

# **HYST TECHNOLOGY**

## **SOLUTIONS FOR FOOD SECURITY**

## **RENEWABLE ENERGY AND**

## **SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES**

**Pier Paolo Dell'Omo**  
President of *Scienza per Amore*

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## HYST: HOW IT WORKS



*HYST system for the energy sector (working capacity: 1-5 t/h)*

Hyst is a system designed to physically process agricultural products and residues, in order to extract components for:

- **Food and nutraceutis**
- **renewable energy**
- **Green chemistry**
- **Drug industry**

The system carries out the disaggregation of the biomass through multiple crushing stages of the raw material conveyed in a high speed air flow.

To operate, it requires only electric power. No emissions of any liquid and/or gaseous waste are released into the environment.

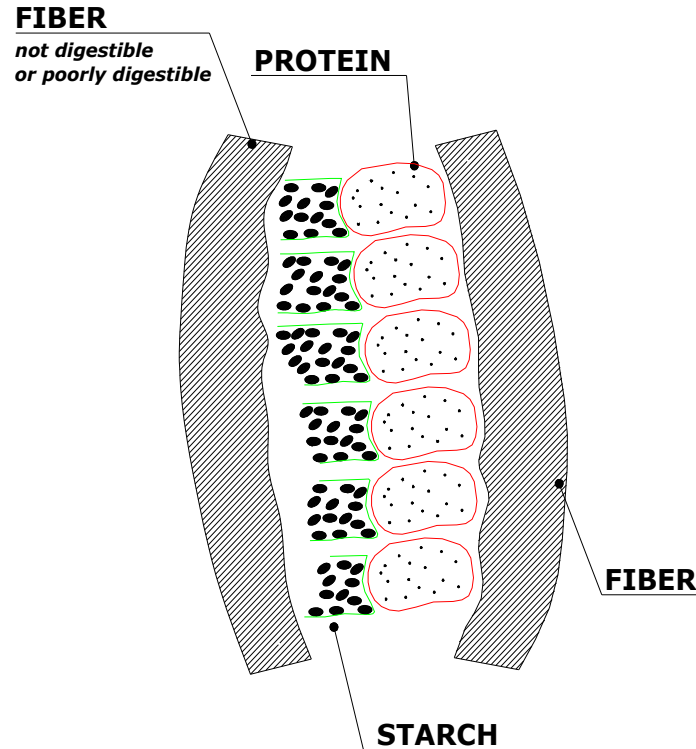
The process and the components are patented worldwide.



## HYST TECHNOLOGY: FUNDAMENTALS

Any plant-derived material contains nutrients such as proteins, lipids and digestible carbohydrates as well as vitamins and minerals.

In many plant materials, these nutrients are trapped in fiber structures, which makes them unusable for humans and of little nutritional value for animals.





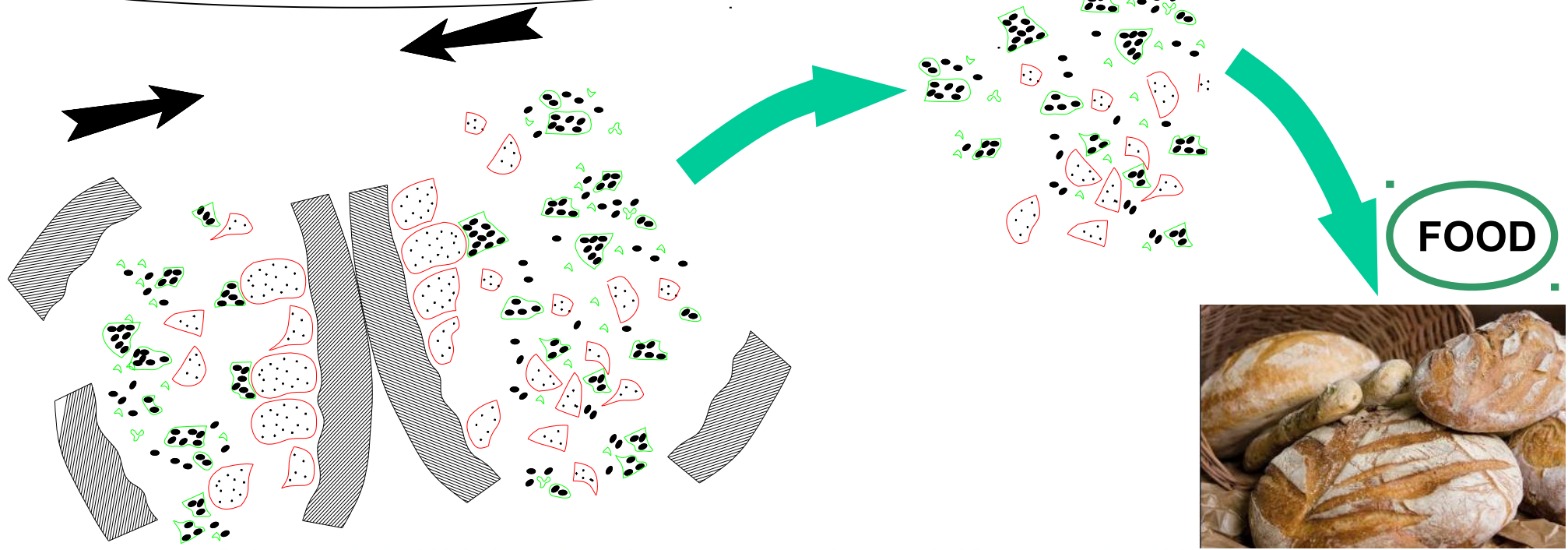
## HYST TECHNOLOGY: FUNDAMENTALS

Through collisions caused by high-speed air flows, HYST systems break down the structure of the plant material, releasing its nutrients. The nutrients are thus separated from the fibrous part and become food for humans and animals.

**BREAKAGE BY HIGH VELOCITY IMPACTS**

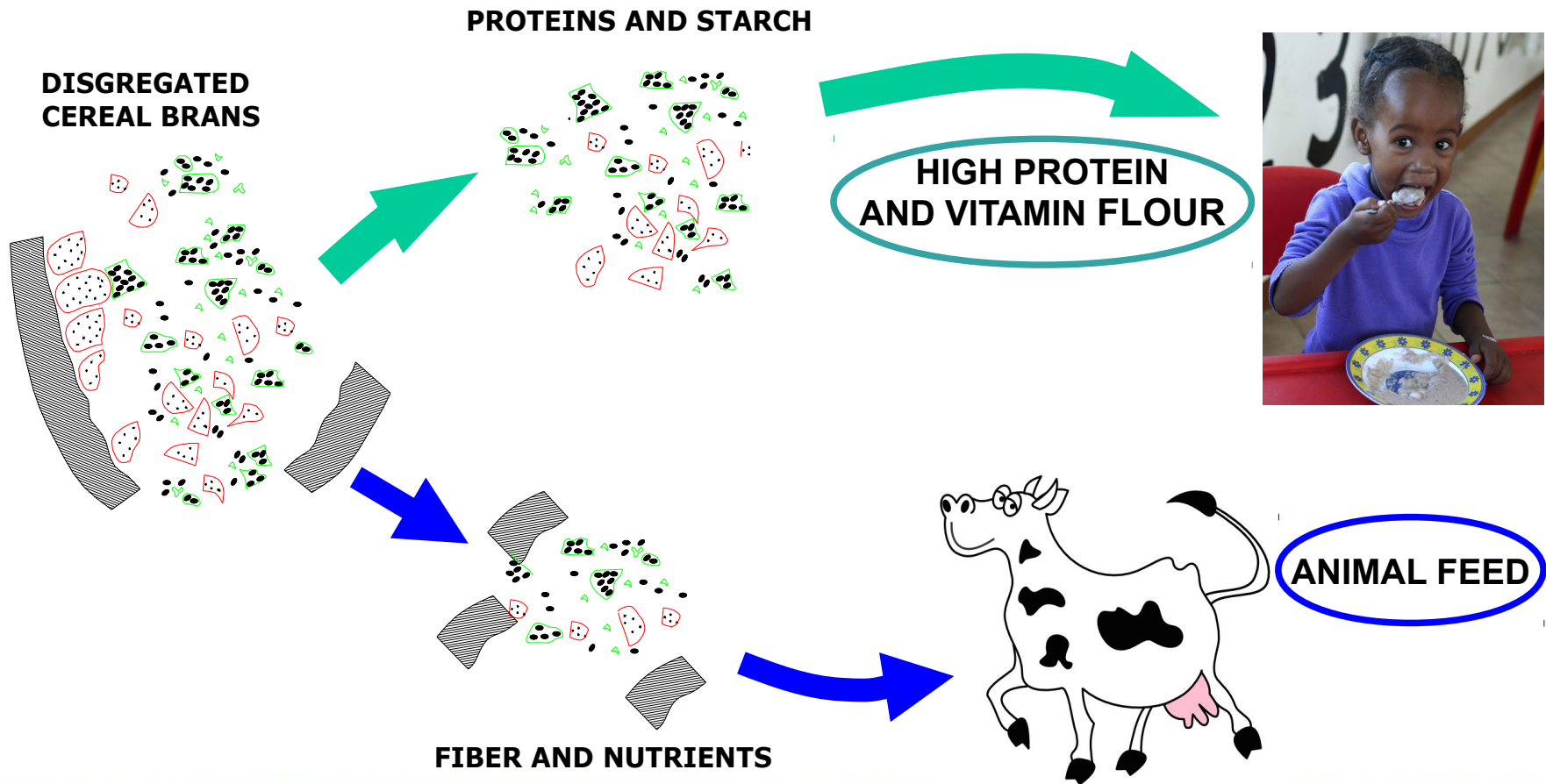
**SELECTION OF NUTRIENTS**

**FOOD**



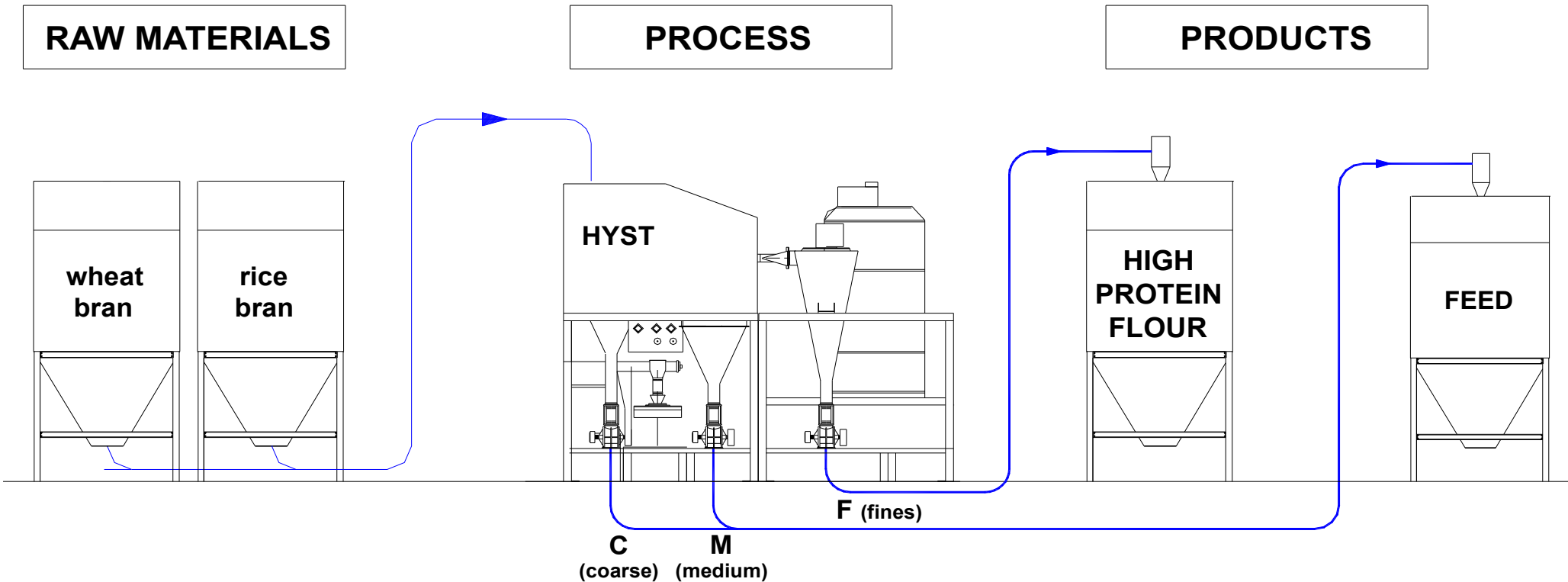
# HYST TECHNOLOGY: CEREAL PROCESSING

**Example n. 1:** The Hyst process is used to extract nutrients from cereal brans (millet, sorghum, etc) to obtain a flour with an high protein content and nutritional value for human consumption.



# HYST TECHNOLOGY: CEREAL PROCESSING

## SKETCH OF THE INDUSTRIAL PROCESS



HYST treatment of cereal bran produces a high nutritional profile flour, suitable for the functional food market.

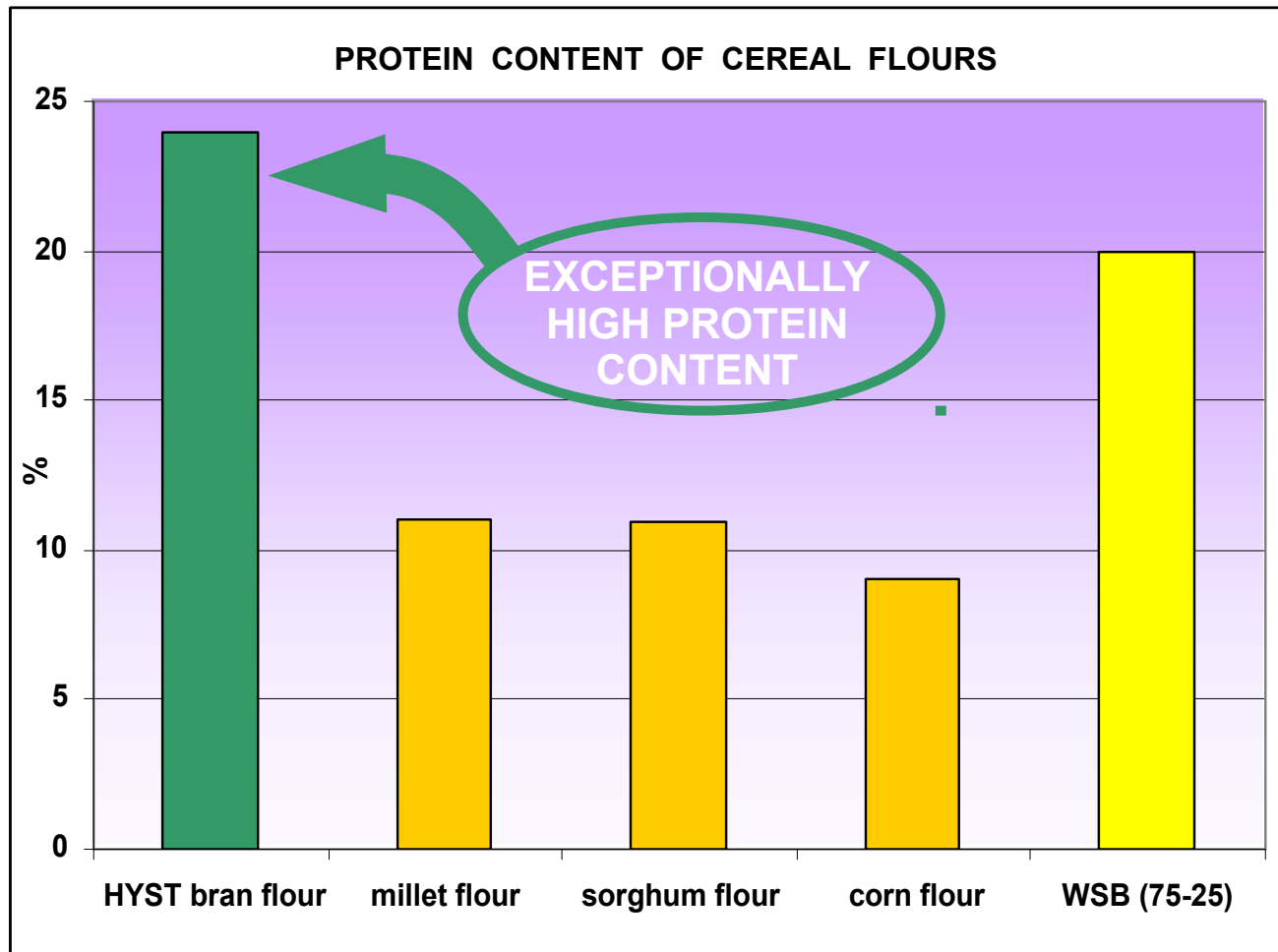
At the mean time, a high-fiber fraction displaying an improved digestibility is produced. This can be conveniently used as animal feed.





# HYST TECHNOLOGY: CEREAL PROCESSING

## FLOUR NUTRITIONAL PROPERTIES



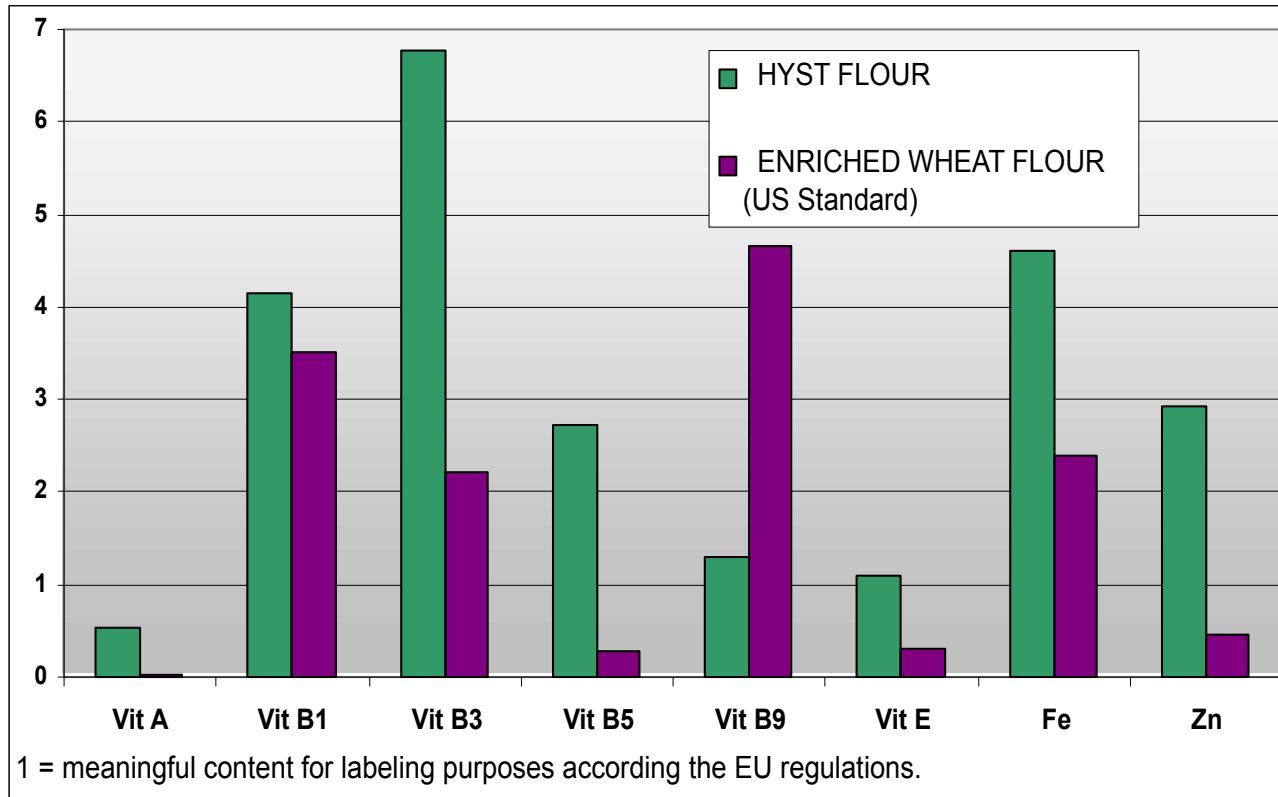
HYST flours from wheat bran display a double protein content than common cereal flours.

**WSB:** wheat soybean blend, 25% soybean, used in WFP programs.



# HYST TECHNOLOGY: CEREAL PROCESSING

## FLOUR NUTRITIONAL PROPERTIES



Vitamins and essential elements are ten times more abundant in HYST flour than in common food, and they are even more abundant than in artificially enriched flours.

100 g of HYST flour contain:

- the Recommended Daily Allowance (RDA) of vitamin B3;
- more than 60% RDA of vitamin B1, which has been recognised by the *European Food Safety Authority* as a promoter of brain health in children.





## HYST TECHNOLOGY: FOOD SUPPLEMENTS FOR FIGHTING MALNUTRITION

**Example n. 2:** Use of an edible weed, stinging nettle (*Urtica Dioica*), to produce iron supplements.



*Urtica dioica*

HYST



**Iron extract.** A teaspoon of the extract from nettle is able to satisfy the recommended daily intake of a person.

**Iron deficiency is a major problem in the field of malnutrition.** Each year, approximately 600,000 children are stillborn or die within the first week of life from lack of iron, added to which there are more than 15,000 pregnant women that meet the same fate. Approximately 50% of preschool children from developing countries present mental and motor deficits due to lack of iron.



## HYST TECHNOLOGY: ANIMAL FEED AND ENERGY

### Example n. 3. Hyst processing of water hyacinth (*Eichhornia crassipes*)

The water hyacinth is the most widespread and damaging aquatic plant species in Africa. Costs for controlling the weed may be as much as US\$100 million annually.

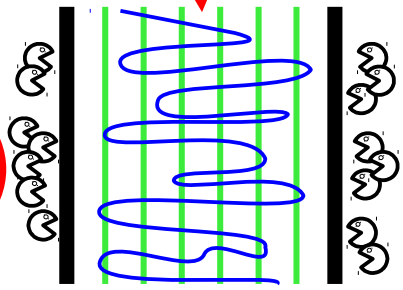
Because of some obstacles to overcome for its exploitation, controlling the weed is currently only a cost and generates neither food nor income.



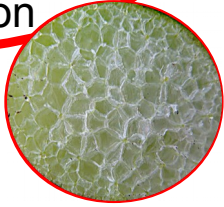
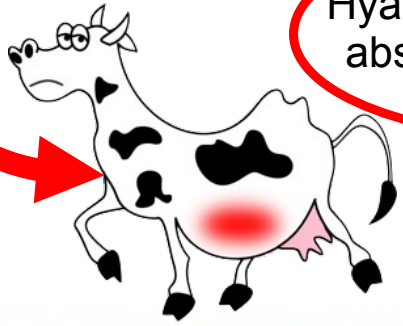
Fiber content is too high for feeding fish



anaerobic digestion is slow and poorly effective due to its lignocellulosic nature



Hyacinth spongy structure absorbs too much water during digestion



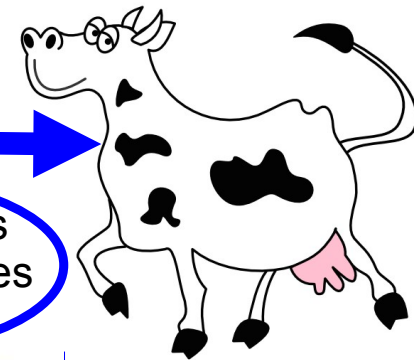


# HYST TECHNOLOGY: ANIMAL FEED AND ENERGY

Example n. 3. Hyst processing of water hyacinth (*Eichhornia crassipes*)  
Overcoming obstacles through HYST processing.

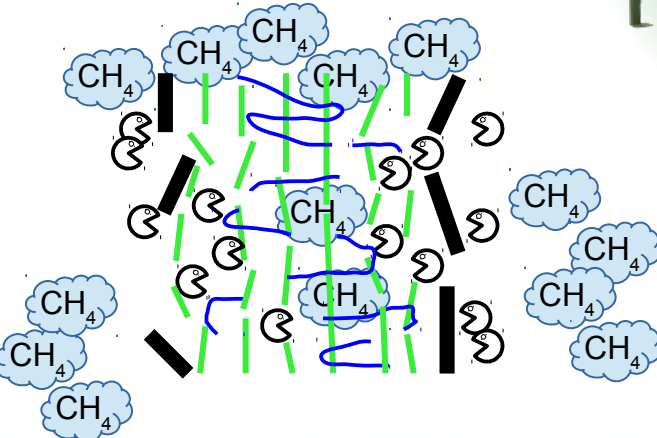


High protein  
and low fiber  
content feed



Spongy structures  
destruction improves  
feed quality

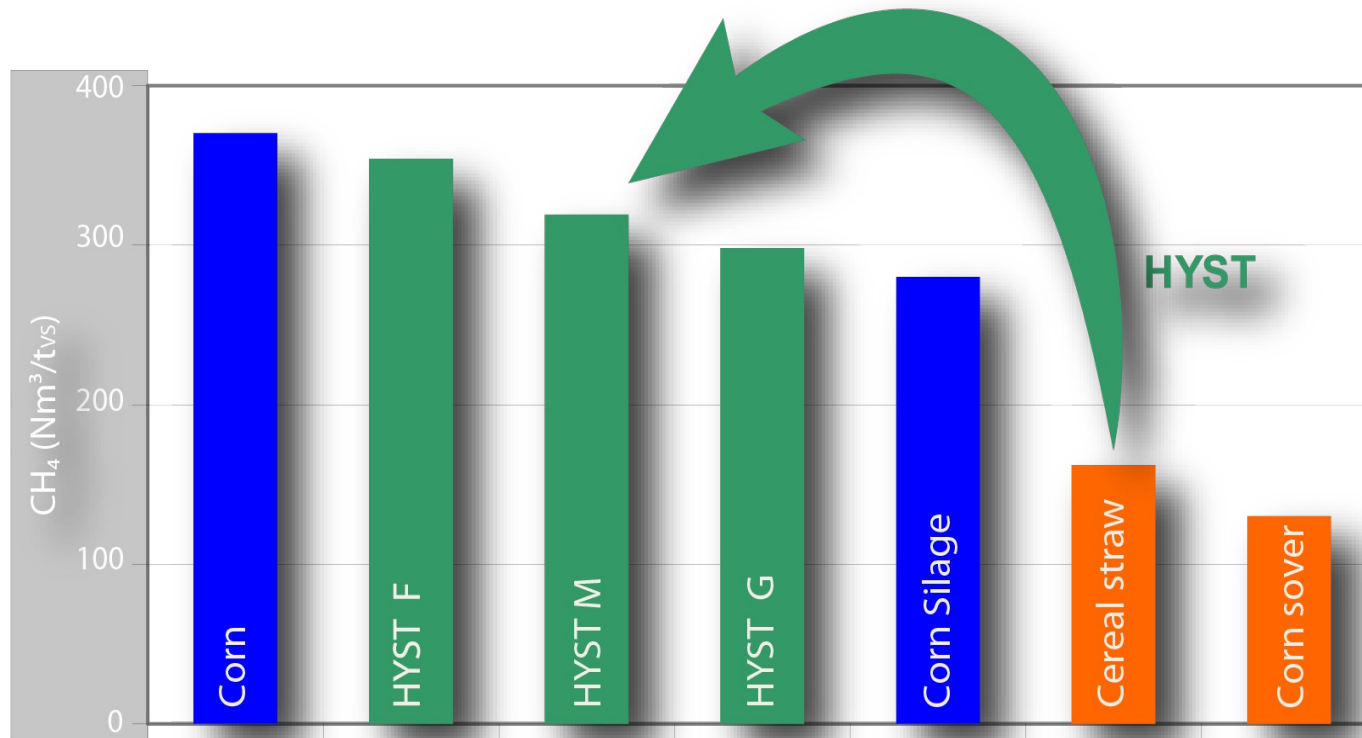
Large  
biogas production  
improvement





## DETAILED ANALISYS: IMPROVING BIOGAS PRODUCTION...

Hyst systems are particularly efficient in the "pre-treatment" of lignocellulosic biomass to allow a more abundant biogas production. Experiments carried out in Europe on cereal straws have shown that it is possible to double biogas production.



Effect of Hyst pretreatment on the methane yield of anaerobically digested straw (Nm<sup>3</sup>/t<sub>sv</sub>).



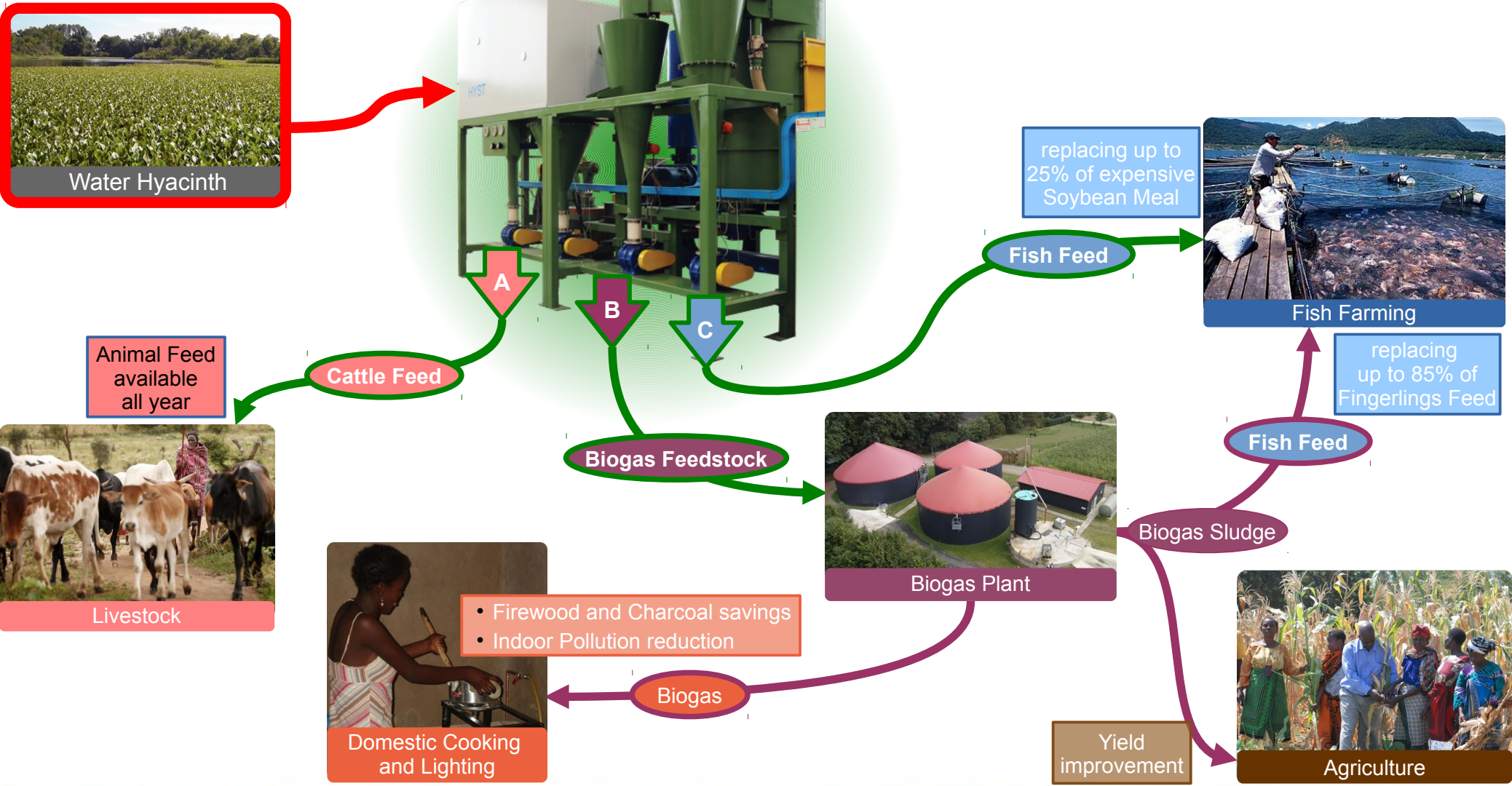


# HYST FACILITY FOR INTEGRATED WATER HYACINTH EXPLOITATION

- 1. HYST plant
- 2. Feed mill
- 3. PV plant
- 4. Storage area
- 5. Feedlot
- 6. Biogas plant
- 7. Cylinder filling area
- 8. Mooring platforms
- 9. Fish farm









## **INTEGRATED APPROACH: ENVIRONMENTAL BENEFITS AND IMPROVEMENT OF LIFE CONDITIONS**

- Where possible, the availability of biogas can replace large quantities of firewood and charcoal used for cooking. This allows to conserve natural resources, particularly forests.
- Biogas sludge, a residue of biogas production is an excellent organic fertilizer very rich in nutrients. Its use allows to improve crop yields, protect the soil from erosion and, therefore, counter desertification.
- The biogas can suitably be used for domestic cooking and lighting. In addition to the environmental benefits, use of biogas leads to an improvement of hygienic conditions, thanks to the reduction of air pollution from solid fuels. This pollution is responsible for over 350,000 deaths each year across Africa (WHO, 2006).



## CONCLUDING REMARKS

### STRONG POINTS

- Hyst units do not use water and chemicals
- Hyst units are particularly suitable for the enhancement of resources deemed of little value (eg agricultural waste) for food and energy purposes;
- Hyst units feature reduced energy consumption, making it possible to create self-sufficient units;
- Hyst units can be used for small projects (villages, small communities) up to large industrial sites.
- A consultation procedure with the Italian Ministry of Health led to the following acknowledgment: Hyst products for human consumption can be considered SAFE in compliance with the current relevant EU regulations.

### CRITICAL ISSUES

- Fresh feedstocks need drying before processing.

