

PROCEEDINGS
APS SEMINAR 2006

FUTURE PRODUCTS
FOR THE AGRICULTURE
AND FISHERIES
SECTORS IN MALTA

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INTRODUCTION

The topic of the 2006 APS Bank Seminar held on 17 February was “Future Products for the Agriculture and Fisheries Sectors in Malta”. It was thought fit to deal with this subject in view of the ever increasing competition the two sectors are facing from abroad.

As has now become the practice, the seminar was organised in collaboration with the Ministry of Rural Affairs and the Environment and the Food and Agriculture Organisation of the United Nations, together with the Institute of Agriculture of the University of Malta and COPA-COGECA (EU). We are indebted to all of them for their active support and participation in what has now become one of the recognised annual events which focuses on the challenges in the local agriculture and fisheries sectors.

We had five speakers on this occasion who presented papers related to the chosen theme from diverse angles and promoted a number of ideas that could possibly be adopted. These included alternative livestock breeding, the growing of aromatic and medicinal plants and more selective ‘close to shore’ fishing.

The purpose of the APS Bank Annual Seminar is to create the awareness and instigate the required thinking process that should lead to the appropriate course of

action. The Bank is conscious of the fact that a half-day seminar cannot go much farther. This publication of the proceedings, however, creates a permanent record and gives the opportunity to broaden the debate.

I trust readers will have some thought provoking reading.

E. Cachia
Chief Executive Officer
APS BANK

Address of Welcome by E. P. Delia, Chairman APS Bank

FUTURE PRODUCTS FOR THE AGRICULTURE AND FISHERIES SECTORS IN MALTA

Honourable Minister, Excellencies, Ladies and Gentlemen,

On behalf of APS Bank, I welcome you to the Seventh APS Bank Annual Seminar on the Development of Agriculture and Fisheries in the Maltese Islands. Thank you for accepting our invitation. Your presence ensures an open discussion of the topic under consideration. It encourages us to continue organising this annual event.

These seminars focus on specific issues that influence directly the operators in the sectors of agriculture and fisheries. The preceding six encounters assessed the role of insurance and water supply in a competitive agricultural environment; the management of fisheries in the Mediterranean with the objective of rendering them sustainable; and the importance of dynamic and effective co-operatives in agriculture and fishing, a form of organisation on which farmers and fishermen relied for support and guidance to date. The contributions focused on the basics that had to be identified, addressed and/or strengthened prior to Malta's membership of the European Union.

Now that we have been members for almost two years, it is imperative that we focus on the way ahead; hence the

subject of this conference. A future competitive productive sector in agriculture and fisheries must account for the rather radical changes under way in which nations trade agricultural produce and in which people manage the seas with the aim of rendering them economically viable and naturally sustainable. The future composition of economic goods need not be identical to those in place today. Nor do the processes that generate these goods need be the same. We have to think in terms of a two-way process: strengthen the competitive edge of existing products and, at the same time, identify potential alternative products and channel resources in order to encourage their production. Unless this long-term vision is charted clearly for all operators to understand and act upon, the incentive schemes currently in place may not be conducive to the attainment of long-term goals. Instead, they will encourage a misallocation of resources, a continuation of misplaced initiatives with the possible outcome of the erosion of the economic base in agriculture and fisheries, and the survival of obsolete perceptions of best-behaviour practices.

The spatial dimensions of the Maltese Islands are given. In terms of agricultural usage, this constrained space may be re-dimensioned downwards unless the appropriate legislative measures regarding land use and the transfer of related property rights are conducive to a dynamic investment policy in land for agricultural purposes. Similar considerations refer to the exploitation of the marine resources. Such long-term development must be supported by an equally long-term oriented vision of the viable agriculture and marine set up that can promise reasonable rate of return to those who are prepared to undertake initiatives. At the same time, such economic activities have to account also to the long-term interest of society in these Islands and to the wider interests of the

European Union. One can even go further, and bring into the analytical scenario, the entire Mediterranean basin, since this region brings together all interested parties that are inter-related in a degree of free trade, with the option of increasing such integration. It is in this evolving economic context, that incorporates an ever-increasing sensitivity to environmental considerations, that agriculture and fisheries in the Maltese Islands have to consider their long-term development and growth.

To guide this audience – and other readers later on once the proceedings are published – we are pleased to have a group of speakers who can draw on their vast experience and develop the themes under discussion. Mr. Peter Griffiee, from the FAO, will be reviewing the work being carried out on alternative crops and cultivars. It is important to locate the local strategies in the context of international research with the aim of gaining inspiration from such work and, hopefully, contributing to its enhancement. Mr. Gabriel Trenzado Falcón, representing COPA-COGECA, will address the EU dimension, as reflected in a revamped Common Agriculture Policy in a revitalized World Trade agreement. He will explore the responsibilities of those organisations that coordinate resource use in this sector.

In turn, three Maltese speakers coming from the Institute of Agriculture, of the University of Malta, and from the Malta Centre for Fisheries Studies, will present their views on possibilities for future development. Mr George Attard considers alternatives for Maltese livestock; Mr. Everaldo Attard assesses the role of aromatic and medicinal plants in a competitive future agriculture in these Islands; and Mr. Matthew Camilleri queries the future prospects for artisanal fisheries.

I thank both the speakers for accepting to share their views with us, and the organisations to which they are

attached for supporting today's initiative. Without their contributions today's seminar would have been the poorer. APS Bank is also indebted to the former representative of Malta to the FAO, Mr. Abraham Borg, and to the present representative, Mr. Pierre Hili. They were always ready to discuss the projects proposed by the Bank and support them. Our thanks also go to the Ministry of Rural Affairs and the Environment for their constant collaboration and to the Honourable Minister Mr. George Pullicino who accepted to open this symposium and spell out Government's views on this subject.

I now invite the Honourable Minister to present his address.

OPENING SPEECH BY
THE HON. GEORGE PULLICINO,
MINISTER FOR RURAL AFFAIRS AND
THE ENVIRONMENT

Mr Chairman, Distinguished guests, Ladies and Gentlemen,

It is indeed an honour for me to open this seminar organised by APS Bank. This seminar is one of the initiatives taken by the Bank which benefit the local agriculture and fisheries sectors.

I would like to take this opportunity to thank the Bank for its continuous collaboration with my Ministry's Departments.

Turning onto today's theme, the trend of producing alternative crops throughout has become more attractive to the farmer during the last few years. The various factors that have stimulated interest in crop diversification in recent years include commodity price instability, increased pesticide-resistance in pests, and losses in genetic biodiversity. At the same time, consumer dietary changes have generated new markets for alternative food products.

The same tendency was seen locally. It is evident that the local market is expanding for diverse and alternative products. This is providing increased opportunities to market non-conventional crops. Nevertheless,

diversification is still in its early stages and practised by a few. More farmers are to be encouraged to embark onto alternative cropping as a buffer against traditional crops to counteract against a possible decrease or shift in demand of local traditional crops.

Alternative crops provide a number of advantages both from the production and marketing point of view. Apart from the fact that alternative crops can command higher prices due to the scarcity of the product on the market, diversifying can spread farmers' economic risk and exploit different niche markets. Over and above, alternative crops can soften impacts on environmental resources. These can be added to a rotation to break up insect pest, weed and disease cycles, to scavenge nutrients for other crops and/or to improve soil structure and fertility.

Furthermore, direct marketing of alternative crops creates local opportunities to process, package or sell new products. Through producers' organisations, farmers can invest jointly to process and market such products. Specific operational programmes presented by producers' organisations can be also financially assisted through EU funds.

The Ministry for Rural Affairs and the Environment is aware that experimenting with an alternative crop involves both risks and opportunities, from both the production and the marketing standpoints. Farm diversification using alternative crops requires considerable research and planning, from assessing available resources, to selecting potentially feasible crops, to exploring the crop market.

The need for more focused research in this area has also been felt by the Ministry. Research activities are being carried out within the Research and Development Centre at Għammieri. Among others, trials on the cultivation of medicinal and aromatic plants are ongoing. These trials are necessary not only to help the Ministry give better

extension advice to the growers on such practices, but also to help the same growers to see the impacts, benefits and risks of such alternative systems and crops.

Identification and valuation of indigenous vegetables and fruit varieties is also being carried out. A number of EU-funded projects have included the clonal and sanitary selection and characterisation of local clones. The selection of such indigenous clones will not only help the conservation of local germplasm but will offer alternative varieties that can be cultivated.

Malta's fishing industry has also been facing new challenges over recent years, particularly since our country's accession to the European Union. Securing a balance between modernisation of our fleet, sustainable management of our fisheries resources and the safeguarding of the artisanal characteristics of Maltese fisheries has called for careful planning and responsible decision-taking which will shape the future of the industry.

The competition between the Maltese fishing fleet and the more industrial-type foreign fleets, fishing in the central Mediterranean is a reality which must be addressed and the Government is committed to safeguard the interest of our fishermen through legal and financial instruments of the EU and regional fisheries management organisations such as the General Fisheries Commission for the Mediterranean (GFCM) and the International Commission for the Conservation of Atlantic Tunas (ICCAT). It is also essential, however, that fishermen seek to promote their quality products and adopt new marketing strategies, and in this the Government can also assume an assisting role.

From the outset of accession negotiations with the EU, Malta clearly stated that it was culturally and socially important to protect local fisheries, which are predominantly artisanal, and that from an environmental point of view

no increase in fishing effort within the 25-mile fisheries management zone should be allowed.

As you well know, Malta was successful in maintaining this zone on the basis of scientific evidence which demonstrated the presence of essential fish habitats within the zone and a sustainable fisheries exploitation rate. This was a bright start but it must be supplemented by further efforts from the fishermen themselves to reap the benefits from opportunities offered by the EU and coordinated by Government to alleviate the struggles being experienced by the industry.

Though limited, Malta's coastal zone is a valuable resource for several stakeholders and thus the interest of all must be considered in management plans. The artisanal fisheries community is practically dependent on the coastal zone and I can assure you that Government's policy is to assign a high stakeholder status to this community in the ongoing process of the development of a sustainable use management strategy for the coastal zone.

I firmly believe in the coexistence of marine protected areas and artisanal fishing, with fishermen being directly involved in the establishment of such areas which would ultimately enhance their catches. The intimate relationship of Maltese fisheries with tourism and the quality catering industry also lays down criteria for a strategy to continue upgrading Malta's coastline tourist facilities and attractions whilst boosting the fisheries sector. In addition, it is of utmost importance that large scale fishing and aquaculture continue to develop in harmony with artisanal fishing with a common goal – to exploit our marine resources in a sustainable manner with environmental, socio-economic and cultural considerations.

In conclusion, I feel that the Maltese agriculture and fisheries produce need to be given the identity they deserve.

We must portray ourselves to the rest of Europe as a country which has successfully managed its resources, conserved its traditional methods, developed our sectors in a sustainable manner and responded to the ever increasing demand for a variety of high-quality produce. We only need to make strides forward to market this product both locally and on the continent, as has been done with some of products already, in order to guarantee a bright future for these two sensitive, yet important sectors.

I wish you all a fruitful seminar.

Thank you.

FAO'S GLOBAL WORK ON ALTERNATIVE CROPS AND CULTIVARS

This article reviews FAO's global work on alternative crops and cultivars. It also provides references to internet tools that facilitate the spread of knowledge about FAO's research programmes and the emerging results. Besides, it considers two species that may be cultivated more intensively in the Maltese Islands. It has to be recalled that it is the economics of markets, legislation and the sensitivity to needs that will determine the way forward for research and development in the various regions.

FAO's global research work

The development of new cultivars or the promotion of alternative or underutilised crops, couple with new agricultural enterprises, offer potential benefits to those who produce them and also to those who ultimately consume them. Farmers are given an opportunity to diversify their farming systems thereby reducing their reliance on a few established crops or businesses. Research widens the potential for output creation and, as a result, the possibility of enhancing incomes and sustainable

economic growth in many agricultural regions. Following a decline in market prices for many established crops in recent years, farmers must be given the opportunity to replace existing production with a wider range of crops or/and novel cultivars. It is only in this way that economic and social security, as well as health prospects, can be made a realisable option for many.

The FAO classifies the following commodities as Industrial Crops. These are annual/ semi-perennial or perennial oils, beverages, bio-fuels, colourants, control plants, dye and tanning, elastomers, fertilizer plants, fibers, gums and resins, poisons, herbs and spices, medicinal and aromatic plants, starches, stimulants, sweeteners and waxes. In addition, there are the ever-increasing industrial markets for molecules from all plant commodities.

FAO traces the performance in these commodity groups by many internal or serious external enquiries every week either through clients or through projects. The crops underlined in the preceding paragraph are the most demand-driven. Examples of the utility of ongoing research are given below.

Oil Palm

The discovery of cold-tolerance in oil palm (an alternative cultivar) has opened up diversification in the highlands of many countries where rainfall is often more advantageous. In West Kenya, for example, sugar companies can now establish oil palm at 1500 meters above sea level. They are less exposed to low sugar prices. Besides, smallholders have access to healthy, red palm oil that is a source of vitamin A and E and that can be used for cooking. Smallholders also generate income through soap making.

Sweet sorghum

Due to the discovery of male sterility in sweet sorghum, researchers in China developed saline and drought-tolerant cultivars for the production of feed and fuel (ethanol) with very high biomass yields. A technical cooperation programme that the FAO supported produced the first ethanol as an alternative product in China.

Rubber

In the Federal Democratic Republic of Ethiopia, attempts were made to diversify agriculture from its main export crop, coffee, to other crops that could replace imports of industrial raw material. To achieve this end, rubber (an alternative crop) was introduced into depressed coffee plantations in the western highlands. In 2001, Ethiopia produced its first Smoked Sheet rubber alongside 45.5 hectare of rubber around Bebeke.

Coconut

Due to low copra prices, alternative products are being developed in coconut. Coconut has a very serious problem in the lack of cultivar resistance to the lethal yellowing disease, a mycoplasma-like organism. Research has successfully produced an organic soap from cold-pressed coconut oil ('virgin coconut oil').

Coffee

Depressed market for coffee hit Asian producers hard. FAO successfully worked on ochratoxin removal and quality coffee products for the local market. These research programmes resulted in coffee manuals for Myanmar and Laos,

Pepper

FAO's projects resulted in a production guide for quality pepper products that are grown following good agricultural practices.

Artemisia Annua

Work is being carried out on the anti-malarial *Artemisia annua*. This plant may be considered both as an underutilized species and also as a cultivar. FAO and the WHO so far produced a monograph on this plant, *Artemisia annua: the plant, production, processing and medicinal applications*.

In short, FAO's research is ongoing. It covers the underlying work necessary to identify the qualities and marketing potential of the many plants under study, which work is published to lay the ground for further development. Following this initial stage, work can be undertaken by FAO or by other interested parties to take development further either by developing new strains or even by identifying and producing new commodities.

Indeed, FAO is particularly involved with organic production of medicinal and aromatic and dye plants for domestic and export markets in various countries. FAO contributed to the WHO monograph on Good Agricultural and Collection Practices for Medicinal Plants. FAO published *GAP for Robusta Coffee in Thailand*; the publication on *Artemisia Annua* referred to above has a section on GAP and the audit trail. Besides, FAO encourages conservation agriculture, particularly minimum tillage systems.

FAO's work on alternatives via the Internet

There are several internet tools that can be utilised to gain information on the work being carried out by the FAO on alternative crops and cultivars. These are described below.

i. Ecocrop (FAO) – <http://ecocrop.fao.org>

Ecocrop can be applied to four principal tasks. It can:

- Identify plants for a specified environment
- Find plants for a defined use
- Identify plants with a specific growth habit
- Look up the environmental requirements and uses of a given species

Go to URL [http://ecocrop.fao.org/GPPIS.exe\\$EC_SearchStart](http://ecocrop.fao.org/GPPIS.exe$EC_SearchStart) and fill in the description, localised ecological data and uses fields. Then choose the number of plants and 'load search'. In a test using some Malta summer environment data only with a pH restriction (no description or use), 223 plants were found. Refining this by entering a salinity data restriction, the result was reduced to 83 plants. This was a 'rough' test and, evidently, more accurate data need to be entered in real time. Besides, this test gives only a list of species. Given the limited Maltese potential, as explained below, then other restrictions take precedence.

ii. EcoPort (Foundation) – <http://ecoport.org>

The following is the mission statement of the EcoPort Foundation.

Whereas we believe that:

- Individual responsibility and local action are the critical and primary requirements for effective and sustainable management of natural resources;

- Custody and stewardship require ecological knowledge to shape the values and convictions that inform the decisions that determine our common future;
- Creating knowledge of ecology requires a continuous process of integration of personal experience and self-educating action communicated and expressed through the dynamics that build community; and that
- Open, unfettered access to information and procedures to share information are essential for the personal empowerment required to drive and inform policy decisions and implementation at all levels.

It is our Mission and Pledge to:

- Establish and sustain a “Knowledge Commons” where individuals and communities can work and learn together to develop sustainable ways to manage the Earth’s natural resources;
- Facilitate access to information through a public service that will enable participants to own and update the knowledge created by their collective effort through application of EcoPort’s procedures;
- Promote the availability and use of EcoPort’s information and procedures as a Global Public Good to provide education to communities and individuals engaged in natural resources management and conservation; and to
- Make provision to ensure data quality through peer review and to preserve and display individual ownership of shared information.

After entering through the splash page, search for, say, plant entities by inserting the scientific or common name. Searchers can obtain data on the species’ description, ecology, agronomy and so on.

iii) FAO Internet Services

The Codex Alimentarius Commission was set up in 1963 by FAO and WHO to develop food standards, guidelines and related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme. The main purposes of this programme are protecting health of the consumers and ensuring fair trade practices in the food trade, and promoting co-ordination of all food standards work undertaken by international governmental and non-governmental organizations. Information on this programme may be accessed at: http://www/codexalimentarius.net/web/index_en.jsp#

The International Portal on Food Safety, Animal and Plant Health facilitates trade in food and agriculture products and supports the implementation of the Sanitary and Phytosanitary (SPS) Agreement by providing a single access point for authorised official international and national information across the sectors of food safety, animal and plant health. It can be accessed at <http://www.ipsaph.org/Eng/default.jsp>.

The IPPC is an international treaty to secure action to prevent the spread and introduction of pests of plants and plant products, and to promote appropriate measures for their control. It is governed by the Interim Committee on Phytosanitary Measures (ICPM) that adopts International Standards for Phytosanitary Measures (ISPMs). The ICPM established the IPP as the forum for national reporting and exchange of more general activities of the Convention. It is hosted by the FAO. Information of the IPPC is found at <http://www.ippc.int/IPP/En/default.jsp>.

The FAO Statistical Database is an on-line multilingual database currently containing over one million time-series records from over 210 countries and territories covering statistics on agriculture, nutrition, fisheries, forestry, food

aid, land use and population. The site is <http://faostat.fao.org/faostat/default.jsp?version=int&hasbulk=1>.

Very often, many get confused regarding the plant scientific names. The following databases are useful for checking such names:

w³TROPICOS <http://mobot.mobot.org/W3T/Search/vast.html>

Kew:ePIC <http://www.kew.org/epic/index.htm>

All Species
Foundation <http://www.all-species.org>

Legislative Considerations

There are several considerations regarding appropriate legislative aspects that have to be accounted for when considering alternative crops and cultivars. The following issues have to be assessed carefully before drafting such legislations.

- Threatened wild resources and Plant Genetic Resource(PGR) conservation
- Intellectual Property Rights
- Propagation sources and Pest Risk Analysis
- Labour; social responsibility (for example, the 'Fair' label)
- GACP (for example, EuropGAP and Integrated Plant Production and Protection – IPPM); establishing an audit trail
- The International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC – Map)
- Standards established by the World Trade Organisation; trade issues) CODEX and IPPC). To note especially the

CODEX's new General Standard for Food Additives (GSFA).

- European Union's regulations, both regional and national.

It is only after policy makers take account of these regulations and after they carry out a critical assessment of the respective markets in which agricultural and forestry products are to be exchanged that they can decide on the agricultural/forestry product mix to encourage for sale and/or for future development for environmental reasons.

The Maltese potential

The potential for alternative crop development and cultivation in the Maltese Islands is obviously limited by a series of factors. These constraints include the following:

- A very restricted availability of suitable agricultural land
- Water supply
- Competition, particularly from large and intensive foreign activities
- A low priority in the face of other, more lucrative, investments such as tourism
- Overseas market access and related regulatory systems.

We refer to two species that could be considered for expansion in the Maltese Islands, after assessing carefully the factors listed above.

(i) Capers

Caper is a deciduous dicotyledonous perennial subshrub grown for the flower buds. The plant may reach 1 to 1.5m when erect. However, uncultivated caper plants are more often seen hanging, draped and sprawling as they scramble over soil, rocks and stone walls, as seen in Malta. They are used as a condiment in salads and sauces or in the manufacture of cosmetics and medicines. The edible shoots are used as a vegetable.

(ii) Safflower

Safflower would grow well in Malta. It over-winters in the rosette stage and produces one of the healthiest plant oils. The seed is sold also as bird-seed. The petals are used for dyeing.

Summary

The range of potential cultivars, which can be exploited for commercial usage, is constrained by a series of factors. These factors are partly nature-made and partly man-made in the form of legislative rules that are made to either encourage the consumption – and hence the growth and development – of new plants and their uses or to inhibit such consumption and growth. It is the geography of a place and its proximity to markets that in the end will determine what should be developed and what should be laid aside. The determination of such a plant list is an outcome of extensive research and international collaboration apart from local undertaking. The FAO is contributing in various ways to such a collaborative search and is facilitating the dissemination of this growing knowledge through different means. The

paper listed in brief the on-going research and indicated several internet sites that can be accessed to obtain the information sought.

THE FUTURE OF AGRICULTURAL CO-OPERATIVES IN THE EUROPEAN UNION

Ladies and gentlemen, firstly, I would like to thank the APS Bank for the invitation which provides me with the opportunity to present, and debate with you, the situation of Agricultural Co-operatives in the EU vis-à-vis recent and up-coming political and market challenges.

Two years ago a colleague from COGECA participated at a seminar also organised by APS Bank, and explained with some degree of detail, the reality in EU farming co-operatives. Today the situation has not changed, but the needs and challenges are now bigger (*Norman Palmér, 2004*). A snapshot of the agricultural sector in the European Union may be observed in Table 1.

Table 1 Agriculture in the European Union

COGECA has recently updated a publication on European agricultural co-operatives and has, once more, recognised the difficulty of obtaining statistical and other data necessary to characterise the agricultural co-operative sector. This difficulty, already recognised by the European Commission, is even more relevant in the New Member States.

European agricultural co-operatives represent over 50% of agri-food industry in today's EU-25 (over 60% in EU-15). The available data (incomplete) shows a total number over 40,000 co-operatives (2003) with a global turnover volume that exceeds 260 billion Euros.

Table 2 Top 25 Agricultural Co-operatives in the European Union

In the 25 EU top-30 co-operatives, there are 8 French, 6 Dutch, 5 German, 3 Irish, 2 Finnish, 2 Danish, 2 Swedish, 1 Swedish-Danish, and 1 Austrian. There are none from Spain, Portugal, Greece, and Italy. The southern countries are not represented.

From the top-10 in agri-food, the first (Arla-foods) is Swedish-Danish (Milk & Dairy). The second is Danish (Meats). Two are Dutch (Milk & Dairy) and one is Irish (Milk & Dairy).

Table 1: Agriculture in the European Union, 2003

	Total Area (Km ²)	Population (‘000 inhabitants)	UAA (‘000 ha)	UAA per holding (ha)	Employment in agriculture (%) ^b	GVA/ GVP (%)
EU-25	3,973,200	453,683	163,479*	:	5,2	1,6
EU-15	3,234,627	379,483	130,004*	:	4,0	1,6
NMS	738,573	74,200	33,475*	:	:	:
<i>Belgium</i>	30,528	10,356	1,392	25,4	1,7	1,0
<i>Czech Republic</i>	78,865	10,203	3,674	66,9	4,5	1,1
<i>Denmark</i>	43,098	5,384	2,641	54,7	3,3	1,6
<i>Germany</i>	357,031	82,537	17,008	41,2	2,4	0,7
<i>Estonia</i>	45,227	1,356	796	21,6	6,3	2,2
<i>Greece</i>	131,957	11,018	3,897 ^a	:	16,3	5,4
<i>Spain</i>	504,880	40,683	25,270	:	5,6	3,6
<i>France</i>	549,087	59,629	29,430	45,3	4,3	2,0
<i>Ireland</i>	70,295	3,964	4,370	32,3	6,4	1,9
<i>Italy</i>	301,336	57,321	15,097	:	4,7	2,2
<i>Cyprus</i>	9,251	715	136	3,5	5,2	3,7
<i>Latvia</i>	64,589	2,332	1,582	10,2	14,6	2,1
<i>Lithuania</i>	65,300	3,463	2,531	9,1	18,7	2,6
<i>Luxemburg</i>	2,586	448	128	52,3	2,4	0,5
<i>Hungary</i>	93,034	10,142	5,865	5,6	5,4	2,7
<i>Malta</i>	316	397	11	1,0	2,5	1,6
<i>Netherlands</i>	35,525	16,193	1,924 ^a	23,5	2,7	2,0
<i>Austria</i>	83,858	8,067	3,374	:	5,5	1,2
<i>Poland</i>	312,685	38,219	16,136	7,0	18,2	2,3
<i>Portugal</i>	91,909	10,408	3,745	:	12,8	2,5
<i>Slovenia</i>	20,273	1,995	509	6,3	8,4	1,6
<i>Slovakia</i>	49,034	5,379	2,236	29,8	6,0	1,2
<i>Finland</i>	338,140	5,206	2,246	29,9	5,3	1,0
<i>Sweden</i>	450,295	8,941	3,129	46,1	2,5	0,6
<i>United Kingdom</i>	244,101	58,329	16,352 ^a	57,4	1,2	0,7

Source: "Agriculture in the European Union: Statistical and economic information 2004; European Commission, 2005

* - Estimate

: - data not available

a – data from 2002

b – Employment in agriculture, forestry, hunting and fishing sector, expressed as the share in employed civilian working population (%)

UAA – Utilised Agricultural Area.

GVA/GDP – Contribution of the Agricultural Gross Value Added to the Gross Domestic Product expressed in percentage.

NMS – New Member States (joined the EU on 01-05-2004): Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia.

Table 2: Top Twenty Five Agricultural Cooperatives in the European Union, Year 2003

(Indicator: turnover)

Name	Country	Activity / Sector	Turnover (b€)	Farmer members ('000)	Employees ('000)
1 Metsäliitto ⁽¹⁾	<i>FI</i>	Forestry	8,300	131,000	29,000
2 Bay Wa	<i>D</i>	Supplies	5,891	:	15,540
3 Arla Foods	<i>DK-S</i>	Dairy	5,460	6,600	7,000
4 Danish Crown	<i>DK</i>	Meats	5,420	19,700	18,000
5 Friesland Coberco Dairy Foods	<i>NL</i>	Dairy	4,575	11,000	18,005
6 KERRY	<i>IE</i>	Dairy	3,693	9,700	15,003
7 Campina	<i>NL</i>	Dairy	3,655	9,084	6,940
8 AGRAVIS	<i>D</i>	Supplies	3,380	:	4,000
9 Svenska Lantmänen	<i>S</i>	Cereals, Feedingstuffs	3,100	52,000	11,000
10 TERRENA	<i>F</i>	Supplies	2,973	27,500	9,900
11 Union IN VIVO	<i>F</i>	Cereals, Supplies	2,727	:	1,500
12 Humana Milchunion	<i>D</i>	Dairy	2,444	:	3,000
13 Nordmilch	<i>D</i>	Dairy	2,226	11,748	4,211
14 GLANBIA	<i>IE</i>	Dairy	2,110	18,663	6,963
15 SOCOPA	<i>F</i>	Meats (Beef)	1,930	:	6,100
16 FloraHolland	<i>NL</i>	Horticulture	1,919	3,996	2,287
17 DLG	<i>DK</i>	Supplies	1,880	23,500	2,000
18 SODIAAL	<i>F</i>	Dairy	1,870	13,000	7,700
19 Irish Dairy Board	<i>IE</i>	Dairy	1,791	0,070	2,903
20 TEREOS	<i>F</i>	Sugar	1,729	9,500	9,000
21 Valio-group	<i>FI</i>	Dairy	1,600	14,000	4,500
22 Bloemenvelling Aalsmeer	<i>NL</i>	Horticulture	1,598	3,245	1,848
23 The Greenery	<i>NL</i>	Horticulture	1,570	4,150	2,083
24 RWZ Rhein-Main	<i>D</i>	Supplies	1,543	:	2,710
25 RWA	<i>A</i>	Supplies	1,530	:	1,388

Notes:

:- Data not available

(1)- Forest owners' members rather than farmer members.

An initial analysis of the data from COGECA's publication gives us the first conclusion: there is no single European model of agricultural co-operatives.

We can clearly identify different trends of co-operative models in the EU 25.

In the Nordic Members States we can find a high degree of integration (achieved mostly through mergers), a very limited number of co-operatives, very big and highly specialised.

In Southern European Countries co-operatives are very atomised, with smaller dimension of trading structures, and integration is achieved through 2nd degree co-operatives.

In the New Member States the Co-operative model is either lagging behind in development or faces the results of past strategic choices.

Members and owners – the farmers – control co-operatives. The re-distribution to its members of the added value generated in the productive process is a function of every member's activities and deliveries and not (only) on the capital invested.

The basic Co-operative principles are democracy, social dimension and solidarity. They are, therefore, the only tool to improve the competitive and economic viability of many farm holdings in the EU whose dimension if operating alone would not secure, *per se*, market viability. The main Co-operative objective is to improve the production efficiency and life quality of their members – the farmers.

One of the current key concerns for co-operatives throughout Europe is the concentration process in the retail sector, with particular emphasis in the hard discounters which, through their operation push in a downward spiral the prices paid to their suppliers (including farmers

and their co-operatives). At the same time, concentration in the co-operative sector is not evolving at the same pace as our clients and competitors. Therefore, currently, we are facing a strong imbalance of power in our business relations with the retail sector.

For the time being, agricultural co-operatives are not involved in the retail sector, but that is a question that needs to be analysed critically.

To circumvent this issue and other difficulties, two main strategic trends can be identified in co-operative development:

- Mergers and specialisation for those co-operatives that aim at being global players (Northern EU countries), and;
- Alliances and diversification for those who target local markets (Southern EU countries).

An example of concentration is the German case. Relevant mergers occurred in sectors such as dairy and meats clearly pointing to three main areas of activity (6% of co-operatives have 75% of the total turnover).

- Processing co-operatives: they process their members' production and sell it directly to retailers (milk & dairy, meats, wine, fruit & vegetables).
- Co-operatives acting on the concentration of the produce and selling it to third parties (cereals, oilseeds, feeding stuffs).
- Supply co-operatives: supplying members and third parties (e.g. building material).

The farming sector and, in particular cooperatives, need to face new challenges posed by the CAP Reform.

Its main elements are based on:

- Single Farm Payment: abolishment of the link between production and support;
- Cross-compliance: respect of the statutory management

requirements and maintaining of agricultural land in good agricultural and environmental conditions, and;

- Modulation: Rural Development policy (the so called 2nd Pillar of the CAP) will receive funds from the Single Farm Payment.

The main element for concern is the impact of decoupling. CAP has shifted from an income guarantee tool to a framework where market forces are to operate more freely and therefore a concomitant reduction of prices and co-operative turnover is expected.

Some co-operatives are likely to lose part of their membership, for example, in Spain.

Other Member States (e.g. Italy), however, see this as a positive filter as, in the end, only the more motivated and market oriented farmers will remain.

Co-operatives must therefore play a more proactive and market oriented role than that demonstrated to date. Due to this, concentration to reduce costs and face the necessary investments is increasingly necessary.

Concerning the 2nd Pillar – Rural Development Policy – COGECA insists on its use as a major tool to improve the sectors' competitiveness and, in particular, for co-operatives to develop the added value of their products and engage in the "promotion" of second generation co-operatives.

The international market will play a mayor role in the development of the cooperative decisions. An increasingly globalised economy puts WTO negotiations in a pivotal role vis-à-vis the future of the European model of agriculture.

Various factors must be taken into account on those issues. Amongst them are:

- Market access: there is pressure on the EU to open up its frontiers to imports.

- Internal support: (Amber, Blue and Green Box). The 2003 and 2004 CAP Reform have put the 80% of the farming payments into the green box. However, even the definition of Green box is being questioned. CAP Reform must be respected.
- Export Subsidies: Export Restitutions and other equivalent measures. EU has taken the compromise in Hong Kong (December 2013) to terminate export restitutions in 2013 if other countries do the same on equivalent measures. Some European countries (Ireland, France and Denmark) have requested a longer transitional period.
- Non-Trade Concerns: Animal Welfare, Quality and protection of Denomination of Origins, Environment and Food Safety are strategic questions for the European producers to face the world competition. Those subjects are not being treated in the negotiations. The agenda is to agree negotiation modalities at the end of April 2006 and reach a general agreement by the end of this year in order to apply the agreement in January 2008. There are some elements that could encourage outcomes in the negotiations, especially the deadline for EEUU Fast Track that allows the EEUU Governments to get an agreement without the permission of the Congress. But negotiations are expected to be tough.

According to this scenario EU cooperatives are facing many challenges that could be identified as the following:

- To face market concentration and globalisation;
- To improve members' efficiency and life quality (the majority of which are small to medium farmers);
- To maintain co-operative control in farmers' hands and ensure an appropriate use of Second Pillar funds to finance the necessary investments;

- Research and Development and Investment;
- To guarantee generational change and evolution;
- Logistics has become a crucial element in the increasingly concentrated and globalised markets;
- To promote dimension increase and growth;
- To develop alliances both at national and trans-national level;
- To ensure an active participation in regional development;
- Food safety and security, traceability and quality;
- Improve the positioning in the food chain – processing – (thus adding added value to the members’ production), in the retail sector and in the diversification of activities (petrol stations, garden centres).

The list is certainly long, but the key question is not what to do but how to do it.

The main challenge is how co-operatives can organise themselves.

Is concentration or collaboration among co-operatives the way forward?

Should agricultural co-operatives go beyond national frontiers creating alliances with other European and non-European co-operatives?

Can we change the cooperative governance in order to be more efficient on the market while maintaining the social specificities at the same time?

Can we, and are we willing to, do that even if it means changing untouchable co-operative rules and principles?

The answer to those questions must open a debate in our organisations to find the best model for us.

The objective is not a mystery – to be competitive and place our members’ production in a sound place in a competitive and open market.

However, as frequently happens, we mistake the tool with the objective.

An agriculture co-operative is a tool for the farmer and we are forced to make it attractive and useful for both our members and their business.

Only if we are brave and flexible, can the co-operative movement find its own model throughout the enlarged EU and communicate it as an interesting and valid model of enterprise for the farmers, the society and, of course, the political class.

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ALTERNATIVE PRODUCTS BY THE LIVESTOCK SECTOR IN MALTA

Introduction

Malta became a member state within the European Union in May 2004. The Maltese agricultural sector now has access to one of the largest markets, but in return had to remove all sorts of protectionism from inbound European products. As we stand to-date, two years post membership, the livestock sector is expressing a lethargic attitude and portraying an air of despair and confusion. In evaluating the real extent of deterioration, one should separate the facts from perceptions of the present situation as compared to the real situation prior to accession.

Fortunately, several reliable comprehensive references are available. They include a comprehensive study entitled *Malta Agricultural Policy and EC Membership: Challenges and Opportunities* by FAO; *Animal Waste in Maltese Agriculture* by Peter Jackson; and *Census of Agriculture 2001* published by the National Statistics Office, Malta. FAO's project had the objective of carrying out an agricultural sector review aimed at the implementation of the new international and domestic policy changes necessary for eventual EU membership. The findings, with particular emphasis on

the proposal for dealing with key agricultural policy, were presented in the report.

The aim of this paper is to compare and contrast aspects of livestock production pre and post membership. Alternatives to meet the challenges and opportunities will also be suggested.

Main constraints

The boundary within which the livestock industry has to operate defines the parameters that limit animal production in Malta. These main constraints can be summed up as the 1) availability of land base, 2) availability of water suitable for livestock and crop production, 3) quantity and quality of feed and 4) production and disposal of manure.

As could very well be understood, since surface area is limited, pressure on land from the non-agricultural sector has caused the agricultural production base to decrease. Presently, about 11,620 hectares of different land classes are available for agriculture. Over the last few decades, part-time farmers were encouraged to contribute to agriculture resulting in a situation whereby presently less than 10% of farmers are full-timers permanently engaged in agriculture. This influx of part-timers, all wanting to cultivate their vegetable patch, has had a significant overall negative effect of the sector. The average farm size is 0.876 hectares and 45% of farms are between 0.1 and 0.5 hectare. Furthermore, the situation is further confounded with the nesting problems of ownership, fragmentation and the tenancy act. Following the transfer of Church-owned property to the State, Government became the largest landowner, possessing some 60% of the national territory. Farmers and individual landlords own the

remaining 40%. However, the farmer that tills it owns only a relatively small percentage, 19.5% of holdings. This structure of ownership has hardly changed over the years since the State is reluctant to sell. In addition, landlords tend to hold on to their property as a means of investment in the hope that someday their property might qualify for urban development. Farmers tend to divide their land equally amongst all their children in a way that each child gets an equal share of the land. Tenancy rights are inherited in similar manner to ownership and without obligation of informing the landlord. Land fragmentation very often leads to problems in relation to access roads, water share, agricultural investment and tenancy rights. Under this system of land tenure, farmers make productivity enhancing investment only in farmer owned land.

Summing up all the forces in play, one can easily conclude that the average farm of 0.876 hectares may 1) in whole or in part be property of third parties, 2) not be in one parcel of land, and 3) since the tenant is protected by the tenancy act, the tenant may be using farming as an excuse to retain access to the land for activities other than farming, very often related to hunting. This unique situation is of particular significance to the livestock sector. The super micro-scale of the production surface base is the main culprit for: 1) the evolution of highly dense, highly intensive production systems; 2) the huge challenge of manure storage and disposal, and 3) roughage production.

The small land-based animal production units are the main driver responsible for the evolution of the highly intensive livestock system. Very often complications of inadequate farm design, animal flow, lack of automation and high stocking densities are characteristics of the

average animal farm. Furthermore, manure storage, handling and disposal are challenges faced by the majority of production units. All these factors combined pose a serious threat to the general production efficiency, including animal health and welfare.

Since Malta lacks any form of permanent surface fresh water bodies, the majority of crops are fed by rain. The semi-arid nature of the islands is characterised by wet winters and hot, dry summers, with a predominance of rainfall during the month of October. Unfortunately, this pattern of precipitation provides moisture during a period when demand by crops is relatively low, i.e. when rate of plant growth is at its slowest. Conversely, when the potential for plant growth is high, natural moisture is almost completely absent. Furthermore, the high variability in rainfall patterns could have a drastic effect on crop quantity. On the other hand, fodder quality is significantly correlated to time of harvest. Taking sulla (*Hedysarium coronarium*) as an example, it reaches maximum nutritive values at 10% bloom, and hence should be harvested at this stage of maturity. In reality, this fodder crop is harvested at a much later stage, when the plant would have reached maximum bulk at the expense of nutritive value. The bulk would be highly lignified and the only nutritive parts i.e. the flower and leaves are so brittle that they snap off and are lost during harvesting. Only the highly lignified portion would eventually be harvested. Quality roughage is a fundamental prerequisite for efficient ruminant production.

These issues mentioned above summarise concisely one of the most fundamental problems confronting the livestock sector. These obstacles need to be tackled urgently by the competent authorities to establish solid foundations conducive to the proper development of a

sustainable livestock enterprise. Following such a reform, the livestock sector would not only survive, but also be in a position to capitalise on the fact that we are an island EU member state in the middle of the Mediterranean.

Livestock Sector Pre-Accession

The livestock industry in Malta pre-accession accounted for 65% of gross agricultural output. The main livestock enterprises were 1) dairy including cows, sheep and goats, 2) beef cattle, 3) swine, 4) poultry, and 5) rabbits. It is reported that at the time, Malta produced adequate pork, poultry and rabbit meat, and sufficient eggs to meet its requirements. This statement is not completely correct and should be viewed in the following manner. Commercially available balanced feeds are in their major part corn and soybean based. All cereals intended for human or livestock consumption are imported and the livestock industry depended completely on imported feeds. Imports amounted to the total feed requirement in the case of swine and poultry needs and 75-80% of requirements in the case of ruminants. Feed in the form of balanced compounded rations is available commercially from feed mills. Therefore the above statement should not be interpreted that Malta had at anytime achieved any level of food security, but rather it should be interpreted as having the capacity to transform imported cereals into animal products to meet national demand for meat and eggs.

The bulk of the milk produced by the dairy sector was processed as fresh liquid milk. Some 20% was transformed into rikotta cheese, yogurt, cream and other products. All the requirements of milk powder, condensed milk and

butter, and also the bulk of its cheese requirement were imported. The dairy industry also accounted for 30% of the beef consumed, supplying bulls at 15-18 months and beef from cull dairy cows. Sheep and goats gave a small contribution to the dairy sector too. Most were kept to produce milk for home consumption and for the production of cheeselets. Only a few flocks were licensed to sell milk. Licensed producers operated under a quota to supply milk. Since all milk is sold at the same price, the milk is not marketed separately. Some meat is produced from lambs and kids not required for replacements and from culled animals.

Locally produced pork accounted for one third of total meat consumption. The 160 pig farms operated under a quota system. The quota system did not create pressure on the swine industry to be more efficient in terms of sow performance or in growth efficiency since 16 market pigs per sow per year had a guaranteed market place and price. This industry had no competition and imports of pork for direct consumption were not possible. The total breeding herd amounted to about 7,600 sows and F1 breeding stock was obtained from local multipliers. Farmers may not have been aware of the potential production since no research on pig production was available. The main concern was to have sufficient pigs ready for market to meet the monthly quota allocation.

The poultry industry in Malta had started a development programme in the 60's to transform the traditional backyard system to the most modern system possible at the time. The facilities present on most farms poultry, namely buildings and equipment, were still those acquired during the 60's. Many buildings needed to be either redesigned or rebuilt. Similarly, many of the layer cage units needed replacement. No egg-grading system

was available and most eggs were sold loose. Facilities for chilling and grading eggs were very limited. Following developments of the egg sector in the 60's, a similar development programme was initiated on broilers. Malta had a total capacity of 5.5 million broilers per year. All day old chicks were hatched locally and some 80% of hatching eggs were imported.

Rabbit meat accounted for an estimated 8% of total meat consumption. Rabbit production was predominantly a backyard industry where in a significant number of cases, rabbits were produced to meet the needs of the immediate family. Breeds used in this system were of mixed genetic background with a significant incidence of inbreeding. Hybrids based on New Zealand White and California breeds are used on the few commercial run units.

The intensive production system coupled with the lack of on farm physical space makes it difficult to handle manure with all the animal dung and urine being concentrated in the buildings and yards. Manure from cattle, sheep and goats accounts for 60% of total manure production and pigs and poultry for 25% and 15 % respectively

Post-Accession Alternative Options

In analysing the impact of EU membership on the agricultural field, the FAO report states that the primary concern in the immediate future has to focus on how to achieve sustainable agriculture and rural development. Although the economic role of the sector has been quoted as being of minimal importance, agriculture still plays a major role in the offsetting of the negative effects of over urbanisation; in contributing to the protection and improvement of the quality of rural areas as both a habitat

and landscape. The foremost concern is to consolidate the performance of the livestock sector, with particular emphasis on retaining the land base for productive and ecological purposes. To achieve this consolidation the FAO report recommended the following measures: 1) review land tenure system and improve the management of land resources, 2) improvement in the management of water resources, 3) introduction of high yielding, cost effective and environmentally acceptable production techniques, and 4) improvement in the marketing of agri-products.

The key constraint to the livestock sector in Malta as discussed in the beginning of this paper is the unresolved land tenure and fragmentation issues. Land fragmentation very frequently leads to problems in relation to access roads, irrigation water, agriculture investments and tenancy rights. In view of the urgent need to improve the present system, the competent authority should propose a programme that would facilitate the acquisition of land through the purchase and ownership by those willing to invest as full time farmers. This reform will affect in particularly the level of technology applied to the production of annual and perennial crops, thereby indirectly affecting milk and meat production. The programme should promote the consolidation of small holdings and the access to the now larger more efficient parcels. This could result in a reduction in full time farmers and would permit those remaining to benefit through a reorganisation of holdings into economically-sized production units. This would also promote higher labour productivity and the employment and increased agricultural output. Following the reform, those that remain within the sector would have their main source of income from agriculture. Thus, the degree of commitment

would be much higher than that of a part-time farmer whose revenues depend on other sources.

It is generally acknowledged that the lack of sufficient quantities of good quality water is one of the most important factor that limits development in the agricultural sector. As already explained access to adequate land and water resources are fundamental for the utilisation of manure and the production of quality roughage. Presently, wheat constitutes the main cereal grown followed by barley and oats and small quantities of maize and millet. In the case of fodder legumes, sulla is the main crop grown. Part-time farmers grow most cereals and folder crops on non-irrigated land. In some cases part-time farmers employ labour for seeding and sell the crop either standing or in bales. Originally crop varieties were selected for early maturity, as the dry climate could induce shattering instead of ripening. Varieties are now being selected for long straw characteristics, since cultivation is solely for animal fodder production. The fact that cereal cultivation is predominantly done by part-time farmer reflects that in most cases these farmers are using the land for other non-agricultural related activities. Cereal cultivation is just an excuse to be covered by law and impede eviction.

Hydroponics grass production may be a suitable candidate. Commercially available "grass machines" are available on the market in a range of sizes and capacities. These units are essentially a small greenhouse structure, equipped with hydroponics and climate control equipment, where trays of seeds sprout and grow into green fodder in an 8-day cycle. Widely used in Australia as an insurance against drought, this technology could be applied here to overcome limitations in land and water resources. The system is capable of producing trays of green grass, around 20cm high, after only 8 days from

seeding. One kilogram of seed yields 6 - 10 kgs of green fodder. Since the system uses no medium of any sort, it means that the cattle get to eat not only the emergent leaves, but also the entire root system, the latter adding to the fibre and protein content of the feed. Feed analysis show that the nutritive value of the fodder compares favourably in terms of its crude protein and Metabolisable Energy (ME). As fibre levels are generally low, in practice it is generally regarded as a supplement to the diet. Any cereal grain can be used in the system, but barley and oats give the best results in terms of yield weight.

According to the last Census of Agriculture, the 8,332 milking cows are dispersed over 281 herds, bringing the average herd size to 30. Dr. Peter Jackson states that the average yearly milk yield per cow stands at 4,800 kg. These two facts alone give a clear indication that the dairy sector has ample room for technological development. If cows are grouped in herds approaching 100 milking cows, producers would accumulate sufficient numbers to justify full-time employment. Furthermore, with proper management, production could easily approach their genetic potential in milk yield, i.e. at least 10,000 kg per cow per lactation. If both recommendations were to be implemented, the same quantities of milk could be obtained from 45 units each housing a herd of 100 milking cows. Such a recommendation would allow the remaining farms to capitalise on the economy of scale whilst liberating the rest to diversify. Many options are available for consideration in evaluating diversification. Some of the empty units could be converted into the custom heifer production units. With the accessibility to modern technology, the national herd could be synchronised and impregnated with high genetic merit sexed embryos. Once born, they would be managed on specialised units

that will enhance the proper development of these heifers and supplied to the local and regional market demands.

Indigenous sheep and goats are renowned for their hardiness and prolific capabilities even under our Mediterranean environment. Unfortunately, the few remaining animals are poor examples of the pure breeds that once roamed so freely. A huge effort should be undertaken to rediscover, maintain and improve the genetic base of these populations. Concurrently, milk should be processed and marketed separately so as to achieve product identification and also provide the raw material for the development of other value added goods such as dairy and cosmetic products. Efforts to regain these populations are well justified also bearing in mind that these breeds enjoy an excellent reputation all over the basin and a market for stock already exists.

Other non-traditional options should also be given due consideration. The following is an example from Northern Italy. Buffalo farming is typical to Central-Southern Italy. Buffalo milk is not controlled by quota systems, has a higher fat content than cow's milk, commands a higher price and is processed into fresh Mozzarella. This typical product is well known and highly appreciated both in locally and on international markets. The Italian buffalo was incorporated into a genetic selection and improvement program resulting in an animal with an average live weight of about 600 kg and a genetic potential to produce an average milk yield of 2,168 kg per lactation. Buffalo is a recent introduction into the Po Valley of Northern Italy. For economic reasons, the small dairy farms sold off their quota to larger more efficient dairy producers in Central Italy. The buffalo is an ideal candidate since farmers could purchase stock and utilize the same on farm facilities that were previously used for cows. In this case buffaloes

represent a promising possible alternative to dairy farming. In our scenario, the buffalo offers in addition its hardy rustic nature to withstand our environment and has the ability to digest poor quality roughage and to recycle endogenous nitrogen more efficiently than cows.

Beef production may also have interesting potential. The fact that beef numbers are small, the ideal situation is to create a market niche around locally produced beef. Prior to the availability of commercially available feeds, imported yearlings were fattened on a diet composed of cereals, carob, cotton seed expeller. These traditional diets need to be revived, tested and improved so that local beef could be branded so. Thus an industry based on the concept of a Maltese steakhouse offering locally produced beef could emerge.

The swine industry likewise needs restructuring. The national sow herd should be reorganised into units each housing not less than 100 sows to achieve efficient resource utilisation. Opportunities may exist in organising the sector to produce quality F1 stock to export into neighbouring countries. This concept is not a new venture for Malta. Bowen-Jones reports that in the 1960's Malta exported Large White breeding stock into Yugoslavia. The 7,600 sow population offers sufficient diversity that if properly managed could serve as the base for a professionally run genetic improvement program. Potential of exporting growing finishing pigs as well as breed stock should be seriously considered.

The poultry sector is also in need of restructuring, not only with respect to production units but also with regards to providing facilities for egg grading and an organised structure to oversee egg production and for the marketing of live broilers. Nonetheless, alternatives are also available for this sector. Producers should specialise

according to activity (layer or pullet), and type of bird (white vs. brown hens) kept. The layer industry should consider branding its products to capture market niches. Egg shell colour, yolk colour, nutritive value and free range classification all have potential. On the other hand, the broiler industry also has room for improvement. The simplest improvement involves the rearing of broilers according to sex. This would allow the producer to have better feed management and a more homogeneous broiler crop. This simple modification would result in immediate profits to farmers. Other improvements leading to greater profits could be found in rearing techniques, speciality products and proper marketing.

Conclusion

The main characteristics of Malta's relatively small agriculture sector and its obvious limitations to growth, may be perceived as a sector that has a minimal contribution on a national scale. The smallness in Malta's potential production of any commodity can never aspire to be a price giver on an international market, but rather will have to be happy as a price taker. This paper has identified constraints affecting the livestock sector that are not connected to EU membership. Once these difficulties are overcome, the livestock sector should grab the opportunity to face the challenges and take advantage of all the opportunities. Our smallness and the physical isolation from main land Europe provides us with unique market niches for our livestock sector since high health standards could easily be achieved and maintained.

ALTERNATIVE CROPS, WITH SPECIAL REFERENCE TO MEDICINAL AND AROMATIC PLANTS, FOR A COMPETITIVE MALTESE AGRICULTURE

Introduction

The exploitation of alternative crops is a complex issue. In this context, the cultivation of medicinal and aromatic plants, as alternative crops, shall be discussed. Medicinal and aromatic plants link the fields of agriculture and health. As a matter of fact, up to a few years ago, one looked at these plants in this way. Today, there is an array of products that have different degrees of medicinal and food implications. Although within the European Union, there are directives and regulations for medicinals, food and even cosmetics, different countries have a different perspective regarding these three areas.

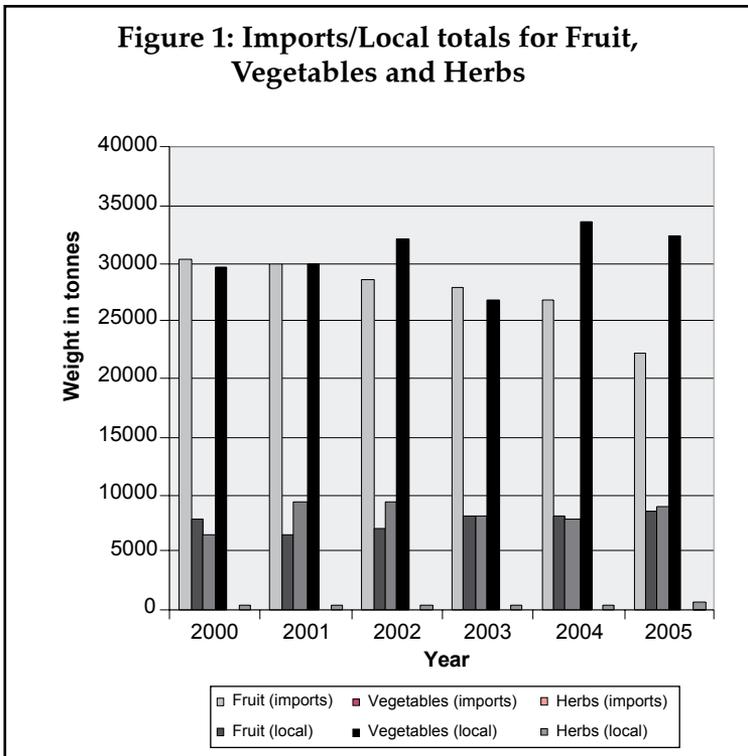
The main highlights of the following article are:

1. the situation of the fruit and vegetable production on the Maltese Islands,
2. the importance of the herbs in the agricultural and industrial sectors, and
3. the commercial exploitation of herbs as alternative crops.

Analysis of Imports and Local Production of Agricultural Products

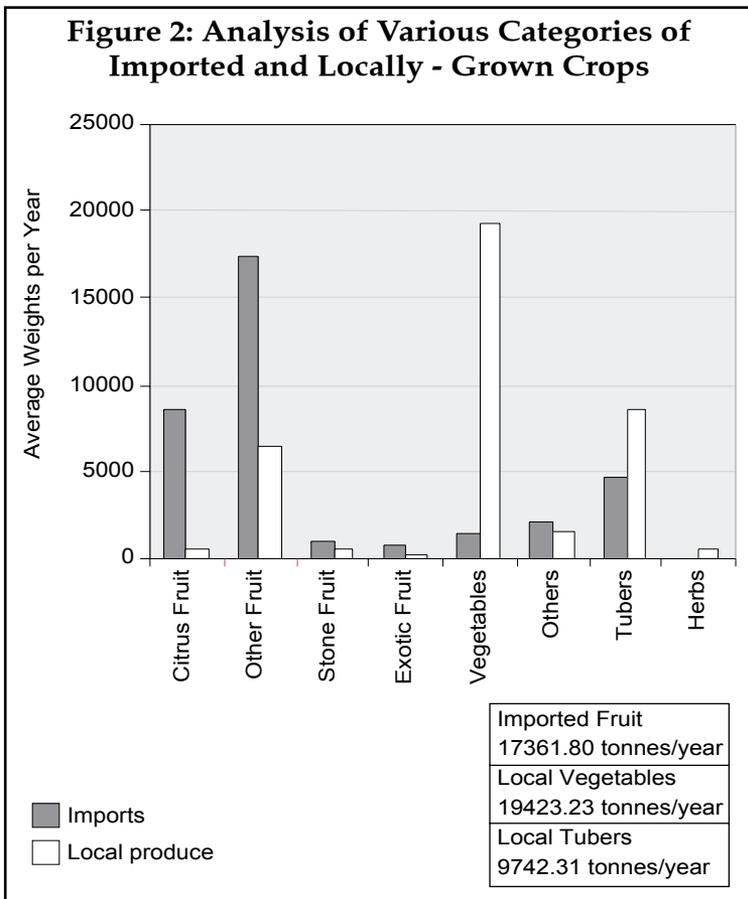
A quantitative survey was undertaken, to determine the demands of fruit and vegetables in Malta. This involved the analysis of data obtained from imports (PQS, 2006) and local production of fruit and vegetables (Pitkalija, 2006) between the year 2000 and 2005. The analysis was carried out for four categories of fruit (citrus, stone, exotic and others), three categories of vegetables (fresh vegetables, tubers, processed vegetables) and herbs.

As observed from the statistics over the six-year period (figure 1), fruit were mostly imported while the vegetables



predominated in local production. It is worth noting that the quantities of imported fruit and local vegetables are approximately mirrored each other on a yearly basis.

The most popular category within the imported fruit group (figure 2), was that of apples, bananas, pears and grapes for pressing (with average imports of 17361.80 tonnes/year, 62.96 % within the fruit group). As regards the local vegetables grown, cabbages, carrots, cauliflower, lettuce, marrows, and tomatoes constituted the main



bulk within the group (with an average entry of 19423.23 tonnes/year, 63.25 % within the vegetable group). The tuber category includes both the locally sold and the exported Spring crop potato (9742.305 tonnes/year). Despite all this massive data, when it comes to herbs, one would observe that the average import was 24.32 tonnes/year and the average local production was 476.98 tonnes/year. From the last figures, it was observed that the locally produced herbs outweighed those imported and the local producer is already growing these herbs on a small scale.

3 Herbs: The Local Perspective and Potential Uses

3.1 The Local Perspective

In Malta, herbs are exclusively grown for culinary purposes. From statistical data (figure 3), the most commonly cultivated herbs include parsley (63 %), mixed herbs (21 %), basil (7 %) and fennel (6 %) (Pitkalija, 2006).

These have been rarely exploited for other purposes, except for chamomile and olive leaves harvested for the production of tea bags and the use of prickly-pear for the production of a stress-fighting extract.

Although the Maltese Archipelago has a restricted environment due to its small size, the diversity in biological species is vast. There are about 1264 vascular plant species, including casual or naturalized aliens. The bioclimatic conditions of Malta are also found in coastal regions of other Mediterranean countries (Haslam et al., 1977). In fact, about 66% of the flora of Malta is common to other Mediterranean regions while the other 34% of the flora is adapted to cold European and sub-tropical conditions. Out of these, 458 species possess medicinal

**Figure 3: The locally - cultivated herbs
(average for 2000-2005)**

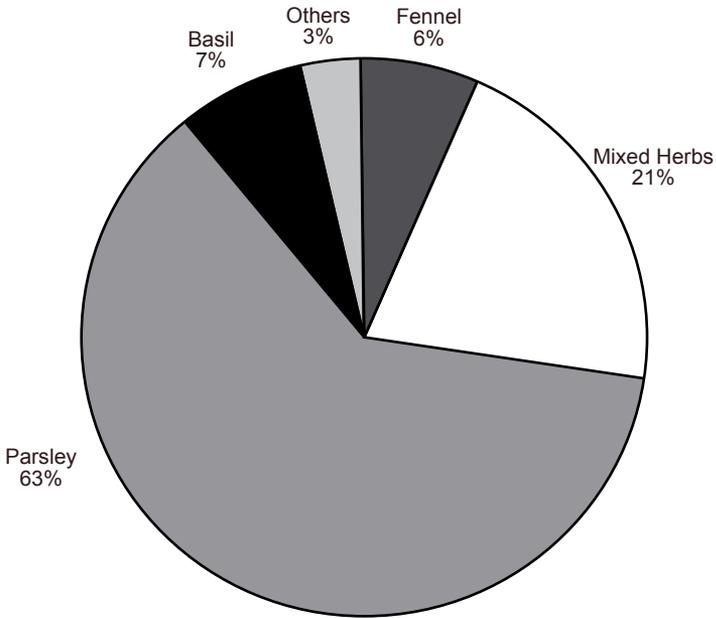
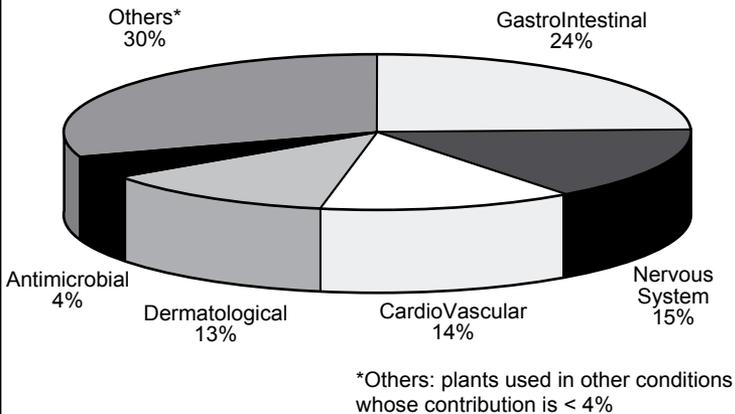


Figure 4: Local Traditional Uses of Medicinal and Aromatic Plants



virtues (Attard 2004) and have been used in traditional medicine (Lanfranco 1993; Lanfranco 1975) for several ailments (figure 4). These medicinal and aromatic herbs are sparsely distributed throughout the country.

3.2 Potential Applications

Herbs may have several important applications other than culinary in the strict sense. In fact, added-value crops and their products may be found in the following categories:

1. Traditional Foods/Crops, those crops that have been abandoned with the introduction of modern and perhaps more vigorous varieties;
2. Functional Foods, those crops that may provide a health benefit beyond basic nutrition;
3. Nutraceuticals, crop derivatives enclosed within a pharmaceutical dosage form;
4. Medicinals and Cosmetics, crop derivatives/ phytochemicals with health benefits.

Taking the tomato crop as the classical example,

- Old tomatoes varieties fall within the traditional crop category,
- A tomato variety with a high lycopene content (which is a chemopreventive) falls under the functional foods group
- an encapsulated lycopene extract, derived from tomato, is a nutraceutical.
- an encapsulated tomato extract is a medicinal although this category suites more non-edible plants.

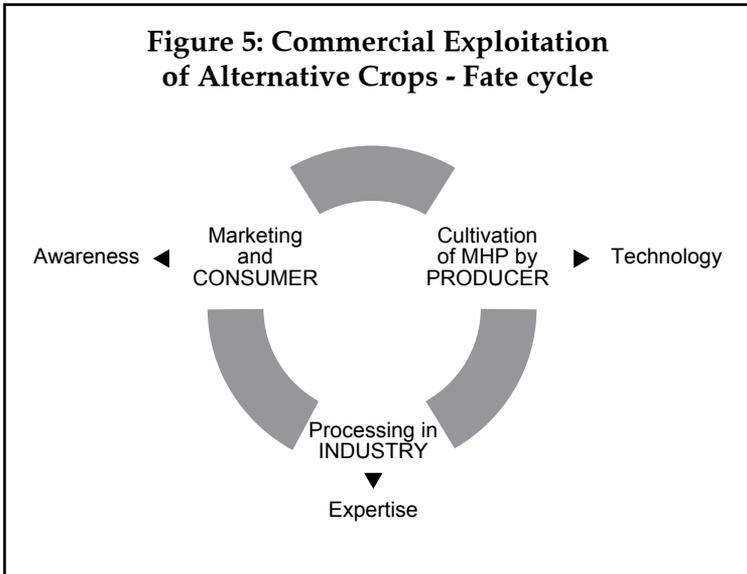
Reasons for cultivating alternative crops

According to the Common Agricultural Policy, producers within the European Union are obliged to set aside a portion of their agricultural land in return for the subsidies they receive on their main crop/s. However, this fallow land can be used to grow other crops that are not intended for food purposes. Crops used as raw materials for medicinal and cosmetic products are in a particular permitted category. This opens the possibility for cheap raw materials for plant-based products (Grant, 1997). Despite this opportunity, there are certain elements that are counterproductive in such a subsidised agricultural system. These may include administrative difficulties from the paying agencies, and the misuse and abuse from the producer's side, amongst others. This will hinder the good will of the dedicated producers.

The use of fallow land for the cultivation of herbs that require minimal care and maintenance will enhance the producers to build their trust in this new crop or crops, which might eventually lead to the replacement of some established crops.

Commercial exploitation of added-value crops

In most cases, the alternative crops, in discussion, do not reach the market in the crude state, but should be processed to give an added-value finished product. Therefore, the producer and industry must work hand in hand to accomplish this. The end user is the consumer. This makes the cycle complete with the supply and demand factors linked together by industry (figure 5). If one of the components is affected, the whole system will collapse.



Collaboration and communication can be achieved by direct discussions between members of the three parties. The weakest link in the cycle is the processing component. In fact, in the past the farmers' co-operatives failed in the processing of agricultural products and wine-making (Walker, 2004).

There are several factors that affect the commercial exploitation of herbs, all of which are particular to each individual herb in question. These include

- (a) production of alternative crops (technical feasibility)
- (b) industrial processing (economic feasibility)
- (c) marketing and the consumer (market potential)
- (d) role of collaborative research

5.1 Production of Alternative Crops (Technical Feasibility)

This factor greatly depends on the **agronomic factors** including both biotic and abiotic components, which

may lead to the success or failure of production. The first question that will surely come to mind is, whether the crop can be grown on a field scale or not. This is the most important hurdle which determines whether the crop may be considered as an alternative or not. If we are considering here, an established wild medicinal plant, the factors that affect its growth and vigour should be considered when this is being domesticated.

Several studies should be performed at this stage to determine whether the medicinal value is retained, enhanced or deteriorated with domestication. For example in the case of borage, plant spacing affects the seed yield but not the fixed oil content (Coleiro, 1994). Sage is more quickly propagated by cuttings rather than seeds and shading is preferred over a sunny position (Azzopardi, 1994). For lavender and spearmint, the type and quantity of fertiliser affects the composition of the essential oil (Caruana, 1996; Barbara, 1996). These are a few examples of some plants studied locally.

However a problem may arise due to **producer resistance** to growing a new crop. In general, in almost all countries, growers are somewhat reluctant to risk their main crop, which is rendering a living, for a new alternative crop. On the other hand, if the grower succeeds in growing the alternative crop or crops, then he would be very keen to know what returns he would get, should there be a surplus in production. Therefore for new crops, there should be a contract between the grower/s and industry. Moreover, a kind of association or cooperative should be in function to lease between the two parties and hence avoid surpluses or insufficient quantities of crop.

The production cost is greatly influenced by the **yield of the crop** which is indeed inversely related to the unit cost. Since the initial phase is the cultivation of the crop,

this will particularly affect the producer. The producer will surely grow the most profitable crops on the most suitable piece of land at his disposition. Therefore, even though an alternative crop tends to grow better or gives a better yield on this soil type, as established by its technical feasibility, it is more profitable to grow the alternative crop in less 'advantageous' areas. After all, with the right conditions at hand, wild-type species may not necessarily require strict care when domesticated.

Another important point is the **government involvement** when it comes to subsidies on crops. If there is a subsidy exclusively on the main stream crops, then alternative crops will be side-lined and their production ceases. However, if there are incentives and subsidies on the production and commercialisation of new alternative crops, then agricultural economy will rise, keeping in mind that from such crops, even the industry will benefit.

At this point the producer will decide on the fate of the new crop, whether to exploit its commercial potential or not. However, once the crop's performance has been established, economic evaluation is the next step in line.

5.2 Industrial Processing (Economic Feasibility)

There are two important factors that mainly affect the economic feasibility of a crop: **the price of the end-product**, and the **cost of industrial production** from field to consumer (finished end-product). Economic feasibility is merely the balance between these two factors. However, a new product on the market will have a high initial intrinsic value to the consumer, that is, the price of the end-product will surely outweigh the production costs. With time, if there are competing products for this new alternative crop, or if an already market-established crop

is being cultivated, then the price of the end-product is governed by the price of the competing products.

For example, if we have a natural cream for chilblains prepared from nettle (Lanfranco, 1993), there are merely few natural alternatives with the same effect, so initially the consumer will be willing to pay a price that might be higher than that for the commercial conventional creams used for chilblains. However, if there are competing natural products on the market, the price of the chilblain cream has to be reviewed. Another product that would qualify under this situation would be the flavonoids in the caper plant (Spiteri, 1998), to be prepared as a topical formulation for varicose veins. On the other hand, we find several natural and alternative insect repellent sprays on the market, mainly based on citronella oil and derivatives. A Maltese medicinal plant with significant insect repellent properties is the pennyroyal which has over 90 % of the insect repellent component (pulegone) (Tanti, 1994). The price of pennyroyal oil or formulated spray has to be adjusted according to the competing sprays, just from the start. Another example is in the field of functional foods. Added-value tomatoes contain a high concentration of lycopene, a well-known chemopreventive. The consideration of a local variety with such potential has to be thoroughly evaluated as regards the product costs, as compared to already established high lycopene-containing tomato varieties.

As a result of these pros and cons, there might be a **resistance of industrial processors** to new crops. A processor, having an already-established industrial plant, will find it difficult to change the already established processing conditions to suit the processing of a new crop product. This is more so when the processor has to invest in new equipment for a product that still needs to be

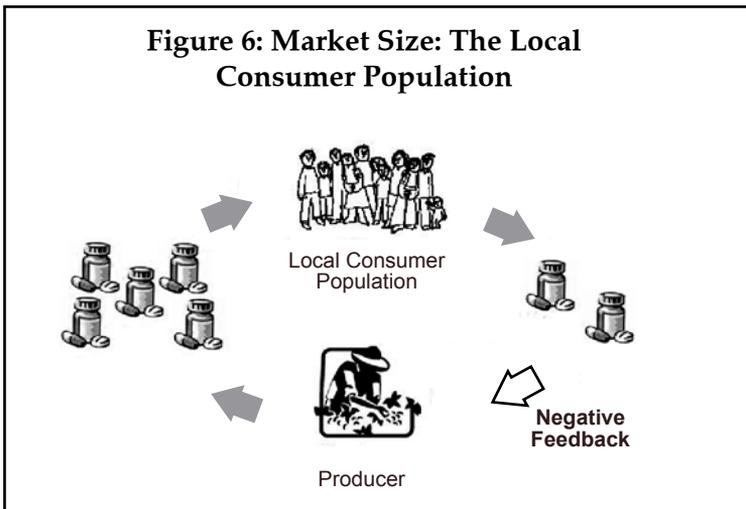
tested. This is not the case, in Malta, as there are relatively few companies that process crop products, even more with the medicinal and cosmetic fields.

At this point, the problems in technical and economic feasibility measures, are overcome with the selection of the appropriate instruments. However, the next question will be: Will the product reach the market?

Marketing and the Consumer (Market Potential)

Market Size

The size of the market will determine whether the crop production and processing will be feasible or not. Considering the local consumer population, the market size becomes the bottle neck for the commercialisation of processed products from alternative crops (figure 6). In fact, the demand will greatly influence the supply of product. Even though the crop is potentially able to make a running profit, these limitations will stifle the whole commercialisation process. This means that in the case of



Malta, markets beyond the local one should be exploited for sustainability.

Therefore an international market should be looked at in the long run. Recently, there have been interests from Central Europe in the revival and introduction of Greek-Arabic medicine into the European market. Due to our exclusive geographical and political position, Malta forms part of the European Union and part of the Magreb Region. Besides, Malta has a history of North African and Southern European occupations, which suggests the brewing of a multicultural civilisation, eventually leading to our uniqueness in this respect. This gives us the opportunity to re-discover our cultural roots, including the use of medicinal and aromatic plants, and apply the commercial implications of these in the context of the modern world. So effectively, one may take medicinal plants, used in the past and formulate them into a suitable medicinal or cosmetic product.

Considering Council Directive 2004/24/EC, the bibliographical or expert evidence to the effect that the medicinal product requires medicinal use of at least 30 years preceding date of application, including at least 15 years within the Community. Although all this is out of the agricultural context, this is the strong evidence where locally, the cultivation of such crops would be an advantage. In spite of these opportunities, the challenges may imposed by countries that have a similar historical background.

The Cost of the Product

Although this factor would be already considered at an earlier stage during economic feasibility studies, this will emerge again if the market is exploited from a wider perspective, i.e., beyond the national perspective.

In fact, the cost of the products vis-à-vis the **competing products** on the markets and the **product quality** are part and parcel of the absolute cost of the product. **Product stability** is another problem in question, especially if the growth cycle of a crop is very long. As a result, annual herbs are preferred over perennial herbs for two main reasons: primarily to practice crop rotation once the plant is harvested and to obtain an immediate significant yield of crop without waiting for years (in case of trees).

Rate of Market Penetration

A factor that limits market penetration is perhaps a balance between **supply and demand**.

For example, from the supply point of view, the multiplication of germplasm to obtain sufficient yields for propagation, may be a limiting factor. In most instances, a crop can multiply within the five to tenfold range, therefore sufficient seed stocks will probably be achieved within five to seven years. However, this problem may be overcome by selecting plants with a high seed turnover within a single crop, the use of micropropagation techniques and the use of alternative propagation methods (e.g. cuttings - sage, bulb division - squill, etc.).

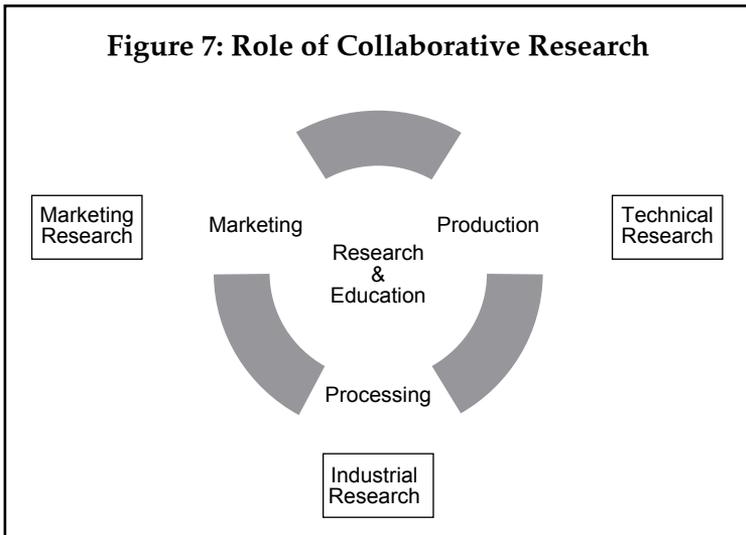
However, the problem arises in predicting the supply of crop by the end of the cycle. This is called **supply uncertainty**. Although a crop might give a high yield, supply uncertainty will be possible if at the same time the crop might be also prone to production failure.

On the other hand from the demand point of view, this depends on advertising and **consumer awareness**. In fact, market penetration from this end, might be difficult if the consumer is unaware of the new product or if there is **consumer resistance**. The product is passed on from the processor to consumer, via the distributor. Here is

another form of low market penetration, when there is **distributor resistance**, usually arising from the fear that the product will not reach the sales expectations. Apart from this, distributors of **already-established competing products**, tend to take counteractions to this by increasing public awareness strategies to beat the new entrant.

Role of Collaborative Research

The three points discussed above lead to the success or failure of a crop or crop product to reach the market. However, all this has been based on the knowledge and predictions. In fact, research and education are the key success to the commercial exploitation of alternative crops. There are three research areas considered: technical (agronomic) research, industrial research and marketing research (figure 7). Although the production of a crop product goes from production to processing to marketing, the three research instruments, mentioned, should be applied in the reverse order. This means that first the



market should be studied to determine which products are demanded by the consumer, the economic feasibility comes next and finally the technical feasibility.

Currently, the Institute of Agriculture (University of Malta) is involved in a number of projects related to alternative crops with a special reference to medicinal and aromatic plants. Since basic knowledge on these local plants is lacking, the Institute has embarked on a project, in collaboration with the Department of Anatomy (Faculty of Medicine and Surgery) to determine the potential pharmacological activity of a wide range of plants. This project is funded by the National RTDI. Another project developed between the Institute and the Ministry for Rural Affairs and the Environment, involves the cultivation of a number of medicinal plants to conserve the endangered species through *ex situ* and *in vitro* propagation and to stimulate the interest of the local producers in order to cultivate these medicinal plants as alternative crops. Another project, still in its preliminary phase, is the collaboration between the Institute and industrial processors, willing to embark on the processing and finalization of alternative crop-derived products, especially with medicinal and cosmetic values. This is not limited to local processors but also processors from EU member states.

Apart from research projects, the Institute has the responsibility of educating the producer, processor, consumer and persons involved in this sector. In fact, the Institute offers a wide range of courses related to the use and exploitation of medicinal and aromatic plants as alternative crops.

Conclusions

In the absence of government assistance, it is likely that only new crops with potentially new uses will be developed. It would seem sensible therefore for the government to fund extensive research on new crops up to the point where it is possible for them to make money, and at that point allowing the private sector to take over. The government would also help the farming community by providing the necessary assistance to grow these alternative crops. It is only through these means that a range of alternative crops are likely to be produced.

The realisation of this sector relies solely in the hands of those who are willing to set things going and collaborate. As a matter of fact, as mentioned earlier, the establishment of a cooperative for alternative crops, would be a good start. Although it is easier said than done, no alternative crop will manage to make it to the market unless the three major components, of the 'fate cycle' mentioned (figure 5), are managed on the same level.

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IS THERE A FUTURE FOR MALTESE ARTISANAL FISHERIES?

Introduction

Artisanal fishing is a prevalent activity in the Mediterranean and holds a strong socio-economic importance in most countries. Many interpretations of the term “artisanal” are given. But the General Fisheries Commission for the Mediterranean formulated a comprehensive definition as follows:

“Traditional fisheries involve(ing) fishing households (as opposed to commercial companies), using relatively small capital and energy, relatively small fishing vessels (if any), making short fishing trips close to shore, mainly for local consumption. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export and are sometimes also referred to as small-scale fisheries” (GFCM, 2001).

Maltese fisheries are of a typically Mediterranean artisanal type which are not species selective and are frequently described as multi-species and multi-gear fisheries, with fishermen switching from one gear to another several times throughout the year. The social and cultural importance of the Maltese fishing industry

far outweighs its negligible economic contribution that is just over 0.1 percent of the national Gross Domestic Product. The livelihood of most of the local fishermen depends on the sale of highly prized species which are available to the consumer as fresh fish of highest quality caught by traditional artisanal methods during very short fishing trips. The variety and quality of these fish species also give a significant contribution to the important tourism industry since local restaurants boast of high quality seafood, which is a significant attraction, along with the colourful traditional fishing vessels, for the tourists visiting Malta. It is also worth mentioning that the front-cover of several holiday brochures and tourist guides depict Maltese fishing boats.

In recent years, several statements have been made about artisanal fisheries, particularly during negotiations with the European Union prior to Malta's accession. In support of the protection of the Maltese fisheries, Malta had explained that "the introduction of industrial fishing methods and any further increase in artisanal fishing would have negative impacts on the population involved in the fishing industry which is economically, geographically and culturally heavily dependent on this kind of activity". It had also argued that "offshore industrial fisheries operating in the central Mediterranean have adopted a discarding practice which if applied in the Maltese Exclusive Fishing Zone, would seriously affect artisanal catch rates and, both from an ecological and food security point of view are unacceptable". Furthermore, addressing the specific issue of purse seining and industrial longlining, Malta stated that the introduction of these activities into the Maltese 25 mile Zone would "completely disrupt the activities of the

artisanal Maltese fishing fleet which depends totally on the resources available within the Zone for its economic livelihood”.

The regional perspective of artisanal fisheries

In view of the importance of artisanal fisheries in the Mediterranean, COPEMED, a sub-regional project of the Food and Agriculture Organisation of the United Nations (FAO), ventured into a study in 1998 to primarily compile of an inventory of artisanal fisheries and to undertake a preliminary evaluation of their status in various countries of the Central and Western Mediterranean, including Malta (Coppola, 2000). This provided a sound basis to analyse the present situation, to highlight problems being encountered and to identify priorities for the sustainability of these fisheries. In this context, a review on the future of artisanal fisheries in the Mediterranean was carried out by COPEMED (Griffiths et al. 2005). According to this review, artisanal fisheries in Mediterranean countries has been relegated to a marginal role in a period in which the demand for high-quality fresh fish and shellfish has grown enormously while the state of fish stocks has, overall, become greatly weakened by over-fishing, especially by the industrial fisheries, and by environmental degradation. It further underlines that the rehabilitation of the artisanal fishery sector in the Mediterranean has been lost in the wider discussion on the future status of fisheries in general and it is the weakest element when large-scale management issues are being discussed.

Notwithstanding the above, Griffiths et al. (2005) suggested, in this review, that there is a future for artisanal fisheries provided that enough effort is made

to reduce their precariousness in terms of a number of factors namely:

- The state of the fish stocks they exploit and their collaboration in providing information useful for fish stock assessments
- Physical and commercial competition from industrial fisheries
- The harmonization of regulations of common interest to the industrial and artisanal fisheries in terms of control of fishing pressure on stocks of specific target species and in the light of the ecological circumstances of each species
- Predictability of the demand for, and value of, their landings
- Evolution of operational costs including those associated with technological development, landing facilities and transportation of catches
- Added value of fishery products
- Replacement of old artisanal fishermen by new, committed well trained artisanal fishermen
- The status of the artisanal fisheries community as a coastal zone stakeholder and conflicts arising
- Opportunities for technology investment
- Involvement of the artisanal fishermen in the development and management processes of Marine Protected Areas

The Maltese perspective

In the light of the factors listed above, it may seem that local artisanal fisheries are facing challenges which are too tough to handle in order to survive and thus one may argue that in view of rapid technological developments

nowadays, the option of replacing the large artisanal fleet with a small industrial fleet may be a more viable solution. However, this strategy would totally ignore the socio-economic importance of local artisanal fisheries highlighted in the introduction. It would be more responsible to address the matter by establishing at high priority, for example, the development of markets for catches of artisanal fisheries together with the assurance of high quality landings, not only to maximise their price at time of sale, but also to meet the growing requirements of national and European food safety regulations.

The Maltese artisanal fisheries product has a number of properties which should be exploited to maximise its value. The fact that the product is caught using traditional methods during a one-day fishing trip, is caught from a special Fisheries Management Zone, has a well conditioned appearance and consists of a variety of species, calls for a special marketing strategy to be adopted such as through certification and labelling procedures.

Product certification and ecolabelling – how relevant are they to Maltese fisheries?

Within the framework of the International Plan of Action (IPOA) to prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing drawn up in 2001, the FAO published a document containing guidelines for the ecolabelling of fish and fishery products from marine capture fisheries (FAO, 2005). Wessells et al. (2001) explained how product certification could be used as a measure by governments, often mutually agreed upon by regional fisheries management organizations, to ensure that only legally harvested and reported fish landings

can be traded and sold in the domestic or international markets. They added that product certification can influence consumers' choices when it is accompanied by a label to inform consumers. It is common for labels to highlight characteristics and attributes of the product including product composition, product quality and the production method; when the label acts as a seal of approval for products with fewer impacts on the environment it is called an "ecolabel".

Product certification and ecolabelling schemes are commonly considered as rewarding schemes for fisheries complying with management and conservation measures. They create market-based incentives for better management of fisheries by creating consumer demand for seafood products from well-managed stocks. In the case of artisanal fisheries, the final aim would be that the artisanal certified ecolabelled product will be identifiable and should enhance its marketability and value (locally and internationally), alleviating the pressures of competition from large scale industrial fishing and even IUU fishing. According to Wessells et al. (2001) such schemes could create market access opportunities in premium markets and make it easier to get development finance and technical resources.

The question is whether certification and ecolabelling are the keys to securing a bright future for Maltese artisanal fisheries. What is certain is that the Maltese artisanal product has the ideal attributes to exploit such tools which are gaining popularity and success worldwide and the future depends on how proactive the local community would be in implementing such a strategy, whilst being guaranteed a high status as a stakeholder of the coastal zone in order to surmount the tough challenges presented by today's rapidly developing world.

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Mr Griffiee is currently a Senior Officer for industrial crops within the Food and Agriculture Organization in Rome. He has 38 years of post-graduate multidisciplinary experience in production of annual and perennial crops generally; including major and underutilized species. His qualifications include; 1966: MSc (honours) in Agronomy – Bath University; 1967: MSc (distinction) in Plant Pathology – Imperial College, London; 1982: Diploma in Forestry Planning and Management – Oxford University. He has strong inter-personal relationships due to extensive ‘hands on’ agricultural experience in environments extending from close international smallholder friendships to boardrooms.

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Dr Attard graduated in B.Sc from the University of Guelph (Ontario, Canada) from where he also obtained his Master Degree in 1998. In

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Dr Camilleri graduated in fisheries science and ocean science from the University of Plymouth (UK) and later obtained a doctorate from the same University with his thesis entitled "Maltese fisheries and the sustainability of resources around the Maltese Islands". He has also been awarded the status of chartered biologist from the Institute of Biology (UK). Dr Camilleri is a consultant to the government on fisheries management and is currently the Head of the Malta Centre for Fisheries Sciences. He is national coordinator for regional scientific projects of the FAO. Dr Camilleri has recently also been re-elected chairman of the Sub-Committee on Statistics and Information of the General Fisheries Commission for the Mediterranean.

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