



TRansition paths to sUstainable
legume-based systems in Europe

TRUE Case 16: Protein Crops in Croatia

Overview of the sector and policy
recommendations



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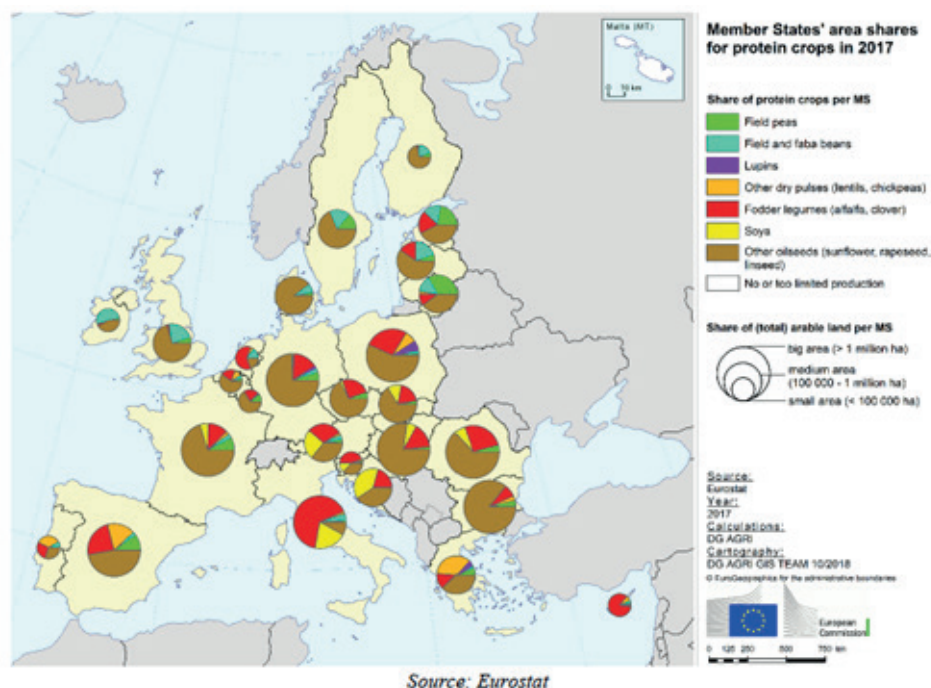
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Introduction

Over the last decade, interest in protein crops has greatly increased, both globally and in the European Union. Issues of global warming associated with livestock farming, increased consumer interest in plant-based protein (driven by various motives - environmental, ethical, nutritional/health, novelty food factor etc.), emergence of concerns on nutritional needs of a growing global human population in general, food safety (GMO vs. non-GMO) and food security issues, among others, are driving the interest in this food/feed segment. This growing interest has been recognised by UN FAO's proclamation of the year 2016 as the year of legumes, even dedicating 10th February as World Pulses Day, highlighting global importance of this group of crops, and its associated products and services. In Europe, concerns regarding this segment of agriculture are reflected in various initiatives, most significant of which is the EU Protein Crop Strategy, which aims to enlighten the issues surrounding this increasingly important segment of agriculture, and to maximise the uptake of protein crops by European farmers in the context of the post 2020 EU CAP.

Protein crops can offer numerous advantages and improvements both for the European agribusiness sector, and European consumers and citizens, in general. This debate is ongoing, as European stakeholders and decision-makers strive to develop a comprehensive strategy that would maximise the benefits of protein crops for all stakeholders involved, while addressing their numerous challenges (for example, EIP-AGRI Focus Group on Protein Crops provides a comprehensive in-depth overview of the issues surrounding protein crops).



¹<http://www.fao.org/pulses-2016/en/>; <http://www.fao.org/world-pulses-day/en/>

²<https://ec.europa.eu/eip/agriculture/en/publications/eip-agri-focus-group-protein-crops-final-report>



In an effort to further inform the issues surrounding protein crops, a number of syndicated research projects have been initiated over the past few years in Europe, (LEGVALUE, TRUE, Legume-Futures etc.). They are all looking for ways to develop better understanding and market & policy proposals for the sector, in order to inform all relevant stakeholder groups pertaining to this interesting sector, from farmers looking for better returns to NGO groups involved in the issues of environmental protection and sustainable development. For more in depth understanding of the underlying issues and general trends in legume sector, please see the relevant projects, as well as the recent work undertaken by the EU Commission on plant protein, which has received a wide-ranging positive response, even from the traditionally sceptical "green" stakeholder groups.

From food/feed security and feed input traceability and GMO-related issues, to the need for more balanced, healthy and nutritious diets, legumes offer many potential benefits for both the European farmers and consumers. The sector is not without its challenges: in some crops Europe is greatly dependent on imports from countries where monoculture production is causing serious socio-economic and environmental problems (soya in particular); while some legumes are facing challenges in being less than competitive in contrast to some other crops, most notably cereals and maize, thereby limiting their financial attractiveness for the European farmer. In addition, European yields of many of the protein crops lag behind those of Europe's main competitors. The context of food security is becoming more prominent in recent years, as global changes in geopolitics and trade suggest overdependency on imports can have serious unpredictable consequences, thereby competitive domestic production is seen as a risk mitigation issue, as well.

Croatian Plant Protein Sector - overview and challenges

In this context, Republic of Croatia, as the newest EU-member state, is also experiencing various market trends in legumes, up to a point, in line with trends expressed in the rest of the EU, albeit in the context of its own specific circumstances. Pre-1991 independence, Croatia was one of the member republics in the Federation of Yugoslavia, itself a socialist country, with a centrally planned economy and agricultural policy, which was nevertheless allowing for a certain level of private enterprise in agriculture. This historical context is relevant in the fact that with the switch to market economy, and associated conflicts in the Balkan wars of the 1990's Croatia's agriculture has suffered considerably - in terms of yields and total production many sectors have never recovered. Furthermore, historically agriculture was designed around large, vertically integrated industry-agriculture complexes, which were linking many small farmers as cooperants in upstream, and were often present in the downstream market segment, all the way to retail. With the collapse of these value chains, small farmers, including legume producers, have lost a key market access channel.

Croatian agriculture has passed through a few phases; initially the State has privatised and dismembered former combines, often through less than transparent privatisation processes.

³ http://www.foeeurope.org/sites/default/files/agriculture/2018/soyalert_report_fv_web.pdf

⁴ <http://www.legvalue.eu/>; <http://www.legumefutures.de/welcome.html>; <https://www.true-project.eu/>

⁵ https://ec.europa.eu/info/events/development-plant-proteins-europe-opportunities-and-challenges-2018-nov-22_en

⁶ <http://www.arc2020.eu/eu-protein-plan-positive-caveats/>





Policy emphasis was on support for large number of small family farms, on one side (populist support measures), and support for large private corporates which have emerged from the privatisation of former combines (due to their considerable lobbying power). This "wandering" in agricultural policy has resulted in a paradox: from the period from 2005 to 2014, Croatian State has invested, through various support programs and measures, over EUR 4,8 billion into the agriculture sector: in the same time frame, production of agriculture goods and services has fallen by 27%. Agriculture imports have exploded, and with a fully open market economy, many agriculture sectors have become increasingly uncompetitive. Unfortunately, sector of legumes is also largely affected by these previous policy choices.

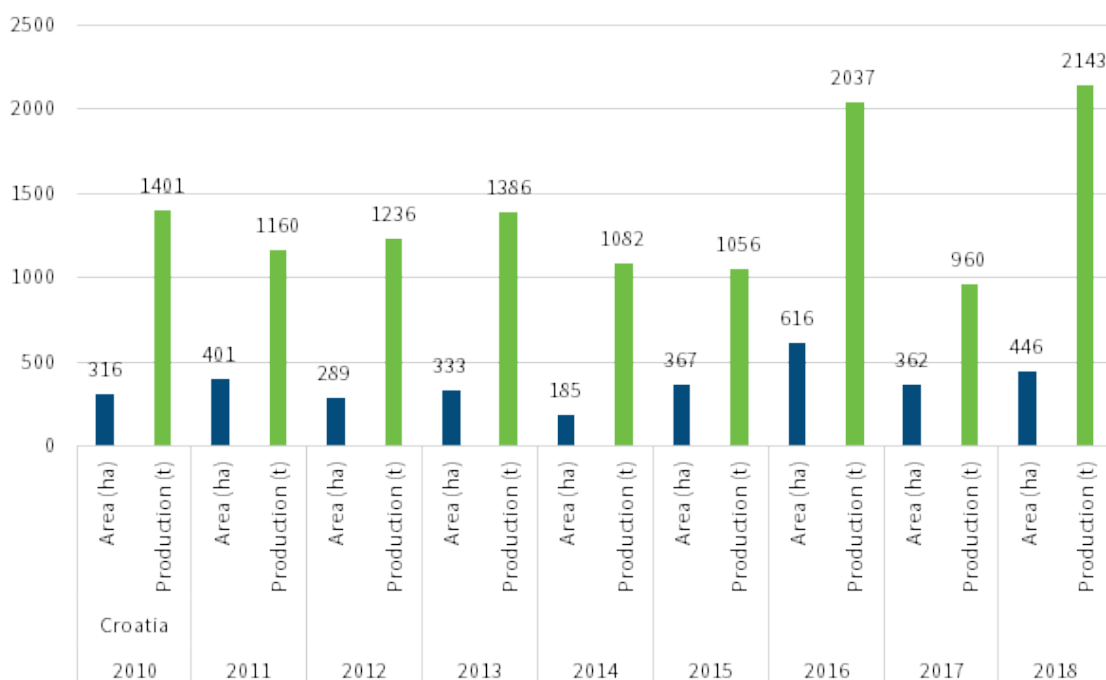
Pulses - beans, peas and other relevant legumes

A good example of this situation is the sector of pulses (beans, green beans, peas etc.), which has remained largely stagnant, as far as total production is concerned, contrary to the general trend in the EU, which has experienced significant growth in this sector. Production of fava beans, chickpeas and lentils in Croatia is even more modest, almost symbolic.

For example, there is only one large corporate entity around which the cluster of peas production is formed (Podravka Plc.), while other pulses are largely produced by a certain number of small farmers, where sales are either conducted directly (on farm or at the open green market), or through wholesalers; mainstream retail market is largely supplied by imports from China, Italy and Canada.

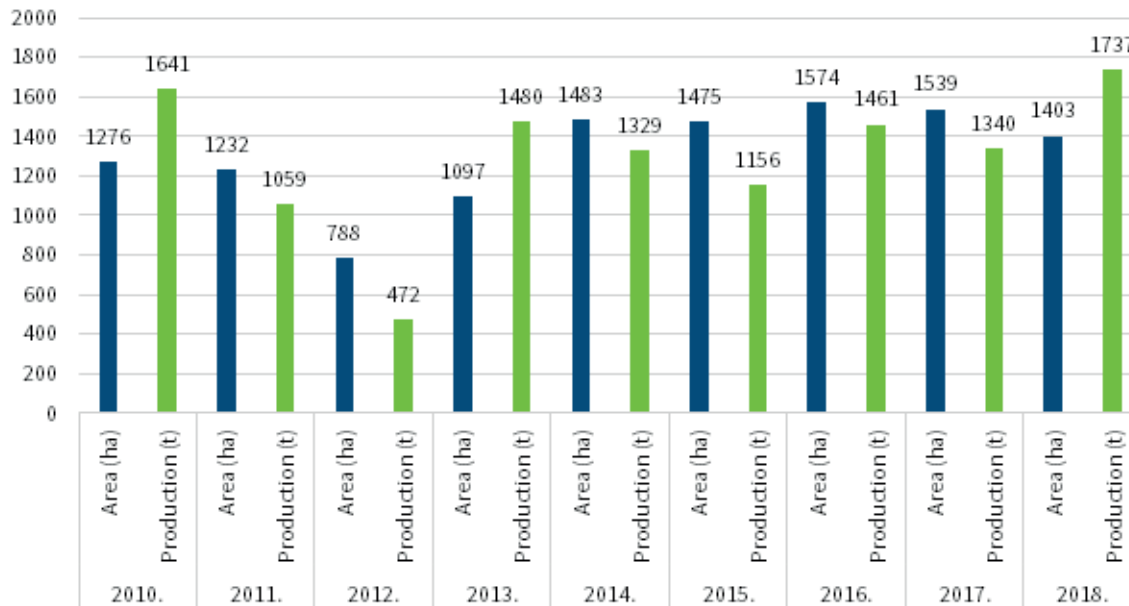
The most recent attempt at the more organised production of pulses, through a cooperative in NE Croatia, cropping 300 ha of beans in 2016 and organising more than 100 producers, has unfortunately experienced financial difficulties and is now in receivership.

Fresh Beans - area (ha) & production (t) 2010-2018



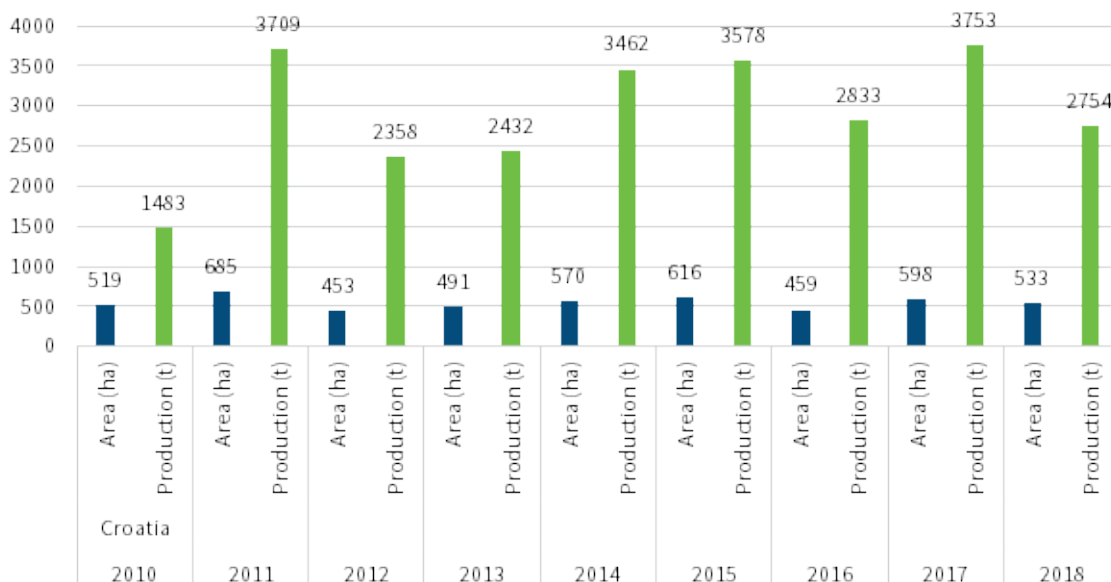


Dry beans - Area (ha) & production (t) 2010-2018



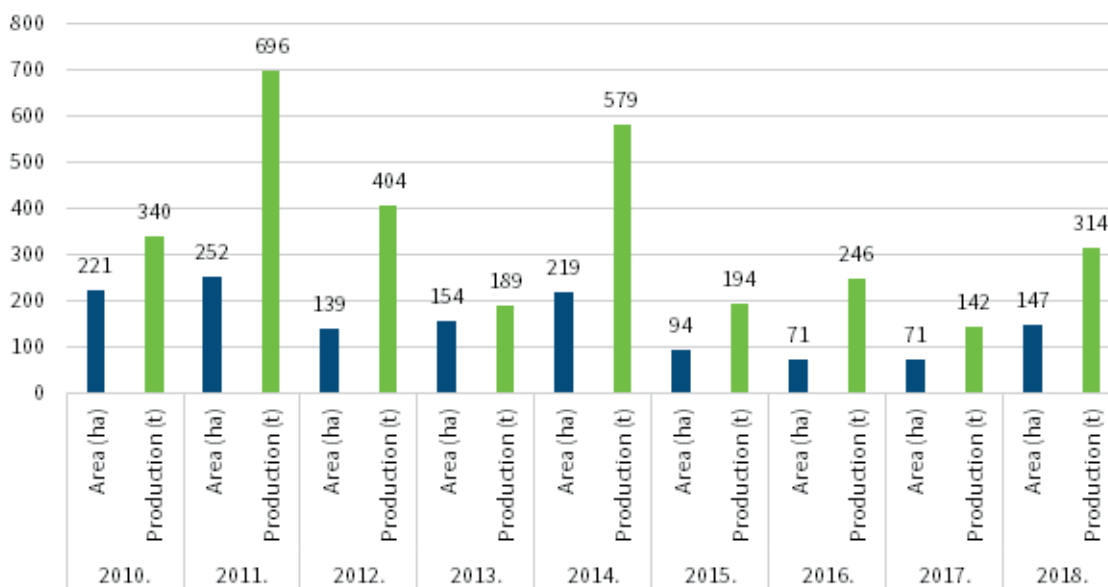
We can see that for fresh beans, there exist a clear trend in increase in production and planted area in the last few years, although this is also rather variable year per year. Whether this is related to the significant price fluctuations, thereby attracting more farmers to the sector on the ad-hoc basis, or some other reason, is unclear. As to the regards to dry beans production, we can see that there are no significant fluctuations for a number of years.

Fresh peas - area (ha) & production (t) 2010-2018



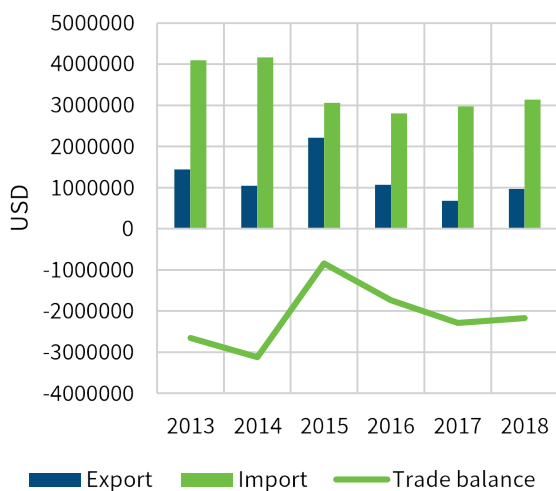


Dry peas - Area (ha) & production (t) 2010-2018

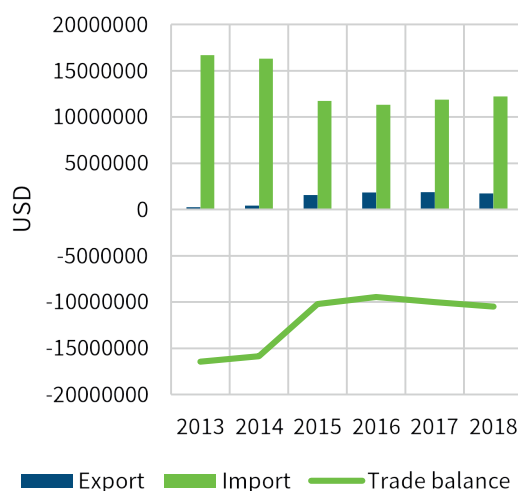


Production of fresh peas in Croatia is holding steady, more or less, over an extended period, but the production of dry peas is in steady decline.

Trade balance Croatia - Peas



Trade balance Croatia - Beans

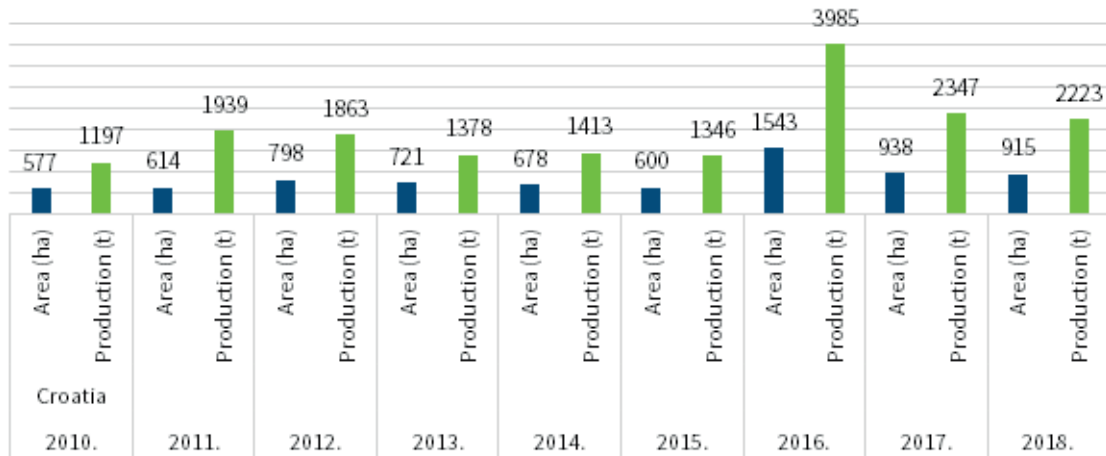


We can see that both for peas and beans, Croatia is running a long term trade deficit, which is especially drastic in the case of beans.





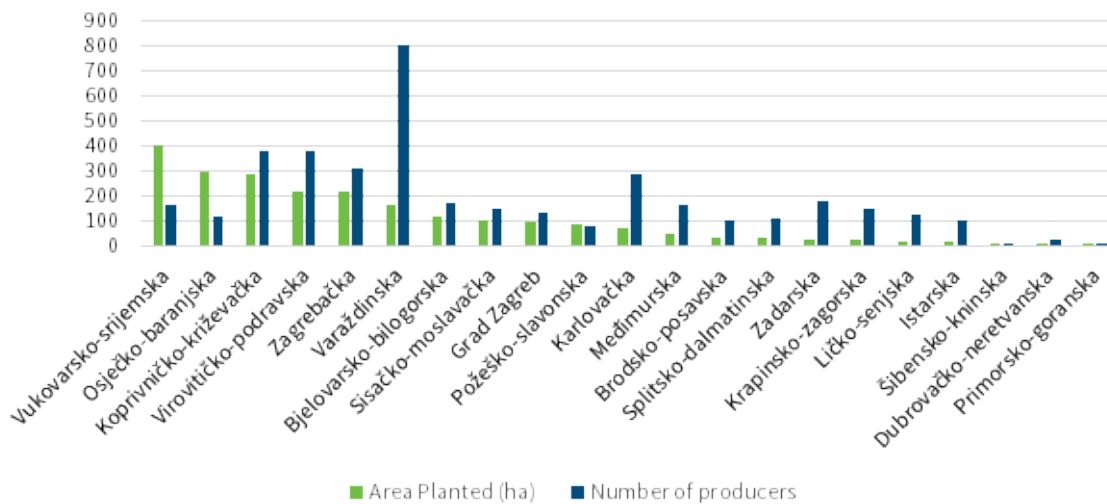
Field peas - area (ha) & production (t) 2010-2018



Field peas have experienced certain growth in area planted and production quantities as of 2016; this is most likely again related to the onset of "green" support measures, courtesy of EU CAP post-2016 environmental reforms. Most field peas are consumed by livestock farms which produce them. Quantities of field peas appearing on the retail animal feed market are largely imported, mostly from neighbouring countries.

In principle, producers of pulses are small producers with modest acreage and yields, and are under strong pressure from imports, they lack the developed infrastructure for up-scaling, and suffer lock-in with few existing processors who enjoy a monopoly position. Small pulse farmers cannot afford high tech equipment and are not cost effective in competition with cereals; in short, risks for farmers are too high to expect any significant growth in the sectors of beans, peas, lentils and latches in the near future.

Legume Vegetable Crops by County (Broad bean, Bean, Peas, Lentil, Chick-pea, Yardlong bean) - 2018





We can see that per cropping area, eastern Croatia dominates, but for number of producers, NE Croatia has a very large number of producers, traditionally small family farms and hobby producers.

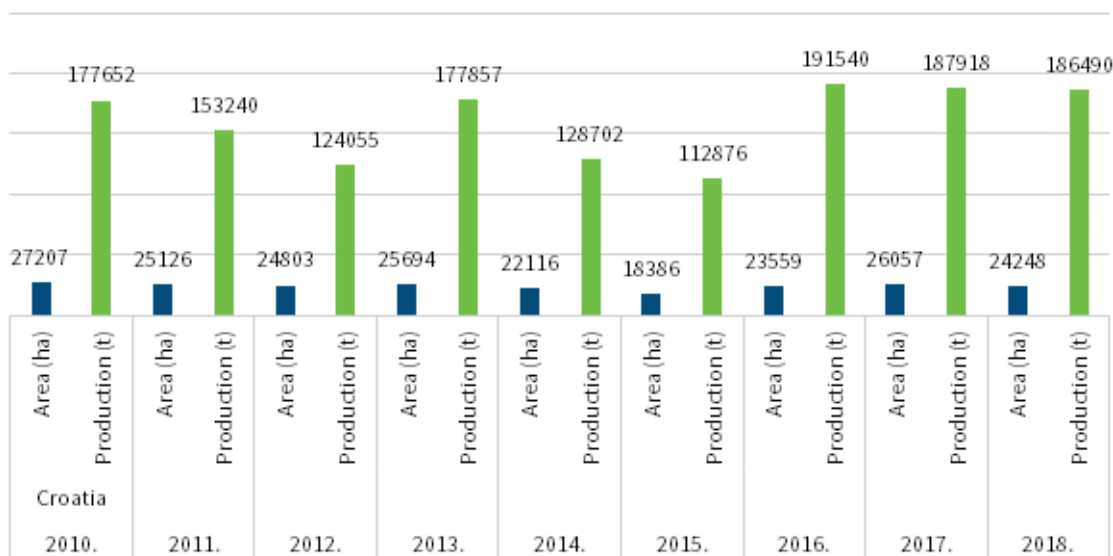
Fodder protein crops (alfalfa, clovers and grass-clover mixtures)

Fodder protein crops are traditionally grown by Croatian farmers as feed for their livestock, and a marked growth is reported in the area planted in the period after the EU accession, especially after the introduction of so-called "Green" payments in 2016, although the overall quantities are varying over the years (this does not signify a marked increase in cultivation, rather a change in how statistical data is recorded).

Most fodder is produced by farmers for the consumption in-situ, while a small portion of production ends up on the farm-to-farm market, mostly as dry hay. Persistent decline in the number of livestock (especially bovine) in Croatia over the past few years is constraining the growth in fodder legumes.

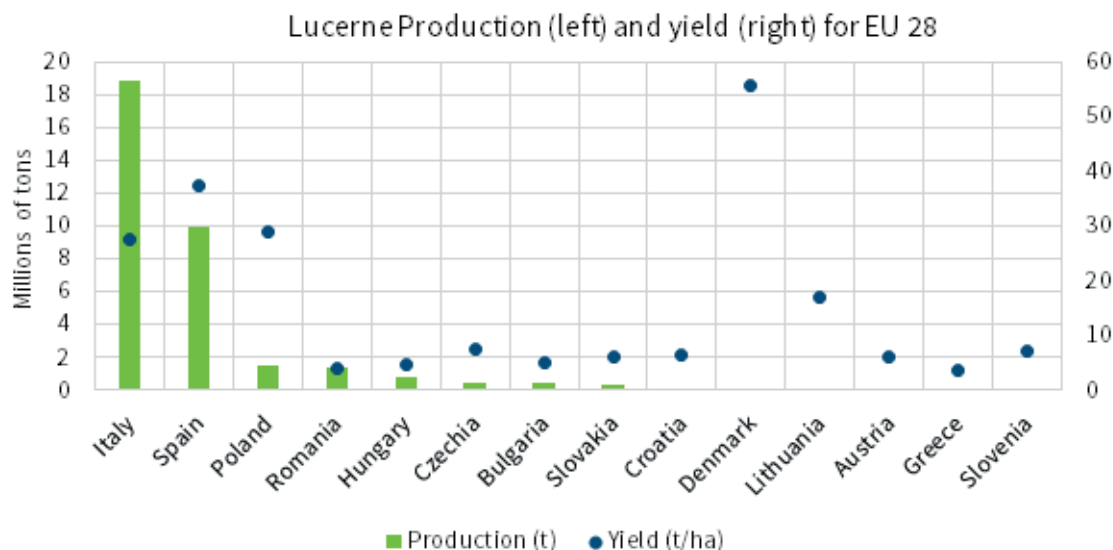
Fodder protein crops are recognised by the Ministry of Agriculture as cost effective and sustainable sources of high-quality protein fodder for livestock, therefore it is looking at a possibility of proposing additional support mechanisms (future RDP set of measures, direct & coupled payments, environmentally beneficial measures, as well as indirect measures like promotion, extension service, research etc.), and is even considering the development of a separate strategy for protein fodder crops. Since the EU accession, Croatian farmers are increasingly implementing legume crop rotations, benefiting from the "Green" agriculture and rural development support measures.

Lucerne - Area planted (ha) & production (t)

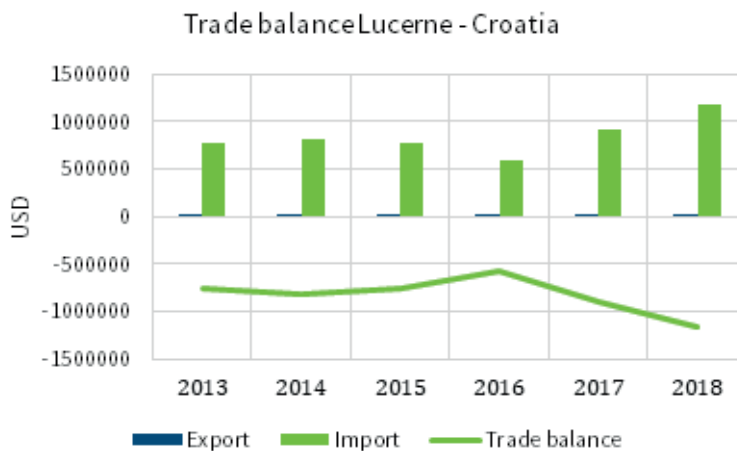


⁷ According to an interview with a senior official in Croatian Ministry of Agriculture, these ideas are under consideration, subject to further consultations in the context of the post 2020 EU CAP negotiation process.





We can see that in Europe, Italy especially, and Spain, dominate in the production of Lucerne, and they are also significant exporters to other EU countries, and to the Middle East and North Africa. With ideal climate and soil conditions, they also obtain very high yields. Other countries with high yields (Poland and Denmark) tend to produce wet crop (fermented fodder crop) as they lack the weather conditions suitable to drying.

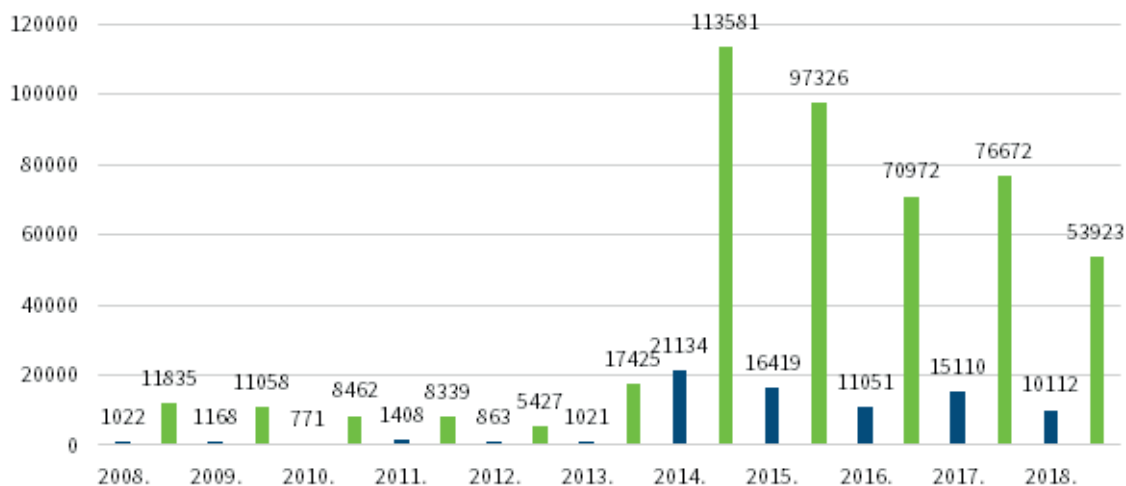


We can see that the trade in Lucerne is largely symbolic, as Croatian farmers strive to satisfy their livestock feed needs by growing their own fodder, and usually utilising it as hay. Some hay is traded domestically, as can be evidenced in the agriculture classifieds. Imports of Lucerne are mostly in the form of pellets, and are used in the animal feed industry, either as a stand-alone feed or as part of a feed mix.



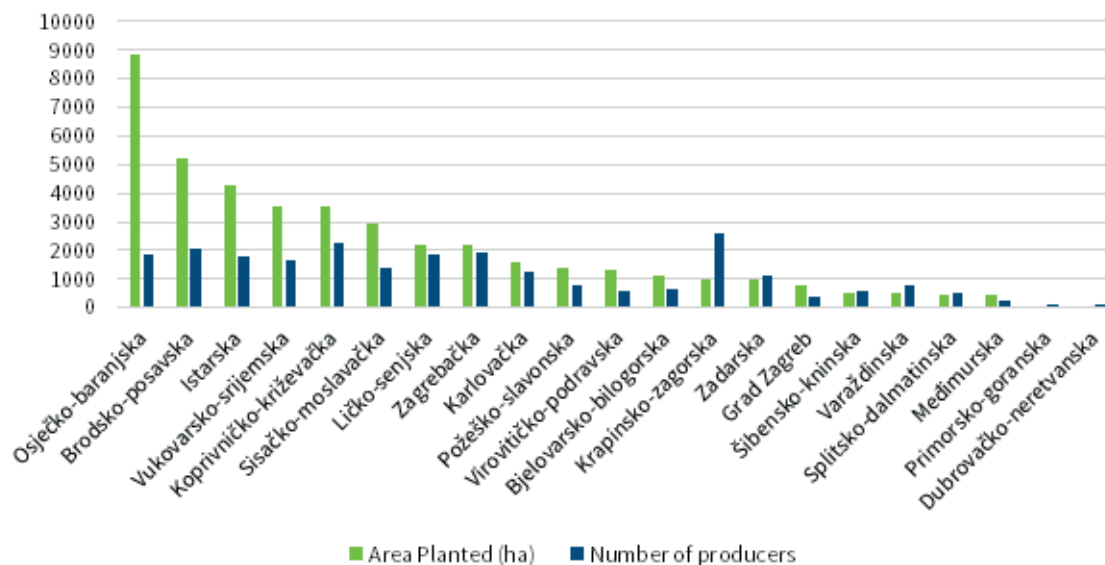


Other fodder legumes cut green - area (ha) & production (t) 2008-2018



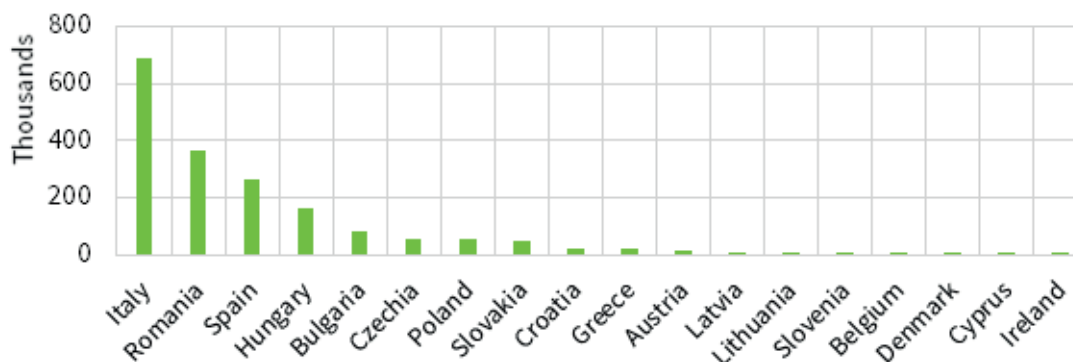
Again, we can see a drastic "increase" in the area planted and quantity of fodder produced, but this is misleading, as the reason for this increase is the onset of EU CAP support measures, benefiting this statistic - before 2014, producers were most likely cropping similar area. Besides, what is evident over the past 5 years is a steady decline in the area planted and total production, probably corresponding to the steady decline in the Croatian livestock sector.

Fodder Protein Crops per County - 2018
 (Clover, Lucerne, Lupin, Mixture of Legumes and Cereals, Soybean fodder, Field Bean, Field Peas)





Lucerne - harvested area in EU 28 per country (ha)

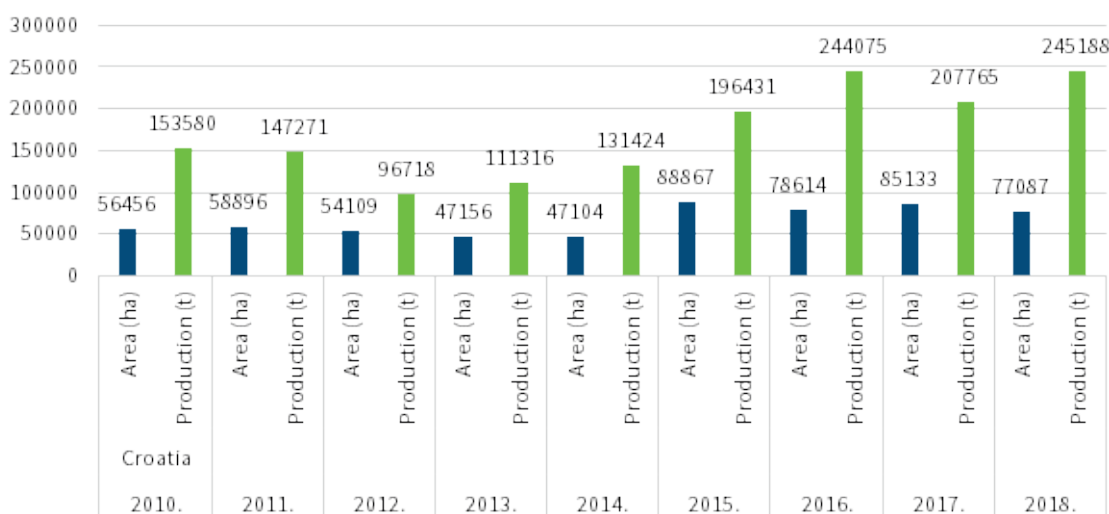


In general, it could be said that the situation in protein fodder sector is stagnant, in a sense that the market for the staple crops, alfalfa and clover, barely exists. Most of domestic production is consumed on-farm, with very little to be sold on the open market. Export is virtually non-existent, with very modest imports, as the price of top-quality hay is usually prohibitively expensive for Croatian livestock farmers.

Soya

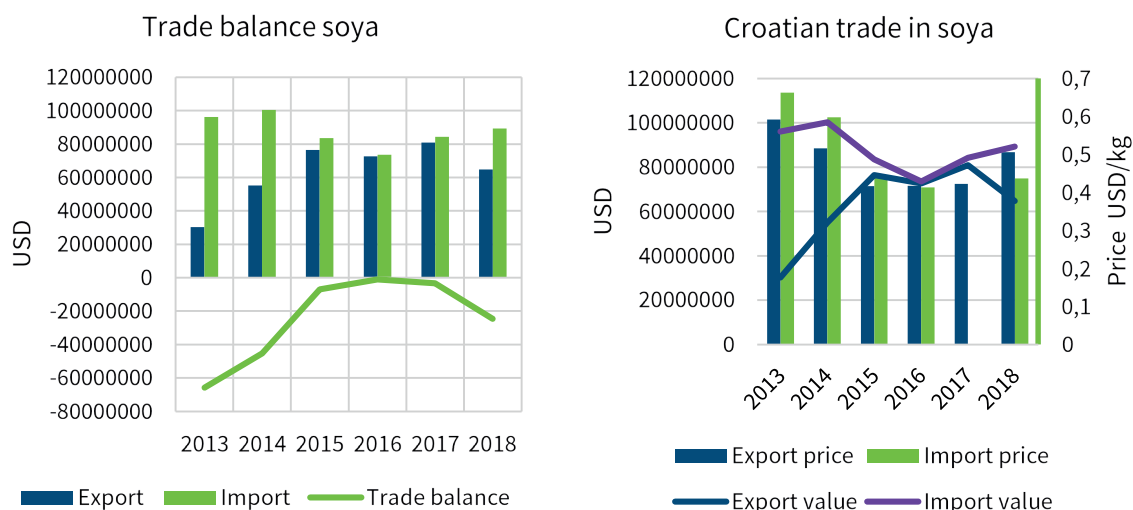
Production of soya exhibits the strongest growing trend, and it could be said that this is clearly the most prosperous protein crop in Croatia. Today, Croatia is among the larger soybean producers in the EU, with a strong growth trend, fuelled by the demand for non-GMO soya in Europe. Croatia has a respectable soya seed development sector, reflected in the 70% market share in planted soya being sourced from locally developed cultivars. Most of domestic production ends up as exports, while domestic market (mostly animal compound feed) demand is covered by imports, mostly from South America (via Slovenia).

Soya - area (ha) & production (t) 2010-2018

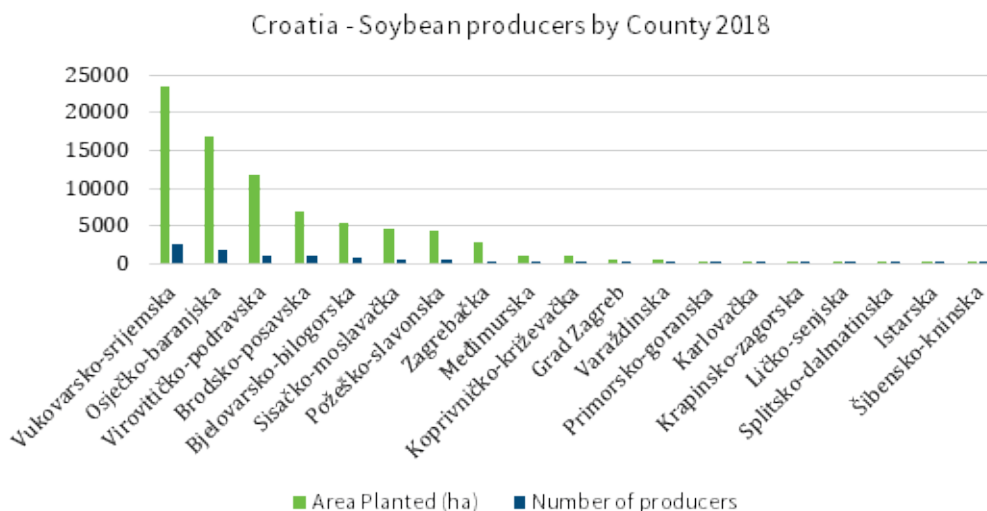




With soya, we can see a clear positive increase in cultivated area and total production quantity: over the last five years production of soya in Croatia has doubled. EU support measures have certainly helped in this case, but also the fact that this is coinciding with the revival of soya cultivation in Europe, in general. Namely, Croatian farmers mostly plant local soya cultivars, all of which are guaranteed and certified GMO-free. European demand for non-GMO soya is growing, and Croatian soya farmers are benefiting from this trend.



In terms of trade, Croatia is not far from a balanced trade position in soya; indeed, export price of Croatian non-GMO soya in the past few years is regularly higher than the price of imported soybean meal from South America, utilised as a protein source by the local compound feed producers. According to the Croatian Chamber of Commerce, in 2017 Croatia has exported virtually all of its soya production (231,594 tons valued at EUR 90 million), while at the same time it has imported only 11,600 tons of soya. Unfortunately, 185,056 tons of soybean meal worth 66,95 million euro was imported to Croatia in 2017, to satisfy the demand of the compound feed sector supplying Croatian and livestock farmers.



Regarding geographical positioning of soya producers, most of them are located in the east of the country, on the fertile plains of Pannonian basin, in the region of Slavonia, bordered by the rivers Sava, Drava and Danube; this is logical as the region is by far the most suitable for consistent cropping of soya, as it has by far the best preconditions for its cultivation within Croatia.

By far the main user of soya is the animal feed sector, as the largest user of protein crops in general, and there is an ongoing consolidation in the industry. Sector can be broadly divided as consisting of a few major players (Pehra and TSH Cakovec are major commercial animal feed producers; companies Belje, Vindija and Zito are also large players, vertically integrated agri-companies mostly producing for their livestock/milk farms and cooperation farmers), as well as significant, but decreasing number of smaller local/regional animal feed producers/traders (Grupa Sedlic for example).

Soya wholesalers and animal compound feed producers are located in the Eastern and Northern parts of the country, close to the farmers who produce soybeans, and on the other hand utilise compound feed in livestock production. Critical missing link in the soya value chain in Croatia is the lack of modern processing capacity: consequently, virtually complete Croatian production of soya is exported, mostly in the region, for processing (major importer and processor of soya is Serbia, importing over 100,000 tons in 2017 for processing). As a consequence, Croatia's soya sector is limited to primary production, and is missing out on adding value and truly capitalising on the demand growth for non-GMO soya products in Europe.

European animal feed producers are increasingly using European-sourced, certified non-GMO soya in their premium feed lines; non-GMO soya is increasingly used in a growing niche of vegan and non-dairy food products in Europe, where the demand for such novel foods is increasing. Only one animal feed producer in Croatia, PEHRA, is certifying its compound feeds as GMO-free, and is trying, through innovations and marketing, to position itself as a premium feed manufacturer on the Croatian and wider European market, with some success. Croatian market for premium animal feed is rather limited, as the ability of Croatian meat and dairy farmers to translate the added cost of premium feed use to the benefits of the consumers is limited.

Soya market supply chain is functioning in a following way: farmer-wholesaler-processors: market actors usually either form ad hoc commercial relationships based on estimation of spot price of soya, or seasonal (sometimes multiannual) contractual agreements. Most often, farmers enter into contractual agreements with the wholesalers, which in turn support farmers by providing them with all production inputs, and in turn they buy back the finished product (soya, for example).

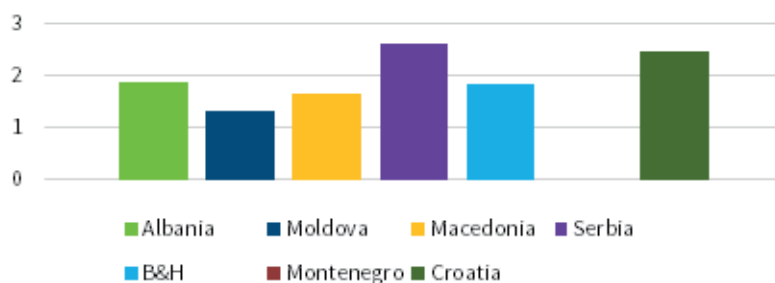
This model of production/trade is quite common in Croatia and has become largely popular due to systemic lack of liquidity in the agriculture sector in Croatia. Sometimes, wholesalers are corporate entities, and sometimes they are cooperatives in joint ownership and with significant land holdings under crops. In principle, all major players on the market adhere to the legal GMO-free requirements and use some form of QC certification (SGS non-GMO standard, Danube Soya certificate etc.)

⁸ <https://www.fanon.hr/en/about-us.html>





Yield of soyabean - CEFTA average 2012-2017



We can see that the yields of soya in Croatia (and Serbia, another significant European producer) are consistently higher than the peer group in the region, and latest available FAO figures for yields are placing Croatian and Serbian soya producers at the top of Europe, with over 3,1 tons per hectare harvested in 2016, in contrast to the Europe average yield of just over 2 tone per hectare.

Main export markets, processors & wholesalers of soya in Croatia

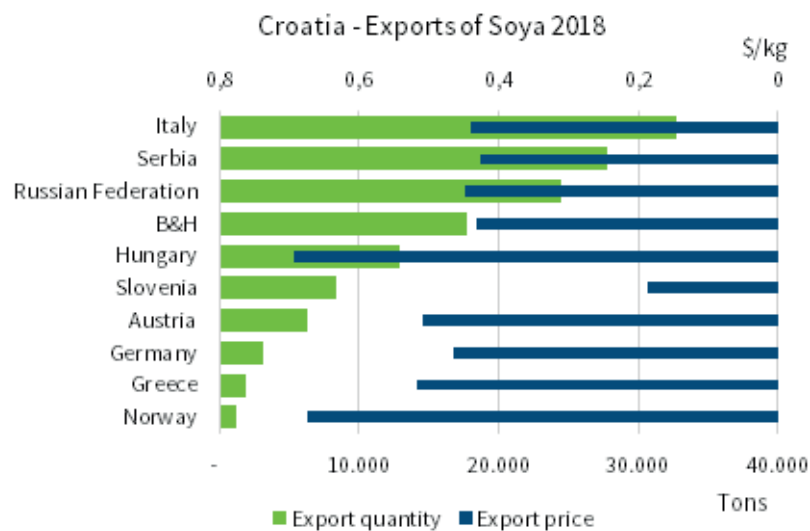


The above illustration is of the Croatian soya supply chain, and main export (blue) and import (red) routes (names and list of all relevant corporate entities are not listed, this is for illustration purposes only).





Most of Croatian soya is exported for processing to Serbia's Vojvodina region - itself a leading European soya producing region, Italy (EU market leader in soya production) and Bosnia & Herzegovina, as well as via Danube barges and the Black Sea ports to Russia. Most imports come from South America (Brazil mostly, via the Slovenian sea port of Koper). Brand names on the map are the major wholesalers and processors of Croatian soybean in Croatia and relevant processors importing significant amounts of soya in the neighbouring countries (the list of brand names is not exhaustive, it is for illustration purposes only).



As we can see from the graph above, main buyers of Croatian soya are located in the neighbouring countries, with the exception of the Russian Federation. All main importers are buying soya from Croatia as a commodity for further processing.

According to a key stakeholder (CEO of a leading livestock feed production company, GMO-free certified), the sector is consolidating in a way that larger manufacturers are pivoting towards vertical integration, developing own livestock production facilities in order to internalise the costs and create value added in the final product (dairy, poultry, pig & beef meat production); alternatively some are trying to position themselves more towards premium feed markets, but they are limited in Croatia so increased focus is towards exports, where quality control, innovation, certification and cost control are paramount; small/medium feed producers are under threat and are finding it harder to compete, as they are trying to cater to the demand of farmers to process/extrude soya for their internal requirements. Overall, soya market is highly commoditised, as Croatian soya is exported for processing abroad, and Croatia largely consumes imported soybean meal, usually GMO, from South America. According to him, only two manufacturers are certified GMO free in Croatia. Significant part of the problem is the inadequacy of existing processing capacity, as there is no modern soya processing plant in Croatia.

Danube soya - Euro soya Initiative

Currently, Croatian Ministry of Agriculture is developing cooperation with the Danube Soya consortium, which already has strong presence in Croatia, specifically in the east of the country, region where most of soya is produced.



A comprehensive media & PR strategy to communicate the benefits of production of legumes, soya in particular, is in development, in order to animate all relevant groups of stakeholders, with particular emphasis on farmers and processors. The idea is to invest resources into a campaign whose aim is to further increase the uptake of soybean farming by Croatian farmers, and to effectively communicate the benefits of non-GMO, certified soya to the agriculture community and the general public.

Soya sector for human consumption in Croatia

As far as soya-based human food value chain in Croatia is concerned, there are a few small entrepreneurs producing branded soya-based vegan and vegetarian food products (tofu, tempeh etc.) supplying a growing niche of Croatian retail/HORECA outlets catering for the consumers of organic/vegetarian/vegan food products. They are supplied mostly from domestic producers of certified non-GMO/organic plant protein producers, whenever possible. This is a strongly growing niche market, increasingly encroaching into mainstream food supply chains, signified by the entry of Croatian super markets into this area (METRO, SPAR etc.), offering plant protein meat/dairy substitutes. In terms of general uptake and popularity with consumers, this niche is slowly but surely entering mainstream, exemplified by the increased popularity of events like the annual "ZeGeVege" festival in Zagreb, attracting over 50,000 visitors. HORECA sector is also starting to respond to the growing demand for plant protein foods in Croatia, with the opening of food delivery and sit-in restaurants, catering for this niche.

Croatian Media's attitude to plant proteins

Swift overview of mainstream Croatian media shows a rather modest interest and promotion of legumes over the past few years. Google search of key phrases has returned only a handful of articles discussing issues surrounding legumes, mostly related to UN FAO's 2016 as a year of Legumes/Pulses initiative. Certain number of web search results relates to various health benefits of legumes for humans, and culinary recipes using legumes. Further hits show web sites and portals which are more specialised and discuss issues relating to agricultural aspects of legume growing and processing (largely catering to the education of farmers), while on the other side there is some web presence of highly specialised niche interest groups and retailers specialising in vegan/vegetarian/flexitarian nutrition issues, including web sites of various NGO's.

The longest emitting show on Croatian national television, HTV, is an agriculture show named "Plodovi Zemlje" (eng. "Fruits of the Land"; it has been running for over 60 years and is by far the most popular TV show in the country, drawing regularly over 500,000 viewers in a country of 4 million. It runs on Sundays, midday, and covers current issues in agriculture sector, trends, problem issues and success stories. Occasionally, there are episodes which cover various aspects of legume growing, covering sectors of soya, beans, green beans, peas, faba beans.

⁹ <http://annapurna.hr/>

¹⁰ <https://www.biobio.hr/bioblogija/odakle-slonu-misici-prica-o-biljnim-proteinima-2824/>

¹¹ <https://www.zegevege.com/?lang=en>

¹² <http://zrnobiobistro.hr/>; <https://vegehopp.hr/en>



Overall, the impression is that the issue and topic of legumes for human and animal consumption does receive certain media exposure, but there is no active, ongoing, consistent and sustainable campaign of promotion or discussion of the topic in legumes in the Croatian media. Rather, the impression is of a sporadic, uncoordinated, current-issue style coverage of various aspects of legume crops, from issues relating to cultivation, market conditions, individual farmer stories, and on the other side, human consumption of legumes (health benefits of legumes, culinary aspects, recipes etc.).

It could be said that, in Croatia, media outlets are in a position, in terms of programming and infrastructure, to be able to organise media campaigns and promotional activities with the aim of popularisation of protein crops and their associated benefits to all stakeholder groups. The following is a proposal of a possible legumes media communication strategy to be implemented in Croatia.

Legumes: communication strategy draft - media

Increasing legumes use for food in Croatia and the region is a process shaped and influenced by a number of factors, with communication being an important driver of the desired change.

Rather than simply suggesting a media campaign, this task requires a holistic approach that will take into account all the different stakeholders involved in the process and adjust communication so as to effectively reach them all.

The communication should be carried out via a selection of appropriate channels, chosen based on their capacity to deliver a specific message to a target audience.

Simply put, the objectives of this communication are: a) raise awareness of legumes and their health benefits among general public, thus driving demand; b) influence the supply chain so they deliver on the expectations, i.e. ensure sufficient amounts of legumes available to end consumers.

- 1) Target audience: General public = end consumers;
 - a. mass media campaign will ensure sufficient visibility levels of the message to drive awareness & consideration
 - i. TV for quick reach (30" TVC, 3 weeks on air, national coverage) can ensure as many as 80%+ of Croatians actually see the message
 - ii. Print/ Online for additional, in depth information about legumes, their health benefits, nutritional value, usage suggestions etc
 - b. Leveraging the power of influencers (nutritionists, doctors) can help strengthen the message
 - c. Several flights a year (4-5) are needed to ensure full adoption of the key message and successfully initiate behavioural changes required to achieve the objectives set
 - i. The communication can change over time; i.e. several TVCs with different variants of the same key message throughout the year





TRansition paths to sUustainable
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- d. Current market trends are beneficial to our task: the rise of veganism has opened up an ongoing conversation about the sources of proteins we use for food instead of meat. This has become very topical among certain consumer segments and has already “planted the seed” of consideration among a wider group. The audience is now more educated and easier to influence providing the message is strong enough and relevant.
- 2) Target audience: business stakeholders (legumes producers, distribution channels/ retailers)
- a. Mass media campaign will already have reached them, hence driving awareness of the topic
 - b. Lobbying: engage with relevant groups (consumer groups, relevant public institutions, etc) to influence the dynamics of the category (both ways: producers and retailers) and motivate positive change
 - i. Policies encouraging growth of the category
 - ii. Events enabling positive interactions among key stakeholders
 - iii. Selected media to further reinforce the message
 - iv. Promoting success: awards, recognitions for achieving the set milestones in development of the category

The above is a draft approach to communication strategy that would help shape the public opinion of the topic and initiate the (consumer) behavioural changes needed for the category to grow.

According to a senior media strategist, a comprehensive campaign on legumes could be organised and implemented in Croatia relatively quickly, as all the elements of the chain are present, and with increasing popularity of niche markets, in tandem with traditional popularity of food legumes (especially beans and peas), this campaign could yield significant consumer interest, increased awareness and change in spending/consumption habits/pattern rather quickly, and at reasonable cost. Key would be to develop the strategy and implement it with the inclusion of a wide range of stakeholders, including the entire value chain.

Relevant Croatian R&D sector activities for legumes in the context of sustainability

Scientific work on the legumes in Croatia is focused largely on soya, where local varieties still hold over 70% of the market and are successfully exported to the neighbouring countries. There is co-operation with domestic applied science (mainly Agriculture Institute in Osijek, and to an extent BC Institute Zagreb) on locally-developed non-GMO cultivars, reflected in the strong and constant presence of these varieties on the Croatian market. From 1976 to 2016, 43 Croatian varieties of soya have been recognised and registered, many of these are used by Croatian and neighbouring farmers; 15 of these are EU-registered. A number of Croatian academic institutions are conducting research activities in various aspects of sustainability of legume production, and the academic community has recognised the systemic lack of research in this field with recent establishment of a Centre of Excellence for Biodiversity and Molecular Plant Breeding, financed with EU funds .

¹² The research team involves scientists from three faculties (University of Zagreb, Faculty of Agriculture; J. J. Strossmayer University of Osijek, Faculty of Agriculture; University of Zagreb, Faculty of Science) and three institutes (Institute of Agriculture and Tourism Poreč, Agricultural Institute Osijek, Institute for Adriatic Crops and Karst Reclamation Split) and thus includes the prominent scientists from all higher education institutions as well as all the research institutes in the field of agriculture in Croatia; web site of the initiative: <http://biodiv.iptpo.hr/en/bioraznolikost-i-molekularno-oplemenjivanje-bilja-2/>



There is some presence of locally developed cultivars of clover and alfalfa, but these are largely varieties developed almost 30 years ago (many of the old varieties are still used by the farmers, and there is some work undertaken by the Institutes in Zagreb and Osijek on improvements of these), but more and more farmers are turning to the varieties offered by importers (mainly from the Netherlands and Italy).

Regarding peas, there are private corporate initiatives to develop and further optimise local varieties of peas (via private research efforts of the leading regional food processor Podravka Plc.), and in cooperation with the institute in Osijek and Faculty of Agronomy in Zagreb.

The following are some of the scientific projects, either recently completed or still ongoing, which are looking into various aspects of legume development from a sustainability perspective. Of significant importance is a recent project (further elaborated bellow), aiming to enhance and upgrade domestic R&D capacity in plant genetics.

Key infrastructure development project

ESTABLISHMENT OF THE CENTRE OF EXCELLENCE FOR BIODIVERSITY AND MOLECULAR PLANT BREEDING

Short description of the project

The purpose and justification of the project derives from the current situation of plant breeding in the Republic of Croatia as one of the key components of the development of agricultural production. The beginnings of plant breeding in Croatia date back to the beginning of the 20th century, and during the last 60 years over 1,200 domestic cultivars have been registered. These cultivars were made using classical breeding methods based on the analysis of agronomic properties in field trials. Although classical methods have greatly contributed to the increase in yield and quality, in the 21st century they are no longer sufficient for effective breeding and development of new cultivars. Modern breeding programs include various methods of phenotyping and high yield genotyping, and the consequences are clearly visible by analysing the seeds market in Croatia in the last 25 years where multinational breeding companies are becoming dominant.

The application of the method of high permeability phenotyping and genotyping in plant breeding in Croatia has so far been modest due to: (1) fragmentation of research groups, (2) insufficient scientific expansion, and (3) short-term and financial constraints of previous research projects. By implementing the proposed project, the Science Centre of Excellence for Biodiversity and Molecular Plant Breeding (SCE CroP-BioDiv) will become a top research network with the aim of creating new knowledge for the purpose of enhancing the higher education system, incorporating into the European Research Area and promoting Plant Breeding and Seeding as a strategic sector of Croatian agriculture. The transfer of knowledge from the area of activity of SCE CroP-BioDiv will have a positive effect on the development of the national seed and planting industry, and thus on the development of the whole agricultural and food industry.



OBJECTIVES AND EXPECTED RESULTS

The aim of the project is to improve plant breeding in the Republic of Croatia based on (1) the profits increase deriving from sustainable use of plant genetic resources for food and agriculture, (2) introduction and optimization of modern high yield phenotyping techniques necessary for identification of key plant species properties 3) introduction and optimization of modern genotyping based on new generation sequencing with the application of new approaches in the statistical analysis of data.

TOTAL VALUE OF PROJECT: 37.511.157,82 KN (cca EUR 5,000,000)

AMOUNT SUFINANCING EU: 31.884.484,15 KN (cca EUR 4,3 million)

PROJECT DURATION: 2018-2023

The project was co-financed by the European Union from the European Regional Development Fund.

<http://biodiv.iptpo.hr/en/bioraznolikost-i-molekularno-oplemenjivanje-bilja-2/>

List of the more relevant recent scientific projects in the area of plant protein development

Faculty of Agronomy University of Zagreb - projects relating to legumes

Estimation of genetic adaptability to drought conditions in Croatian varieties of maize and soya for the purpose of development of drought-resistant cultivars

Competition title: Support for research and development activities in the area of climate change

Funding: Croatian science foundation

Total value: 1 967 000,00 HRK (EUR 250,000)

Funded amount: 1 967 000,00 HRK

Start date: 01. 04. 2017.

Abstract - Of all the extreme weather caused by climate change drought has the greatest economic impact on society (1). Drought is the main and most common cause of unprofitable yields of the most important agricultural crops in CROATIA (2). According to global and local climate change scenarios, more frequent drought intensity (3) is expected in the near future, which will affect the sustainability of the production of the most important agricultural crops of strategic importance for CROATIA. In two consecutive years, the genetic adaptability of the most important and the latest varieties of corn and soybeans in terms of tolerance to drought for the identification of superior germplasm and selection methods for breeding purposes will be examined. A consortium of 9 research organizations will conduct field experiments on 20 locations across Croatia (continental and coastal areas) with the intention of capturing "incidental drought" and assessing a range of the same genotypes in different climate scenarios and their Reactions to optimal and drought conditions. In all experiments, the phases of growth, development and the most important economic properties of certain genotypes will be analysed.



Laboratory physiological and molecular-genetic tests will be conducted in parallel for the "rapid detection of tolerant genotypes", and these methods will be validated with actual results from Polish experiments. All experimental locations will be collected and analysed micro-meteorological data required to evaluate the occurrence, intensity and duration of the drought. Advanced statistical analysis of meteorological and biological data will identify the genotypes of corn and soy that best tolerate drought conditions and the methodology for testing that best discriminates against such genotypes, which would improve the production and Selection process to this property in the current plant breeding program (4). A detailed analysis of experimental and historical climatic data from regular climatic measurements will allow precise assessment of real economic damage in agriculture in Croatia, as the basis for future development policies.

Leaders

Prof. Ivan Pejić, PhD
University of Zagreb Faculty of Agriculture

Project partners

Higher education institution in Krizevci, HCPHS, Department of Seed and Nursery, Osijek
Institute for Adriatic Crops and karst reclamation, Split, Institute for Agriculture and Tourism, Poreč, Bc Institute Zagreb, Faculty of Agriculture, university J. J. Strossmayer, Osijek
National Hydro-Meteorological Institute, Zagreb, Agricultural Institute Osijek

Determining the gene sequences and divergence of local populations of red clover compared to commercial cultivars

Competition title: HRZZ partnership in research
Funding: Croatian science foundation
Total value: 53 461,00 HRK (EUR 4,220)
Funded amount: 53 461,00 HRK (EUR 4,220)
Start date: 01. 12. 2012. End date: 30. 11. 2015

Abstract - Red Clover (*Trifolium pratense* L.) is a two-to-three-year feed species. Its center of origin and Diversity is the Mediterranean Center (area of southeast Europe and Central Asia). Red clover belongs to the legume family, has a diploid number of chromosomes ($2n = 14$), is self-incompatible and pollinating using bumblebees and bee. It is cultivated for the production of high-quality fodders and silage and repairs the soil's fertility and structure. Due to the economic importance of red clover, in Europe and Croatia, interest in the assortments of this culture is increasing. In the absence of domestic, the production of the stern is mainly used import varieties, most of which due to in adjustment to our agroecological farming conditions yield weaker yields or often fail after the first year of cultivation. Thanks to the diversity in climate and relief, the local populations of red clover adapted for cultivation in certain agroecological conditions were developed in the territory of the Republic of Croatia, such populations represent a rich source of genetic variability and enormous potential of using these sources in the creation of new cultivars.



In the largest number of researches in our world, the most studied commercial varieties, smaller local populations, and at least the local populations and commercial varieties were studied, and their comparison in the studied properties. In the period from 2006 to 2009. In the wider area of Croatia, the seed of local populations of red clover was collected within the framework of The SEEDNet Regional program (South East European Development Network on Plant Genetic Resources) financed by the Swedish and the national program for the preservation and sustainable use of plant genetic resources for food and agriculture in the Republic of Croatia financed by the Ministry of Agriculture, Fisheries and Development program. Local populations of red clover form the basis of the project in which the application of modern biotechnology methods would study the morphological and molecular characteristics and agronomic properties of populations and compare with commercial cultivars to create an initial plant breeding germplasm for the creation of new domestic cultivars.

The results of the research will be a direct contribution to:

- (1) The development of domestic germplasm of red clover valuable genetic basis for adaptability to different agroecological breeding conditions of certain agricultural areas of Croatia,
- (2) The use of local populations of red clover in the future breeding development of new domestic cultivars that will contribute directly to the added value of final products, and thus to rural development as a whole and to increase the offer of domestic, red clover varieties. The value of germplasm, studied, described and selected under this project will have a significant contribution in future scientific research projects on the one hand and in the creation and placement of new varieties in the field of R. Croatia on the other, which would had not only a direct influence on the development of livestock and dairy industry, but also on the development of the Croatian economy.

Genetic variability of red clover and tolerance to abiotic stresses

Competition title: 178-1780691-0686

Funding: MZOS

Total value: 443 654,70 HRK (EUR 60,000)

Start date: 01. 01. 2007.

End date: 31. 12. 2013.

Leaders

Prof. Snježana Bolarić, PhD

University of Zagreb Faculty of Agriculture

Useful microbial communities in sustainable Leguminosae production

Competition title: 178-1780692-0558

Funding: MZOS

Total value: 423 668,00 HRK (EUR 57,000)

Start date: 01. 01. 2007. End date: 31. 12. 2013.

Leaders

Prof. Sanja Sikora, PhD

University of Zagreb Faculty of Agriculture





TRansition paths to sUustainable
legume-based systems in Europe

Protein Crops in Croatia
Overview of the sector and policy
recommendations
www.true-project.eu

New technologies in the production of peas and beans for livestock farming

Competition title: 178-0000000-3587

Funding: MZOS

Total value: 150 000,00 HRK (EUR 20,000)

Start date: 01. 01. 2007.

End date: 30. 11. 2011.

Leaders

Assoc. Prof. Darko Uher, PhD

University of Zagreb Faculty of Agriculture

Phenotypic and molecular characterization of natural populations of *Risobas* that nodulate Lucerne (*Medicago sativa* L.)

Competition title: call for financing research proposals of Zagreb University

Funding: University of Zagreb

Total value: 30 000,00 HRK (EUR 4,000)

Start date: 01. 10. 2013.

End date: 30. 06. 2014.

Leaders

Prof. Sanja Sikora, PhD

University of Zagreb Faculty of Agriculture

Microbial biotechnology in the function of increasing the competitiveness of bean production

Competition title: call for science & applied research in agriculture & rural areas (2012)

Funding: VIP - Council for research in agriculture

Total value: 105 000,00 HRK (EUR 15,000)

Funded amount: 105 000,00 HRK

Start date: 13. 11. 2012.

End date: 13. 11. 2014.

Leaders


Prof. Sanja Sikora, PhD

University of Zagreb Faculty of Agriculture

Agriculture Institute Osijek - Department of Industrial Plants

The most relevant institution conducting applied research and development of legumes in Croatia is the Agriculture Institute in Osijek, specifically its Department of Industrial plant's work on the development of local soybean varieties. Conducting research for over 60 years, it has developed and registered 43 varieties of soybean, 15 of which are on the EU list, and 10 of which represent over 70% of planted area under soya in Croatia and are contributing significantly to the increase and advancement in production.

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 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727973



The main goal of breeding is to continuously create new better genotypes of soybean and sunflower for the production practice, by using the appropriate breeding methods, while implementing constant monitoring and using the trends used in the world for breeding these cultures. Aside from the breeding work, the Department also conducts various agricultural engineering research studies on their own product range in order to be able to provide recommendations in wider practice.

The scientists from the department have published over 250 scientific and professional papers, several books and studies and edited 11 Proceedings from the soybean conference in Osijek; over 100 papers are indexed in reference databases. Direct link to Institute's research work is:

<https://www.poljinos.hr/en/science/departments/department-of-industrial-plants/#research-activities>

In addition, Institute's **Department for Forage Crops**¹⁴ is conducting R&D and field trials on alfalfa, clover, field and dry peas, 10 cultivars of which are recognised & registered by the EU; in total 26 cultivars were developed and registered since the 1960's. Cultivars developed by the Institute are widely used in Croatia, but in recent years more prominence is given to the imported varieties.

Bc Institute Zagreb

This is a private company entity with a long tradition (over 100 years) of agriculture seed development in Croatia. It is mainly focused on cereal crops - it does not have a direct program on soya development: in this field it collaborates with the Agronomy Faculty of Zagreb University and S.I.S., Società Italiana Sementi. The Institute has developed a number of cultivars of legume forage crops in the past - clovers, alfalfa and field peas, but focus now is mostly on the maintenance and marketing of existing varieties, rather than the development of new ones.

In general, science on legume crops in Croatia is sporadic and there is no systemic approach to this area of research. Often research is focused on the scientific, and less on the applied aspects: linkages between academia and industry are weak (despite some notable exceptions), and there are few major, multi-institutional and multidisciplinary, long term scientific programs looking into legumes. Hopefully, the establishment of the Science Centre of Excellence for Biodiversity and Molecular Plant Breeding will serve to improve the situation in the R&D sector.

National and EU-28 legislation on pulse crop production

Croatian legislation on protein crop production

Croatia, as an EU member State, is in full compliance with the **Acquis Communautaire** legislation pertaining to the production and processing of protein crops. In EU 28 legislation on pulse crop production and supports to enhance cultivation are governed by several regulation for direct payments, rural development and CMO:

¹⁴ <https://www.poljinos.hr/en/science/departments/department-of-forage-crops/>





- REGULATION (EU) No 1307/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of the 17 December 2013 establishing rules for direct payments to farmers under support scheme within the framework of the common agricultural policy,
- REGULATION (EU) 2017/2393 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 December 2017 amending Regulations (EU) No 1305/2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), (EU) No 1306/2013 on the financing, management and monitoring of the common agricultural policy, (EU) No 1307/2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy, (EU) No 1308/2013 establishing a common organization of the markets in agricultural products and (EU) No 652/2014 laying down provisions for the management of expenditure relating to the food chain, animal health and animal welfare, and relating to plant health and plant reproductive material,
- REGULATION (EU) No 1305/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005,
- REGULATION (EU) No 1303/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No 1083/2006,
- REGULATION (EU) No 1306/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 on the financing, management and monitoring of the common agricultural policy, and repealing Council Regulations (EEC) No 352/78, (EC) No 165/94, (EC) No 2799/98, (EC) No 814/2000, (EC) No 1290/2005 and (EC) No 485/2008,
- REGULATION (EU) No 1308/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 establishing a common organization of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007

These legal requirements are transposed into relevant Croatian legislation, most importantly in this context, the Law on Agriculture production and the Law on Food Safety & Food Security.

National and EU grants and financial support measures for protein crops

Under CAP legumes are recognized as important plants in environmental point of view and production is supported under greening measures-through the possibility to grow certain nitrogen-fixing crops that are beneficial for biodiversity on Ecological Focus Areas (EFA), and a crop diversification requirement.



Furthermore, within direct payments, there is voluntary coupled support (VCS) on direct payments scheme and each MS have their own national decree for its implementation. VCS can be provided to sectors with certain difficulties and to maintain a current level of production. Within the Rural Development program (RD) it is possible to use measures to support protein crops, MS may give farmers support for introducing protein crops in rotation or maintaining green cover to improve soil and water quality in defined areas. There is opportunity also to implement specific operative program within CMO.

By 1 August 2014, 16 Member States had notified the European Commission of their decisions to grant coupled support for the production of protein crops. Based upon their decision, about 1% of the annual amount available for granting direct support in EU-28, i.e. 10.6% of the amounts earmarked to VCS, were available for the production of protein crops from 2015. Some 20 measures (same number as in the previous period 2015-2016) are targeting specific types of farming and/or regions in which the protein crop sector and production undergo difficulties in 15 Member States (1 less than in the previous period 2015-2016).

The share of annual direct payments amounts dedicated to this sector remains unchanged for the period 2017-2020 at EU level. The table below provides an overview of the notified measures. For the period 2017-2020, the quantitative limit at the EU level for the protein crops related coupled support is 4.7 million hectares, which increased approximately by 0.3 million hectares in comparison to the previous period (2015-2016).

The following table illustrates the individual member state sectors eligible for support payments, nominated areas under crops, type of crops, and the amount requested and approved by the Commission.

MS	Measures VCS	quantity limits (ha)	Yields	Envelope 2017	Envelope 2018	Envelope 2019	Envelope 2020
Bulgaria	Measure for Coupled Support for Protein Crops	102 356	5,2	15 864 520	15 895 180	15 925 840	15 925 840
Czech Republic	Protein crops	134 000	3,91	16 864 007	17 234 158	17 233 958	17 456 180
Ireland	Coupled Aid for Protein Crops	4500	5	3 000 000	3 000 000	3 000 000	3 000 000
Greece (3 measures)	Coupled Support for the production of pulses (legumes for human consumption)	16 500	1,8	4 882 207	4 828 375	4 774 548	4 774 548
	Support to Protein Feed Fodder	40 000	1,7	6 835 089	6 759 725	6 684 367	6 684 367
	Protein hay crops	94 558	1,65	25 809 281	25 531 408	25 256 552	27 164 626
Total Greece		151 058		37 526 577	37 119 508	36 715 467	38 623 541
Spain	Ayuda asociada a los cultivos proteicos: proteaginosas y leguminosas	360 759	1,03	21 645 540	21 645 540	21 645 540	21 645 540
	Ayuda asociada a los cultivos proteicos: oleaginosas	572 287	1,15	22 891 489	22 891 489	22 891 489	22 891 489
Total Spain		933 046		44 537 029	44 537 029	44 537 029	44 537 029





France	Aide à la production de légumineuses fourragères	883 986	7,8	93 985 473	93 664 293	99 343 117	96 558 518
	Aide à la production de soja	49 736	2,75	5 749 862	5 730 213	5 710 563	5 907 276
	Aide à la production de protéagineux	397 132	3,38	33 557 385	33 442 709	33 328 032	34 476 087
	Aide à la production de légumineuses fourragères déshydratées	83 145	10,9	7 673 091	7 646 870	7 620 649	7 883 158
	Aide à la production de semences de légumineuses fourragères	18 614	0,45	3 826 632	3 813 555	3 800 478	3 931 394
Total France		1 432 613		144 792 443	144 297 640	143 802 839	148 756 433
Croatia	COUPLED SUPPORT FOR FODDER PROTEIN CROPS	70 000	5,3	4 822 500	5 587 700	6 352 900	6 121 600
Italy	Colture proteiche nel Nord Italia (soia)	183 370	3,5	9 612 836	9 492 401	9 371 973	9 371 973
	Colture proteiche nel Centro Italia	214 893	21	13 792 330	13 619 531	13 446 743	13 446 743
	Colture leguminose nel Sud Italia	204 259	18	11 493 609	11 349 609	11 205 619	11 205 619
Total Italy		602 522		34 898 775	34 461 541	34 024 335	34 024 335
Latvia	Support for protein crops	38 449	6,88	4 608 620	5 105 840	5 603 080	6 055 080
Lithuania	Coupled support for protein crops	101 400	1,28	11 842 438	12 475 774	13 109 110	13 109 110
Luxembourg	Aid for protein crops	800	6,05	160 000	160 000	160 000	160 000
Hungary	Coupled support for protein fodder	196 656	4,3	13 431 340	13 430 100	13 428 670	12 691 580
	Coupled support for soybean and protein crops (grain)	64 414	1,6	13 431 340	13 430 100	13 428 670	12 691 580
Total Hungary		261 070		26 862 680	26 860 200	26 857 340	25 383 160
Poland	Płatność do strączkowych roślin wysokobiałkowych na ziarno	116 066	1,84	51 177 810	51 468 540	51 757 680	46 979 619
	Płatność do paszowych roślin wysokobiałkowych	182 609	24,4	17 059 270	17 156 180	17 252 560	15 659 873
Total Poland		298 675		68 237 080	68 624 720	69 010 240	62 639 492
Romania	Schema de sprijin cuplat în sectorul soiei	91 630	1,3	31 602 000	32 518 000	33 434 000	33 892 000
	Schema de sprijin cuplat pentru lucerna	344 300		15 12 911 250	14 632 750	16 354 250	17 215 000
Total Romania		435 930		44 513 250	47 150 750	49 788 250	51 107 000
Finland	Protein crop premium, whole Finland	176 570		6 300 000	6 300 000	6 300 000	6 300 000
Total EU 28 EUR				464 829 919	468 810 040	472 420 388	473 198 800
Total average EU 28 per ha: 99 EUR/ha							

As it can be seen from the above table, most EU member states have decided to provide some form of targeted support to protein crop cultivation either through voluntary coupled schemes or so-called Green payments for Ecological Focus Areas, or both in the case of 15 EU member states.



Member State notifications on the use of VCS (X) and EFA (green field) for different protein crops in 2019

Country	Pea	Faba bean	Chickpea	Lupine	Alfalfa	Soya bean	Oilseeds (other than soya bean)	VCS* (ha)
AT								
BE								
BG	X	X	X	X	X	X		102.356
CY								
CZ	X	X		X	X	X		134.000
DE								
DK								
EE								
EL	X	x	X	X	X	x		151.058
ES	X		X	X	X	X	X	943.046
FI	X	X		X				176.570
FR	X	X			X	X		2.206.061
HR	X	X		X	X	X		70.000
HU	X	X	X	X		X		261.070
IE	X	X		X				4.500
IT	X	X	X	X		X	X	602.522
LV	X	X		X	X	X	X	38.449
LT	X	X		X	X			101.400
LU	X	X	X	X	X			800
MT								
NL								
PL	X	X	X	X	X	X		298.675
PT								
RO					X	X		426.360
SE								
SK	X	X				X		430.104
SI								
UK								

* VCS: Fixed number of hectares based upon the historical production area in 2009-2013

In total, EU member states are supporting legume production on 4,74 million hectares in period 2016-2020 with the annual amount of EUR 4,7 billion, or EUR 99/ha per year on average. Croatia has requested, and was granted, VCS and EFA support funds for the cultivation of peas, fava beans, lupine, alfalfa and soya bean, while only EFA support was requested for chickpea production. Nominated land area is 70,000 hectares, and the average annual amount of support is cca EUR 5,7 million, or just under EUR 82 per hectare, on average.





Location and concentration of Croatian legume producers

The following maps illustrate geographical concentration of Croatian legume producers, distributed according to the administrative divisions (counties), shown here through the number of producers and area cultivated, by county. Legume varieties considered are the following: soya and pulses (beans and peas).

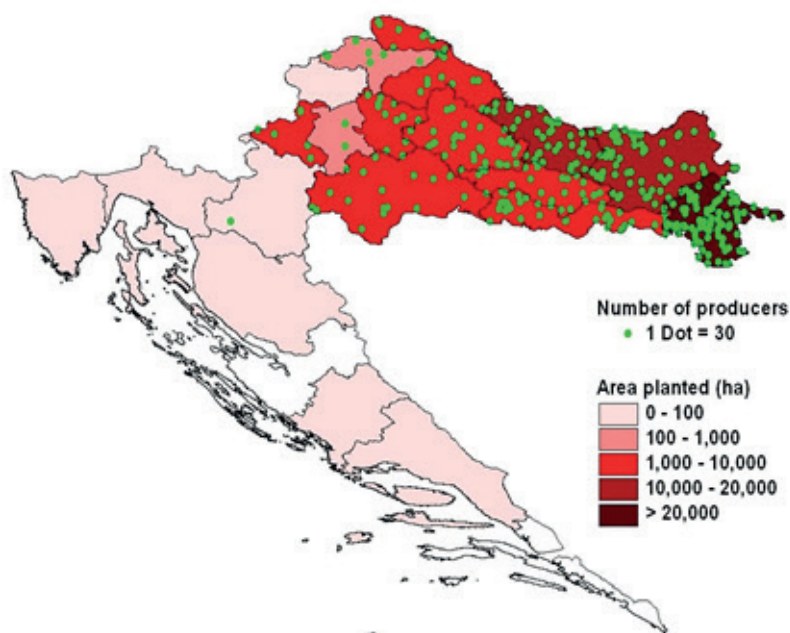


Figure I Location and density of soya production - area planted and number of producers

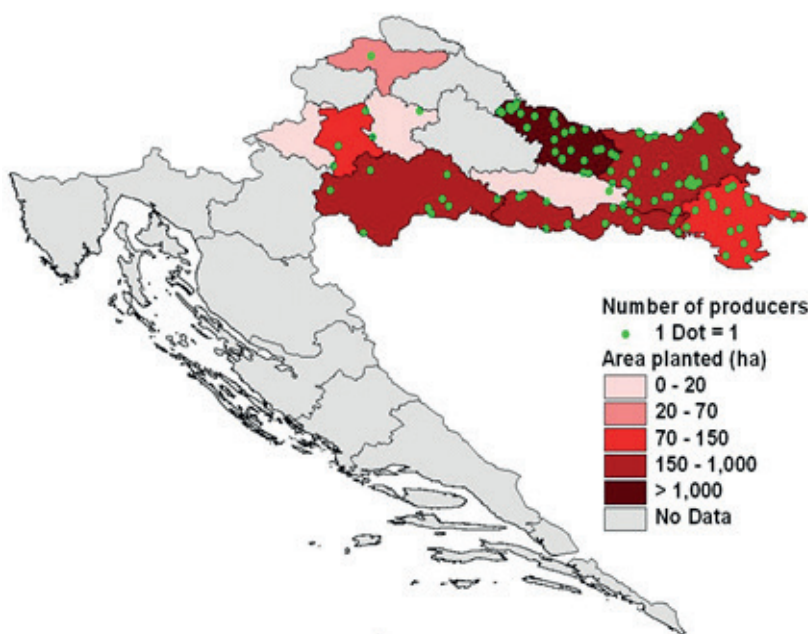


Figure II Location and density of organic soya production - area planted and number of producers



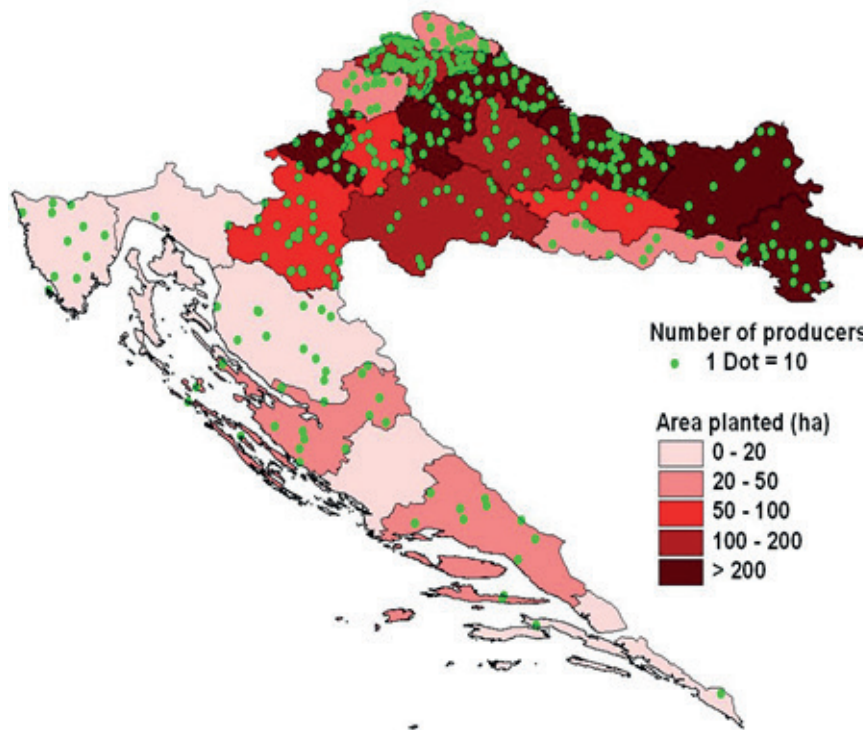


Figure III Location and density of pulses production - area planted and number of producers

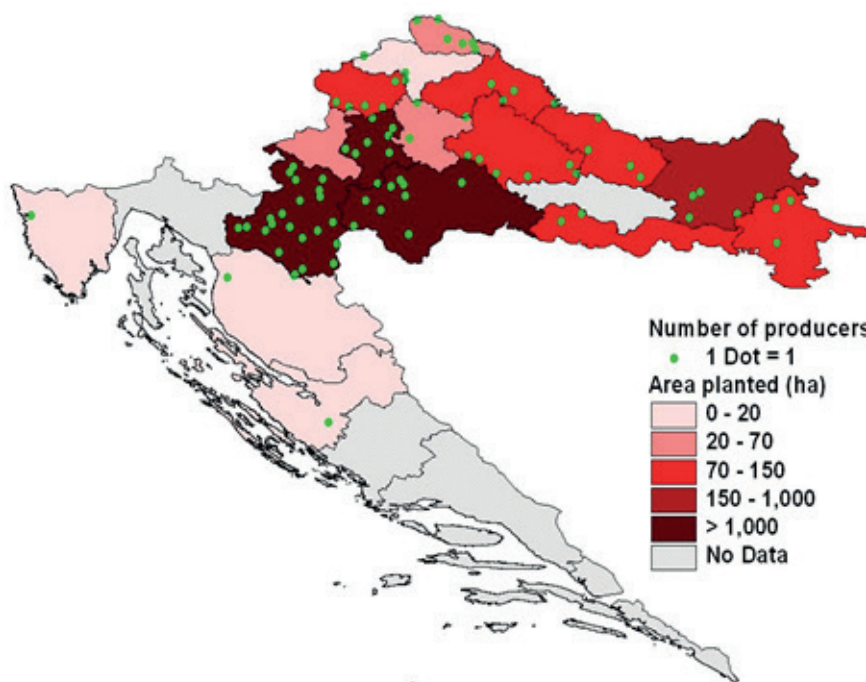


Figure IV Location and density of organic pulses production - area planted and number of producers



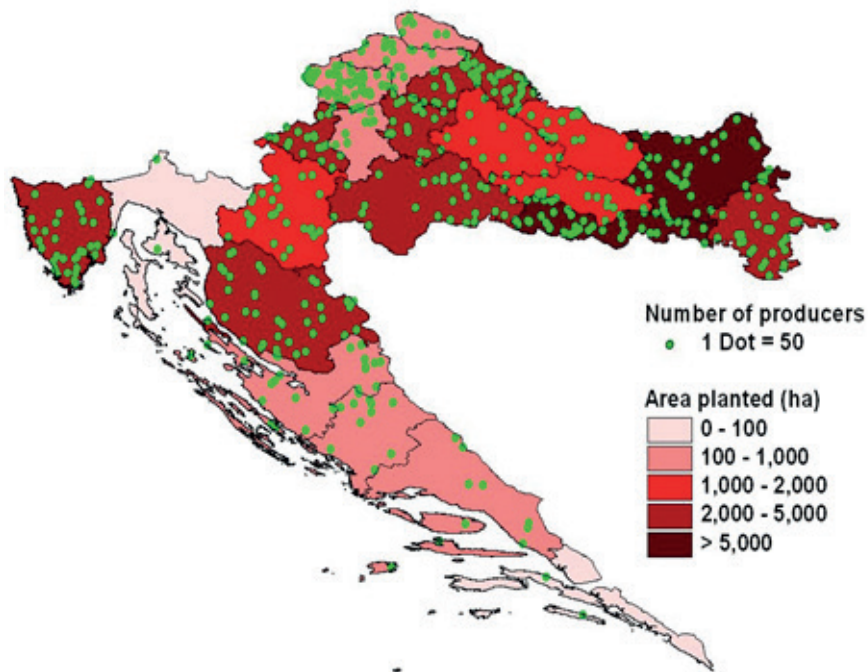


Figure V Location and density of fodder production - area planted and number of producers

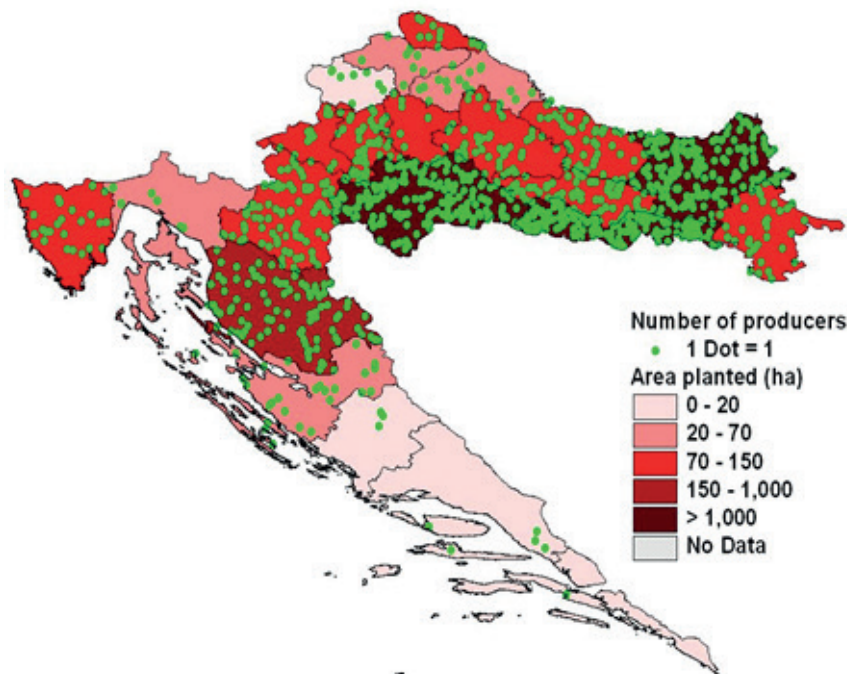


Figure VI Location and density of organic fodder production- area planted and number of producers





As it can be seen from the maps, legume producers in Croatia are mainly concentrated in the continental part of the country: beans and peas production is concentrated in the NW of the country, close to the main processor Podravka, while soya production is mainly concentrated in the North and East of the country, there most of the large areas of fertile land are located. Fodder production is more evenly distributed throughout the country: bigger producers are in the East.

For most legumes, small number of producers are present in other parts of the country: these are largely symbolic in terms of number of producers and area cultivated. In regard to organic production of legumes, in case of soya, there is an obvious cluster forming in the North part of the country, away from the traditional eastern area adjacent to the Danube river. In case of organic production of pulses, clustering is evident in the central part of the country, in sharp contrast to the concentration of conventional producers, located in the North (population density) and East (area density). Regarding organic fodder production, here most of the production is located in the central and eastern parts of the country, with strong presence in other part as well.

Density of legume production in EU 28 member States

The following maps illustrate the density of legume production in European Union, and variations in production and type of legumes produced among member states .

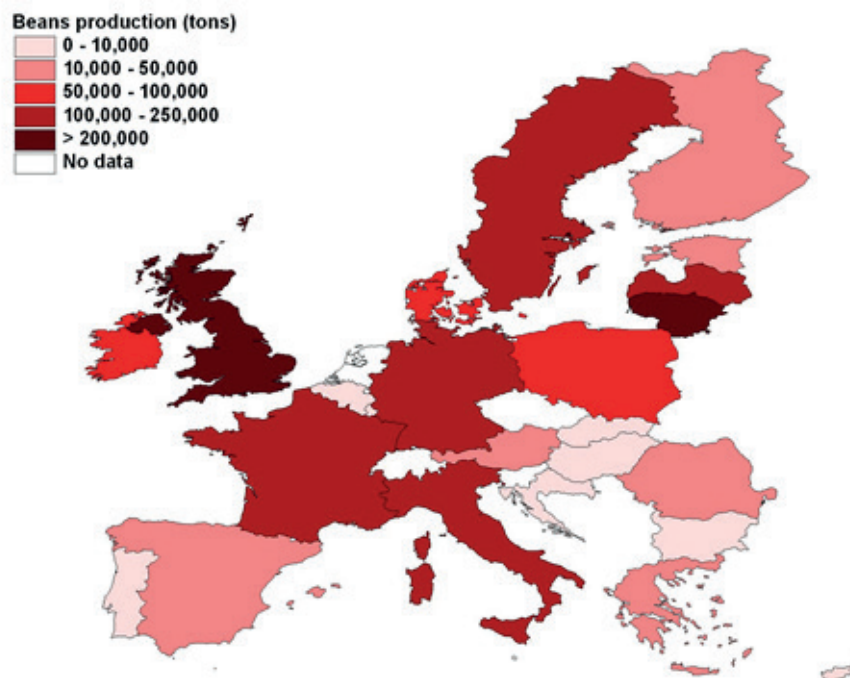


Figure VII Production density of beans in the European Union

¹⁵ Due to the lack of reliable and complete data, certain countries were left blank: it would be interesting to observe long-term trends in production of legumes among member states, in order to better understand the evolution of legume production in Europe.





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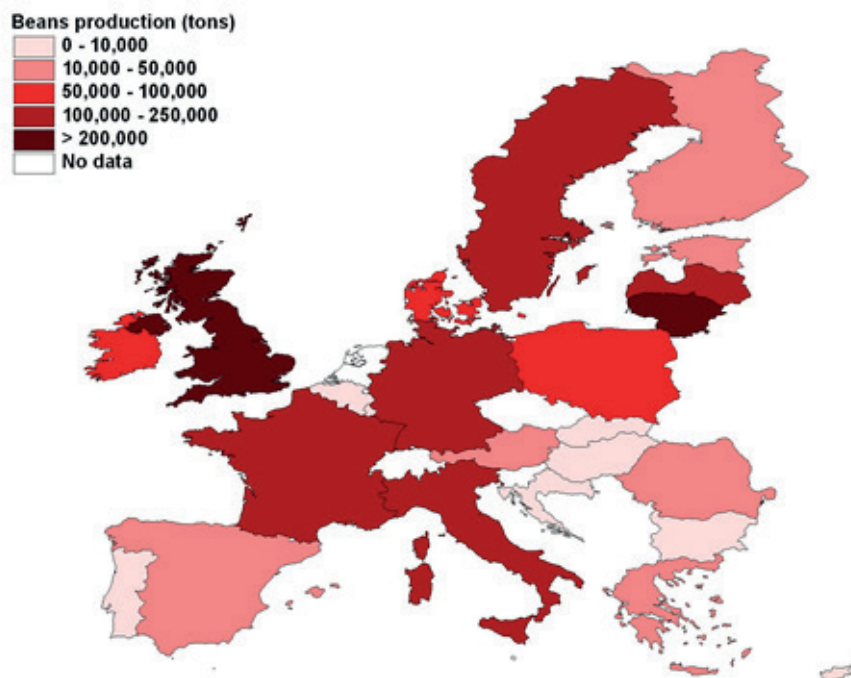
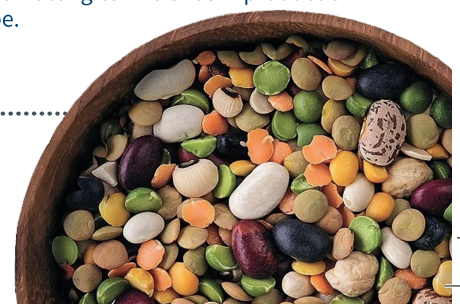


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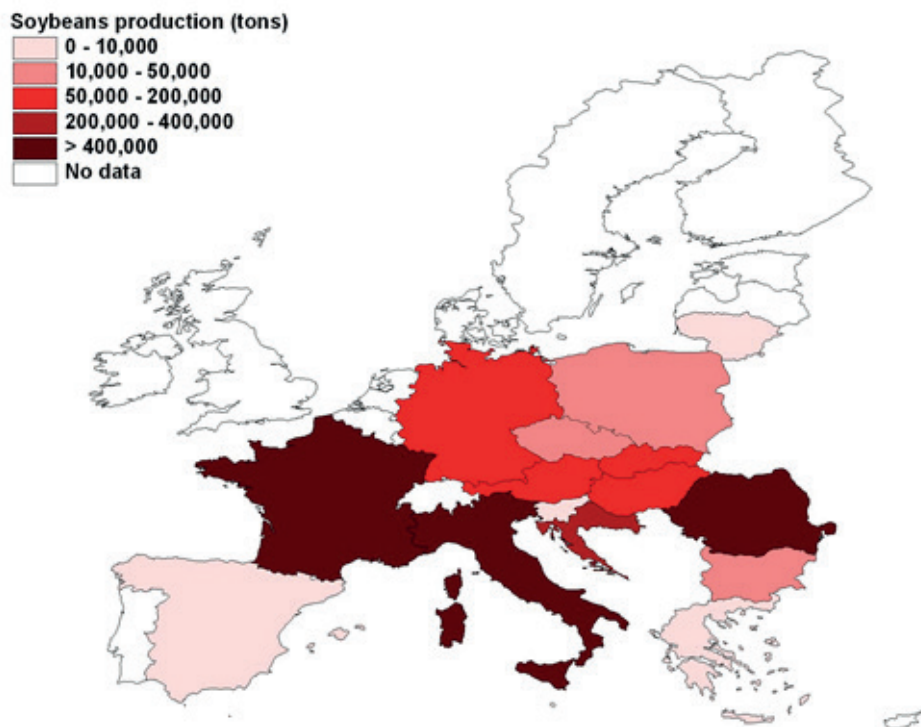


Figure X Production density of Soya in European Union

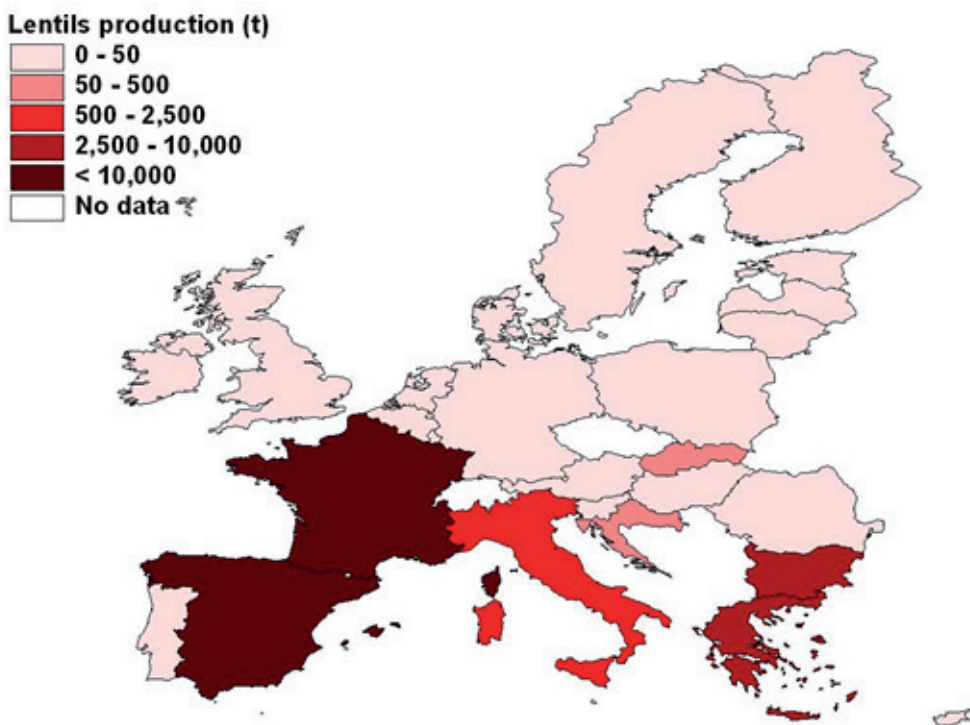


Figure XI Production density of lentils production in the European Union





Vetches production (t)

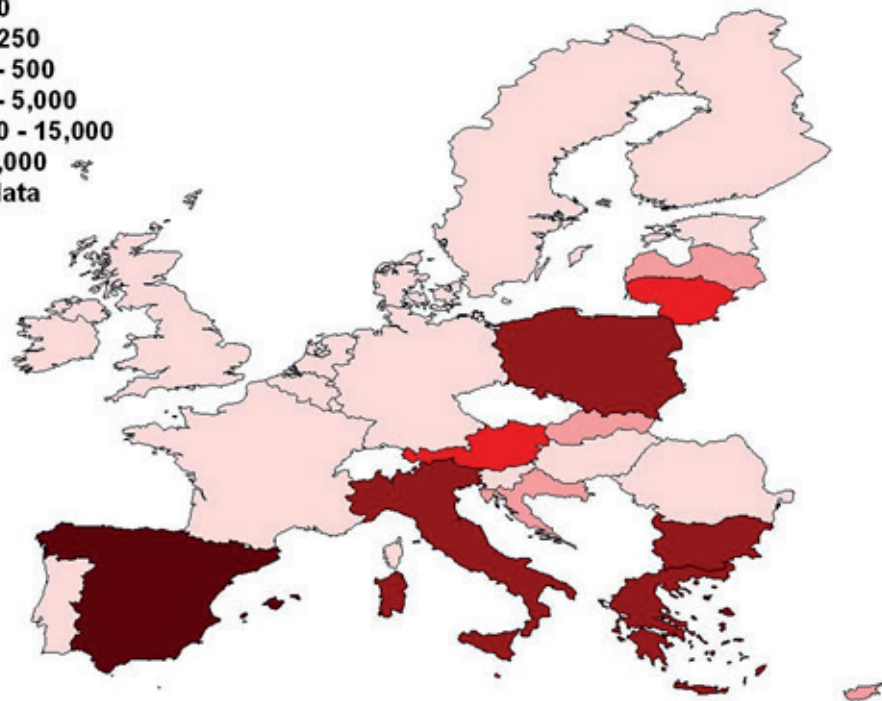
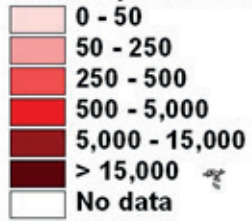
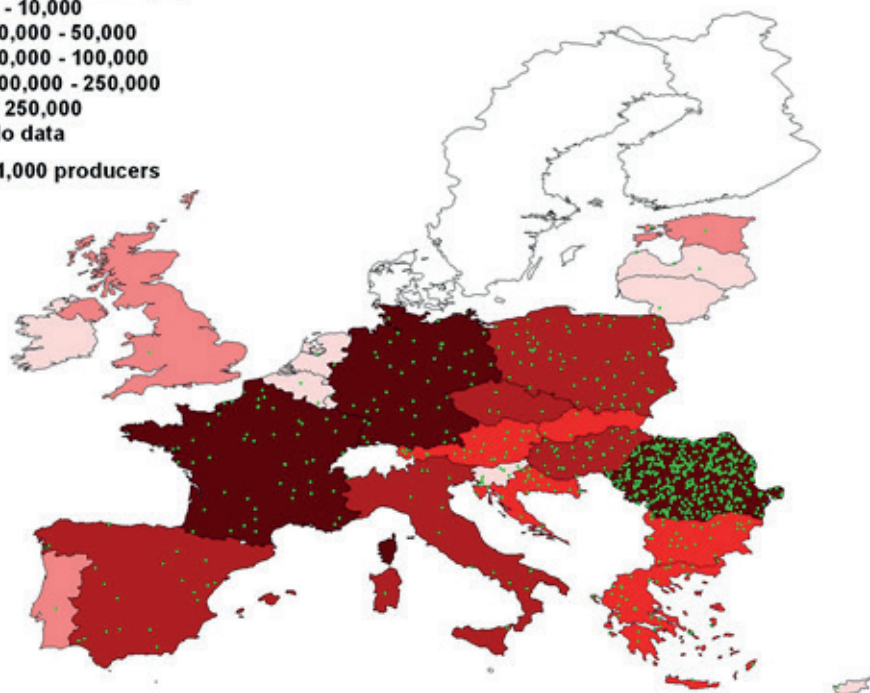
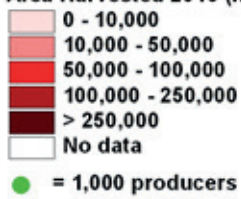


Figure XII Production density of vetches in the European Union

Area Harvested 2016 (ha)



Best practice example of EU-28 legume legislation, grants and support

All countries in Europe follow a common legal rulebook, framed by relevant EU Directives and there are no significant deviations in this context on the national level, mainly due to the fact that one of the pillars of European Project is a legal level playing field. The main difference here would be the flexibility offered through national nomination of agriculture support measures in Pillars I & II provided in EU CAP, most importantly in VCS and EFA mechanisms where we can see significant variations in the choice of supported sectors and amounts.

These measures are pivoting towards environmental issue mitigation in the new CAP (pending further discussions) and will most likely offer additional mechanisms of targeted support. The idea is also to simplify the CAP and Rural Development Support rulebook, in order to expedite the implementation of measures and uptake of support by farmers, and to streamline administrative burden on all stakeholders. According to the interview with a key policy stakeholder, Croatian government is very actively looking into the policy support measure package for the Post 2020 CAP, and legume support is high on the agenda, mainly driven by the desire to sustain the strength of the soya sector, and to help livestock farmers, on one side, and on the other, to give more emphasis to the issues of environmental sustainability of the farming sector.

Each country's choice of support measures has evolved according to its specific circumstances, including its geography and climate: perhaps the only way to approach this issue is to look at the numbers: here the best examples are large producers of legumes, as they are also providing the most support? Here lies the problem: for example, many EU countries were growing certain types of legumes (protein fodder, for example) as a Nitrogen fixer, but these productions have collapsed with the introduction of cheap nitrogen fertilizer in the 1960's and 70's. Now, when we are trying to reduce the application of artificial fertilizers, due to their detrimental effects on the ecosystem and climate, nitrogen-fixing crops are enjoying a revival. Sometimes, it takes decades to realise the negative effects of policies which seemed like a great idea at the time.

Another good example are EU's production coupled support measures in the past (France in 1980's for example) which have created massive spikes in production of certain agriculture products, including legumes, but with the withdrawal of financial support, these productions had returned to previous levels very quickly, as farmers have lost financial incentive to grow them. Single support measures, often coming from other sectors (biofuel and bioethanol market support and quota measures, for example), have caused massive increase in the growing of rapeseed in France, for example, but have acted as limitations on the competing sectors of oilseeds, especially soya. We can see that in the past, isolated, narrowly defined support measures for certain favoured sectors have shown themselves as counterproductive, in the wider context, and in the longer timeframe.

Perhaps those EU countries which offer little or no direct support, but are focusing on the functioning market, rule of law and strong support infrastructure for the farming sector, including agri-finance and high quality of the extension service, are choosing the best long-term path for the sustainability of their agriculture in general, including legumes? Perhaps certain global issues and trends (deforestation, food safety & security, climate change, health concerns in human diets, etc.) will be strong enough drivers for the sustainable development of legumes in the European Union?



Legumes have come into greater focus half a decade ago with the UN FAO's legume challenge, and the Greening of the CAP; this is coinciding with the development and mainstreaming of the protein food sector (some analysts are predicting that the global meat-alternative plant protein food market will grow to USD 200 billion by 2030, driven mainly by the demand in OECD countries). Agriculture feed and human food policies and supporting measures are perhaps not long enough in place to pass judgement on the choice which are the best, therefore it is important for each country to develop a set of measures best suited to its specific set of circumstances?

Recommendations for local, regional and national decision makers

As stated in the introduction of this document, a number of syndicated research projects are examining various aspect of the plant protein sector in Europe, looking in-depth at the animal feed and human food supply chain, studying long term trends and evolving shifts in supply and demand, developing data sets/scenarios and trying to inform the debate on the current state and future projected development paths of this interesting and growing sector. Looking at the local, regional and national levels, it is important to acknowledge also the supranational (EU policy & market demand issues) and even global (climate change & deforestation, WTO trade) issues, which influence the sector of plant proteins. It would be foolish to try to devise policy without the due attention being given to the wider context of the issue at hand.

In general, European decision makers are evolving towards a multi-stakeholder approach in policy development, with the common goal of sustainable development of the legume sector. In order to better target proposed measures, involvement of an unprecedented scope of actors is necessary. In response, a number of European countries (Netherlands, Germany, France, Denmark, to name a few) are developing strategies and policy instruments which are cross-sectoral, wide both in depth and scope, and aim to engage a wide range of stakeholders. Some of the common elements to all of them are:

- strong emphasis on the functioning of the market mechanisms and transparency of information, including certification and quality control, price signals and transaction costs;
- cross-disciplinary cooperation, especially between science/academia and industry, as the need to develop new, more productive and better adopted cultivars is becoming of paramount importance;
- strong consideration for the demand side issues, in order to create sustainable and viable markets for the legumes produced - here premium feed and human food chains are the main target;
- strategic communication towards the general public and consumers in general on the beneficial aspects of legumes, including nutritional and health aspects, in order to stimulate interest and the debate in public;
- development of networks of practitioners, establishing mechanisms to disseminate experience and knowledge in the growing of legumes - farmer training and exchange of information are key, as well as cross-national cooperation among academic institutions;
- development of short supply chains on the local/regional level in order to maximise value added, and to reduce transaction costs and commoditization of legume crops; popularization of the various market niches: traditional (PDO & PGI), organic, vegan, flexitarian legume-based foods;



- strong emphasis to be given to the beneficial environmental aspects of legume cropping, inclusion of full-cost accounting and life-cycle analysis in order to put the real price on the imported legumes;
- development of non-financial support measures which should serve as enablers and which should serve as a reinforcer of the EU CAP support measures, but should cover intangible aspects of the legume sector.
- agriculture development policy, in order to be successful, must be aligned with other relevant public policy sectors (environment, energy, transport, food safety, consumer protection etc.)

This list is not exhaustive, of course, as each country and region should develop a set of measures best suited to their own circumstances (which are inevitably unique). Here perhaps the overarching message is this: policy makers should give great care to the process of support policy development, trying to avoid populist impulses and to base their decisions on credible, verifiable and relevant information. They should involve all relevant stakeholders in the consultation process and should have the political will to implement those elements which could hurt particular interests in the short term but would provide long-term sustainability of the plant protein sector in Europe.

As the world moves towards more integration, and large production/trade blocks are emerging, it is imperative for the European Union member states to work together and to synchronise their national policies with the common goal of a successful, sustainable European agriculture sector. Smaller EU member states, with limited resources (especially New Member States) should give emphasis to international cooperation and to leverage EU-wide support mechanisms in order to bridge the gap in their institutional and resource capacity.

Croatia is currently in the process of development of its agriculture development strategy, the consultation process is ongoing, and it is coinciding with the consultations on the post 2020 EU CAP. It would be wise for the Croatian policy makers to exploit this opportunity and to try to devise a comprehensive, relevant, applicable and informed set of policy measures, which would recognise the above listed aspects/trends, and therefore ensure that the implementation of this strategy should signal the revival of Croatian agriculture, protein crops included.

Croatian legume sector - summary of findings and recommended measures

In general terms, Croatian legume sector, besides soya, is on a long-term stagnation and even declining trajectory, characterised by small farm holdings, low level of technological sophistication, lacking economies of scale, with an inefficient and fragmented value chain. All these factors contribute to the farmer's lack of interest to enter this sector on a larger scale. Therefore, efforts should be made to try to create conditions to ensure survival of these niche sector productions, as some of them are on the brink of collapse. In regard to the soya sector, its strong growth and future development should be sustained and supported by a package of measures, which should help the sector to migrate towards higher value added, economies of scale and premium market positioning, all of which are prerequisites for creation of sustained market competitiveness. The following is a summary of findings regarding legumes in Croatia.



Soya - key advantages

- Key legume and arable crop sector in Croatia, with stable and significant growth, relative size of the sector is significant in the regional and EU context (over 80,000 ha cropped and 245,000 tons produced in 2018), and therefore it should be considered as a priority sector to leverage attention of policy makers in terms of its significance
- Existence of locally developed varieties with competitive characteristics and with strong market presence (over 70% market share), signalling opportunity to further develop genetic capacity to increase yields and plant resistance to adverse conditions, in order to maintain their market share
- 100% market share of non-GMO soya is a strong opportunity for market growth in the context of the European feed & food trends (increased consumer awareness, non-GMO certification & traceability, organic, vegan and premium sector growth)
- Regional initiatives like the European Soya and Danube Soya to which Croatia is a signatory and where Croatian soya producers/processors are included offers a market opportunity/pull to further develop soya sector and to continue growth. These platforms should be exploited and leveraged to improve access to market signals, to develop international cooperation and to develop international cooperation
- Clustering of production, trade and processing in the continental part of the country creates opportunities to capitalise on economies of scale and to limit transport and logistic costs, assisting competitiveness, cooperation and market opportunities

Soya - key disadvantages

- Almost all soya produced is exported as a commodity for processing abroad - most value added is created elsewhere, therefore soya sector is missing out on one of the few clear opportunities to create value added in Croatian agriculture
- Under capacity of modern, large scale processing facilities limits the ability to capitalise on the primary sector's strengths
- Inadequate horizontal cooperation among farmers and processors limits the stakeholder's capacity to innovate and implement new technologies
- Modern advances in science of soya genetics require R&D capacity which presently does not exist in Croatia - local varieties are in danger of becoming marginalised in the future
- Majority of livestock farmers are hampered by the limits of Croatian meat & dairy market which is largely focussed on cost competitiveness, limiting their ability to afford premium animal feeds, costs and benefit of which would need to be recognised by the end-users and should be reflected in the price - demand for premium meat and dairy segment in Croatia is still very limited
- Soya market for human consumption is largely served by retail imports of foreign brands, with few notable exceptions of local processors catering to the niche and fringe markets (vegan, vegetarian, health conscious etc)



Therefore, efforts should be made to upscale and upgrade the whole supply chain, in order to ensure its long-term viability, namely to:

- Create conditions to capitalize on the local production scale and trend by investing in processing capacity to ensure value added is created and retained locally, thereby creating stronger market pull for farmers, traders and processors
- Local varieties should be developed further, via investments in R&D capacity, in order to protect and enhance their genetic potential
- 100% non-GMO status should be exploited and leveraged within EU as a chance to position the sector as premium producer of soya related products and feeds, therefore QC certification and standards should be promoted and widely implemented
- For farmers focused on in-house production of soya as feed protein for their livestock, education and assistance in development of in-house capacity for processing should be made available
- Creation of demonstration platforms in the form of "Farms of Excellence" should be explored, in order to facilitate knowledge transfer and education of farmers in the field

NOTE: as soya sector has become increasingly significant and sustainable, it might perhaps become disqualified from the EU criteria for Voluntary Coupled Payment support. In that case efforts to create conditions to ensure its long-term sustainability will become even more important, as there were historic cases of collapse of certain soybean productions (and other legume crops) in Europe, in cases where financial incentives for farmers were removed, as in principle, legume crops have difficulty to compete with cereal crops in Europe.

Pulses - Beans, green beans and peas - human food consumption

- Croatian production of these pulses is very modest in the regional and EU context, almost exclusively by small scale, artisan farmers lacking economies of scale, know-how and technology, all of which limits their ability to access and compete on the market as they have almost no access to large retail chains - sales are limited to green markets, small speciality shops, sales on doorstep and in the end, to home consumption
- Vegetable wholesalers and indirectly, large retail chains, dictate the price - lack of competitiveness in contrast to imports from major global producers means that over 3/4 of domestic demand is covered by imports
- Peas - presence of only one serious processor limits the choice of farmers on the market - especially pea producers where time to processing is very short and therefore limits their options due to associated distances
- High up-front investment costs in harvesting equipment prohibits vast majority of pea farmers from modernisation, as they crop areas which are hopelessly too small in order to be able to justify the associated investment costs
- Domestic demand prefers locally produced beans and peas, traded on local green markets and in local convenience stores, as a legacy of traditional food habits in the region - this offers an opportunity for local producers to make efforts to focus on this sales channel - the key is to assist farmers in their efforts to access this market and to position themselves at a price, which should help in the revival of this traditionally popular and valuable niche production





TRansition paths to sUustainable
legume-based systems in Europe

- Therefore, efforts should be made to develop local/short supply chains, to upscale production and to try to achieve economies of scale through horizontal cooperation among farmers, and vertical integration with processors;
- Increased popularity of traditional, novelty, organic, vegan and similar foods niches should be exploited as they offer an opportunity for small scale producers to compete at a price premium, therefore efforts like demand creation through increased consumer awareness and product labelling should be explored, in order to increase market interest and awareness of these food niches and associated legume crops.

Other pulses grown for human consumption - Faba beans, lentils, chickpeas etc.

- General situation is similar to the beans and peas sector, but even more complicated - very small quantities are produced on small farms lacking technology, economies of scale, access to market and relevant know-how
- Opportunities to differentiate as premium niche products are limited, as they are perceived as fringe niche foods, reflected in the very symbolic number of farmers involved in their production
- Despite some indication that niche markets (traditional food, organic, vegan, flexitarian) are on the increase in Croatia, this demand is too modest, in absolute terms, to significantly impact the largely negative trends in this sub-sector of protein crops.
- Nevertheless, efforts should be made to try to organise the farmers, upscale and modernise production, and to develop short supply chains where access to markets interested in these products could be exploited to ensure sustainability of the sub-sector
- Faba beans specifically, as a popular traditional legume in Dalmatian (Mediterranean) region of Croatia, should be branded and efforts should be made to explore the possibility to give it a protected traditional status (PDO/PGI label) in order to help to position and sustain this legume production

GENERAL NOTE ON PULSES: Having in mind recent trends in Western Europe towards "health" foods and novelty niche "superfoods", perhaps sector actors should invest resources to try to position themselves in those niches, as they offer higher price premiums and loyal consumer base, as there is increased evidence that Croatian consumers, especially in larger urban areas, are discovering these niche products.

Fodder protein crops - Lucerne & alfalfa

- Significant areas are cultivated, throughout the country, and utilised as hay and silage, by livestock farmers for their own consumption - market is very modest, and often conducted ad hoc, dependant on the farmer's ability to produce adequate quantities on site - in seasons of less favourable weather patterns, there is some trade in fodder crops
- Traditionally, coastal area farms purchase fodder feed for their farms from producers further inland, but there are very few fodder legume crop producers who specialise in the production for the market



- Market very much depends on the seasonality and weather patterns - making entry to the market risky and uncertain for potential producers looking to enter the market as commercial suppliers of fodder crops
- Lack of both import and export market - Croatian farmers in principle to not trade fodder on commodity markets as we lack both quality and quantity to compete with serious producers in Europe
- Equipment for processing (drying and/or pelleting) is virtually non-existent in Croatia - this limits the ability of farmers to produce consistently high quality of fodder legume crops, and to increase annual yields and quality of roughage

General comments on legumes and Croatian agriculture policy

Croatia should continue supporting all legume crops via their inclusion in the 1st and 2nd pillar of the EU CAP - direct area payments and Rural Development measures, as they offer both financial incentives for farmers to plant these crops, and mechanisms by which farmers can access capital support programs through which they are able to modernise their farming practices and increase competitiveness and productivity. Nevertheless, these support measures and financial incentives alone will not ensure long term viability and competitiveness of these products, without the implementation of a wider scope and scale of activities to upscale, modernise and position on the local and EU markets.

Only a comprehensive set of measures and efforts, not only by policy makers, but by all relevant stakeholder groups and vested interests, will create conditions for Croatia's legume sector long term viability and sustainability. In this context policy and market efforts aimed at the creation of increased domestic market demand for these products are indispensable in ensuring long term increase in demand, as the only sustainable long-term measure ensuring that farmers remain interested in the growing of these crops.

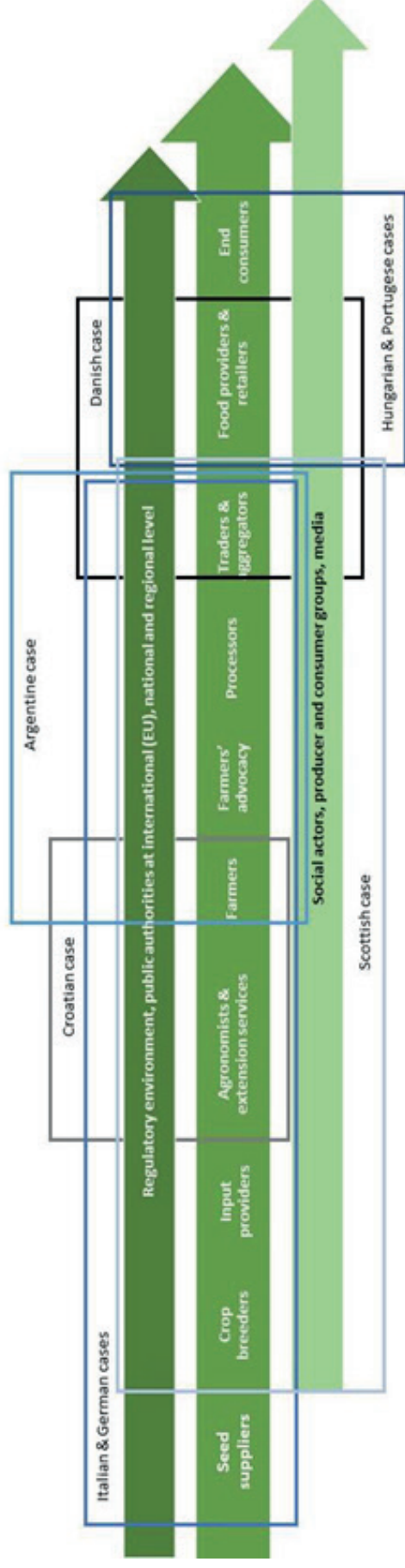
In this context, certain general negative aspects which characterise Croatian agriculture positioning and development should be addressed, namely:

- Functioning of the agriculture sector in general is characterised by a number of gaps in capacity - relatively weak rule of law, inefficient payment mechanisms, inadequate protection of farmers from unfair trading practices, outdated land use policy, insufficient quality of farm support mechanisms (including advisory services), lack of knowledge transfers, unavailability of adequate agriculture financing etc.

In this context, which is obviously outside of the scope of this report, timely development of the new National Agriculture Development Strategy should be leveraged to try to address these issues, and to create a more competitive landscape for all Croatian farmers, legume producers included.



Instead of a conclusion



TRUE Project - Schematic representation of policy-relevant stakeholder groups in various countries, indicating variability in focus to policy creation

Above schematic, taken from the policy package deliverable of the TRUE project, illustrates how various countries are focusing of specific aspects of the value chain in focusing their legume development policy. It can be observed that the Croatian approach is focussed on the farmers and associated support services, whilst completely ignoring upstream and downstream stakeholder actors, thereby adopting a very narrow policy framework. At the same time, we can observe that other European cases considered are either adopting a much more comprehensive policy framework, or focus more on the demand side issues, looking to incentivise consumers and stimulate demand.

Although a copy-paste approach to policy making should not be encouraged, perhaps Croatian stakeholders and policy makers should look into these differing approaches (which are rather comprehensively elaborated through this Horizon 2020 project) and should try to adapt and implement those elements which are suited to our specific circumstances. In order for such an approach to be viable, a wide and comprehensive stakeholder dialogue and inclusion in policy creation should be encouraged, as the only mechanism that can ensure that all interested parties become involved, ensuring their understanding, acceptance and participation in successful policy execution.



Table summary of recommendations

The following tables are an overview of the proposed policy and value chain group measures and initiatives, the purpose of which is to bridge existing identified gaps, and to leverage existing strengths in legume production sub-sectors in Croatia. They are segmented and outlined according to the sub-sectors, level of relevance, importance; according to relevance to stakeholder groups, and finally, divided according to supply and demand measures.

Agriculture & Cross-Sector Measures	Soya Feed	Field Peas & Beans	Other Feed Lupins	Fodder Crops Alfalfa & Lucerne	Beans, Green Beans & Peas	Other Lupins Lentils, Faba Beans & Chickpeas	Soya Food
Local level policy recommendations	"Champions of excellence" farms Farmer education - study tours etc QC Certification Knowledge transfer	"Champions of excellence" farms Farmer education - study tours etc Knowledge transfer	Farmer education Study tours etc Knowledge transfer	"Champions of excellence" farms Education of farmers - Study tours & Knowledge transfer	Short supply chain development Green markets Direct sales networks Novelty foods PDO/PGI/TSG	Short supply chain development Green markets Direct sales networks Novelty foods PDO/PGI/TSG	Novelty food market development support Market linkages with processors Co-ops
Regional level policy recommendations	Clustering - horizontal cooperation Adding value - processing	Clustering - horizontal cooperation	Clustering - horizontal cooperation	Horizontal market linkages Market development	Wholesale market development Horizontal market linkages School & Public Inst. procurement	Wholesale market development Horizontal market linkages School & Public Inst. procurement	Branding - Non-GMO Croatian soya Clustering Promotional activities towards consumers
National & EU level policy recommendations	EU CAP post 2020 support VCS(?), EFA & RDP R&D on genetics Int. Cooperation Agri Dev Strategy	EU CAP post 2020 support VCS, EFA & RDP Agriculture Development Strategy	EU CAP post 2020 support VCS, EFA & RDP Agriculture Development Strategy	EU CAP post 2020 support VCS, EFA & RDP Agriculture Development Strategy	EU CAP post 2020 support VCS, EFA & RDP Retail sector support Agriculture Development Strategy	EU CAP post 2020 support VCS, EFA & RDP Agriculture Development Strategy	EU CAP post 2020 support VCS, EFA & RDP Retail Sector Penetration - supermarkets, speciality shops, direct sale
Priority/importance level	Key sector - national & international importance	Domestic Importance	Marginal importance	Domestic Importance	Regional importance	Marginal importance	Rising sector - increasing niche importance



Stakeholder Group Measures	Soya Feed	Field Peas & Beans	Other Feed Lupins	Fodder Crops Alfalfa & Lucerne	Beans, Green Beans & Peas	Other Lupins Lentils & Chickpeas	Soya Food
Farmers & Producer Groups	"Champions of excellence" farms Farmer education Study tours Horizontal co-operation QC & non-GMO certification	"Champions of excellence" farms Farmer education Study tours Horizontal co-operation	Farmer education Study tours Co-ops	"Champions of excellence" farms Farmer education Study tours Horizontal co-operation	Short supply chain development Green markets Direct sales networks Novelty foods PDO/PGI/TSG & organic labelling	Short supply chain development Green markets Direct sales networks Novelty foods PDO/PGI/TSG & organic labelling	Novelty food market support Market linkages with processors Organic and Non-GMO certification & labelling
Wholesalers & Processors	Certification standards Investment in processing technology International cooperation Long-term cooperation with farmers	Certification standards QC Long-term cooperation with farmers	N-A	N-A	Clustering of producers Technology transfer Long-term relationship development with farmers - "trusted supplier" initiatives	Long-term relationship development with farmers - "trusted supplier" initiatives	Branding - Non-GMO Croatian soya Business relationship development with farmers - "trusted supplier" initiatives
Public Institutions, Academia & Regulators	EU CAP post 2020 support VCS, EFA & RDP R&D on genetics Support through Agri Dev Strategy Knowledge transfers	EU CAP post 2020 support VCS, EFA & RDP R&D on genetics Support through Agri Dev Strategy Knowledge transfers	EU CAP post 2020 support VCS, EFA & RDP Support through Agri Dev Strategy	EU CAP post 2020 support VCS, EFA & RDP R&D on genetics Support through Agri Dev Strategy Knowledge transfers	EU CAP post 2020 support VCS, EFA & RDP Support through Agri Dev Strategy	EU CAP post 2020 support VCS, EFA & RDP Support through Agri Dev Strategy	EU CAP post 2020 support VCS, EFA & RDP R&D on genetics Support through Agri Dev Strategy Knowledge transfers



Stakeholder Group Measures	Soya Feed	Field Peas & Beans	Other Feed Lupins	Fodder Crops Alfalfa & Lucerne	Beans, Green Beans & Peas	Other Lupins Lentils & Chickpeas	Soya Food
Support services - Input Providers & Advisory Services	Extension service upgrade Farmer support Know-how transfer	Extension service upgrade Farmer support Know-how transfer	Extension service upgrade Farmer support Know-how transfer	Extension service upgrade Farmer support Know-how transfer	Extension service upgrade Farmer education Know-how transfer	Extension service upgrade Farmer education Know-how transfer	Extension service upgrade Farmer education Know-how transfer
Food providers, retailers	N-A	N-A	N-A	N-A	Inclusion & promotion of local suppliers	Inclusion & promotion of local suppliers	Inclusion & promotion of local suppliers
End consumers & Consumer Groups	N-A	N-A	N-A	N-A	Education, informing and promotion of consumption of protein plants		
Media	Leveraging existing & new media platforms to inform and attract all relevant value chain stakeholders to the sector, on all appropriate levels, on case to case basis				Development of a comprehensive media campaign strategy on advantages & benefits of protein plant foods Targeted media platform utilisation for campaign implementation in order to stimulate domestic demand		



Animal feed sector	Supply side recommendations	Demand side recommendations
<p>Soya</p>	<ul style="list-style-type: none"> Farmer education & cooperation Knowledge transfer & QC Certification (non-GMO & organic labelling) Creation of value added - processing capacity R&D in competitive genetics International cooperation - Danube Soya/EU Soya EU post 2020 CAP Support Measures - VCS, EFA & RDP funding package New National Agri Development Strategy - inclusion of protein crops 	<ul style="list-style-type: none"> Informing stakeholders about the benefits of legume crops; opportunities in creation of value added through investments in processing and advantages in premium positioning Development of a media strategy to inform end-users about the impact of non-GMO and organic feed certification on the end products' market positioning (meat & dairy)
<p>Protein Fodder Crops</p>	<ul style="list-style-type: none"> Farmer education & cooperation EU post 2020 CAP Support Measures - VCS, EFA & RDP funding Agri Development Strategy - high visibility of protein crop sector Investments in processing technology to ensure quality and increase yields 	<ul style="list-style-type: none"> Education of farmers on the importance and benefits of high-quality legume forage as source of cost effective and nutritious animal feed source, and associated soil & environmental benefits
<p>Other animal feed legumes (field peas etc)</p>	<ul style="list-style-type: none"> Farmer education & cooperation EU post 2020 CAP Support Measures - VCS, EFA & RDP funding Agri Development Strategy - high visibility of protein crop sector 	<ul style="list-style-type: none"> Education of farmers on the importance and benefits of high-quality legume forage as source of cost effective and nutritious animal feed source



Human food sector	Supply side recommendations	Demand side recommendations
<p>Beans, green beans & peas</p>	<ul style="list-style-type: none"> Farmer education & cooperation EU post 2020 CAP Support Measures - VCS, EFA & RDP funding package New National Agri Development Strategy - inclusion of protein crops Short supply chain development Green markets sales at premium price Direct sales networks Novelty foods market placement PDO/PGI/TSG status recognition - branding/positioning Wholesale market development Quality certification including organic labelling 	<ul style="list-style-type: none"> Informing stakeholders about the benefits of legume crops; Development of a communication strategy to inform end-users about the benefits of pulses as valuable, ecological and nutritional source of protein School & Public Inst. procurement demand stimulus
<p>Other lentils - faba beans, lentils & chickpeas</p>	<ul style="list-style-type: none"> Farmer education & cooperation EU post 2020 CAP Support Measures - VCS, EFA & RDP funding Agri Development Strategy - inclusion of protein crop sector Short supply chain development Green markets sales at premium price Direct sales networks Novelty foods market placement PDO/PGI/TSG status recognition - branding/positioning Quality certification including organic labelling 	<ul style="list-style-type: none"> Informing stakeholders about the benefits of legume crops; Development of a communication strategy to inform end-users about the benefits of pulses as valuable, ecological and nutritional source of protein School & Public Inst. procurement demand stimulus
<p>Soya</p>	<ul style="list-style-type: none"> Farmer education & cooperation EU post 2020 CAP Support Measures - VCS, EFA & RDP funding Agriculture Development Strategy - inclusion of protein crop sector Short supply chain development Direct sales networks Novelty foods market placement Quality certification including organic labelling 	<ul style="list-style-type: none"> Development of a communication strategy to inform end-users about the benefits of legumes as valuable, ecological and nutritional source of protein Positioning soya products as dairy & meat alternatives - exploit new market niches



APPENDIX - Competitiveness analysis - Croatian Legume Sector - Summary of findings

Note on methodology

Competitiveness analysis is a newly developed proprietary tool, designed to assist decision making processes in agriculture sector. It can be applied in public policy development, or as part of a corporate development strategy. It serves as a mechanism to gain a better insight into the competitive position of a region, country, or a company, in relation to its activities in agriculture production. It is designed to serve as a tool, which should give a clear indication about the competitive position of a certain agriculture sector, in relation to its competition, and general trends, be it national, regional or global. Over 30 various indicators are gathered from reputable databases on agriculture trade and production, including price and import/export signals, and they are analysed in order to create a picture as accurate as possible about the supply and demand of a certain product or a group of products. Quantitative data are analysed and superimposed on a number of qualitative sources of information pertaining to a certain produce or crop, in order to create as complete a picture as possible. Competitiveness analysis is only as reliable and accurate as the input data and information it is based on, and therefore gaps or inaccuracies in databases can influence its results, but every care is taken in order to reduce the chance of such inaccuracies to a minimum. In short, competitiveness analysis does the following:

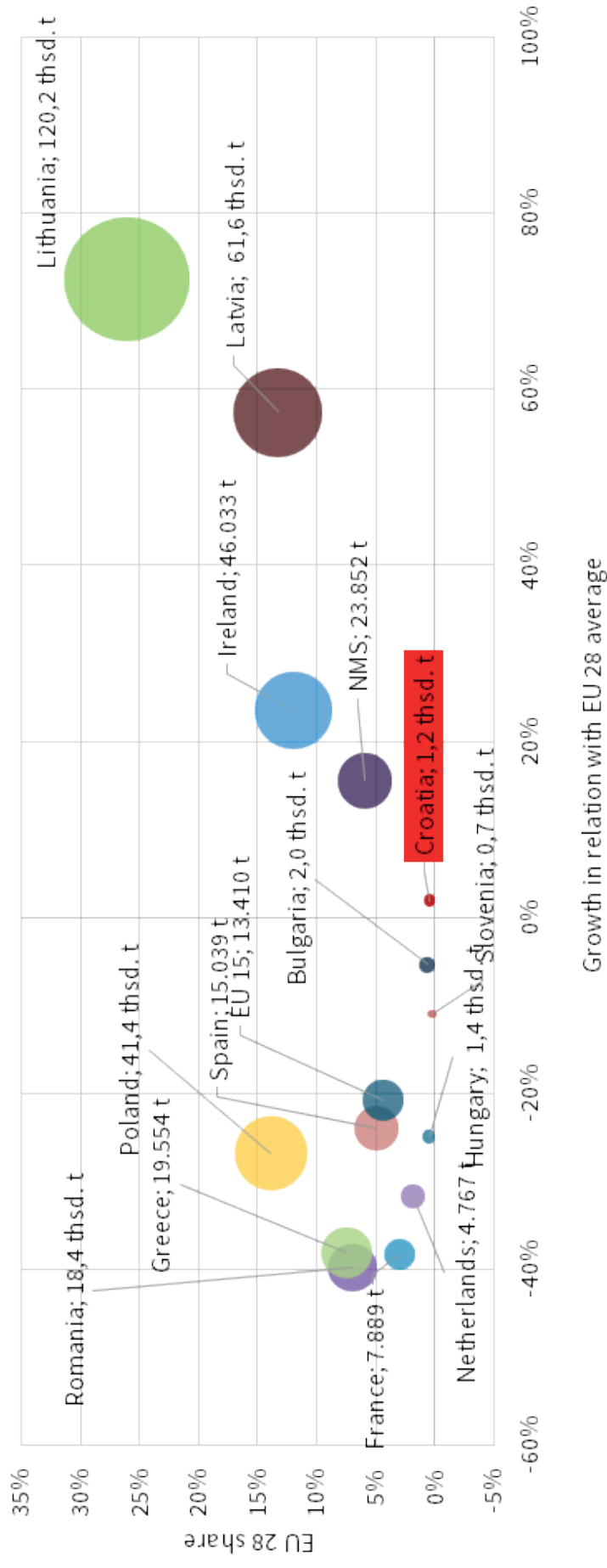
- SHARE and TREND analysis for each product in area harvested, production, yield trade, unit value of import, unit value of export;
- Calculating price and quality competitiveness;
- Countries, as well as regions, are ranked and marked;
- Graphs of different ranks, as well as marks, offer an easy tool to spot that country's competitiveness for each product considered;
- Data for each product is compared to World data, as well as regional data. Trends are based on the last five years of data available;
- Research showing which countries and which regions are competitive;
- Each product has been analyzed from the supply and demand side for every region and country the analysis is relating to;
- Supply analysis consists of production data (production quantity, area harvested, production yield) and of export data (export quantity, export value, unit value of exported goods); Demand analysis is considering only import data with information corresponding to the export data set.

The following pages will present the competitiveness situation of Croatia's legume sector, compared to its main EU competitors.

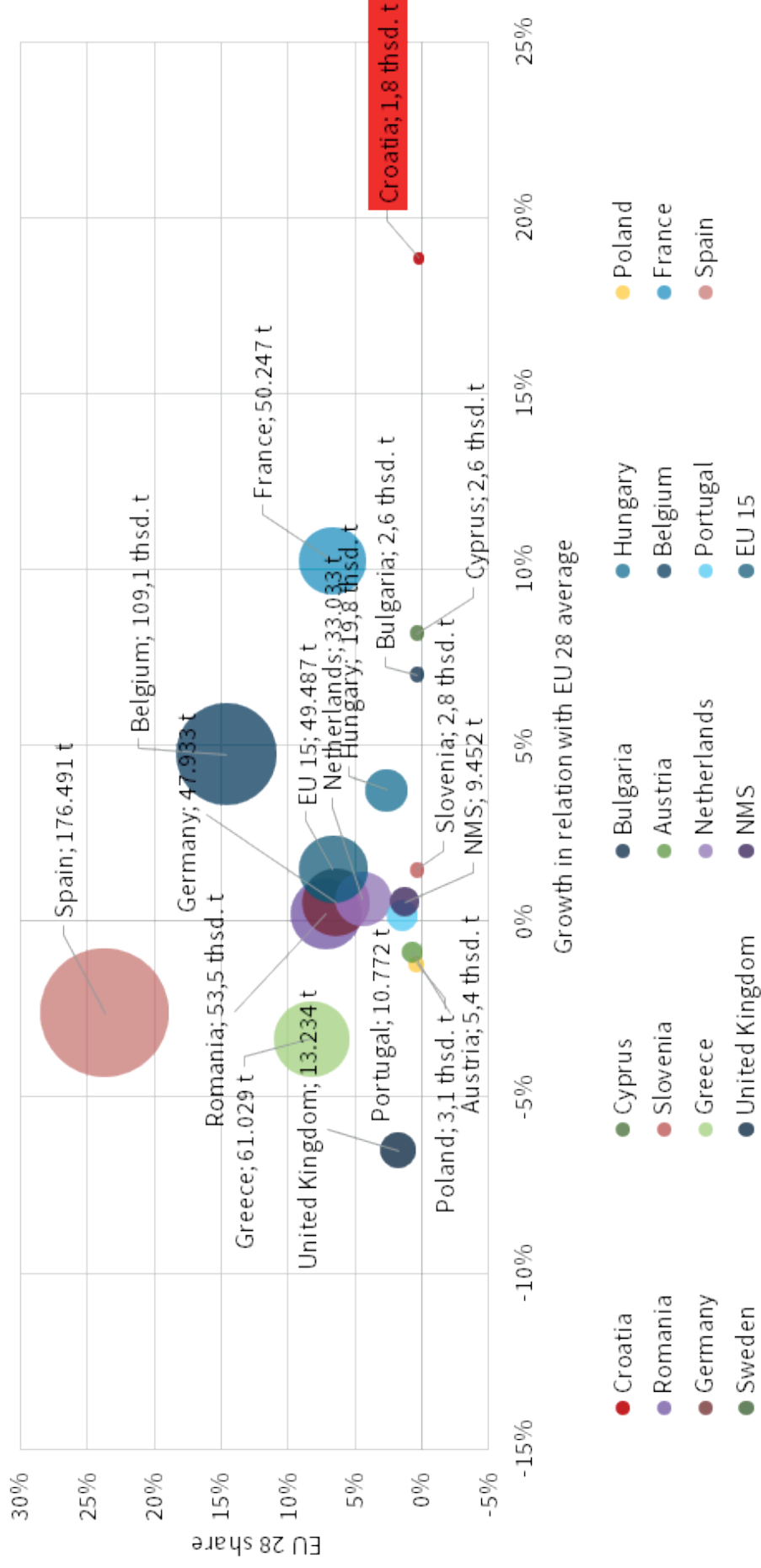


Dry Beans - Production trend of selected countries in relation to EU 28 for period 2012-2017

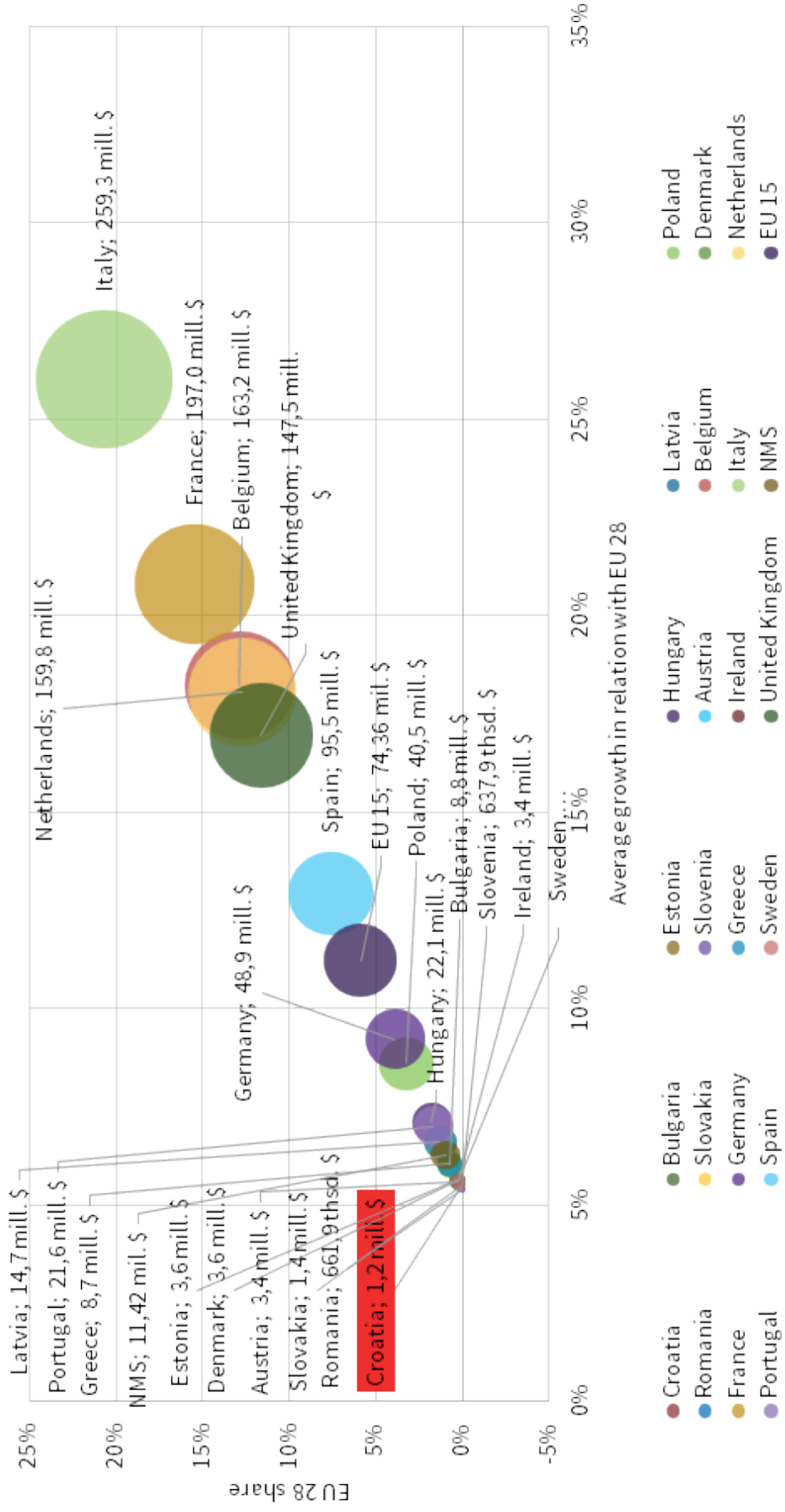
Estonia excluded for better visibility-growth of 250%

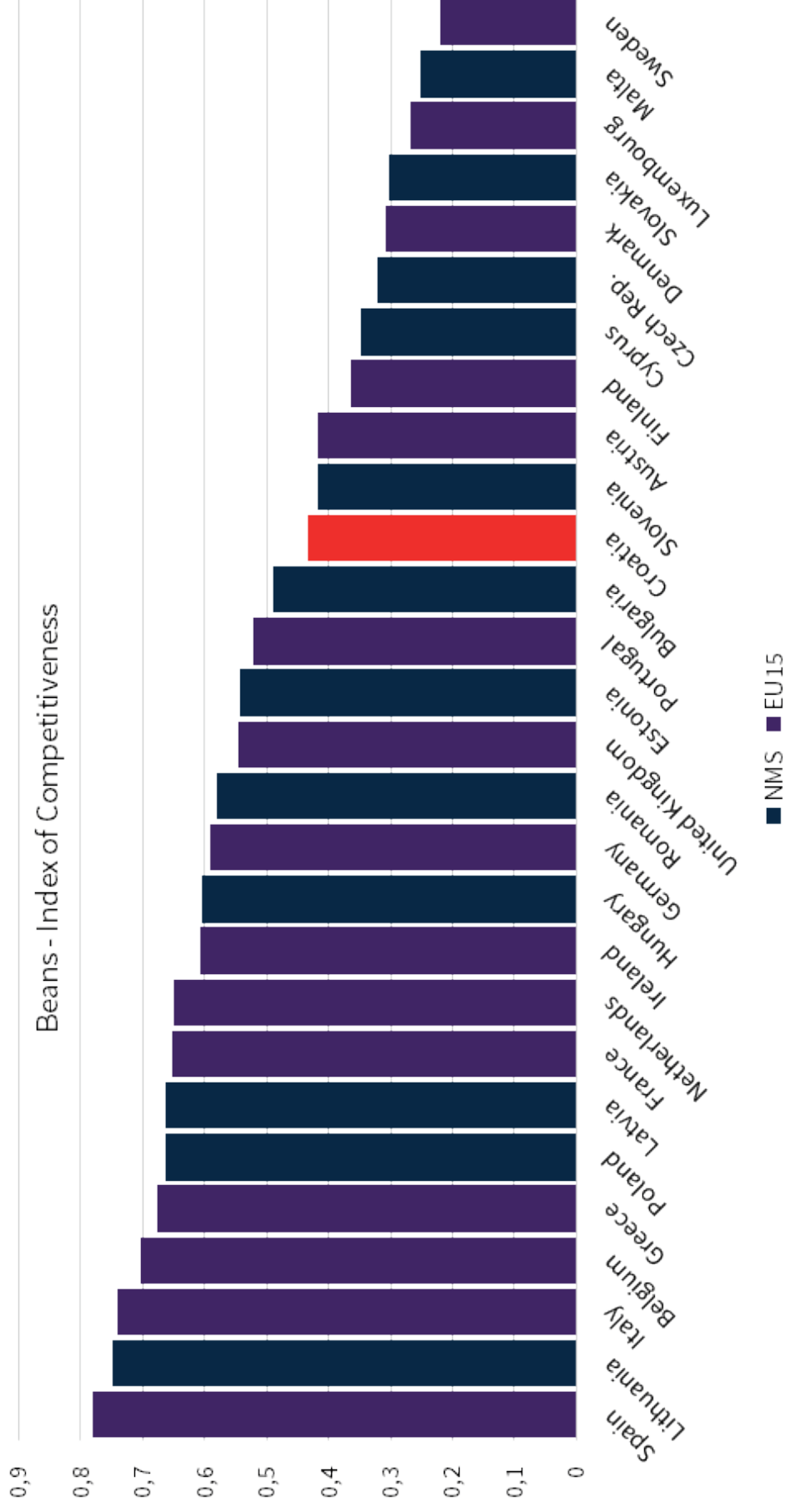


Green Beans - Production trend of selected countries in relation to EU 28 for period 2012-2017

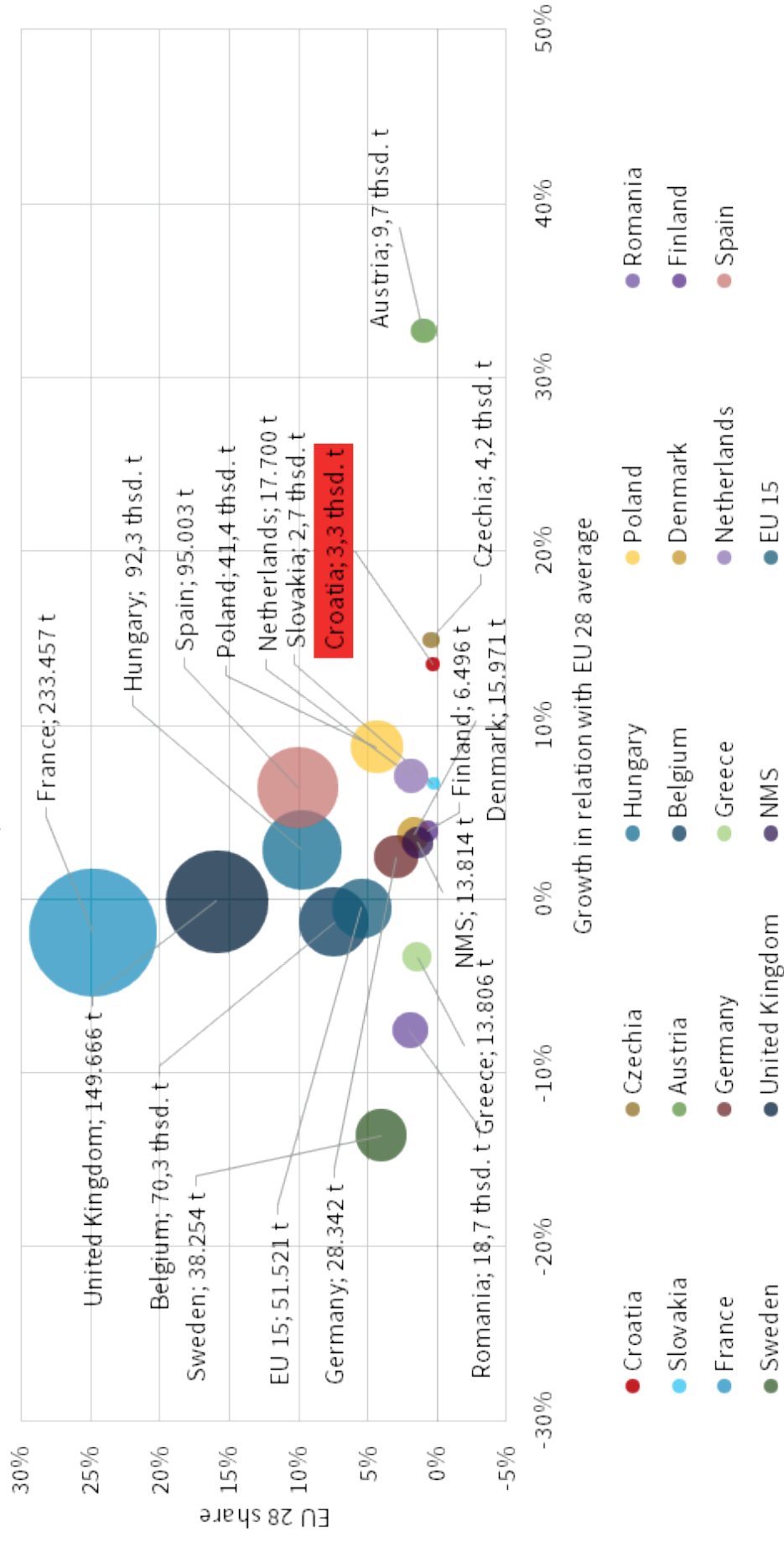


Export trend in beans for selected countries in relation with EU 28 average for period 2013-2018

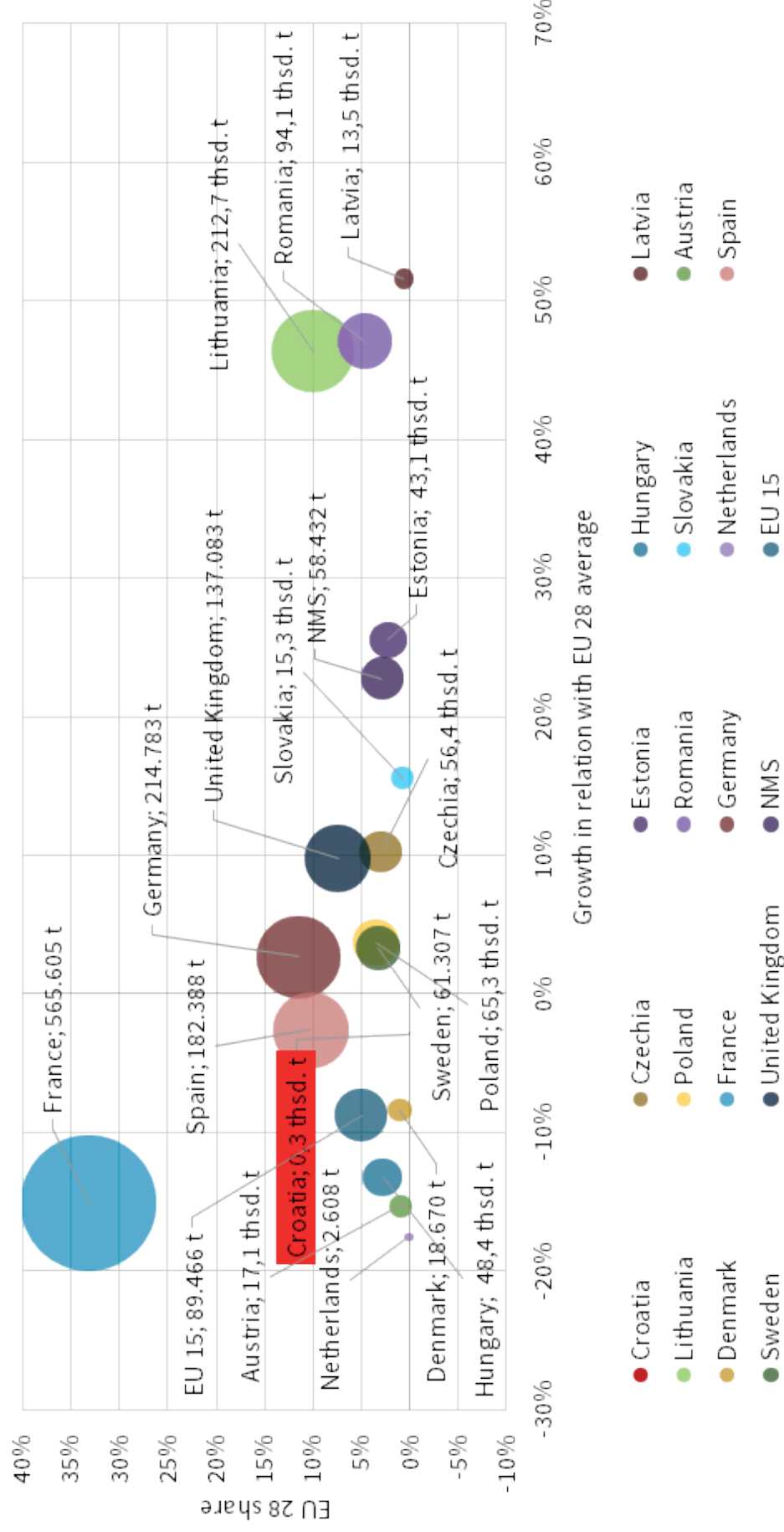




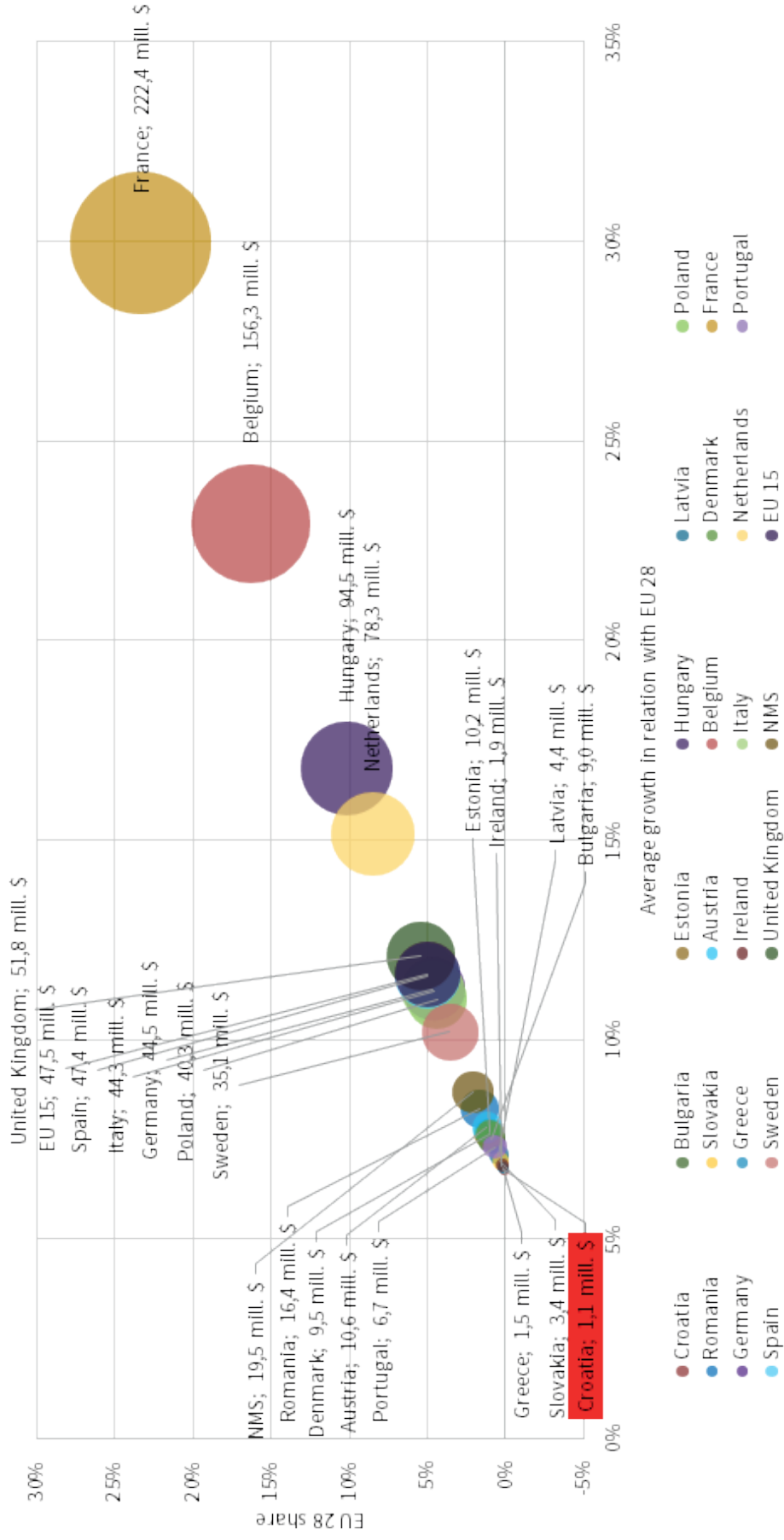
Green Peas - Production trend of selected countries in relation to EU 28 for period 2012-2017



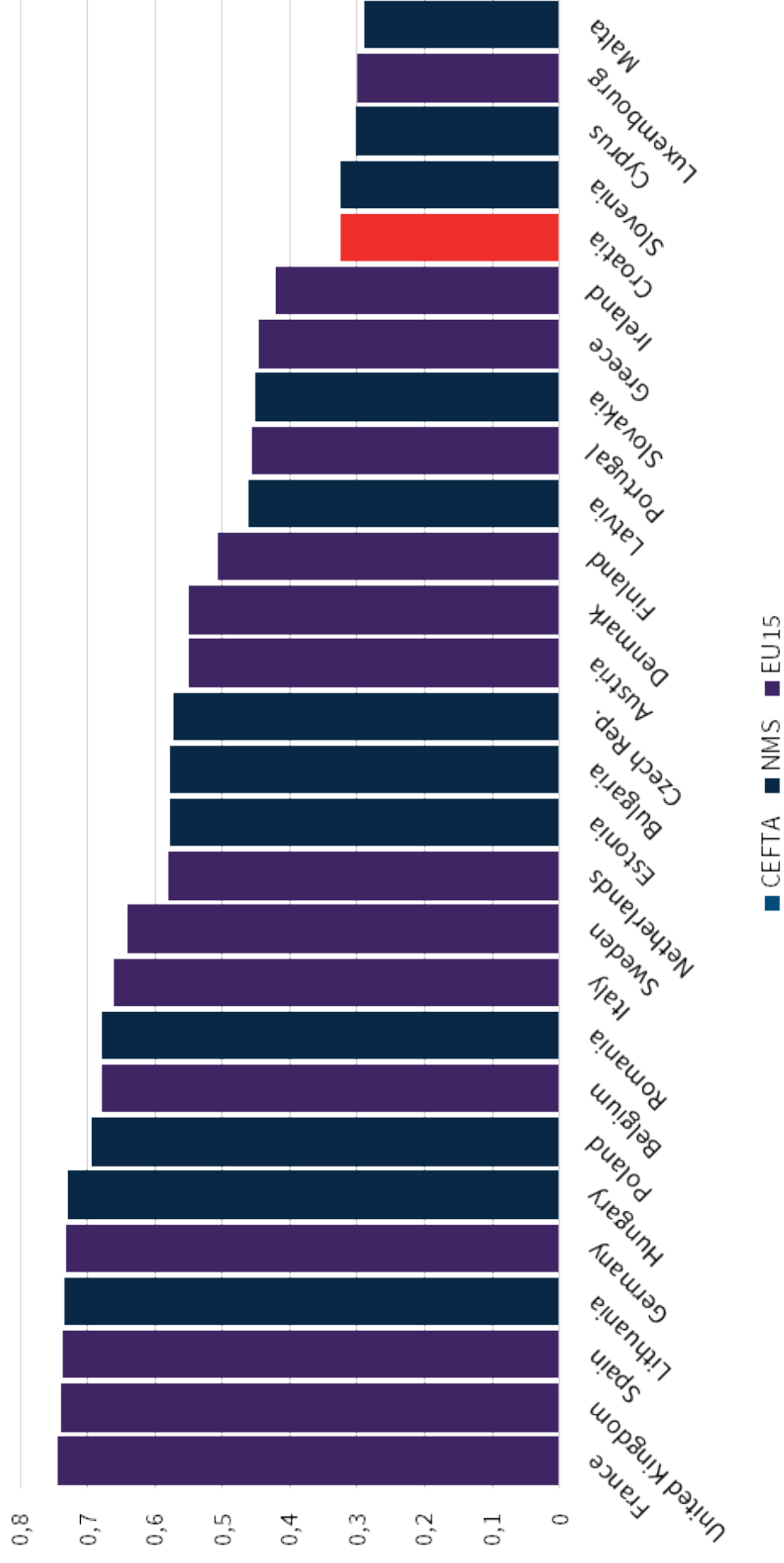
Dry Peas - Production trend of selected countries in relation to EU 28 for period 2012-2017



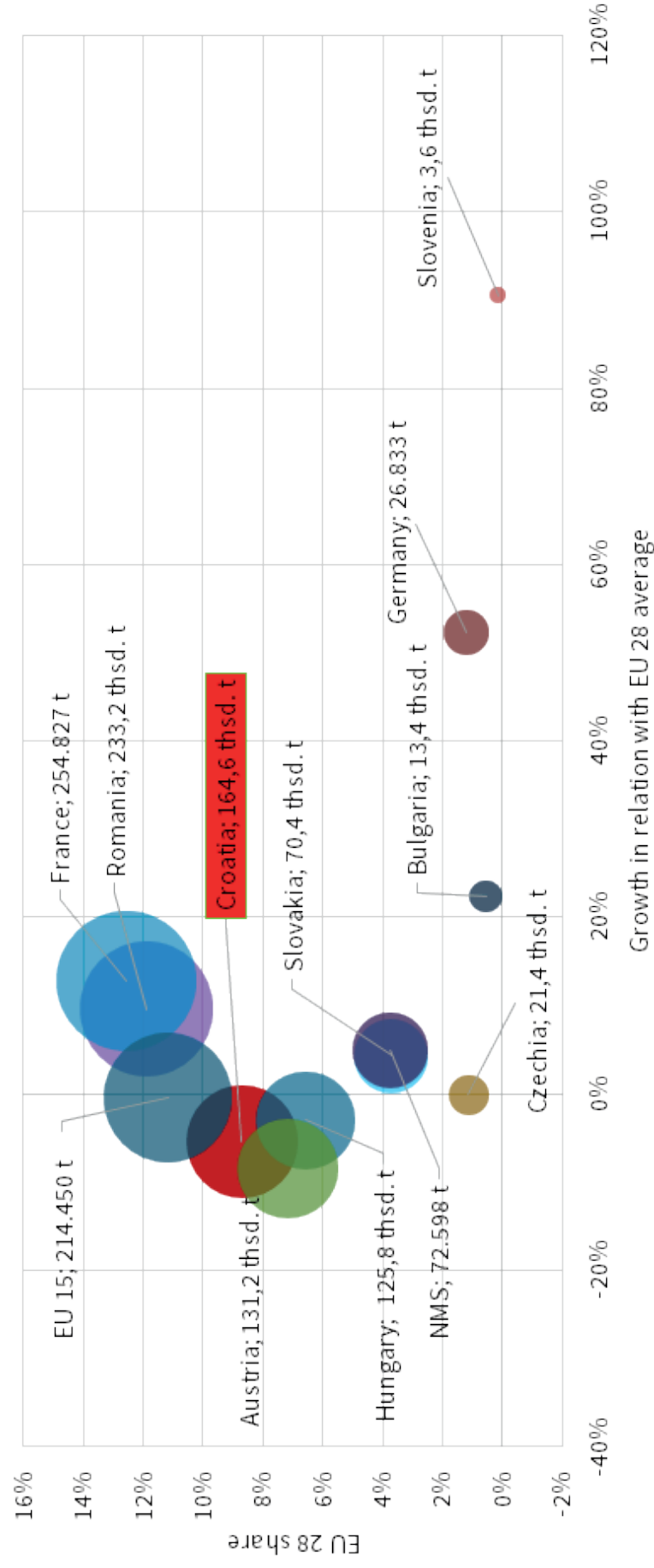
Peas - Exporttrend for selected countries in relation with EU 28 average for period 2013-2018



Peas - Index of Competitiveness



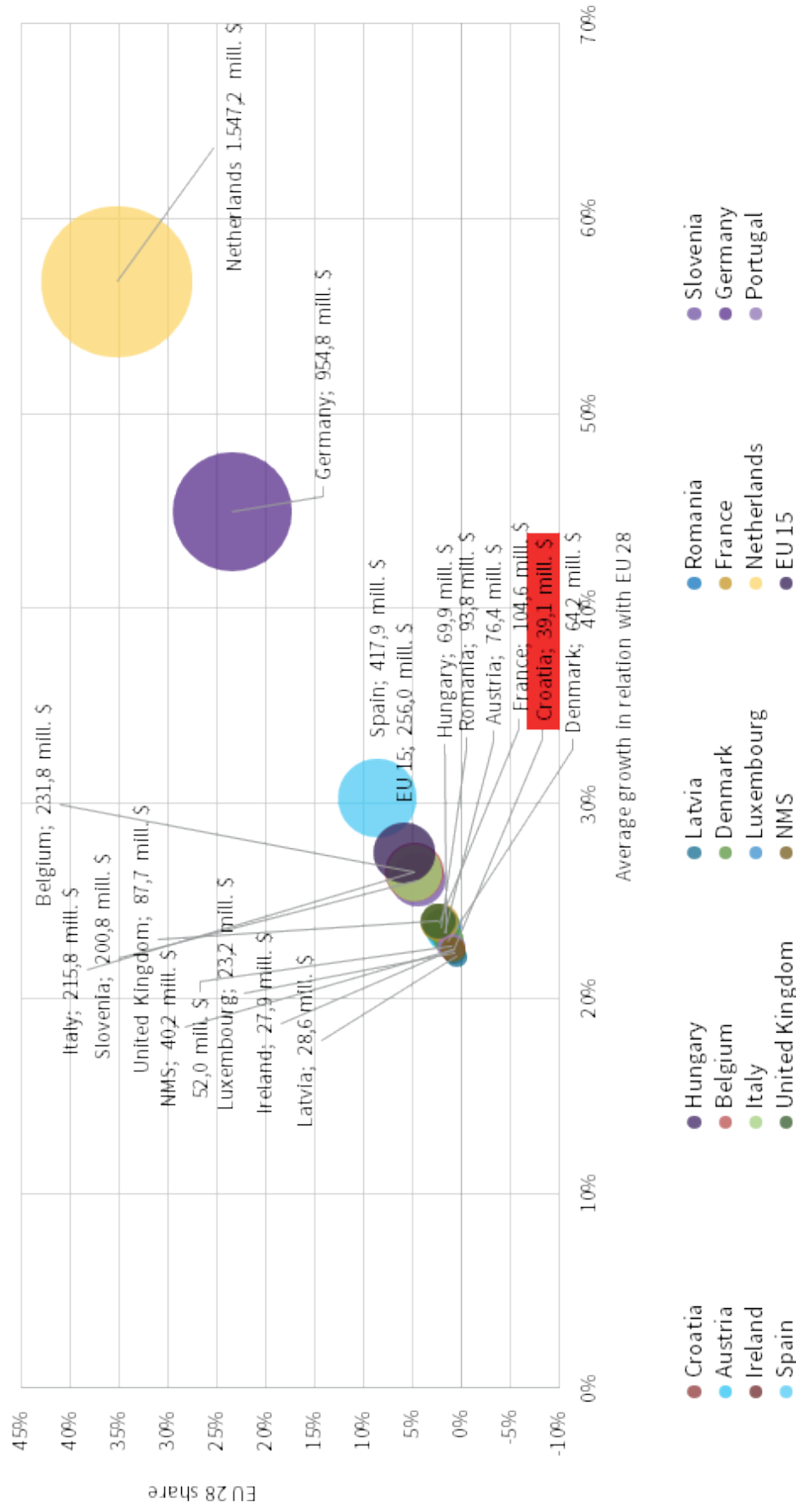
Soya - Production trend of selected countries in relation to EU 28 for period 2012-2017



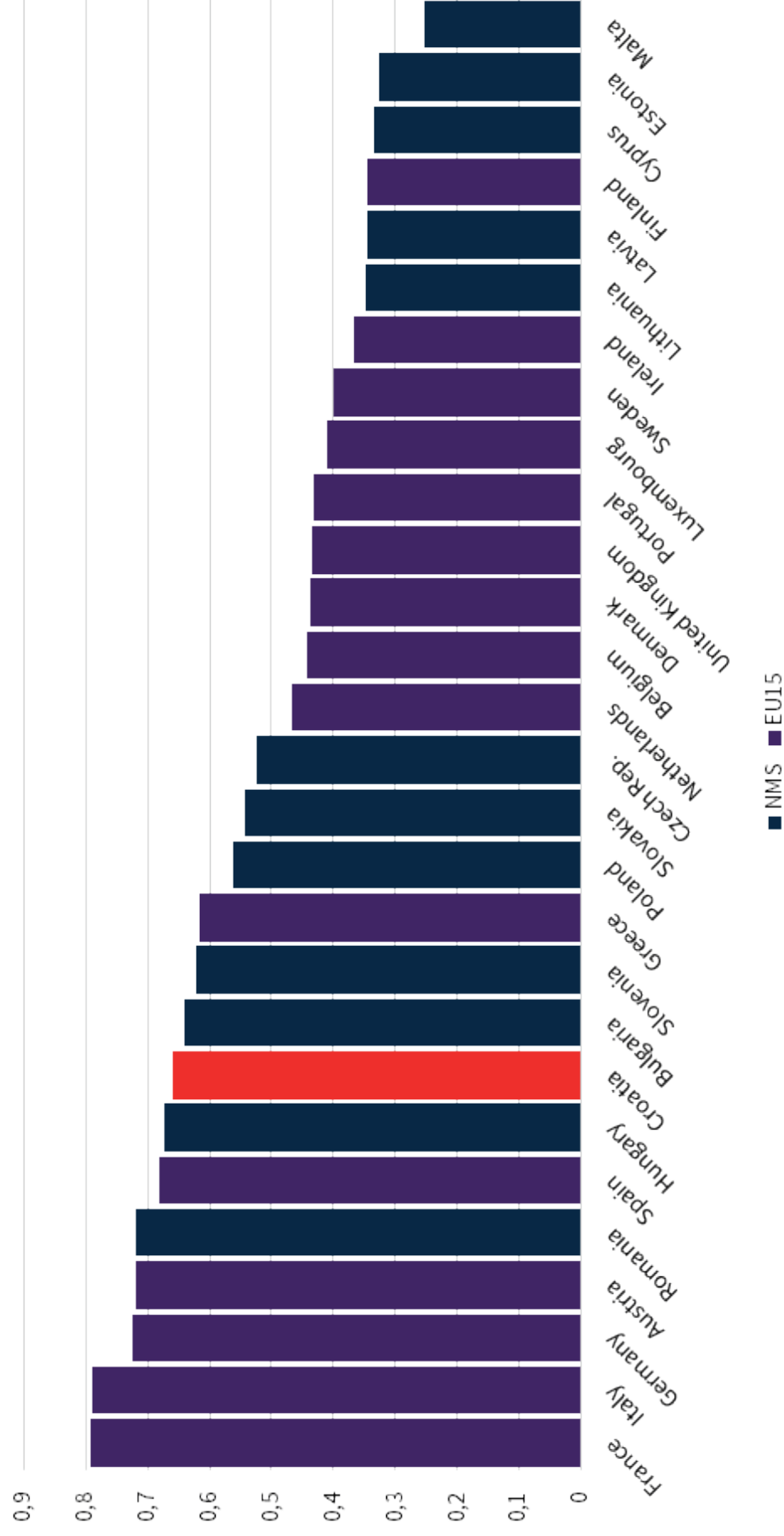
● Croatia ● Bulgaria ● Czechia ● Hungary ● Romania ● Slovakia ● Slovenia ● Austria ● France ● Germany ● NMS ● EU 15



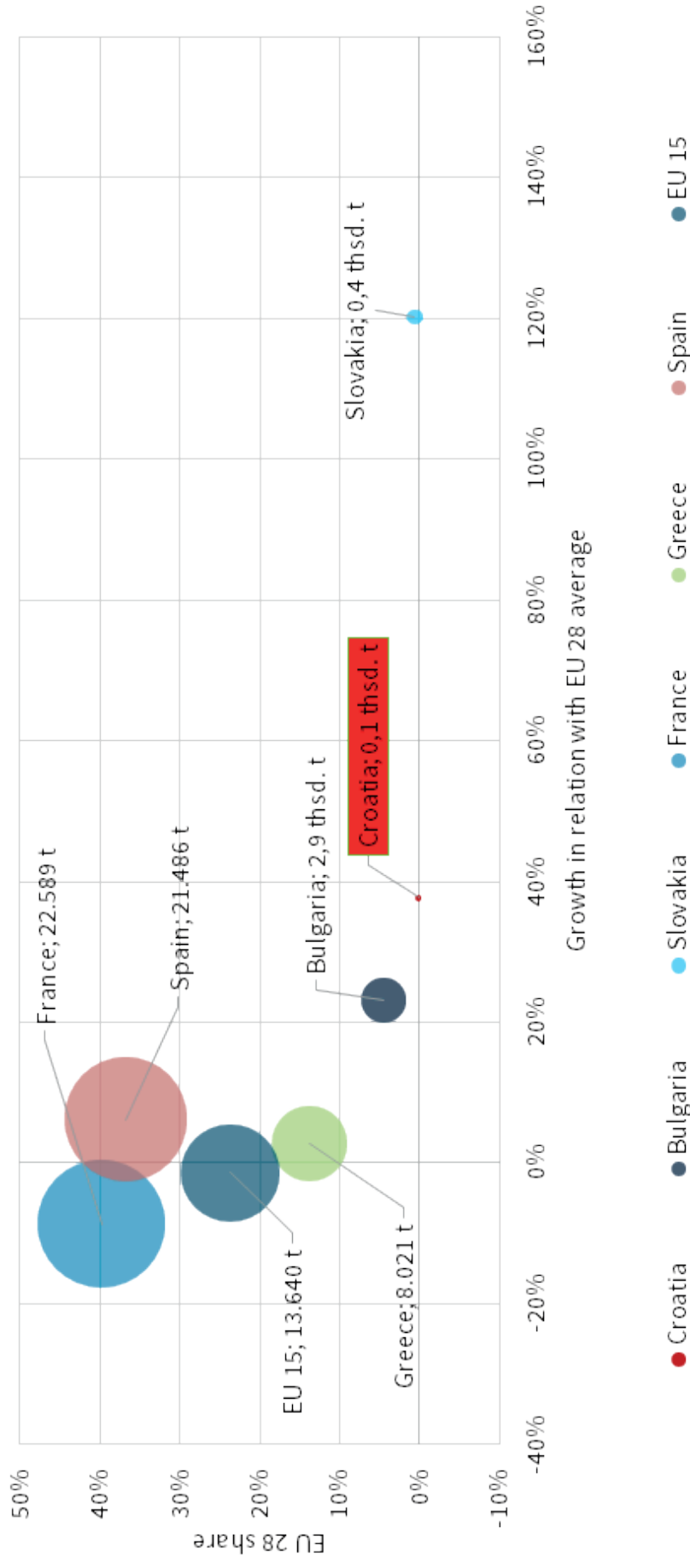
Soya - Export trend for selected countries in relation with EU 28 average for period 2013-2018

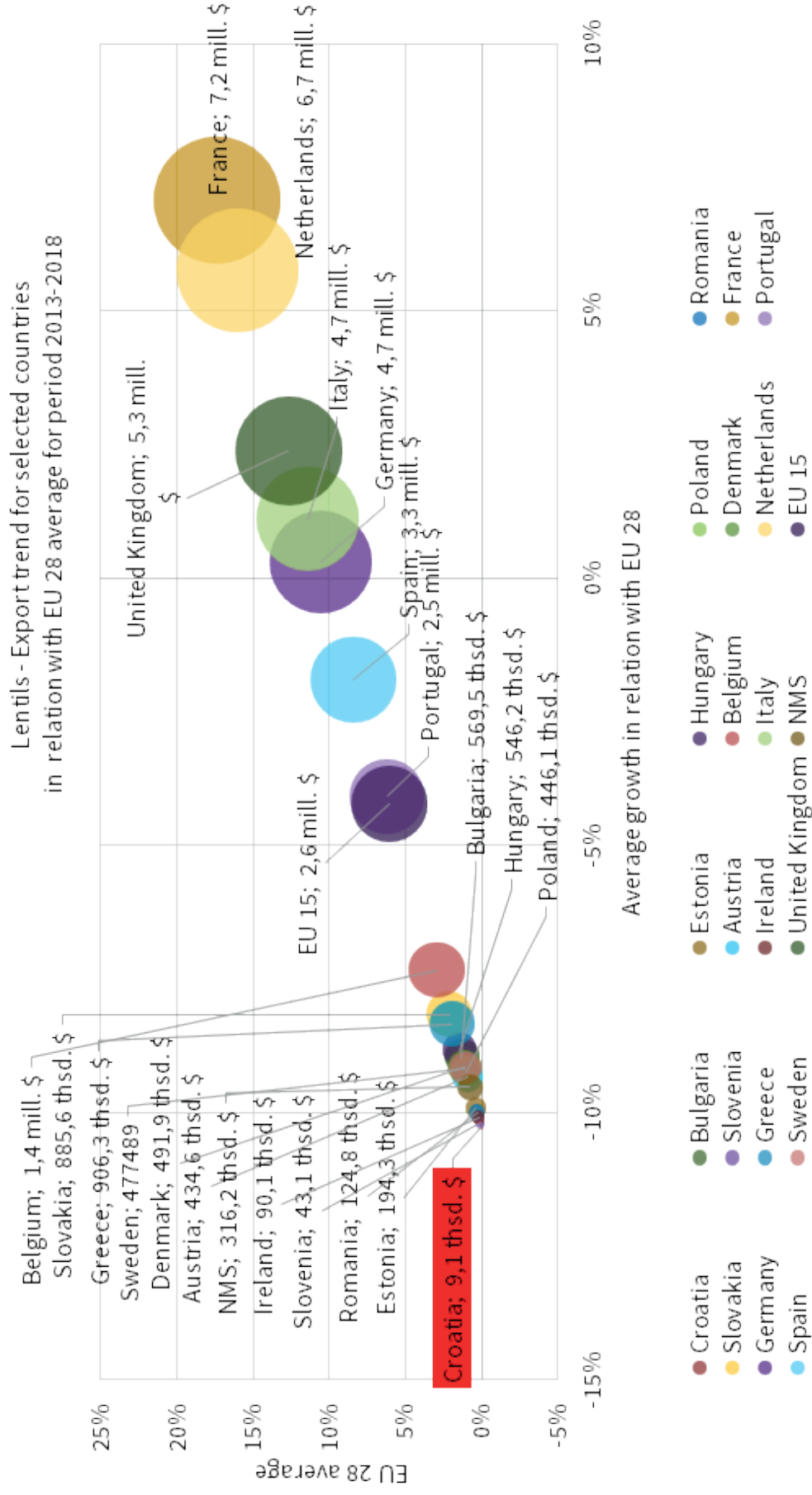


Soya - Index of Competitiveness

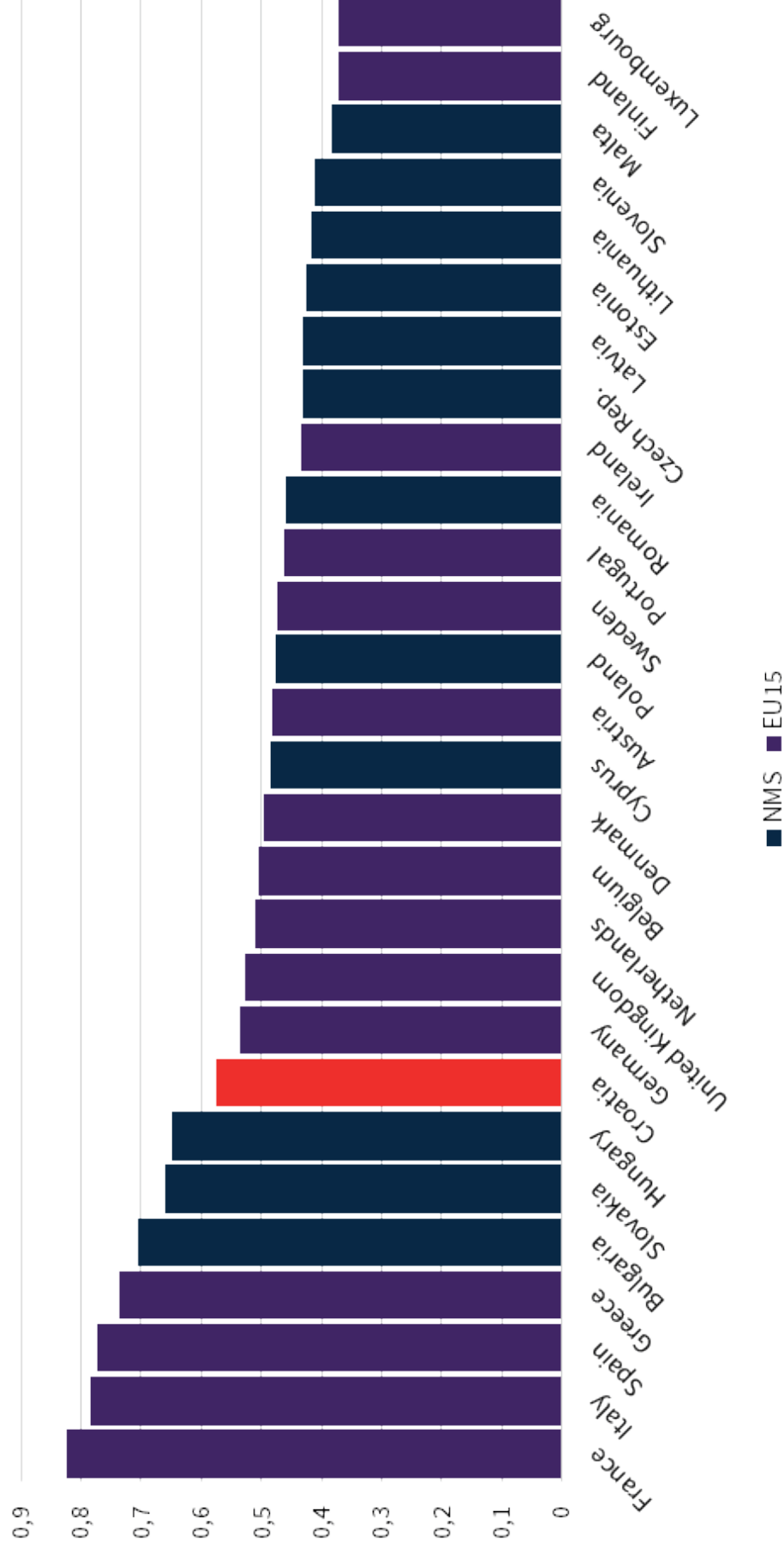


Lentils - Production trend of selected countries in relation to EU 28 for period 2012-2017

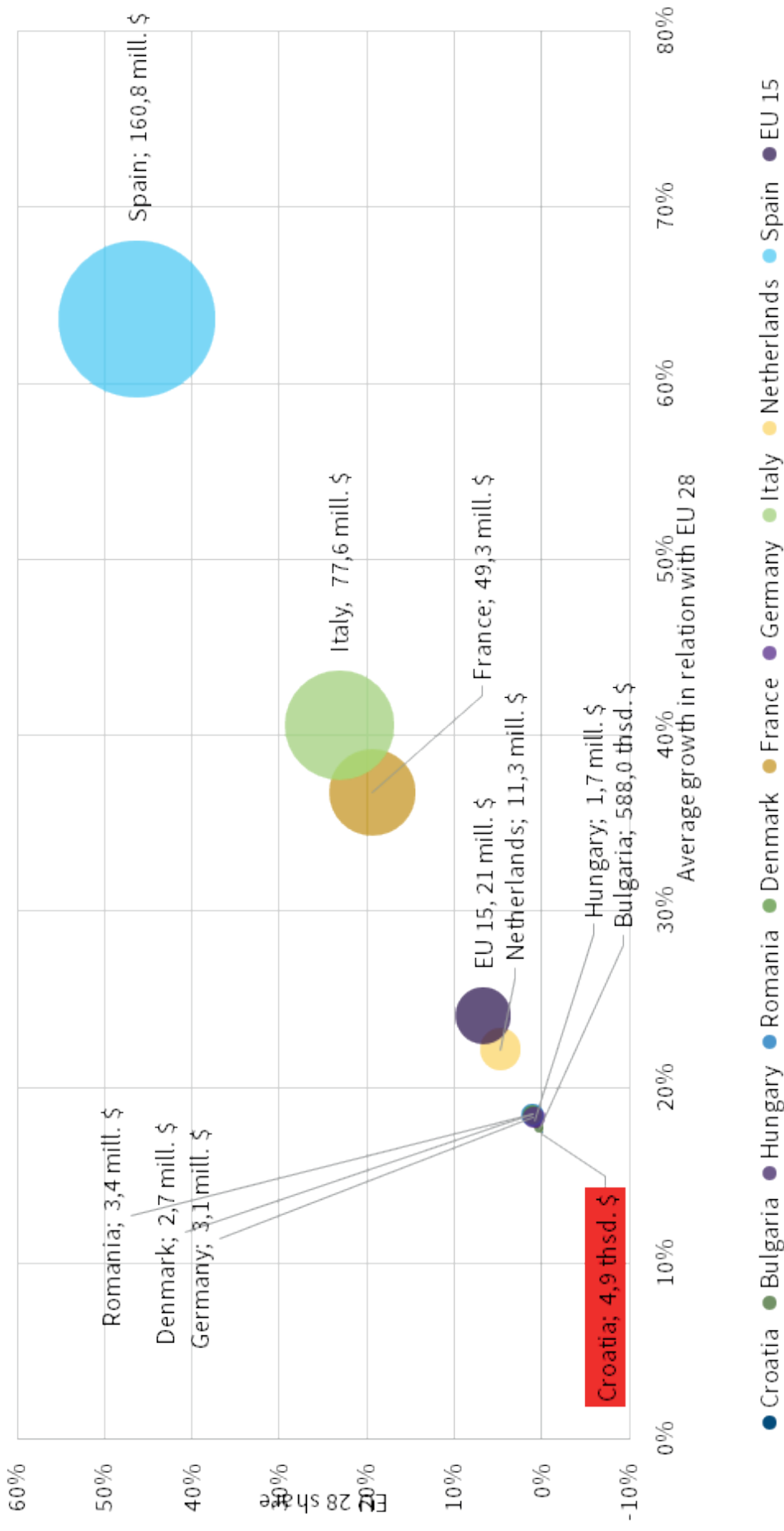




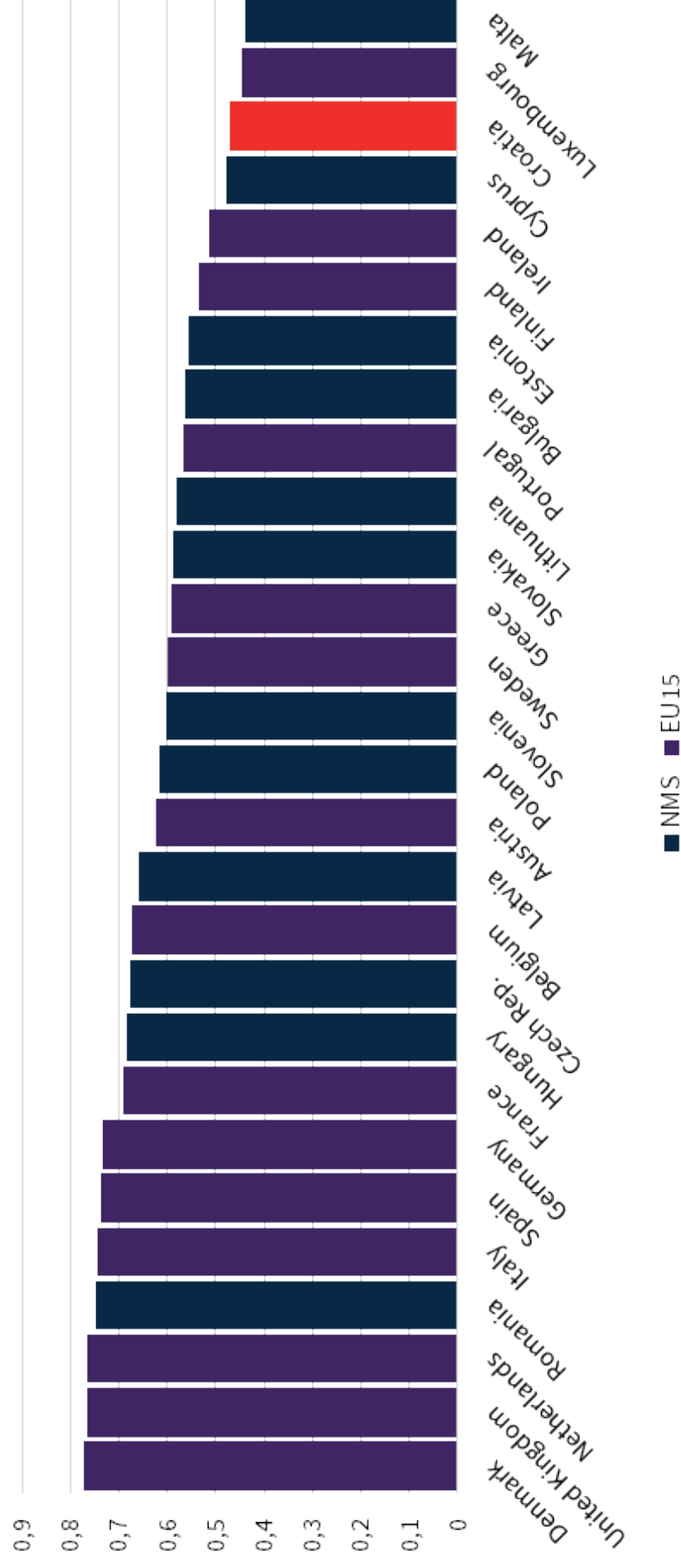
Lentils - Index of Competitiveness



Lucerne - Export trend for selected countries compared to EU 28 average 2013-2018



Lucerne - Index of Competitiveness



In general, it can be concluded that according to this analysis, Croatian legume sector is largely uncompetitive, in the context of the EU 28-member state production and trade. The exception is soya production, which is positioned relatively strongly, and with signs of strong growth and resilience, it is by far the most prosperous legume crop grown in Croatia, therefore it should be provided with strong support and focus by the policy makers and producers.





TRansition paths to sUustainable
legume-based systems in Europe

Protein Crops in Croatia
Overview of the sector and policy
recommendations
www.true-project.eu

References

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