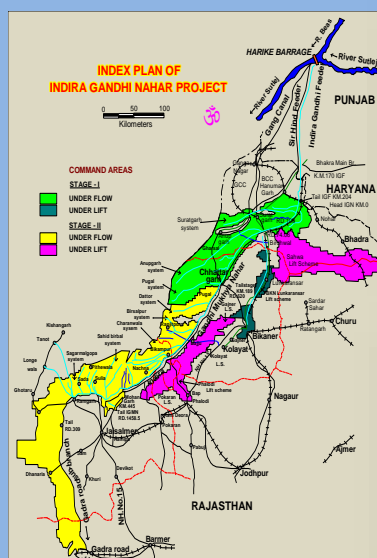


PROBLEM

- ❖ Stage-I of command area has even topography, intensively cropped, surface irrigation (flood, check basin). **Water logging, soil salinization, low crop water and nutrient use efficiency** are major problems.
- ❖ Stage-II of command area has light soils, uneven topography, low and irregular availability of water. **Low land- as well as water-productivity, higher inter-annual yield variability, low water and nutrient capacity of soil, wind erosion** are major problems in this area.
- ❖ Decreasing water availability for crop production and land degradation caused by **poor crop water management** warrants identification of management strategies to sustainably utilize water in agriculture in the IGNP command area.



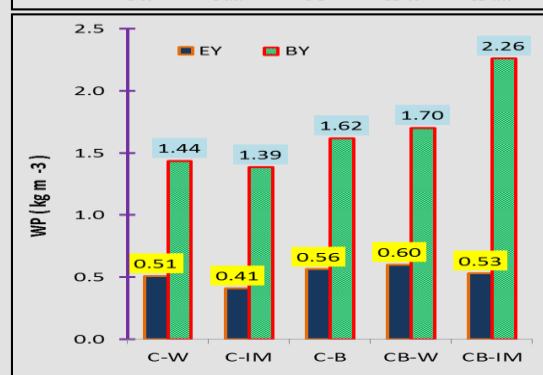
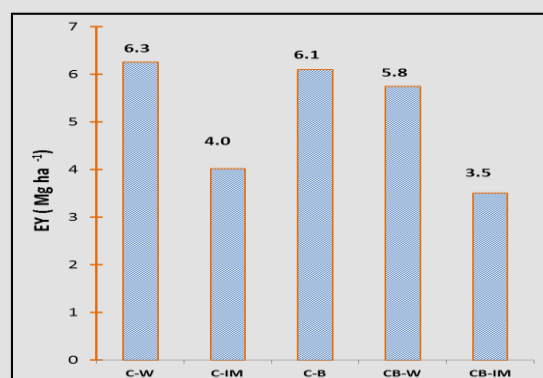
OBJECTIVES

- ❖ To assess yields, profits and water productivity of different crops and cropping systems under existing crop management practices in the IGNP command area
- ❖ To quantify yield and water productivity of crops under different application rates of irrigation and fertilization;
- ❖ To validate and evaluate performance of CropSyst crop simulation model for different selected crops;
- ❖ To build capacity of stakeholders

RESEARCH RESULTS

Assessing yield, profit and water productivity of crops and cropping systems

- ❖ In IGNP stage-I, the EY varied from 3.5 to 6.3 Mg ha⁻¹. Cotton-wheat cropping system had highest EY followed by clusterbean-wheat, cotton-mustard and clusterbean-mustard. Averaged across two years, clusterbean-based cropping systems had 2X higher profit than cotton-based cropping systems.
- ❖ The WP of cropping systems measured in terms of EY ranged from 0.36–0.66 kg m⁻³; highest being for clusterbean-wheat and lowest for cotton-mustard cropping system. Clusterbean-based cropping systems were more water productive in terms of yield and monetary return than wheat-based cropping systems.
- ❖ In stage-II, groundnut-wheat cropping system had 62 and 66.2 and 63.5, 23.5 and 100.2 percent higher seed yield over groundnut-cumin, groundnut-isabgol, groundnut-mustard and clusterbean-chickpea systems, respectively.



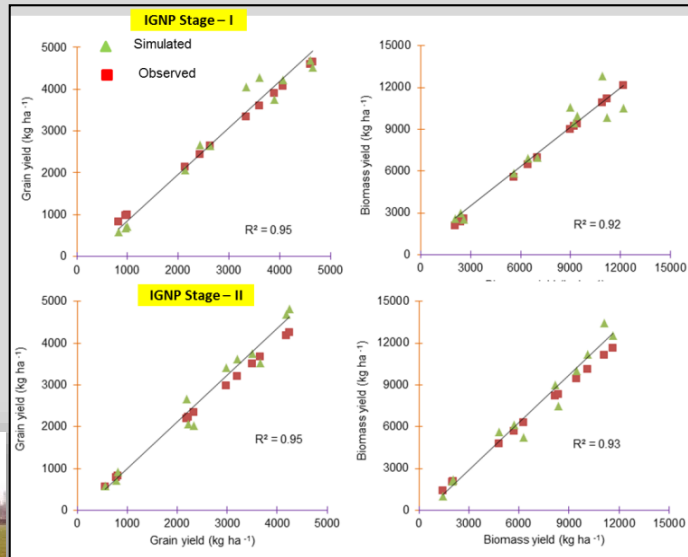
*EY: Economic yield; BY: Biomass yield; WP: Water productivity



Yield and productivity of crops under variable rates of irrigation and N

Effects of irrigation and N application rates on yields and WP of wheat

| N rate (kg ha ⁻¹) | Irrigation | | | Mean |
|---|------------------|------------------|------------------|---------------|
| | I ₂₀₀ | I ₄₀₀ | I ₆₀₀ | |
| Grain yield (kg ha⁻¹) | | | | |
| N ₀ | 986g | 967g | 817g | 923D |
| N ₅₀ | 2434ef | 2633e | 2133f | 2400C |
| N ₁₀₀ | 3341d | 4066b | 3900bc | 3769B |
| N ₁₅₀ | 3603cd | 4600a | 4650a | 4284A |
| Mean | 2591B | 3067A | 2875A | |
| Biomass yield (kg ha⁻¹) | | | | |
| N ₀ | 2600g | 2369g | 2052g | 2340D |
| N ₅₀ | 6983e | 6433ef | 5583f | 6333C |
| N ₁₀₀ | 9203d | 11183bc | 10517c | 10301B |
| N ₁₅₀ | 9385d | 12833a | 12167ab | 11462A |
| Mean | 7043AB | 8205A | 7580B | |
| Water productivity (kg m⁻³) | | | | |
| N ₀ | 0.49e | 0.24fg | 0.14g | 0.29D |
| N ₅₀ | 1.22b | 0.66d | 0.36ef | 0.74C |
| N ₁₀₀ | 1.67a | 1.02c | 0.65a | 1.11B |
| N ₁₅₀ | 1.80a | 1.15bc | 0.78d | 1.24A |
| Mean | 1.30A | 0.77B | 0.48C | |



Simulated and observed yield of wheat in IGNP



CropSyst model validation and performance evaluation

| Wheat (Stage I) 2016-17 | I1 = 200mm | | | | I2 = 400 mm | | | | I3 = 600mm | | | | Mean |
|-------------------------|------------|-------|-------|-------|-------------|-------|-------|--------|------------|--------|--------|--------|---------------|
| | N0 | N50 | N100 | N150 | N0 | N50 | N100 | N150 | N0 | N50 | N100 | N150 | |
| Grain Yield | | | | | | | | | | | | | |
| RMSE | 1062.5 | 528.5 | 307.9 | 388.8 | 303.3 | 220.0 | 287.9 | 482.4 | 790.5 | 342.8 | 592.9 | 879.4 | 515.6 |
| RRMSE % | 39.2 | 16.0 | 8.5 | 10.8 | 10.0 | 5.7 | 6.7 | 10.2 | 30.0 | 9.5 | 13.3 | 17.0 | 14.7 |
| IOA Yield | 0.97 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.98 | 0.99 | 0.99 | 0.99 | 0.98 |
| AGB | | | | | | | | | | | | | |
| RMSE | 3841.1 | 808.8 | 518.0 | 704.7 | 1562.1 | 556.8 | 373.0 | 1094.2 | 1816.5 | 1214.5 | 2370.2 | 2236.1 | 1424.7 |
| RRMSE % | 43.3 | 6.7 | 3.9 | 5.2 | 16.0 | 4.2 | 2.6 | 7.2 | 19.9 | 9.8 | 15.6 | 13.6 | 12.3 |
| IOA AGB | 0.96 | 0.99 | 0.99 | 0.99 | 0.99 | 1.00 | 1.00 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |

- Irrigation at 400 and 600mm had 21 and 46% higher grain yield than 200 mm irrigation. WP was 20% higher at 400 mm than at 600 mm irrigation.
- In stage-II, the highest wheat yield (4565 kg/ha) was recorded at N = 150kg N/ha with 600mm irrigation level which was 25 and 60% higher over 400 mm and 200 mm irrigation level, respectively.
- RRMSE ranged from 2.6 to 31% and the model predicted yield well at moderate levels of irrigation.

CAPACITY BUILDING

- ❖ Five post-graduate students of SKRAU completed these work
- ❖ Two workshops, one brainstorming session and one international training on CropSyst modeling were organized at CAZRI
- ❖ Three scientists from ICAR attended International Training at ICARDA, Jordan.



PUBLICATIONS

- ❖ Published a Special Issue of Annals of Arid Zone Research Journal on improving water productivity in dry areas
- ❖ Five research papers published in peer reviewed international journals
- ❖ One Ph.D. and four M.S. theses published
- ❖ Media coverage by Rajasthan Patrika newspaper

