



CLIMATE RESILIENT AGRICULTURE IS IT POSSIBLE ?

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Courtesy: NRLM, MoRD, GoI



A farmer praying
for early rains in
Bhanpur Village
near Bhopal,
Madhya
Pradesh. Photo:
A.M.Faruqui

Gajendra Singh Rajput from Dausa.
Hargovind Harane from Vidarbha .
Gosai Patra from Bardhaman. Why
did these farmers take their own
lives? In light of the burning issue of
farmer suicides across the country,
here is a look at the plight of the
marginalised cultivator.

Over 60,000 farmers have taken their lives from 1995
Maharashtra and Andhra Pradesh have the highest
suicides in 2013-14



The Theme

Can Small Holder Farmer
Feed The nation

Preserve the Natural Resources

Sustainable and ecofriendly
agriculture

Income generation

The Challenge

Sustainable agriculture conserves our soil and water resources, protects our climate, enhances agro-diversity, ensures biodiversity, meets the demand for food and safeguards livelihoods. In short, it ensures that the environment thrives, the farm is productive, the farmer makes a net profit and society has enough nutritious food. Community Managed Sustainable Agriculture (CMSA) is one such initiative which is implemented in the state of Andhra Pradesh through the women SHGs and their federations. WBSRLM (West Bengal State Rural Livelihoods Mission) has planned to introduce this CMSA practices in two districts (Malda & South 24 Parganas) of W.B with the help of best practitioners of A.P and Telengana.

(a) To bring Sustainability to Agriculture based livelihoods and to improve the quality of life with special focus on SF/MF and women farmers.

(b) To reduce cost of cultivation by avoiding chemical pesticides and fertilizers without compromising on yields.

(c) Providing households nutritional security

(d) Providing livelihoods to the land less poor through land lease and NPM shops etc.

(e) Enhancement of Natural Resource

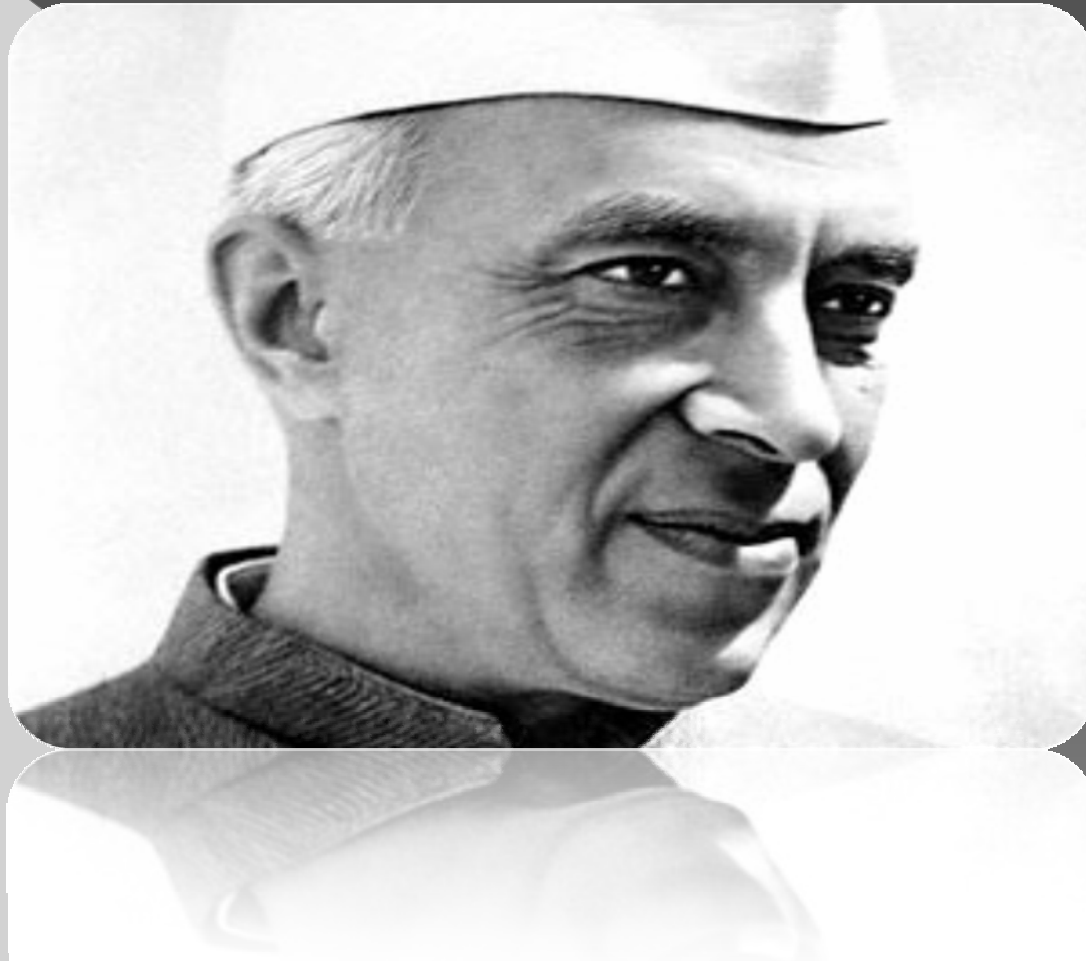
The Challenge :

“Every thing can wait not agriculture- Jawhar Lal Nehru, India's First Prime Minister”

Challenges –

- Shrinking and degrading natural resources, change in climate
- From food security to nutrition security
- Global trade regimes

After Independence The P.M thought



Lets look at Indian Agriculture
From Post Independence
to the present state



First the Natural resources India has

- It's soil
- It's cropping systems
- and crops
- It's water resources
- Farmer's of India





Black soils of India

India also has vast amount of degraded soil unsuitable for cultivation

- Net sown area – 119 m ha in 1950-51 to 142 m ha in now
- Cropping intensity – 137 %
- **100 m ha is degraded**
- WUE- only 40%- can grow to 90%
- Arable land – 162 m ha of which 60 m ha is irrigated
- **Even with full potential used India cannot have more than 50% land irrigated**

Indian water resources



Nagarjuna Sagar dam on river Krishna



Monsoon India

- 60% of India is rainfed
- agriculture
- Four months of rainfall
- which means one crop can be taken
- Farmer waiting for the rain
- Drought a regular feature
- Climate change now playing havoc



Food security scenario in India

1950

| | |
|-------------------|-------------|
| Population | 361 million |
|-------------------|-------------|

| | |
|-----------------------------|-----------------|
| Foodgrain production | 50.8 million mt |
|-----------------------------|-----------------|

| | |
|-------------------------|----------------|
| Foodgrain import | 4.8 million mt |
|-------------------------|----------------|

| | |
|---------------------|-----|
| Buffer stock | Nil |
|---------------------|-----|

| | |
|--------------|------------------|
| Total | 55.6 million mt# |
|--------------|------------------|

India: Food shortages reappeared in the sixties

- Fertilizer-responsive high-yielding varieties were needed to meet the Challenge

- **New varieties brought for nation-wide testing**

- 1965: Rice from IRRI;
 - 1966: Wheat from CIMMYT

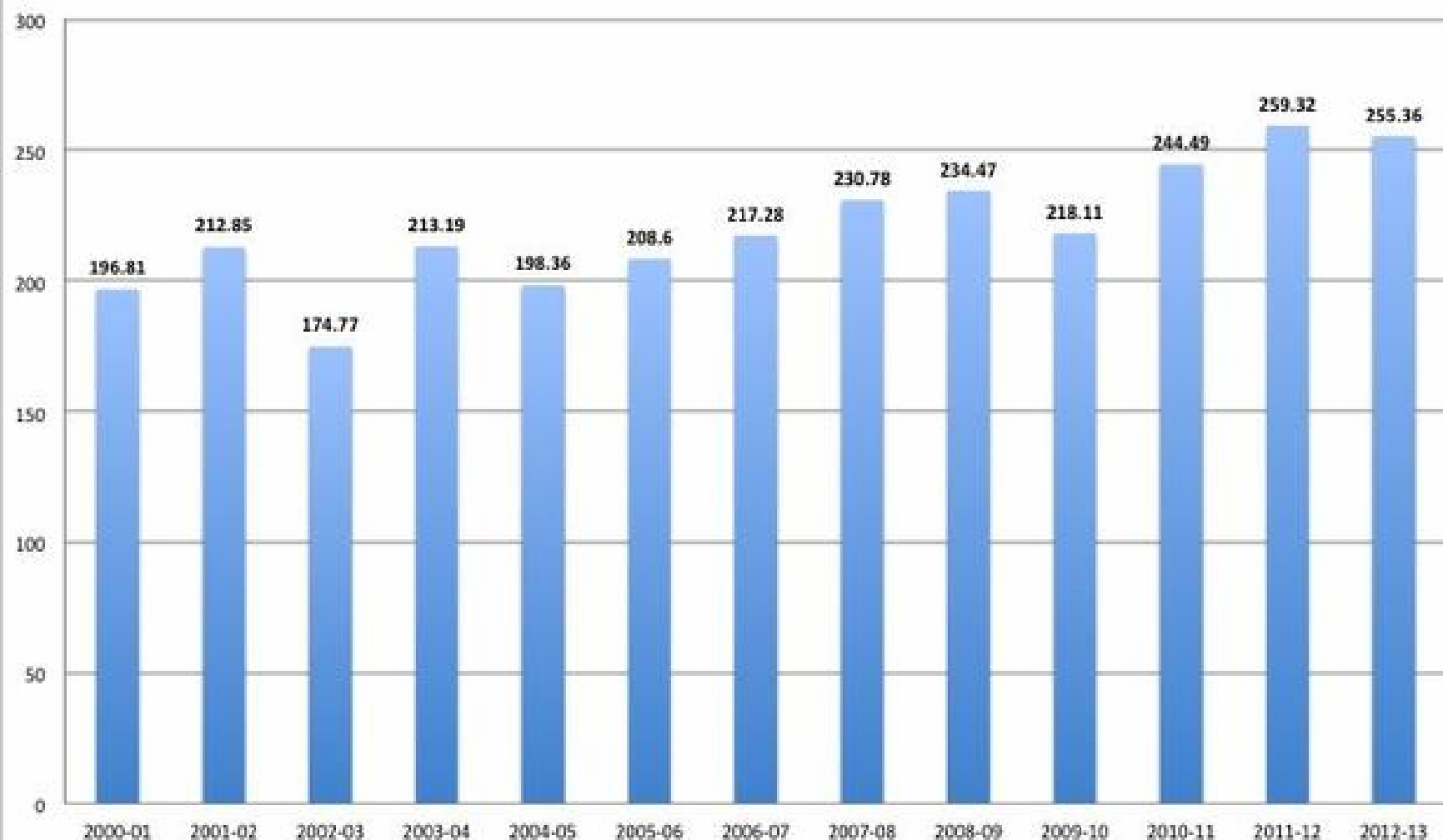
| | 1950 | 1960 | 1970 |
|-------------------|------|------|-------|
| Population (mio.) | 361 | 439 | 548 |
| Food prodn (mt) | 50.8 | 82.0 | 108.4 |
| Imports (mt) | 4.8 | 10.4 | 7.5 |
| | Nil | | |
| Buffer (mt) | | 2.0 | Nil |

Status in Indian Agriculture

- 97 m ha under food grain production
- 18 % irrigated
- 500 kg/ha is the production
- Population 361 mil
- 2007-8
- Food – 230 mt
- Fruit – 63 mt
- Vegetable – 125 mt
- Milk=- 100 m litre
- From 5 eggs to 42 e3ggs /head availability
- **3300 varieties released 700 horticultural crops**

Food grain production growth

Chart 1: Foodgrains production (mn tonnes)



- The Era of crisis in Indian food production
- Heavy imports of wheat and rice
- No buffer stock
- Begging Bowl syndrome to International community
- PL 480 wheat from US to save Indian from disaster
- Also brought weed problem

Swaminathan and Norman Borlaug Fathers of Green Revolution



*A bumper wheat harvest in 1968
kicked off the 'Green Revolution'*

Indian scientists quickly switched the husk color to amber, making the flour color desirable for chapati-making.

Advent of green Revolution

- Dwarf wheat and rice from CYMMIT and IRRI
- Fertilizer responsive, high yielding but water guzzler varieties
- Indian Agric Universities were quick to release varieties for Indian consumer acceptance
- Also started International Institutes for research and birth of CGIAR

India became a net exporter of food from net importer

- Comfortable buffer stock of close to 80 mt
- India needs this to stave off bad years
- Huge inventory
- Warehouse problem
- Huge wastage – a national shame

Fall out of Green revolution

- Policy distortion – research money to mostly cereals, oilseed , pulses , vegetables were neglected
- This is because Food security was the prime requirement
- Problem of plenty – lack of warehouse
- Minor millets which are climate resilient were also neglected
- Dry land farming remained where it is
- Emphasis was on irrigated high input farming

Other problems which has brought the word Sustainability to the fore

- Uncontrolled irrigation (overuse) brought salinity
- Ground water depletion in Punjab Haryana, A.P. and many other states
- Policy distortions – free electricity for Vote banks- case of Punjab and Haryana
- Mono cropping became the order of the day
- Distortions on cropping systems

- Input intensive agriculture- lure of cash crops which are unsustainable – case of cotton in India
- Result- suicides are rampant
- Market dictated cropping systems – unsuitable for environment- e.g. cotton after cotton or rice after rice after rice
- Even rice became a cash crop in Punjab and Haryana- huge pollution problem
- *Model of high input agriculture which has become unsustainable*

- Traditional cropping systems which the soil and water can sustain were `abandoned
- As a result resilient cropping systems to climate change were absent bringing crop failure – The year of 2002 and 2014 drought year in India
- **Even the dry lands became input oriented resulting heavy loss in enterprise**

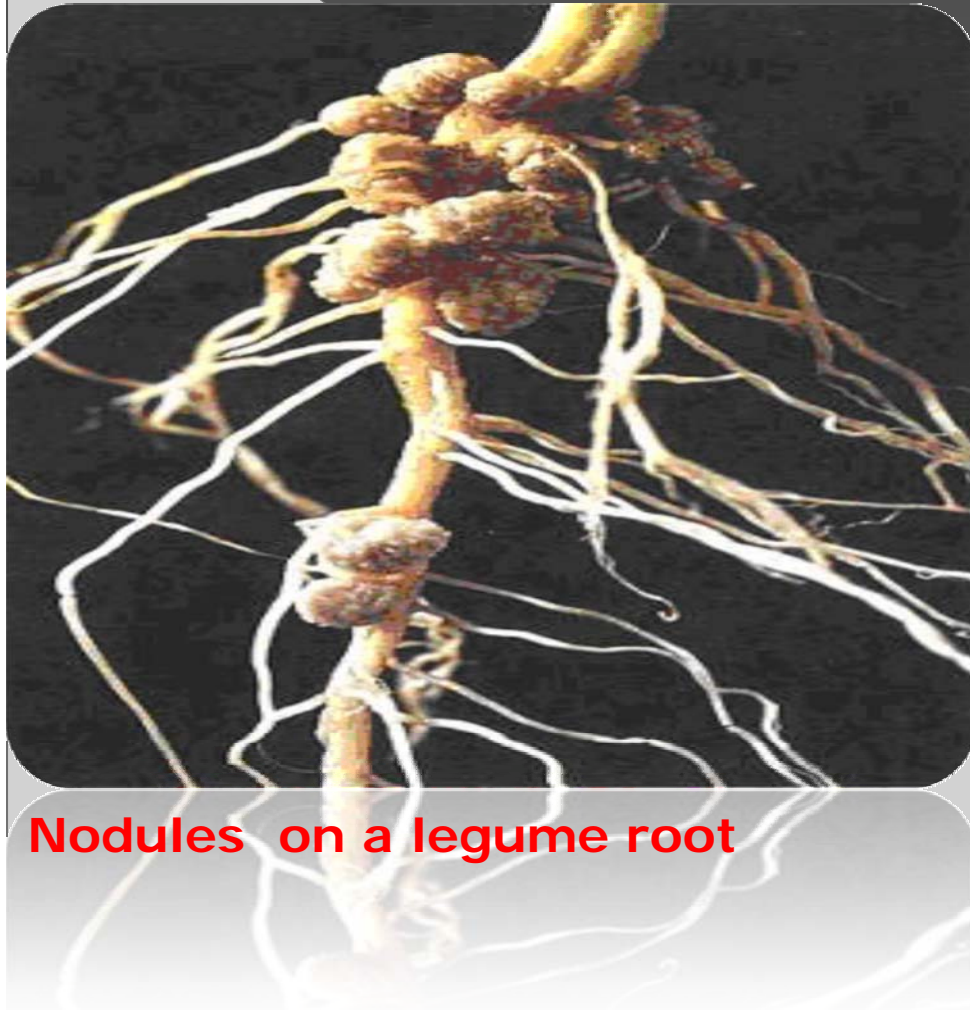
Over all farming has been
unattractive, unsustainable
specially for small and
marginal farmers

Some of the issues are

- ◉ Chemical VS Non- chemical farming
- ◉ Case of nitrogen – gain and loss of nitrogen, form of uptake
- ◉ Role of legumes
- ◉ Microbial activity
- ◉ Uptake by crops

Case of Nitrogen most used and most abused

- NUE – 2-50%, P, and micro – 20% to 2%, K – 50%
- Very high ratio in Punjab, Haryana –
- 35:9:1 and 75:24:1
- Recommended 4:2:1



Nodules on a legume root



Dhaincha Cultivation before ploughing

Mono cropping VS intercropping, poly cropping, mixed cropping



are example



The Challenges :

The final estimate of food grains production for the last year has been revised upward marginally to a record 259 million tonnes,

Per capita availability of food grains stood at 438.6 grams per day in 2010 compared to 445.3 grams per day (2006)



His life revolves around myriad of problems

- Difficult for him to invest in inputs- getting loan
- Risk prone
- Policy decisions affect him
- Power availability – erratic power
- Market dynamics
- Socio economic factors



The Challenges:

- **Post-1990**
 - “Technology fatigue”
 - Declining returns on input use;
 - Better solutions not forthcoming.
 - Shrinking size of holdings and viability of smallholder farming
 - 85% of farms are smallholdings
 - They occupy 44% of land area;
Rest 15% medium & large farmers
- Technologies offered to farmers are the same as those meant for irrigated agriculture – not suitable



Why a community based approach

- Age old practice and indigenous knowledge
- Growing resilient crops
- Need cropping systems suitable for the soil and climate
- Drought resistant crops
- Pest and disease resistant crops

Some of the components are

- Knowledge based extension and information system
- Minimum input maximum output - **ROI**
- Crop diversification
- Maintaining soil fertility – use of legumes, green manures etc
- Biomass incorporation – residue management
- Manipulate microbes in the soil
- Rain water management – watershed technology

Knowledge management is one of the key intervention

- ICT enabled extension system – tablet based extension/information system for real time exchange
- Mobile based advisory systems for weather, market, input advise – e.g farmer at Adakkal
- IMD has initiated 24/7 weather information from January 1 in India.

Access to Market



A Mandi

Can smallholders also make money



To find sustainable ways of raising farm productivity, and
Improve farmers' access to market.

- *Still a challenge in rural India!*

Empowering the women – Self Help Group movement in India MKSP

Empower a small farmer
and change lives





**Mechanization as there is acute
Shortage of labour**

Mechanization
is possible
Even with small
farmers



Technology

- Agricultural extension
- Better organization
- Financial services
- Connectivity

Services

- Genetics and plant breeding
- Soil fertility solutions
- Crop protection
- Irrigation
- Mechanization

- Transport
- Storage
- Information
- Logistics
- Contracts

Access to markets

Millions of small farmers are reached commercially through farm inputs, *but remain starved of services and have weak access to market*

Now, viability of small holdings is at a threat, so also the livelihood security of these farmers.

Way out - according to experts: Further increase in productivity & generating more off-farm rural employment opportunities.

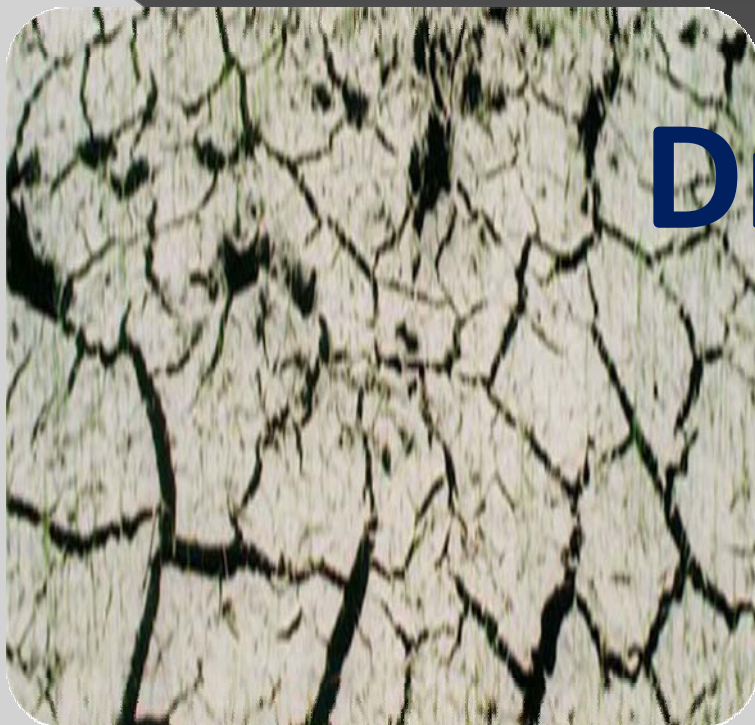
Harnessing Eco-system Services for Meeting Crop Nutrient Needs





Sustainable agriculture A Challenge

Drought



Climate resilient
Agriculture



Untimely rains put farmers in a bind

Paddy and horticulture farmers suffer great loss

*Paddy damaged over 15000 ha and
horticulture
crops over 1000 ha*

Hindu : Sunday, April 26th

Climate change and options for CMSA

- Climatic vulnerabilities are drought, flood, cyclone, heat wave, cold wave etc.
- Interventions include resource conservation practices and technologies for natural resource management,
- Efficient use of resources and inputs for improved crop, livestock and fisheries production
- *Enhancing resilience is the key to achieve sustainability in agriculture especially in the context of climate vulnerability*

Climate resilient Agriculture

- Scientists are working all over the world to tackle climate change which is real
- New varieties which are drought resistant,
- Mature even in high temperature during crop growth
- Resistant to pests and diseases
- Shorter duration crops to escape mid-season drought
- Selecting crops which are climate resilient

What is climate change and how it affects farmer's livelihood

- Unusual weather conditions and its effect on farming
- Unseasonal rainfall, hail storm, drought, flooding all are climate change effects
- Sudden high temperature during growing period
- Sudden drought during critical period of growth

Some of best practices to mitigate effects of climate change

- Rejuvenation of farming in cyclone and flood prone coastal
- Agro-ecosystems through land sh
- Community paddy nursery as a contingency measure for delayed planting
- Direct seeded rice for promoting water use efficiency
- Drum seeding of rice for water and timeliness in planting
- Drought tolerant paddy cultivars tackle deficit rainfall situations

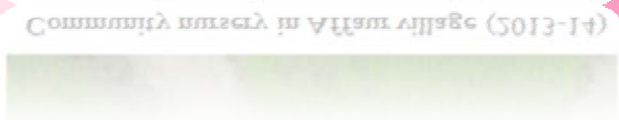
LKP capacity building



community mat nursery (Sahbhagi dhan 2012-13)



Community nursery in Affaur village (2013-14)



Community nursery in Affaur village (2013-14)

- Short duration finger millet varieties for delayed monsoon / deficit rainfall districts in south interior Karnataka
- Short duration crop varieties suitable for late sowings
- Crop diversification for livelihood security and
- resilience to climate variability
- Community tanks / ponds as a means of augmentation and management of village level water resources



Stored water level being used for providing irrigation to second crop

- Individual farm ponds for improving livelihoods of small farmers
- Jalkund - low cost rainwater harvesting structures
- Check dam - storing excess-runoff in streams
- Recharge of wells to improve shallow aquifers
- Integrated Farming System modules



Cultivation of off-season vegetable (chillies) using harvested water in farm pond

- Improved planting methods for enhancing water use efficiency and crop productivity
- Zero till drill wheat to escape terminal heat stress
- *In situ incorporation of biomass and crop residues for improving soil health*
- *Village level seed banks to combat seed shortages*
- Fodder cultivars to tackle fodder scarcity

Some specific recommendations for unusual rain during March-April 2015

- **Telangana**
- **Areas affected:** Nizamabad, Adilabad, Ranga Reddy, Mahabubnagar
- **Crops and damage:** Turmeric, Safflower, Onion, Chillies and Rabi sorghum affected
- **Advisory:**
 - Provide surface drainage in standing crop
 - Quick drying of harvested rhizomes and bulbs
 - Postpone harvesting of maize crop.

- **Andhra Pradesh**
- **Areas affected:** Coastal districts
- **Crops and damage:** Rice fallow pulses and rabi maize affected
- **Advisory:**
 - Harvest green cobs
 - Drain out excess water from fields in standing maize
 - Shift harvested cobs for safe drying
 - Reference :

Mitigating climate change - CMSA

| Contributing factor for climatic change | Mitigation method in CMSA |
|---|--|
| GHG emissions | SRI in Paddy Using biomass for composting rather than burning Eliminating chemical fertilizer usage Aerobic composting methods like NADEP |
| Energy use | Low or no fossil fuels Animal power or human power No machinery using fossil fuels |
| Increased Co ₂ in atmosphere | Bund plantation of green leaf manure and other plants |



Drought tolerant maize (Jaunpari makka)



Cultivation of off-season vegetable (chillies) using harvested water in farm pond



Soybean + Pigeonpea (4:2)



Drought proofing with soybean (JS-95-60) + pigeonpea (BDN-708) intercropping (8:2) for delayed monsoon



Short duration and drought tolerant finger millet variety (GPU-48)



Ghanajeebamrit :
substitute of Urea



Home made Bio
Pesticides





NADEP Compost