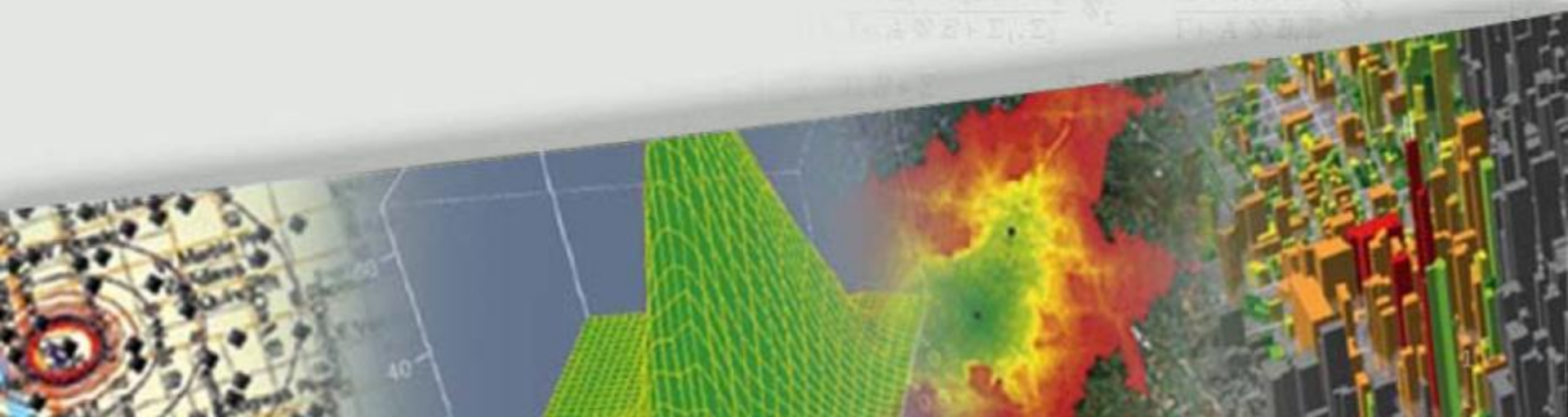




Selection of the appropriate data source for Agriculture Risk Modelling

Mozambique Agro Risk - Barue District

Presented By: Pushpendra Johari



Agri. Risk Model Components

- Hazard Module – Hazard related information
- Vulnerability Module – Crop wise and region specific curves
- Exposure Module – Crop production and acreage data
- Insurance Module – Policy Information, Indices – by policy, by Geographic areas, Perform accumulation control, Portfolio analysis ,Cession limits, Liability limits

Hazard Module – Hazard related information

Primary parameters - Rainfall and Temperature

- Available from local Met Agencies
- Available from local Agriculture departments
- Satellite based
 - TRMM (Tropical Radar)
 - NOAA
- Synthetic – Santa Clara University

? WHICH ONE TO USE

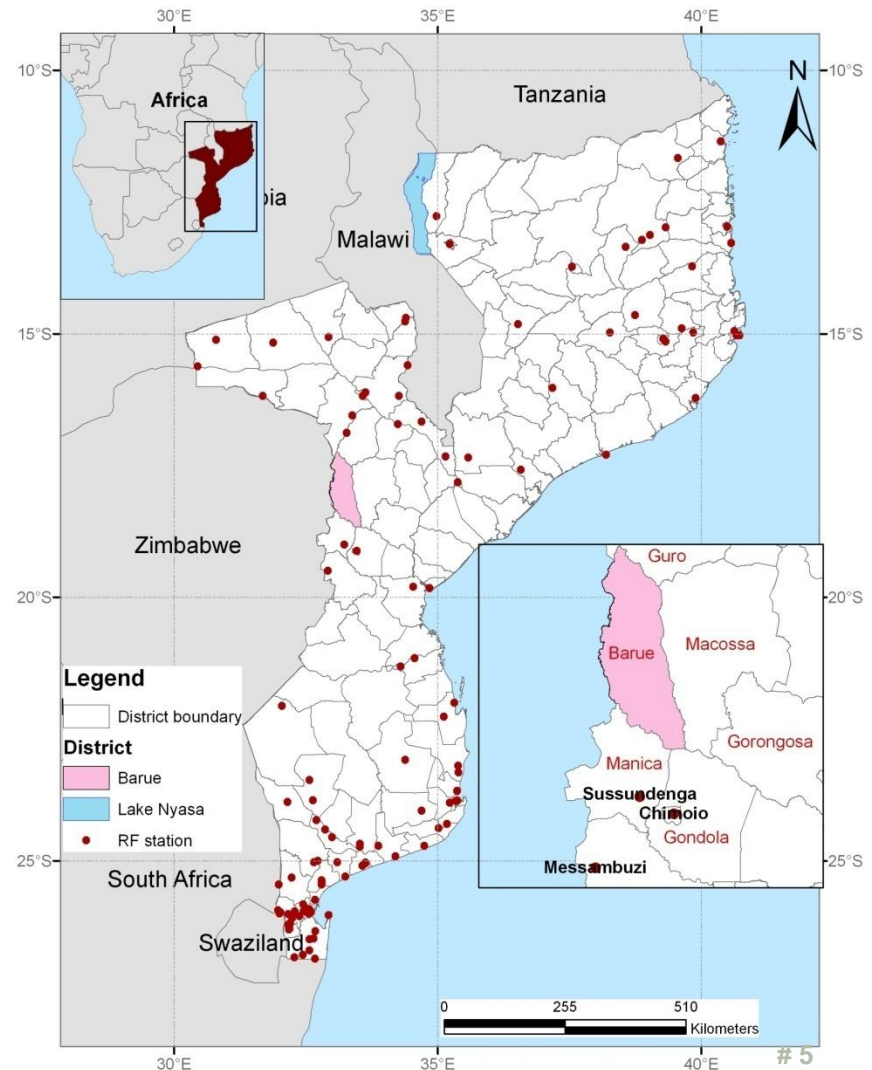
Mozambique Agro Risk - Barue District

General Information about Barue

- Area:
 - 5,800 km² (equivalent to 160km * 40km)
 - 0.73% of country area
 - 60% of districts are smaller
- Maize production:

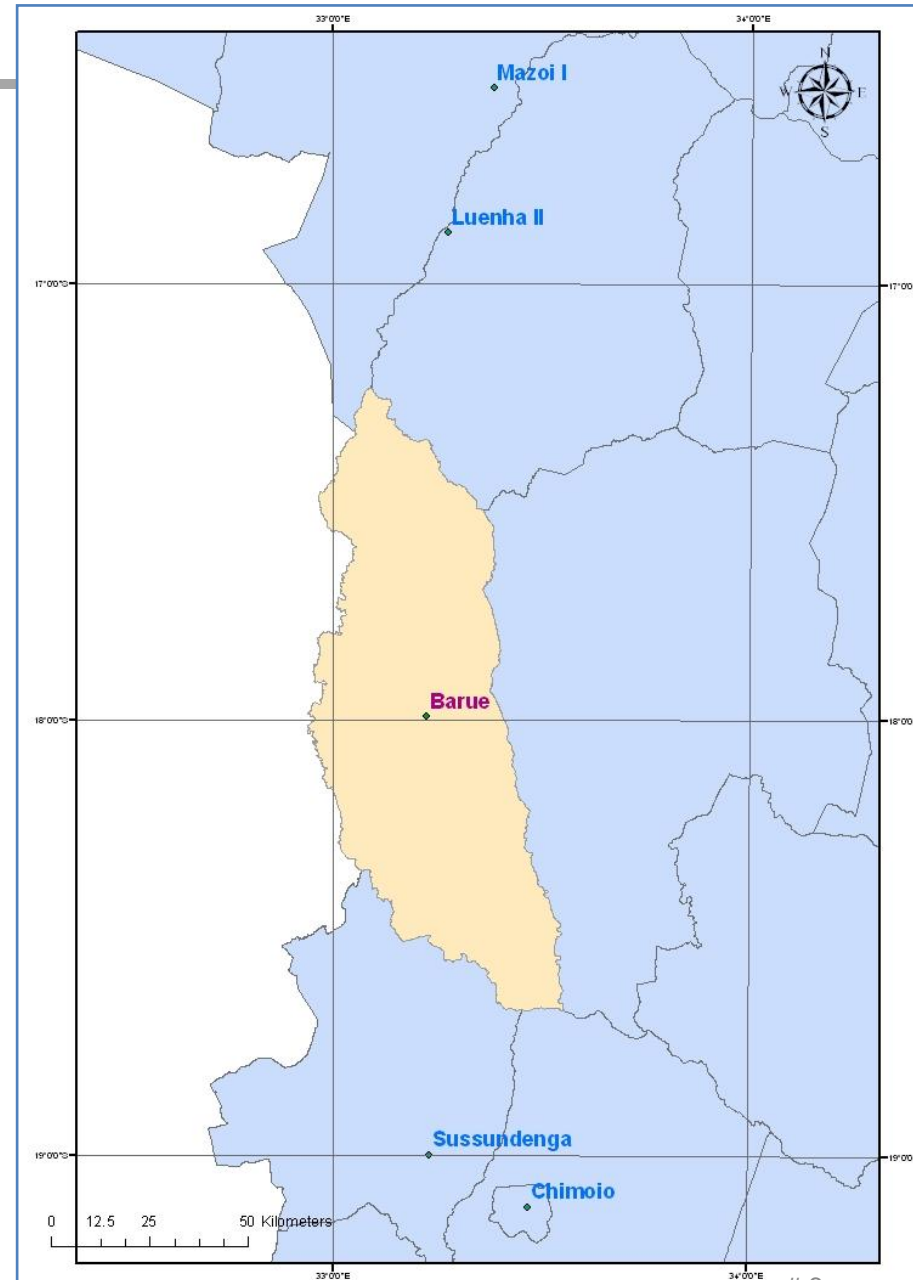
	Year Season	2009 2008-09
Planted area Ha	Barue	18,825
	Country total	1,613,405
	Percentage	1.2%
Production Tons	Barue	28,237
	Country total	1,842,993
	Percentage	1.5%
Yield Ton/ha	Barue	1.50
	Country range	0.4 to 2.0

115 RAINFALL STATIONS LOCATION MAP
BARUE DISTRICT AVAILABLE RAINFALL STATION



Rainfall Stations

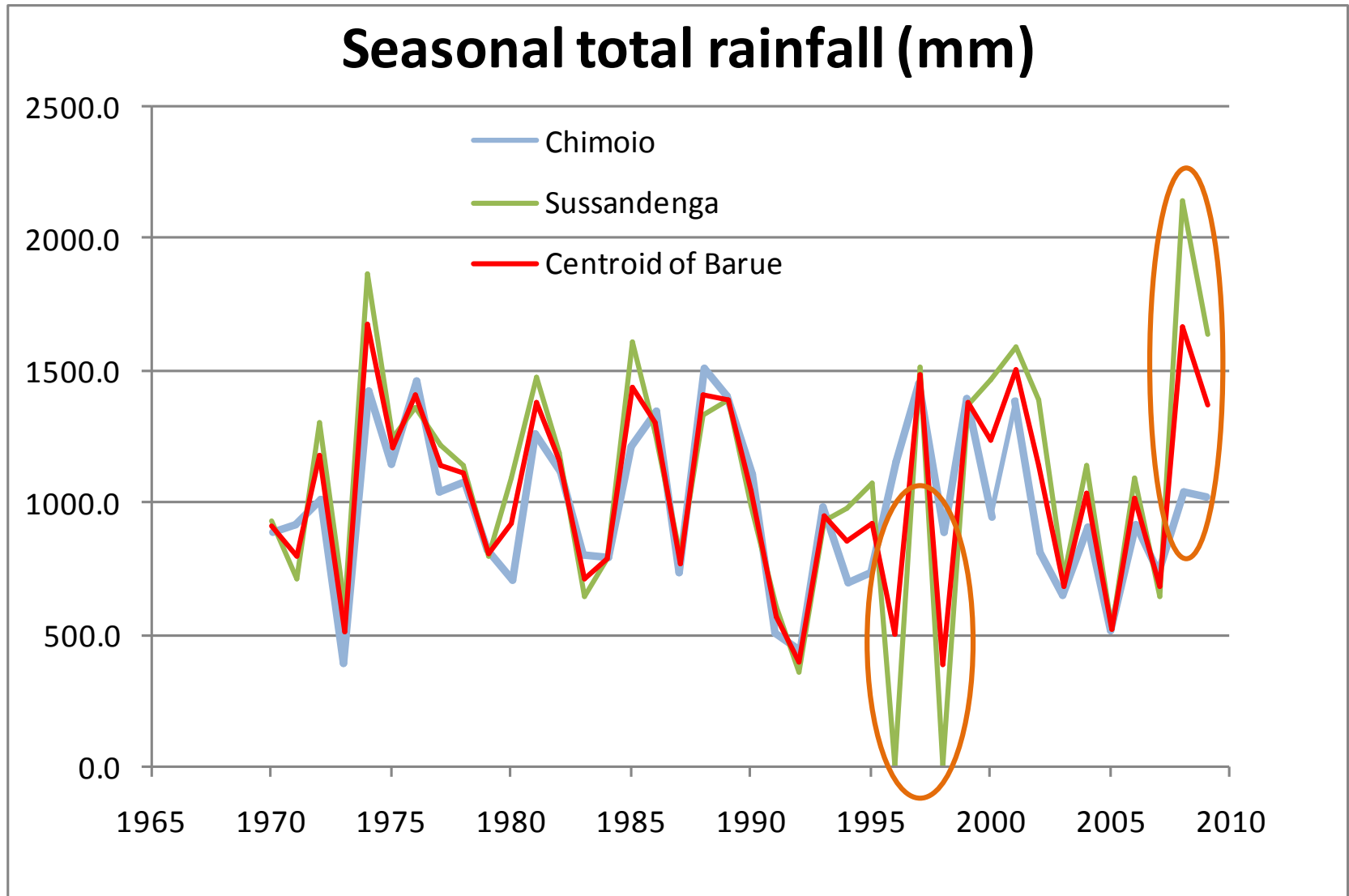
- No rainfall stations located in the district
- Two stations (Luenha II, and Mazoi I) located north
- Two stations (Sussundenga, and Chimoio) located south.
- Luenha II has about 17% missing data and Mazoi I has about 51 % missing. These two stations are from DNA. Ignored.
- Sussundenga and Chimoio (From INAM/IAM) have continuous data for nearly 40 years. Used in this study.



Stations Sussundenga and Chimoio

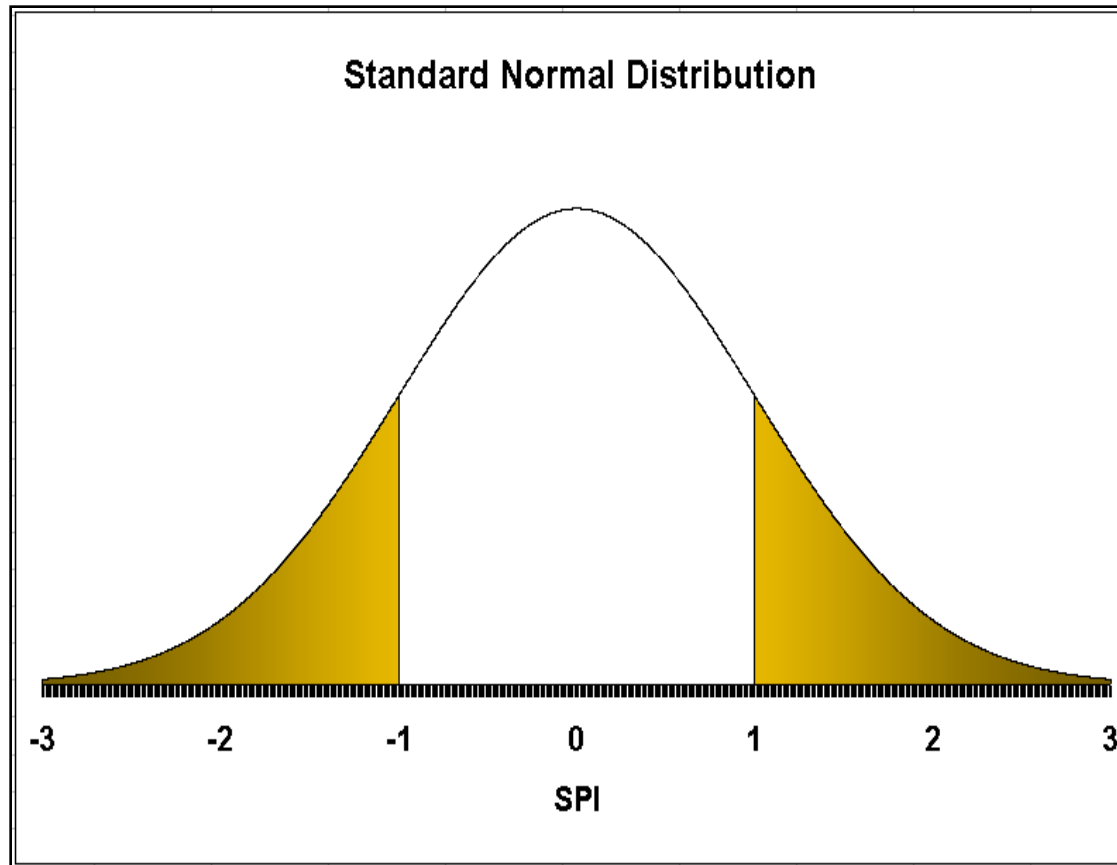
- 41 years of daily rainfall (1969-2009)
 - Chimoio (1960-2009)
- Distance from Barue centroid
 - Sussundenga: 111.3 km
 - Chimoio: 127.3 km
 - Weighted by the inverse of distance²
 - They are essentially averaged.
- Seasonal rainfall: sum of November to April (6 months)

Seasonal Rainfall Comparison



SPI- Index

The standard normal distribution has a mean of zero and a standard deviation of one. SPI is a representation of the number of standard deviations from the mean at which an event occurs. The unit of the SPI can thus be considered to be standard deviation or a Z score.

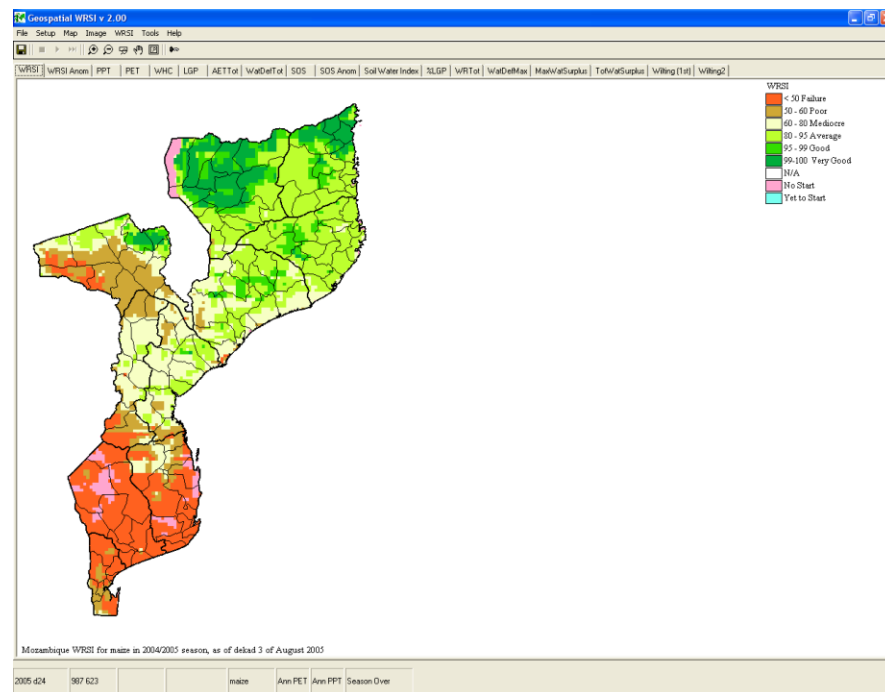


SPI VALUES	
Above 2.0	Extremely Wet
1.5 to 2.0	Very Wet
1.0 to 1.5	Moderate Wet
-1.0 to 1.0	Near Normal
-1.5 to -1.0	Moderately Dry
-2.0 to -1.5	Severely Dry
Below -2.0	Extremely Dry

GeoWRSI

- is a geo-spatial, stand-alone application for estimation of WRSI (Water Requirements Satisfaction Index)
- is implemented by the USGS for the FEWSNET Activity.
- runs a crop-specific water balance model for a selected region in the world, using raster data inputs
- Includes satellite based Dekadal rainfall from 1995 onwards.
- produces a range of outputs which can either be used qualitatively to assess and monitor crop conditions during the crop growing season, or can be regressed with yields to produce yield estimation models and yield estimates.

(<http://hollywood.geog.ucsb.edu/wb/geowrsi.php>)



Year Classification: Normal, Dry & Wet

- Deviation from Normal
 - + 25 % from - Wet year,
 - - 25% from Normal - Dry Year
 - SPI greater than 0.5 - Wet year
 - SPI less than - 0.5 - Dry Year
- Summary rainfall (mm per season)

Mean	1032.6
75%Mean	774.5
125%Mean	1290.8

Year Classification

Season	Barue Seasonal RF	Barue Seasonal SPI	Classificaion Deviation	Classification SPI	Season	Barue Seasonal RF	Barue Seasonal SPI	Classificaio n Deviation	Classification SPI
1969/1970	911.1	-0.21	N	N	1989/1990	1041.3	0.14	N	N
1970/1971	795.3	-0.56	N	D	1990/1991	562.8	-1.38	D	D
1971/1972	1175.6	0.48	N	N	1991/1992	389.7	-2.17	D	D
1972/1973	510.5	-1.60	D	D	1992/1993	950.0	-0.10	N	N
1973/1974	1677.2	1.56	W	W	1993/1994	852.3	-0.39	N	N
1974/1975	1202.1	0.55	N	W	1994/1995	921.9	-0.18	N	N
1975/1976	1403.8	1.01	W	W	1995/1996	502.2	-1.64	D	D
1976/1977	1138.0	0.39	N	N	1996/1997	1486.5	1.18	W	W
1977/1978	1113.1	0.33	N	N	1997/1998	382.2	-2.21	D	D
1978/1979	801.6	-0.54	N	D	1998/1999	1380.7	0.96	W	W
1979/1980	923.3	-0.18	N	N	1999/2000	1239.4	0.64	N	W
1980/1981	1381.4	0.96	W	W	2000/2001	1504.1	1.22	W	W
1981/1982	1158.3	0.44	N	N	2001/2002	1135.2	0.38	N	N
1982/1983	709.4	-0.84	D	D	2002/2003	685.1	-0.93	D	D
1983/1984	787.7	-0.59	N	D	2003/2004	1038.7	0.14	N	N
1984/1985	1438.7	1.08	W	W	2004/2005	516.1	-1.58	D	D
1985/1986	1300.9	0.78	W	W	2005/2006	1015.1	0.08	N	N
1986/1987	766.3	-0.65	D	D	2006/2007	681.3	-0.94	D	D
1987/1988	1404.9	1.01	W	W	2007/2008	1664.1	1.54	W	W
1988/1989	1391.8	0.98	W	W	2008/2009	1365.9	0.92	W	W

Rainfall Stations SPI

- Combination of both stations
 - SPI derivation
 - Seasonal
 - 6 month ISPI (Nov through March)
 - 3 month ISPI (Jan, Feb, March)

Drought	Nov	Dec	Jan	Feb	Mar	Apr	Total
Weights for 3 months	0.00	0.00	0.55	0.30	0.15	0.00	1.00
Weights for 6 months	0.05	0.05	0.50	0.25	0.10	0.05	1.00
Flood	Nov	Dec	Jan	Feb	Mar	Apr	Total
Weights for 3 months	0.00	0.00	0.50	0.25	0.25	0.00	1.00
Weights for 6 months	0.10	0.20	0.30	0.15	0.15	0.10	1.00

- Chimoio station
 - SPI derivation
 - Seasonal
 - 6 month ISPI (Nov through March)
 - 3 month ISPI (Jan, Feb, March)

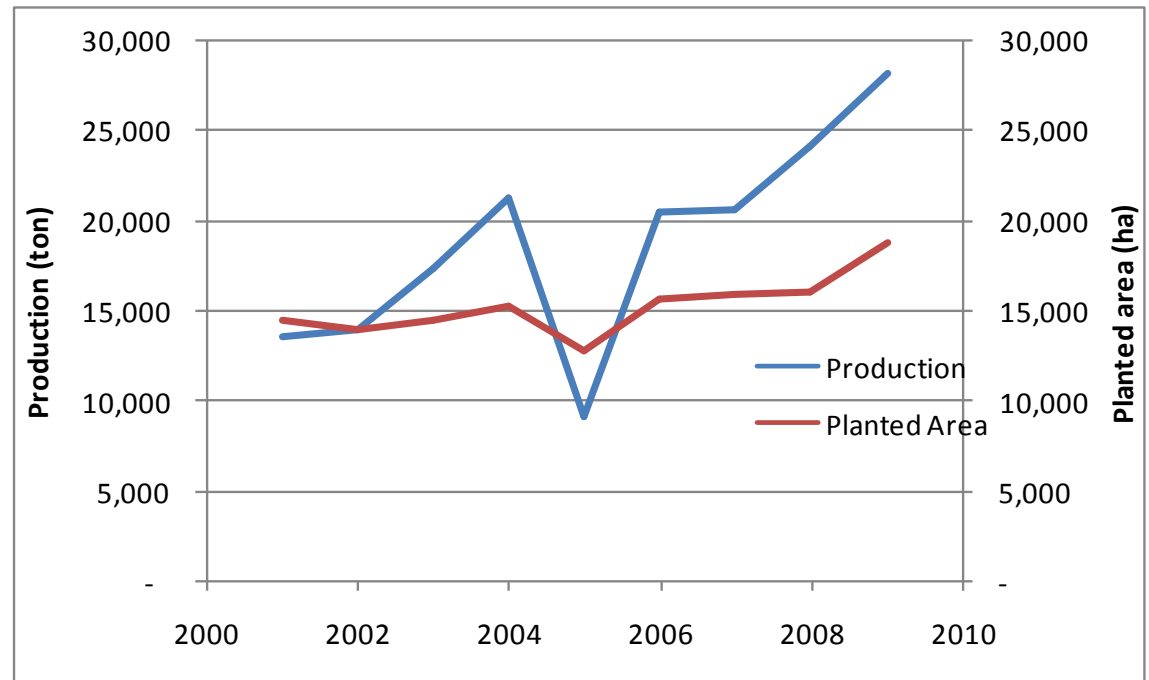
Water Requirement Satisfaction Index

- Dekadal (10 days) rainfall at 10km grid (1995-2011) (WRSI)
 - SPI derivation
 - Seasonal
 - 6 month ISPI (Nov through March)
 - 3 month ISPI (Jan, Feb, March)
- WRSI analysis
 - Dekadal values
 - 16th Dekad after planting WRSI values correlate best with production

Planted Area and Production

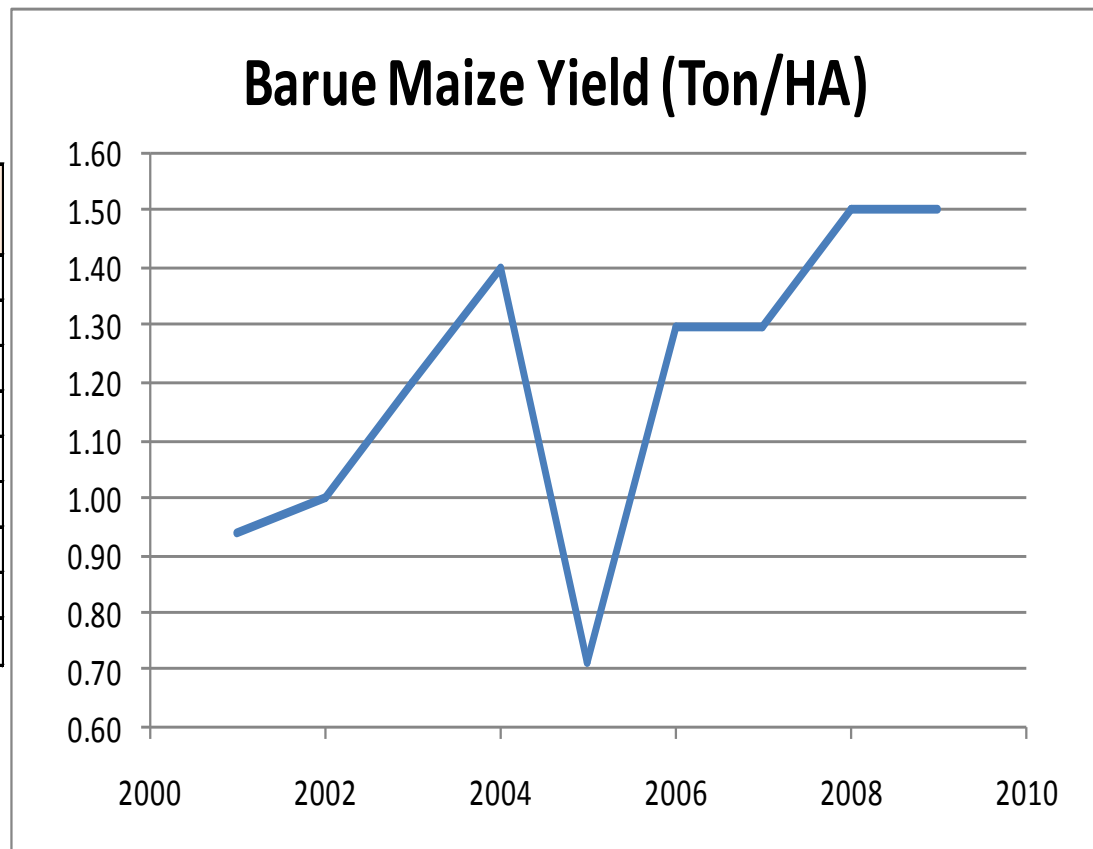
- Nine years of Maize crop data

Season	Barue Production(t)	Barue Planted Area (ha)
2000/2001	13,618	14,487
2001/2002	13,969	13,969
2002/2003	17,421	14,517
2003/2004	21,326	15,233
2004/2005	9,212	12,877
2005/2006	20,452	15,732
2006/2007	20,689	15,915
2007/2008	24,134	16,090
2008/2009	28,237	18,825

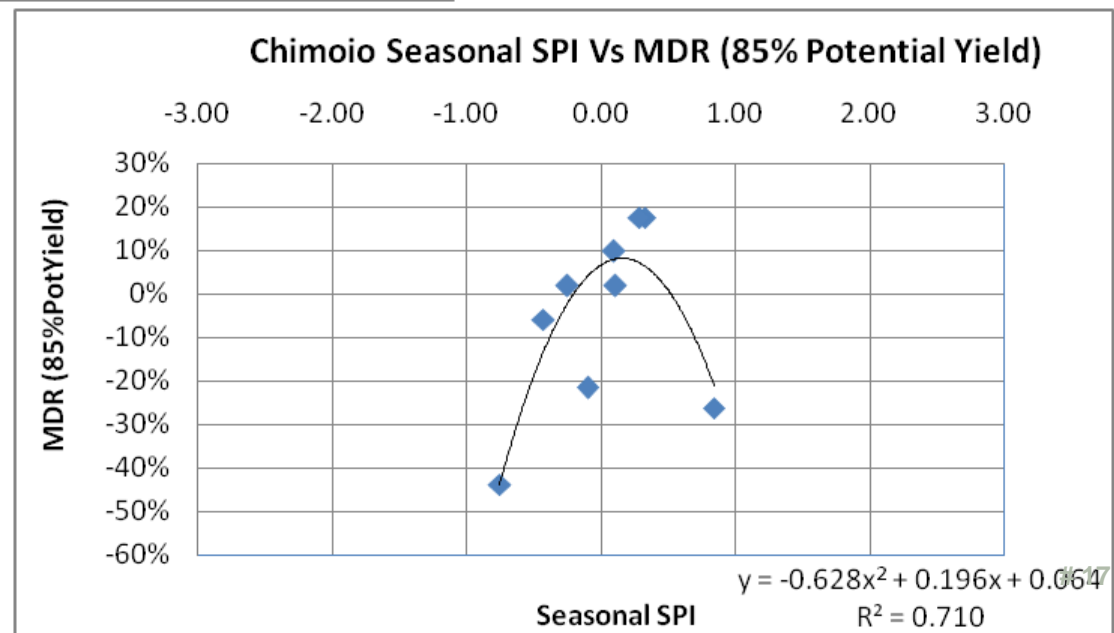
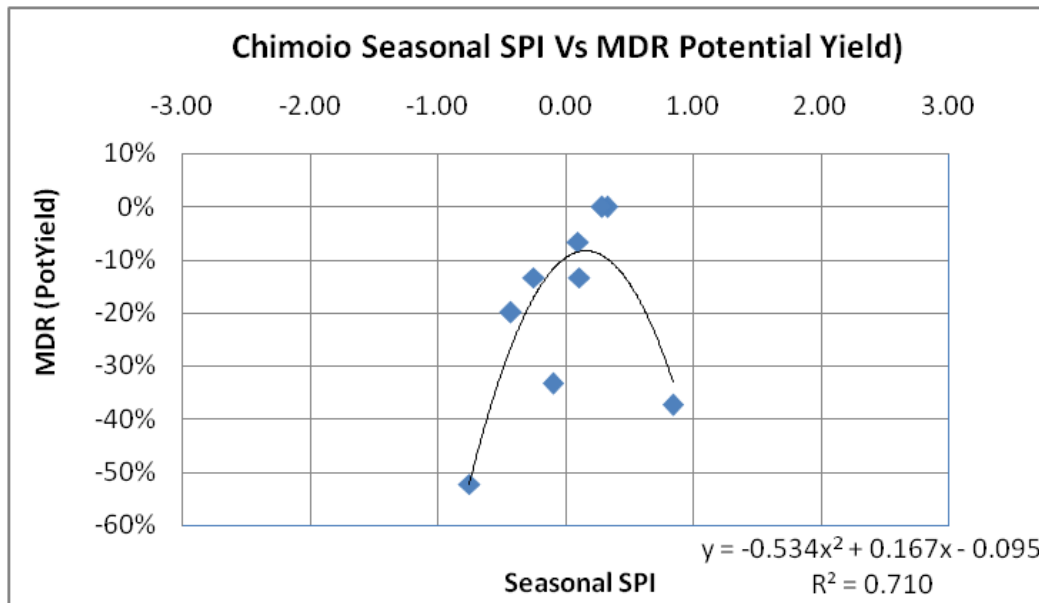


Maize Yield (Ton/ha)

Season	Barue Yield (t/ha)	Pot Yield	85% Pot Yield	Barue Seasonal_SPI
2000/2001	0.94	1.50	1.28	1.22
2001/2002	1.00	1.50	1.28	0.38
2002/2003	1.20	1.50	1.28	-0.93
2003/2004	1.40	1.50	1.28	0.14
2004/2005	0.72	1.50	1.28	-1.58
2005/2006	1.30	1.50	1.28	0.08
2006/2007	1.30	1.50	1.28	-0.94
2007/2008	1.50	1.50	1.28	1.54
2008/2009	1.50	1.50	1.28	0.92

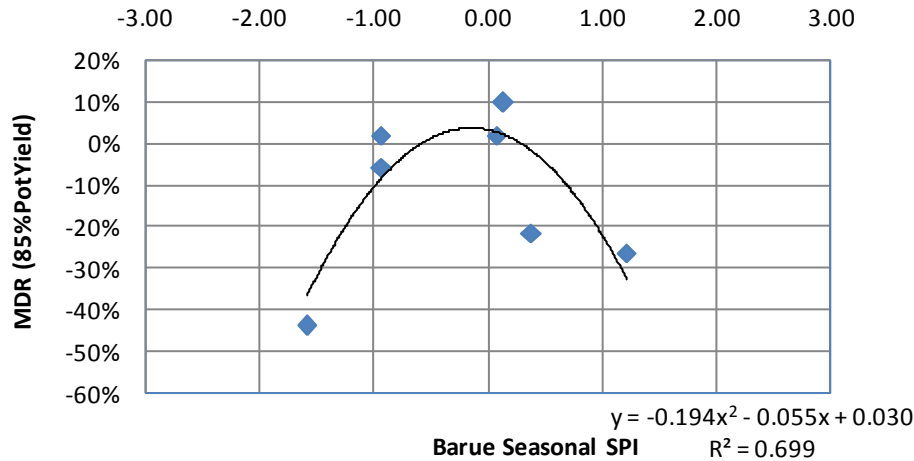


Chimoio Potential Yield vs. 85% Potential

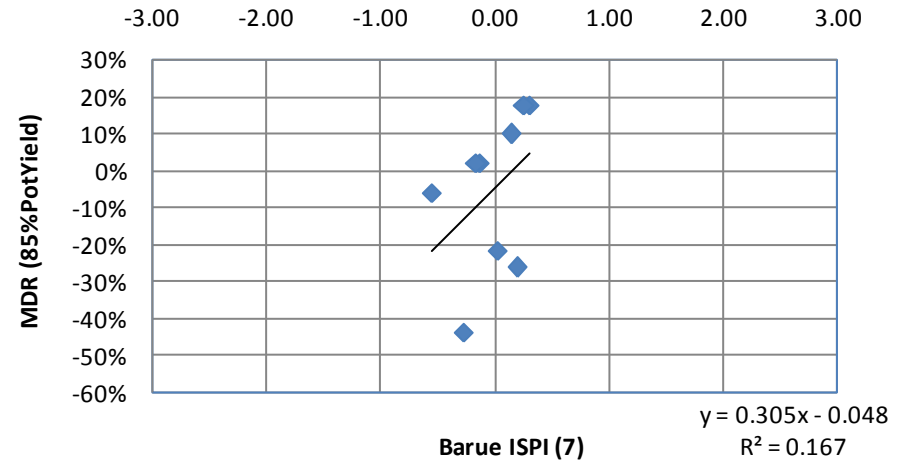


Seasonal SPI vs. ISPI (6 months)

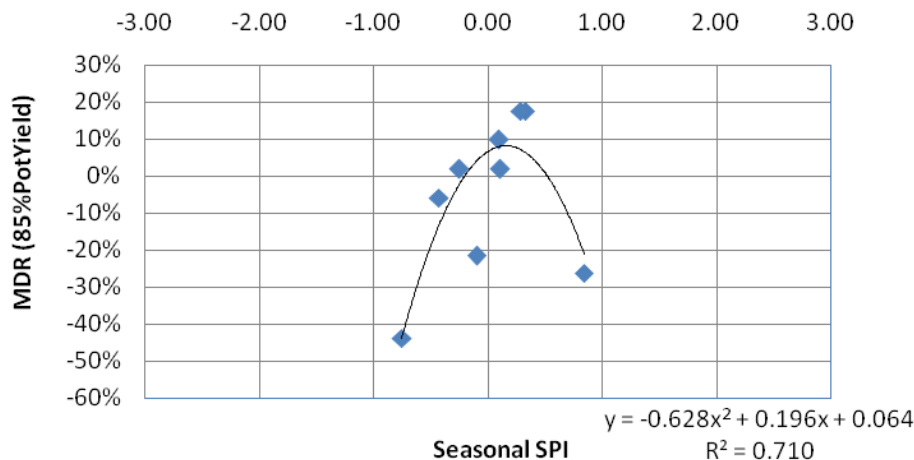
Barue Seasonal SPI Vs MDR (85% Potential Yield)



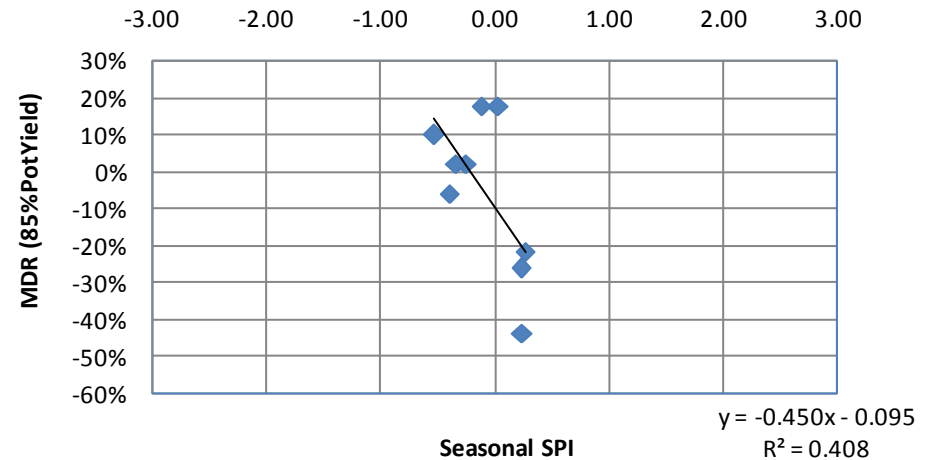
Barue ISPI (7) Vs MDR (85% Potential Yield)



Chimoio Seasonal SPI Vs MDR (85% Potential Yield)

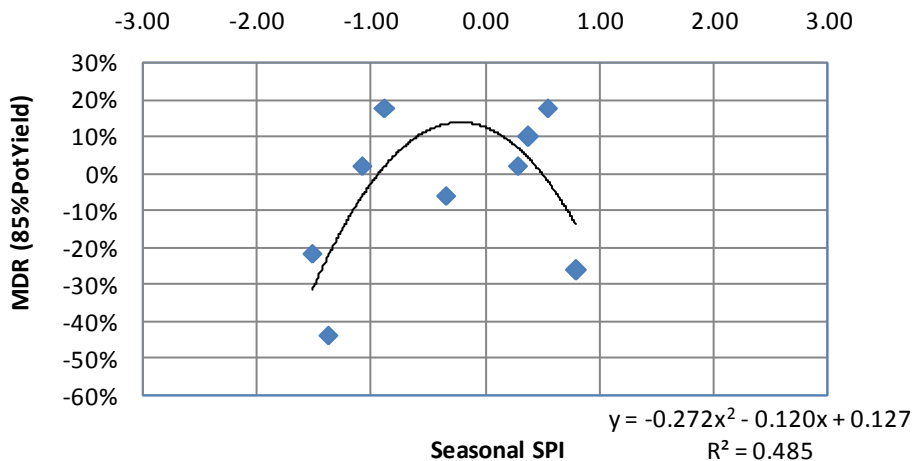


Chimoio ISPI Vs MDR (85% Potential Yield)

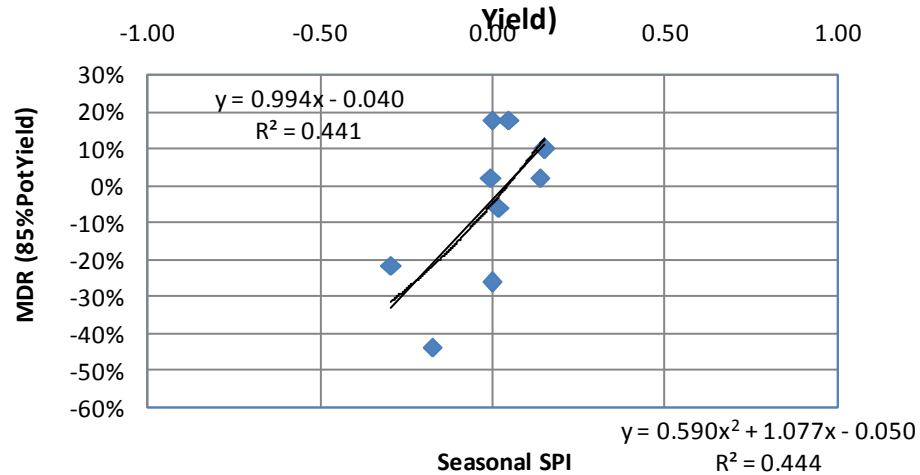


SPI WRSI PPT – Seasonal & ISPI (6)

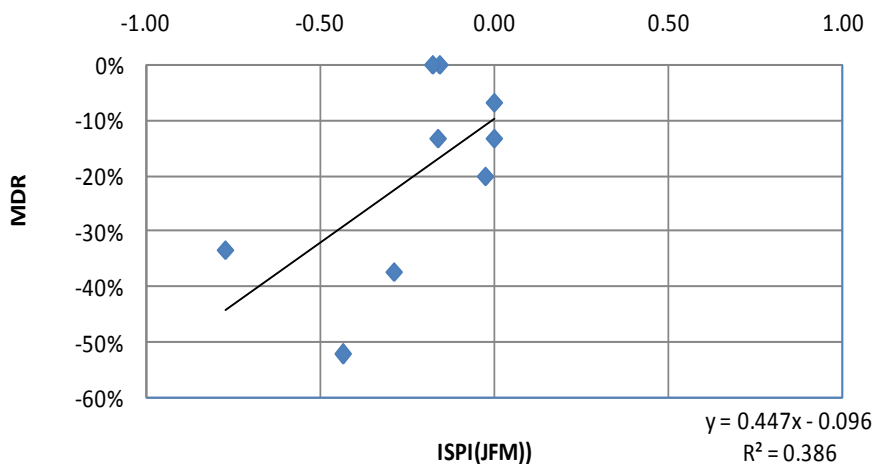
Barue WRSI Seasonal SPI Vs MDR 85% Potential Yield)



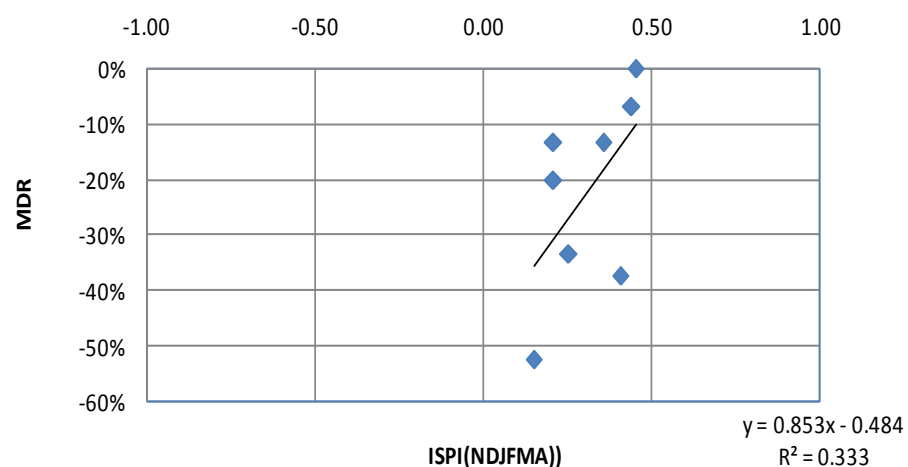
Barue WRSI IISPI (ONJFM) Vs MDR (85% Potential



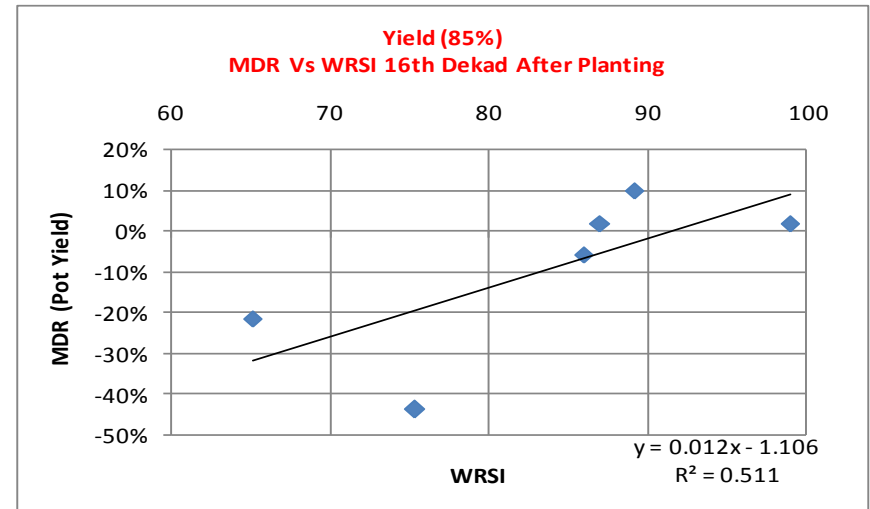
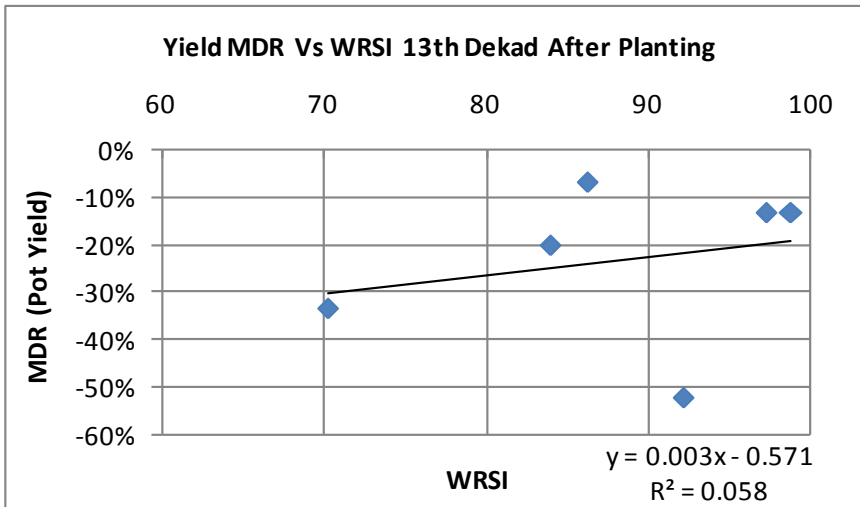
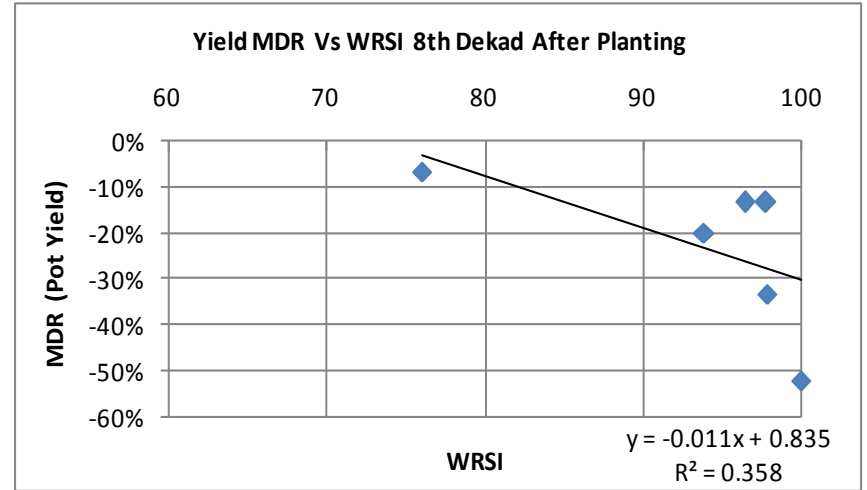
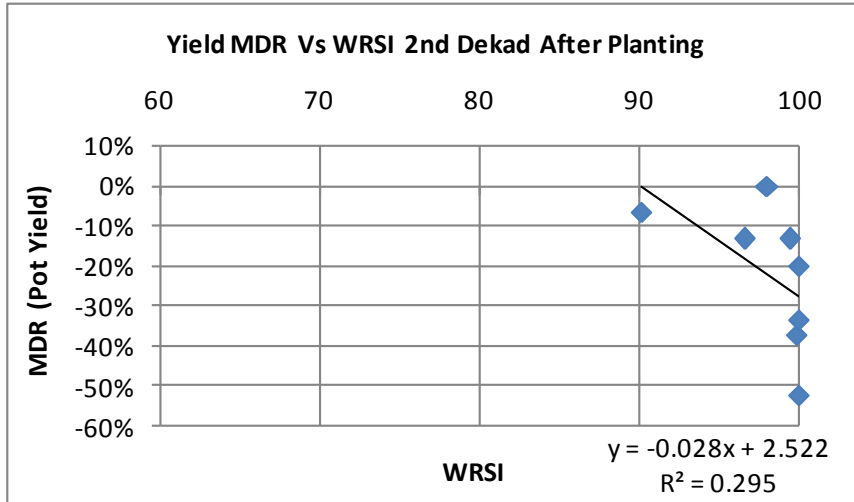
Drought - ISPI(JFM) Vs MDR (Potential Yield)



Flood - ISPI(NDJFMA) Vs MDR (Potential Yield)

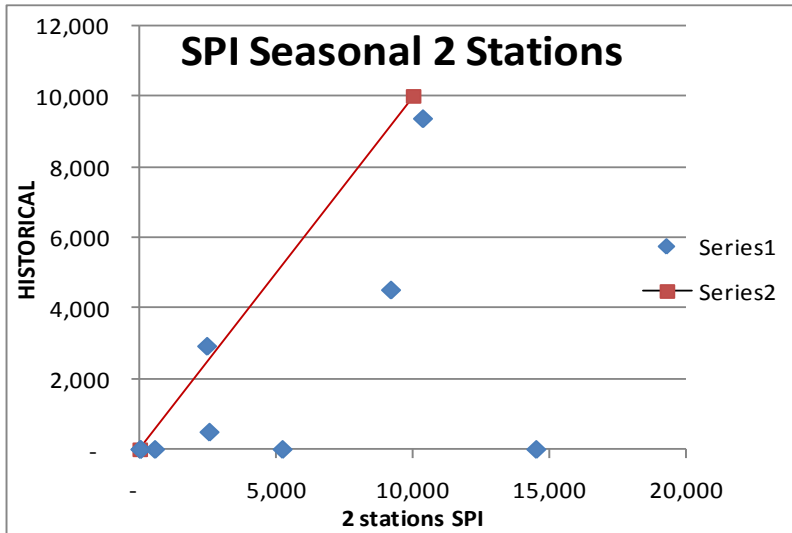


WRSI Variation from 2nd to 19th Dekad

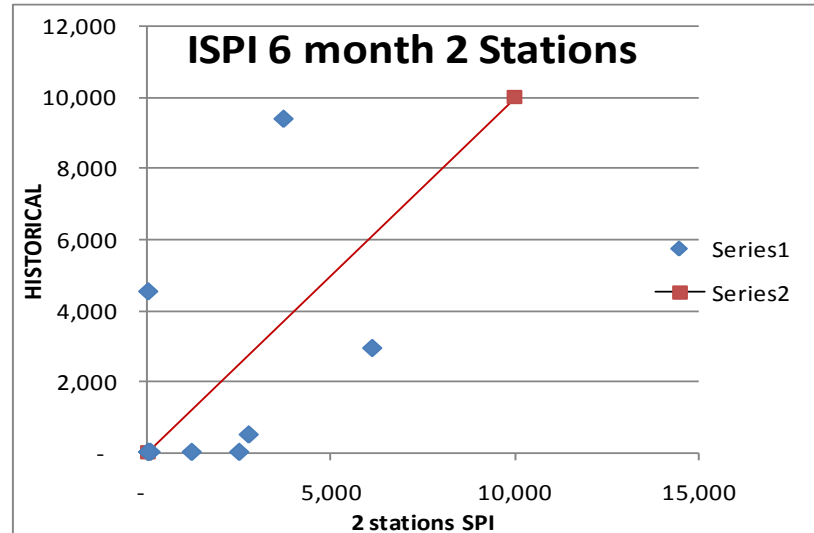


Reconstruction of Historical Events (Expected mode)

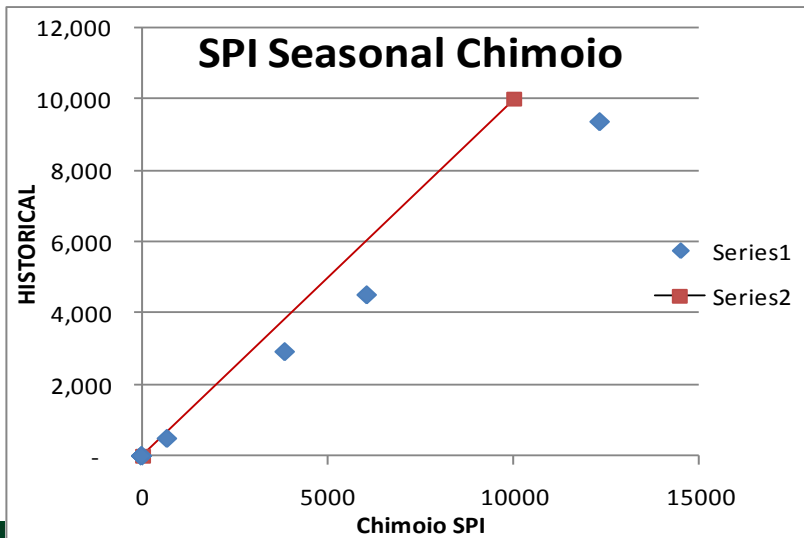
AAL Historical: 1,926 tons



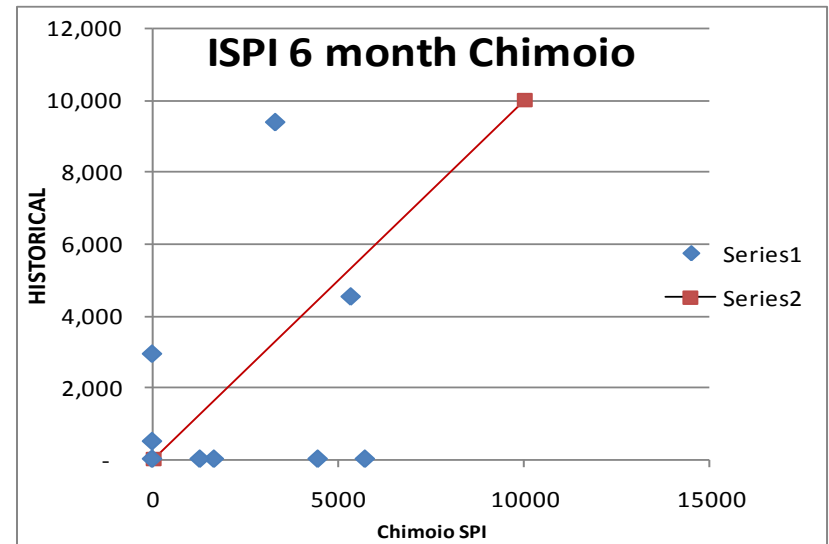
AAL = 4,982



AAL = 1,803



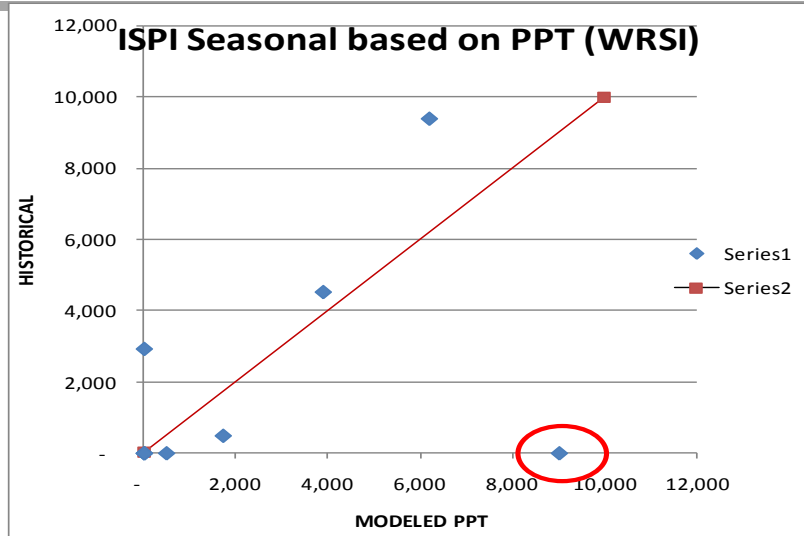
AAL = 2,423



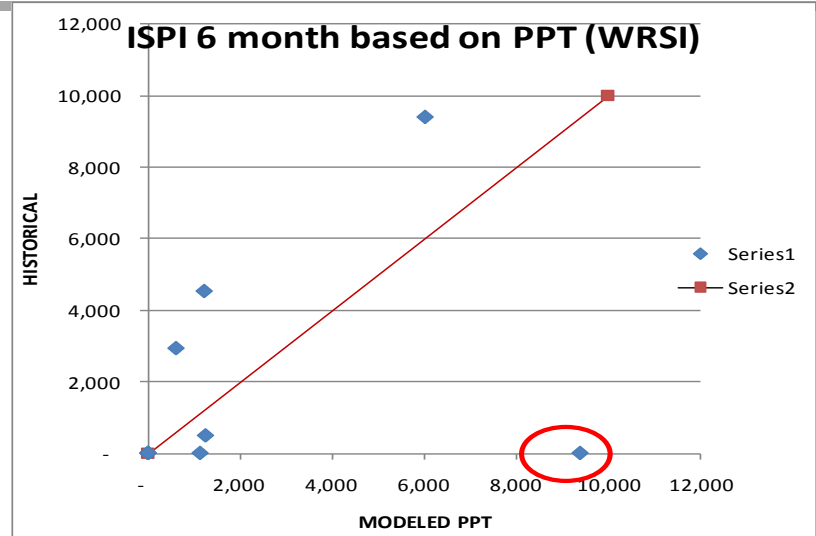
AAL = 2,545

Reconstruction of Historical Events (Expected mode)

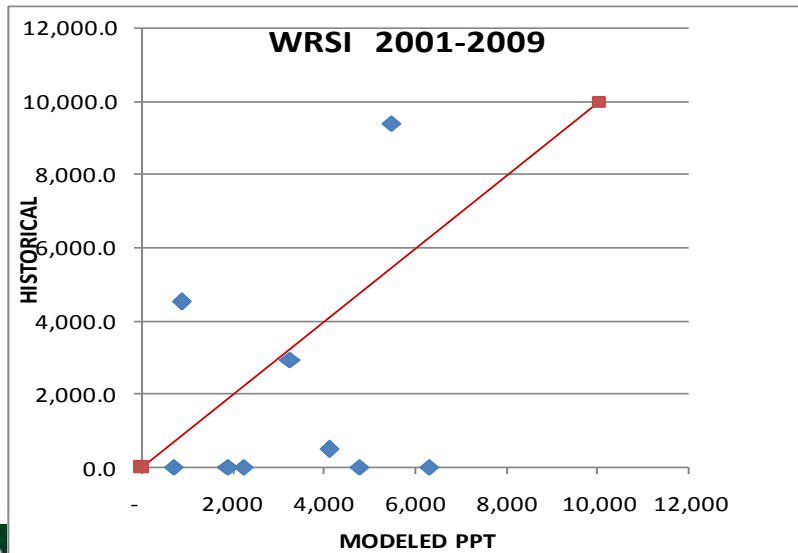
AAL Historical: 1,926



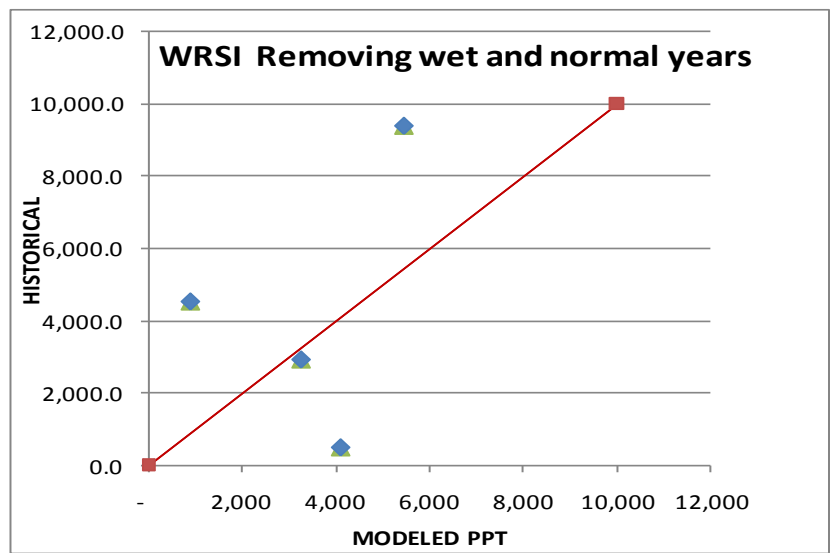
AAL = 2,364



AAL = 2,177



AAL = 3,284



AAL = 1,518

Conclusions

- A significant amount of uncertainty is associated with the correlation weather parameter-MDR
 - The seasonal parameters behave better than the weighted parameters – counter intuitive
 - Seasonal SPI based on WRSI PPT and Seasonal SPI based on station Chimoio reconstruct best the last 9 years of production
- The overall risk can be estimated with a reasonable of confidence
- The loss in a specific year may be significantly miscalculated
- Pursue WRSI and WRSI PPT

Thank you !