Crop rotation

Crop rotation was already mentioned in the Roman literature, and referred to by great civilizations in Africa and Asia. From the end of the Middle ages until the 20th centuary, the three-year rotation was practised by farmers. In the Green revolution, the practice of crop rotation was given away in several parts of the world by the practice of simply adding the necessary chemical inputs to the depleted soil, e.g., replacing organic nitrogen with ammonium nitrate or urea and restoring soil pH with lime. However, disadvantages of monoculture from the standpoint of sustainable agriculture have since become apparent.

Crop rotation is the practice of growing a series of dissimilar type of crops in the same space in sequential seasons. The choice and sequence of rotation crops is depends on the nature of the soil, the climate, and rainfall, which together determine the type of plants that may be cultivated. A traditional component of crop rotation is the replenishment of nitrogen through the use of legumes in sequence with cereals and other crops.

The aim of rotation is threefold: to balance nutrient demands, to control insect and disease attacks, and to deter weeds. The crop rotation can be practised by selecting the crops based on the following basic principles:

- Based on nutrient requirements (nutrient rotation)
- Based on nutrient depleting crops and nutrient supplying crops (legume rotation)
- Based on root growth (nutrient management),

Nutrient Rotation

The challenge here is trying to balance the nutrient demands each crop makes on the soil. Divide your crops into the following four types, for four different seasonal rotations:

Jaison J. Jerome MSc Agri, Chidamparapuram, Suchindrum P.O, Kanya Kumari District, Tamil Nadu – 629704.
Phone - 04652 258380. Cell phone – 094433 58380. Email – jaisonjerome@rediffmail.com

- **Leaves**: ***Thrive on nitrogen***; examples include lettuce, spinach, broccoli, Brussels sprouts, salad greens, cabbage, cauliflower, knol kohl, etc.
- **Fruits**: ***Need phosphorus***; examples include squashes, cucumbers, melons, pumpkins, tomatoes, chilies, eggplants, etc.
- **Roots:** ***Love potassium***; examples include onions, garlic, leeks, carrots, beets, turnips, radishes, etc.
- **Soil builders and cleaners**: Legumes are excellent for the soil because they store nitrogen from the air and release it into the soil;
  Examples of cleaners include corn and potatoes,
  Examples of builders include beans and peas.

The first season of planting could be devoted to leafy plants, the next season to fruits, followed by the root plants and then legumes. Requirement for Nitrogen along with agricultural lime increases when farmers go to corn after corn, said Lloyd Murdock, UK soils specialist. Extra nitrogen, from 20 to 25 pounds, is needed in corn after corn and nitrogen costs are soaring. Extra agricultural lime also is needed when farmers chose to grow continuous corn. The fact that suitable rotations made it possible to restore or to maintain a productive.

Legume rotation

Alternate legumes with cereals and other plants that require nitrates. Legumes fix nitrogen in the soil, providing for subsequent non-legumes in the rotation. Legumes, plants of the family Fabaceae, for instance, have nodules on their roots, which contain nitrogen-fixing bacteria called rhizobium. A common modern crop rotation is alternating soyabeans and maize (corn).

Nutrient management

Alternate shallow-rooted plants like cabbages or lettuce with deep-rooted plants like tomatoes or squash. The nutrients from the manures that are applied to the shallow rooted crops will be leached and will be taken to the sub-soil level. Hence if we select a deep rooted crop for the next season the leached nutrients that are in the sub-soil level will be properly utilised. Moreover by this

Jaison J. Jerome MSc Agri, Chidamparapuram, Suchindrum P.O, Kanya Kumari District, Tamil Nadu – 629704.
Phone - 04652 258380. Cell phone – 094433 58380. Email – jaisonjerome@rediffmail.com

we allow the plants roots to do much of the soil loosening that would otherwise have to be done by hand.

Advantages of crop rotation

Increase in the yield

One immediate economic benefit of crop rotations is improved yields. For example, sunflower yields over eight years at Crookston, Minnesota, USA were often significantly greater in rotation with other crops than when continuous sunflower was grown (Table 1). Similarly Wheat yields were also greater with rotation than continuous wheat in an eight-year study conducted with different crops at Fargo (Table 2).

Table 1. Yields of sunflower following sunflower and in rotation with other crops at Crookston, MN.

	Sunflower yield, lb/A				
Previous Crop	**1973**	**1975**	**1977**	**1978**	**4 yr Avg**
Sunflower	852	1338	1852	1781	1456
Potato	908	1279	2348	1605	1535
Sugarbeet	770	1683	2358	2168	1745
Pinto Bean	946	1410	2282	1674	1578
Wheat	1284	1549	2339	1655	1707

Table 2. Effect of previous crop on wheat yields, Fargo, ND .

	Wheat yield, bu/A-Conventional tillage								
Previous Crop	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**8 yr. Avg.**
Wheat	22	26	35	37	34	39	43	16	31
Barley	27	25	35	37	42	46	48	18	35
Flax	31	37	36	35	37	47	43	37	38
Corn	31	32	43	37	45	53	39	38	38
Soybean	42	43	42	42	46	49	54	45	45
Sunflower	29	33	44	41	45	39	43	44	40
Sugarbeet	34	34	41	38	44	43	52	47	42
Average	31	33	39	38	42	44	46	35	

Source: Miscellaneous Report 166 - 1979, AES, University of Minnesota.

Pest and disease control

Jaison J. Jerome MSc Agri, Chidamparapuram, Suchindrum P.O, Kanya Kumari District, Tamil Nadu – 629704.
Phone - 04652 258380. Cell phone – 094433 58380. Email – jaisonjerome@rediffmail.com

Crop rotation can also break the cycles of pest and disease problems that build up in soils planted repeatedly to the same crop. The idea is to plan your rotation so that no two crops subject to similar diseases follow one another within the disease's incubation period. The same principle holds for insect pests: crop rotation makes it harder for emerging insects to find their preferred food. Plant rotation by family is good for this purpose.

Family	**Common names**
Allium	Chive, garlic, leek, onion, etc
Cucurbit (Gourd family)	Bitter gourd, bottle gourd, cucumber, ribbed gourd, melons pumpkins, snake gourd, squash, etc
Crucifer (Brassica)	Bok choy (petchay), broccoli, Brussels sprouts, cabbage, Chinese cabbage, cauliflower, knoll kohl, mustard, radish, turnip, etc
Legume	Common beans, black bean, broad bean, clover, cowpea, garbanzo, kidney bean, lintel, mungbean, peanut, pigeon pea, pea, soybean, string bean, white bean, etc
Aster	Lettuce, artichoke, etc
Solanaceous	Potato, tomato, pepper, eggplant, etc
Grains and cereals	Corn, rice, sorghum, wheat, oat, barley, millet, etc
Carrot family	Carrot, celery, dill, parsley, etc
Root crops	Cassava, sweet potato, yam, etc

Plants within the same taxonomic family tend to have similar pests and pathogens. The crop rotation will help to avoid the buildup of pathogens and pests that often occurs when one species is continuously cropped. For instance if annual vegetable crops are grown in the same place year after year, there is a risk that soil borne pests and diseases will become a problem.

Crop rotation is also used to control pests and diseases that can become established in the soil over time. By regularly changing the planting location, the pest cycles can be broken or limited. Several insect pest cycles are interrupted, especially those of the northern and western rootworm species, which can be devastating to corn. Several plant diseases are suppressed, including soybean cyst nematode.

Jaison J. Jerome MSc Agri, Chidamparapuram, Suchindrum P.O, Kanya Kumari District, Tamil Nadu – 629704.
Phone - 04652 258380. Cell phone – 094433 58380. Email – jaisonjerome@rediffmail.com

Weed control

Weed control is enhanced as perennial weeds are destroyed through cultivation of annual grains; most annual weeds are smothered or eliminated by mowing when legumes like alfalfa, sun hemp are in production.

Soil fertility maintainance

Crop rotation can also improve soil fertility by alternating deep-rooted and shallow-rooted plants. Crop rotation also seeks to balance the fertility demands of various crops to avoid excessive depletion of soil nutrients. By crop rotation farmers can keep their fields under continuous production, without the need to let them lie fallow, and the need for artificial fertilisers, both of which can be expensive.

References :-

a. Crop rotation - Retrieved from "http://en.wikipedia.org/wiki/Crop_rotation"
b. Crop rotation - Adapted from *Straight-Ahead Organic,* by Shepherd Ogden
c. Crop rotation - PAN Germany, OISAT; Email oisat@pan-germany.org
d. Teetes, G.; Pendleton, B. (1999): *Insect pests of sorghum.* Department of Entomology. Texas A&M University.
e. Brooklyn Botanic Garden. (1999): *Natural insect control: The ecological gardener's guide to foiling pests.* Handbook # 139. Brooklyn Botanic Garden, Inc. Washington Avenue, Brooklyn, NY
f. Daxl, R.; von Kayserlingk, N.; Klien-Koch, C.; Link, R.; Waibel, H. (1994): *Integrated pest management: Guidelines.* Deutsche Gesellschaft fur Technische Zusammenarbeit. Eschborn,
g. Crop Rotations for Increased Productivity, EB-48 (Revised), January 1998, Dr. Michael D. Peel, NDSU Small Grains Extension Agronomist