Impact of ENSO on Indian food grain and oilseed production

R. Selvaraju
Department of Agricultural Meteorology, Tamil Nadu Agricultural University, Tamil Nadu, India
selvaraju_r@hotmail.com

The impact of El Niño-Southern Oscillation (ENSO) on the Indian foodgrain and oilseed production was analysed for the period 1950-1999. The inverse relationship between sea-surface temperature (SST) anomalies from June to August (JJA) over NINO3 sector of the tropical Pacific Ocean and Indian foodgrain (r = -0.50) and oilseed (r = -0.58) production anomalies were significant at 1% level. During the warm ENSO phase, the total foodgrain production frequently decreased (12 out of 13 years) by 1 to 15%. In 10 out of 13 cold ENSO phase years, the total foodgrain production increased from normal. The relationship between the seas-surface temperature based NINO3 ENSO index and Kharif season (June – September) foodgrain production anomalies (r = -0.52) was greater than for Rabi season (October – February) foodgrain production (r = -0.27). The ENSO impact on rice production was greatest among the individual crops. The average drop in rice (Kharif season crop) production during a warm ENSO phase year was 3.4 million tonnes (7%). In a cold ENSO phase year the average production increase was 1.3 million tones (3%). Wheat (Rabi season crop) production was also influenced by ENSO as it depends on the carryover soil water storage from Kharif season. Sorghum and chickpea production are not significantly influenced by ENSO extremes.

During all the warm ENSO phase, the total oilseed production decreased (13 out of 13 years) by 0.5 to 21%. In 11 out of 12 cold ENSO phase years, the total oilseed production increased from long-term trend. The average drop in total oilseed production during a warm ENSO phase year was 0.60 million tonnes (5.8%). In a cold ENSO phase year the average production increased by 1.05 million tonnes (8.5%). The relationship between the seas surface temperature index and peanut production anomalies (r = -0.60) was greater than for mustard production (r = -0.32).

Inter-annual fluctuation of the gross value of Indian foodgrain production was very large, reducing up to 2183 million US Dollars in a warm ENSO year and increasing up to 1251 million US Dollars in a cold ENSO year. On average, warm ENSO year lost 773 million US Dollars and cold ENSO year had a gain of 437 million US Dollars from normal.

The cumulative probability distributions of foodgrain and oilseed production anomalies during cold and warm ENSO phases are shifted positively or negatively, relative to the neutral distribution. The warm ENSO forcing significantly (1% level) reduced the probability of above average production. The cold ENSO forcing moderately increased the above average foodgrain production over the neutral ENSO phase (5% level). A simple conditional probability forecast based on annual and JJA NINO3 SST predicted the category of foodgrain production in 11 of the 14 years. The results demonstrated that the relationship between NINO3 ENSO index and foodgrain production could be used for agricultural applications and policy decisions on food security for the larger growing population in India.

Friday II (Talk)