

GOVERNMENT OF INDIA  
MINISTRY OF AGRICULTURE AND FARMERS WELFARE  
DEPARTMENT OF AGRICULTURAL RESEARCH & EDUCATION

**LOK SABHA**  
**UNSTARRED QUESTION NO. 356**  
TO BE ANSWERED ON 01/12/2015

**WORLD BANK'S REPORT ON CLIMATE CHANGE**

356. SHRI PONGULETI SRINIVASA REDDY:

Will the Minister of AGRICULTURE AND FARMERS WELFARE  
कृषि और कृषक कल्याण मंत्री be pleased to state:

- (a) whether the Government has taken note of World Bank's report regarding adverse impact of climate change and global warming on agriculture and poverty in the country;
- (b) if so, the details thereof; and
- (c) the steps taken by the Government to develop heat-tolerant crops for preventing adverse consequences of climate change on food security for poor people?

**A N S W E R**

MINISTER OF STATE IN THE MINISTRY OF AGRICULTURE AND FARMERS WELFARE  
कृषि और कृषक कल्याण मंत्रालय में राज्य मंत्री  
**(DR. SANJEEV KUMAR BALYAN)**

- (a) Yes, Madam.
- (b) The Potsdam Institute for Climate Impact Research and Climate Analytics, Washington DC published a report entitled, "Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience" for World Bank in June 2013.

A significant reduction in yield of crops especially rice and wheat due to heat extremes and reduced availability of irrigation water primarily in states of West Bengal, Bihar, Jharkhand, Odisha, Tamil Nadu, Kerala and Karnataka has been reported. Further, longer dry spells in rainfed areas will make agriculture more risk prone. The summary of report related to India is presented in **Annexure-I**.

- (c) The National Agricultural Research System (NARS) comprising ICAR, Central Agricultural Universities and SAUs are taking adequate steps to develop suitable varieties which can withstand the severe weather aberrations including high temperature and deficient rainfall/ drought. Short duration varieties have also been released to escape or overcome the vagaries of weather. The details are presented in **Annexure-II**.

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**The salient points related to India in the World Bank Report on “Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience” by the Potsdam Institute for Climate Impact Research and Climate Analytics, Washington, DC.**

- Future heat extremes may pose a significant risk to production of rice and wheat crops.
- If temperatures increase beyond the upper temperature for crop development (25–31°C for rice and 20–25°C for wheat, depending on genotype), rapid decreases in the growth and productivity of crop yields could be expected, with greater temperature increases leading to greater production losses.
- Aggravating heat stress due to climate change is expected to affect rice crops. States of West Bengal, Bihar, Jharkhand, Orissa, Tamil Nadu, Kerala, and Karnataka. The situation may be aggravated by reduced water availability due to changes in precipitation levels and falling groundwater tables, as well as by droughts, floods, and other extreme events
- Atmospheric aerosols and greenhouse gases, reduced incoming radiation and increasing minimum temperatures, have contributed to the recent slowdown in rice harvest growth.
- Increasing minimum temperatures (3.4%) has caused more than half of the total rice yield decline.
- Average rice yield in India could have been almost six percent higher without changing climatic conditions and increasing minimum temperatures may have a greater impact on yield than changing monsoon characteristics.
- Rice yield reductions are likely to be larger in the future with projected increasing temperatures and variability in monsoon.
- The major rice production in India, is from irrigated agriculture in the Ganges Basin. Changes in runoff patterns in the Ganges River system are projected to have adverse effects even on irrigated agriculture.
- Wheat crop yields peaked in around 2001 and have not increased despite increasing fertilizer applications.
- Wheat crop responses to extremely high temperatures in northern India may have significant and substantial negative effect following exposure to temperatures above 34°C.
- In India more than 60% of the crop area is rainfed. The rainfed agriculture for food production carries high risks, as longer dry spells may result in total crop failure.
- Indian agriculture may be affected due to the shortage of surface water availability in the 2080s as a significant reduction in the lower parts of the Ganga, Bahamani-Baitrani, and Subarnrekha rivers and the upper parts of the Mahanadi River has been projected.
- Total annual precipitation is projected on average to increase over southern India and decrease over northwestern India resulting in drought like situation.
- Effect of the increasing atmospheric CO<sub>2</sub> concentration may counteract the negative impacts of increased temperature. For the intensive agricultural areas of northwest India, enhanced wheat and rice yields might be expected under climate change, provided that current irrigation can be maintained.
- In the longer term CO<sub>2</sub> fertilization effects would not be able to offset the negative impacts of increases in temperatures beyond 2°C on rice and wheat yields.
- With a temperature increase of 2.0–2.5°C compared to pre-industrial levels, by the 2050s reduced water availability for agricultural production may result in more than 63 million people no longer being able to meet their caloric demand by production in the river basins.

**The high yielding varieties that can withstand severe change in weather pattern including deficient rainfall/drought and varieties suitable for biotic and abiotic stresses**

**Food Crops**

Varieties	Traits	Zone / State
<b>Rice</b>		
Hybrid 6129	Resistant to Blast, brown spot and brown plant hopper	Irrigated areas of Punjab & Tamil Nadu
Improved Samba Mahsuri	Resistant to bacterial blight	Irrigated/shallow lowlands of Andhra Pradesh, Chhattisgarh, Jharkhand, Orissa, Bihar, Gujarat, Maharashtra
Improved Pusa Basmati 1	Resistant to blast	Basmati-growing areas of Delhi, Punjab, Jammu and Kashmir, Uttarakhand
SahabhaziDhan, Vandana, Anjali, Satyabhama, DRR Dhan 42, BirsaVikasDhan 203, BirsaVikasDhan 111, RajendraBhagwati, JaldiDhan 6, IR64 Drt I	Drought tolerance	Upland rice areas
CSR 27, CSR 30, CSR 36, NarendarUshar, Shankar Dhan 3, Lunishri	Salinity stress tolerance	Inland Saline areas
CR Dhan 402, CR Dhan 403	Salinity stress tolerance	Coastal areas
Swarna Sub1, Savitri Sub1, CR Dan 401 and Chakaakhi	Submergence tolerance (can sustain flood and flash flood upto 7-12 days)	Flood prone shallow lands areas
CR Dhan 500, Varshadhan, Hanseswari, CR Dhan 505, Jayantidhan, Jalamani and Durga	Waterlogging condition upto 75 – 100 cm	Flood prone shallow lands areas
CR Dhan 201	Moderately resistant to leaf blast, sheath rot, stem borer, leaf folder, whorl maggot and rice thrips	Chhattisgarh & Bihar under aerobic condition
CR Dhan 202	Moderately resistant to stem borer, leaf folder, whorl maggot and rice thrips	Jharkhand and Odisha under aerobic condition
CR Dhan 407	Moderate resistance to BLB, Leaf Blast	Odisha and West Bengal under rainfed shallow lowlands
CR Dhan 505	Moderately resistant to leaf blast, sheath rot, sheath blight & rice tungro virus.	Odisha and Assam under deep water condition
Pusa Basmati 1509	Improved short duration basmati	Western Uttar Pradesh and Delhi under irrigated transplanted condition

<b>Wheat</b>		
PBW550	Resistant to yellow rust	Punjab, Haryana, West Uttar Pradesh (except Jhansi division)
VL 892	Medium fertility and restricted irrigation condition	Hills of Himachal Pradesh and Uttarakhand
H1 1544	High fertility and irrigated conditions	Madhya Pradesh, Rajasthan (Kota and Udaipur divisions) and Gujarat
PBW 527	Drought tolerance	North west plains
HI 1531, HI 1500, HI 8627	Drought tolerance	Central Zone
HD 2888	Drought tolerance	Eastern India
HPW 349, PBW 644, WH 1080, HD 3043, PBW 396, K 9465, K 8962, MP 3288, HD 4672, NIAW 1415, HD 2987	Drought tolerance	Northern and central wheat growing areas
NIAW 34	High temperature stress tolerance	Peninsular zone late sown conditions
Raj 3765	High temperature stress tolerance	North western plain for late sown conditions
Raj 4037	High temperature stress tolerance	Peninsular India for normal sown conditions
KRL 14, KRL 19, KRL 210, KRL 213	Salinity stress tolerance	Inland saline areas
HD 2967	Rusts resistance	North Western Plain Zone and North Eastern Plain Zone
Narendra Wheat 4018	Resistant to brown rust and leaf blight	Uttar Pradesh
<b>Maize</b>		
QPM Hybrid HQPM7	Quality protein single-cross hybrids	Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra
QPM Vivek 9	Early maturing and quality protein	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Andhra Pradesh
Buland	High temperature stress tolerance	Northern parts of India
PMH 1	High temperature stress tolerance	Irrigated areas of Punjab
PMH 3	High temperature stress tolerance	Northern parts of India
HM 9	High temperature stress tolerance	Bihar, Jharkhand, Orissa
Pusa hybrid Makka 1	Drought tolerance	Rajasthan, Gujarat, Madhya Pradesh
HM 4	Drought tolerance	Punjab, Haryana, Uttar Pradesh, Andhra Pradesh, Maharashtra, Tamil Nadu and Goa
Pusa hybrid Makka 5	Drought tolerance	Whole of India
DHM 121 (BH 41009)	Medium maturity, yellow, semi-dent and tolerant to moisture stress conditions	Odisha, Bihar, Jharkhand, West Bengal, Gujarat, Rajasthan, Chhattisgarh and Madhya Pradesh in kharif season

HM-5, Seed Tech-2324, HM-10, PMH-2	Deep water/submergence/water logging tolerance	Maize growing areas
<b>Sorghum</b>		
CSH 25	Dual purpose and tolerant to grain mold diseases	Maharashtra, Andhra Pradesh, Madhya Pradesh, Karnataka and Gujarat
CSH 19 R, CSV 18	Drought tolerance	All rabi sorghum area
CSH 15 R	Drought tolerance	Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu
<b>Millets</b>		
<b>(i) Pearl Millet</b> HHB 67 improved, GHB 757, GHB 538, GHB 719, Dhanshakti, HHB 234, MandorBajra Composite 2, HHB-226, RHB-177, Pusa Composite 443	Drought tolerance	All dry areas of Western Rajasthan and Gujarat
<b>(ii) Finger Millet</b> GPU 67, DHRS 1, PRM-2, KMr-301, VL Mandua 347, Indira Ragi-1, Dapoli safed-1, HIMA, KMR 204, VL Mandua-352 (VL352), Phule Nachani-1 (KOPN- 235)	Drought tolerance	Millets growing dry regions
<b>(iii) Foxtail Millet</b> Sia 3085, SiA 3156	Drought tolerance	Millets growing dry regions
<b>(iv) Barnyard Millet</b> CO(KV)2	Drought tolerance	Millets growing dry regions
<b>(v) Kodo Millet</b> Indira Kodo-1	Drought tolerance	Millets growing dry regions
<b>Barley</b>		
RD 2660, K603	Drought tolerance	North west plains region

### Pulses

Variety	Trait	Zone
<b>Chickpea</b>		
Karnal Chana	Tolerance to salinity	North West Plain Zone
CO1, ICCV 10	Drought tolerance	Southern Zone
Vijay, Vikas	Drought tolerance	Central Zone
RSG 14 , RSG 888	Drought tolerance	North West Plain Zone
PKV Kabuli 4, IPCK 2004-29, Phule G 0517	Extra large seeded Kabuli	Central Zone
MNK 1	Extra large seeded Kabuli	South Zone
JG 6, JG 14	Resistance to wilt	Central Zone
DCP 92-3	Lodging tolerance	Central Zone
GNG 16	Lodging tolerance	North West Plain Zone

<b>Pigeonpea</b>		
BSMR 736, BSMR 175, Asha	Wilt/Sterility mosaic disease tolerance	Central Zone
NDA 1, MAL 13	Wilt/Sterility mosaic disease tolerance	North East Plain Zone
Pusa 992, PA 291, PAU 881	Short duration suitable for multiple cropping	North west plain Zone
<b>Mungbean</b>		
HUM 1	Yellow mosaic virus tolerance	Central and Southern Zone
CO6	Yellow mosaic virus tolerance	South Zone
IPM 02-3	Yellow mosaic virus tolerance	North East Plain Zone
Samrat, IPM 2-3, Meha, SML 668	Early maturing suitable for spring/summer	North west plain zone and North East Plain zone
IPM2-14, TM96-2, LGG 460, LGG 410	Resistant to powdery mildew suitable for rabi/spring	South Zone
<b>Urdbean</b>		
WBU 109, PantU31, Azad Urd 1	Short duration suitable for multiple cropping	North East Plain zone
IPU-02-43, LBG 625, Vamban 4, WBG 26	Resistant to powdery mildew suitable for rabi/spring	South Zone
<b>Lentil</b>		
HUL57,KLS218,PL8	Resistance to rust	North East Plain Zone
DPL 62, PL 6, PL7, IPL 406, IPL 315,IPL316	Large seeded	Central Zone and North Western plain Zone

### **Oilseeds**

<b>Variety</b>	<b>Trait</b>	<b>Zone</b>
<b>Castor</b>		
DCH 519	Resistance to wilt and leaf hoppers	All castor growing zones
GC 3	Resistant to wilt	Gujarat
Jwala	Tolerance to salinity and resistance to wilt	All castor growing zones
<b>Rapeseed Mustard</b>		
NRCDR2	High temperature tolerance	North West Plain Zone
LET-18, Pusa Mustard 21, Pusa Mustard 24, RLC1	Low erucic acid	North West Plain Zone
NRCDR 601	High temperature and salinity tolerance	North West Plain Zone
VL toria 3	Tolerance to cold	North Hill Zone
<b>Soybean</b>		
JS97-52	Resistance to Yellow mosaic virus and collar rot	Central Zone and North Eastern Zone
NRC7	Pod shattering resistance	All soybean growing zones
SL668, JS 97-52	Yellow mosaic resistance	All soybean growing zones
NRC-7, JS 71-05	Pod shattering and drought tolerance	All soybean growing zones

NARI 38, SSF 658	Resistant to wilt	All castor growing zones
JS 97-52, JS 20-38 and PK 472	Suitable for water logging condition.	Soybean growing zones
NRC 7, JS 95-60	Drought tolerance	Soybean growing zones
<b>Groundnut</b>		
Ajiya, Girnar1, TAG-24, GG20, Kadiri 6, ICGV 91114	Drought Tolerance	Central and South zone
Girnar2, Kadiri9, Kadiri, Haritandhra, Greeshma	Short duration suitable for rabi/spring	South Zone

### Commercial Crops

Variety/Hybrid	Traits	Zone
<b>Cotton</b>		
HD 324	Tolerance to Fusarium wilt and Leaf curl virus	North Zone
Hybrid Kalyan	Tolerant to Cotton Leaf curl virus	North zone
G.Cot.Hy 12	Tolerant to aphids and jassids	Central Zone
LRA 5166	Tolerance to drought	Central Zone
KC 3	Tolerance to drought	South Zone
Kanchana, L - 604	Resistance to whitefly	South Zone
MCU 5 VT, Surabhi	Resistance to verticillium wilt	South zone
Suraj	Long staple with jassid tolerance	South and Central zone irrigated conditions
HD 324, CICR-1, Raj DH 7, Jawahar Tapti, PratapKapi, Suraj, Surabhi, Veena, AK 235	Drought Tolerant	Cotton growing areas
<b>Sugarcane</b>		
Co 94008 (Shyama)	Tolerant to drought and salinity	Peninsular Zone
Co 2001-3 (Sulabh)	Moderately resistant to red rot, smut and wilt	Peninsular Zone
Co 98014 (Karan-1)	Tolerant to drought, water-logging	North West Zone
CoS 96268 (Mithas)	Moderately resistant to red rot and good ratooner	North West Zone
CoSe 6436 (Jalpari)	Tolerant to water-logging and good ratooner	North Central Zone
Co 0233(Kosi)	Moderately resistant to red rot and smut	North Central Zone
CoC 01061	Moderately resistant to red rot.	East Cost Zone
CoLk 94184 (Birendra)	Tolerant to drought and waterlogging with good rationing	North Central Zone
Co 0118	High sucrose content and resistant to red rot, wilt and smut, tolerant to water logging	Punjab, Haryana, Rajasthan, Central and Western Uttar Pradesh and Uttarakhand

Co 0239, Co 0238, Co 06927, Co 0403, Co 86032	Tolerant to drought	Southern and central zone
<b>Jute</b>		
JRO 204 (Suren), JBO-2003-H (IRA)	Early sowing suitability with fine fibre quality	Tossa jute belt
JRC-532 (Sashi)	Very fine fibre fineness white jute	White jute belt
JRC 80 (Mitali)	Premature flowering resistance	White jute belt
JBO 1 (Sudhangsu)	Drought tolerance	Tossa jute belt of West Bengal, Assam, Bihar & Orissa
S19, Tarun, JRO 7835, JRO 524, JRO 878, JRC 321, JRC 7447, JRC 532, JRC 517, Bidhan Pat - 1	Suitable for water logging condition.	Jute growing belts

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