IIT KHARAGPUR

NPTEL ONLINE CERTIFICATION COURSES

Organic Farming for Sustainable Agricultural Production

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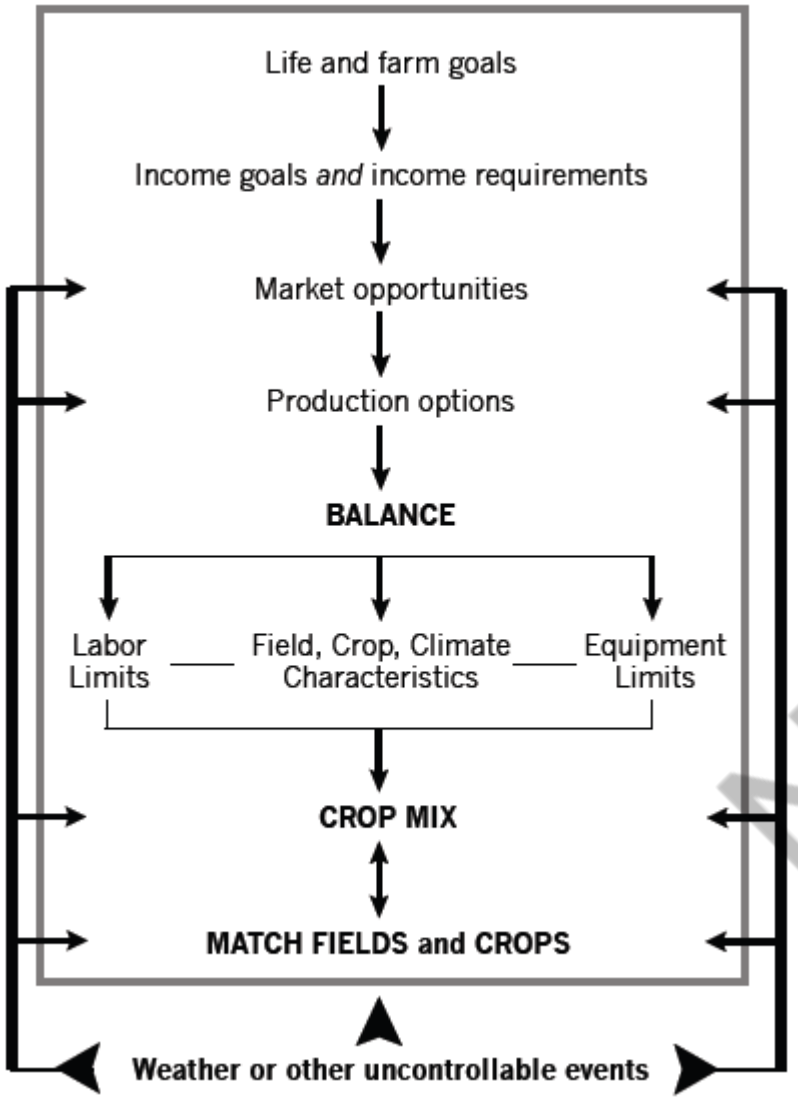
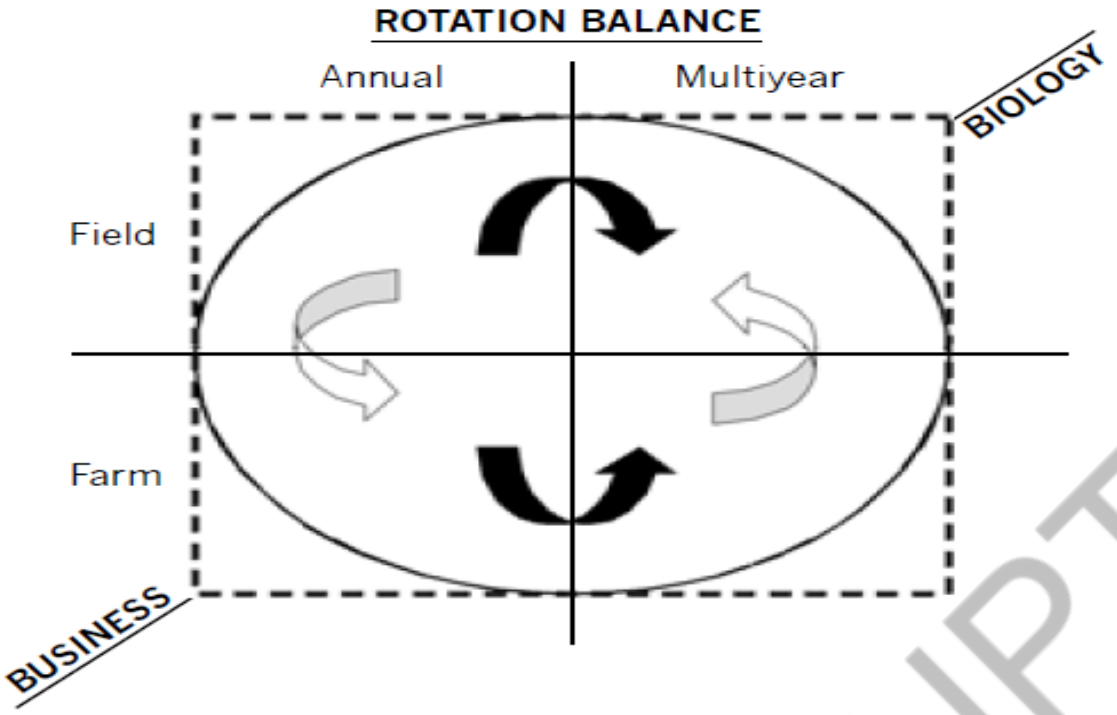
Lecture 31: Crop planning and rotation design in organic system (Contd.)

Schematic Summary of Crop rotation Planning



- Many expert farmers do extensive planning and record keeping on paper. Most have some form of field maps. Some use computers. A few keep all details in their heads. Most of the panel farmers agreed that farmers should write down their field records and plans.
- Many of the key responsibilities and tasks require reflection and observation as well as information.
- The chart illustrates the central role of rotation in the overall farming operation. The chart does not cover all aspects of farm management—only those that the farmers thought were most important in determining the rotation and that are linked to rotation management.


ROTATION BALANCE
Annual
Multiyear
BIOLOGY
Field
Farm
BUSINESS

Key responsibilities and tasks involved in “managing a crop rotation system”

Ten Most Important Tasks

1. Maintain crops.
2. Implement production plan.
3. Prepare soils as soon as weather permits.
4. Plant crops timely
5. Walk fields regularly to observe crops and fields.
6. Review overall farm operation.
7. Draft annual [rotation] plans.
8. Monitor soil and crop conditions.
9. Adjust actions according to field and crop conditions.
10. Identify problems that can be addressed through rotation.

Ten Most Difficult Tasks

1. Assess profitability on a whole-farm and crop-by-crop basis.
2. Maintain crops.
3. Assess pest, disease, and weed pressures.
4. Investigate new market opportunities.
5. Review overall farm operation.
6. Review regulations.
7. Analyze weather probabilities.
8. Determine if successes or failures were due to on-farm or regional factors.
9. Develop collaborations to verify successes and solve problems.
10. Tweak the crop mix.

Effects of Rotation Crops

Studies have shown that organic matter losses from intensively tilled row crops can be regained when the field is rotated into a perennial sod crop.

Two processes :

First, the rapid rate of organic matter decomposition from tillage is stopped under the sod crop. This benefit, of course, is also gained when a no-tillage cropping system is employed.

Second, grass and legume sods develop extensive root systems that continually grow and die off. The dead roots supply a source of fresh, active organic matter to the soil, which feeds soil organisms that are involved in building soil aggregation.

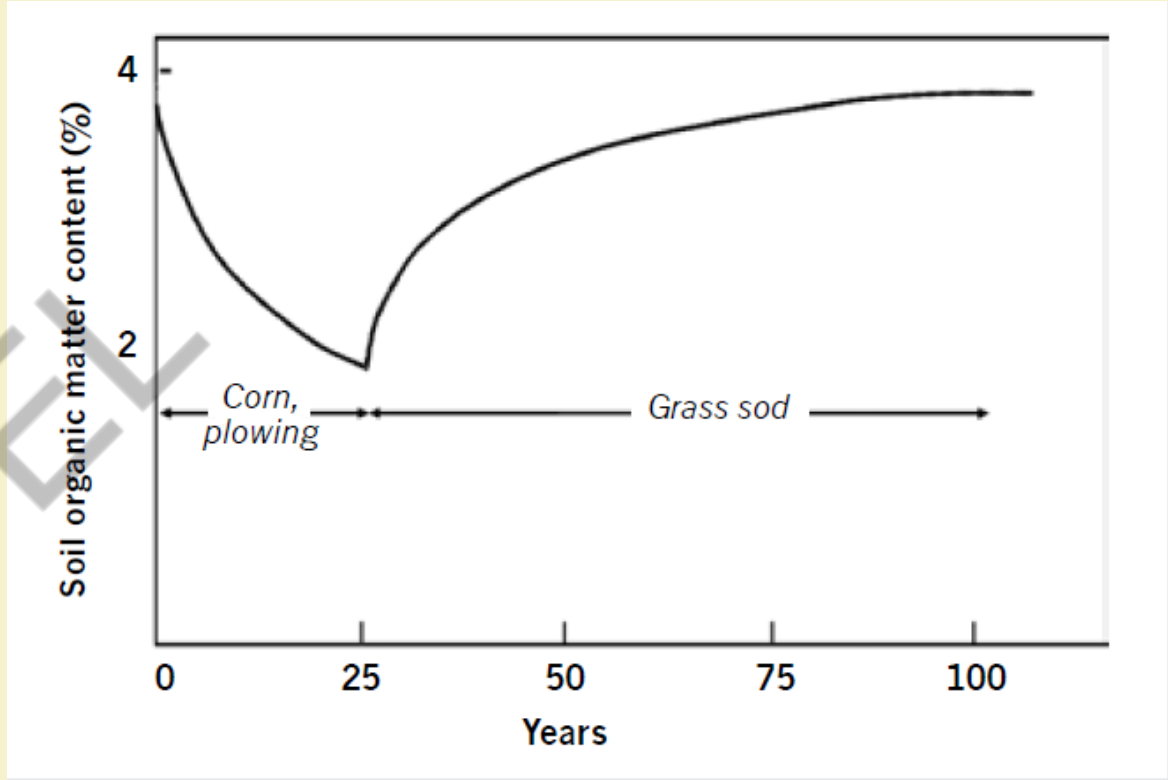


FIGURE 3.6 Loss and gain of soil organic matter under tilled corn followed by grass sod. *Source*: From reference 68. Used with permission.

Designing crop rotation experiments

The design of crop rotation experiments depends strongly on the **specific objectives** of these experiments.

- **Flexibility**: There is often a need to change management and include new aspects or investigations over the course of the experiment. Changes should be kept at an absolute minimum within a rotation course, and only introduced for each new course of the rotation.

- **Reference:** A static part (treatment) as a reference is desirable for documentation. However, even the static part should be changed/adjusted when it gets too academic.

- **Scale:** Plots/fields should be as large as possible.

- **Time:** Often long time periods from time of conversion are required for interpretation even in low budget years.

Designing crop rotation experiments

- **Design:** A factorial design should be used, but kept simple (from the beginning, at least). An example of the effect of such a factorial design on statistical tests is given by Olesen et al. (1999).

- **Management:** Detailed guidelines on the practical management of the crops and plots should be formulated in order to minimise effects of change in management over time. Management staff often a needs to learn the functions of the rotation, before proper experimentation can start.

- **Minimum dataset:** A protocol for a minimum dataset should be set up based on existing standards. This has to be absolutely minimal in order to achieve funding

Differences in Crop Nutrient Uptake

Crop nutrient uptake varies due to many factors,

- including rooting depth and breadth;
- variety;
- and environmental factors,
- including soil tilth.

Generally, crops may be characterized as having **low, medium, or high nutrient** demands based on their nutrient uptake efficiency

Different varieties within any crop may be more or less efficient at taking up nutrients. Those crops with a high nutrient demand (predominately N) require higher levels of those nutrients to be present in the soil solution.

contd

Organic Transition Economics

- **Step 1: develop a transition production plan…**

Example – You inherited a 240-acre farm. It is currently in a corn-soybean rotation. You want to transition into organics.

You decide to transition field-by-field.

For simplicity,

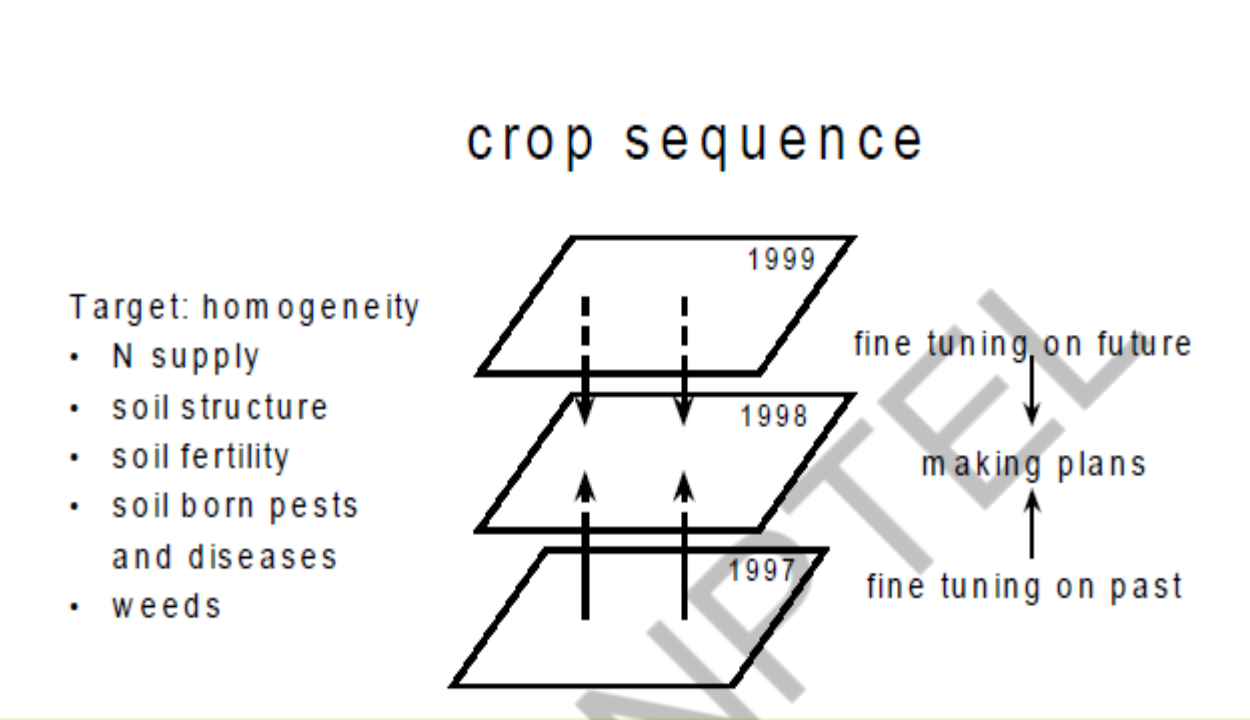
Assume you can divide the 240 acres into 4, 60-acre fields. And you will be producing conventional and transitioning crops on the same farm.

Step 2: To determine profitability, let's shift to a budget-driven decision tool… (keep in mind this is a test model…)

Step 3: Evaluate - Is it profitable to transition to organics from conventional agriculture?

Field Plan

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr6
Field 1	Conv Corn	Conv Sb	Conv Corn	Legume	Trans Alfalfa	
Field 2	Conv Sb	Conv Corn	Trans Oats	Legume	Organic Corn	
Field 3	Conv Corn	Trans Oats	Legume	Organic Corn	Organic Sb	
Field 4	Trans Oats	Legume	Organic Corn	Organic Sb	Organic Oats	



Planning of the crop rotation includes looking backwards and forwards in time