FERPODE: A BETTER AGRONOMICAL USE OF LAYING HEN MANURE

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1 INTRODUCTION

The production of a SNF (non-synthetic fertilizers) can transform laying hen manure (LHM) into a commercial product (PAV manure) hygienically safe and with a quality in accordance with the legislation on fertilizers. Actually the farmers offer poultry manure free of charge. Therefore this activity is not yet a business, but it involves further costs for transport. Furthermore often poultry farms do not have sufficient land to use this waste as fertilizer on cropland (Quiroga et al., 2010). An on farm quality fertilizer production will introduce the strategy to transform all the manure into a marketable fertilizer with the aim to obtain an economical advantage.

The goal is to find a solution with minimal financial investment : if the breeder examines his actual economic advantages derived from production and marketing of LHM, he may decide to make further investments to expand the product market and to automate the production process. Therefore a breeding business growth can be expected, with different phases that will evolve gradually over time, each characterized by different investments.

This contribution reports the results of a specific situation with the application of the treatment described in the patent EP 1314710 A1 (Amek and CTI, 2002) to laying hens with MDS drying manure, taking as reference a barn for manure storage. The final fertilizer transport was foreseen up to a maximum distance of 100-150 km from the production plant, in order to keep low transportation cost, foreseeing local production and use of fertilizer.
In relation with the economic assessment, the project has to consider the entire chain and to optimize it, taking into account all the products, the biological catalyst (PAV), the fertilizers and the innovative application systems adopted for all types of products. Then the cost-effectiveness resulting from the implementation of the new product (PAV manure) was assessed for the fertilizer producer. Furthermore some economic aspects which affect the end-user were considered.

2 MATERIALS AND METHODS

The feasibility study includes an analysis of the production process to be carried out to produce PAV manure; they were analyzed: the new process in its various stages and its development over time, the required activities sequence and their timing, the estimated fertilizer amount that can be realized during the considered period.

It's important to consider the changes of the existing manure management process and the implementation of the investments for the fertilizer production from hen manure. Then, by financial methods, the economical advantages were considered. The assessment of investments in innovation (new product) presents special difficulties in relation with other industrial investments, such as uncertain expected returns or the market response.

The method used is the NPV (Net Present Value), which tells you whether the payments or receipts made during the lifetime of the project result in an overall gain or loss, considering economic values at time zero (i.e. when you do the assessment) (Fontana and Caroli, 2006). If the NPV is positive the project is economically advantageous.

We consider a single real case: an intensive laying hen farm in Mordano (Bologna, Italy) and in particular the treatment of manure produced by 320,000 caged hens. LHM is removed from the housing after 24-36 hours by means of manure conveyor belts and dried in a tunnel outside the housing (MDS, Manure Drying System) in the subsequent 72 hours and then sent to a barn with impermeable floor, used for manure storage, where 3 piles can be set up. MDS is classified as a Best Available Technique (BAT) according to BREF (EC, 2003).

2.1 Experimental design

The first step is expected to produce PAV manure only in bulk, which will be loaded onto trucks and transported to farmers (B2C, business to consumer) or to traders (B2B, business to business), without packaging. The final production of fertilizer will amount to 328 t/pile, taking into account 20% of losses for mineralization and water evaporation occurring during the 120 days of refining.

In the first year you have 2 cycles of production (production of 6 piles in all), but only one traded (the first 3 piles made); the second year, however, there will be only one production cycle, but 2 stages of commercialization (sales of the 3 piles of the preceding year and 3 made in the year). It can be assumed that this situation, characterizing the cycles of production and marketing in 2 years, will be repeated cyclically over time, so X the average values for each year will be used.

The first step is characterized by the minimum investment that the company can achieve for the production of manure PAV. In this case it is expected to make an opening in the back shed to allow access to the third pile, install three PVC walls, one at the front opening, to fix the overlapping from external secondary contacts and from weathering. The refining stage of manure requires an adequate aggregation ventilation, provided by the side openings in the warehouse. The investment prospectus is reported in Table 1.

TABLE 1 **Investment prospectus**

	Investment (€)	**Amortization term (years)**	**Annual fee amortization (constant) (€ / year)**
Door opening	409	/	/
Moving walls and rear door	25.277	5	5055,4
Mosquito nets	2.375	/	/
Total	28.061		

The operational costs are: labour, maintenance, energy consumption, transport. The average amount of transported material is 1476 t/y for a total cost for transport of about 18.450 €/y in the case B2C; B2B is without transport. The commercial price for the PAV manure was assumed at 20 €/kg PAV with the treatment of 1845 t/y. All operative costs are reported in table 2; about transport costs, for project assessment, the previous costs are emended by the costs that farmers would pay to send dejections to manure soils.

TABLE 2 **Operational costs**

Operational costs	**B2C €/y**	**B2B €/y**
Labour	15.000	15.000
Energy and maintenance	300	300
Transport (B2C)	6.642	
Transport (B2B)		-11.808
PAV material	11070	11070

General costs are related with administrative fees, laboratory analysis costs, marketing promotion, etc. In table 3 all the general costs are summarized.

TABLE 3 **General costs**

General costs	**Amount**
Subscribing to register	1.000 € (first year)
Analysis	1.000 €/y
Administrative and Commercial (B2C)	18.000 €/y
Administrative (B2B)	10.000 €/y
Promotion	2.500 € first year
	700 € other years
Trade Mark Creation and registration	1.500 € first year
	80 € other years

The PAV manure (in an estimated quantity of 1.476 t) can be sold at 85 €/t in case of B2C, included transport, and at 60 €/t in case B2B (Dall'Ara, 2010). In table 4 the yearly proceeds are presented.

TABLE 4 **Obtained yearly proceeds**

Obtained yearly proceeds	Amount (€)
B2C	125.460
B2B	88.560

3 RESULTS AND DISCUSSION

In Table 5 the assumptions used for the NPV implementation are reported. NPV is calculated on the basis of costs and incomes related to operational management and investments (buildings and equipment) which can generate amortization. We specifically considered all the discounted cash flows in a 5-year period as a time horizon of the project for the two options. For the NPV determination a PAV cost of 20 € / kg (minimum price) was used. Through a series of tests, it can be observed that even if the price of PAV increased to 25 or 30 € / kg, the NPV of the project (both in the case in B2B and B2C) would still be positive.

TABLE 5 **Net Present Value (NPV) calculation assumptions**

Project time	5 years
Expected production	1845 t/y
Expected marketing	1476 t/y
Production period	168 days (123 +45 for pile formation)
Processing time	6 piles in the first year and three in the second year Marketing during Jul/Aug/Sept and Feb/Mar/Apr
PAV/pile dose	0,3 kg PAV/t manure
finished product storage and transport	Storage on farm and offered transport in case of B2C
Storage	A barn for 3 manure piles
Amount of not treated manure	886 t/year
Discount rate	0,05
Sale Format	In bulk

Results: NPV = 136.876 euro in case of Business to Consumer (B2C)
Results: NPV = 114.255 euro in case of Business to Business (B2B)

In the second step it was assumed that besides the production of PAV manure in bulk, the other 886 t manure are treated in big-bag and marketed. The manure is inserted by conveyor belts directly into big-bags, where, after 120 days of maturation to ensure quality and sanitation, it becomes marketable fertilizer. The largest investments are related to the investment in the a big-bag filling machine and a warehouse storage construction as above mentioned. The assumptions used as reference for the implementation of NPV are reported in Table 6.
Results: VAN in case B2C = 20.353,35 euro; VAN in case B2B = 4.071,09 euro

4 CONCLUSIONS

The present assessment is a preliminary approach, useful to provide practical and operational guidance. Economic theory argues that the prospectus forecast of net present value represents the most rigorous and reliable method for evaluating an investment. Where the NPV is greater than 0 the project should be accepted because it produces economic benefit. The NPV of step 1 is positive in both cases (B2C and B2B) which indicates that the production of PAV manure is beneficiall for breeding farms. Even if the product is packed in big bags and sold, NPV is positive but with very small margin: the main limitation is represented by the cost of warehouse storage of big bags.

The economic evaluation of the project can became even more higher: maybe it is possible to reduce refining time to 90 days instead of 120. This would reduce downtime in the production process and the losses for mineralization during maturation and would then increase the amount of PAV manure (weight) and proceeds.

Furthermore a lower price was awarded which doesn't reflect its fertilizer qualities (in particular the presence of slow release Nitrogen).

Thus the production situation can only get better than that analyzed, with a consequent increase in the amount of NPV. Apart from an economic assessment, it is important to emphasize that the development of a natural material utilisation , resulting from the use organic products rich in nutrients, provides a new valuable tool to the world community to combat the depletion of soil fertility and desertification, an issue that involves not only developing countries but also industrialized nations, which increasingly should be committed to preserving their natural resources, rather than oriented to their depletion, thus altering the equilibrium consumption-regeneration of terrestrial ecosystem.

TABLE 6 **Net Present Value (NPV) calculation assumptions in step II**

Project time	7 years
Expected production	1470 big-bag/y
Expected marketing	1470 big-bag/y
Production period	123 days
Processing time	2,5 hours/big bag and 15 big-bag/year
PAV/big bag	0,8 kg
Finished product storage and transport	Storage on farm and offered transport in B2C case
Storage	Warehouse construction
Discount rate	0,05
Sale Format	Big-bag

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