Environmental assessment of biofuels

Environmental assessment of biofuels: The case of alfalfa

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Context

Alfalfa stems are a potential source for **second-generation bioethanol** production:

- 50% of the crop biomass
- Least digestible/protein content than leaves
- High content of cellulose and hemicellulose

Aim and scope

To compare the **environmental performance** of using conventional **gasoline** (CG) and mixtures of gasoline with **10% and 85% of bioethanol** from **alfalfa stems** (E10 and E85)

Methodology

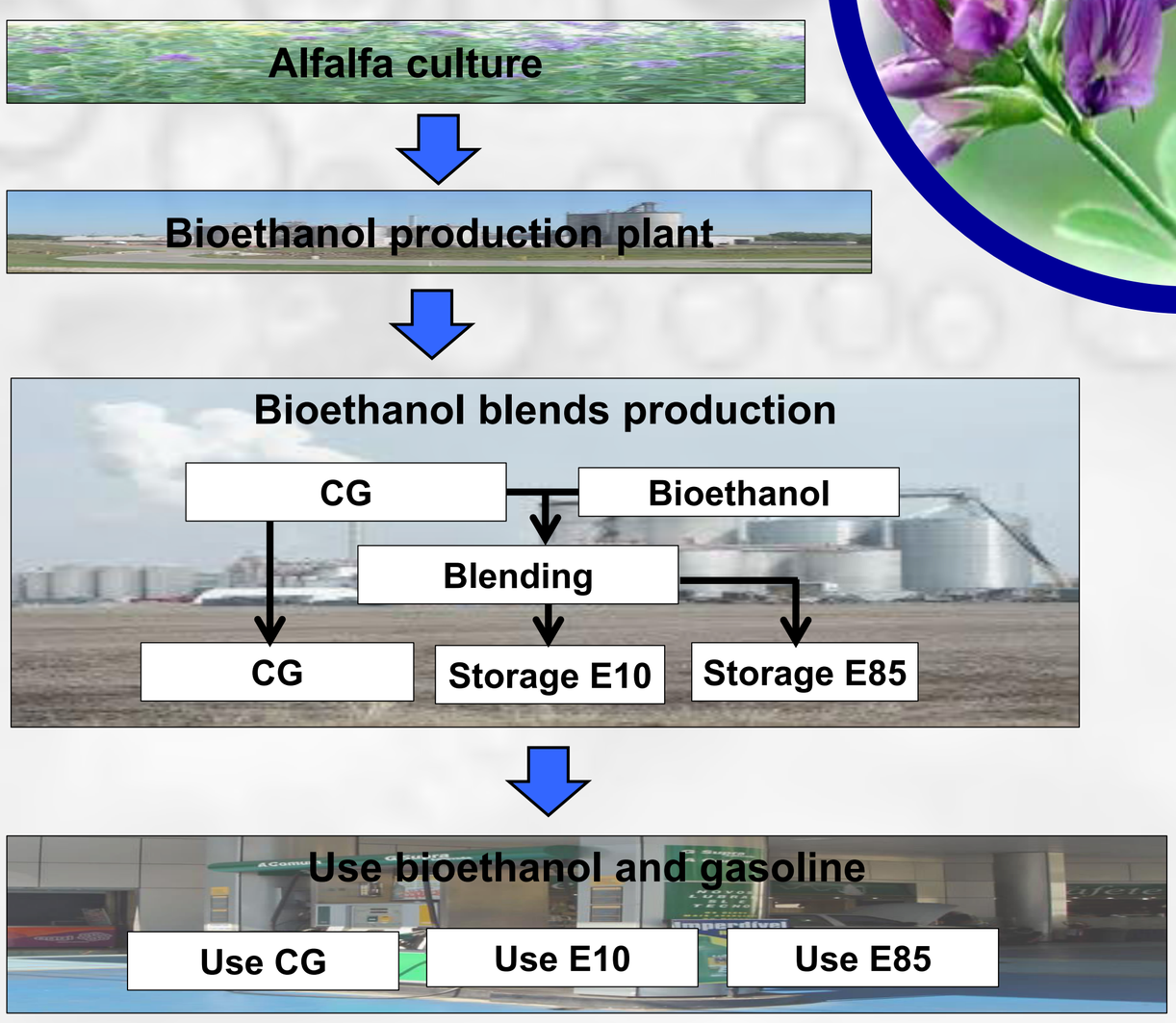
Life cycle assessment (LCA) has been carried out taking into account ISO 14040/14044 standards

Comparative **functional unit**: **1 km** distance driven

Impact categories measured

- *Global warming* (GWP)
- *Acidification* (AP)
- *Eutrophication* (EP)
- *Photochem. oxidant formation* (POCP)

System boundaries

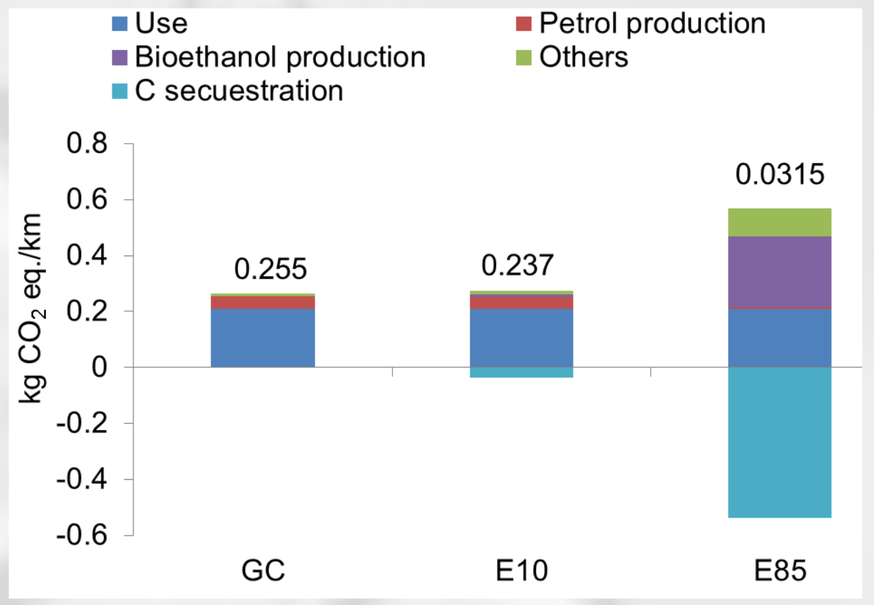


Results

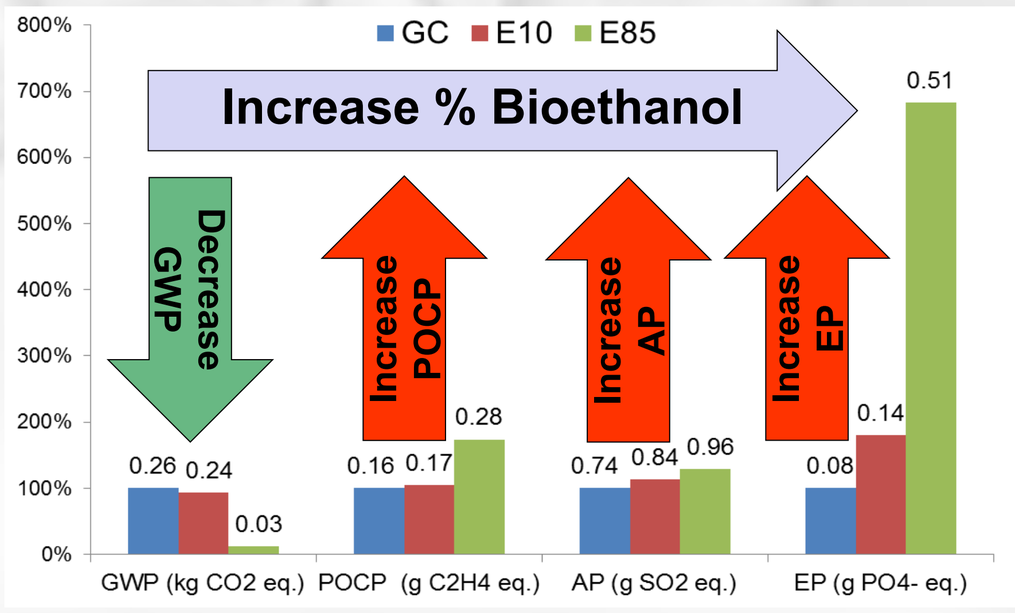
Main contributors to GWP

CG and E10
Use and CG production

E85
Bioethanol production, use and C sequestration



Comparative results for GWP, AP, EP and PO



Decrease GWP: C sequestration
Increase POCP:CO and NMVOC (diesel agriculture)
Increase AP: SO2 (production fertilizers)
Increase EP:NO_3^- and PO_4^- (application fertilizers)

Conclusions

- Alfalfa stems are a potential source for second-generation bioethanol production (high biomass generation and content of cellulose and hemicellulose and less protein content than leaves)
- The use of bioethanol produced from alfalfa will lead to a decrease in GWP, and an increase in POCP, AP and EP mainly due to agricultural activities

Source of alfalfa flower photo: http://www.cuidarlasalud.com/alfalfa/