

# Technological Inputs for Doubling Farmers Incomes

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(\* with inputs from Dr Suhas Wani, Formerly Director, IDC, ICRISAT)

# The Global Scenario

- World population expected to reach 9.6 billion by 2050
- > 1 billion poor and hungry people (~65% of poor and 70% of hungry people) live in rural areas
- India's population is projected to be 1.5 billion in 2050
- Food and nutrition security will be critical under the climate change scenario
- > 85% of Indian farmers are smallholders, with a per-capita arable land availability of <math><0.6\text{ ha}</math>
- Farmers will need climate-resilient high-yielding varieties and supportive agronomic management technologies and practices to meet the demand for food



# PM's Doubling Farmers Income

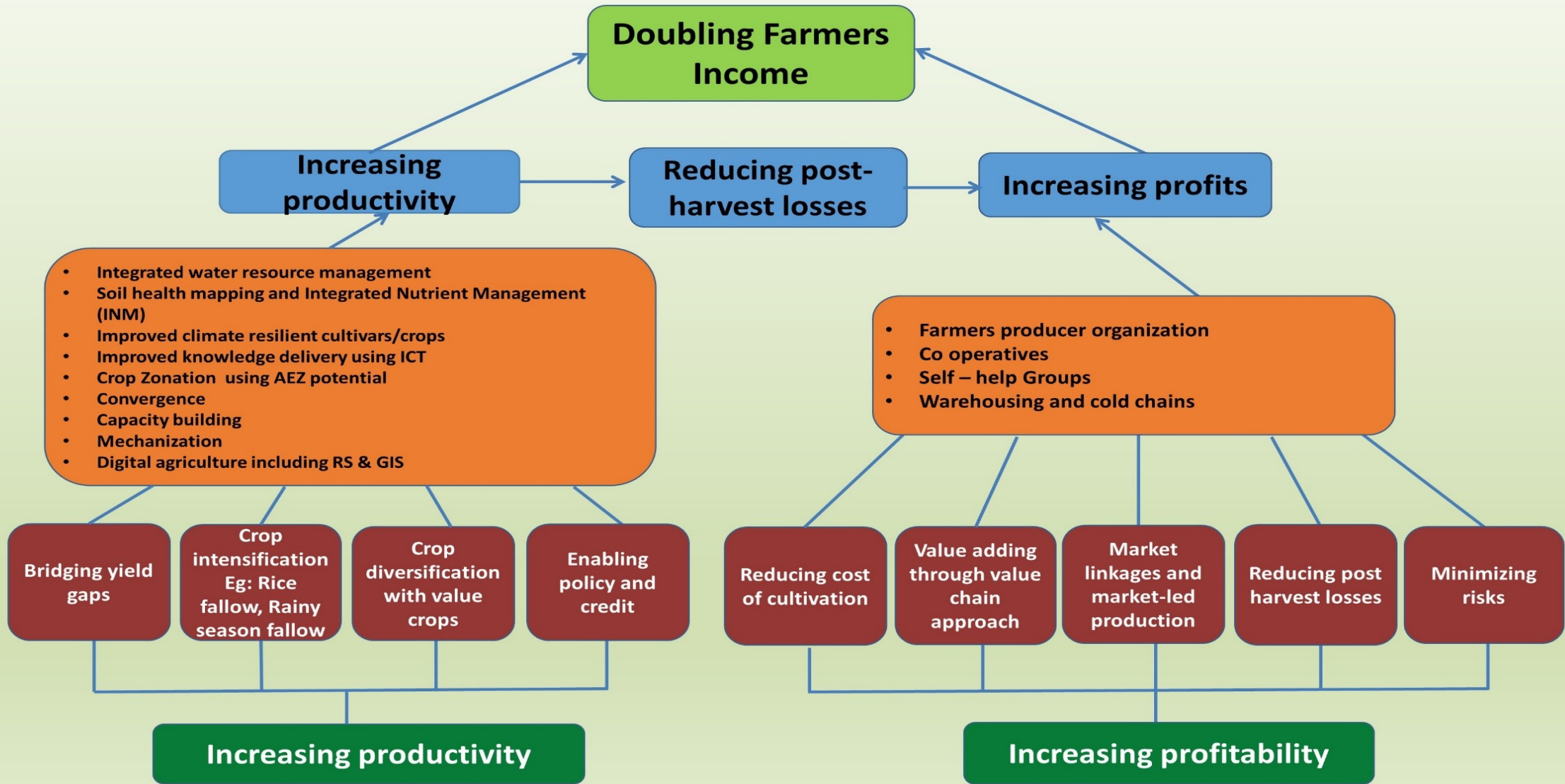
*"The Hon'ble Prime Minister of India made a statement on 28 February 2015 at Bareilly on Doubling Farmers' Income by the year 2022."*

## **Prime Minister's Seven Point Strategy for Doubling Farmers' Income by 2022**

1. Focus on irrigation (more crop per drop);
2. Quality seed and soil health;
3. Investments in warehousing and cold chains;
4. Value addition through food processing;
5. Creation of a national farm market;
6. New revolutionary crop insurance scheme to mitigate risks at affordable cost;
7. Promotion of ancillary activities like dairy, poultry, beekeeping, and fisheries.



# Climate Resilient Market Oriented Agriculture for Increased Incomes





# Ways to Double Farmers Incomes

- **Increase crop productivity and production per unit area**
  - Improved crop varieties and agronomic management of crops
  - Irrigation/ Assured rainfall (Water-use Efficiency)
  - Availability of Credit and Inputs (Fertilizers, Pesticides, etc.,)
- **Remunerative prices for agriculture produce**
  - Linking farmers to markets effectively
  - Avoid middlemen and exploitation by traders
- **Secondary Agriculture**
  - On-farm activities
  - Off-farm activities

# High Yielding Crop Varieties for Niches

- **Disease/ Pest resistant varieties for endemic areas**
  - Resistant pearl millet varieties that overcame Downy mildew disease
  - Fusarium wilt resistant varieties in chickpea and pigeonpea
  - Rice varieties resistant to BPH (Brown plant hopper)
- **Extra-short duration varieties for double cropping with wheat**
  - UAPS 120 and ICPL 88039 pigeonpea for *Kharif*, followed by wheat
- **Short duration varieties to match available soil moisture**
  - ICCV 2, KAK 2, Vihar chickpea for Southern India short season
- **Varieties for Relay-cropping /Utera cropping**
  - Short duration Mung bean and Black gram varieties after rice harvest

# Chickpea Revolution in Andhra Pradesh

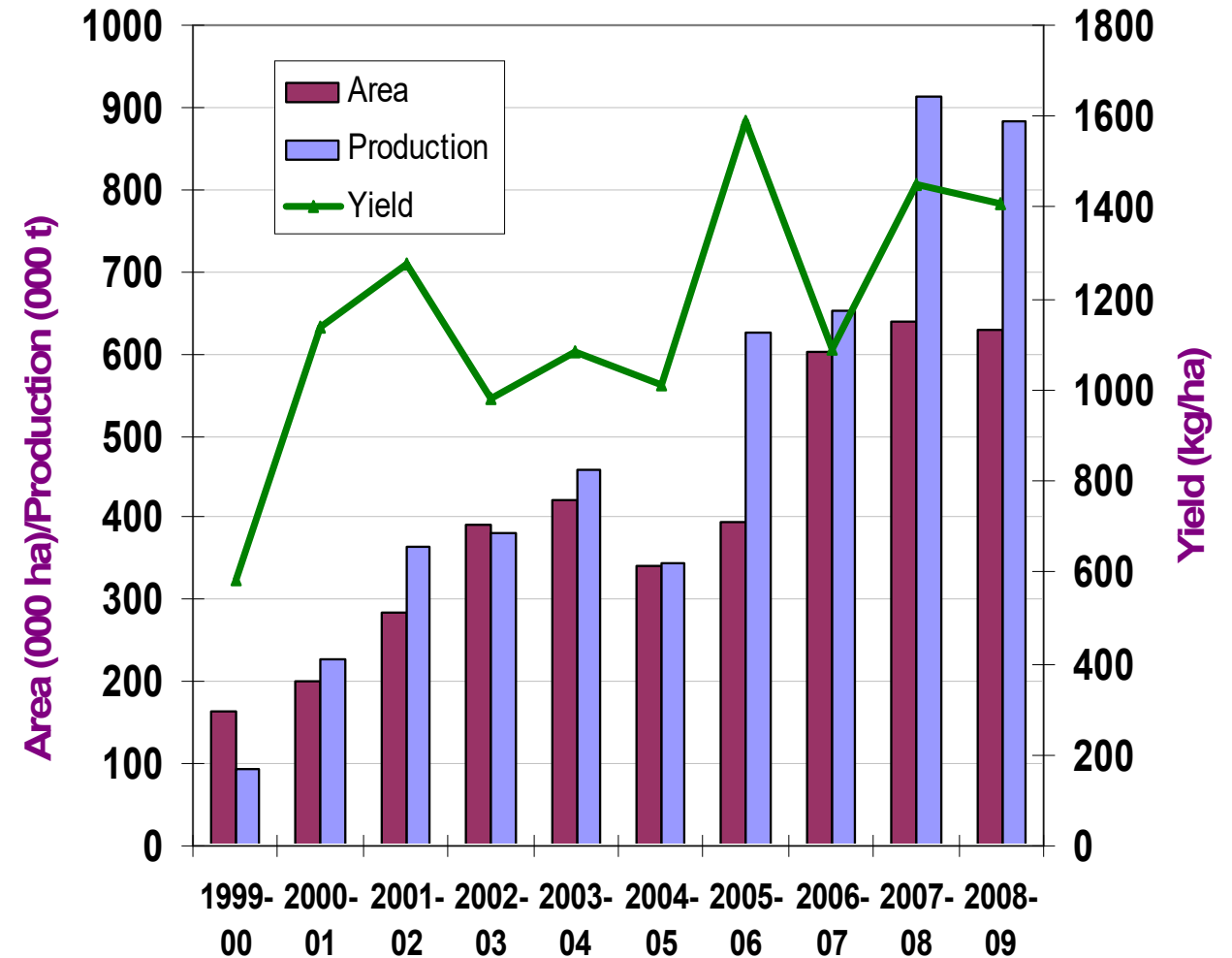
- Chickpea is cool season crop, not fully adapted to S India
- ICRISAT led the development of short and extra-short duration varieties adapted to peninsular India conditions
- SAU scientists and AP State Seed Corporation led the seed production and distribution, supported by farmers
- Ambient warehouses and Cold Storages helped store harvested grain to be sold later when prices were high
- Area, production and productivity increased substantially

# Chickpea success story in Andhra Pradesh

## Chickpea revolution in Andhra Pradesh

During 1990 to 2009:

- 4-fold increase in area
- 2.4-fold increase in yield
- 9-fold increase in production
- Over 80% area under improved cultivars



Trends in chickpea area and production



# Bhoochetana: Holistic Scaling Up in Karnataka, India using integrated genetic and natural resource management (IGNRM)

## HARNESSING DIVIDENDS FROM DRYLANDS

INNOVATIVE SCALING UP WITH SOIL NUTRIENTS


Edited by KV Raju and SP Wani



### Interventions




### IMPACTS


 Scaled up over **3.73 million ha** in **30 districts** of Karnataka

 **4.75 million** farmers benefit over 4 years

 **7.4 million ha** Rainfed area covered by improved management practices

 **35% Additional income** on average

 Benefits observed in wet and drought years

 **20-66%** increase in crop yield (Benefit-cost ratio: 2:1-14:1)

 **US\$453 million** net profits in 7 years

Raju KV & Wani SP, 2016: Harnessing Dividends from Drylands: Innovative Scaling up with Soil Nutrients

Wani SP et al., 1997: Rainfed Agriculture: Unlocking the Potential



## Improved Soil & Water Management

### Edapho-climatic based water conserving strategies

- Maintenance of water/moisture
- Maintenance or improved soil fertility
- Reduction of soil erosion
- Enhanced yield and incomes



Deep tie ridge



Residue bund



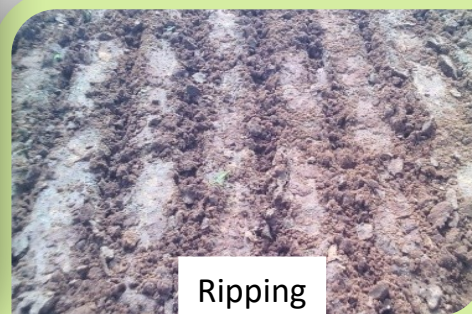
Mulching



Conventional ridge



Cover crops



Ripping



High and flat ridge

# Secondary Agriculture for Income Generation

- Farmers not fully and gainfully employed throughout the year
- Non-farm income increased from 20 to 68% and on-farm income decreased from 74 to 32% between 1970 to 2015
- Intensity of farm operations depends on agro-ecologies/ crops
- On-farm Secondary Agriculture activities
  - Poultry, Dairy, Goats/ sheep, Piggery, etc.,
  - Bee keeping, Vermi-compost, Mushroom cultivation, etc.
- Off-farm Secondary Agriculture activities
  - Post-harvest processing (cleaning, grading, packing, storing, etc.)
  - Value addition– Dal making, etc.
  - Custom hiring of farm equipment



# Micro-enterprises: For Increasing Income from Secondary Agriculture

- Vermicomposting
- Value addition: *Daal* mills installed
- Village-based seed bank
- Nursery raising by SHGs





# Diversification with High Value Crops for Efficient Water Use and Incomes



**As a result of increased water availability high-value crops such as banana, vegetables and Bt cotton in the watershed has increased with drip irrigation using the groundwater for supplemental irrigation  
Income increased from 11000 to 1 L/ha per season**



# Higher Income from Organic Agriculture

- ▶ Organic products are sold at higher price
- ▶ Belief that organic products are more tastier and healthy
- ▶ Studies have not shown significant differences in taste, but pesticides residues are definitely lower in organic produce
- ▶ Greater demand for organic foods in the markets in future

# Suitability of Organic Farming in Different Niches/ Agro-ecologies

- Organic farming is feasible and practical in perennial horticulture crops such as fruit orchards (apple, peach, orange, etc.), and plantations (coffee, tea, rubber, cocoa, coconut, etc.) that are commercial crops and profits are high
- Farmers in areas with fertile soils, supported by good and reliable rainfall are able to practice organic agriculture for annual crops such as staple food grains and pulses
- Farmers in arid and semi-arid regions (characterized by degraded soils and low and erratic rainfall) either cannot afford or risk applying external inputs (chemical fertilizers, pesticides, etc.) due to the low-input, subsistence farming (organic-by-default)

# Concept of “Soil as a Bank of Plant Nutrients”

- **Organic Agriculture requires good soil fertility (soil organic carbon and essential macro and micronutrients), appropriate soil structure and adequate soil moisture**
- **Most dryland areas have degraded soils, low soil fertility, high air and soil temperatures, coupled with low and erratic rainfall**
- **Crop yields are low, and farmers also harvest the crop residues to feed their cattle**
- **Soil organic matter is low, and also degrades fast due to high temperatures.**
- **Study shows non-feasibility to maintain organic matter in soils with less than 600 mm rainfall and daily average temperatures of >15C**

## Content of major nutrients (%) in various manures and fertilizers\*

Nutrients	Farm Yard Manure (FYM)	Cattle Manure	Sheep manure	Chicken Manure	Urea	Single Super phosphate	Potassium sulphate
Nitrogen	0.5-1.5	0.6	0.7	1.1	45-46	-----	-----
P2O5	0.4-0.8	0.15	0.3	0.8	-----	16-22	-----
K2O	0.5-1.9	0.45	0.9	0.5	-----	-----	50-53

\* Amalgamated information from different sources, for comparison only.

# Organic farming to be pragmatic and holistic

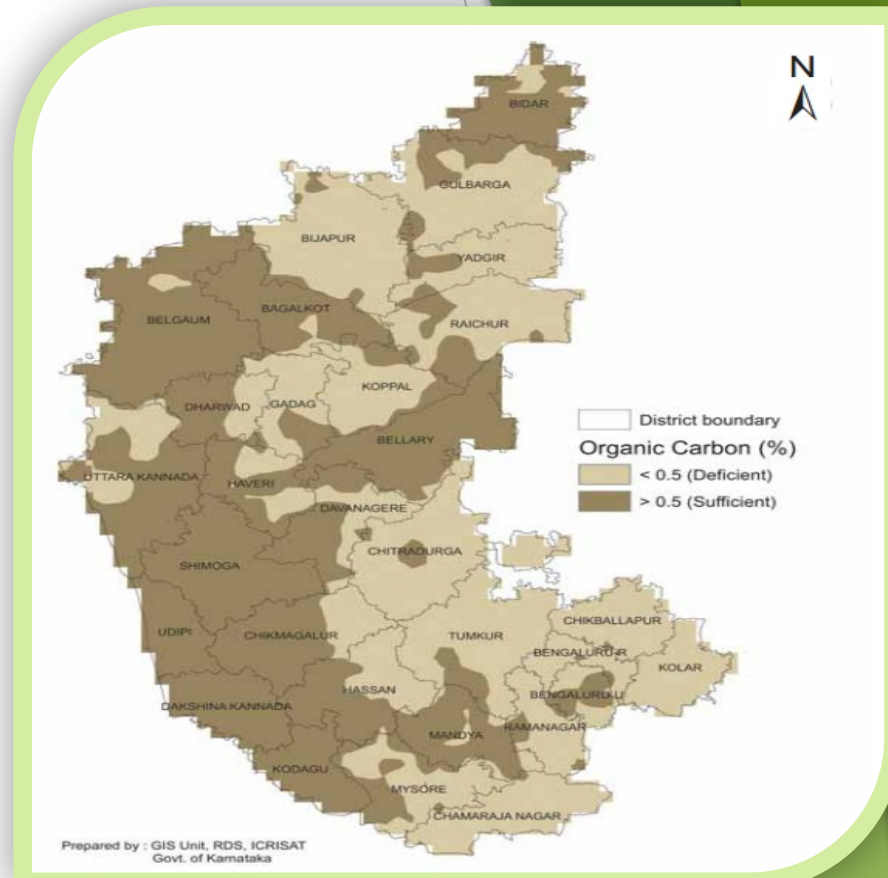
- Large amount of nutrients are removed from the soil; e.g. One ton/ha of maize crop removes ~161kg N, ~66 kg P<sub>2</sub>O<sub>5</sub> and ~48 kg of K<sub>2</sub>O
- Nutrients need to be replenished after every harvest to maintain a positive balance of nutrients in the soil
- Based on average of 0.5% N in manure, farmers' need to add 9.2 ton of organic manure to get the equivalent of 100 kg of Urea containing 46% N.
- Farmers need to provide a combination of proper amounts of both organic and other fertilizers to ensure improved soil health and sustainability
- We need to harness the synergies of amalgamating the best practices from traditional knowledge and modern science and technologies



# Soils are not only thirsty but hungry also

❖ Widespread deficiency of micronutrients across India demands its application to increase crop yields

State	No. of farmers' fields	Low OC (%)	Av.P (ppm)	K (ppm)	S (ppm)	B (ppm)	Zn (ppm)
Andhra Pradesh	8693	77	24	7	67	68	72
Gujarat	82	12	60	10	46	100	85
Jharkhand	115	42	65	50	77	97	71
Karnataka	61897	60	38	12	69	65	58
Kerala	28	11	21	7	96	100	18
Madhya Pradesh	341	22	74	1	74	79	66
Orissa	157	17	69	4	97	3	99
Rajasthan	663	60	53	10	65	56	49
Tamilnadu	119	57	51	24	71	89	61
India	72095	61	37	12	69	65	60



OC = Organic Carbon; AvP = Available phosphorus

# Farmer Producer Organizations (FPOs)

- ▶ Collective of farmers who are primary producers
- ▶ Facilitates linking farmers to markets (no brokers)
- ▶ Supported financially by NABARD, and others
- ▶ Producers are shareholders in the FPO
- ▶ Aggregates the produce and negotiates price
- ▶ Involved in processing and value addition
- ▶ Bulk procurement and supply of inputs
- ▶ Profits are shared by all FPO members
- ▶ FPOs enhance farmers incomes substantially





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