Radiation Interception, Forage Yield and Quality of Sorghum-Legume Intercropping Systems in the Southern High Plains



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USDA ARS

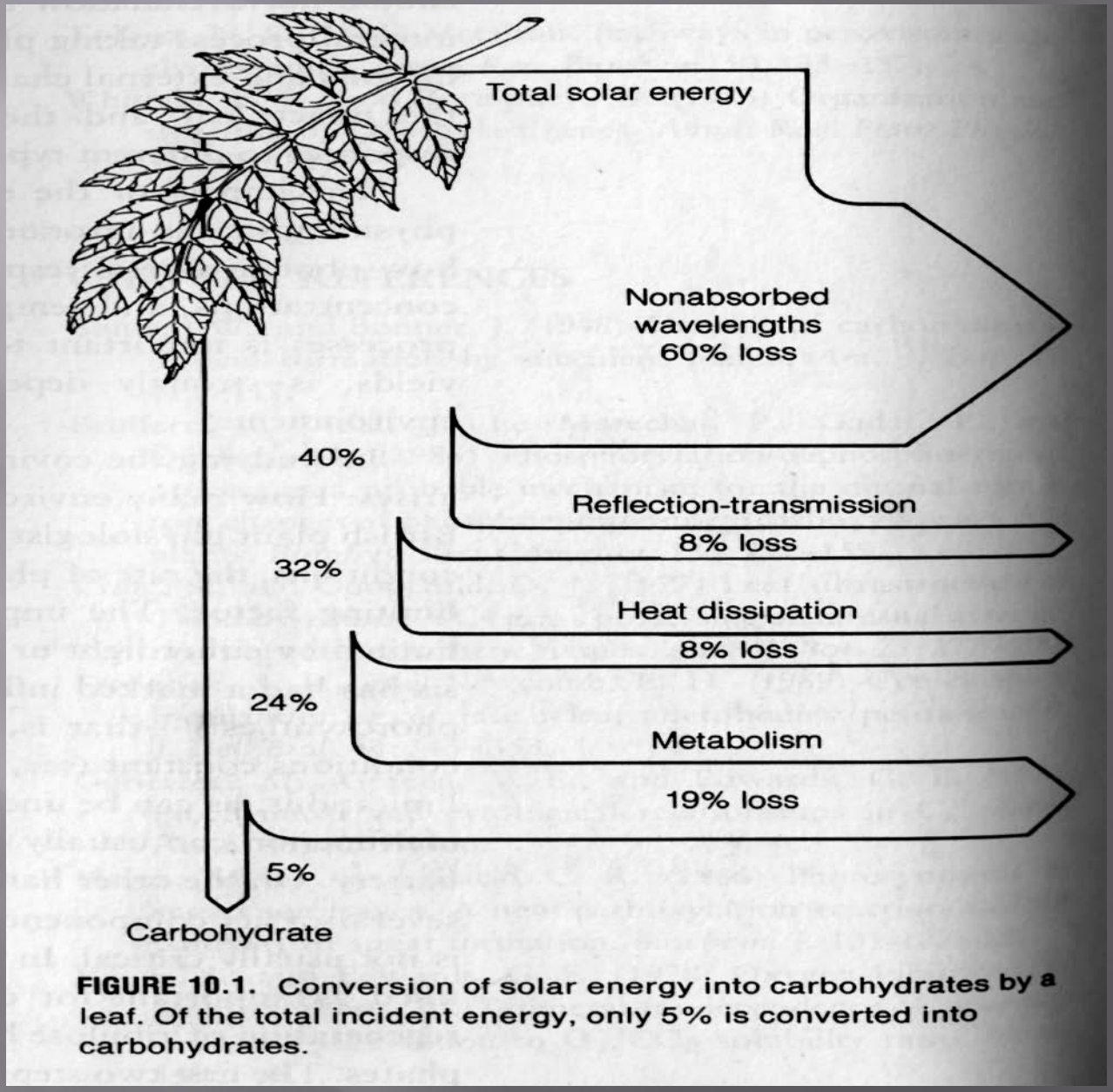


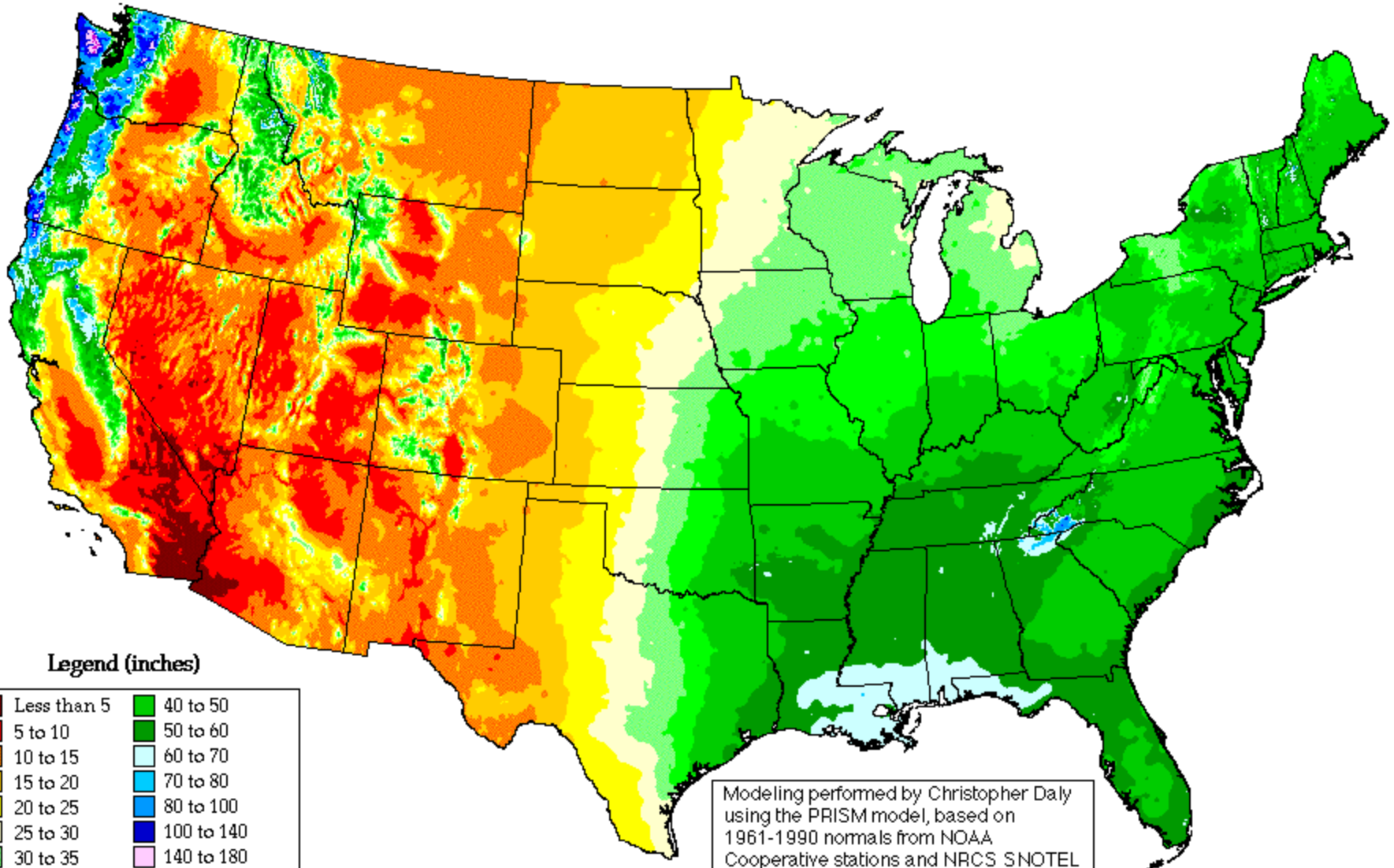
FIGURE 10.1. Conversion of solar energy into carbohydrates by a leaf. Of the total incident energy, only 5% is converted into carbohydrates.

(Source: Taiz & Zeiger. Plant Physiology. N.Y. The Benjamin/ Cummings Publishing Company, Inc., 1991)

Ecosystem productivity

Annual Average Precipitation

United States of America



Legend (inches)

Less than 5	40 to 50
5 to 10	50 to 60
10 to 15	60 to 70
15 to 20	70 to 80
20 to 25	80 to 100
25 to 30	100 to 140
30 to 35	140 to 180
35 to 40	More than 180

Period: 1961-1990

Modeling performed by Christopher Daly using the PRISM model, based on 1961-1990 normals from NOAA Cooperative stations and NRCS SNOTEL sites. Sponsored by USDA-NRCS Water and Climate Center, Portland, Oregon.

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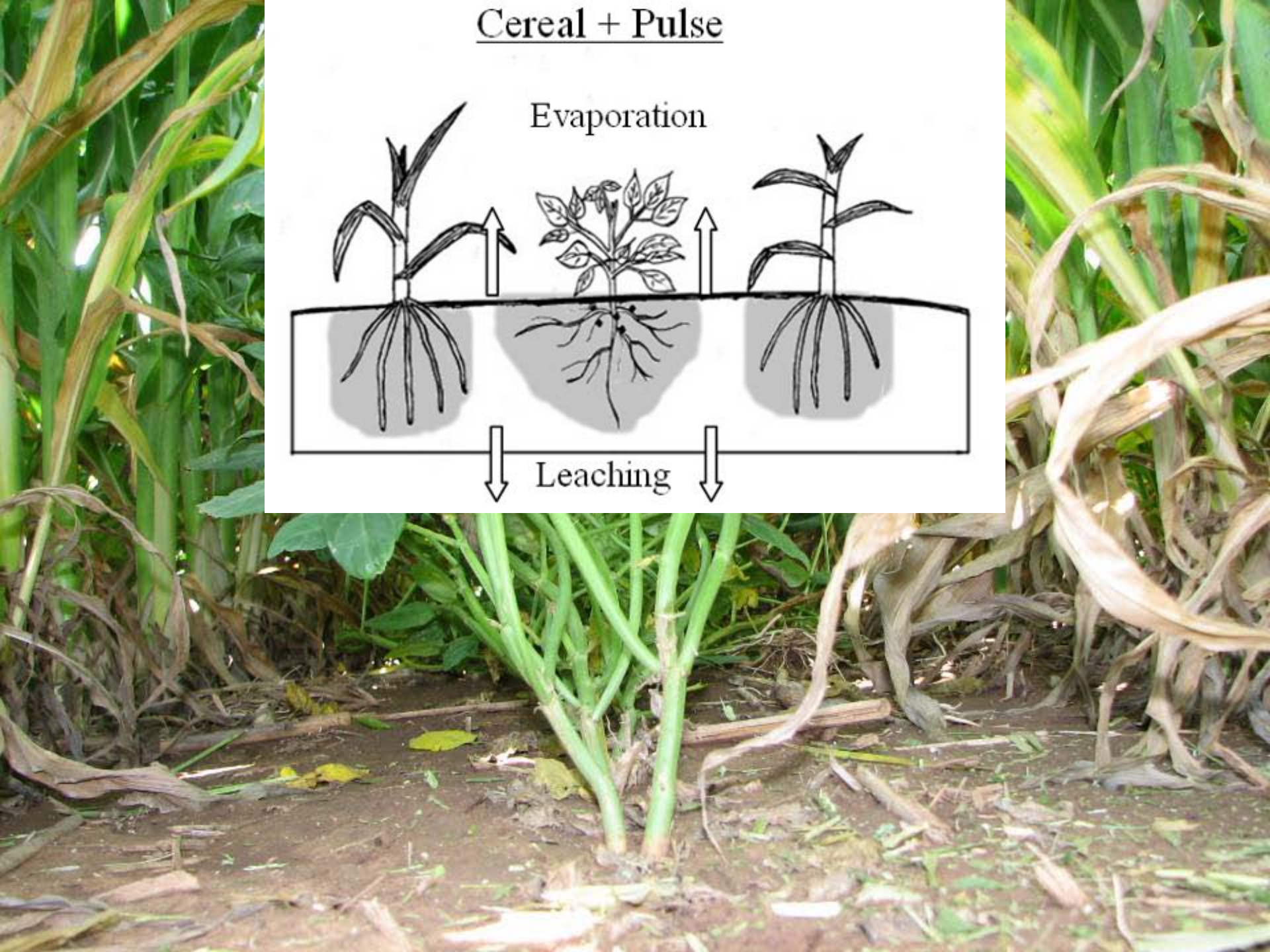

Cereal + Pulse
Evaporation
Leaching

Objective: To study radiation interception and forage production (DM) and quality of sorghum-legume intercropping systems

Materials & Methods

Intercropping systems: Sole-sorghum cropping, Sorghum-lablab bean and Sorghum-pole bean

Row spacing: 75 cm. Legumes were planted between sorghum rows

Seeding rates: 8.2, 38.0, 66.5 Kg ha^{-1} for sorghum, lablab and pole beans, respectively

RCBD with 4 replications

Location: Agricultural Science Center at Clovis

Planting date: 31 July 2008 and 1 July 2009

Irrigation type: Surface drip (2008) and Center pivot (2009)

Irrigation was applied as needed to keep plants out of water stress (226.1 mm in 2008 and 189.9 mm in 2009)

Data Collection

Radiation interception

Leaf area index (LAI)

Photosynthetic activities

Sunscan Canopy Analysis & Li Cor 6400 Systems

(1 meter linear quantum probe sensor for measuring PAR at ground level and another sensor (model BF2) semi-global tri-pad based for measurement of incident PAR)

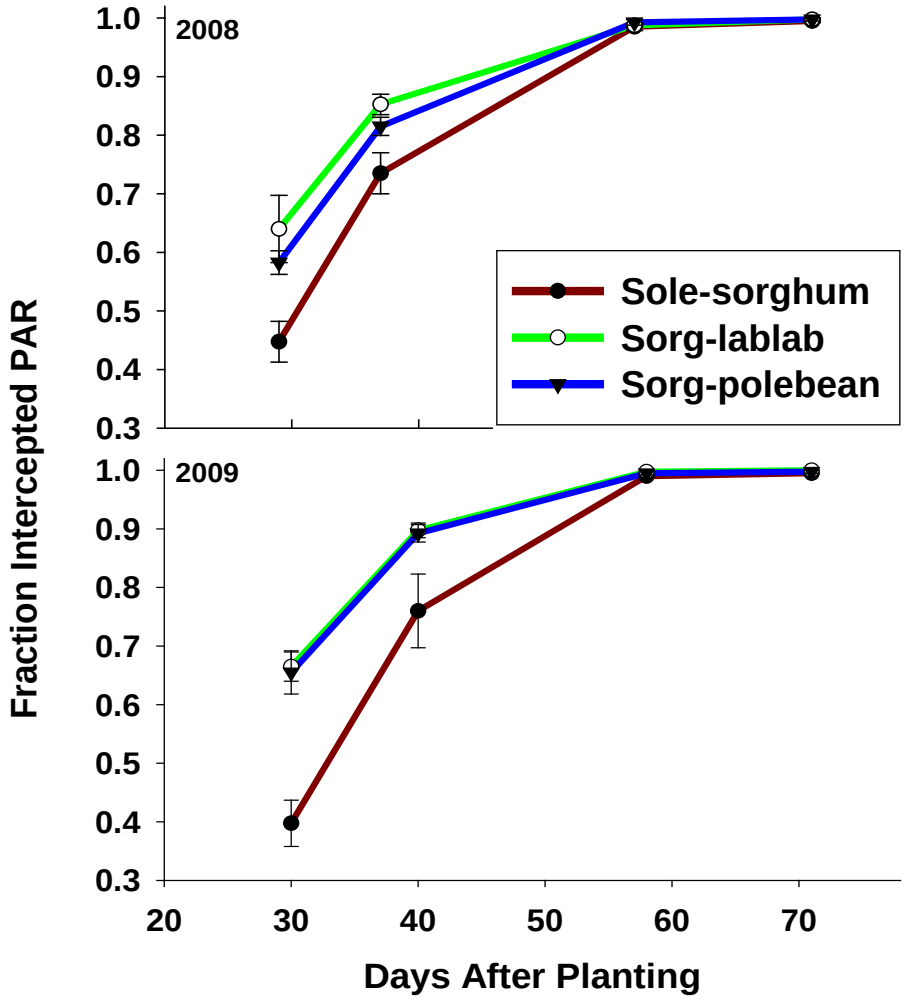
(CO_2 assimilation, stomatal conductance & transpiration)

Dry matter accumulation

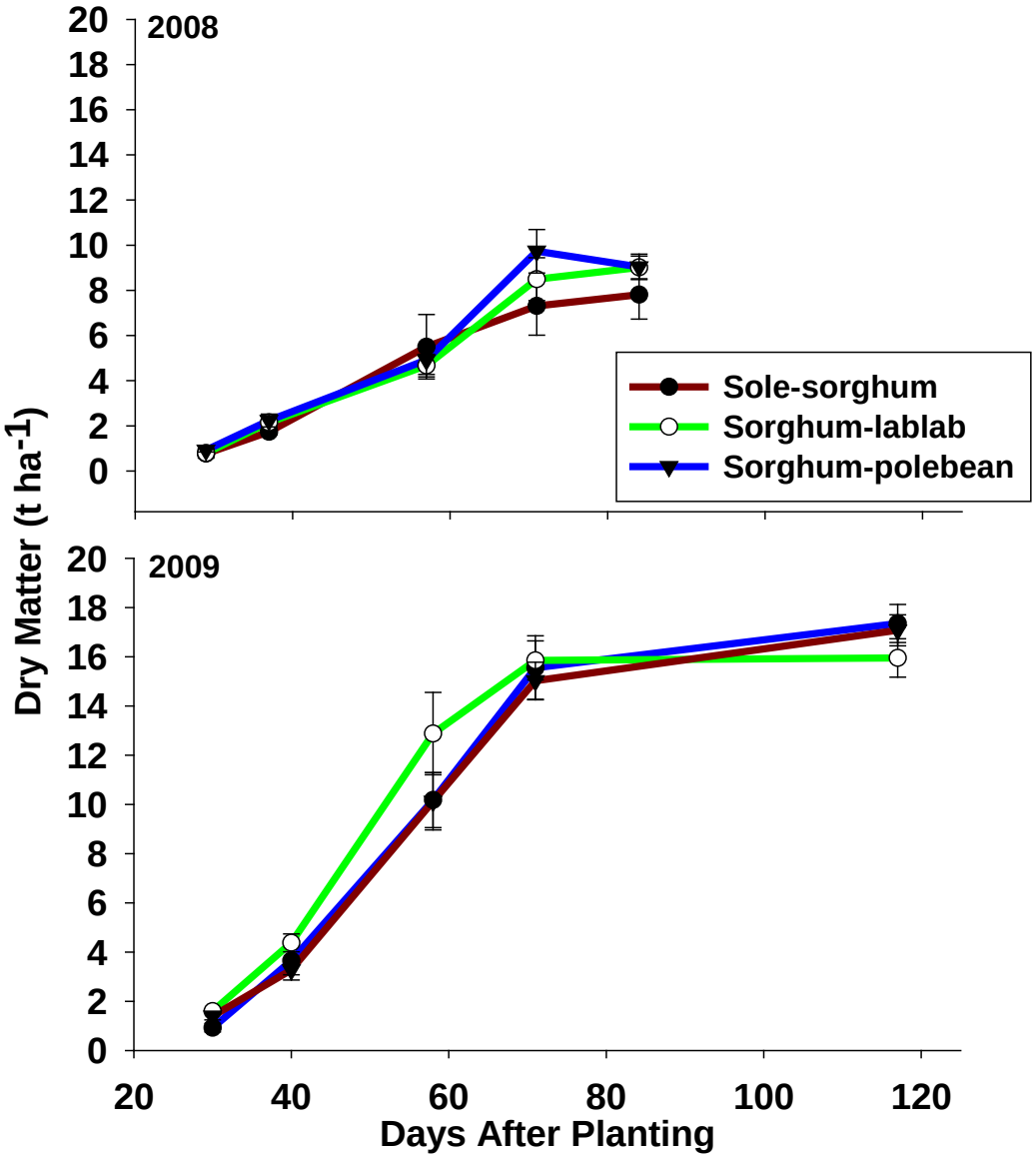
(1 week interval and final harvest in October) were harvested for seasonal forage yield and quality accumulation determination

Forage quality

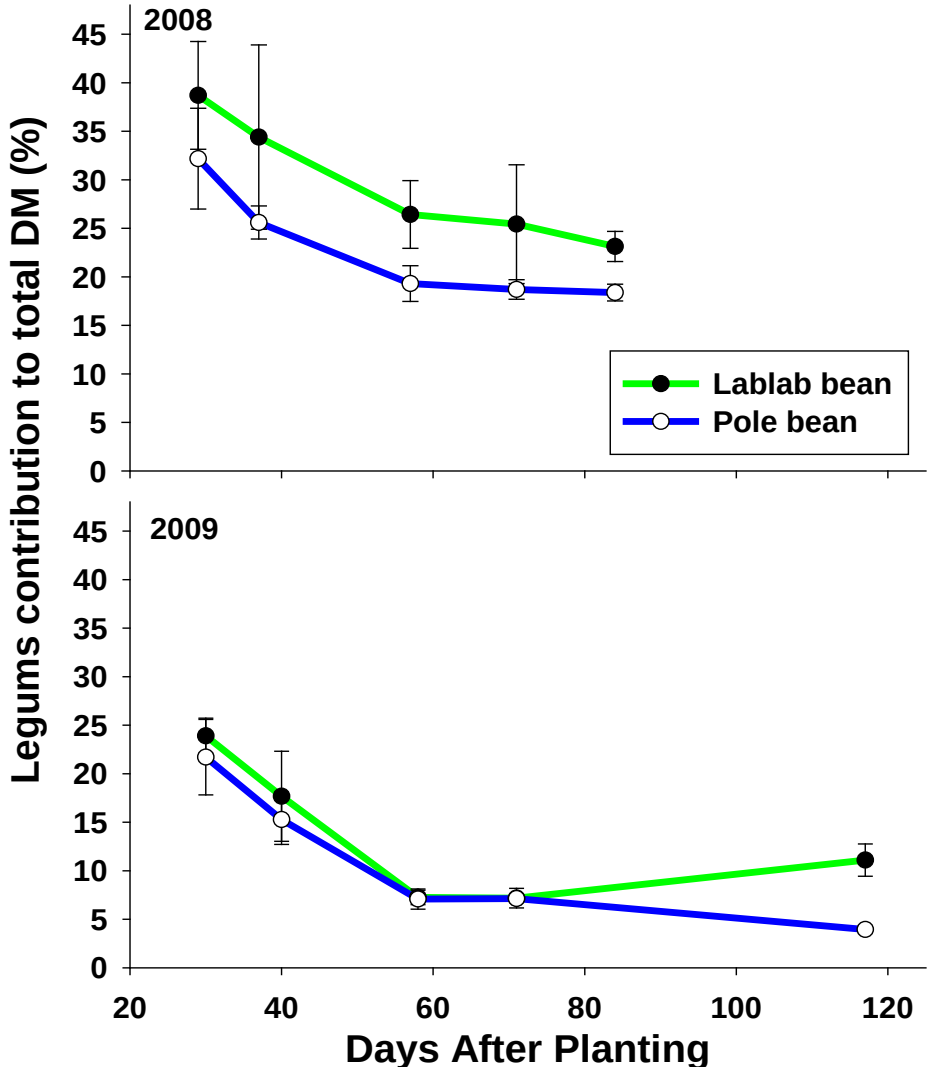
Crude protein (CP), acid detergent fiber (ADF) and neutral detergent fiber (NDF)



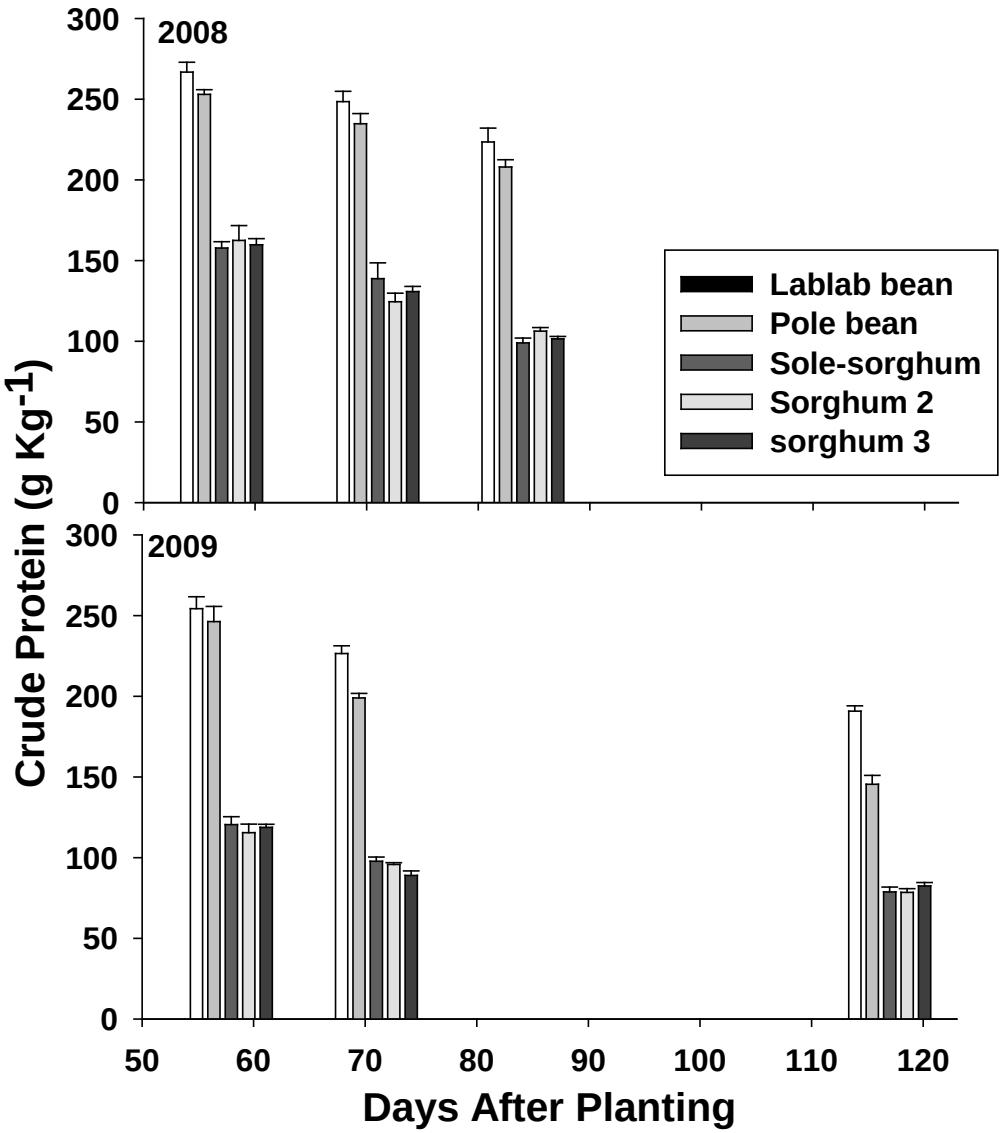
Seasonal radiation interception by sorghum-legume intercropping ystems



Seasonal dry matter accumulation by sorghum-legume intercropping systems



Seasonal legumes contribution to total dry matter in sorghum-legume intercropping systems



Seasonal crude protein accumulation by sorghum-legume intercropping systems

Conclusions

Early season radiation interception & dry matter (DM) yield were higher for sorghum-legume intercropping than sole-sorghum cropping systems

At final harvest there was no difference between sorghum-legume intercropping and sole-sorghum cropping systems for DM yield

Legumes contribution to total DM yield declined as the season progressed (10-15%)

Legumes with significantly higher crude protein than sorghum
a sorghum-legume intercropping system has potential in improving overall quality and forage yield in the Southern High Plains

More research would be needed in regards to the choice of density and cultivars of sorghum differing in canopy architectures so that radiation reaching legumes and biomass contribution to total forage yield and quality are enhanced

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