Basic terms

SUSTAINABLE AGRICULTURE
AND
FARMING SYSTEM

SS RANA
SR SCIENTIST

Agro-ecology

- Agro-ecology is a scientific discipline/sub-discipline of Agronomy that uses ecological theory to study, design, manage and evaluate agricultural systems that are productive and resource conserving.

Alternative Farming/Alternative Agriculture

Environmentally-friendly practices and enterprises, different from prevailing or conventional agricultural activities. "They include:

- nontraditional crops, livestock, and other farm products;
- service, recreation, tourism, food processing, forest/woodlot, and other enterprises based on farm and natural resources (ancillary enterprises);
- unconventional production systems such as organic farming or aquaculture; or
- direct marketing and other entrepreneurial marketing strategies

Best Management Practices (BMPs)

- BMPs are established practices that also provide quality benefits. They include such practices as cover crops, green manure crops, and strip cropping to control erosion; and soil testing and targeting and timing of chemical applications (similar to IPM) to prevent the loss of nutrients and pesticides.

Biodiversity:

- “biodiversity is the sum total of all the plants, animals, fungi and microorganisms in the world, or in a particular area; all of their individual variation; and all the interactions between them."

Agrobiodiversity

- "Agrobiodiversity includes not only a wide variety of species, but also the many ways in which farmers can exploit biological diversity to produce and manage crops, land, water, insects, and biota."

Biodynamic Agriculture/Biodynamic Farming

- Method of farming that aims to treat the farm as a living system which interacts the environment, to build healthy, living soil and to produce food that nourishes and vitalizes and helps to develop man kind. The methods are derived from the teachings of Rudolf Stainer and subsequent practitioners. The underlying principle of biodynamics is making life-giving compost out of dead material.Use of preparations is a common feature of biodynamic agriculture. So far 9 biodynamic preparations have been developed, named as formulation 500 to 508. Out of these, formulation-500 (cow horn compost) and formulation501 (horn-silica) are popular Formulations-502 to 507 are compost enrichers and promoters, while formulation 508 is of prophylactic and control fungal diseases.

Biointensive Gardening/Mini-farming

- John Jeavons and Ecology Action have refined a production system that makes it possible for one person to **grow all of** his or her **family's food** using truly sustainable methods that maintain the fertility of the soil without relying on nonrenewable resources like petrochemicals or imported organic matter. The concepts and practices of biointensive gardening were synthesized and introduced to the U.S. by the English master horticulturalist, Alan Chadwick. Important components include double-dug, raised beds; intensive planting; composting; companion planting; and whole system synergy.

Biological Farming/Ecological Farming

- Biological and Ecological Farming are terms commonly used in Europe and developing countries. Although sometimes strictly defined, e.g., "Biological farming is a system of crop production in which the producer tries to minimize the use of 'chemicals' for control of crop pests,". Both biological farming and ecological farming are terms used in the broader sense, encompassing various and more specific practices and techniques of farming sustainability, e.g., organic, biodynamic, holistic, natural.
- Norman et al. point to some differentiation between the two terms: "In Europe (e.g., the Netherlands), the term biological often refers to organic farming, whereas the term ecological refers to organic plus environmental considerations such as on-farm wildlife management (i.e., the relationships between parts of the agroecosystem."

Biotechnology

- Although farmers have been practicing biotechnology in the broadest sense (i.e. plant and animal breeding to achieve certain traits) for thousands of years, it is the recent breaking of the genetic code that has pushed this science into a new era altogether. **Genetic engineering** differs significantly from traditional biotechnological techniques in that DNA from different species can be combined to create completely new organisms (Genetically Modified Organisms - GMOs). Whether this technology is compatible with sustainable agriculture, and if so, in what ways, provokes much controversy among sustainable agriculture advocates. Products such as plants engineered for herbicide tolerance or insect resistance, and bacteria engineered to produce drugs for livestock may point to reduced chemical use and other sustainable applications. But what are the risks?
- The Union of Concerned Scientists' list of potential risks related to GMOs include those to human health--new allergens in the food supply, antibiotic resistance, production of new toxins, concentration of toxic metals, enhancement of the environment for toxic fungi; and those to the environment--gene transfer to wild or weedy relatives and increased weediness, change in herbicide use patterns, squandering of valuable pest susceptibility genes, poisoned wildlife, creation of new or worse viruses, and other, so far, unknown harms.
- In addition, "The issue of who will be served by this technology and who will set the research agenda of the experts becomes intensely important when so few people control the tools and language of the trade."

Carrying Capacity

- Carrying capacity is the theoretical equilibrium population size at which a particular population in a particular environment will stabilize when its supply of resources remains constant. It can also be considered to be the maximum sustainable population size; the maximum size that can be supported indefinitely into the future without degrading the environment for future generations.

Conservation Buffer Strips:

- Conservation Buffer Strips are areas or strips of land maintained in permanent vegetation, designed to intercept pollutants and erosion. Placed around fields, they can enhance wildlife habitat, improve water quality, and enrich aesthetics on farmlands. Various types of buffers include **Contour Buffer Strips**, **Filter Strips**, **Riparian Forest Buffers**, **Field Borders**, **Windbreaks/Shelterbelts**, **Hedgerows**, **Grassed Waterways**, and **Alley Cropping**.

Conservation Tillage:

- Conservation Tillage is a term that covers a broad range of soil tillage systems that leave residue cover on the soil surface, substantially reducing the effects of soil erosion from wind and water.
- Some specific types of conservation tillage are **Minimum Tillage**, **Zone Tillage**, **No-till**, **Ridge-till**, **Mulch-till**, **Reduced-till**, **Strip-till**, **Rotational Tillage** and **Crop Residue Management**.

Ecosystem

- Any collection of organisms that interact or have the potential to interact along with the physical environment in which they live, form an ecological system or ecosystem.
- Ecosystems are composed of elements and processes. (These are usually referred to as ecosystem structures and functions or the patterns and processes of an ecosystem). As an example, the elements of a forest ecosystem might include trees, shrubs, herbs, birds, and insects, while the processes might include growth, mortality, decomposition, and disturbances.

Environmental Indicators

- There are diverse interpretations as to what constitute environmental indicators and how they should be used. In any system, however, the "goal of environmental indicators is to communicate information about the environment--and about human activities that affect it--in ways that highlight emerging problems and draw attention to the effectiveness of current policies... an indicator must reflect changes over a period of time keyed to the problem, it must be reliable and reproducible, and, whenever possible, it should be calibrated to the same terms as the policy goals or targets linked to it."
- An **agri-environmental indicator** measures change either in the state of environmental resources used or affected by agriculture, or in farming activities that affect the state of these resources. Examples of sustainable agriculture processes monitored by such indicators are soil quality, water quality, agroecosystem biodiversity, climatic change, farm resource management, and production efficiency.

Farmland Preservation/Protection

- "The irreplaceable land that produces our food and provides us with scenic open space, wildlife habitat and clean water is increasingly at risk from urban sprawl and rural subdivisions... According to a 1997 American Farmland Trust study, every state in the nation is sacrificing irreplaceable agricultural resources to urban sprawl. We are converting a total of 1 million acres a year, and while the quantity of top-quality agricultural land being lost varies from state to state, the process of conversion increases the pressures on agriculture even beyond the acres that are actually taken out of production."
- Actions to reverse this trend are being taken on many levels. Tactics include focusing on policies related to property tax relief and protection from nuisance lawsuits for farmers, purchase of agricultural conservation easement (PACE) programs, special agricultural districts where commercial agriculture is encouraged and protected, comprehensive land use planning, and farm-friendly zoning ordinances.

Holistic Management (HM):

- "Holistic Management is a decision-making process that enables people to make decisions that satisfy immediate needs without jeopardizing their future well-being, or the well-being of future generations. This decision-making process helps people identify their most deeply held values which helps to create clarity in vision and commitment in action. Using that vision to help them create a long-term picture toward which they will progress, people can then use a simple testing process to ensure that the decisions they make will be economically, environmentally, and socially sustainable."
- Holistic Management originated in a personal quest by Zimbabwean biologist Allan Savory to solve the riddle of desertification. The decision-making process that is now at the heart of Holistic Management (originally called **Holistic Resource Management - HRM**) arose from discoveries made earlier by Savory and others on the relationships between land, animals, and humans.

Integrated Pest Management (IPM)

- IPM is an ecologically based approach to pest (animal and weed) control that utilizes a multi-disciplinary knowledge of crop/pest relationships, establishment of acceptable economic thresholds for pest populations and constant field monitoring for potential problems. Management may include such practices as "the use of resistant varieties; crop rotation; cultural practices; optimal use of biological control organisms; certified seed; protective seed treatments; disease-free transplants or rootstock; timeliness of crop cultivation; improved timing of pesticide applications; and removal or 'plow down' of infested plant material."

- The term **Biointensive IPM** emphasizes a "range of preventive tactics and biological controls to keep pest population within acceptable limits. Reduced risk pesticides are used if other tactics have not been adequately effective, as a last resort and with care to minimalize risks."

- **Biological Control/Bio-control**: "Biological control is, generally, man's use of a specially chosen living organism to control a particular pest. This chosen organism might be a predator, parasite, or disease which will attack the harmful insect. It is a form of manipulating nature to increase a desired effect. A complete Biological Control program may range from choosing a pesticide which will be least harmful to beneficial insects, to raising and releasing one insect to have it attack another, almost like a 'living insecticide.'"

Intensive/Controlled Grazing Systems

- "The term 'intensive grazing' is meant to describe livestock and grass management practices that focus on increased levels of manager's involvement, leading to increased productivity and the sustainability of the land. Managers practicing intensive grazing closely follow the interactions between plant, animal, soil and water. They determine where, when and what livestock graze and control animal distribution and movement."
- "Controlled grazing is a flexible management method that balances plant and animal requirements. Controlled grazing relies on management, not technology. It uses variable rest periods, short graze periods, high stock densities, and a minimal number of relatively large herds. It requires changing the stocking rate to match annual and seasonal changes in carrying capacity."
- Other terms, related to both dairy and meat production, that fall under the category of Intensive/Controlled Grazing are: **Rotational Grazing**, **Management Intensive Grazing (MIG)**, **High-Intensity Low-Frequency Grazing (HILF)**, **Time-Controlled Grazing (TCG)**, **Holistic Range Management**, **Grassfarming**, **Pasture-Based Farming**, and **Voisin Management Grazing**.

Local/Community Food System

- A community food system, also known as a local food system, "is a collaborative effort to integrate agricultural production with food distribution to enhance the economic, environmental, and social well-being of a particular place (i.e. a neighborhood, city, county or region)."
- "One of the primary assumptions underlying the sustainable diet concept is that foods are produced, processed, and distributed as locally as possible. This approach supports a food system that preserves local farmland and fosters community economic viability, requires less energy for transportation, and offers consumers the freshest foods."

Low Input Agriculture

- Low input farming systems "seek to optimize the management and use of internal production inputs (i.e. on-farm resources)... and to minimize the use of production inputs (i.e. off-farm resources), such as purchased fertilizers and pesticides, wherever and whenever feasible and practicable, to lower production costs, to avoid pollution of surface and groundwater, to reduce pesticide residues in food, to reduce a farmer's overall risk, and to increase both short- and long-term farm profitability."
- The term is "somewhat misleading and indeed unfortunate. For some it implied that farmers should starve their crops, let the weeds choke them out, and let insects clean up what was left. In fact, the term low-input referred to purchasing few off-farm inputs (usually fertilizers and pesticides), while increasing on-farm inputs (i.e. manures, cover crops, and especially management). Thus, a more accurate term would be different input or low external input rather than low-input."

Natural Farming

- Natural Farming reflects the experiences and philosophy of Japanese farmer Masanobu Fukuoka. His books *The One-Straw Revolution: An Introduction to Natural Farming* describe what he calls "do-nothing farming" and a lifetime of nature study. "His farming method involves no tillage, no fertilizer, no pesticides, no weeding, no pruning, and remarkably little labour! He accomplishes all this (and high yields) by careful timing of his seeding and careful combinations of plants (polyculture). In short, he has brought the practical art of working with nature to a high level of refinement."

Nature Farming

- Nature farming grew out of the philosophy and methodology of Japanese philosophist, Mokicho Okada in the mid-1940s. "The theory of Nature Farming, as Okada expounded it, rests on a belief in the universal life-giving powers that the elements of fire, water, and earth confer on the soil. The planet's soil, created over a span of eons, has acquired life-sustaining properties, in accordance with the principle of the indivisibility of the spiritual and the physical realms, which in turn provide the life-force that enables plants to grow. To utilize the inherent power of the soil is the underlying principle of Nature Farming." Practices focus on analyzing and building soil through composting, green manuring, mulch, and various other soil management techniques. Similar in many ways to organic farming, nature farming is most commonly practiced in the Pacific Rim countries of Asia and North America.

Nutrient Management

- Nutrient management is "managing the amount, source, placement, form, and timing of the application of nutrients and soil amendments to ensure adequate soil fertility for plant production and to minimize the potential for environmental degradation, particularly water quality impairment."

Organic Farming

- a system of farm design and management to create an eco system, which can achieve sustainable productivity without the use of artificial external inputs such as chemical fertilizers and pesticides

Permaculture

- A contraction of "permanent agriculture," the word "permaculture" was coined by Australian Bill Mollison in the late 1970s. One of the many alternative agriculture systems described as sustainable, permaculture is "unique in its emphasis on design; that is, the location of each element in a landscape, and the evolution of landscape over time. The goal of permaculture is to produce an efficient, low-maintenance integration of plants, animals, people and structure... applied at the scale of a home garden, all the way through to a large farm."

Precision Farming/Agriculture

- Precision agriculture is a "management strategy that employs detailed, site-specific information to precisely manage production inputs. This concept is sometimes called **Precision Agriculture**, **Prescription Farming**, **Site-specific Management**. The idea is to know the soil and crop characteristics unique to each part of the field, and to optimize the production inputs within small portions of the field. The philosophy behind precision agriculture is that production inputs (seed, fertilizer, chemicals, etc.) should be applied only as needed and where needed for the most economic production." This system requires the utilization of sophisticated technology including personal computers, telecommunications, global positioning systems (GPS), geographic information systems (GIS), variable rate controllers, and infield and remote sensing. Chemical inputs are reduced in precision agriculture, but several factors make it controversial in the sustainable agriculture community, including the requirements of large capital outlay and advanced technical expertise.

Regenerative Agriculture

- Robert Rodale coined this term, and it subsequently was expanded to "regenerative/sustainable agriculture" by the Rodale Institute and Rodale Research Center. Two reasons given for the emphasis on "regenerative" are (1) "enhanced regeneration of renewable resources is essential to the achievement of a sustainable form of agriculture," and (2) "the concept of regeneration would be relevant to many economic sectors and social concerns."

Sustainable Development

- During the past 20 years, considerable interest in sustainability as applied to all areas of human activity has emerged worldwide. Sustainable development must ... "meet the needs of the present without compromising the ability of future generations to meet their own needs."
- "The vision is of a life-sustaining Earth. We are committed to the achievement of a dignified, peaceful and equitable existence. A sustainable Nation will have a growing economy that provides equitable opportunities for satisfying livelihoods and safe, healthy, high quality of life for current and future generations. Our nation will protect its environment, its natural resource base, and the functions and viability of natural systems on which all life depends."

Whole Farm Planning:

- Whole farm planning strategies share a conservation, family-oriented approach to farm management, although specific components may vary from farm to farm, and from community to community. "Whole farm planning provides farmers with the management tools they need to manage biologically complex farming systems in a profitable manner. As a management system, it draws on cutting-edge management theory used by other businesses, industries and even cities. It encourages farmers to set explicit goals for their operation; carefully examine and assess all the resources -- cultural, financial, and natural -- available for meeting their goals; develop short- and long-term plans to meet their goals; make decisions on a daily basis that support their goals; and monitor their progress toward meeting goals."

Cropping System:

- Cropping system is an important component of farming system: It represents cropping pattern used on a form and their interaction with resources, other farm enterprises and available technology, which determine their makeup.

Cropping Pattern:

- Cropping pattern means the proportion of area under various at a point of time in a unit area. Or it indicates the yearly sequences and spatial arrangement of crops and fallow in an area.

Crop Rotation:

- Crop sequence and crop rotation are generally used synonymously.
- Crop rotation refers to recurrent succession of crops are so chosen that soil health is not impaired.

Cropping Scheme:

- Cropping scheme is the plan according to which crops are grown on individual plots of a farm with an object of getting maximum return from each crop without impairing the fertility of soil is known as cropping scheme.

Shifting Cultivation

- It refers to farming system in north-eastern areas in which land under natural vegetation (usually forests) is cleared by slash and burn method, cropped with common arable crops for a few years, and then left unattended when natural vegetation regenerates. Traditionally the fallow period is 10-20 years but in recent times it is reduced to 2-5 years in many areas. Due to the increasing population pressure, the fallow period is drastically reduced and system has degenerated causing serious soil erosion depleting soil fertility resulting to low productivity. In north-eastern India many annual and perennial crops with diverse growth habits are being grown.

Taungya Cultivation:

- The *Taungya* system is like an organized and scientifically managed shifting cultivation. The word is reported to have originated in Myanmar (Burma) and tauang means hill, *ya* means cultivation i.e. hill cultivation. It involves cultivation of crops in forests or forest trees in crop-fields and was introduced to Chittagong and Bengal areas in colonial India in
- 1890. Later it had spread throughout Asia, Africa and Latin America. Essentially, the system consists of growing annual arable crops along with the forestry species during early years of establishment of the forest plantation. The land belongs to forest department or their large scale leases, who allow the subsistence farmers to raise their crops and in turn protect tree saplings. It is not merely temporary use of a piece of land and a poverty level wage, but is a chance to participate equitably in a diversified and sustainable agroforestry economy.

Zabo Cultivation

- Zabo is an indigenous farming system practiced in north eastern hill regions particularly in Nagaland. This system refers to combination of forest, agriculture, livestock and fisheries with well-founded soil and water conservation base. The rain water is collected from the catchment of protected hill tops of above 100% slopes in a pond with seepage control. Silt retention tanks are constructed at several points before the runoff water enters in the pond. The cultivation fully depends on the amount of water stored in the pond. The land is primarily utilized for rice. This system is generally practiced in high altitude hill areas, where it is not possible to construct terraces and or irrigation channels across the slope. This is a unique farming system for food production to make livelihood. Zabo means impounding of water. The place of origin of zabofarming system is thought to be the Kikruma village in Phek district of Nagaland.

Thanks