CroPMan

A **Cro**p **P**roduction and Risk M**an**agement Model for Agricultural Practitioners

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Standard for Exchanging Costs and Returns Information

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Crop Production

A

B

C

Yield

$

(environmental implications)

=

MANAGEMENT

Tillage
Irrigation
Fertilizer
Pesticides
Equipment
Crop
Variety
Planting date
Plant arrangement

Marketing

X

Spatial & Temporal Variation (LIMITATIONS)

Climate
Soil properties
Production costs
Commodity price

Pests

CroPMan?

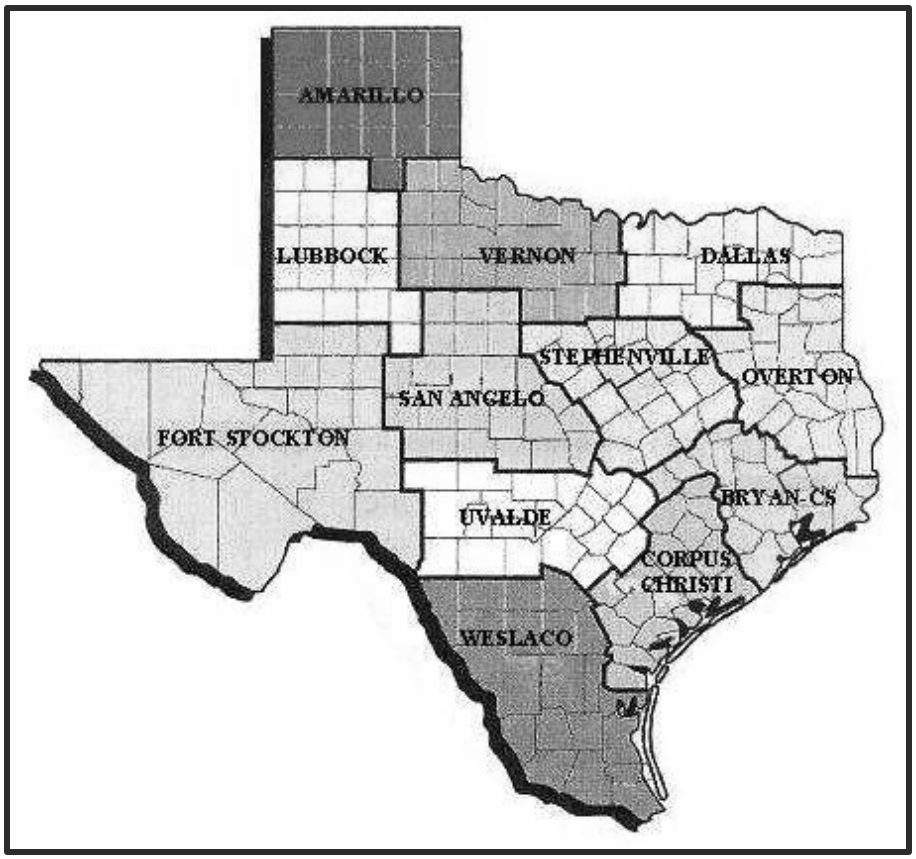
- Windows version of EPIC:
  - **E**nvironmental **P**olicy **I**ntegrated **C**limate Model (1980-present)
- CroPMan (1996 to present)
  - Windows 98, 2000, ME, XP
  - 200 to 500 MB hard disk
  - 64-128 MB RAM

Factors Simulated in CroPMan

- Fertilization: N, P (added as mineral or manure)
- Water management
  - Irrigation: flood, furrow, & sprinkle
  - Dryland
- Crop
  - Maturity, specie (20/100), rotation
  - Sowing date, row spacing, populations
- Tillage: Conventional, Reduced, No-till
- Economics
  - Cash flow, Gross & Net profit, Costs (Operation, Fixed & Total)
- Losses: Nutrient, Soil, and Pesticides

Databases

- Soils (NRCS MUUF, by county)
- Weather (6-10 per Region)
  - **Observed ’56-’99 (44-y)**
  - **Simulated (100-y)**
- Operation Budgets, Crops & Cropping systems
- Equipment, Pesticides, Fertilizer (global)



Special features

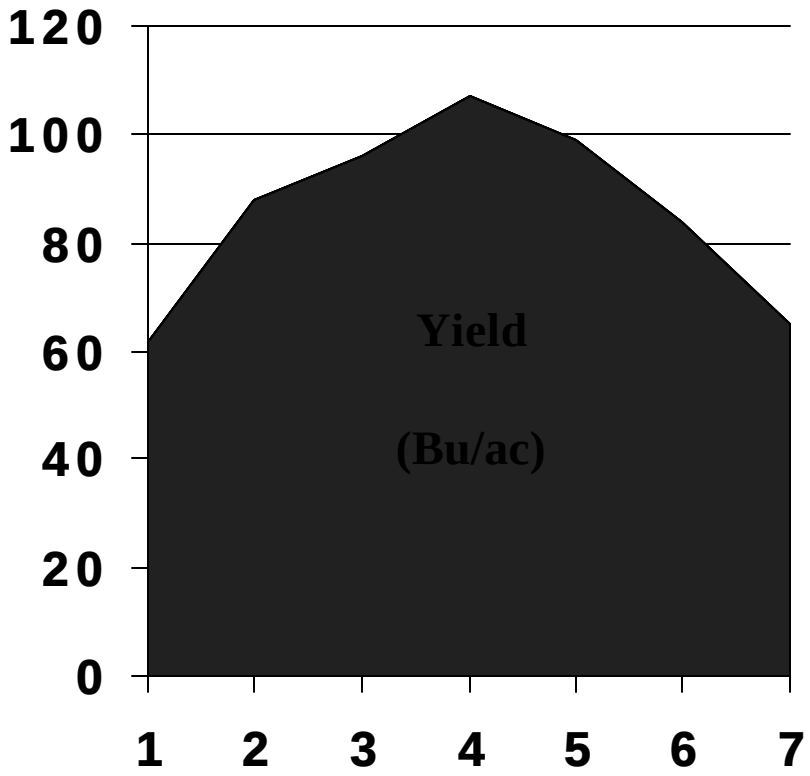
- Update/modify/customize database
- Updates & changes:
  - Saved at Default, Permanent, Temporary
- Soil properties: fixed or dynamic
- Perform direct comparisons of:
  - Soil characteristics, cropping systems, and/or management options
- Unit conversion: English/Metric

Special features

- Versatile Output capability
  - Built-in graphics for single run or multiple runs
  - Export simulated data to spreadsheets & statistical packages
- Built-in HELP
- Built-in utility to add or replace weather records to existing files*
  - Update files to current day
    - Simulate daily weather, if missing

APPLICATIONS

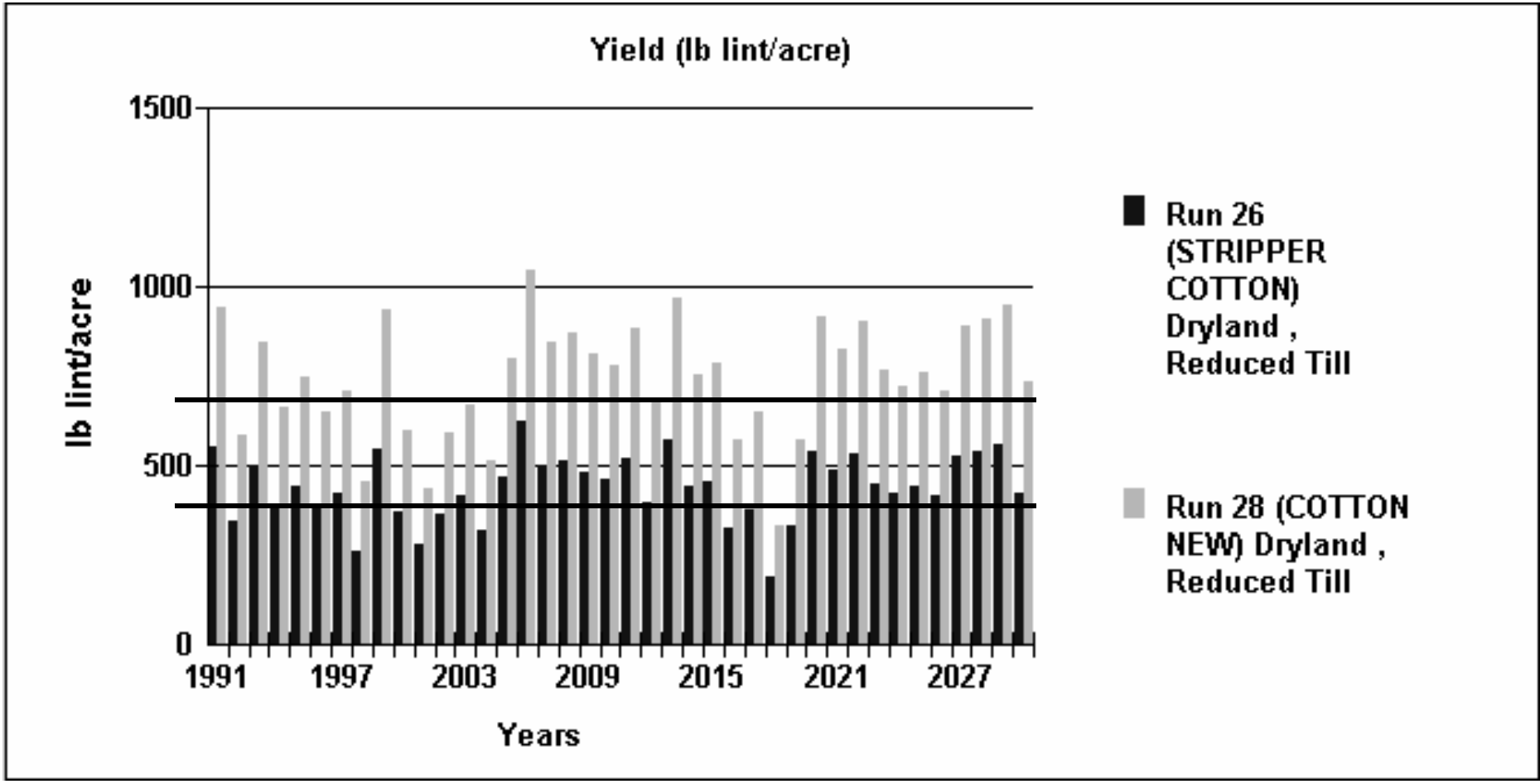
Optimization



- what is the goal?
- where are we?
- what is going on?
- how do we get there?
- what is the limiting factor(s)?
- Costs & benefits?
- what if ….?
- evaluation?

Dryland Cotton (before/after BWE)

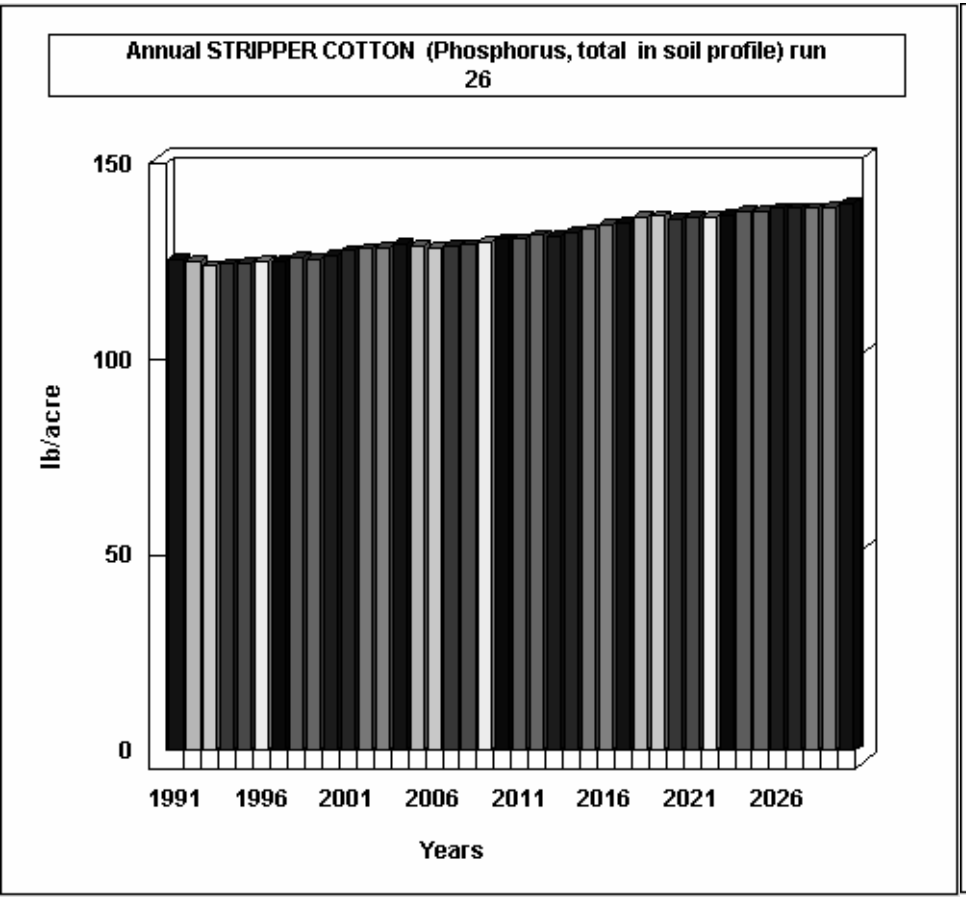
San Patricio Co.



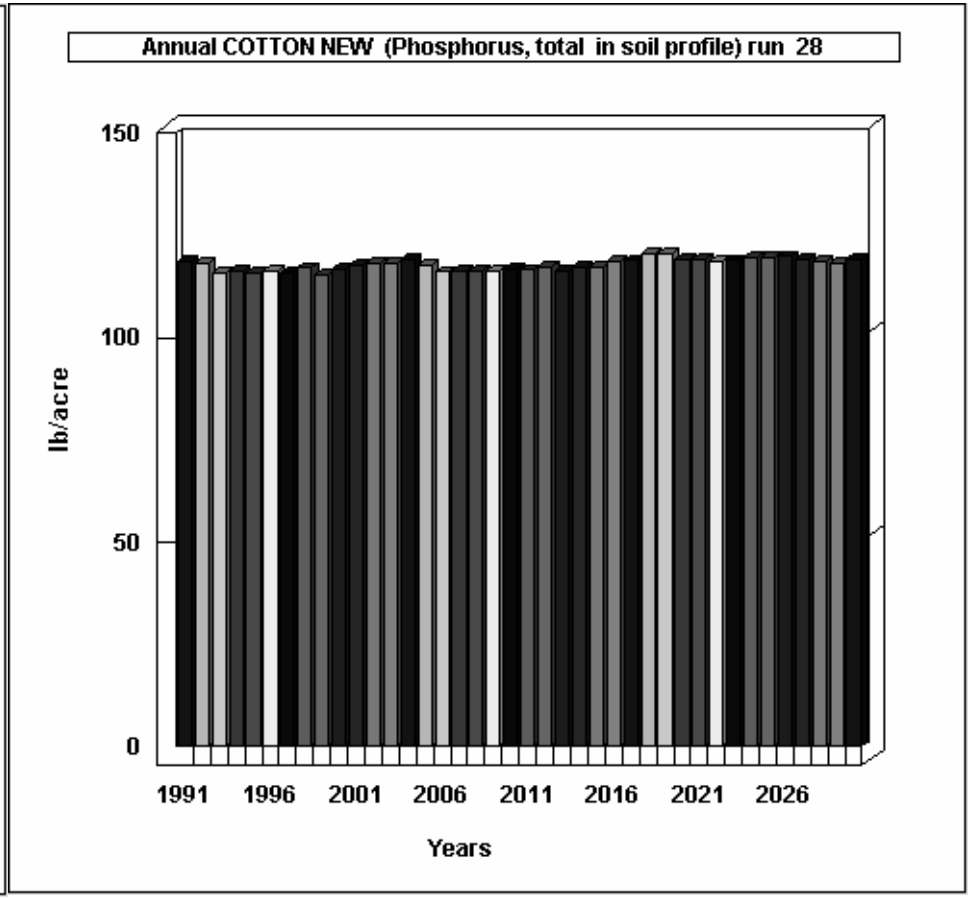
Soil Phosphorus (before/after BWE)

San Patricio Co.

Before



After



Strategic Management

- Identify production constraints
- Quantitatively evaluate the cost:benefit of alternative cropping practices
  - Risks: Climatic & soil
  - Clients, Landlords & Lenders
- Identify BMP's to overcome climate/soil constraints
  - El Nino/La Nina effects
- Identify BMP's to reduce erosion, nutrients, pesticides in runoff

Tactical Management

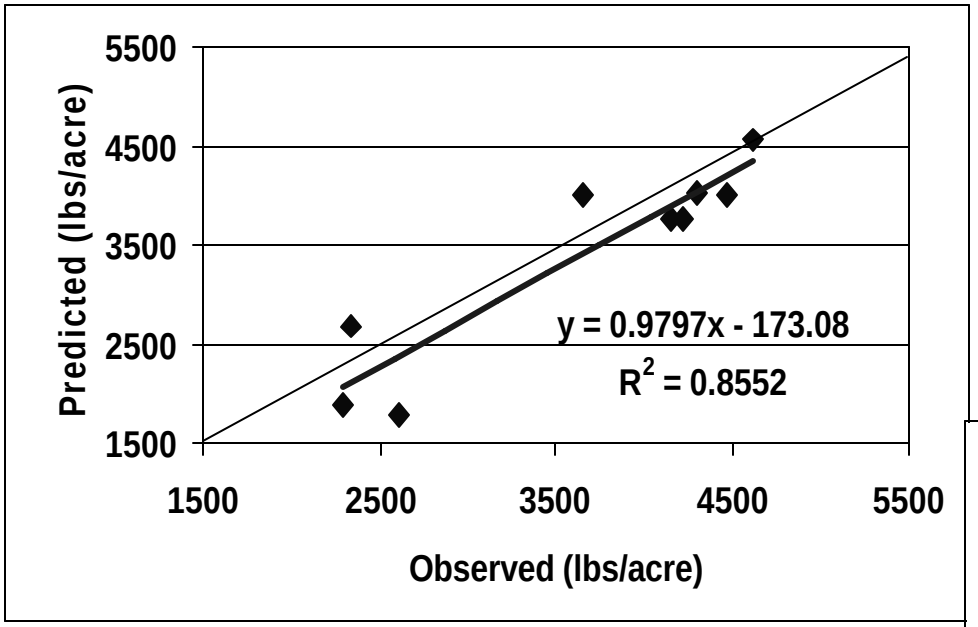
- Irrigation (timing, amt., and cost)
- Replant decisions
- Late planting options
- Fertilizer optimization
- Estimate yield
- Drought Analysis
  - El Nino/La Nina effects
- Quantify nutrient/pesticides in runoff

Current Limitations

- “No consideration” of insect, disease, weed pest pressure
- Irrigation Methods: trickle, LEPA, etc.
- Skip-row production systems
- K, Fe, Zn
- Crop/grazing systems (in EPIC)
- Crop parameters for forages, horticultural, & minor agronomic crops
- Share-cropping cost/expense in economic analyses
- Integrate w/ Precision Agriculture Technology
- Limited of detail in crop models (no fiber quality or grain quality)

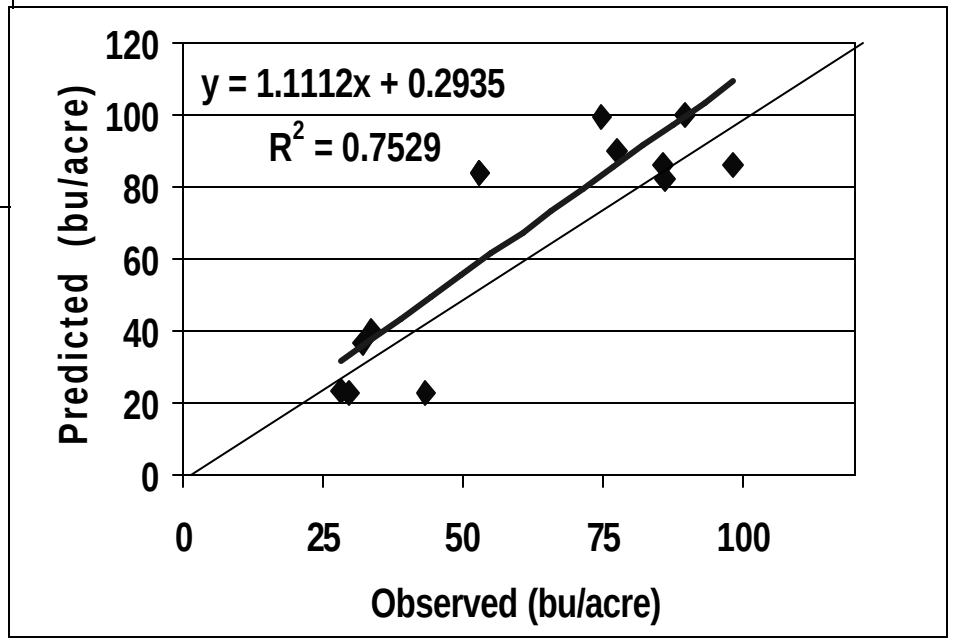
Observed vs Predicted Yield

Stiles Farm Foundation, Taylor
Production Fields 1996-2000



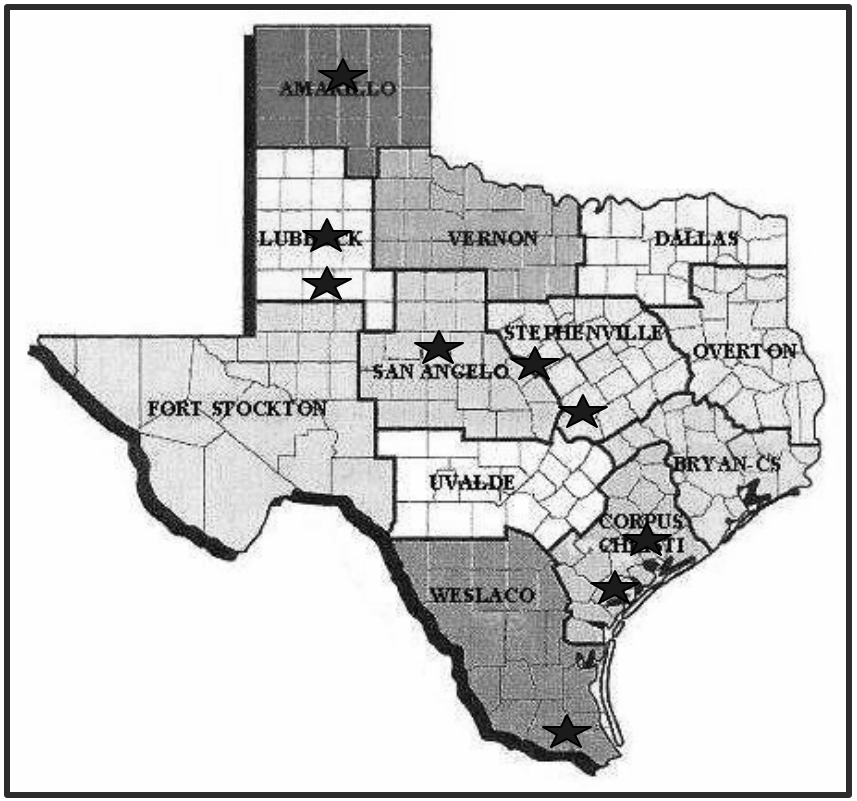
Grain Sorghum

Corn



Current Activities

- β-testing & customizing databases
- Training:
  - TCE, TAES, and & others
- Improve model
  - Find/correct bugs
  - New features



CroPMan
A Crop Production Management Model

CroPMan is a production-risk management aid to help agricultural practitioners optimize crop management and maximize production and profit, to identify limitations to crop yield, to assist growers with replant decisions, and to identify best management practices that minimize impact of agriculture on soil erosion and water quality. It is a windows-based application of **EPIC** (Environmental/Policy Integrated Climate model) originally developed by USDA-ARS that simulates the interaction of natural resources (soil, water, climate) and crop management practices to estimate impacts on harvested crop yield, soil properties, soil erosion, profitability, and nutrient/pesticide fate. **CroPMan** is distributed on CD-ROM and operates under *Windows*® 98, 2000, ME & XP with 64 MB RAM. It is installed on a hard-drive (using 250 to 500 MB minimum). The databases for basic model operation are organized by agricultural region and contain baseline information for model operation so the user can perform basic operations with minimum effort, but the user can customize this information for his/her site-specific conditions and needs. Databases for model operation are currently available for Texas and Missouri, but can be constructed for operation in other agricultural regions.

Crop management simulated:

- Fertilization: N and P (mineral, manure)
- Planting date, crop maturity, crop type, and rotation sequence
- Irrigation
- Plant population & Row spacing
- Tillage/ residue management
- Pesticide (economics and fate)

Databases included:

- Weather: observed daily maximum and minimum temperature and precipitation and monthly statistics from selected class 1 or coop weather sites to operate weather generator
- Soils 5, Management Unit Use Files by County
- Pesticides, Fertilizers & Equipment
- Management: sequential farming operations by cropping system: crop, tillage (conventional, reduced, and no-till), and water application (irrigation versus dryland)

Special Features:

- Unit Conversion: English/Metric
- Generates daily weather from monthly statistics if daily weather data are missing
- Update/ modify soils, weather, crop growth, and management to current conditions
- Performs direct comparisons of soil type/characteristics, cropping systems, management practices to identify best opportunities over- and within- cropping season.
- Information saved and sorted by Producer name, Soil, County, Weather Station, Cropping System, Farm, Field, and Management unit.
- Built in utility to update daily weather records to current day from user collected/supplied daily records.

pplications:

Strategic Assessments (over years)

Examine production practices for site-specific climate and soil variation to identify production constraints and maximize yield, profit, and production efficiency.

Assess fertility requirement, and nutrient and pesticide fate

Identify the “Best Management Practices” for site-specific circumstances to minimize cropping impact on soil erosion, water quality, and runoff.

Assess climate impacts on productivity: El Nino/La Nina

Real-time Analyses (current year)

Late planting options (maturity/crop type)

Replant decisions

Fertilizer optimization

Irrigation timing and amount

Estimate yield & profit

Nutrients/pesticides in runoff

Output: Graphical/numeric display, hard copy, or saved to digital file

- **Economics**
- Operation, Fixed, & Total Costs
- Gross Returns
- Cash Flow
- Profit
- **Stresses:**
- Drought
- Low Temperature
- Excess Water
- Nitrogen
- Phosphorus
- **Crop yield:**
- Biomass
- Yield (grain, forage and/or lint yield)
- Nitrogen in yield
- Phosphorus in yield
- **Water balance:**
- Precipitation
- Surface runoff
- Water use efficiency
- Evapotranspiration
- Irrigation applied
- Crop available water
- Percolation below root zone
- Lateral subsurface flow
- **Nutrient balance:**
- Phosphorus mineralized
- Phosphorus applied
- Nitrogen applied
- Lime applied
- Organic carbon in plow layer (6")
- Organic carbon in soil profile
- **Non-point Losses:**
- Soil loss (water erosion – small watershed)
- Soil loss (wind erosion)
- Soluble phosphorus loss in runoff
- Phosphorus in percolate
- Phosphorus loss with sediment
- Organic nitrogen loss with sediment
- Soluble N in surface runoff
- Mineral N loss in lateral subsurface flow
- Mineral N loss in percolate
- **Pesticide losses:**
- Biodegraded (foliage)
- Biodegraded (soil)
- In drainage system
- Remaining In soil (EOM: end of month statistics)
- Losses by leaching
- Losses in runoff
- Losses in sediment
- Remaining On foliage (EOM: end of month statistics)
- **Other:**
- Planting date
- Emergence date and Harvest date
- **For Information on CroPMan and Workshop Dates Contact:**

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The Team

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  - Project Leaders
- Jimmy Williams, Avery Meindarus
  - EPIC programming
- John Greiner & Larry Francis
  - VB output programming
- Evelyn Steglich & Melanie Magre
  - Beta-testing
  - Database construction & maintenance
  - Manual & website construction/maintenance