A Summary of Professional Accomplishments

in the proceedings for a postdoctoral degree in agricultural sciences
in the field of agronomy

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Contents

1. Biography and professional career

1.1. Education

- 1995–2000; master's course in Agronomy, Faculty of Agriculture, August Cieszkowski Agricultural University of Poznań, Poland
- 25 May 2000 – Master of Science in Engineering, Agronomy; master's thesis '*Using ELISA Test for Field Qualification of a Potato Plantation*' (supervised by dr Maciej Czajka, (PhD))
- 2000–2004; doctoral studies, Faculty of Agriculture, August Cieszkowski Agricultural University of Poznań, Poland
- 30 September 2005 – doctoral degree in agricultural sciences – agronomy; the doctoral dissertation '*The Influence of Cultivation Systems and Foliar Feeding on the Yield and Functional Traits of Yellow and Narrow-Leaved Lupine*' was distinguished by the Rector of the August Cieszkowski Agricultural University of Poznań (Appendix 6.1).

  Supervised by Prof. Jerzy Szukała

1.2. Employment history

No.	Period of employment	Place of employment	Time	Position
1.	1 October 2005 – 30 January 2006	August Cieszkowski Agricultural University of Poznań, Department of Soil and Plant Cultivation	part time	instructor
2.	1 February 2006 – 30 September 2006	August Cieszkowski Agricultural University of Poznań, Department of Soil and Plant Cultivation	full time	assistant lecturer
3.	1 October 2006 – 24 July 2016 since 25 July 2016	August Cieszkowski Agricultural University of Poznań, Department of Soil and Plant Cultivation Poznań University of Life Sciences, Department of Agronomy	full time	assistant professor

1.3. Other documented forms of scientific and vocational education (Appendix 6.2)

Apprenticeship programmes

- 29 May 2000 – 27 July 2000 – Belgium, apprenticeship at the Condi-Plants s.c. company – a seed potato producer and distributor
- 15 June 2001 – 25 July 2001 and 9 June 2004 – 15 July 2004 – Germany, apprenticeship at the NKL Neue Kröpeliner Lagerhaus company – a seed potato producer and distributor
- 16 March 2015 – 21 May 2015 – apprenticeship at the Institute of Plant Protection - National Research Institute in Poznań, Poland
- 1 September 2015 – 16 October 2015 – apprenticeship at the Regional Plant and Seed Protection Inspectorate in Poznań

Courses

- 2006 – a course in pedagogy for PhD students, August Cieszkowski Agricultural University of Poznań
- 2011 – a training in occupational safety and health organised by the Poznań Vocational Training Centre

Trainings

- November 2008 – the training ‘Plant Protection in Areas Covered by the Agri-Environmental Programme’ organised by the Institute of Plant Protection - National Research Institute in Poznań
- November 2012 – the training ‘Laboratory Assessment of Cereal and Legume Seeds’ at the Plant Breeding and Acclimatisation Institute – National Research Institute in Radzików, Poland
- 2012-2013 – a 52-hour series of trainings in planning, writing and management of research projects and intellectual property protection as part of the ‘R&D for Greater Poland’ project co-financed by the European Social Fund
- September 2014 – the training workshop in the DANUBENERGY project ‘The Production of Bioenergy from Biomass in Meadows of the Danube Basin and Other Riverside Areas in Central Europe in Installations Independent of the Electrical Grid’

- November 2017 – the training 'Seed Production in the Light of Activities of the Agri-Environmental-Climate Programme' at the Agricultural Advisory Centre in Brwinów, Poznań Branch.

Erasmus + Programme

- 18 September 2017 – 22 September 2017 – a series of English lectures on the global production and methods of growing legumes at the Latvia University of Agriculture in Jelgava, Latvia.
- 24 September 2018 – 28 September 2018 – a series of English lectures on the significance of legumes in contemporary agriculture at the Escola Superior Agrária do Instituto Politécnico de Coimbra, Portugal.

2. Scientific research accomplishments following Article 16 Paragraph 2 of the Act on Academic Degrees and Titles and on Artistic Degrees and Titles of 14 March 2003 (Official Journal 2016 Pos. 882 with amendments in Official Journal 2016 Pos. 1311):

2.1. Title of scientific accomplishment (Appendix 3)

Agnieszka Faligowska (2018). '*The yield and quality of yellow lupin seeds and their effect resulting from the use of conventional and long-term reduced soil tillage systems*'.

Wydawnictwo Uniwersytetu Przyrodniczego w Poznaniu ISBN 978-83-7160-911-4. Dissertations, book 504, pp 112.

2.2. Introduction to research problem and discussion

In the 1990s the areas of legume plantations, including lupine, became considerably reduced due to the lower cost-effectiveness of cultivation, limited use of seeds for feed and export possibilities, as well as the occurrence of anthracnose – a serious lupine disease. The decreasing share of leguminous plants in the crop structure was also caused by the introduction of free market economy, which resulted in a systematic increase in the post-extraction import of soybean meal (Podleśny & Księżak, 2009). After 1989 the free market economy caused changes in the agrarian structure and resulted in simplified crop rotation. The share of cereals in the crop structure increased to over 74%, and in some regions of Poland even up to 80%. In consequence of these changes, post-harvest residues were no longer entered into soil, which reduced the inflow of organic matter (Rośliny strączkowe…2012). Recently the interest in this group of plants has increased due to various factors. One of them is the environment-friendly agricultural policy of the European Union, which is aimed at effective production of high quality food based on optimal technologies, not threatening the natural environment. Legumes are perfectly suited for this purpose as they can be cultivated in pure sowing, cereal-legume mixtures or intercrops. Therefore, these crops are included in numerous agri-environmental programmes, whereas subsidies from the European Union increase their cost-effectiveness. In this context, legumes have both economic and ecological advantages (Raport końcowy…2015), mostly due to the fact that papillary bacteria, which they are symbiotic with, have the capacity to fix atmospheric nitrogen (Podleśny, 2005, Nemecek et al., 2008, Florek et al., 2012, Voisin et al., 2014, Foyer et al., 2016).

The attempt to ensure 'national protein security' based on the production of high protein feeds from native plant species is an important issue that causes increased interest in legume cultivation. It is also important that in the future it will be necessary to implement the provision written in Article 15 of the Feed Act of 22 July 2006 (Official Journal 2006, No. 144, Pos. 1045 with amendments), which bans the use of genetically modified feeds and genetically modified organisms as feeds in Poland (Raport końcowy ... 2015).

According to the data published by the Central Statistical Office (2017), in 2016 the area of leguminous plants grown for seeds together with mixtures amounted to about 226,000 ha, including 34,200 ha with leguminous plants grown for green fodder. Lupine plantations occupied the largest area, i.e. 147,000 ha. Although narrow-leaved lupine is the main species, the cultivation of yellow lupine is also important mainly because it has lower requirements concerning the site and it is more tolerant to soil acidification (French et al., 2001, Wolko et al., 2011; Dymarska & Grabowska, 2014). Being a light soil plant, it can be used for crop rotation in the places where the selection of other crop species is limited. Legumes, including yellow lupine, have a deep and well-developed root system through which they limit soil degradation, create its structure and have ameliorative effects (Florek et al., 2012). Apart from that, they enrich soil with organic substance, leaving post-harvest crop residues rich in macro- and micronutrients (Jasińska & Kotecki, 2001, Malarz et al., 2010). They improve the soil culture, maintain it in good condition and increase the efficiency of follow-up plants (Sadowski et al., 2000).

Legumes are economically significant mainly due to the use of their seeds for animal feeding (Podleśny, 2005, Nemecek et al., 2008, Voisin et al., 2014, Foyer et al., 2016). According to Buraczewska et al. (2010), of the three lupine species, yellow lupine seeds have the highest content of protein in the dry matter, which makes them a valuable component of feed for pigs, poultry and fish (Pereira & Oliva-Teles, 2004; Kim et al., 2008; Zduńczyk et al. , 2014). Apart from that, yellow lupine can be successfully grown for green fodder and silage (Podleśny, 2008, Faligowska & Szukała, 2009, Faligowska & Selwet, 2012, Jarecki & Bobrecka-Jamro, 2014). Due to the health-promoting properties of yellow lupine researchers also conducted investigations on the potential use of the species as an ingredient in functional food (Skibniewska et al., 2003; Lampart-Szczapa et al., 2007; Lampart-Szczapa & Łoza, 2007).

The reduction of production costs is of key importance in modern agriculture (Małecka et al., 2012). Currently there is a tendency to reduce the cultivation intensity, especially to shallow tillage or to replace it with other treatments to reduce the costs (Orzech et al., 2003). Undoubtedly, there are a lot of advantages of tillage. It loosens soil, overturns and fragments the arable layer, facilitates the entering of post-harvest residues into deeper soil layers and equalises the content of nutrients in the entire arable layer. However, there are also negative effects of tillage. It destroys the natural soil structure, favours erosion, contributes to soil crusting, slows down work and increases fuel consumption (Holland, 2004; Dzienia et al., 2006; Morris et al. , 2010). Therefore, we can observe increasing interest in various solutions limiting production costs and mechanical interference with soil. The most popular solution is simplified (no-till) cultivation, where plant residues are incorporated in the surface layer, but some of them remain on the soil surface (Małecka et al., 2012). In another method of no-till cultivation all soil treatments are completely abandoned from the forecrop harvest to the sowing of follow-up plants, and specialised seed drills with disc coulters are used for sowing. The solution in which all plant debris is left on the field surface is called direct sowing or no-tillage (Małecka et al., 2012).

The reduction of production costs is of key importance in modern agriculture (Małecka et al., 2012). Farmers' increasing interest in legume growing requires not only research to increase the yield volume and accuracy but also to improve the cost-effectiveness of production. It is noteworthy that the introduction of subsidies to legumes in 2010 became the main factor motivating farmers to grow these crops. In consequence, the share of this group of plants in the crop structure increased slowly but steadily from 1.7% in 2010 to 3.0% in 2016 (GUS, 2017). After the political transformation farmers showed little interest in leguminous crops. As a result, in comparison with other crops, there was little progress in agricultural techniques used for the cultivation of legumes and the yield increased only slightly. The potential quantitative progress in the yield of yellow lupine, which was calculated on the basis of standard yields in experiments conducted by the Central Research Centre for Crop Cultivars over a period of 36 years, amounted to 18 kg per annum (Prusiński, 2007). According to Podleśny and Księżak (2009), the low yields of seeds were chiefly caused by the disappearance of the tradition of cultivation of these plants and by agrotechnical mistakes. Meanwhile there was a significant technological progress in the cultivation of cereals, rapeseed, sugar beets and maize. It was caused by the introduction of more cost-effective, simplified farming systems and the availability of specialised farming machinery (Budzyński et al., 2000; Jankowski & Budzyński, 2000 ; Głowacka, 2007; Koziara et al., 2007, Pabin et al., 2008, Piechota et al., 2013, Zimny et al., 2015, Jaskulska et al., 2017). Between 2002 and 2004 the Experimental and Educational Station in Złotniki conducted investigations on the possibility of using simplified cultivation and direct sowing of yellow and narrow-leaved lupines. However, the procedures were applied only once and did not have regular nature. The experiments showed that simplified (no-till) cultivation was more cost-effective than traditional tillage. However, the problem of lupine yield in long-term simplified cultivation in crop rotation was not solved.

2.3. Aim of research

The main aim of my own research was to determine the influence of three tillage systems (conventional, simplified and direct sowing) on the plant development, the yield, sowing and feed value of seeds as well as the economic effects of the cultivation of the yellow lupine variety 'Mister'.

The secondary objectives of the research were to:

- assess the influence of weather factors on the growth, development and yield of yellow lupine cultivated in a four-field crop rotation system, with a 50% share of cereals,
- determine the influence of long-term simplified cultivation on the biological properties of soil, weed infestation, generative development and papillation of lupine,
- determine the optimal nitrogen fertilisation for follow-up crops in the following order: winter wheat, winter rapeseed, winter wheat,
- identify the subsequent influence of yellow lupine on the yield of winter wheat cultivated in the conventional, simplified and direct sowing systems,
- determine the cost-effectiveness of different yellow lupine cultivation systems.

2.4. Material and methods

Between 2012 and 2017 field experiments were conducted at the Gorzyń Experimental and Educational Station, Złotniki Branch, which belongs to the Poznań University of Life Sciences. The research object was the yellow lupine cultivar 'Mister' grown in a four-field crop rotation system, with a 50% share of cereals. The following crop rotation order was used: yellow lupine, winter wheat, winter rapeseed, winter wheat. The two-factor experiments were conducted in the split-plot design in four replicates. The tillage system (conventional, simplified and direct sowing) was the first-order factor. Nitrogen fertilisation at doses of 0 kg $N \cdot ha^{-1}$, 60 kg $N \cdot ha^{-1}$, 120 kg $N \cdot ha^{-1}$, and 180 kg $N \cdot ha^{-1}$ was the second-order factor in the experiments on winter wheat and winter rapeseed.

The following elements were identified in the experiments on yellow lupine:

- the influence of the weather conditions on the growth, development and yield,
- the influence of permanent simplified cultivation on: the biological properties of soil, weed infestation, plant density, LAI and SPAD indexes, the dry mass of roots and root papillae, the number of flowers generated and dropped by the plant, biometric features, seed yield, the sowing value and vigour of seeds, the content of organic components and ash in seeds, the protein yield, the energy value of seeds, the energy efficiency of seed yield, the dry matter yield of vegetative plant organs, the mineral

composition and accumulation of mineral components in the vegetative organs, the economic effect.

The following elements were identified in the follow-up experiments:

- the yield of winter wheat and winter rape resulting from the permanent simplified cultivation and different doses of nitrogen fertilisation,
- the influence of yellow lupine on the yield of winter wheat grown in the second and fourth year of crop rotation.

2.5. Research results

The long-term abandonment of conventional cultivation in favour of simplified cultivation and direct sowing caused an increase in the count of soil microorganisms (fungi, bacteria, actinobacteria) in the 0-10 cm soil layer, whereas the opposite tendency was observed in the 10-20 cm soil layer. There was higher urease activity in the topsoil samples collected from the simplified cultivation and direct sowing variants than in the sample of soil collected from the conventionally cultivated variant. Apart from that, the long-term simplified cultivation and direct sowing significantly increased weed infestation, both in terms of the weight and number of weeds.

The soil tillage systems did not cause differences in the yield of yellow lupine seeds, their protein efficiency and energy efficiency in a very humid year and in years with average rainfall. However, in a dry year the direct sowing system significantly reduced these parameters in comparison with the conventional cultivation system. The weather conditions did not cause significant differences between the conventional and simplified cultivation systems in the following parameters: plant density, LAI, the dry weight of roots and root papillae, the number of flowers on the main shoot and side shoots of plants, the number of aborted flowers, the plant height, the number of pods and seeds on the main shoot, on side shoots and on the whole plant, the seed yield and protein yield. Long-term simplified soil cultivation may improve the quality of yellow lupine seeds due to the higher protein content, sowing value and seed vigour. The larger number of seeds on the side shoots deteriorated their quality due to lower germination capacity. On the other hand, the increase in the thousand kernel weight increased the germination capacity. The seeds with the higher germination capacity were also characterised by better vigour, which was manifested by a very strong positive correlation between the germination capacity and the results of the seedling growth test and the seedling growth rate test.

When subsidies were added, the conventional cultivation system ensured the highest agricultural income and the lowest cost of seed production of the three tillage systems. Pesticides had the highest share in the direct costs and they mostly determined the costs of yellow lupine production.

The yield of wheat grown in the direct sowing system in the first year after yellow lupine was 0.6 $t \cdot ha^{-1}$ lower than in the conventional tillage system. The simplified cultivation system resulted in a small but statistically significant decrease in the yield of wheat grain. The research proved that the use of a favourable forecrop could not compensate for the strong negative reaction of wheat to the direct sowing cultivation system.

There was a similar observation in the rapeseed yield. In comparison with the conventional cultivation system the yield of winter rape was significantly lower, i.e. 12.0% lower in the simplified cultivation system and 47.7% lower in the direct sowing system. When the maximum nitrogen dose of 180 $kg \cdot ha^{-1}$ was applied, winter rape cultivated after yellow lupine and winter wheat (the second year of crop rotation) gave the highest yield.

Winter wheat grown in the last year of the four-year crop rotation cycle (after yellow lupine, winter wheat and winter rape) gave the highest yield in the conventional cultivation system. On the other hand, the grain yield was significantly reduced by 6.5% in the long-term simplified cultivation system and by as much as 16% in the direct sowing system.

Regardless of the cultivation system, the optimal nitrogen dose for winter wheat grown in the second and last year of the four-year crop rotation cycle was 120 kg $N \cdot ha^{-1}$. The dose of 180 kg $N \cdot ha^{-1}$ did not result in a significantly higher yield of winter wheat than the dose of 120 kg $N \cdot ha^{-1}$.

The research showed that the yield of winter wheat grown directly after yellow lupine in a four-field crop rotation system with a 50% share of cereals was on average 19.3%, i.e. 1.2 $t \cdot ha^{-1}$ higher than in the variant after winter rapeseed.

2.6. Summary

The attempts to ensure ‘national protein security’ with high protein feeds made from native plant species require not only investigations to increase the yield volume and faithfulness but also actions to improve the cost-effectiveness of production. Subsidies undoubtedly increased farmers' interest in leguminous plants, but the abovementioned goal can be implemented by the introduction of new, economical cultivation technologies. At present many farms have suitable equipment and simplified systems are widely used in the cultivation of cereals, beets and rapeseeds. Earlier studies on simplified soil tillage systems used for the cultivation of leguminous plants were usually fragmentary and limited to a single use of simplified cultivation systems.

The research results presented in the monograph on the permanent application of simplified cultivation brought a lot of new, interesting information which led to important conclusions not only for science but also for agricultural practice. In my opinion the following conclusions are the most important:

- permanent, simplified tillage may be recommended for yellow lupine grown both for fodder and for seed reproduction because long-term simplified cultivation does not reduce the seed yield and it may even improve the quality of yellow lupine seeds by increasing the protein content, sowing value and vigour of seeds,

- winter wheat grown directly after yellow lupine in the long-term simplified cultivation system with crop rotation with a 50% share of cereals significantly increased the yield and reduced nitrogen fertilisation to a dose of 120 kg $N \cdot ha^{-1}$,
- the yields of winter rapeseed grown in the third year of crop rotation and winter wheat grown in the fourth year of the four-field crop rotation cycle with a 50% share of cereals were significantly reduced in the long-term simplified soil tillage and direct sowing systems.

Another interesting issue, which has not been discussed in studies on simplified cultivation before, is the assessment of its influence on the development of plants, i.e. the intensity of formation of root papillae, the LAI and SPAD indexes, the number of flowers formed and aborted by plants and the quality of seeds. The research results led to the following conclusions:

- the cultivation systems which were used permanently in crop rotation significantly affected the development of yellow lupine. In the direct sowing system the dry mass of root papillae was significantly higher than in the conventional cultivation system and yellow lupine developed a larger number of flowers on the plant (mainly on side shoots). However, regardless of the cultivation system, the number of flowers dropped by the plant from side shoots was very high (88-92%),
- permanent use of simplified cultivation systems decreased the leaf area index (LAI) and increased the plants' nutrition with nitrogen, expressed with the SPAD index,
- long-term simplified cultivation may increase the seed protein content, sowing value and vigour,
- the larger number of seeds on the side shoots deteriorated the quality of seeds by reducing their germination capacity, whereas the increase in the thousand kernel weight increased the germination capacity of seeds and improved their vigour.

According to the publishing house reviewer, it was particularly valuable to combine the course of the weather conditions with the characteristics of plants and the yield of lupine and to show how these parameters varied according to the cultivation system, the amount of rainfall and air temperature. Such analyses are very rare. Usually researchers characterise the course of the weather and briefly refer to this issue or make no reference at all. However, variability in the course of ontogenesis caused by the course of the weather and its influence on the yield of legumes is particularly important.

- The weather conditions determined the growth and development of yellow lupine. The highest variability was observed between the emergence and the phase of 2-3 leaves and between the flowering phase and the pod formation. The smallest variability was observed between sowing and the emergence of plants.

- Among the weather factors, rainfall had significantly greater influence on the variability of individual periods of yellow lupine development than temperature.
- Between the flowering and pod formation the number of days and rainfall were highly positively correlated with the seed yield. Between the pod formation and full maturity the seed yield was similarly but negatively correlated with the number of days and rainfall.

To sum up, the monograph is one of few publications that includes such a wide range of investigations on the application of permanent simplifications in yellow lupine cultivation. It includes the analysis of soil, the influence of long-term simplified tillage systems on weed infestation, the development, yield and quality of yellow lupine seeds. It also assesses the economic effects and the consequences of yellow lupine cultivation on the yield of other plants in crop rotation (winter wheat and winter rape).

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3. Other scientific research accomplishments

3.1. Simplified cultivation of soil under legumes (Appendix 4.1)

The main area of my interest is simplified cultivation of soil, with a special focus on its influence on the development and yield of legumes.

Between 2002 and 2004 experiments were conducted on the possibility to use conventional cultivation (tillage), simplified cultivation (no-till) and direct sowing (zero) for yellow and narrow-leaved lupines. The research involved assessment of the influence of single application of diversified cultivation systems on weed infestation, yield elements, seed yield, seed quality, feed efficiency and economic effects. The simplified cultivation system proved to be the most favourable due to the lowest weed infestation, the highest seed yield and the highest protein and energy efficiency. The quality of yellow and narrow-leaved lupine seeds was as high as in conventional cultivation (tillage). All the three cultivations systems ensured agricultural income, but simplified cultivation (no-till) gave the highest income.

Between 2005 and 2007 an experiment was conducted on peas grown in the conventional cultivation (tillage), simplified cultivation (no-till) and direct sowing (zero) systems. The highest seed yield was obtained in a no-till system. The yield obtained in the conventional system (tillage) was significantly lower. The sowing value of pea seeds was not significantly modified by the research factor.

In the subsequent years experiments were carried out on yellow and narrow-leaved lupines grown in permanent simplified farming systems. The published fragmentary results of the research conducted between 2008 and 2010 indicated the possibility of growing both lupines in simplified systems, without the risk of lower seed yield. The cultivation systems did not affect the seed sowing value of narrow-leaved lupine, whereas the yellow lupine seeds from the zero cultivation system were characterised by the lowest thousand kernel weight and the highest germination energy.

Between 2012 and 2014 experiments were conducted in the fields where the no-tillage system had been in use since 1992. The research included the comparison of the yield of seeds, protein and metabolic energy of peas, yellow lupine, narrow-leaved lupine and white lupine as well as economic assessment of the cultivation system. Among the species under study, white lupine gave the highest average yield, whereas the lowest yield came from yellow lupine. The highest amount of protein per 1 ha was obtained from white lupine. The amounts of protein per 1 ha obtained from the other species were smaller: by 25% (245 kg) – yellow lupine, by 29% (284 kg) – narrow-leaved lupine and by 42% (409 kg) – peas. The pea seeds were characterised by the highest concentration of metabolic energy in the dry weight of 1 kg of seeds for pigs. The lowest concentration of metabolic energy was noted in the seeds of yellow and narrow-leaved lupines. The cultivation of narrow-leaved lupine involved the lowest direct costs, whereas the cultivation of peas involved the highest costs.

To sum up, the research results showed that simplified soil cultivation could be used both once and permanently for the growing of leguminous plants, without the risk of significantly lower yields than in the conventional tillage system. In addition, simplified cultivation reduces costs and seeds harvested in this system do not differ in quality from seeds obtained in the traditional tillage system.

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2. Faligowska A., Szukała J. (2007) Plonowanie i wydajność paszowa łubinu wąskolistnego w zależności od systemów uprawy roli i dolistnego dokarmiania mikroelementami. Zesz. Probl. Post. Nauk Rol. 522: 209 - 217.
3. Faligowska A., Szukała J. (2008). Effect of soil cultivation systems and foliar microelement fertilization on the yielding and usability of yellow lupin. EJPAU 11(1), #23.
4. Faligowska A., Szukała J. (2008). Wpływ systemów uprawy roli na zachwaszczenie łubinu żółtego i wąskolistnego. Prog. Plant Protection/Post. Ochr. Roślin 48: 343-347.
5. Faligowska A., Szukała J. (2011). Wpływ deszczowania, systemów uprawy roli i polimeru na plonowanie i wartość siewną nasion grochu. Fragm. Agron. 28(1): 15 – 22.

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3.2. Lupine efficiency and feed quality (Appendix 4.2)

Another research area rarely discussed in available reference publications was the possibility to use lupine as a raw material for the production of green fodder and silage. Between 2005 and 2007 experiments were conducted to determine the feed efficiency and quality of silages made from yellow, narrow-leaved and white lupines. Lupine was harvested at two phases: at the flat pod phase and at the green ripe seed phase. The following parameters were measured in the experiment: the yield of fresh weight of green fodder, the dry matter content, the dry matter and protein yield as well as the chemical composition of green fodder. Next, the green fodder made from lupine was ensilaged by adding biological or chemical preservatives, which were another experimental factor. After ensilaging the microbiological and chemical compositions of lupine silage were assessed in a laboratory.

The yields of green fodder from yellow and white lupines were higher than the yield of green fodder from narrow-leaved lupine. When the harvest time was delayed to the green ripe seed phase, the dry matter content and dry matter yield increased significantly. The lupine silages were good quality. The chemical composition of silage was modified by the weather conditions to a greater extent than by the green fodder harvesting time. Both additives improved the quality of silages by increasing the content of lactic acid bacteria and limiting the occurrence of unfavourable bacteria of the *Clostridium* genus, bacteria from the *Coli* group, yeasts and fungi.

To sum up, yellow, narrow-leaved and white lupines may provide considerable amounts of good raw material for silage if the plants have been dried and treated with preservatives. Another advantage of growing lupine for silage is the fact that the site can be released as early as the first half of July and it can be used for winter crops.

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2. Faligowska A., Szukała J., (2009). Wpływ terminu zbioru na skład chemiczny i plon zielonki z łubinu białego, żółtego i wąskolistnego. Fragm. Agron. 26(2): 26-32.
3. Faligowska A., Selwet M. (2012). Jakość i stan higieniczny kiszonek z łubinu żółtego w zależności od terminu zbioru surowca i dodatków kiszonkarskich. Nauka Przyr. Technol. 6, 1, #15.
4. Faligowska A., Selwet M., Panasiewicz K., Szymańska G. (2014). Quality and hygienic conditions of white lupin silage, affected by forage stage of growth and use of silage additives. Turk. J. Field Crops 19(2): 261-266.
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3.3. Seed sowing value and vigour (Appendix 4.3)

A large part of my experiments was supplemented with research on the influence of specific agrotechnical factors on the seed sowing value and vigour.

Between 2001 and 2003 the influence of desiccants on the sowing value of lupine seeds was assessed. The research showed that the seed sowing value depended on the genetic factor (species/cultivar) and desiccants. The Basta 150 SL (glufosinate ammonium) and Reglone Turbo 200 SL (diquat dibromide) preparations improved the germination capacity of the seeds of the Bardo and Katon white lupine cultivars and the Polo yellow lupine cultivar. The Roundup Ultra 350 SL (glyphosate) reduced the germination capacity of the seeds of the Katon determinate cultivar below the minimum limit for qualified seed materials. The use of this agent as a desiccant resulted in the highest share of abnormally germinating seeds in the seed material.

Between 2002 and 2004 there was research on the influence of the foliar feeding of white, yellow, narrow-leaved lupine and peas with microelements and the influence of inoculation of the seeds of these plants on their yield and quality. The seed sowing value depended on the course of the weather conditions in individual years and on the plant species. The narrow-leaved lupine seeds were characterised by the lowest energy and germination capacity. The foliar fertilisation of mother plants with microelements and seed inoculation did not have significant influence on the sowing quality of the seeds.

There were further experiments on the effect of sprinkling and seed dressing on the sowing value and vigour of yellow and narrow-leaved lupine seeds. The research was conducted on seeds collected in the experiments where the water variant was the factor (non-sprinkled and sprinkled variants). After harvesting the seeds were dressed with the Vitavax 200 FS preparation containing carboxin and thiram. The sprinkling of the mother plants reduced the energy and germination capacity of the seeds and increased the share of mouldy and rotting seeds as well as healthy non-germinating seeds. The vigour tests showed that the sprinkling reduced the sowing value of the seeds. The dressing reduced the share of mouldy and rotting seeds but it significantly increased the share of healthy non-germinating seeds.

Between 2011 and 2012 there was research on the loss of the sowing value and vigour of yellow, narrow-leaved, white lupine and pea seeds as a result of mechanical harvesting with a combine. Manually harvested seeds were used as the control variant. It is known that during harvest seeds are damaged, but in reference publications it is difficult to find information about the extent (percentage) of damage and whether it translates into the loss of seed germination capacity and vigour. The research showed that mechanical harvesting significantly reduced the germination capacity of yellow, narrow-leaved and white lupine seeds (by 8%, 12% and 5%, respectively) and increased the share of abnormally germinating and/or non-germinating seeds. The electrical conductivity test also showed that the seeds lost their vigour. However, mechanical harvesting had different effect on the pea seeds. Their germination energy increased significantly by 14%, whereas their germination capacity and the share of abnormally germinating and/or non-germinating seeds were not significantly different. The different reaction of the pea seeds to mechanical harvesting can be attributed to differences in the seed covering structure. Seeds with a more consistent covering, which contains more lignin, are more resistant to mechanical damage.

To sum up, the sowing quality of legume seeds is a very complex issue, which depends on the genetic factor, the weather conditions during the growing season and agrotechnical aspects. While the weather conditions during the growing season are out of control, it is worth considering whether a particular agrotechnical procedure will not negatively affect the seed sowing value and vigour, and significantly reduce these parameters.

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2. Faligowska A., Szukała J., Kowalska M. (2009). The influence of foliar fertilization with microelements and seed inoculation on the crop yield and quality of seeds of leguminous plants. Zesz. Probl. Post. Nauk Rol. 541(1): 113-119.
3. Faligowska A., Panasiewicz K., Szymańska G., Bartos-Spychała M. (2013). Jakość siewna nasion łubinu żółtego w zależności od wybranych czynników agrotechnicznych. Prog. Plant Protection/Post. Ochr. Roślin 53(2): 293-296.
4. Faligowska A., Panasiewicz K., Szymańska G., Bartos-Spychała M., Ratajczak K. (2015). Jakość siewna nasion łubinu wąskolistnego w zależności od deszczowania i zaprawiania nasion. Fragm. Agron. 32(1): 10-16.
5. Faligowska, A. (2015). Utrata wigoru i wartości siewnej nasion łubinu białego i grochu siewnego na skutek mechanicznego zbioru. Nauka Przyr. Technol.,9, 4,#49.
6. Faligowska A., Szymańska G., Panasiewicz K. (2015). The influence of combine harvest on the vigour and sowing value of narrow-leaved lupin seeds. Fragm. Agron. 32(3): 17-23.
7. Faligowska A., Szymańska G., Panasiewicz K. (2016). The loss of vigour and sowing value yellow lupin seeds (*Lupinus luteus* L.) as a result of mechanical harvesting. Plant Breed. Seed Sci. 73: 53-62.

4. Synthetic summary of scientific accomplishments

The list of my scientific accomplishments includes 57 original creative works (Table 3), i.e. one monograph, one individual study and 55 co-authored studies, including 26 studies where I was the lead author. 20 of them were published in English, including 8 publications in the journals from List A of the Ministry of Science and Higher Education (Table 1). The total number of points awarded by the Ministry of Science and Higher Education, including the major scientific accomplishment, is 505. My Impact Factor value is 4.32. I am the author/co-author of 56 abstracts and 36 popular science articles. My accomplishments also include 77 reports on commissioned research topics, where I was the manager.

According to the *Web of Science* database, my articles were cited 4 times in journals such as Legume Research, Turkish Journal of Field Crops, and Pesquisa Agropecuaria Tropical. According to the *Scopus* database, my articles were cited 7 times. According to the *Web of Science* and *Scopus* databases, my Hirsch Index is 2. There were also 22 other citations.

Table 1. A list of dr inż. Agnieszka Faligowska's (PhD Eng) publications in journals included on List A with points awarded by the Ministry of Science and Higher Education and the IF value according to the Journal Citation Reports for the year of publication

Journal	Year of publication	Impact factor	Points awarded by Ministry of Science and Higher Education	Number of publications		Number of publications
				before doctorate	after doctorate	
Turk. J. Field Crops	2014 2015 2017	0.618 0.418 0.689	20 20 20**	0	3	3
Legume Res.	2014 2017	0.146 0.232	15 15**	0	2	2
Plant Soil Environ.	2017	1.421	25**	0	1	1
Przemysł Chemiczny	2018 2018	0.399* 0.399*	15** 15**	0	2	2
Total	-	4.32	145	0	8	8

* points awarded for 2017

** points awarded for 2016

Table 2. A list of dr inż. Agnieszka Faligowska's (PhD Eng) publications in reviewed journals included on List B with points awarded by the Ministry of Science and Higher Education for the year of publication (or the first year of awarding the points)

Journal	**Year of publication**	**Points**	**Number of publications**	**Number of publications**		**Total points**
				before doctorate	**after doctorate**	
Prog. Plant Protection/Post. Ochr. Roślin	2002	2	1	1	9	49
	2006	2	1			
	2007	2	1			
	2008	4	1			
	2010	6	1			
	2011	6	1			
	2012	5	2			
	2013	5	1			
	2015	12	1			
Zesz. Probl. Post. Nauk Rol.	2003	4	3	3	6	38
	2007	4	4			
	2009	4	1			
	2010	6	1			
Rocz. AR Poz. Rol.	2006	2	2	0	2	4
EJPAU	2008	4	1	0	1	4
Fragm. Agron.	2009	4	1	0	13	128
	2011	6	1			
	2014	5	2			
	2015	12	3			
	2016	12	2			
	2018	12*	4			
Nauka Przyr. Technol.	2012	5	3	0	6	39
	2014	6	1			
	2015	9	1			
	2016	9	1			
J. Res. Appl. Agric. Engng	2013	5	1	0	3	29
	2016	12	1			
	2017	12*	1			
Herba Pol.	2016	14	1	0	1	14
Pol. J. Agron.	2016	10	1	0	1	10
Plant Breeding and Seed Science	2016	11	1	0	1	11
Acta Agrobot.	2017	14*	1	0	1	14
Monograph published by Poznań University of Life Sciences	2018	20	1	0	1	20
Total	-	-	49	4	45	360

* points awarded for 2016

Table 3. A numerical summary of dr inż. Agnieszka Faligowska's (PhD Eng) scientific accomplishments

Specification		Number of publications		Total
		before doctorate	**before doctorate**	
Original creative works (list A)	Lead author	0	4	4
	Co-author	0	4	4
Original creative works (list B)	Individual	0	1	1
	Lead author	0	23	23
	Co-author	4	20	24
Monograph published by Poznań University of Life Sciences		0	1	1
Total		**4**	**53**	**57**
Total IF		0	4,32	4,32
Total number of points awarded by Ministry of Science and Higher Education		14	491	505
Popular science articles		3	33	36
Conference proceedings/abstracts		0	56	56
Participation in grants/research projects		1	2	3
Management of a commissioned research subject registered by Poznań University of Life Sciences		0	77	77

Signature...A. Faligowska