

Class 02: Classification of Agricultural Practices: Conventional, Integrated/Reasoned, Organic

Introduction: In the field of agro ecology, there are several agricultural production systems distinguished by their objectives, practices, and environmental impacts. This assignment aims to compare three major crop management systems: conventional agriculture, integrated (or reasoned) agriculture, and organic agriculture.

1. Conventional Agriculture

Definition and Objectives: Conventional agriculture (also called intensive, modern, or productivity agriculture) is the dominant production system since the post–World War II period. Its main objective is to optimize productivity and yields to meet food demand. Conventional agriculture is characterized by intensive use of chemical inputs (synthetic fertilizers for fertilization, plant-protection products such as pesticides and herbicides) and heavy mechanization (intensive plowing, large machinery). This model has benefited greatly from the availability of inexpensive fossil energy (enabling the manufacture of nitrogen fertilizers and powering machinery), the development of refrigerated transport, and high-yielding varieties.

Typical Practices and Inputs Used

Common practices in conventional agriculture include:

- Intensive monocultures over large areas, often with limited crop rotation.
- Frequent deep tillage and soil work.
- Heavy mineral fertilization using synthetic chemical fertilizers (e.g., manufactured nitrogen fertilizers).
- Crop protection with synthetic pesticides (insecticides, fungicides, herbicides) applied preventively or curatively depending on phytosanitary risks.
- Use of high-yield varieties (hybrids, and potentially GMOs in some countries) and possible use of growth regulators and additives to increase productivity.
- Intensive irrigation in arid regions or for high-value crops to remove water limitations on production.

External inputs (fertilizers, pesticides, energy) are therefore used in large quantities, resulting in very high yields per unit area.

Environmental Impacts and Sustainability

While conventional agriculture delivers high yields, it entails notable environmental risks. Intensive use of fertilizers and chemical pesticides often causes soil and water pollution (leached nitrates, eutrophication of waterways, pesticide residues) as well as erosion of local biodiversity. Monoculture and phytosanitary treatments negatively affect insects, birds, and soil life, contributing to the observed decline in agricultural biodiversity. For example, the removal of hedgerows or fallows in intensive landscapes deprives wildlife of refuges, and insecticides eliminate not only target pests but also their natural enemies.

Moreover, heavy mechanization and the manufacture of synthetic inputs involve substantial energy consumption and greenhouse-gas emissions (CO₂ from farm fuel, N₂O emitted by over-fertilized soils, etc.). Intensive agriculture can also lead to long-term soil degradation (loss of organic matter, compaction, and erosion). Altogether, these effects raise questions about the long-term sustainability of the conventional model. Efforts are nevertheless underway (better-input management, precision agriculture, etc.) to mitigate its impacts.

2. Integrated or Reasoned Agriculture

Definition and Objectives: Integrated/reasoned agriculture is defined as an intermediate path between intensive conventional and organic systems. In France, the notion of “reasoned agriculture” emerged in the early 2000s and aims for a balance between agricultural production and environmental protection. The central idea is to maintain satisfactory productivity and farm profitability while reducing negative environmental impacts.

Practically, farmers engaged in this approach adapt practices to the specifics of their local agro-ecosystem (soil, climate, biodiversity) and put environmental stewardship and animal welfare at the core of their priorities. The goal is to optimize inputs rather than maximize them: every intervention (fertilization, pesticide treatment, etc.) must be reasoned that is, justified by a proven plant need and applied at the optimal dose.

Typical Practices and Inputs Used

Integrated/reasoned agriculture relies on preventive agronomic techniques and precise input management. Examples include:

- **Integrated pest management (IPM):** Bio-aggressors (insects, diseases, weeds) are actively monitored, and chemical intervention occurs only when a proven threat exceeds a tolerance threshold. Upstream biocontrol methods are favored: using beneficials (natural enemies of pests), installing nest boxes or hedgerows favorable to predators, using natural repellents, etc. The aim is to protect crops while avoiding systematic chemical control. For instance, farmers choose disease-resistant varieties, practice long rotations to break pest cycles, and perform mechanical weeding instead of applying herbicides when possible. As a last resort, synthetic pesticides may be used, but only if necessary and by selecting the most targeted, least persistent products (reduced doses, localized application).
- **Reasoned fertilization:** Nutrient inputs are calculated as closely as possible to crop needs, accounting for soil supply (soil tests, residual nitrogen) and available organic inputs. Organic fertilizers (manure, compost) are often combined with mineral fertilizers to balance nutrition without excess. The principle is to avoid both under-fertilization (which would penalize yield) and over-fertilization (economic waste and pollution).
- **Water-efficient management:** Where practiced, irrigation is optimized (soil moisture monitoring, drip systems, choosing less water-demanding species) to preserve water resources.
- **Soil and biodiversity conservation:** Practices such as cover cropping (green manures, winter covers) are encouraged to prevent erosion and improve soil structure, along with maintaining landscape elements (grassed strips, hedges, groves) on the farm to provide refuges for wildlife and beneficial insects.

Environmental Impacts and Sustainability

Thanks to reduced chemical inputs, integrated/reasoned agriculture has lower environmental impacts than conventional systems. By limiting excess fertilizers, it reduces the risk of water pollution (fewer nitrates leached). Reasoned pesticide use and alternative methods (biocontrol, prophylaxis) help preserve functional biodiversity (pollinators, earthworms, soil microorganisms, beneficial birds, etc.), even if biodiversity levels generally remain lower than in organic systems. Overall, the ecological footprint of reasoned agriculture improves: fewer GHG emissions from inputs, better long-term soil health, and partial preservation of local ecosystems. In terms of sustainability, it is often considered part of sustainable agriculture,

seeking a lasting balance among economic viability, environmental respect, and social acceptance.

Economically, integrated agriculture aims to maintain yields close to conventional, simply minimizing superfluous inputs. When well-managed, it can achieve nearly the same production levels as classical management while reducing costs tied to inputs (savings on fertilizers and pesticides). Yields thus remain high with a better cost/benefit balance for the farmer in many cases, and growing appeal for environmentally conscious consumers.

3. Organic Agriculture

Definition and Objectives: Organic agriculture (OA) is a sustainable agricultural production system distinguished by rejecting synthetic inputs and respecting natural balances. Defined by early pioneers in the 1920s and formalized globally in 1972 with the creation of IFOAM, OA aims to respect ecosystem cycles, maintain soil fertility, plant and animal health, and preserve biodiversity.

The core principles of organic agriculture include no use of synthetic chemicals (mineral fertilizers, pesticides, artificial regulators, etc.), a ban on GMOs, and farming practices that respect animal welfare and the environment.

The objectives of organic agriculture are multiple: produce food of high nutritional and sanitary quality (free from synthetic pesticide residues), protect the environment (water, soil, air, biodiversity) on and around the farm, and ensure livestock welfare. More broadly, OA fits within a vision of rural development (local job creation, maintaining small farms) and the agro ecological transition of agriculture.

Typical Practices and Inputs Used

- **Organic fertilization:** Soluble mineral fertilizers (e.g., urea, nitrates) are prohibited the fertility is maintained with inputs of natural origin. These include compost and manure from livestock, green manures (intermediate crops incorporated to enrich soil with humus and nitrogen), recycled organic waste, etc. Inputs are calculated to avoid both deficiencies and excesses. Certain natural amendments are allowed (rock phosphate, natural potash, etc., in limited quantities) to supplement when needed.

- **Crop rotation and intercropping:** Rotation is mandatory in organic systems. Different plant families including nitrogen-fixing legumes are alternated on a plot to break disease/pest cycles and improve soil structure.
- **Plant protection without synthetic products:** Prevention comes first (varieties adapted to local conditions, sowing dates that avoid pest peaks, insect-proof nets, etc.). In case of attack, biological control methods are used: for example, mating disruption against certain insect pests, natural preparations (plant teas such as nettle, neem extracts, and *Bacillus thuringiensis* against caterpillars...), and classical biological control (releasing ladybirds against aphids, etc.).
- **Organic livestock (where present):** Animals must be fed organic feed, have access to the outdoors or pasture, and stocking densities are limited for welfare. Preventive chemical veterinary treatments (e.g., antibiotics in the absence of disease, growth hormones) are prohibited; phytotherapy or homeopathy may be used preventively, and conventional allopathic medicines are used sparingly with extended withdrawal periods before products are sold. The goal is animal production that respects both the animal and the consumer.