand, grain yield increased in both the genotypes under elevated CO_2 but low P and high temperature caused reductions in both the genotypes and the yield enhancement was more in wheat genotype C-306. The concentration of proteins and major and micro grains nutrients declined under all the treatments in both the genotypes irrespective of the treatments and low P and high temperature effects were more detrimental.The study concludes that optimum P supply is essential for maintaining enhanced growth, biomass, rate of photosynthesis and macro and micro nutrients in wheat genotypes under high CO_2 environment and high temperature tolerant cultivars can perform better and thrive well under low P supply and elevated CO_2environment.