

eg bacteria/fungi/eg rust (wheat)  
 Energy used in immune response rather than biomass production

chemical reactions - pop growth  
 limiting factors - energy fixed \*  
 Definitions - production GPP, NPP biomass

Mineral ions  
 can be a limiting factor because they form functional parts of molecules eg  
 Fe (Haemoglobin)  
 Mg (Chlorophyll)  
 CO<sub>2</sub> limiting factor in P/S ie glucose production.

Importance of limiting factors and how they affect production

AO1

PLAN

Temp - rate of enzyme-controlled reactions limited

Light - main limiting factor for light-dependent stage of photosynthesis

Water  
 - Raw material in P/S. Support (turgidity).  
 - Transport

Examples of AO2: "how limiting factors affect production"

(Production in agricultural / ecological sense: both plants and animals). (Clear A level explanation of link).

- Temp - warmer temps will increase crop growth rate and yield (= production of biomass). For animals (eg cows) if they are kept warmer more energy can be used for (biomass) growth if less is used to maintain body temp.
- Light - limiting factor for P/S and ∴ crop yield (= production). Overcome in some cases by using artificial light eg greenhouses. Photorespiration + compensation point
- Disease - eg fish / mammals are given antibiotics to reduce energy used in immune response so that energy is channelled into biomass (yield). Pests - ~~reduction of yield~~ compensation point.
- Chlorophyll essential to photosynthesis so a lack will lead to a lower rate of P/S (production of glucose → cellulose or protein eg.  
 or  
 Haemoglobin in O<sub>2</sub>-carrying role. If limited, less resp for building molecules assoc. with growth eg proteins.
- CO<sub>2</sub> as a raw material in P/S to make glucose and then → other molecules eg protein/muscle (= growth/production of biomass).
- Mineral ions eg NO<sub>3</sub>, PO<sub>4</sub>. NO<sub>3</sub> as major component in proteins, nucleotides ATP + DNA (ie new cells ∴ production).