Vegetable Production Technologies and Organic Production

Prakash S Naik
Indian Institute of Vegetable Research
Varanasi

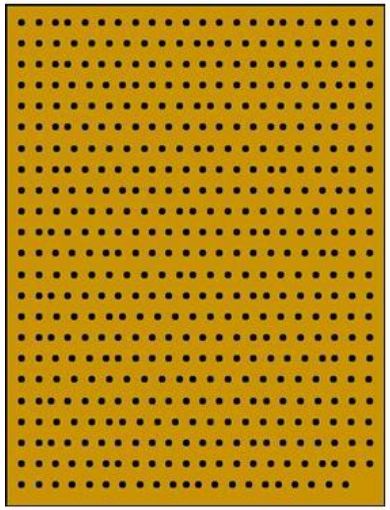
Healthy seedling is single most important ingredient for successful vegetable production

- Seedlings should have a strong stem
- Profuse root development .
- Dark green leaves.
- Should be free from pests & diseases.
- Should be of uniform height & straight stem.
- Right age of seedlings .

Nursery management

Nursery bed preparation

Solarization



Sowing of seeds

Polythene shelter during rains

Insect proof net (40 mesh) for protection against insects

Chemical fertilizers are added in nursery soil @ 100 kg N/ha, 50 kg P/ha and 50 kg K/ha

Arka Microbial Consortium improves seedling vigour and can be used for organic production

(+)

(-)

Arka Microbial consortium (*Azospirillum* spp, *Azotobacter* spp, PSB and *Peudomonas fluorescence*) contains N fixing, P & Zn solubilizing and plant growth promoting microbes.

- Early germination
- Increase vigour of seedlings
- Increase fertilizer use efficiency
- Reduce inorganic fertilizer application (N, P and Zn)
- Yield increase up to 5- 6 %

Simple interventions for profitability

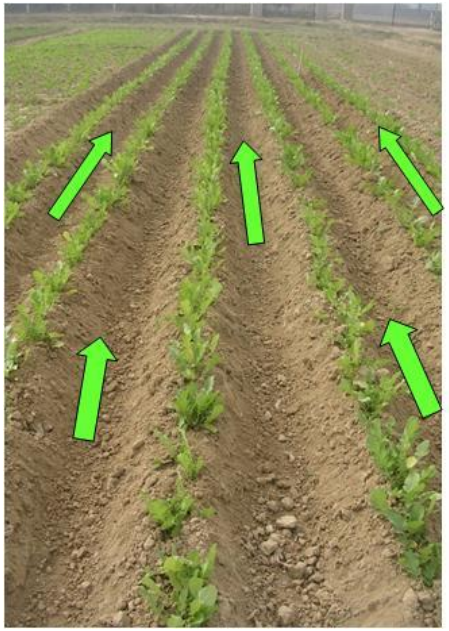
For advancing harvesting of cucurbits by about one month, seedlings can be raised under covered condition during December for zaid season and in May for rainy season and transplanted at normal sowing time of cucurbits. By this, one can get two times more returns by early harvest of cucurbits.

Raising seedlings on benches under polythene cover can protect them from rain, hails, water logging and soil borne diseases.

Furrow irrigated raised bed (FIRB) planting

- FIRB planting alone can saves about 36% water over conventional flood irrigation. There are other advantages like better aeration to roots, less weeds, plants do not fall in furrows etc.
- FIRB planting coupled with paddy straw mulch (7.5 tones/ha) have registered maximum fruit yield (45 t/ha) in tomato than conventional irrigation without mulch (29 t/ha). Saves about 45% water with 55% enhancement in yield.

Partial root-zone irrigation (PRI) saves water and enhances yield



Alternate furrow irrigation (AFI) can save 31% water.

Fixed alternate furrow irrigation (FAFI) if coupled with black polythene mulch can save 54% water and also increase yield by 27%.

Micro-irrigation and fertigation methods save water and fertilizers

- ☞ Water saving up to 40-60%
- ☞ Yield increase 60-100%
- ☞ Saving in fertilizers and chemicals (40 - 60%)
- ☞ Improved produce quality and higher returns
- ☞ Less pests and diseases incidence

Drip irrigation in tomato

Water saving in vegetable through drip irrigation

Vegetables	Water required (litres) to produce one kg	Water saving using drip irrigation (%)
Tomato	100-140	35
Watermelon	140-150	40
Okra	330-370	22
Brinjal	225-275	53
Bitter gourd	140-165	53
Ridge gourd	110-125	59
Cabbage	135-150	35
Radish	130-140	45
Beet root	145-160	30
Chilli	350-425	35
Paddy	2500-2700	
Wheat	1000-1200	

Mulching

- Mulches conserve soil moisture, modifying soil temperatures, improve soil properties, reduce weed growth and enhance crop yield.
- Paddy straw mulch (7.5 tones/ha) in tomato gave 34% higher yield (40 t/ha) in comparison to non-mulched control (29.8 t/ha) with 15% water savings.
- Water saving and yield enhancement with plastic mulch was more than paddy straw mulch.

Enhancing productivity and nitrogen use efficiency in tomato

1. Seedlings raising in Protrays
2. Seedling treatment with biofertilizers (*Azospirillum* and Phosphorus Solubilizing Bacteria (PSB) (one kg each Biofertilizer 500g Jaggary + 4 lit. of water)
3. Three foliar sprays of Water Soluble Fertilizers (NPK 19:19:19) @ 0.5% 30 DAT at 10 days interval.
4. Foliar application of micronutrient mixture (zinc & boron) @ 0.1%
5. Black plastic mulching of the beds

	Yield (t/ha)	Nitrogen use efficiency (t/Kg N)
Treated	52.0	0.43
Control	28.1	0.23

Application of micronutrients in Cole crops increase yield and reduce physiological disorders

- ✓ Three foliar Sprays of micronutrients mixture (Zn, Cu, Fe, Mn @ 100 ppm and Mo and B @ 50 ppm) at 10 days interval 30 days after transplanting
- ✓ 76.6 t/ha (44% higher than control).
- ✓ Mo @ 50 ppm reduces hollow heart in stems.

- ✓ Three foliar Sprays of micronutrients mixture (Zn, Mo and B @ 100 ppm) at 10 days interval 30 days after transplanting
- ✓ 37 t/ha
- ✓ B @ 100 ppm checks browning of curds.

Wherever possible cucurbits should be grown on bower system to improve yield and quality

Bower system: 37.4 t/ha

A Field View of Bottle Gourd

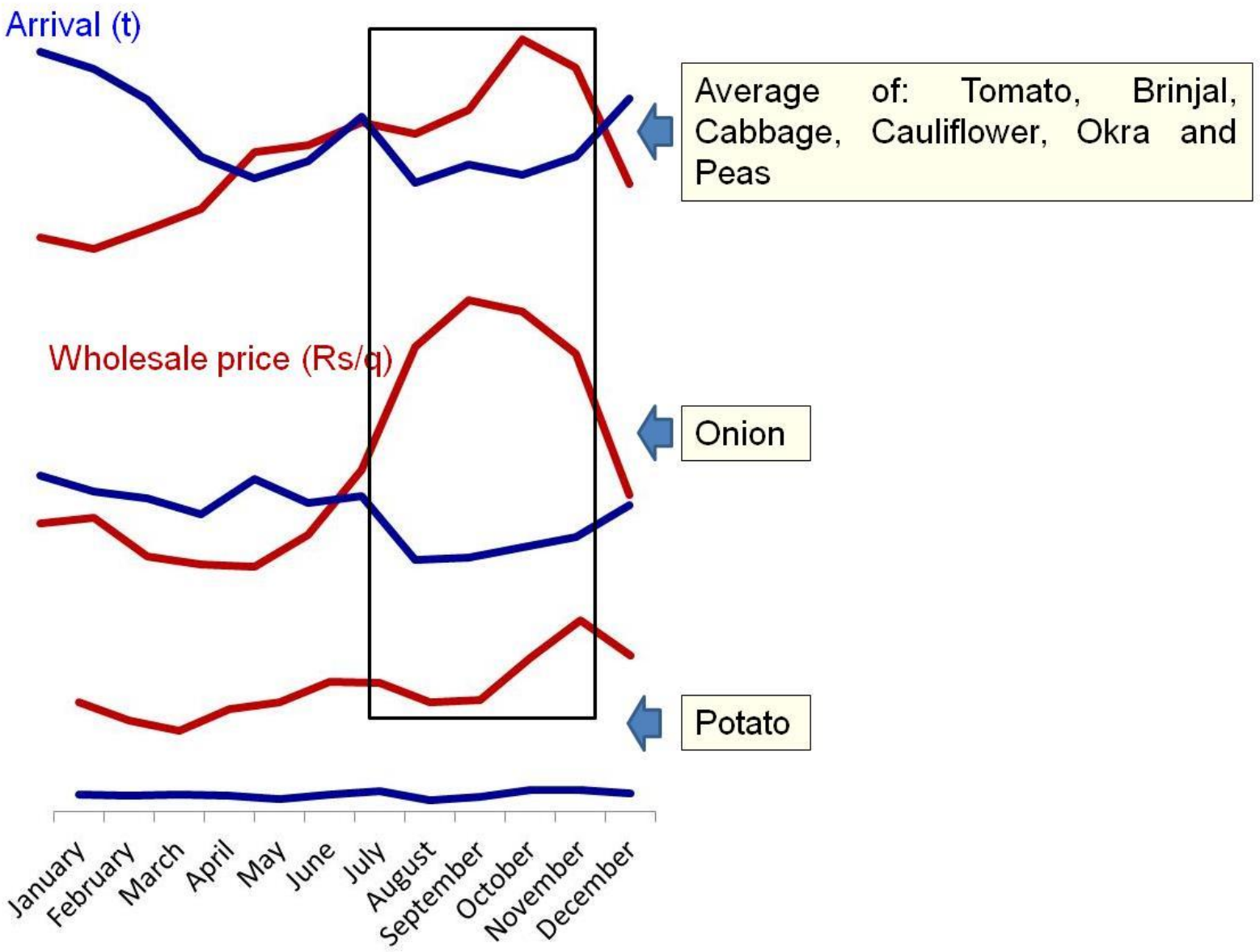
Field: 23-25 t/ha

Stacking in tomato improves yield and quality

Stacking: 70-75 t/ha, best quality fruits

Non-stacking: 45-50 t/ha, poor quality fruits

Fluctuations in arrivals and wholesale prices of major vegetables in 4 metropolitan cities of India during 2013



Temporary poly-huts for growing vegetables during rainy season

Growing vegetables under rain shelters

Tomato under rain-shelter during kharif season at IIHR, Bangalore: 83 t/ha in 110 days

Low cost and Hi-Tech protected cultivation structures

Shade House

Net house

Polyhouse

Hi-Tech protected structure

Protected structures give high yields of best quality produce

Tomato (300 t/ha/year)

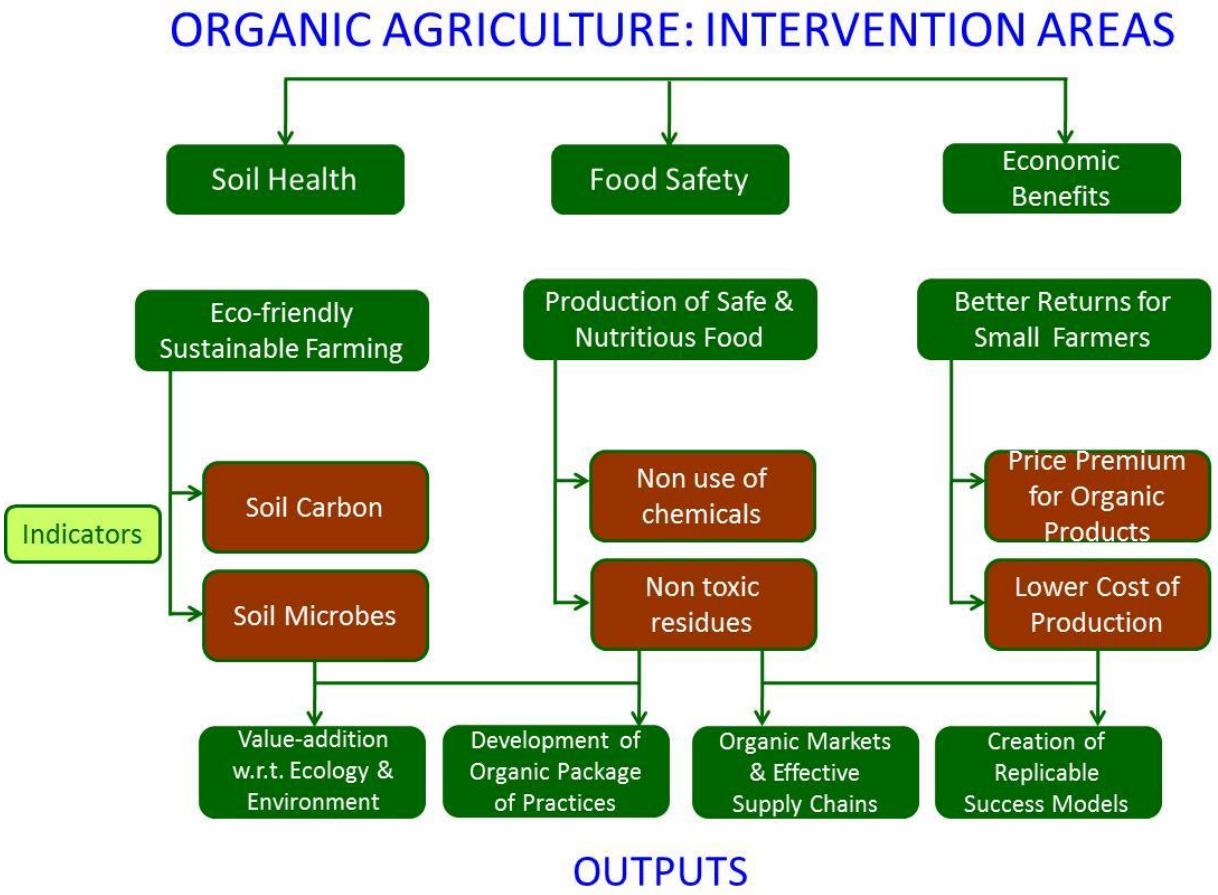
Capsicum (200 t/ha/year)

Cucumber :
73.2t/ha in 75 days
(Late summer)

Muskmelons:
60t/ha in 100 days
(winter)

Organic cultivation of vegetable crops

- Primary focus on management practices that promote and enhance ecological harmony.
- No synthetic substances or chemicals, hormones, GM crops are permitted.
- Only natural inputs, bio-fertilizers, botanicals, bio-agents are permitted



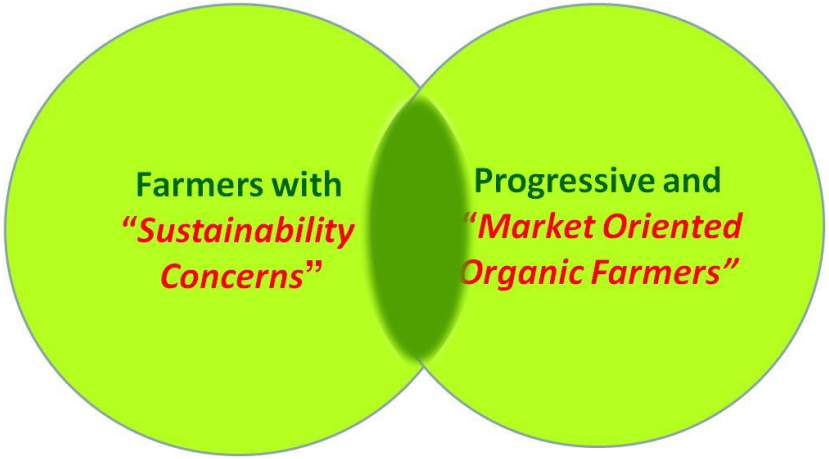
Why organic?

Conventional production

Livelihood security crisis: High cost of inputs, negative returns and emergence of input related new problems.

Water crisis: Water crisis in both urban and rural areas calls for water prudent agriculture

Health crisis: Input related health hazards to farmers and consumers.



Organic production

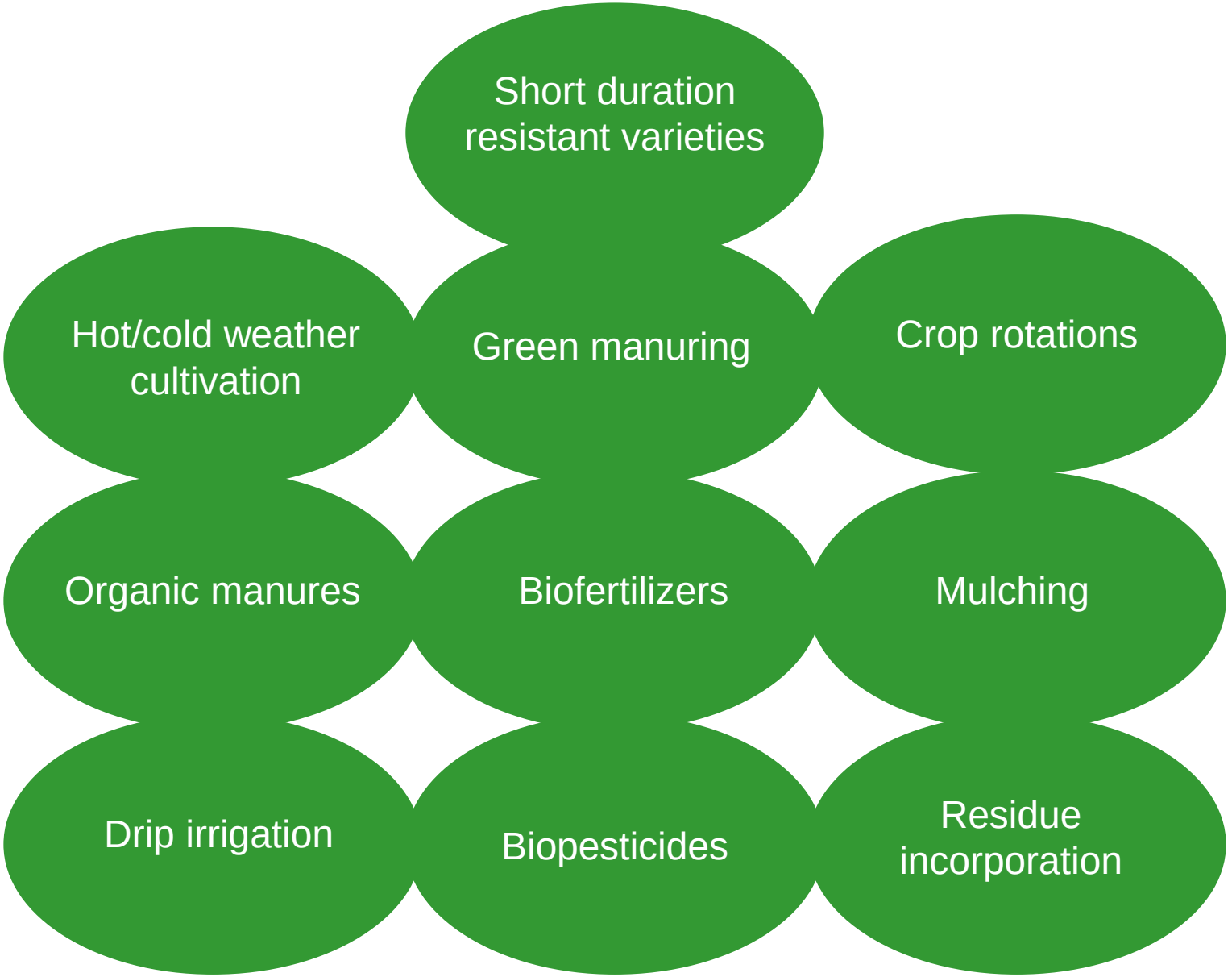
Reduced inputs & higher income: Converting to organic for input cost reduction and better income, makes sense

Drought management: Organic farming helps manage drought conditions better to grow crops

Agri-business opportunities: Organic agribusiness is bringing more profit

Reduced health hazards: Helping reduce health risks of farmers and consumers.

Integral components of organic farming



GRAFTING OF VEGETABLE SEEDLINGS

Tomato on Brinjal root stock

Watermelon on *C.maxima* root stock

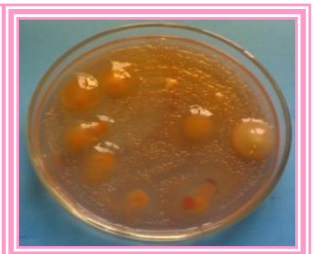
Flooding tolerance in grafted tomato

Providing ground cover, reducing tillage and residue incorporation

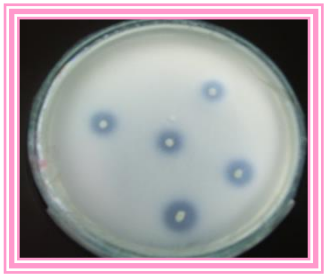
Biofertilizers


Azotobacter

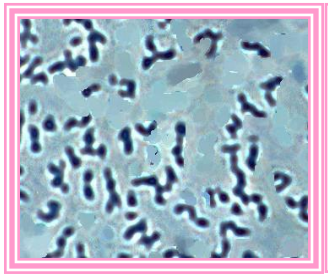
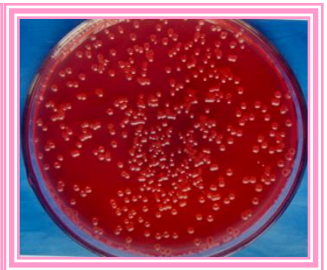

Blue green algae

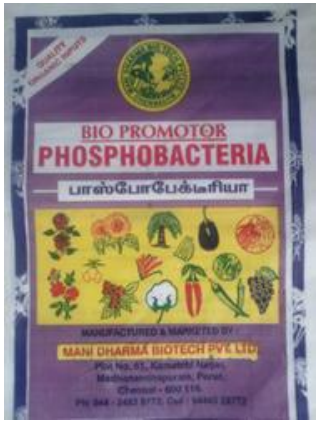
Rhizobium




Phosphate solubilizing bacteria

Azospirillum



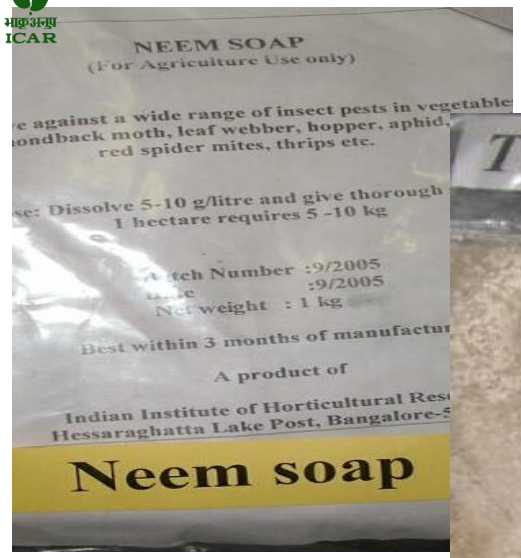
Integrated nutrient management in organic cultivation

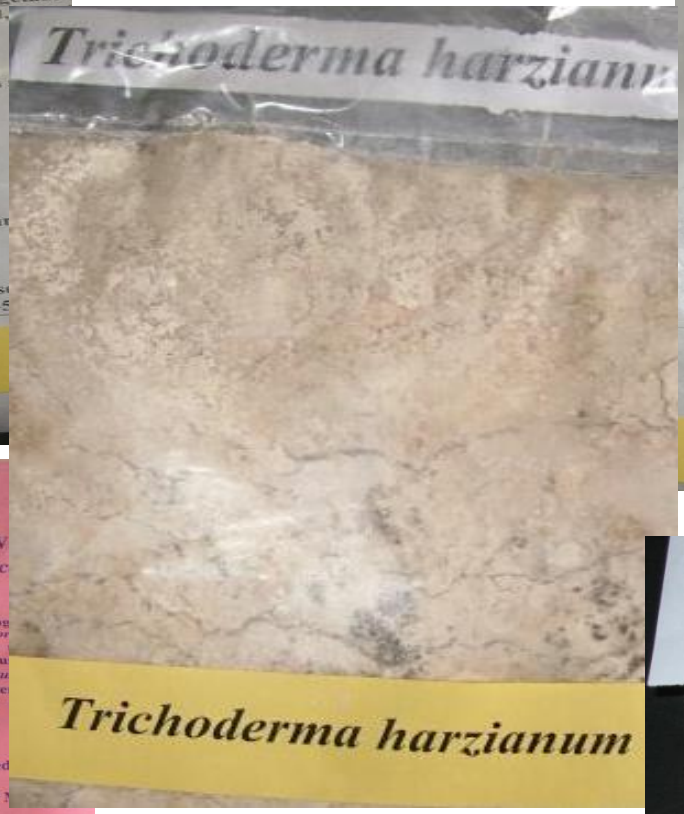
- Crop rotations with legumes
- Green manuring
- Residue incorporation
- Application of organic manures
- Application of enriched organic manures

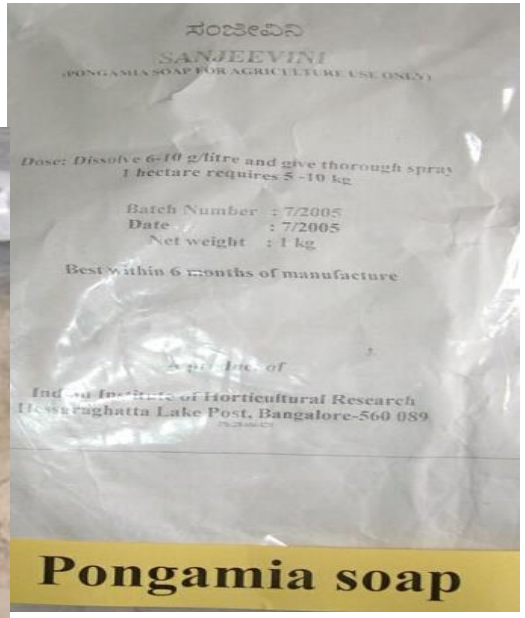
***Enrichment of FYM with Trichoderma and Bio-fertilizers*:**

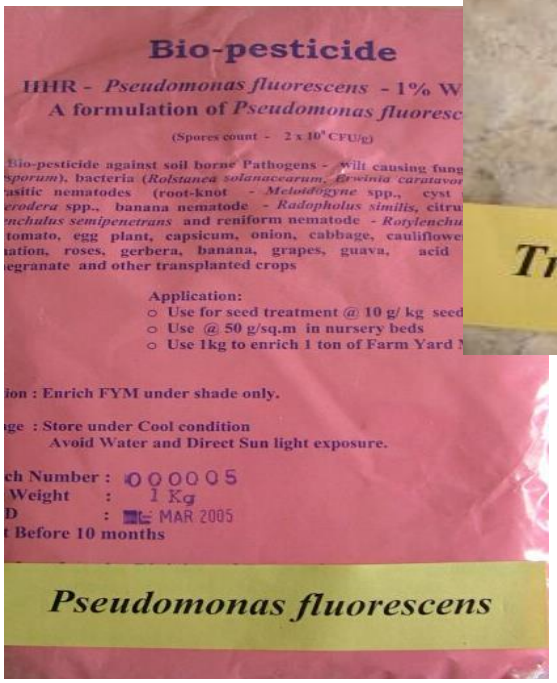
Well decomposed FYM is thoroughly mixed with *Trichoderma harzianum* , *Azatobacter* or *Azospirillum* and Phosphate Solubilizing bacteria (PSB) , *Pseudomonas, Paecilomyces* - all (@ 1 kg/tonne of FYM), moistened with sprinkling water and covered with plastic sheet or dried coconut fraunds and kept to incubate for 15 to 20days. This enriched FYM should be mixed with 10 t of FYM before applying to the field.

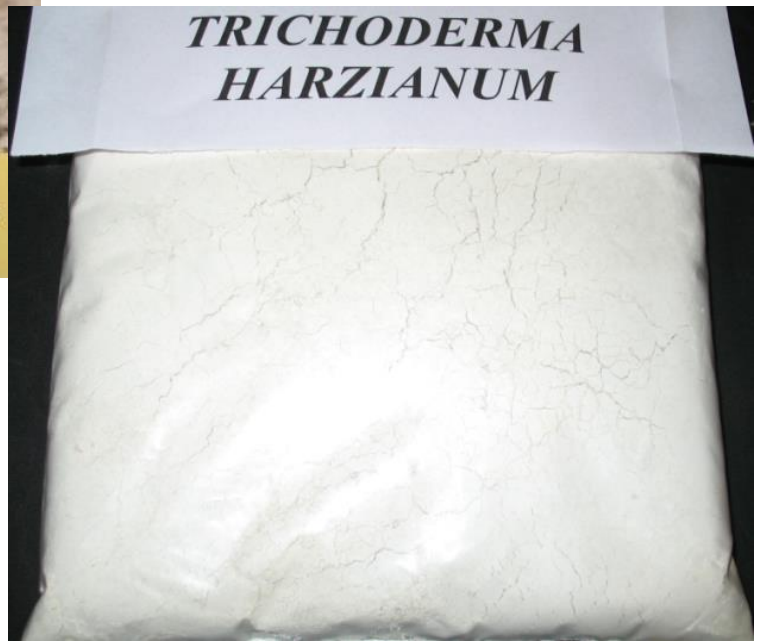
Botanicals and bio-pesticides for IPM











Barrier cropping

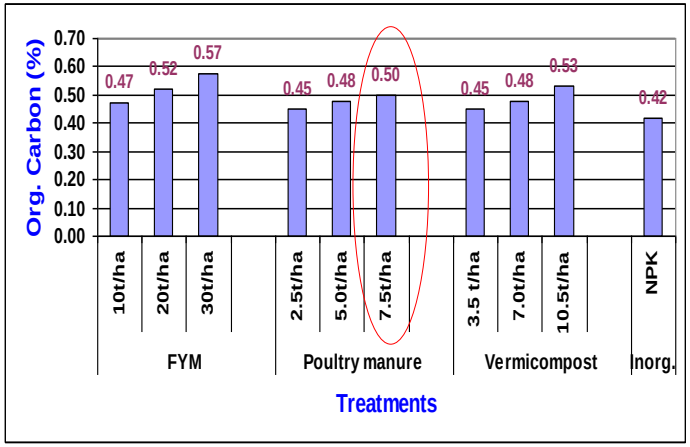
IPM using merry gold as trap crop

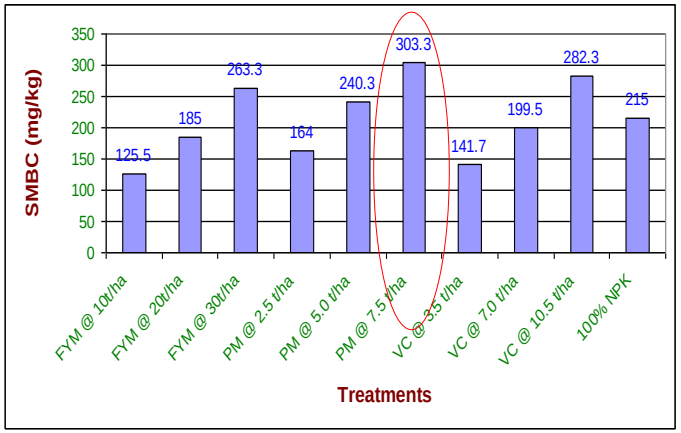
Organic production of vegetables

Organic tomato (50-60 t/ha)

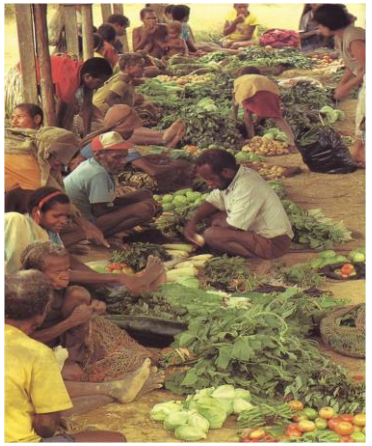
Organic cabbage (50-55 t/ha)

The soil health in terms of organic carbon, bulk density, water-holding capacity, microbial biomass carbon and dehydrogenase activity is improved under organic system as compared to inorganic system.





Organic products



Thank You