

# **Climatic Variability and its impact on rice yield under new alluvial agroclimatic zone of West Bengal**

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# Introduction

In new alluvial zone of West Bengal, first fortnight of July is the normal dates of transplanting for rice crop and average yield of rice cultivar Shatabdi is ~ 5 tonnes/ha. In those years when monsoon onset is delayed, farmers generally use aged seedlings for transplantation up to 10 August and yield reduces considerably i.e. ~ 3.0 tonnes/ha.

Assured irrigation facility from deep tube well exists along with provision of good drainage in the region. The soil of the experimental field is alluvial in nature (Entisol) and silty clay in texture and well drained.

The climate of the zone is sub-tropical with an average annual rainfall of 1467.5 mm ranging from 1195.5 to 1691.9 mm.

# Materials and Method

CERES-Rice crop simulation model V4.0 has been used for analysing the effect of climatic variability on rice growth and yield. Also to explore the study the effect of delayed monsoon in rice growth & yield and to evaluate better adaption strategies.

The basic field experiment was collected for the year 2003,04,05 and 2006 in medium to low land condition at the University Farm of Bidhan Chandra Krishi Viswavidyalaya, Nadia District, West Bengal (22<sup>0</sup>8' N Latitude and 88<sup>0</sup>30' E Longitude) for important phonological states of widely grown rice variety "*Shatabdi*" in the region has been used for calibration & validation.

Daily weather data on maximum temperature, minimum temperature, rainfall, and bright sunshine hours for 14 years (1994 – Oct 2009) has been analysed to study the variability in terms of rainfall and temperature. Solar radiation required by crop model was calculated from bright sunshine hours.

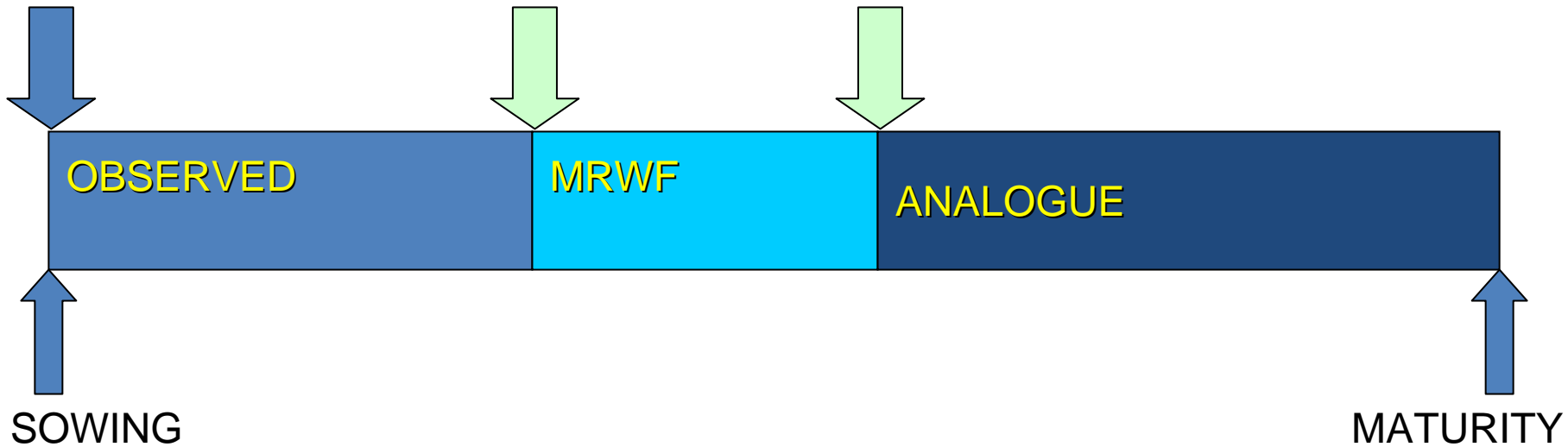
Soil information includes drainage, runoff, evaporation and radiation reflection coefficients, soil water holding capacity amounts, and rooting preference coefficients for each soil layer and initial soil water content etc.

# Weather Data Scenarios

2009  
21 October

31 October

1 November



## Calibration and Validation of CERES- Rice cultivar -Shatabdi

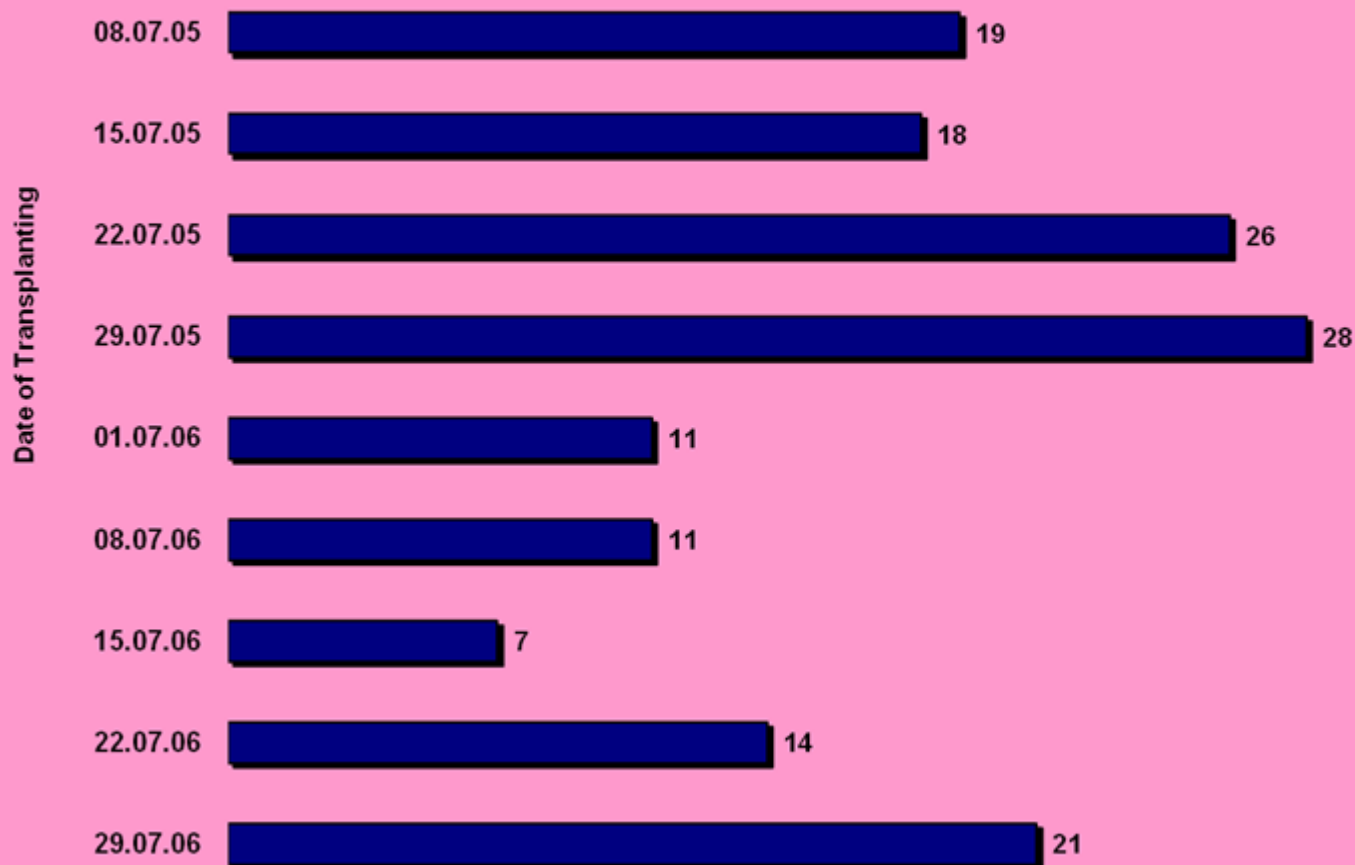
DoT	Anthesis		Physical Maturity		Yield		LAI	
	Obs	Sim	Obs	Sim	Obs	Sim	Obs	Sim
30.06.0 <sub>2</sub>	53	58	83	86	2855	5276	3.05	3.97
14.07.0 <sub>2</sub>	53	59	85	87	3797	5208	4.25	4.08
28.07.0 <sub>2</sub>	51	57	81	86	2865	4808	4.05	3.67
11.08.0 <sub>2</sub>	51	55	79	86	1967	4472	2.49	3.28
25.08.0 <sub>2</sub>	49	55	77	87	1433	4220	1.98	2.78
24.07.0 <sub>4</sub>	81	58	115	88	4900	4928	6.04	3.46
01.07.0 <sub>4</sub>	56	58	83	86	5220	4576	3.45	4.08

# Validation

DoT	Anthesis		Physical Maturity		Yield		LAI	
	Obs	Sim	Obs	Sim	Obs	Sim	Obs	Sim
18.07.0 5	55	58	91	85	5431	4562	7.73	3.41
15.07.0 5	52	56	86	86	4182	4600	8.81	3.23
22.07.0 5	47	57	85	85	4107	4316	6.75	3.14
29.07.0 5	50	55	83	84	3434	4231	8.19	3.09
01.07.0 6	61	68	83	86	4551	4914	5.15	3.90
08.07.0 6	59	58	84	86	4515	4898	6.37	3.89
15.07.0 6	56	58	80	86	4011	5095	4.46	3.88
22.07.0 6	55	56	76	84	3007	4758	7.77	3.74
29.07.0 6	49	55	75	83	2817	4502	4.42	3.57

# Validation of CERES- Rice cultivar -Shatabdi

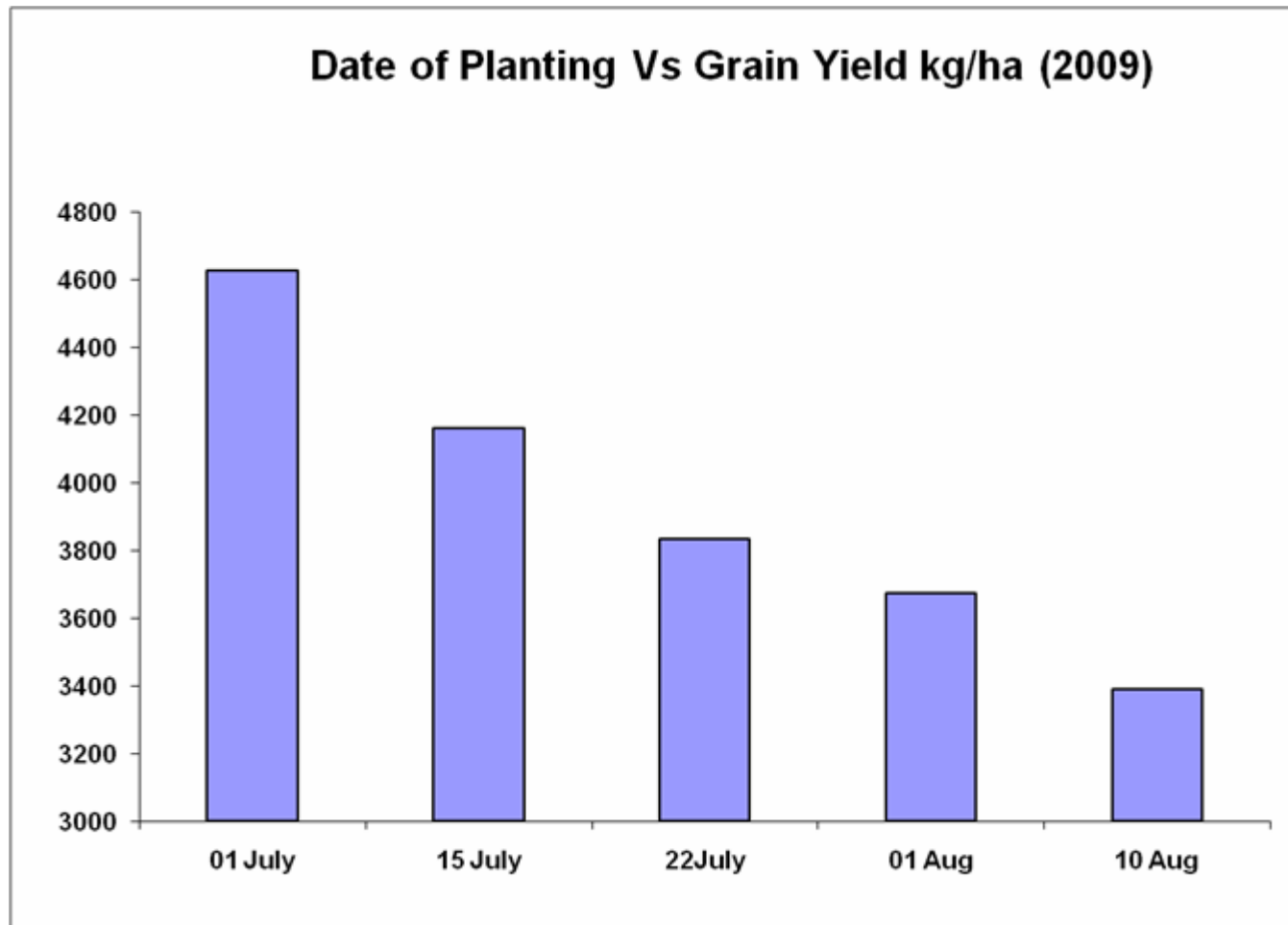
## Percentage Deviation from Observed Yield



# RESULTS

## Rice yield estimates for year 2009 in Kalyani region

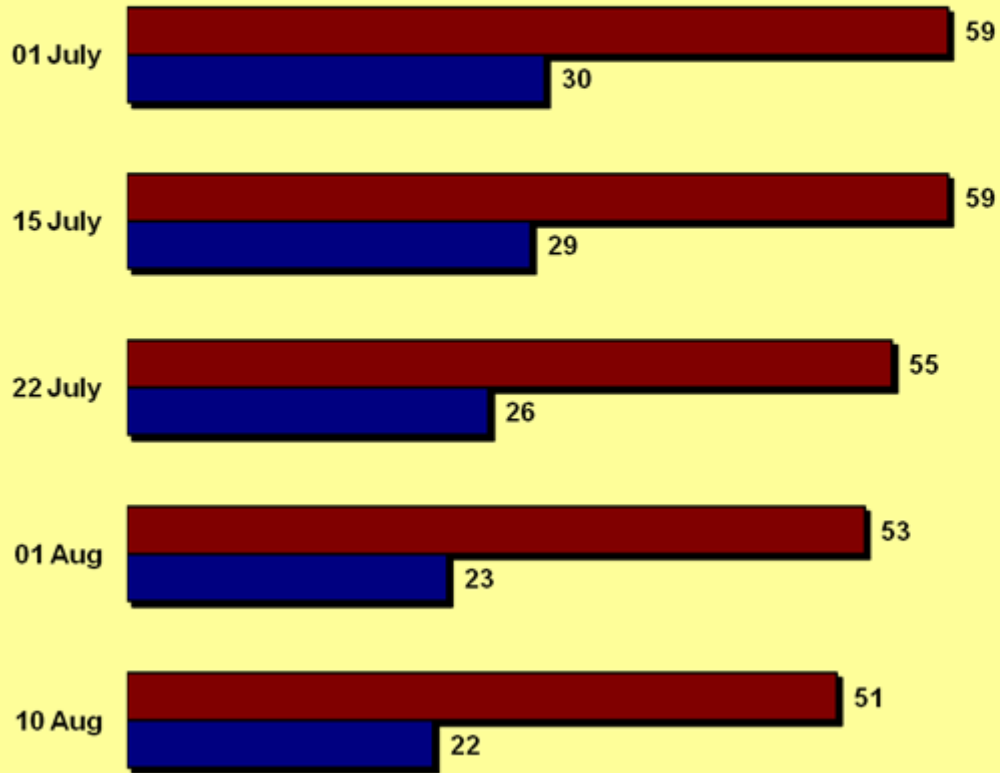
*Cultivar: Shatabdi*



**Rice yield estimates for year 2009 in Kalyani region**  
**Cultivar: Shatabdi**

<b>Date of Transplanting</b>	<b>Grain Yield (Kg/ha)</b>	<b>% Deviation</b>
<b>01 July</b>	<b>4625</b>	
<b>15 July</b>	<b>4160</b>	<b>-10</b>
<b>22 July</b>	<b>3832</b>	<b>-17</b>
<b>01 Aug</b>	<b>3672</b>	<b>-21</b>
<b>10 Aug</b>	<b>3388</b>	<b>-27</b>

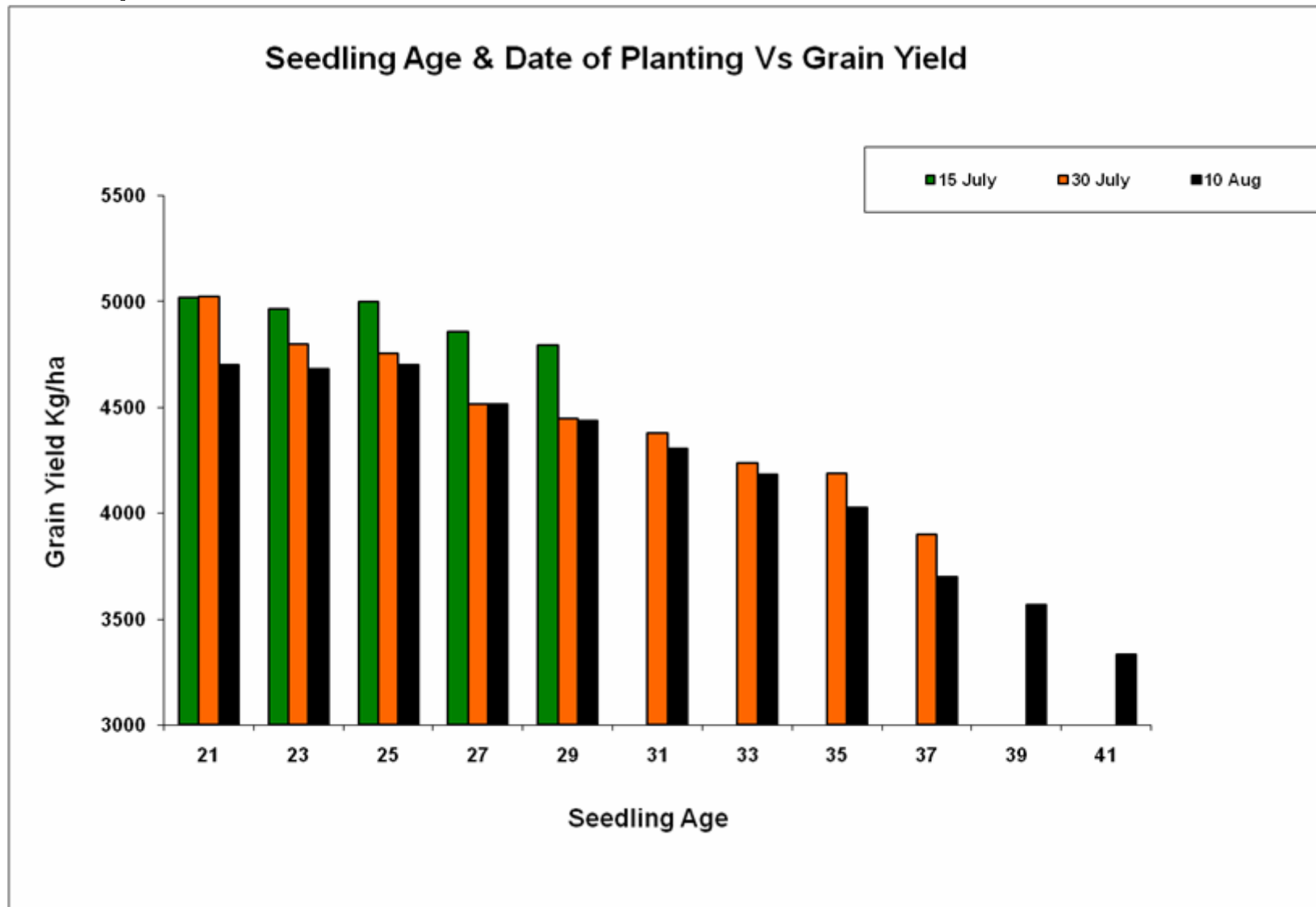
### Date of Transplanting (2009) Vs Phenology



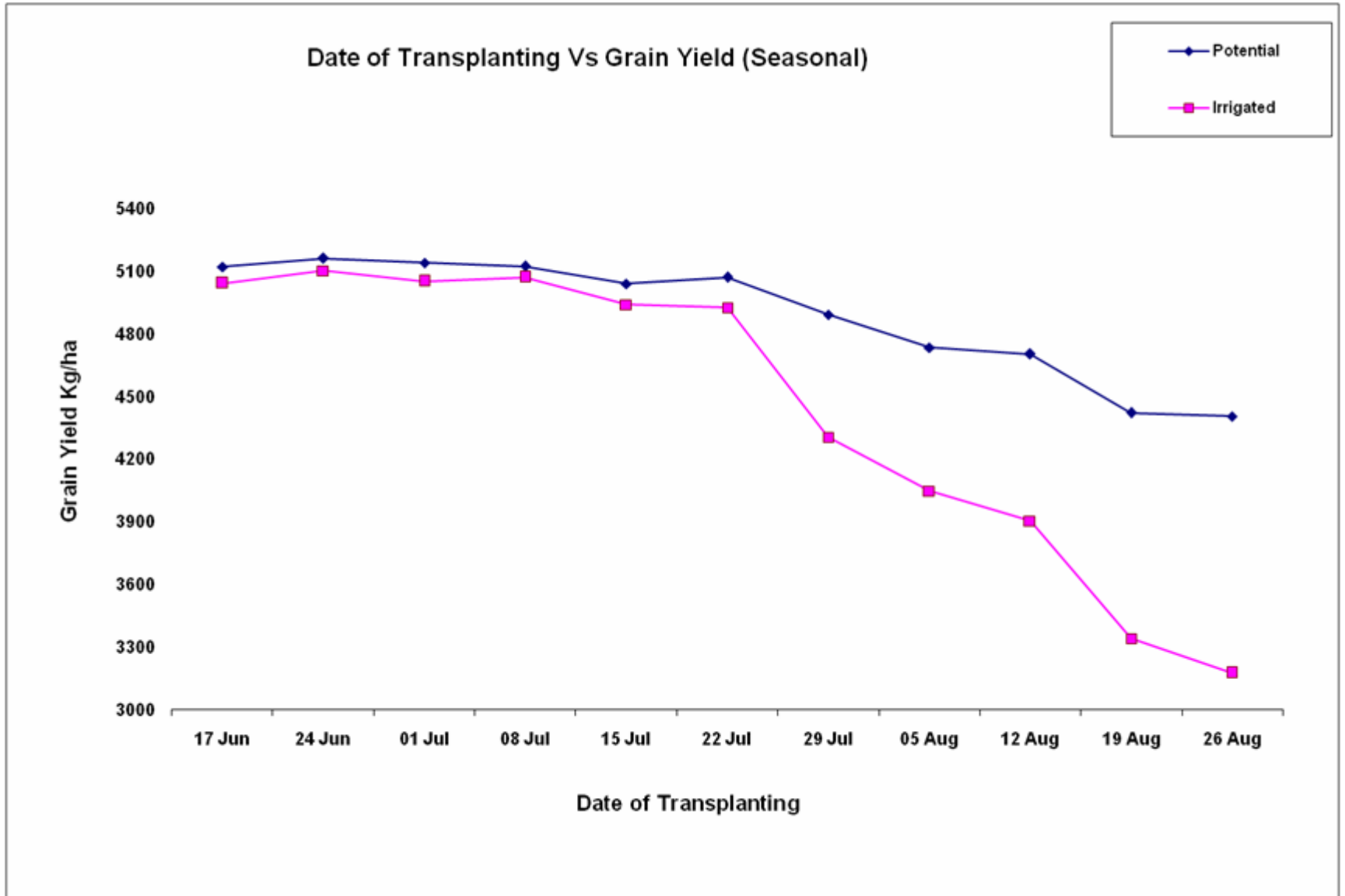
■ Anthesis

■ Panicle Initiation

# Response of grain yield to Date of transplanting, age of seedling based on seasonal analysis ( weather data used for years 1996-2008)



# Potential and irrigated condition yield for *Shatabdi* cultivar



# Limitations:

Crop model simulation outputs are valid at appoint or small farm.

Other factors are nutrients assumed to be in abundant supply in the soil, so as not to cause any stress on crop.

Similarly loss due to weed, pest and diseases are also not included in the model. Due to favorable weather conditions the pest and diseases infestation may cause loss to the crop that is not accounted at present by the model.

Mechanical loss due to aberrant weather is not accommodated.

# Summary

- The model estimates shows reduction in grain yield by ~ 10, 17, 21 and 27 percent for transplanting done on 15 July, 22 July 01 Aug and 10 Aug respectively compared to the 1 July transplanted rice during monsoon 2009.
- Anthesis and Panicle initiations occur earlier by 2-8 days and 4-8 days in delayed condition of transplanting compared to 1 July.
- Rice yield estimates were simulated for the different eleven dates of transplanting viz., 17 Jun, 24 Jun, 01 Jul, 08 Jul, 15 Jul, 22 Jul, 29 Jul, 05 Aug, 12 Aug, 19 Aug and 26 Aug, for determining the best time of transplanting under potential and irrigated condition. Under irrigated condition, there was significant yield reduction from 29 July onwards.
- Model results shows maximum yield in first fortnight of July sown paddy with 21 -25 days age seedlings.

*Thank You !*

