C-4 PATHWAY

- The C-4 pathway refers to a series of reactions that have evolved in plants that live in hot, dry (arid) climates.

- The C-4 pathway occurs immediately before the Calvin cycle and provides an alternate method for carbon fixation.

- It is necessary because the stomata of the leaves close during periods of hot, dry weather. CO₂ levels become too low for normal carbon fixation (therefore the production of glucose would stop).

- C-4 plants have extra photosynthetic cells in the leaf (in the bundle sheath cells)

- The enzyme PEP carboxylase (instead of Rubisco) fixes carbon dioxide to a 3-carbon PEP molecule to form a 4-carbon molecule called oxaloacetate (OAA) (instead of the 3-carbon PGA formed during the Calvin cycle).

- PEP carboxylase can catalyze reactions even when CO₂ levels are low. This is not true of Rubisco.

- The 4-carbon compound oxaloacetate gets changed into malate (4-C) which then releases CO₂ into the bundle sheath cells to start the Calvin cycle. (this raises the CO₂ levels so they become high enough for Rubisco to work)

- Examples include sugar cane, corn, other grasses.
C-4 refers to the first stable compound produced during the beginning of the cycle (OAA). PEP carboxylase has a higher affinity for CO₂ than Rubisco does. When CO₂ levels are low, Rubisco catalyzes a reaction between RuBP and oxygen (photorespiration → minimizes productivity) instead of between RuBP and CO₂. Photo → light, Respiration → consumes oxygen (however does not generate ATP) Products of photorespiration include two 2-carbon compounds that are broken down later in the mitochondrion and release CO₂. (siphons carbon from the Calvin cycle)