Scientific Organic Farming Practices

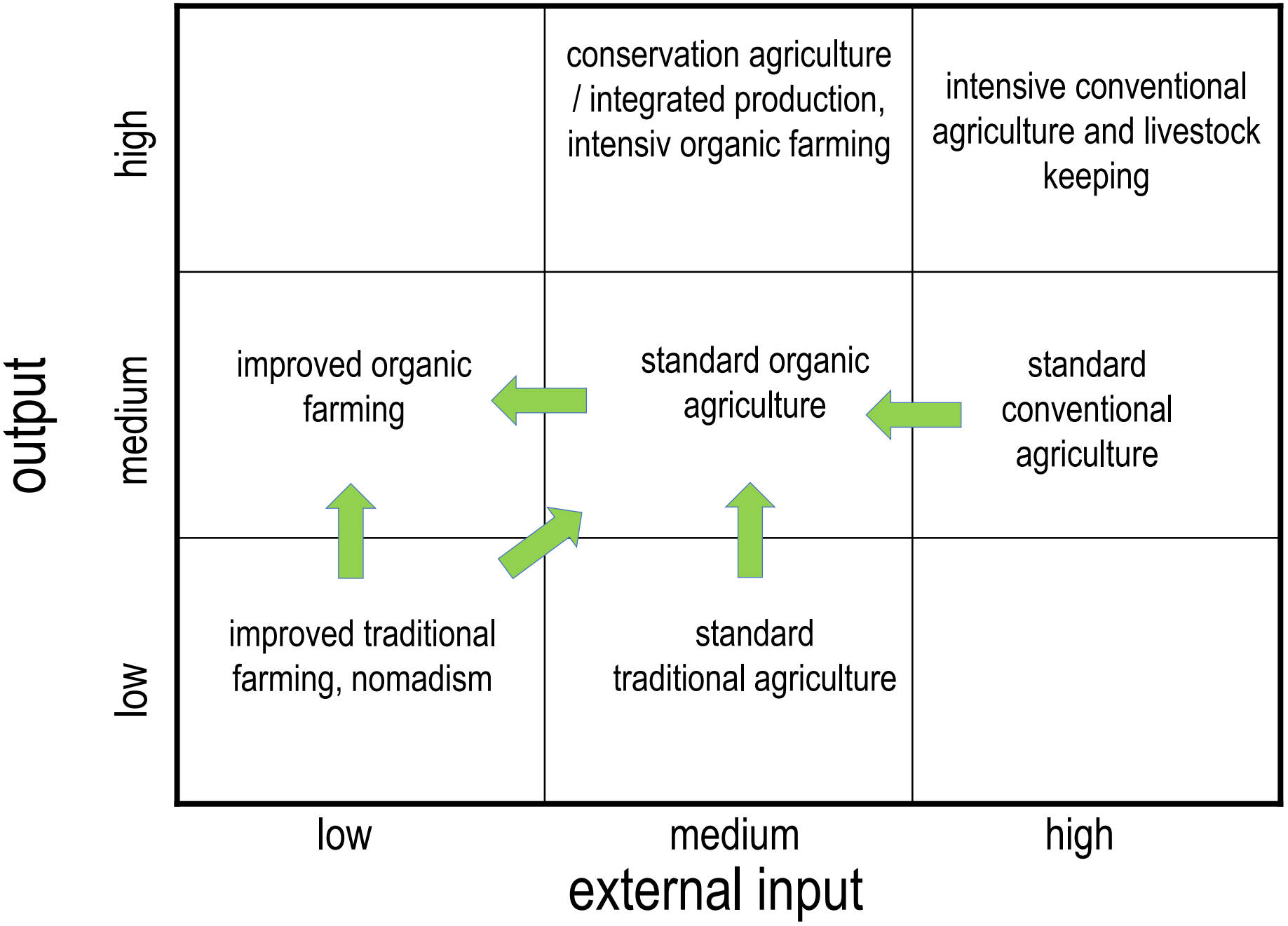
N. Ravisankar
Principal Scientist (Agronomy) & NPI, AI-NPOF
E mail: ifsofr@gmail.com

For NCOF, 28 June 2021

ICAR-Indian Institute of Farming Systems Research, Modipuram

Why organic farming?

Organic and towards organic agriculture (Integrated Crop Management)
Timely intervention: Soil-livestock-human health and sustainability


output
high
medium
low
conservation agriculture / integrated production, intensiv organic farming
intensive conventional agriculture and livestock keeping
improved organic farming
standard organic agriculture
standard conventional agriculture
improved traditional farming, nomadism
standard traditional agriculture
low
medium
high
external input

All India Network Programme on Organic Farming (AI-NPOF)

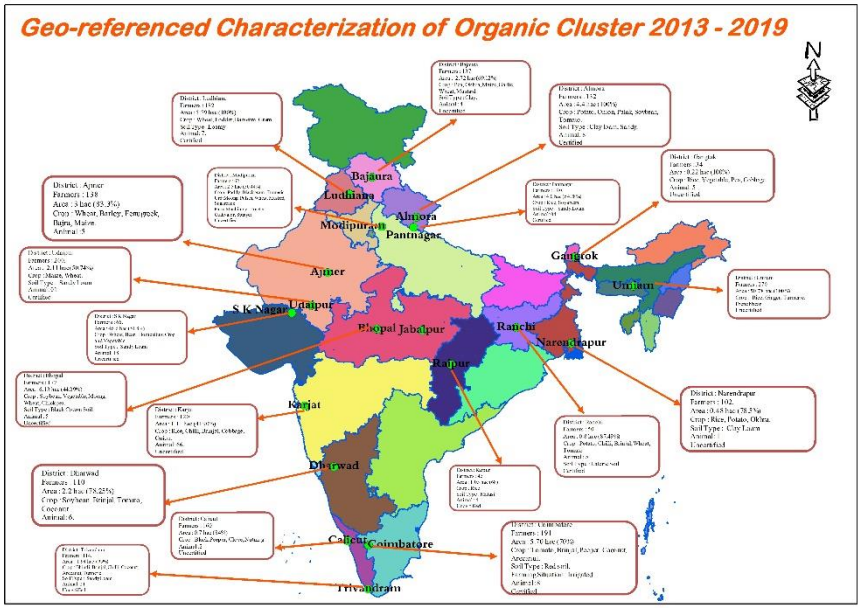
- 20 locations
- 16 States

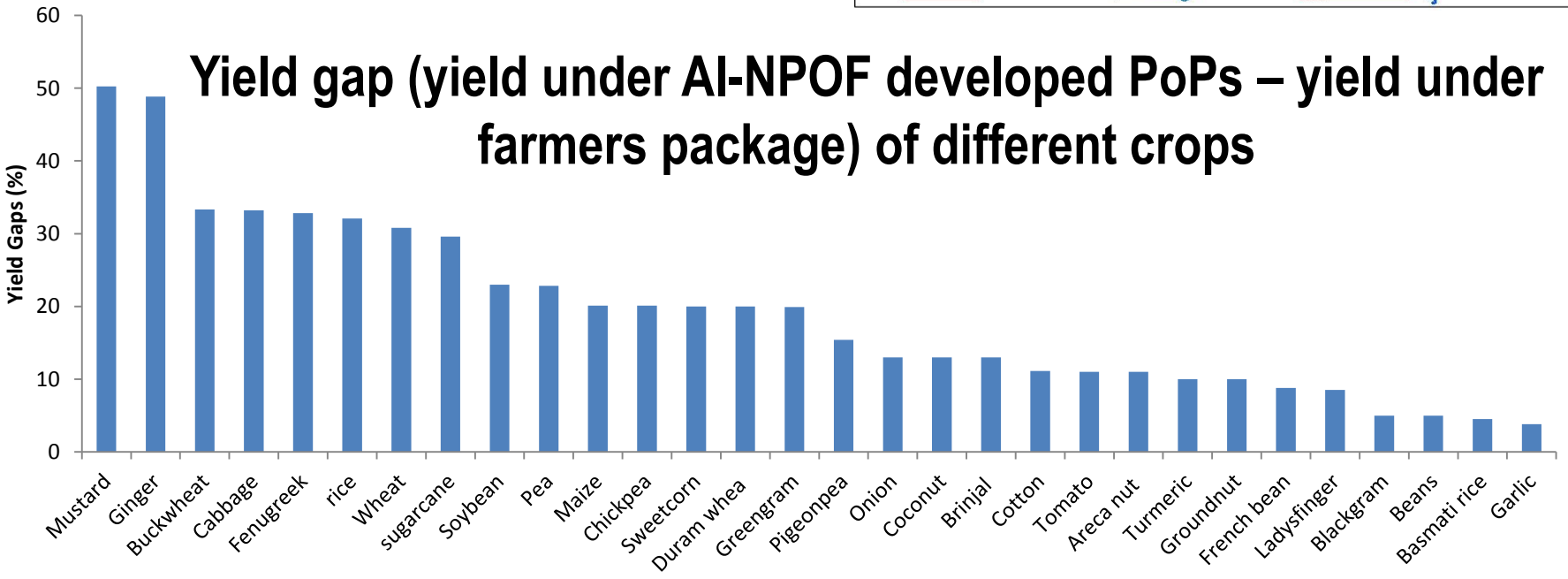
Multi-institutional

- 11 SAU's
- 7 ICAR institutes
- 1 deemed university
- 10 ACZ's
- 12 AERs

Priority: bridging the yield gap

- > 3000 farmers from 16 States
- Yield gap (between farmers and scientific organic farming package) of **30 major crops** analysed
- Yield gap: ranged from **4 % in Garlic to 50 % in mustard**





Issues and strategies addressed through NPOF

Issue	Strategy
High volume of organic materials is required to meet the nutrient demand for organic production	• Combination of sources, the nutrient demand can be met instead of single source and cropping system approach involving green manures and leguminous crops • Reduced application of manures after building up of organic carbon content
Lack of cost effective non-chemical approach of pest and disease management	Cultural (cropping systems) + mechanical (traps) + leaf extract + bio-agents, the pest and diseases can be managed
Non availability of cost effective non-chemical weed management practices	Through cultural + mechanical (cono weeding etc), the weeds can be managed to some extent. However, hand/manual weeding at critical stage is essential

Basic Components

- Diversity plantations
- Diversified cropping systems
- Crop rotations
- Soil fertility management
- Selection of varieties, seeds and planting material
- Nutrient management
- Pest management

Nutrient Supply under Organic Production System

Centre	Cropping System	Sources
Jabalpur	Basmati rice-wheat-berseem (seed)	Vermicompost (VC) + Farm Yard Manure (FYM) + Non Edible Oil Cakes (NEOC) @ 1/3 N
Coimbatore	Cotton-maize-GM Chillies-sunflower-GM	FYM + NEOC @ ½ N each + Panchagavvya (PG)
Raipur	Rice-chickpea	Enriched compost (EC) + FYM + NEOC @ 1/3 N each + Biodynamic (BD)+PG
Kozhikode	Ginger-fallow	FYM + Neem cake (NC) + VC + PG + biodynamic + Rock Phosphate (RP)
Dharwad	Groundnut-sorghum Maize-chickpea Chilli +onion	EC + VC + Green leaf manure (GLM) + biodynamic (BD) + PG
Karjat	Rice-red pumpkin Rice-cucumber	FYM + rice straw + GLM during kharif and FYM + NC + VC during rabi + PG
Ludhiana	Maize-wheat-summer moong	FYM + PG + BD in maize, FYM +PG in wheat and FYM alone in moong

Nutrient Supply under Organic Production System

Centre	Cropping System	Sources
Bhopal	Soybean-wheat Soybean-chickpea Soybean-maize	Enriched compost (EC)+Panchgavvya (PG) + Biodynamic (BD)
Pantnagar	Basmati rice-wheat Basmati rice-chickpea Basmati rice-vegetable pea	FYM + Vermicompost (VC) + Neem cake (NC) + Enriched compost (EC)+ Biodynamic (BD) + Panchgavvya (PG)
Ranchi	Rice-wheat Rice-potato	Vermicompost (VC)+ Non Edible oil cake (NEOC) + Biodynamic (BD) + Panchgavvya (PG)
Umiam	Rice-maize Rice-toria	FYM + Vermicompost (VC) + Panchgavvya (PG)

- Organic nutrient input management clearly establishes that use of either panchgavya or biodynamic practice alone reduces the yield significantly. However, yield advantage is seen when these are combined with other organic inputs.
- Combination of organic inputs such as vermicompost, FYM, neem cake was found to be better compared to application of single source.

Enriched Compost Preparation

Vermicompost

- Ideal earthworm species: *Eisenia foetida* and *Eudrilus eugenae*
- Pit size: 1 m deep and 1.5m wide (Length may vary)
- Culture of Pseudomonas fluorescens may also be added (@ 200g/100kg).

Intercropping of Dhaincha in rice and incorporation through cono weeder

Bio Fertilizers

- Azospirillum
- Azotobacter
- Phosphobacterium
- VAM
- Azolla

Azolla in paddy cultivation

Bio-gas slurry

- Bio-gas slurry is a good source of organic manure
- Bio-digested slurry rich in plant nutrients both macro & micro nutrients compared to FYM.
- Nutrient content 1.43 % N, 1.21 % P and 1.01 % K (dwb).
- 10 tonnes per ha bio-digested slurry is recommended to be applied once in three years

Weed management

Centre	Cropping System	Best performing practice
Raipur	Rice-mustard	Cono-weeder with square planting for rice Stale seed bed for mustard
Coimbatore	Rice-blackgram-GM	2 hand weeding + spray of aqueous leaf extract at 3-4 leaf stage of weeds
Jabalpur	Rice-wheat	2 hand weeding + spray at 3-4 leaf stage aqueous spray of weeds
Dharwad	Groundnut	Spray of *Cassia* and *Prosopis juliflora* as post emergence
Ludhiana	Basmati rice-wheat	Closer row spacing (15-20 cm) + hand weeding at 25-30 DAT
Pantnagar	Basmati rice-wheat-sesbania	One hand weeding at 25-30 DAT during *kharif* and 2 hand weeding at 25-30 and 45-50 DAS during rabi
Umiam	Maize (GC)-mustard	Mulching with fresh eupatorium/ambrosia @ 10 t/ha (after earthling up)

Weed Management

Hand weeding

Mulching

Beetle - Biocontrol

intercropping

Puddling

Non-herbicide weed control strategies

Crop rotation	Land preparation (harrowing)
Intercropping	Tyne weeding (rotary hoeing)
Cover/smother crops	Shallow cultivation
Timing of planting	Deep tillage
Variety selection(early vigour, canopy closure)	Stale seed beds
Plant spacing	Animal drawn weeding implements
Vegetation mulching (live or dead)	Hand tools/Hand weeding
Mulch films (paper, plastic, bio-plastic)	Thermal weeding (solarization, flaming, hot water, steam, microwave)
Mowing	Grit-blasting
Nutrient placement	Robotic weeding
Manure management	**Allelopathy**
Water management (drip, alternate furrow, sub-surface)	Biological weed control (Bioherbicides, insects)
Weed seed predation	
Livestock grazing/weeding	

"Good crop is the best weed killer"

Insect and disease management

Centre	Cropping System	Pest/disease	Best performing practice
Modipuram	Basmati rice-chickpea Basmati rice-mustard	-	Summer ploughing + green manuring
Kozhikode	Gninger-fallow	Shoot borer	Ginger endophytic bacteria (GEB)- 17 & 18, Ginger Rhizobacteria (GRB)- 57
Bajaura	Cauliflower-peas-tomato	Fruit borer & Fruit rot	Karvi (*Roylea cinerea*) @ 10% aqeous leaf extract + cow urine (3%) + tween-80 (0.05%) as emulsifier
Umiam	Maize + Soybean	Monolapta Mylloceros Ephilechma Leaf folder	Panchgavvya (PG) @ 10% and cow urine 3% Anomin 3 ml/litre or PG @ 3%.
		Rust	PG @ 3% + lantana @ 10% + vermiwash @ 10%

Non-chemical approach for management of insect pests in organic cotton

Marigold as a trap crop

Bhendi as a trap crop

Mass trapping of pink boll worm adults by Delta trap

Yellow sticky trap for sucking pest management

Different stages Coccinellids

Eggs

Grubs

Pupae

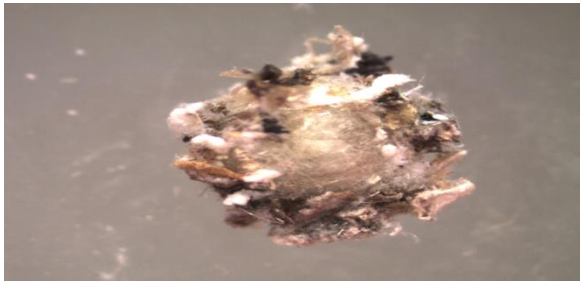
Adult

Use of Trichocard for the management of boll worms

Natural enemies in Organic Cotton ecosystem

Chrysoperla

Stalked Eggs



Pupa

Adult

Syrphid

Maggot feeding on Aphids

Adult

Micromus timidis grub

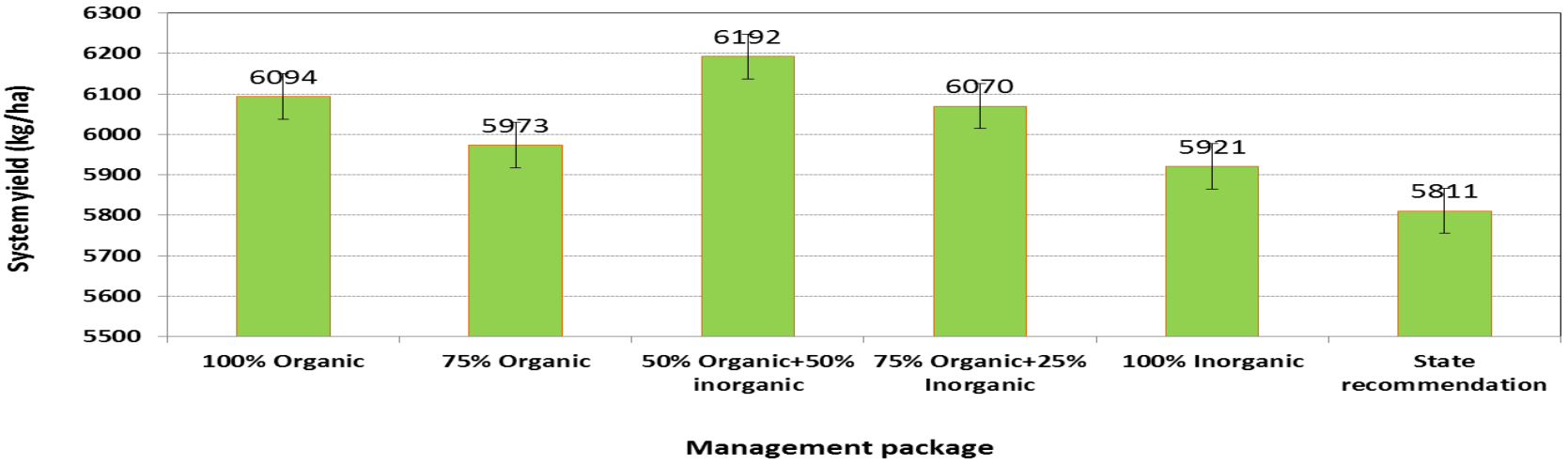
Micromus timidis adult

Spider

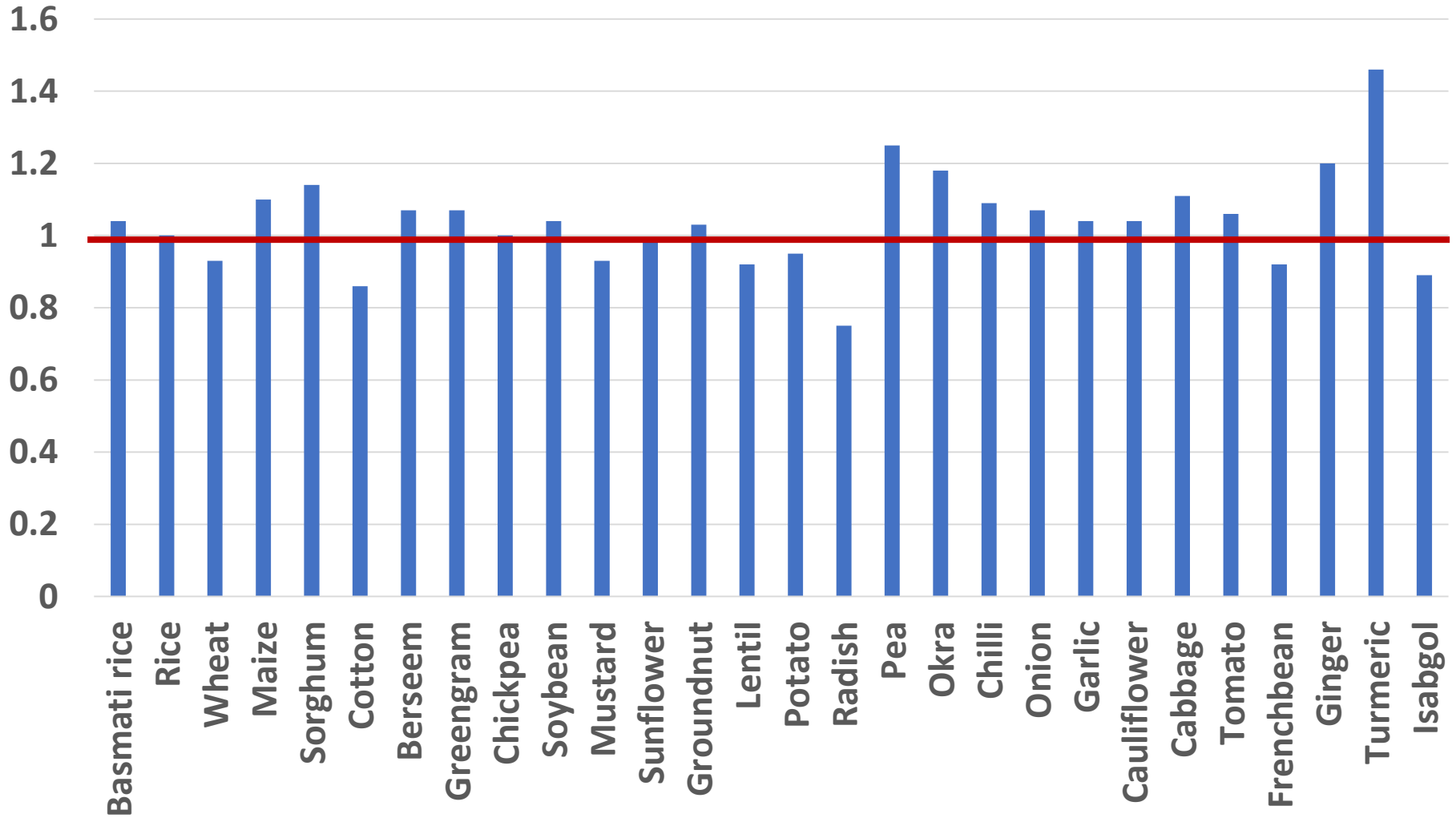
Production Research: Organic and Towards Organic

Organic management as per NPOP *(Organic)* *No synthetics*	**Rotational manuring** (Intermittent supply of 100% nutrients through organic sources and complete organic management)
	Reduced manuring: Supply of only 75% nutrients through organic sources complemented with indigenous practices
Integrated Crop management *(Towards organic)* *Staggered reduction of synthetics*	**Fixed reduction:** 50% organic + 50% inorganic source of nutrients and management excluding chemicals for pest and disease management
	Flexible reduction: 75% organic +25% inorganic source of nutrients and management excluding chemicals for pest and disease management

Basmati rice equivalent yield of Basmati rice-wheat system (mean of 5 locations)

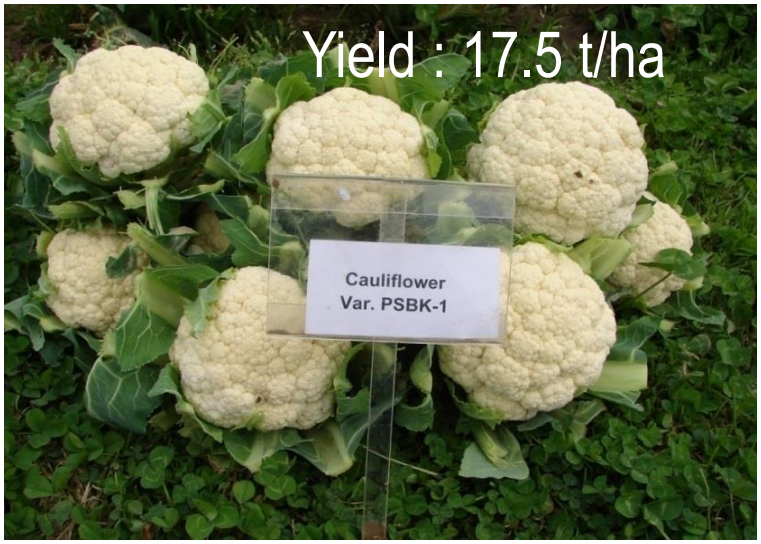


Yield ratio (organic over inorganic)



Varietal identification for organic production system

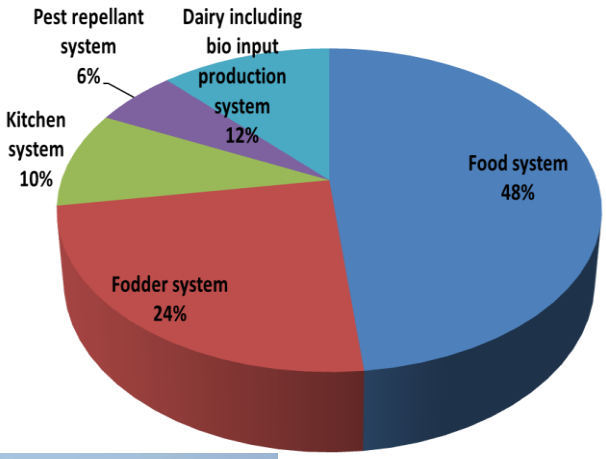
Cereals: coarse rice, basmati rice, durum wheat, maize
Pulses : chickpea
Oilseeds: Groundnut, mustard, soybean
Vegetables: Tomato, pea, okra, cauliflower, french bean)
Spices: turmeric



Reduced manuring packages

State	Crop/Cropping System
Chhattisgarh	Soybean-pea, soybean-chilli
Himachal Pradesh	Okra-pea-tomato (Summer)
Jharkhand	Rice (Basmati type)-wheat
Karnataka	Greengram-sorghum
Madhya Pradesh	Soybean-wheat, soybean-mustard, soybean-chickpea, soybean-linseed
Punjab	GM-basmati rice-chickpea
Uttar Pradesh	GM-basmati rice-mustard
Uttarakhand	GM-basmati rice-vegetable pea + coriander (4:2 rows)

Integrated Organic Farming System models



Nutrient requirement (kg)			On-farm nutrient recycled (kg)			Nutrient Balance (kg)		
N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
66.2	23.6	55.0	63.6	19.6	55.0	-3.7	-4.4	-1.0
Nutrient supply with in the system						94.4 %	81.1%	98.2 %

IOFS model of 0.5 ha (Sikkim)
Timpyem (44 HH) & Nandek (228 HH) in East Sikkim

Crops
+
Horticulture
+
Livestock

System Profitability (Rs/day) 299

Net energy output 73.4×10^3 MJ

Total Input (Rs) 108800

Employment 236 man days

Total energy input 25.8×10^3 MJ

Total output (Rs) 218160

Net Return Rs. 1,09,360

Manure production (FYM) (6.3 t)

Vermicom-post (3.1 t)

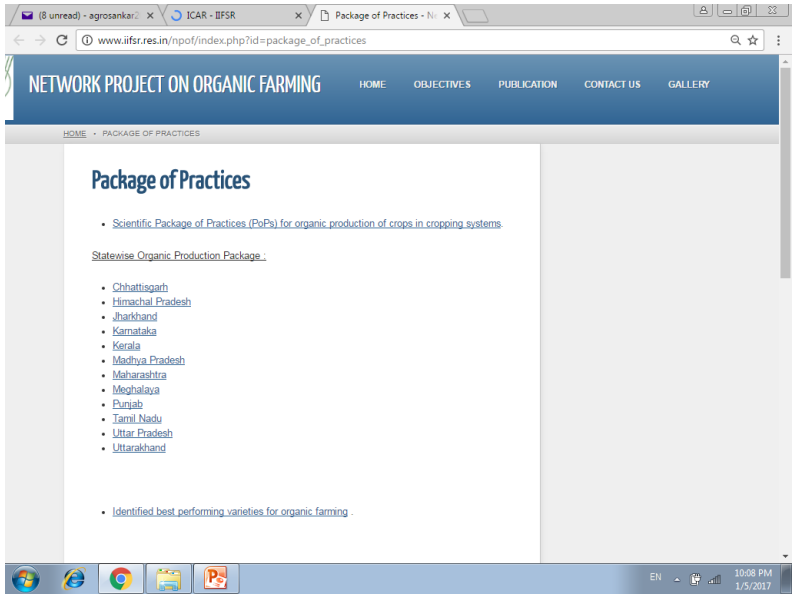
B:C Ratio 2.03

80% of inputs requirement can be produced on-farm through IOFS

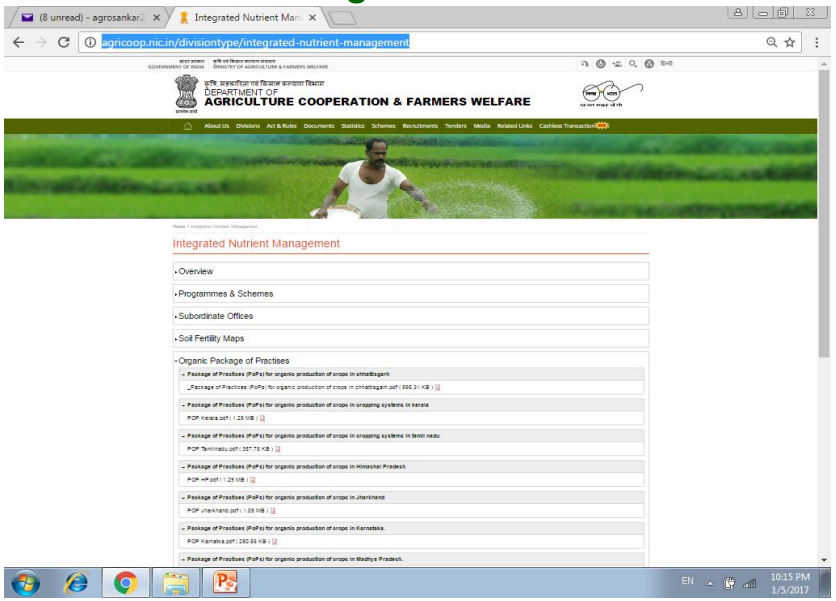
Scientific PoP's for organic production of crops

- **Detailed Scientific PoP's for organic production of crops in cropping systems (51) perspective are prepared.**

www.iifsr.res.in



http://agricoop.nic.in/divisiontype/integrated-nutrient-management




Thank You