

Organic Livestock Farming and Breeding Towards Food Security of Smallholder Farmers in the Tropics

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Lecture Outline

I. Introduction

- A. Origins of organic farming and definition of terms
- B. Principles and standards of organic livestock production
- C. Global and local statistics on organic agriculture/livestock production

II. Regulations and standards for organic livestock farming

- A. Design and management of free-range/outdoor systems
- B. Source/origin of adapted breeds and breeding methods
- C. Feeds and feeding strategies
- D. Animal health and welfare concerns
- E. Organic certification issues

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III. Organic livestock breeding strategies for smallholder farms

- A. Animal genetic resources in organic farming
- B. Conservation of adapted local breeds in organic livestock farming
- C. Genetic improvement programs in organic livestock farming

IV. Organic livestock farming contributing to food security of smallholder farmers

- A. Consumer demand for organic livestock and poultry products
- B. Prospects of organic livestock farming for smallholder farmers
- C. Impacts of organic livestock farming on food security of smallholder farmers
- D. Constraints faced by smallholder organic livestock producers
- E. Recommendations

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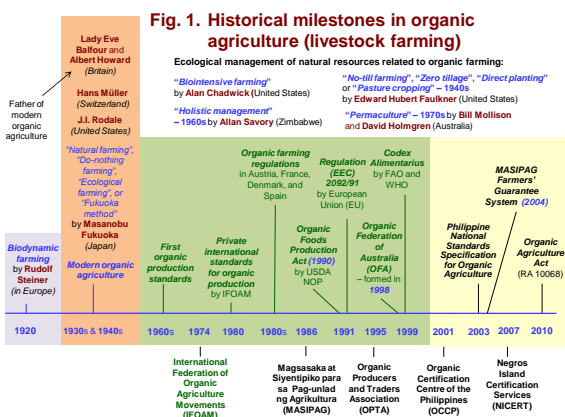
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According to the *IFOAM (2001)*,

"**Organic agriculture**" is a production system that sustains the health of soils, ecosystems and people.

- Relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects.
- Combines **tradition**, **innovation** and **science** to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

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According to *IFOAM (2001)*, *FAO/WHO Codex Alimentarius Commission*, and *USDA National Organic Program*

- "**Organic agriculture**" implies application of agronomic, biological and mechanical methods of production in place of the use of synthetic chemical inputs.
- Most definitions also incorporate **use of several techniques not exclusive to organic agriculture**, as they may be applied in conventional and low-input production systems as well.

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Integration of animals in organic farming

As opposed to crops, **animals** are not just integrated parts of the whole system but they are also **sentient** (i.e. **conscious, living, responsive**) creatures.

- This aspect of dealing with sentient beings gives animals a special status on the farm, i.e. **animals deserve special moral consideration**.
- They are individuals that **need to be protected and provided to cover their (basic) needs**.

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- They **can suffer and can interact** with each other and with the humans around them.
- Animals **demand greater and more constant care and attention** than crops.

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"Organic farming" vs. "traditional farming" vs. "intensive or conventional farming"

(Source: Giovannucci, 2005)

Organic Farming is an internationally certifiable farm management system (with controls and traceability).

Traditional Farming is often subsistence oriented using few or no purchased inputs.

Intensive or Conventional Farming utilizes "Green revolution" methods designed to maximize profit often by extracting maximum output using external purchased inputs.

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Intensive/conventional livestock production

- Designed to **increase farm profit**, by increasing capital, land or labor efficiency.
- The aims are to reduce labor per animal, increase number of animals per land unit, and maximize output per food unit.
- It implies **no direct valuation of the quality of life of the animals** but seek to maintain health and well-being only in so far as it is directly related to performance.

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Problems in intensive or conventional livestock production

- **Productive lifetime** as well as fitness and adaptation in high yielding breeds **are reduced**.
- Housing, feeding and breeding methods lead to system specific **health and fertility problems** such as detrimental effects of chronic concentrate overfeeding in dairy cows and fattening beef animal (i.e. fatty liver syndrome, liver damage, rumen acidosis, foot diseases, etc.).

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- Resulting disease problems are either tolerated or resolved through the routine use of chemical drugs, resulting in **problems of residues and resistance**.
- The detachment of livestock production from the soil also creates **pollution problems** due to the open nutrient cycling as well as off-site degradation on regions where feed and fodder are produced.
- **High reliance on feedstuffs from elsewhere** and problems of **disposing livestock wastes** in environmentally harmful quantities and concentrations creates imbalances on energy and nutrient level.

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Livestock production systems in the tropics

- Classified according to agro-ecological zones.
 - **Smallholder farmers*** dominate the rural sector of agriculture in developing countries found in the tropics.
- * Also referred to as “**small-scale**”, “**subsistence**”, “**marginalized**”, “**resource-poor**” farmers with low income, low external input, low-technology.

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Characteristics of smallholder farmers

(Source: FAO, 2009b)

- Have relatively **low-levels of formal education and training**.
- Tend **not to purchase production inputs**.
- Have **limited access to input and output markets, and to services and credit**.

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Table 1. Regionalization of livestock production according to **agro-ecological zones** (Modified from Uhlig, 1965 and Andreea, 1972)

Humid months	Precipitation (mm/year)	Vegetation belt	Livestock Keeping		
			Species	Production system	Products
12	>1500	Tropical rainforest (always humid and periwinkle)	Buffalo, cattle, goat, sheep, pig, (elephant), poultry	Mainly mixed smallholder livestock keeping	Meat, work, milk, manure, hide, eggs
11					
10					
9					
8	600-1500	Humid savannah (monsoon forest or high grass savannah with gallery forests)	Buffalo, cattle, goat, pig, poultry	Mixed smallholder livestock keeping	Meat, work, milk, manure, hide, wool, eggs
7					
6					
5	300-600	Dryland savannah (mainly short grass, savannah, rarely dryland forest)	Cattle, sheep	Ranches, partially transhumance	Meat, work, milk, manure, hide, wool
4					
- Agronomical dryland border					
3	100-300	Thornbush savannah (salt savannah shrubs)	Cattle, goat, sheep, camel, donkey, horse	Ranches, nomads	Meat, work, milk, hide, wool, hair, fuel, blood
2					
- Dryland border of livestock keeping					
1	<100	Semi-desert	Cattle, goat, sheep, camel	Nomads, hunters	Meat, work, milk, hide, wool, hair, fuel, blood
0		Desert			
Variously		Tropical highlands (1,000 m.a.s.l. mountain, valley)	Cattle, goat, sheep, camel, pig	Mainly mixed smallholder livestock keeping, partly transhumance	Meat, work, milk, manure, wool, fuel

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Table 2. Regional distribution of land area of **livestock production systems** (Modified from Kruska et al., 2003)

	Livestock only/ Grassland	Mixed rainfed	Mixed irrigated	Others*	Total
World total (1,000 km²)	23,189	19,932	5,124	32,599	80,844
Central and South America (%)	23.60	26.24	7.75	28.33	25.15
East Asia (%)	18.68	12.37	26.66	8.57	13.56
Central Asia (%)	8.85	5.05	8.03	1.76	5.00
South Asia (%)	1.50	8.64	29.69	2.45	5.43
Southeast Asia (%)	0.91	7.09	9.38	8.14	5.89
West Asia and North Africa (%)	7.78	7.83	16.14	24.83	15.20
SubSaharan Africa (%)	38.66	32.78	2.35	25.91	29.77

* Others = Landless production systems, i.e. less than 10% of dry matter fed to animals is farm-produced and in which annual average stocking rates are >10 livestock units (LU) per hectare of agricultural land.

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In the Philippines, the livestock industry is dominated by backyard or smallholder farms especially for ruminants such as **buffaloes** (99.6%), **goats** (98.4%), and **cattle** (93.2%).

Lower and decreasing percentages of smallholder or backyard farms are noted for **pigs (64.9%)**, **chickens (45.4%)** and **ducks (71.6%)**.

Source: Bureau of Agricultural Statistics (2014)

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Four principles of organic farming

(IFOAM, 2005)

1. **Principle of Health** - sustain and improve the ecosystem and organisms, i.e. health of soil, organic matter, air, water, plants, animals, humans and our planet and the balance between them.

2. **Principle of Ecology** - based on living ecological systems and cycles, work with them, emulate them and help sustain a high level of biological diversity, i.e. animal welfare standards are highly respected to meet the animals' species-specific behavioral needs.

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3. **Principle of Fairness** - involves building of relationships that ensure fairness with regard to the common environment and life opportunities.

4. **Principle of Care** - should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

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Organic livestock standards

- Values may differ according to cultural background, so standards are not universally recognized.

National and International Standards:

- **International Federation of Organic Agriculture Movements (IFOAM) Standards**
- **Codex Alimentarius (FAO/ WHO) Standards**
- **European Union Standards** – Regulation EEC
- **USDA National Organic Program Standards (NOP)**
- **Organic Federation of Australia (OFA) Standards**
- **Philippine National Standards** – Bureau of Agriculture and Fisheries Product Standards (BAFPS), DA

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Comparison of national and international standards on organic livestock farming

Commonality:

- Limits on non-organic feed, prohibition of growth promoters, prohibition of drugs in the absence of disease

Areas that need harmonization:

- Housing, grazing areas, withholding periods of drugs, conversion time, age at weaning, nose ringing of piglets, etc.

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Some observations:

- **IFOAM standards** focus more on management, physiological and ethological needs (IFOAM, 2002).
- **EU Regulation** pays more attention to the animal ethological needs as compared to other international standards (Schmid, 2000).
- **EU standards** are more detailed than standards from the USA developed within the **National Organic Program (NOP)** in 2002 or from the **Organic Federation of Australia (OFA)**.

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- **Codex Alimentarius** is more environmentally oriented and gives the animals a role in closing the nutrient cycle, improving soil fertility through their manure, and controlling weeds through grazing (FAO, 2001).

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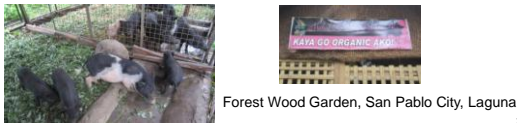
Organic native pig breeding farm
National Swine and Poultry Research Center
BAI-DA, Tiaong, Quezon

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Organic native pig farms – range and complete confinement
Gardenedel Nature's Farm, Candelaria, Quezon



Forest Wood Garden, San Pablo City, Laguna

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Organic pig farm - Schweinezucht breeding farm
Wolpertshausen, Schwäbisch Hall District
Baden Württemberg, Germany

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Free-range crossbred chickens
Animal and Dairy Sciences Cluster
College of Agriculture, U.P. Los Baños

Free-range SASSO chickens
Teresa Farms, Rizal

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Costales Nature Farm, Majayjay, Laguna



Forest Wood Garden, San Pablo City, Laguna

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Organic layer farm
Zeeb's Poultry farm - Frische Alb-Vorland Eier
Reutlingen, Baden Württemberg, Germany

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Bavarian State Institute for Agriculture Teaching,
Research and Technical Center for Poultry
Kitzingen, Germany

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Bioland (Organic) goat farm
Ensmad, Langenenslinge, Germany



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Key indicators of organic agriculture in the Philippines and the world

(Source: Willer and Lernoud, 2014)

	Philippines	World
Organic agricultural land, hectares	80,974	37.5 million
Share of total agricultural land, %	0.70	0.87
Producers	3,008	1.9 million
Organic market size	no data	63.8 bn US\$
Per capita consumption	no data	9.08 US\$

- **Organic livestock and poultry systems** across the world are not nearly so developed compared to the production and trade of **organic cereal, horticultural and even textile products.**

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- **In the Philippines**, organic agriculture is a priority program strategy for addressing rural poverty as an alternative low-input sustainable agricultural strategy **to improve land productivity and to protect our environment** (Giovannucci, 2005).
 - DA has earmarked **PhP636.4 million** for 2015 to R&D programs related to organic farming.
- However, the domestic organic market tends to be small (i.e. US\$6.2 million in 2004, with **US\$2.5 million coming from domestic production** ~ according to DTI estimates).
- **Annual growth rate of organics is approx. 10 to 20%**, most of which is related to herbal and food supplement products.

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- Local organic products are marketed mainly in **weekend organic markets, direct selling**, and to a lesser extent in independent organic stores and mainstream supermarkets.
- Organic products usually carry an average of **20-30% price premium over conventional products.**
- Most important organic product exports include **banana, coconut, mango, muscovado sugar, herbal and food supplements** (Giovannucci, 2005).

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Organic livestock production worldwide

(Source: Willer and Lernoud, 2014)

- Almost 20 percent of the global 37.5 million hectares of certified organic land is dedicated to **arable agriculture.**
- About 2.3 million hectares are used in the **production of green fodder** from arable land.
- **In Australia**, about 97% of the 12 million hectares of organic certified lands are extensive grazing lands.

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- **In Argentina**, 3.3 million hectares of certified organic lands (or 3.6 million ha) are permanent grassland/ grazing areas.
- **In both Australia and Argentina**, the extensive nature of livestock systems is the most suitable management option in dry land conditions and large farms are typical.
- **In contrast to these huge organic animal production properties**, smallholdings characterize organic arable lands (with few exceptions).

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More organic livestock production statistics ...

- Animal products especially **milk and dairy products**, make up a high share of all organic products sold in many countries in Northern Europe. Organic dairy products achieve market shares of about 5% of all dairy products sold and even higher at 10% in Switzerland.
- **Meat and meat products** are very successful, with market shares of around 10% in Belgium, the Netherlands, Finland, and France.
- **Organic eggs** have market shares of up to 20% in Switzerland, and around 10% in most of the countries for which data was available. (Source: Organic Data Network survey)

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- In Europe, out of all organic livestock, **cattle and sheep are the most important species**, with nearly 3% of the total EU livestock population.
- **Organic pigs represented lower proportions**, with less than 1% of the total EU livestock in most of the EU member states (Rohner-Thielen, 2010 as cited by Mayer et al., 2014).

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- **Tropical countries** are now producing and exporting organic agricultural products in ever-increasing quantities, **but represent only a negligible portion of their total livestock production**,

→ due to limited export prospects for organic livestock products because of quality controls (so-called “trade barriers”) and self-sufficiency in importing countries (Harris et al., 2003).

- **In the Philippines**, there is yet no aggregate study on the scope of organic livestock production.

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II. Regulations and standards for organic livestock farming

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The ethological needs of the organically farmed animals should be respected in order to allow the expression of their **natural behavior** (Braghieri and Napolitano, 2009),

i.e. animals must be able to express their natural, species-specific behavior which implies **loose housing systems and going outdoors**, or giving them **access to an outdoor run or pasturing them**.

Extensive rearing system therefore requires: **(1) access to pasture** and **(2) proper housing design**, wherein animals are provided sufficient space.

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Box 1. R&D topics related to **free range/ outdoor systems** in organic livestock farming

1. Provide access to **free range/outdoor areas**.
2. Set desired **stocking rate** to maintain a good vegetation cover, adjusted to the animals' excretion rate (i.e. kg N in manure per ha).
e.g., 100 m² per outdoor pig kept from 20 kg to 100 kg live weight; and 360 m² or 180 m² per sow
3. Reduce **nitrogen (and phosphorus) losses** due to nitrate leaching, ammonium volatilization, and denitrification.
4. Reduce **building costs** using locally available materials.

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Animal sources/origin

- **Organic animals should be born and raised under continuous organic management** from the last third of gestation or at hatching.
- When organic animals are not available in sufficient number, “**non-organic**” animals may be brought onto a holding for breeding purposes.
- **Cloned farm animals** and their descendants as well as use of their products and imports of such animals and products are not allowed **due to the negative effects on animal welfare and ethical concerns**.

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Choice of adapted breeds

- Livestock breeds must be able to **adapt to local natural conditions**, thus ensuring diversity.
- Organic livestock production requires the use of a **number of breeds**.
- Different types of forage-based livestock farms may require **breeds with different characteristics**.
- Some breeds may be developed to be **adapted to a broad range of environments**.



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Breeding (reproduction) methods

- Animals must be able to reproduce independently (*IFOAM website, 2000*), i.e. animals should **reproduce naturally** to express their natural, species-specific behavior.
- Breeding (reproduction) methods to conserve adapted local breeds or their genetic improvement **should not depend on high-end artificial breeding technologies**.
- Reproduction technologies **with the exception of artificial insemination (AI)** are not allowed in the organic system, as they are **detrimental to the welfare and integrity of animals and the naturalness of the biological system**.

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The use of AI in organic farming is allowed indefinitely.

- AI **prevents the spread of transmittable venereal diseases** when exchanging bulls or mating cows with the neighbor's breeding bull (*Den Daas and Van Wagendonk, 1993 as cited by Nauta et al., 2001*).
- Bulls are potentially lethal animals and **keeping them on the farm requires special skills and practical knowledge**.
- Farmers **need not keep as much young stock** in order to have a good choice of animals in on-farm breeding (*Nauta et al., 2001*).

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Box 2. R&D topics related to **adapted breeds and breeding methods** in organic livestock farming

1. Characterize and conserve **local breeds** (indigenous/native genetic resources) suitable for organic production systems.
2. Identify and continuously monitor unique attributes of local breeds (e.g., **genetic disease resistance and heat tolerance; nutritional values of animal food products**) to justify their conservation.
3. Determine if animals which have been bred for conventional production are capable of optimum performance in organic conditions (i.e. **genotype x environment interaction**).

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Box 2. R&D topics related to **adapted breeds and breeding methods** in organic livestock farming

4. Validate the traits selected in conventional breeding to be relevant or comparable to organic farming (i.e. revise **breeding objectives**).
5. Decide to use only one breeding stock (as in conventional farming) or **use certain breeding lines just in organic farming**.

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Minimum requirements for feed and feeding strategies in organic livestock production (Source: Zollitsch et al., 2004)

1. **Pasture-based feeding**, i.e. higher forage-to-concentrate ratio.
2. Use of **organically produced feed ingredients**.
3. **Ban of synthetic amino acids, antibiotics, growth promoters** or any other substances intended to stimulate growth or production as feed additives.
4. Minimize risk of **GMO contamination** of protein sources.

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Box 3. R&D topics related to feed and feeding strategies in organic livestock farming

1. Establish **pasture and forage conservation and demonstration plots** (i.e. grasses, legumes, tree fodder) for organic livestock farming.
2. Determine **nutrient content of organically-grown feed crops**, i.e. conventional feed crops may contain more water, thus causing nutrient dilution.
3. Develop strategies to expand the **scope of home-grown feeds**, produced and handled organically.

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Box 3. R&D topics related to feed and feeding strategies in organic livestock farming

4. Find feed sources with **higher energy to amino acid ratio** needed for animals reared outdoors (for non-ruminants), i.e. energy requirements are higher for animals reared outdoors.
5. Find protein sources that would **compensate synthetic amino acids** that are excluded in organic feed diets.
6. Formulate **high-density diets** in organic livestock production (especially pigs and chickens) to reduce the gap between increased nutrient requirement and limited feed intake capacity for fibrous, bulky feed.

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- The welfare of an animal is usually determined by its capacity to **avoid suffering** and **sustain fitness**, while **animal abuse should not be tolerated**.
- Animals should be given some “freedoms” (*Farm Animal Welfare Council, 2010*), namely
 1. Freedom from **hunger and thirst**
 2. Freedom from **discomfort**
 3. Freedom from **pain, injury or disease**
 4. Freedom from **fear and distress**
- Animal welfare issues are generally related to health problems and their control/treatment involving **veterinary medicine** and even **mutilations**.

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Veterinary medicine

- Major animal health issues pertain to **control or treatment program against parasitic infection** and use of **phytotherapeutic and homeopathic products from medicinal plants**.
- The use of prophylactic antibiotics is prohibited. All **antibiotics are discouraged** except in medical emergencies and may only be used for curative purposes when an animal is so ill that its welfare is at stake.

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Mutilations

- **Animals may not be mutilated** because mutilation compromises animals' welfare and integrity.
- **Horns, tails and beaks should remain intact**, but steps should be taken to prevent animals injuring each other (*Hierden, 1997; Bestman, 2001 as cited by Nauta et al., 2001*).
- Exceptions for mutilations (e.g., **castrations, tail docking, dehorning, and ringing**) should only be given when suffering can be minimized and anesthetics used where appropriate.

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Box 4. R&D topics related to **animal health and welfare** in organic livestock farming

1. Develop **new animal welfare standards** for agricultural practice.
2. Develop **practical and objective measures of animal welfare** in relation to health, productivity, stress physiology, immunology, and normal/abnormal behavior.
3. Discover **biological control of parasites** (i.e. plant-derived anthelmintics).

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Box 4. R&D topics related to **animal health and welfare** in organic livestock farming

4. Due to organic prohibitions on certain veterinary drugs, **new health care protocols** must be developed for each species, including research on alternative and complementary methods of disease prevention, effective non-chemical parasiticides, and preventive health care practices.
5. Develop and evaluate a **Hazard Analysis and Critical Control Points (HACCP) - based management and surveillance system** in organic herds/flocks to prevent diseases and welfare problems by monitoring and controlling the risk factors.

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- Organic certification is an essential element for any country wishing to either **export or develop its internal market**.
- It guarantees not only the **quality of the product** but also the **quality of the production, handling, processing and marketing continuum** under organic management, i.e. production methods are **certified to be safe and sound, as well as environmentally friendly**.

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- The organic label is a **process claim rather than a product claim**.
- It should not be interpreted to mean that the foods produced are healthier, safer or entirely natural.
- It simply means that the **products follow the defined standards of production and handling**.
- The organic standard does not exempt producers and processors from compliance with the general requirements of statutory regulations, such as **food safety regulations, pesticide registration, general food and nutrition labeling rules, etc.**

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Labels or tags associated with OLF:

"additive-free" "antibiotic-free" "bio/ bio-organic",
 "cage-free" "cruelty-free" "chemical-free" "country-fresh"
 "earthy" "ecological" "eco-friendly" "environment-friendly"
 "free-range" "GMO-free" "grass-fed" "green" "healthy"
 "homegrown" "indigenous" "old-fashioned" "native"
 "natural" "naturally pure" "non-synthetic"
 "not artificial or man-made" "pasture-based" "pesticide-free"
 "pollution-free" "probiotic" "produced by nature"
 "rural" "true to nature" "unadulterated"

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Table 3. List of **third party certified organic livestock producers** *Source: Organic Agriculture Production Survey (Philippine Statistics Authority, 2013)*

Region	Province	Municipality	Name of Enterprise	Type of Animal Raised	Name of Certifying Body
Cordillera Autonomous Region (CAR)	Benguet	La Trinidad	Cordillera Organic Research Development Center (COARDC)	Goat, swine	OCCP
Central Luzon	Nueva Ecija	Sta. Rosa	Leone Agricultural Corporation	Baboy damo	OCCP
CALABARZON (Cavite, Laguna, Batangas, Rizal and Quezon provinces)	Batangas	Lipa City	Hacienda San Benito/ Ricky Ocampo	Sheep, horse, spiny, goat, native pigs, free range chickens, ostrich	NICERT
CALABARZON	Rizal	Antipolo	Parusugan Organic Farming	Native pigs	NICERT (NIC 1336)
Western Visayas	Iloilo	Iloilo City	Orchard Valley, Inc	Cattle, sheep, goats	NICERT
Western Visayas	Negros Occidental	Sagay City	Mardal Corporation	Sheep	NICERT
Western Visayas	Negros Occidental	Silay City	Fresh Start General Merchandising	Chickens, Darag native chickens	NICERT
Western Visayas	Negros Occidental	Victorias City	Peñalosa Farms	Hogs, Kabir chickens, ducks, rabbits, Pekin ducks	NICERT
Western Visayas	Negros Occidental	Victorias City	Monchitos/ Peñalosa Farms	Chickens	USDA Organic, Ecocert, FDA, DOST
Davao Region	Davao Del Sur	Bansalan	Lao Integrated Farms, Inc.	Goats	TUV

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Box 5. R&D topics related to organic certification issues

1. Develop alternative strategies to **reduce cost of certification** especially for smallholder farmers.
2. Develop wider variety of **marketing and promotional techniques**.
3. Seek **easier ways of certification** especially for poor smallholder farmers.
4. Seek **bilateral country-to-country or multilateral recognition and equivalence arrangements**.

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III. Organic livestock breeding strategies for smallholder farms

- A. Animal genetic resources in organic farming
- B. Conservation of adapted local breeds in organic livestock farming
- C. Genetic improvement programs in organic livestock farming

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Animal genetic resources in organic farming

1. Imported high-yielding livestock breeds and hybrid lines
2. Local (indigenous) livestock breeds

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Table 4. **Livestock genotypes** used in conventional production systems and organic livestock farming

Farm species	Conventional production systems	Organic production systems
Cattle	Beef: <ul style="list-style-type: none"> • Purebreds • Synthetic breeds • Rotational crossbreeds Dairy: <ul style="list-style-type: none"> • Purebreds (temperate countries) • Crossbreeds (tropics) 	<ul style="list-style-type: none"> • Local (indigenous) breeds • Traditional breeds (may include crossbreeds or composite breeds that contain genetic material from local breeds)
Buffaloes, sheep and goats	<ul style="list-style-type: none"> • Purebreds • Local breeds 	<ul style="list-style-type: none"> • Local (indigenous) breeds
Pigs	<ul style="list-style-type: none"> • 3- or 4- breed crosses • 2-breed crosses • Purebreds 	<ul style="list-style-type: none"> • 2-breed crosses (i.e. exotic x local breed) • Local (indigenous) breeds • Traditional breeds*
Chickens	<ul style="list-style-type: none"> • Commercial hybrid broilers, layers, and free range poultry 	<ul style="list-style-type: none"> • 3- or 4- line crosses • Local (indigenous) breeds

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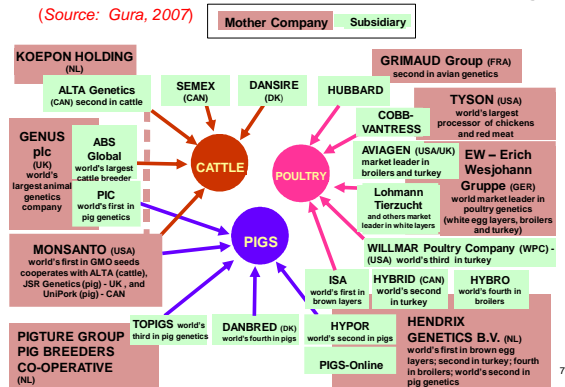
1. Imported high-yielding livestock breeds and hybrid lines

- **Genetically very uniform** and now supplied by a few globally operating genetics companies **BUT based on only a handful of breeds of cattle, pigs and chickens.**
- **High yields being realized in conventional farming** appear to be exclusive to the breeds and crosses provided by conventional breeding ~ **conventional breeding stock**

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Main Genetic Companies in Global Livestock Breeding

(Source: Gura, 2007)



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Imported high-yielding livestock breeds and hybrid lines (i.e. conventional breeding stock) . . .

- There are **ethical concerns** on the use of high yielding conventional breeding stock that may lead to the loss of diversity in livestock breeds.
- Conventional breeding animals have a **very high genetic predisposition for production** and therefore need high quality feed and concentrates ~ **not always provided on organic farms.**

This can lead to health and fertility problems and more intensive veterinary management (Nauta et al., 2001).

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Conventional breeding stock sometimes lack characteristics which are desirable in organic systems, putting animal welfare at stake.

Modern pig breeds have very little body hair and a short snout, which makes them less capable of coping with sun and heat in an outside run. They also have relatively little body fat to protect them from the cold (Van Putten, 2000).

Holstein cows have long, dangerously formed horns which increase butting injuries (Waiblinger et al., 2000).

In hens, negative pecking behavior and cannibalism occur (Bestman, 2000; Kjaer and Sørensen, 1997).

Consequently, animals are mutilated to prevent the onset of such undesirable behavior/characteristics in conventional agriculture.

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- Many livestock breeds or strains developed for intensive or conventional farms still have limited suitability in organic production and **may not be optimally adapted to an organic, low-input farming system** (Weigel et al., 2001).
- Use of higher-yielding breeds **implies an economic risk, especially for resource-poor smallholder farmers**, owing to these breeds' higher input requirements such as require regular, prophylactic veterinary treatments and high-energy concentrated feeds (Bondoc, 2014).

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2. Adapted local (indigenous) and traditional livestock breeds

- Despite the rapid industrialization of the livestock sector, **many local breeds are kept by smallholder farmers** and still predominates domestic animal production in many developing countries (Gura, 2008).
 - They are commonly regarded as **local (or native) to a specific area** and are raised using traditional production techniques by most village households.
- No structured animal breeding program exists to improve their genetic traits.**

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- They exist only in **small numbers** and have generally been kept by only a small number of villagers.
- Even though they represent an important source of meat, milk or eggs raised by most of the rural population, local breeds are **not considered the main source of family earnings**.
- They are not able to provide domestic consumption on a daily basis because of their **low production and variability in performance** (Chander et al., 2011).



Camarines

- However, **local breeds are not impediments to development**.
- Local breeds are **socially and culturally acceptable**.
- They symbolize our **natural (i.e. food, agricultural and cultural) heritage**.
- They matter as the **bedrock of identity as well as life of any society and nation**, especially in organic farming which also shows profound cultural sensitivity and historical-mindedness.



Palawan Lasak

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Nowadays, more **local or native breeds** seem to be used (or are expected) in organic farms than in conventional farms.

- Many local breeds which **utilize lower quality feed** are not only **more resilient to climatic stress**, but are **more resistant to local parasites and diseases**, and hence ensure healthy and stress-free animals (Yarwood and Evans, 2002 as cited by Van Diepen et al., 2007); the need for allopathic medicines and antibiotics is much lower (Chander et al., 2011).

Local breeds are and should therefore be preferred to save them.



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- This gives better recognition of organic production, especially for **multifunctional farms**, which do not need high production performance but have strong connections with consumers and society (Nauta et al., 2009).
- Local breeds are the **basis of livelihoods** and therefore can help achieve local food security objectives.
- Their development through science and technology-driven undertakings **should not only be aimed towards technical excellence but must at all times, be ethical**.

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Table 5. **Local livestock breeds in Southeast Asia**
(modified from DAD-IS FAO, 2014) - (1/3)

Country	Ruminants	Pigs	Chickens	Ducks
Cambodia	Buffalo: Mountain buffalo, Plain buffalo (2) Cattle: Cambodian, Highland Khmer, Kouprey, Lowland Khmer, Moi, Tsine (6) Goats: Indo-Chinese (1)	Chrouk Kandol (1)	Cambodian broiler, Monn Khmer (2)	Tea Ankam (1); Muscovy duck - Tea Kapa (1)
Indonesia	Buffalo: Anoa, Jawa, Kalang Kalsel, Kalang Kalim, Moa, Pampangan, Sumatra-Barat, Sumatra-Utara, Sumbawa, Toraya (10) Cattle: Aceh, Bali, Banteng, Donggala, Glati, Hissar, Jabres, Jawa, Javan-Ongole, Madura, Peranakan Ongole, Pesisir, Sumban Ongole, Sumbawa (14) Goats: Bligon, Etawah, Gembrong, Kacang, Kaligesing, Kosta, Lakor, Marica, Peranakan Etawah, Saburao (10)	Babi-Batak, Babi Hutan, Babi-Persilangan, Babi-rusa, Bali, Batak, Celeng, Iban, Jambi, Jawa, Nias, Papua, Sulawesi, Sumatera, Sumba, Tangerang (16)	Ayam-hutan-merah Sumatra, Babolina Harco, Balenggek, Bali, Banten, Batu, Bekisar, Berugo, Bromo, Bromo Putri, Bukan-Ras, Burung Ayam-ayam, Ciparage, Gaga, Hutan Hijau, Hutan Merah Jawa, Hutan-Merah Sumtera, Kampung, Kats, Keju, Kokok-Balenggek, Merawang, Merawas, Nagrak, Nunukan, Pelung, Rataih, Sentul, Tolaki, Wareng, Yungkilok, Yungkilok Gadang (32)	Alabia, Bali, Bayang, Belbis, Chateup, Jawa, Kalung, Kerinci, Kisaran, Magelang, Maros, Mqjosari, Pegagan, Pitalah, Rambon, Roueen, Talang Benih, Tegai, Tondano, Turi (2); Muscovy duck - Serati (1)

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Table 5. ... *continued* (2/3)

Country	Ruminants	Pigs	Chickens	Ducks
Lao PDR	Buffalo: Khouasy (1) Cattle: Kouprey, Ngoua, Tsine, Yellow Asian (4) Goats: Bac Thao, Bae (2)	Mou Cheed, Mou, Ladt, Mou Mong (4)	Kai Lat (1)	Pet Kab, Pet Thed (2)
Malaysia	Buffalo: Borneo Buffalo, Kerbau-Sawah, Selembu (3) Cattle: Brakmas, Charoke, Kedah-Kelantan, Mafriwal, Malay Banteng, Seladang (6) Goats: Gernasia, Jermasia, Katjang (3)	Iban (1)	Ayam Kampong, Malay, Serama (3)	Belbis, Nila (2)
Myanmar	Buffalo: Myanmar swamp buffalo, Shan Kywe (2) Cattle: Katonta, Mythum, Pya Zein, Shan Nwar, Shwe Ni, Swe Ni Gyi, Thari (7) Goats: Black Bengal, Jade Ni (2)	Badaung Wet, Bo Cake, Taung (3)	Miyogi, Tain Nyin (2)	Khayan Duck (1)

Note: No data available for *Brunei, Singapore, and Timor Leste.*

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Table 5. ... *continued* (3/3)

Country	Ruminants	Pigs	Chickens	Ducks
Philippines	Buffalo: Philippine carabao (1) Cattle: Batangas, Ilocos, Iloilo (3) Goats: Cagayan, Bohol (2)	Benguet, Marinduque, Quezon (3)	Banaba, Bohol, Bolinao, Camarines, Darag, Joloano, Paraokan, Zamboanga (8)	Philippine mallard - Batangas, Pampanga, Quezon (3)
Thailand	Buffalo: Krabue (1) Cattle: Khao Lumpoon, Kho Peun Muang Thai E-San, Kouprey, Thai, Sine (5) Goats: Bangala, Kambing Kajiang (3)	Hailum, Kwai, Puang, Raad (4)	Chee, Dang, Gai Chon, Gai Puen Muang, Luang Hang Khao Pradu Hang Dum (5)	Ped Puen Muang Pak-Nam, Ped Ted Puen Muang Dum, Ped Ted Puen Muang Khao (3)
Vietnam	Buffalo: De, Ngo, Trau Noi (3) Cattle: Baria, Bo Lai Sin, Bo U Dau Riu, Bo Vang, Chau Doc, Coc, H'mong, Kouprey, Than Hoa, Tuy-Hoa (11) Goats: De Bach Thao, De Co (2)	Ban, Ba Xuyen, Bieu, Co, Dbi, H'mong, I Mo, I Goc, Lang Hong, Lon I, Meo, Mong Cai, Meo, Muong Khuong, Phu Minh, Soc, Son Vi, Tay Nguyen Soc, Thuoc Nhieu (20)	Ga Ac, Ga Chol, Ga Dong Tao, Ga Ho, Ga Mia, Ga Mong, Ga Ri, Ga Tau Vang, Ga To, Ga Tre, H'mong Den, H'mong Nau, Lun, Oke, Phu Lu Te, Te, Tien Yen, Vanphu (18)	Anh Dao, Bac Kinh, Bauben, Bau Quy, Co, Hoa, Ky Lua, Moc, Nang, Omon, Tiep Vit Bau, Vit Co (12); Muscovy duck - Ngan noi (1)

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III. Organic livestock breeding strategies for smallholder farms

- A. Animal genetic resources in organic farming
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Organic Livestock Farming and Breeding Towards Food Security of Smallholder Farmers in the Tropics

1. Genetic diversity of local breeds

- **Diversity of breeds** has been developed by farming communities over several thousand years. ~ a result of their **adaptation and evolution** to cope with harsh environments and disease challenges (ICAR, 2000).
- This includes the **development of only a few of these breeds into breeding lines** by breeding cooperatives, government breeding organizations, and breeding companies especially in Europe and North America, which are now used in industrial livestock production.

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- However, the **potential for genetic improvement** has so far only been exploited to a very limited degree (Philipsson et al., 2011).
- Furthermore, the **adapted local breeds are easily irretrievably lost** especially when they are considered to be commercially non-competitive.
- Thus, **maintenance of local breeds in organic livestock farming** is of great importance for the maintenance of genetic diversity.



Darag

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2. Managing breed diversity

- Several actions should be undertaken to **maintain breed diversity as a part of the national strategies for livestock production**.

e.g., Establish a **genetic pool of breeding stock** from which to select desirable traits in close collaboration with some breed associations and producers.



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- Some basic considerations to promote the use of local breeds in organic livestock farms are as follows (e.g., *Andresen, 2000; Nauta et al., 2001; Van Diepen et al., 2007; Bondoc, 2014*):

1. **Choice of adapted breed**. Local breeds must be better adapted to the local production and marketing systems and should be well-suited to free-range systems.
2. **Continuous exposure to local conditions**. Local breeds must be continuously exposed to local conditions to maintain their unique adaptive traits.
3. **Closed herds and flocks**. Local breeds must be maintained in closed herds and flocks.



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4. **Protected geographical indications and designations of origin**. Local breeds must be linked with local marketing to account for **special quality of livestock products** and to protect their **geographical indications and designations of origin**

e.g., **EU quality labels** such as:



Protected Designation of Origin (PDO): produced and processed up to finish product stage in a defined area whose name the product bears.

Protected Geographical Indications (PGI): produced in a geographical region whose name it bears, e.g., "*Siquijor roast beef*", "*Black Tiaong native bacon*"

Traditional Speciality Guaranteed (TSG) - highlights traditional character, either in the composition or means of production

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III. Organic livestock breeding strategies for smallholder farms

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- Breeding should be **based on the principle of naturalness** and should preferably take place within the organic chain, separately from the conventional sector (*Nauta et al., 2005a*),

i.e. breeding is only organic if the breeding animals and their families are kept and housed in organic conditions.

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- The **main breeding strategies** for improving adapted breeds in organic livestock production are **selection within a breed** and **crossbreeding**.

- The breeding strategies not only needs to **ensure farm profitability**, but also to **safeguard animal health and welfare**, **focus on conserving genetic diversity** and **promote human health** in line with the principles and standards of organic livestock farming.

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Organizational structure.

- Smallholder livestock farmers must form into breeding groups or cooperatives and follow a common breeding objective.
- A **farm-specific breeding program** operated by a community-based organization for the genetic improvement of livestock or CBOGIL (*Kahi et al., 2005; Valle Zárate and Markemann, 2010*) is recommended.
- It is **less dependent on conventional institutional structures, ensures more diversity within breeds,** and **encourages the use of local breeds.**

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Breeding objectives and selection criteria.

- Unlike the limited number of traits in intensive or conventional livestock production, the breeding objectives in organic livestock farming may **consider a broader range of attributes.**
- Measures of animal performance in the selection criteria may **shift from feed conversion to functional efficiency and traits related to fitness** (e.g., *Andresen, 2000; Nauta et al., 2001*).

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Breeding objectives in organic livestock production:

- Quantity of meat, milk or eggs
- Quality of products
- Lifetime performance and longevity
 - Disease resistance
 - Hardiness or robustness
 - Vitality
 - Feed intake capacity
 - Ability to utilize broad fodder spectrum
 - Ability to digest rations w/ higher forage percentage
 - Fertility
 - Mothering ability
 - Walking ability

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Selection within breeds.

- The breeding organizations should **help individual smallholder farmers to select and mate (sires) or animals from their own herds with the best breeding values,** depending on his own individual ideas and fancies and breeding goals.
- **A local selection program for improved disease resistance** may be especially important for local breeds showing resistance or tolerance to certain infections.

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Selection of local cattle breeds



Source: RBW (www.rind-bw.de)



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Selection of local pig breeds

Iberian pigs (Spain)



Mangalitzia (Hungary)



Cinta Senese (Italy)

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"Schwäbisch-Hällisches Landschwein"
(Germany)



Bentheim Black Pied (Germany)



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Jamón Ibérico

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2. Crossbreeding systems

- Crossbreeding may be applied in organic livestock farming wherein the productivity of the crossbred offspring can increase due to **hybrid vigor** or **heterosis**.

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Crossbreeding in pigs.

- Crossbreeding in organic pigs allows the use of a **maternal breed** with good mothering ability, good fertility, calm temperament, good lifetime performance and a **paternal breed** with high growth potential and good carcass performance.
- The **production animals**, which will not be used for breeding, are usually of the F2 generation and result from a three-way or four-way cross.
- Many organic swine farms now commonly rely on commercial hybrids with **large proportions of exotic breeds (e.g., Duroc and Berkshire)** and **local pigmented breeds**.

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Crossbreeding in chickens.

Crossing chicken breeds for broiler production,

- Slow-growing strains suitable for organic production systems have been developed by some poultry breeding companies (e.g., SASSO and Hubbard, France; Aviagen, Great Britain, and Cobb-Vantress, USA).
- Organic production traits include slow growing, good social and ranging behavior, robust, and lower requirements on feed quality.
- Unlike conventional broilers, which are ready for slaughter 6 weeks after hatching, organic broilers are fattened for 81 days. On average, these birds grow to 2 kg in eight weeks (Nauta et al., 2001).



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- Conventional layer production commonly involves the development of lines from the Single Comb White Leghorn for **white egg production** and a cross of Rhode Island Reds and Barred Plymouth Rocks for **brown egg production**.
- However, there is limited suitability of conventional strains selected for high egg production in a cage-housing system to be used in organic production, especially now that **laying batteries are phased out and disallowed because they compromise the hens' welfare**.

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- In the Philippines, crossbreeding of native chickens strains such as the “**Paraokan**” and “**Banaba**” with the commercial **SASSO range chickens** under an organic management system have resulted in:

Improved performance of the F1 crossbreds particularly for **ranging ability and production traits** such as body weight at ten weeks old, feed consumption, and feed conversion ratio (Escobin et al., 2005).



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Crossbreeding in smallholder farms.

- Crossbreeding programs used in large commercial farms **may not be suitable for smallholder farmers** because of limitations on herd size especially the number of **replacement purebred females** and number of desirable **males of different breeds**.
- More purebred sires will also be required for natural mating services due to the **low usage rate and success rate of AI in the village herds**.
- Nonetheless, crossbreeding may be practiced in smallholder farms and may involve: (1) **upgrading**, i.e. improvement of local breeds using exotic breeds and (2) **composite breed formation** (Bondoc, 2008).

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3. Genotype x environment interaction

- As of yet, there has been no scientific research to determine **if traits selected in conventional breeding can still be relevant to and comparable in organic agriculture**, especially in resource-limited smallholder farms.
- The hypothesis is that these differences do exist, especially with respect to **functional characteristics such as fertility, disease resistance and behavior**, and when differences between the two types of production are greater (Nauta et al., 2001).

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Organic Livestock Farming and Breeding Towards Food Security of Smallholder Farmers in the Tropics

- To avoid GxE effects, a farm-specific breeding program should require each organic farmer to **select the best animals which are optimally adapted to the specific conditions of the breeder farm or station** such as farm type, soil type, housing system, diet and medical regime (Nauta, 2009).
- The **systems approach** is recommended to decide **what animals within breeds, what breeds and crossbreeding programs** should be used by smallholder farmers (i.e. decision-maker) in organic livestock production.

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Organic Livestock Farming and Breeding Towards Food Security of Smallholder Farmers in the Tropics

IV. Organic livestock farming contributing to food security of smallholder farmers

A. Consumer demand for organic livestock and poultry products

- B. Prospects of organic livestock farming for smallholder farmers
- C. Impacts of organic livestock farming on food security of smallholder farmers
- D. Constraints faced by smallholder organic livestock producers
- E. Recommendations

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Organic Livestock Farming and Breeding Towards Food Security of Smallholder Farmers in the Tropics

- High-quality organically produced foods from livestock and poultry are purchased at higher prices mainly for **health and product safety reasons** and **wider benefits** such as **protecting the environment and animals**.
- The increase in demand for organic products is a response to societal needs that sees the current **factory-farm methods** are responsible for **public health threats, ecological problems concerning air and water pollution, and loss of livestock genetic diversity**.

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- There is also a growing international scientific consensus that **genetically modified products and the corresponding “genetic modification” process may raise any risks over conventional breeding approaches.**

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IV. Organic livestock farming contributing to food security of smallholder farmers

A. Consumer demand for organic livestock and poultry products

B. Prospects of organic livestock farming for smallholder farmers

C. Impacts of organic livestock farming on food security of smallholder farmers

D. Constraints faced by smallholder organic livestock producers

E. Recommendations

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- Smallholder farmers could become important suppliers of organic foods, since **organic practices tend to suit the conditions under which their livestock and poultry animals are raised** (Chander et al., 2011).
- Smallholder farmers in resource-constrained countries are closer to organic farming systems, though largely by default, since **they traditionally use few external inputs**, such as allopathic medicines and antibiotics, and **follow grazing-based extensive or semi-intensive production systems.**

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- Smallholder livestock keepers **have developed a vast veterinary knowledge** and this is somewhat **easier for small farmers to understand** (Gura, 2008).
- Organic livestock farming can also be used as a **tool for poverty alleviation in rural areas** with active and equitable participation of small farmers in farmers' associations.
- Organic livestock farming uses **small farmers' traditional knowledge** of the natural environment and of the unique relationships between various crops or animals and the environment.

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- With indigenous feed ingredients generated from integrated crop-animal systems, **there will be no shortage of organic feed that relies on imported cereals and oil meals.**
- Farmers who **adopt a holistic understanding of organics and are focused on local benefits** such as improved soils, fewer toxic chemicals, and self-reliance in inputs **rather than just on the premium price for the livestock** are likely to better withstand setbacks, reduced premiums, and difficult periods especially during the conversion stages (Giovannucci, 2005).

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- Organic livestock farming **promotes technologies and best practices** that allow smallholder farmers to earn more and protect the environment by reducing the global warming gases that livestock emit (Gerber et al., 2013).

- e.g.,
1. **Improve** the breeding and health of animals;
 2. **Better access** to affordable improved animals;
 3. **Use better quality feeds and better grazing management** to reduce methane emissions;
 4. **Recover and recycle nutrients and energy** contained in manure; and
 5. **Use less energy** along the livestock production chain.

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Organic Livestock Farming and Breeding Towards Food Security of Smallholder Farmers in the Tropics

IV. Organic livestock farming contributing to food security of smallholder farmers

- A. Consumer demand for organic livestock and poultry products
- B. Prospects of organic livestock farming for smallholder farmers
- C. Impacts of organic livestock farming on food security of smallholder farmers**
- D. Constraints faced by smallholder organic livestock producers
- E. Recommendations

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- **Food security** exists when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life (USAID 1992; FAO 1996).

Four “pillars” of food security (Source: FAO, 2011)

- **Food availability** (i.e. food supply).
- **Food access** (i.e. ability of people to obtain food when it is available).
- **Food stability** (i.e. ensuring adequate food at all times).
- **Food utilization** including food safety and nutritional well being.

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Organic livestock farming can be practiced by smallholder farmers to:

1. **Increase production and productivity** to increase consumption of sufficient calories (i.e. prevent undernourishment) and to consume animal-derived food of adequate quality (i.e. avoid malnutrition),
2. **Generate income and employment**,
3. **Promote fair trade/marketing practices**,
4. **Provide adequate food at all times**, and
5. **Ensure food safety and nutritional well-being**.

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IV. Organic livestock farming contributing to food security of smallholder farmers

- A. Consumer demand for organic livestock and poultry products
- B. Prospects of organic livestock farming for smallholder farmers
- C. Impacts of organic livestock farming on food security of smallholder farmers
- D. Constraints faced by smallholder organic livestock producers**
- E. Recommendations

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Organic Livestock Farming and Breeding Towards Food Security of Smallholder Farmers in the Tropics

Constraints to smallholder organic livestock production	Recommendations
1. Limited amount of truly scientific research on organic technologies, especially under small-scale farming conditions	Promote education, research and development activities on organic livestock farming at the smallholder farmer level

- **Education programs** (e.g., joint curriculum and course offering at the undergraduate/ graduate levels in SCUs with foreign universities, TESDA, industry-government-academe partnerships; national/ ASEAN conferences on “Organic Livestock Farming and Research in Colleges/ Universities”)
- **Research and development activities** (e.g., thesis/ dissertations, laboratory/field experiments, demo-farms, participatory and community-based research, and extension delivery services) through the Organic Agriculture RD&E Network (BAR-DA), and Organic Farming Information Network (PCAARRD-DOST).

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Constraints to smallholder organic livestock production	Recommendations
2. Inaccessibility of organic markets to most small farmers and the difficulty small farmers have in negotiating contracts with buyers	Develop niche markets for smallholders to improve value of organic livestock products Provide policy development support for smallholder farmers through joint industry-government-academe initiatives

- Promoting traditional products, creating new products, improving their quality and developing markets may also be a good strategy to conserve traditional livestock breeds – e.g., European quality labels such as **PDO, PGI and TSG**
- Smallholder farmers should be organized to meet the demands for certification, quality, and consistency of increasingly mainstream distribution channels.

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Constraints to smallholder organic livestock production	Recommendations
3. Difficult access to adapted animal breeds	Provide access to adapted animal breeds

- A national breeding program for organic livestock farming, with a National Organic Livestock Database (NOLD) should be pursued through the joint efforts of smallholder farmers' breeding organizations, **UPLB and several SCUs** to be led and coordinated by various line agencies of the Dept. of Agriculture,
 - i.e. **PCC** - for water buffaloes, **NDA** - for dairy cattle, and **BAI** - for beef cattle, horses, goats, pigs, chickens, and ducks.

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Constraints to smallholder organic livestock production	Recommendations
4. High cost of certification	Reduce cost of organic certification for smallholder farmers

- Smallholder livestock farmers must organize in order to facilitate Internal Control Systems and apply for **group certification**.
- **Participatory Guarantee System (PGS)** - locally-focused quality assurance systems which certify producers based on active participation of stakeholders and are **built on a foundation of trust, social networks, and knowledge exchange**.
- Bilateral country-to-country or multilateral recognition and equivalence arrangements may be sought through the **Common Objectives and Requirements of Organic Standards (COROS)**.

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- The **Philippines is the leading country** in terms of producers involved in PGS (10,620) out of over 49,000 small operators currently involved in PGS worldwide (*Willer and Lenourd, 2014*).
- As of 2014, a total of 109 farmers organizations are using the **MASIPAG Farmers' Guarantee System (MFGS)** as a way to guarantee their products, albeit mostly crop-based organic products (*Dr. Charito P. Medina, 2015 personal communication*).

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Thank You!!!

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