

BSc in Tea Technology and Value Addition
Third Year First Semester Examination – July/August 2019

Advanced Tea Physiology (TEA 311-2)

Section II – Essay Questions

MARKING SCHEME

Instructions:

Answer all questions in the given booklet.

No. of questions : Two (02)

No. of pages : One (01)

Time : One (01) hour

Total marks allocated : 60%

01. Discuss the morpho-physiological, anatomical and environmental factors that affect on photosynthesis and dry matter production in tea.

(50 marks)

- *Stomatal Conductance (density/pore size)*
- *Leaf area*
- *Light intensity/canopy architecture and light distribution/shade (Shade can influence P_n indirectly by regulating leaf (T_L) and canopy temperatures)*
- *Leaf and air temperature*
- *Water availability and uptake*
- *VPD*
- *Leaf age- Affects the net photosynthetic rates and the type of compounds synthesized from photosynthetically-assimilated carbon*

E.g. -In immature leaves, a large proportion of the assimilated carbon are incorporated into flavanols (catechins) and compounds which would be utilized in situ (amino acids, organic acids, etc.)

- In mature leaves, most of the assimilated carbon is incorporated into easily translocatable substances, such as sugars

- *CO₂ concentration*
- *Mineral Nutrition*
- *RUE*
- *Genotype*

02. Future climate is predicted to be warmer and drier than the present.

(I) Discuss the potential effects of climate change on tea physiology and yield.

(35 marks)

Introduction: *predictions for future*

- *Long-term gradual climate change involves increasing C_a and warming of the atmosphere*
- *The rising T_a in the atmosphere will modify rainfall patterns, evapotranspiration rates and VPD*
- *Climate change: more warmer and drier periods*
- *long-term climate change impacts on the key physiological and developmental processes that determine the yield and yield components of tea*
- *Responses to different aspects of climate change can be both positive and negative*

Text: *Increased C_a lead to increase photosynthetic rates and yields.*

- *However, there can be genotypic variation in the response to increased C_a*
- *Researcher have shown that an increase of C_a from $370 \mu\text{mol mol}^{-1}$ to $600 \mu\text{mol mol}^{-1}$ increase tea yields in Sri Lanka*
- *Increases in both N_{sh} and W_{sh} contribute to these yield increases*
- *Tea at elevated C_a showed higher P_n and transpiration rates than at ambient C_a*

Negative impacts:

- *Some researchers have identified possible negative impacts on tea yields due to climate change*
- *Thereby reduce the potential yield gains due to increasing C_a*
- *Simulations showed that the yield increases due to increasing C_a were augmented by increasing T_a at high altitudes*
- *But at low altitudes, yield gains of higher C_a pulled back because the rising T_a pushed the already high T_a in to the supra-optimal*
- *Predicted tea yields by year 2050 under the climate change scenarios specified by different Global Circulation Models showed increased yields at higher altitudes, but reduced at lower altitudes.*

Drought: *Under prolonged dry weather conditions the growth of tea plants is adversely affected by water deficits. Soil moisture deficiency severely affects PS-II reaction centre. Moisture deficiency reduced shoot: root ratio, leaf area, stem diameter, net CO_2 assimilation and rearranged dry matter partitioning to roots. Total chl content decreased under dehydration.*

(II) Discuss the anatomical and morpho-physiological attributes that contribute to better survival of tea under drought conditions.

(15 marks)

- *Higher apoplastic water content - Higher apoplastic water content allows a plant to better tolerate drought by transferring apoplastic water to the cytoplasm during periods of water deficits.*
- *Deeper, extensive root system*
- *Effective stomatal control*
- *Maintenance of higher leaf Ψ_w and leaf relative water content (RWC)*
- *Osmotic adjustment*

[End of section II]