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Cattle fattening: The Italian example

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SUMMARY - Beef cattle production systems are widely adopted on large stock farms (from 500 to 5,000 animals) in northern Italy and are characterized by advanced technology and a strong entrepreneurial altitude. The animals used are predominantly young bulls (6-8 months of age). After being imported, they are reared in stables on slatted floors with tanks underneath for slurry collection. They are subjected to prophylaxis and consume a diet based on maize silage. All these technical aspects are investigated experimentally in order to find solutions capable of improving the overall efficiency of the system. In spite of the current difficulties in the beef sector due to a fall in consumption, the Italian fattening centres remain competitive due to the growing professionalism of the stock farmers.

Key words: Cattle fattening, slatted floor, maize silage.

RESUME - "Engraissement des bovins : L'exemple italien". Les systèmes pour engraisser les bovins sont pour la plupart répandus dans le nord de l'Italie, où la taille des élevages est de plus grande échelle (de 500 à 5 000 têtes de bétail). Ces systèmes sont caractérisés par un apport technologique élevé et par un fort esprit d'entreprise. Les bovins utilisés sont des broutards (âgés de 6 à 8 mois) importés, élevés sur caillebotis avec bassin inférieur de collecte des déjections ; les animaux reçoivent des traitements prophylactiques et une alimentation à base de maïs ensilé. Tous ces aspects techniques font l'objet d'études expérimentales visant à mettre au point des solutions qui permettent d'optimiser globalement le système. Le secteur de la viande bovine traverse actuellement une période de crise due à la diminution de la consommation ; toutefois, les centres d'engraissement italiens restent actifs grâce au niveau de qualification sans cesse croissant des éleveurs.

Mots-clés : Engraissement bovin, caillebotis, maïs ensilé.

Introduction

Many aspects of beef production have seen considerable technological evolution over the last twenty years: stock farm location, marketing of the animals, housing system, feeding, health control, etc. Italy is a highly representative example, in this sense, because the change in mentality has been even more radical than advances in technology. In the past, beef production was practically a by-product of the breeding of dairy cattle and work purposes, an activity that enjoyed widespread distribution throughout the country for reasons mainly connected with soil fertility. Today production is concentrated in a small number of large and highly specialized stock farms that are run according to distinctly entrepreneurial criteria. This innovative process first began towards the mid-1970s and led to the development of the new-style farms either private enterprises or co-operatives more or less throughout the entire country but with a prevalence in the northern regions. Just a few years later, however, the farms still operating were those run as private concerns in the Po valley accounting for about 40% of the total bovine meat production. The concentration of the activity in this area is due firstly to the fact that environmental conditions (climate and soil) are very favourable for the production of maize silage, the basic forage for beef cattle, and secondly to the existence of numerous farms of considerable dimensions (100 ha and above) suitable for intensive farming. The failure of the co-operatives was due on the one hand to the lower availability of public money, and on the other to difficulties of a bureaucratic nature which slowed decision-making processes.

The philosophy of the fattening centres

Beef cattle production is run as an independent activity within farms. It can be expanded or shut down without substantially affecting routine farm administration (Giardini and Vecchietini, 1981; Vecchietini and Gaspari, 1985; Vecchietini, 1987). Beef production is virtually an industrial activity.

The young animals, which transform feed and are the end product of the process, are: (i) obtained from various sources, mostly abroad; (ii) reared in stables that require very little in terms of capital investment and/or labour; (iii) fed with well-balanced diets, which are continuously adapted according to cost and availability of the various components and are varied to produce animals that meet the changing needs of the market; and (iv) subjected to selective prophylaxis and therapy in order to keep losses due to health problems within acceptable limits.

The only true link between stock farms and the land is the need to recycle manure.

Fattening animals

Animals for fattening are usually young bulls imported primarily from EU countries (especially France), but also from outside the EU (mainly Poland). However, there are cases where sucking calves are either weaned on the same farm where they are fattened, or more frequently are contracted out for weaning to small family-run farms (to reduce labour costs) or to "weaning centres" in the countries of origin of the animals (to lower health risks).

An aspect that has always caused concern is the assumed fragility of a production system that depends on foreign countries to supply the young animals. Experience of the past twenty years has shown that these fears are ungrounded. In any case, economic conditions in Italy at present are not suitable for the rearing of breeding cows to supply the fattening centres with calves. There is considerable justification in stating that co-operation between the French, Polish, Irish, etc., cow breeders and the Italian calf fattening centres is one of the most successful examples of the creation of a common agricultural market.

Another important factor concerns cattle breeds. For a long time there was much discussion over whether it was preferable to select beef cattle breeds (Limousine, Charolaise, etc.), dairy breeds (Friesian), or crosses. Beef breeds provide the maximum return on feed and facilities as a result of the greater commercial value of live weight gain, but on the other hand the calves are more expensive (being the only product of the cow). Dairy breeds have the opposite advantages and disadvantages, while crosses give intermediate results (Vecchietini, 1989; Giardini, 1993). In reality, as the most acute observers predicted, market results have proved that there is room for all categories of animals. And indeed production covers Charolaise and Limousine on the one hand and Polish Friesians on the other. Likewise consumers prefer meat of both breeds. In any case, as long as it is possible to offset the difference in commercial value of mature animals with the cost of the young animals, there will be room for all breeds.

Although forecasts are difficult, in the future it appears likely that there will be a shift towards the rearing of dairy cattle, principally because the male calf is in a certain sense a by-product of dairy production and therefore has a low initial value. This is a very broad issue that goes beyond the scope of this paper and involves such complex subjects as morphology and productivity of dairy cattle, and consequently the relationship between milk and meat production and EU policies regarding the rearing of "white meat" calves fed on powdered milk.

The aspect of "meat quality" in a certain way is linked to the animals chosen for fattening. The general opinion on this matter vary widely and often betray considerable confusion. "good quality" means first and foremost the production of meat free of harmful or illegal substances (antibiotics, hormones and other growth stimulants) and having nutritional characteristics adequate for human requirements.

However, marketing practices may effect the type of cuts on the carcass weight or the size of the sides, which determines sizing of pre-packed portions for large-scale distribution, etc., or even the promotional requirements (i.e., protection of "labels" that guarantee certain production systems) and, last but not least, the consumer taste, which is notoriously variable, especially as regards colour, tenderness and presence of veined fat (i.e., in Florence consumers like meat with characteristics that would be barely satisfactory in Milan and unacceptable in Naples).

The different quality aspects we have mentioned are both depending on genotype and nutrition: early breeds produce animals that are ready for slaughter at a young age and with relatively low

weights, and likewise high-energy diets result in the animals maturing more rapidly. Clearly all choices that influence meat quality likewise affect other technical parameters (i.e., feed efficiency) and economic factors (i.e., incidence of initial cost of the calf on gain). It is easy to understand how difficult and fraught with dangers it is to attempt to control quality. Cattle breeders must have a high level of professional skills together with great sense of enterprise if they are not to suffer from the whims of a market where pretexts are often used as contractual tools. In order to overcome these obstacles, new contractual formulas are being created based on a commitment on the part of the cattle-breeder to provide the slaughterhouse with animals of well-defined and consistent characteristics (breed, weight and age at time of slaughter, fattens). This in turn ensures the continuous supply of a highly uniform product to large-scale distribution outlets and requires a high level of integration between the various segments of the production chain.

Housing system

The criteria used by beef cattle-breeders to decide which kinds of stables to use could not have been more complicated, and indeed a large number of extremely heterogeneous solutions have been adopted. All the systems have one thing in common: very little concern for the welfare of the animals in the conviction that the buildings to house the cattle had little importance and also any effect on their performance. In reality there is a lack of research which would allow for a real analysis of the various factors involved, perhaps because this type of investigation would be long, difficult and expensive. For this reason the choices made in this sector are still based on the experiences of individual breeders and tend to be highly empirical. The predominant trends are to invest little capital or to keep management costs as low as possible.

The first solution to be adopted was open housing, which requires the free administering of feed to meet nutritive requirements of all the animals. Buildings which are widely used differ mainly for the types of floors, which are either in concrete or are slatted with a tank underneath for effluents collection. With concrete, construction expenses are relatively low and there is little incidence of hoof disease, but litter is required so manure handling becomes very expensive. With slatted floors the opposite tends to be the case. In stables with slatted floors the animals are reared in conditions of high density (0.4-0.5 m² of surface for each 100 kg of live weight) in order to ensure a rapid return on investments.

Stables with slatted floors are always covered, largely to prevent rainwater from entering the effluent tanks. Stables with concrete floors can be either uncovered or covered, and the concrete floor may sometimes be limited to a 1.8-2.5 m strip running parallel to the feed-trough. There are also examples of stables similar to American feed-lots. For each of these basic solutions exist numerous variants. Often many different solutions are adopted on the same farm, partly due to the uncertainty that abounds in the sector and partly to the different degrees of adaptability of the animals to the rearing conditions. Animals belonging to breeds that reach high weights on maturity and animals that have in the past been reared on pasture appear to tolerate slatted floors less than lighter animals which have always lived in stables.

Out of such a broad array of solutions, the closed stable with slatted floor appears to be the one that has been most widely adopted. There are several types of construction, from simple roofs covering the boxes to enormous buildings that contain the boxes. The latter are clearly more expensive and have proved the least efficient, because amortization bears heavily on management costs. In most cases they have been built with public money applied for by co-operatives and are the end result of the bureaucratic philosophy that buildings constructed with state resources must be solid enough to last for many decades.

In our view the solutions we have described do not represent a satisfactory final result, but simply an intermediate stage in the process of farm modernization, a stage that has superseded the old-style small masonry stables with chained-up animals, where construction and management costs would now be unfeasible. Today there is a need for further progress, for building solutions and general husbandry principles that better meet the animals' physical and psychological needs. Public opinion calls for it and on-site observations tend to indicate that improvements in farming conditions could give higher levels of production and economic benefits. Farm size, type of stables, box size (surface area per animal), size of groups and human-animal relations are subjects that have perhaps not been

taken into sufficient consideration in the past, but which will almost certainly be the most important testing ground for beef cattle breeders of the year 2000.

Feeding

The fattening calf is a biological machine that converts feedstuffs into animal products. Its production life is short, so it is generally able to withstand strong production stimuli without suffering undue damage, in other words excess nutrition levels capable of ensuring maximum growth rate. The breeder must choose a growth rate by striking a balance between the cost of feed and the price of meat. The following aspects should also be taken into consideration:

(i) Above a certain nutritional level the effectiveness of the additional energy falls as the administered quantity increases (law of diminishing returns).

(ii) Increasing the energy content of the diet shortens the life of the animal, which becomes mature at a relatively young age (affecting the quality of the meat) and at a relatively low weight (with consequences on the ratio between purchased and produced weight).

It is in the feeding area that the professional skill of the breeder is the most important. Feed accounts for roughly two-thirds of the cost of meat production, and the breakdown of feed expenses shows that the largest portion of the cost is attributable to energy supplied (85-90% of the total) (Vecchietini *et al.*, 1995). This results in the following strategy: proteins, minerals and vitamins must be present in the diet in quantities sufficient to ensure the complete utilization of the energetic level the breeder chooses to give the animals. The main problem is to find economical energy sources: broadly speaking the lower the cost of the energy feedstuffs, the more advantageous it will be to increase the energy in the diet.

In Italy the primary feed used for beef cattle is maize silage and it is mainly for this reason that beef cattle farms are located in the areas favourable for maize growing (Vecchietini, 1993). Maize silage is obtained from a normal maize crop (with a density 1-3 plants/m² higher than average), which is harvested and stored in silos (in large trench silos) until the grain has reached a "waxy" maturity. This feed contains about 0.8 F.U. kg⁻¹ of dry matter, and energy level that is good but not sufficient to ensure acceptable performances. So in addition to protein, mineral and vitamin supplements, the diet must also be enriched with energy feedstuffs, principally cereals. The greater the ratio between the prices of the meat and cereals, the higher the optimum dosage of cereals.

An alternative to cereals for boosting the energy content of the diet is by-products of the agri-industry. These materials are becoming available in increasing quantities due to the boom in the agricultural product processing industry (sugar factories, starch factories, distilleries, fruit and vegetable processing plants). To be of real utility they must be cheap and relatively rich in energy. Great success has been achieved in Italy with the use of pressed sugar-beet pulp, which has an energy content (F.U. kg⁻¹ of dry matter) 30-40% higher than that of maize silage and an energy cost (lire F.U.⁻¹) of just half (Vecchietini *et al.*, 1994). The widespread adoption of these feed, which can represent up to 65-70% of the dry weight of the ration, has had the additional merit of breaking down the cultural barrier that prevented it from being thought possible that such a high-quality foodstuff as beef could be produced by animals fed on a by-product. This is leading to a kind of virtuous circle: the agri-industry exploits agricultural production, while cattle breeding makes use of the least valued by-product of the industrial process.

Health problems

Health control is one of the most problematical and least easily defined aspects of stock farming. Breeders often find themselves powerless in the face of unexpected and apparently unexplainable pathologies. Losses attributed to pathological conditions fluctuate around 10%, covering the sum of dead animals and those that have to be slaughtered prematurely, unachieved performances and veterinary and medical expenses.

Fattening calves are subject to all the diseases common to the species. However, due to the special nature of this farming practice, the most serious health problems concern the respiratory system, the hoof and metabolic disorders.

Respiratory infections strike the animals at the most vulnerable point in their life, on arriving at the farm after the severe strain of the journey. To protect against viral infection the animals are normally treated with vaccines of various kinds, which are continually upgraded to improve their range of action and efficacy. The animals can also be treated against bacteria with antibiotics and sulpha drugs.

In the fattening centres that use stables with slatted floors, injuries to the animals' hooves are a frequent occurrence, both in young animals during the initial adaptation period and in heavy mature individuals. These small injuries are generally caused by the floor and disturbances between animals, and can provide a gateway for bacterial infection. Furthermore it is believed that a low fibre diet can heighten susceptibility to disorders of the hoof region. To alleviate the consequences of this pathology, antibiotics are administered to control secondary bacterial infection and in the most severe cases the animals have to be transferred on litter.

Disorders of the digestive system can be caused by mistakes in the formulation of the diet, but very frequently are due to "calculated risks". They generally stem from a lack of crude fibre that is liable to arise when the energy content of the diet is increased in order to boost the performances of the animals. The cattle breeder has to strike a very fine balance: by reducing the fibre content, he promotes energy recovery, but at the same time places the animal's digestive system at risk. His objective is to reach the limit where potential risk is equal to potential benefit. This is a risky and ethically questionable business, but today is the factor that has the greatest influence on the competitiveness of the breeders.

Protection of the environment

On farms that use stables with concrete floor and litter, the manure left does not in practice cause pollution problems. With slatted floors, by contrast, effluents are considered by public opinion and legislators to pose a risk for the environment and health. This has led to the passing of strict legislation governing the handling of this manure. In one year an animal expels 8-10 tonnes of effluents, containing various pathogens (*Salmonella* spp., *Brucella* spp., *Escherichia coli*, etc.) and 0.3-0.4% nitrogen. In the Italian regions where beef cattle breeding is concentrated severe limits of live weight that can be reared per unit surface area available for the effluents spreading are adopted (2.5-4.0 t ha⁻¹). In some regions it is also mandatory to store the effluents in lagoons separated from the stable for a period of 3-6 months to reduce the microbial content.

In recent years the problem of manure disposal has come to the fore and is an issue that the entrepreneurial world is perhaps not culturally prepared to tackle. Research has not yet solved the problem concerning the relation between distribution of manure on fields (time-scales, quantities and methods, which depend amongst other things on soil and rainfall) and potential pollution of water tables with nitrates (Giardini and Vecchiellini, 1990). Legislators, more sensitive to the pressure of public opinion than to the needs of cattle breeders, have generally opted for restrictive legislation. There is an urgent need for an in-depth analysis of the situation to assess whether such restrictions are really consistent with environment protection.

Future prospects

A number of clouds hang over the future of Italian fattening centres. EU policies appear intent on favouring more and more small or medium-sized farms, located mainly in continental Europe. A key factor in the formulation of these policies is the declared need to safeguard the environment and the perhaps mistaken assumption that large farms equate to large polluters. Nonetheless, the Italian fattening centres are being run with increasing levels of professional skill and for this reason continue to be reasonably competitive.

All the points we have discussed must be continually kept up to date on the basis of cultural and technological development. First and foremost, the philosophy of intensive farming must be

re-examined with greater emphasis on the role of the animal. It would be good to refer to ethology to understand the behaviour of the animals reared and hence create the best compromise between their well-being and production requirements as a way to fully rationalize exploitation of animal by humans.

The various practical aspects of the farm (stables, feeding, health care) come under this general subject. This means it is necessary to decide on concerted action to make the most of all possible synergies. However, the most significant progress can be expected from attention to the animals, reducing the strain of travel and "environmental discomfort" by improving transport, stables and aggregation criteria. These innovations would certainly have direct and indirect positive effects, including improved health and performance of the animals and lower environmental impact of the farm. Unfortunately these interesting prospects are held back by a severe lack of research.

We cannot expect any major new developments in the nutrition sector. At present the most pressing requirement in this sector is to find low-cost energy feedstuffs; for this purpose it is very important to keep up to date with the list of by-products offered by the agri-industry and to verify their real nutritional value experimentally. Another plausible idea would be to concentrate on feed usage technology by controlling the fermentation process in the silos. Here too, research is still at an early stage.

Finally we should look at marketing. The link between meat production and distribution is calling for urgent attention. Of the three actors currently operating in the sector -breeder, slaughterhouse and distributor- one is perhaps unnecessary. It appears most reasonable to expect the first two to unite: either the breeders can join forces to run abattoirs and deal directly with the distributors, thereby orienting production towards the standards required by the market, or the large slaughterhouses can obtain the animals and rear them either directly or through agistment contracts. In Italy there have been examples of this kind, almost all of which have failed due to the low level of professionalism with which the breeders have tackled the slaughtering sector and the slaughterhouses the breeding sector. We must learn from the errors of the past, although we feel that integration between sectors is the only real way forward.

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