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# Seasonal dynamics of surface energy fluxes over a center-pivot irrigated cropland in Saudi Arabia

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## Abstract

**Aim:** This study focused on the seasonal dynamics of energy fluxes over selected agro ecosystems (alfalfa and corn crops) to understand the role of energy partitioning in determining the mechanisms controlling the crop water requirement and irrigation schedules.

**Methodology:** Eddy Covariance (EC) flux tower was installed on a center pivot irrigated field located in the Eastern Region of Saudi Arabia. EC data of nearly three years (May 2013 to March 2016) was analysed for variations in agro-climatic conditions, energy fluxes and their partition under both cropped (alfalfa and corn) and non-cropped (fallow) scenarios.

**Results:** Three-year mean net radiation ( $R_n$ ) varied from 106.8 to 816.54  $W m^{-2}$ , while the recorded sensible heat, soil heat (G) and latent heat fluxes were 291.6, 158 and 3.8  $W m^{-2}$ , respectively. The latent heat was more during the crop growing season (381.38  $W m^{-2}$ ) compared to fallow (23.89  $W m^{-2}$ ); while, sensible heat showed an opposite trend compared to latent heat. The sensible heat recorded during the growing season (38.42  $W m^{-2}$ ) was much lower than for the fallow season (281.35  $W m^{-2}$ ).

**Interpretation:** There was contrasting variations in sensible heat and latent heat fluxes across seasons and corresponding to the changing climate and surface conditions of the field. In the case of silage corn, the proportions of partitioned energy to sensible heat (12.4%) and latent heat (18%) were higher than alfalfa. However, during the alfalfa post-harvest practices, the latent heat flux was always less as the available energy was partitioned as sensible heat rather than latent heat flux.

The aim was to understand the seasonal dynamics of energy fluxes over alfalfa and corn fields

Installation of Eddy covariance (EC) system

Eddy covariance data

- Temperature, wind speed
- Agrometeorology
- CO<sub>2</sub>/H<sub>2</sub>O flux,
- Soil heat flux
- Net radiation, etc.



Study period:  
 May 2013 to March 2016  
 (Alfalfa and Corn crops)



EC data processing through EddyPro (Ver. 5.0) software

Energy flux components ( $R_n$ , H, G and LE)

Crop wise energy flux components

Time-series analysis for energy balance closure and partition of energy flux components

Seasonal dynamics of energy fluxes for the study period