FOOD FOR ALL
Alternatives to Organic Agriculture

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Human civilization is founded on agriculture, which remains as important today as 10,000 years ago when it was born.

Agriculture provided a more dependable source of food, causing populations to increase; eventually excess population migrated to new lands.

First form of agriculture, a type of "Do-nothing Farming" or "Natural Farming"

The dawn of agriculture was at the expense of natural forests

In course of time
Natural Farming paved way for other systems of farming

Shifting cultivation

Land intensification stages evolved over time

Forest fallow (20-25years between crops)

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Bush fallow (6-10years)

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Short fallow (1-2 years)

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Annual cropping

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Multiple cropping

Boserup (1965)

Changes in farming styles continued

- Traditional Organic farming
- Modern farming
- Green revolution style agriculture
- Alternate agriculture ?
- Sustainable agriculture ?

The population debate

Technological changes could mitigate the effect of population growth on food supply by facilitating increase in food production.

World population was just 5 million 10000 years ago

1804: 1 billion
1927: 2 billion (123 years)
1960: 3 billion (33 years)
1974: 4 billion (13 years)
1987: 5 billion (12 years)
1999: 6 billion (12 years)
2011: 7 billion (12 years)
2050: 9.3 billion ?

India

1901: 23.8 crores

1961: 43.9 crores (2 times)

2001: 102.7 crores (2 ½ times)

2011: 121.0 crores

2050: 170.0 cores (projected)

Kerala

1901: 0.64 crores

2001: 3.18 crores

2011: 3.34 crores

2050: 3.70 crores (projected)

Important technologies that have contributed to past increases in yield

1. Improved cultivars, high yielding, responding to fertilizers without lodging
2. Application of fertilizers especially affordable nitrogen fertilizer
3. Development of chemicals to control weeds, pests, and diseases; and
4. Improved irrigation systems

Future agriculture must meet three challenges

- The immediate problem of feeding the present population
- Feeding a growing population, with rising demand for high-calorie diet inclusive of meat products
- Preventing the deterioration of the natural resources that agriculture depends on while simultaneously minimizing its global environmental impacts

Carrying capacity

- Carrying capacity refers to the number of individuals that can be supported without degrading the natural, cultural, and social environment

- Modern farming artificially boosted the 'carrying capacity (K)' of earth through unsustainable agricultural practices, which provided short-term relief.

- Most organisms can do little to change the carrying capacity of their environments, but humans can!

Can organic farming alone bridge the gap?

Widespread notions on organic farming

1. Organic farming can ensure food security by sustaining higher yields
2. Organic food tastes better and is of superior quality
3. Organic food is healthier because it does not contain synthetic pesticide traces
4. Organic farming is environmentally better than the other forms, and is free from chemicals
5. Organic farming improves soil fertility and chemical fertilizers deteriorate it
6. Enough organics are available to replace chemical fertilizers

Food security and organic agriculture

- A recent study published in *Nature* concludes that crop yields from organic farming are generally 34 percent lower than conventional agriculture (Seufert *et al.*, 2012).

- When the best management practices are used for organic crops, overall yields are just 13 per cent lower than conventional levels.

- The carrying capacity of organic agriculture is estimated at 3-4 billion, well below the present world population of 7 billion and more than 9.3 billion projected for 2050

(Buringh and van Heemst, 1979; Smil, 2001).

Factors responsible for lower yields in organic systems than in conventional

1. Low nutrient input
2. low nutrient use efficiency
3. high weed abundance
4. limited possibilities to improve low native soil fertility in resource-poor areas; and
5. Poor control of pests and diseases.

(Kirchmann *et al*., 2008)

Food for all: The challenges ahead

Total land area on earth - 13 billion ha.

- Forests - 32%
- Grasslands - 27%
- Urban settlements - 9%
- Deserts, snow lands, and wetlands - 21%
- Arable lands - 11%

(1.43 billion ha)

- Each individual requires 0.5 ha land for the food he/she requires, if traditional farming is followed (Pimental and Pimental, 2008).

- Considering the constraints on land, de Vries (2001) concluded that a person requires 0.05 to 0.5 ha land depending upon the intensity of farming.

- The per capita availability of agricultural land decreased from 0.5 ha in 1960 to 0.21 ha in 2011.

- Each person requires land for housing, transpiration, industry, commerce, leisure, education and religious needs. It is estimated that the per capita requirement of land for this needs is 0.025ha (Young, 1998).

- A global average of 0.5 % loss of agricultural land per year is estimated.

Future increases in yield

- Globally, only a small proportion of future increases in crop production will come from the cultivation of new land (about 20%)
- The majority should come from intensification through increased yield (67%), and
- Through higher cropping intensity (12%)

(Gregory *et al.*, 2002; Bruinsma, 2003).

Feeding more people would be easier, if all the food we grew went into human hands

- Human consumption - 60%
- Animal feed - 35%
- Biofuels -5%

Changes in food habits

- For producing one kilogram of lean meat, about 25-50 kg of grains is required (Nature, 2004).

Climate change

- Global warming and consequent changes in climate may decrease the total agricultural production by 16% globally by 2020.

Slow down in crop productivity and the causes

- Slow down in the productivity growth of major cereals, wheat and rice, especially in the intensively cultivated lowlands is apparent not only in India but throughout Asia (Pingali and Rosegrant, 2006).

The slow down in rice and wheat productivity growth in Asia since the 1980's has been caused by two major factors:

1. world cereal price-induced factors, and
2. Intensification induced factors.

The most common intensification induced environmental consequences are:

1. The buildup of salinity and water logging
2. The depletion or pollution of ground water resources
3. Formation of a hard pan due to subsoil compaction
4. Changes in soil nutrient status, nutrient deficiencies, and increased incidence of soil toxicities; and
5. Increased pest related yield losses and associated ecological consequences of increased and injudicious use of pesticides.

Severe environmental degradation in intensified agriculture occurs mainly when:

- incentives are incorrect
- due to bad policy, or
- due to lack of knowledge of the underlying processes of degradation

(Pingali and Rosegrant, 2006).

Other issues

- Intensification of farming in the wheat belt of India is showing signs of fatigue because of wheat-rice rotation instead of the original wheat-pulses/oilseeds.

Hunger and poverty

- Currently, about 1.4 billion people live below the international poverty line, earning less than US $1.25 per day.

- According to FAO estimates, in the world, 1.02 billion people suffer from chronic poverty.

Food wastage

- Huge food wastage and excessive consumption in the developed countries
- About 30–40 percent of all food at every step of the food cycle is wasted (Giovannucci *et.al*., 2012).
- This is a political problem, and one that is very unlikely to be solved in the near future.

Access to food

Along with production, we should also focus on two vital areas, more access to food and more nutrition or healthy food.

- Food must be not only available but also that people can afford to buy it.
- Enhancing the productivity of smallholder agriculture must be an important step to eradicate hunger in the years ahead.

The possible options

1. Stop expanding agriculture's footprint
2. Close the world's yield gaps
3. Shift diets away from meat
4. Use resources much more efficiently
5. Reduce food waste.

(Foley *et al.*, 2011).

Crop yields can be categorized into five

- the farm yields
- the practical farm yields
- the experimental station yields
- the record yields
- the theoretical yields

(Plucknett, 1993)

Sustainable agriculture as a modern alternative

- For a farm to be sustainable, it must produce adequate amounts of high-quality food, protect its resources, and be both environmentally safe and profitable (Reganold *et al.,* 1990)

- Sustainable practices are based on an understanding of ecological principles

- Integration is the key in sustainable agriculture.

Sustainable development contains two key concepts

- The concept of "**needs**", in particular the essential needs of the world's poor

- and "**limitations**" imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

Some sustainability issues Kerala encounter

- Threat to food security
- Food imports
- Changes in food habits
- Shortage of water
- Conversion of paddy fields
- Sand mining
- Levelling of hills
- Clay mining from paddy fields
- Increased use of fossil fuels
- Urbanisation

Concept Themes of Sustainable agriculture

- The whole concept of sustainable agriculture is based on the integration of three main goals:
  - **environmental health**
  - **economic profitability**
  - **social and economic equity**

Sustainable agriculture

- **Sustainable agriculture** is one that produces abundant food without depleting the earth's resources or polluting its environment.

- We use **Good Agricultural Practices (GAP)** for achieving sustainability

Major approaches to sustainable farming

1. Maximum biodiversity on the farm
2. Conservation of soil and water
3. Keep the soil covered
4. Minimum tillage
5. Build soil quality and productivity
6. Integrated Nutrient Management
7. Integrated pest Management

8. Integrated Weed Management
9. Diversification of enterprises
10. Protect forest and wildlife
11. Value addition for protecting profits
12. Conserve energy
13. Sustainable animal production practices
14. Economic and social considerations

Conclusion

Progresses in food production could be made by closing yield gaps on underperforming lands, increasing cropping efficiency, changing food habits, and reducing waste

These strategies, if implemented based on sustainable principles, could double food production while greatly reducing the environmental impacts of agriculture.

Thank You