

Water logging – a forgotten problem in pigeonpea

The Problem

- Water-logging is emerging as a pressing concern at the backdrop of climate change in recent years
- A global report on climate change has projected 0.5-1.2°C rise in temperatures by 2020, resulting in unpredictable and excessive rains
- Globally, more than 40 m ha area is estimated to be affected by water-logging
- In India about 8.53 m ha area is affected by water-logging with an estimated crop loss of >2 m tons each year.

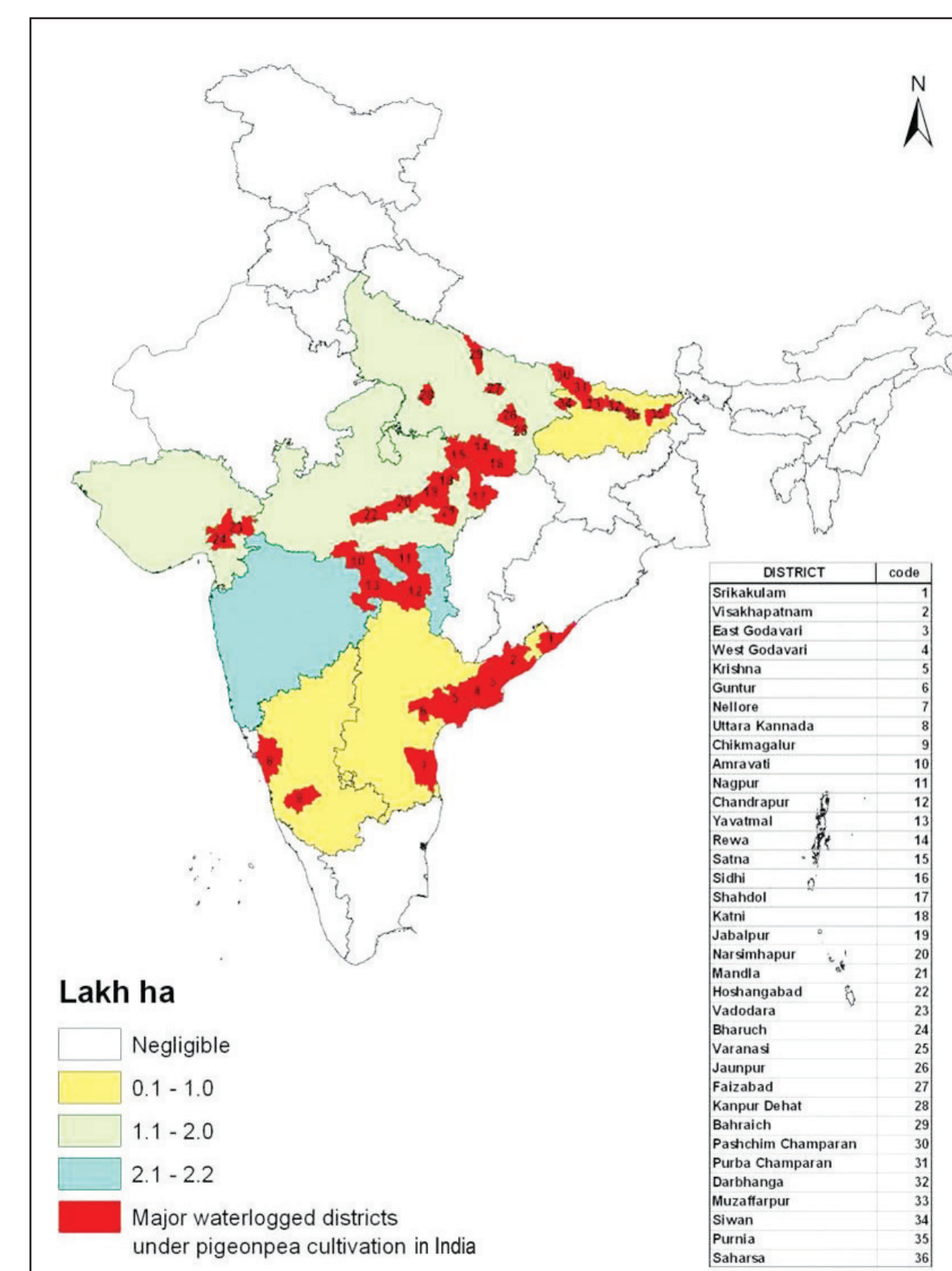
Water-logging and Pigeonpea

- Pigeonpea is mainly grown by resource poor farmers as a rainfed crop in the regions with mean annual rainfall between 600 and 1,500 mm
- It is estimated that each year more than 30% of the pigeonpea growing areas are prone to water-logging problems
- Water-logging also predisposes pigeonpea plants to Phytophthora blight disease during the rainy season, which may sometimes result in up to 100% yield losses
- In India alone the annual losses of pigeonpea crops are estimated at 0.32 m tons, costing about US\$22 m
- Major water-logging affected areas in India are Bihar, Maharashtra, Madhya Pradesh and Uttar Pradesh, contributing to nearly 58% of the total area and 65% of national pigeonpea production.

Table 1: State-wise break up of major pigeonpea growing states affected by water- logging as assessed in 2006-07.

State	Cultivated pigeonpea area (m ha)	* water-logged area (m ha)	Estimated annual losses due to water-logging	
(US\$ m)			production (t)	Amount
Maharashtra	1.107	0.22	77000	5.236
Uttar Pradesh	0.383	0.16	56000	3.808
Bihar	0.033	0.026	9100	0.6188
Andhra Pradesh	0.494	0.074	25900	1.7612
Madhya Pradesh	0.322	0.184	64400	4.3792
Gujarat	0.254	0.188	65800	4.4744
Karnataka	0.601	0.061	21350	1.4518
Total	3.194	0.913(28.15%)	319550	21.7294

*Estimated water-logged area under pigeonpea cultivation



The Potential Solutions

- Breeding water-logging tolerant varieties would be the most viable solution for the resource poor farming community
- Focused research initiatives at the national level are needed to address this problem
- Incorporation of genetic resistance to Phytophthora blight disease in water-logging tolerant high yielding pigeonpea cultivars will bring a long-term solution to this problem.

Germplasm Screening Techniques

Seed level screening – Seeds of pigeonpea germplasm with wide genetic variability will be screened for water-logging tolerance

by assessing their germination and survival rate in submerged conditions. This treatment is given under controlled conditions for seven days at 25-30°C.

Seedling level screening – The pigeonpea genotypes selected after seed level screening will be further grown in trays. Stress treatment is given for three days soon after emergence.

Pot screening at early vegetative stage - The pigeonpea genotypes that survive after seed and seedling level treatments is further sown in pots with perforations at their base. Stress treatment is given by submerging the pots in artificially created ponds for 6 days when the plants are 15 days old.

Field Screening - All the selected genotypes identified through pot screening are screened to identify their responses to artificially water-logged field conditions.



Screening of pigeonpea germplasm at vegetative stage under artificially created pond at ICRISAT, Patancheru.



Field Screening.

Water-logging Tolerant Genotypes Identified

Table 2: Origin and agronomic characteristics of pigeonpea lines showing tolerance to water-logging

Parents	Response to water-logging	Origin	Plant Characters
ICPL 84023	Tolerant	Andhra pradesh, India	Extra short duration, determinate growth habit, yellow flowers with red streaks, green colored pod with purple streaks, brown colored seeds, 9 gram per 100 seed weight, yield 3014 kg/ha
ICPL 90004-1	Tolerant	Andhra pradesh, India	Extra short duration, determinate growth habit, yellow flowers, green colored pod, cream colored seeds, 10.7 gram per 100 seed weight, yield 3014 kg/ha
ICPL 88034	Tolerant	Andhra pradesh, India	Short duration, indeterminate growth habit, yellow flowers with red streaks, green colored pod with purple streaks, brown colored seeds, 10.1 gram per 100 seed weight, yield 3457 kg/ha
ICPL 88009	Tolerant	Florida, USA	Short duration, determinate growth habit, red flowers, green colored pod with light red streaks, brown colored seeds, 9.4 gram per 100 seed weight, yield 3502 kg/ha