International Herbage Seed Group

Newsletter

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IHSG

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Editor's note: Editor's note: While those of you in the southern hemisphere are entering the harvest season, we are experiencing rather cold temperatures as we head full force into our winter months in North America. In this issue, we look at a new slug management position in Oregon and interesting updates related to herbage seed production in the emerging markets of Poland and Nepal. I encourage each of you to review the current information provided for the 9th IHSG International Conference in Pergamino, Argentina - October 30 to November 5, 2017. Please take note that these dates have been slightly adjusted from the last newsletter. It would be very beneficial if many of you IHSG members could help announce the conference information to colleagues in your respective regions. This is issue 55 of the newsletter. Details of the contact person in your area are listed on the back page of the newsletter and on the IHSG website. Please remember to send articles to either of the newsletter editors or to your area contact person to be included in future newsletters.

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Contents

Presidents Column

I have just returned from the Nepal village based seed production project; a project that is explained in detail in this Newsletter. Compared to a Danish/Oregon/New Zealand seed production farm the scale is very small; with areas described in square meters rather than acres or hectares. However when your historical seed source has no seed quality assessment, traceability or is of unknown genetic purity then starting small is essential.

I have enjoyed meeting a number of international herbage seed producing visitors recently; including from Australia (Tasmania, Victoria and New South Wales); Chile and Oregon. Explaining the how and why of our New Zealand seed producing system for ryegrass and being able to separate out the principles from practice to help understand what might or might not work in another environment is a great challenge. In particular understanding the impacts of temperature change especially a rapidly rising temperature in late spring/early summer may have on seed filling rates and seed weight.

The Oregon visitors included Nicole Anderson (our co-editor) with a group of younger-aged seed growers. Nicole has a plant growth regulator (PGR) x N rates trial in cocksfoot/orchard grass at Hyslop Farm, Oregon. Parallel trials have been started in New Zealand at Methven by Murray Kelly (PGG Wrightson Seeds) and near Ashburton by FAR (Foundation for Arable Research). The intention is for all the data to be combined into a publication. This is a very simple collaborative model were no money changing hands and is based on a willingness of all parties to purse a common objective. I hope similar types of projects can be developed by other IHSG members in different parts of the world.

“Arable Y’s” are a group in New Zealand of younger-aged persons (typically 25 to 35 years old) involved in the production of herbage seed and arable crops, either on farms or in supporting service industries. FAR initiated the group about four years ago. This age group don’t often attend field walks and training in part because they are afraid to ask questions when most of the group is older and more experienced. The ‘Arable Y’s’ meet monthly with a programme that is usually technical, but there is also a greater social element compared with typical training meetings. There is no age limit to who attends; and some meetings attract a wide age group. Another very successful FAR initiative is “Women in Arable”, a group that also meets monthly, bringing together women professionals in arable cropping, women farmers and farm wives who are either an active partner in the farm business or perhaps work off the farm but want to understand industry issues that the home farm is facing. Both these initiatives have been very successful and worthy of copying.

Finally our 2017 Pergamino, Argentina Conference at the end of October will be a great time for sharing research outcomes. Calls for abstracts will be in February, so start thinking about what data and research stories that you want to share. Keep an eye on the IHSG website and conference updates and new information is posted.

Phil Rolston, IHSG President, New Zealand

9th International Herbage Seed Conference

Pergamino, Buenos Aires, Argentina. 30-October- 5 November 2017

***Please Note: Conference Dates Have Changed**

The International Herbage Seed Group (IHSG) aims to encourage cooperation between workers actively engaged in herbage seed production research all around the world. Created in 1978, it continues to gather researchers and producers in the field of herbage seed in periodical international meetings. Previous conferences have been held in Europe (Denmark, Germany, Italy and Norway), USA (Oregon and Texas) and Australia. In an attempt to bring participants from different parts of the world closer, conferences have been moved to developing countries, first in China (2015) and next to Argentina, pursuing also in bridging the gap between temperate and tropical seed research.

The 9th IHSG Conference will meet in Pergamino, Argentina from 30 October to 5 November, 2017 at the UNNOBA main campus. **International delegates will meet in Buenos Aires on Sunday 29th** at a hotel near the airport and bus to Pergamino (2 ½ hrs) with stops to view local seed/crop farms on the 30th. **The formal conference will be 31 October – 2 November followed by post-conference tours starting Friday 3 November** to show Argentina´s herbage seed production to international researchers and workers involved in seed topics.

IHSG conferences aim to create a collaborative space to gather agronomists, researchers, seed producers and seed companies, it will include both papers and poster discussion and visits to seed production fields, processing companies and research centers in the area.

Abstracts for the following areas of research are welcome for submission (closing date for abstracts is 15 March 2017):

1- Genetics and physiology for understanding seed yield potential
2- Breeding for seed yield in herbage/turf species
3- Agronomic management to achieve high seed yields
4- Plant protection: weeds, pest and diseases
5- Seed production in developing countries: issues and models for production
6- Seed quality impacts from the field
7- Seed technologies to enhance seed performance
8- Extension, tech transfer and training, the next generation of seed researchers and seed agronomists.

Abstracts can be up to 300 words (not exceeding 1 A4 page) in Times Roman 12 point font; with title, authors and a summary of results.

The call for abstracts and other related information can be reached at IHSG´s webpage at www.ihsg.org or at IHSG2017@gmail.com

We look forward to seeing you in Pergamino in 2017!

Oregon's new slug nemesis!

Rory Mc Donnell

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Rory Mc Donnell was recently hired by Oregon State University to help embattled growers control slug pests in their crops particularly grass seed. Rory is, a native of Ireland, has a BSc and PhD in Environmental Science from the National University of Ireland, in Galway. For the past 10 years his research has focused primarily on the ecology and management of pest slugs and snails throughout Europe and the US, but he has also worked on the conservation and population dynamics of the protected Irish Spotted Slug (*Geomalacus maculasus*), a species that is only found in Western Ireland, Northern Spain and Northern Portugal. He has published 50 peer-reviewed papers, accrued over $2 million dollars in research funding as a PI or as a member of consortia, and presented his research at conferences throughout the world.

Photo Copyright: Rory Mc Donnell

His slug management research program at OSU will encompass a number of areas including biological control. Two years ago Rory and some colleagues discovered three nematode species in California that kill pest slugs. One of these, *Phasmarhabditis hermaphrodita* (Figure 1) was a particularly important find because it is currently being used in Europe as a commercially available biological control agent (Nemaslug®) to successfully manage slug pests in a wide range of crops. Nemaslug® is not currently available in the US but the discovery of *P. hermaphrodita* here by Rory and his colleagues will likely open the door for its introduction to the US market in the future. In Europe this nematode is a lethal parasite of a wide range of pest

slugs and is particularly virulent against the gray field slug, *Deroceras reticulatum* (Figure 2), the primary gastropod pest in Oregon grass seed crops. Rory has initiated surveys in Oregon with the hope of also finding the nematode there. Along with searching for these microscopic worms he is also screening a number of insects within the families Sciomyzidae, Phoridae and Carabidae as potential biological control agents of Oregon's pest slugs.

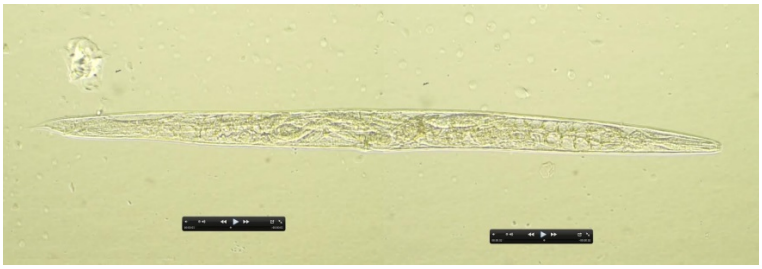

Photo Copyright: Irma Tandingan De Ley

Figure 1. *Phasmarhabditis hermaphrodita*.

Photo Copyright: Rory Mc Donnell

Figure 2. *Deroceras reticulatum*.

In addition to the use of natural enemies, he is also interested in the use of plant extracts as novel biorational molluscicides. His previous research has demonstrated that certain essential oils at low concentration are lethal to the eggs and juveniles of the European brown garden snail, *Helix aspersa*, but do not appear to be phytotoxic. He will build on this research in Oregon and test the potential for using a wide range of plants extracts against *D. reticulatum* and other pest slugs. By combining such biorational molluscicides with novel attractants, which he is developing with colleagues in California, Florida and Hawaii, in an attract and kill strategy, it should be possible to use targeted applications of these extracts and hence reduce the overall cost of such an approach.

Lastly, Rory is also interested in the nutritional ecology of slugs and snails and over the coming years will investigate the potential for using trap plants as novel tools for minimizing slug damage in crops. The theory behind such an approach is that slugs like most animals have a preference for certain plants and if these are present along with the crop, the slugs will likely feed on the trap plants as opposed to the cash crop.

Since many of the pest species in Oregon are also the same pests of grass seed in other parts of the world, many of the tactics Rory is developing could easily be transferred across borders and he is very keen to collaborate with researchers in other parts of the world. He can be contacted at rory.mcdonnell@oregonstate.edu or at +1-541-737-6146. For additional information on his program see http://cropandsoil.oregonstate.edu/content/rory-mcdonnell

Status of seed production of grasses and legumes in Poland

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Introduction

Grasses dominate forage seed production in Poland. In the past, 30-40 years ago, Poland was the leading country in the production of grasses grown for seeds in Europe. The area of seed fields reached about 70,000 ha (Martyniak 2009). Since 1990, after political and economic transformation, the overall area of seed grass production declined. According to data of the Main Inspectorate of Plant Health and Seed Inspection (MIPHSI 2016) the lowest area of certified seed grass plantations was recorded in 2002 (6,564 ha). After Poland's accession to the European Union in 2004 the area of certified seed grass fields (Figure 1) ranged between 10,367 ha (2005) and 16,508 ha (2016). Since 2012, the acreage of plantations is increasing by ca. 1,000 ha per year. Concerning the grass seed production area, Poland is the third main producer of grass seeds in Europe after Denmark and Germany for the last two years.

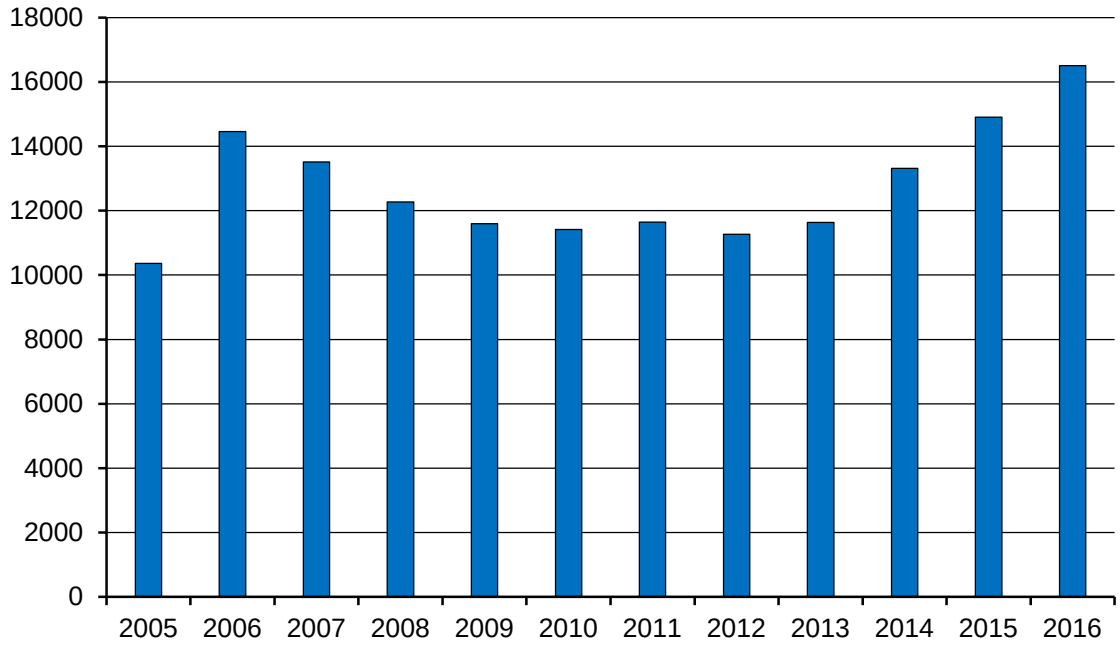

Figure 1. Area of certified seed grass plantations in the years 2005-2016 in Poland (ha)

Status of species in forage seed production

Ryegrass species are the most important grasses in seed production in Poland (Figure 2). With the dominant role of the perennial ryegrass (41.5% in 2016) all ryegrass species represented of ca. 75% of total certified seed area. Among fescue species the most important in 2016 was red fescue (11.9%), followed by meadow fescue (3.2%). The share of timothy in the structure of grass species growing for seeds was 4.5%. Other remaining grass species, like festulolium, fine

leaved sheep's fescue, hard fescue, sheep's fescue, cocksfoot, red top, smooth-stalked meadow grass were mostly cultivated on smaller fields and in total didn't exceed 6% of total certified seed area. Seed crops grown in Poland in many areas, but stronger in seed production are Central and North Poland in comparison to other regions.

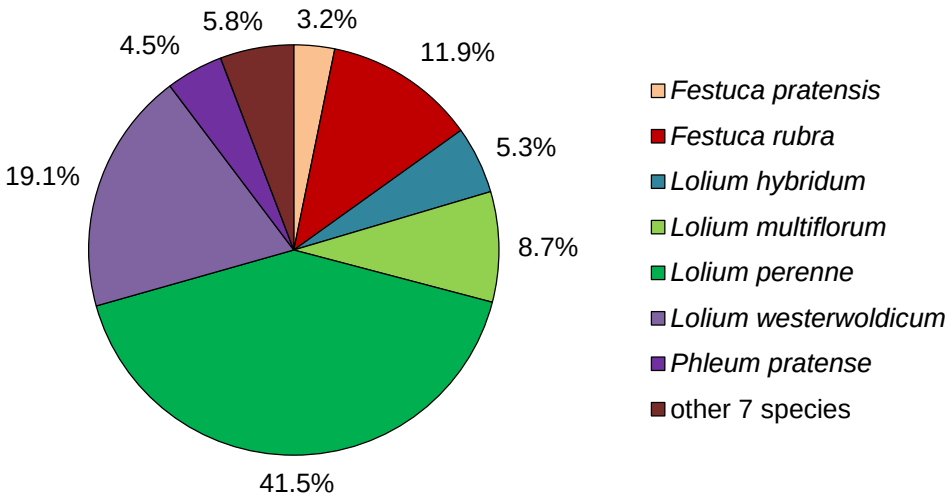

Figure 2. Structure of seed grass production in 2016 in Poland (% of total certified area)

Since 2012, the area of perennial ryegrass seed production continues to grow. From 2012-2016 the certified area of this species has increased by 55.5% (Figure 3). The surface of red fescue grown for seeds ranged from 1,417 ha in 2014 to 1,964 ha in 2016. The certified area of seed fields of Italian ryegrass exceeded the level of 2,000 ha in 2013-2015 and dropped to 1,434 ha in 2016. In contrary, the area of westerwolds ryegrass in 2016 raised considerably up to 3,155 ha.

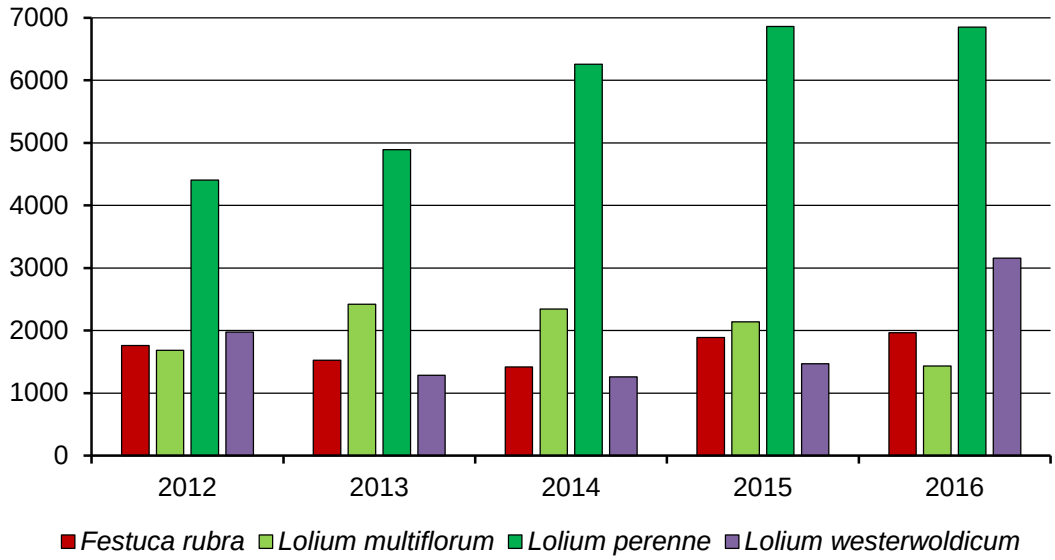

Figure 3. Area of certified plantations of most important grass species in the years 2012-2016 in Poland (ha)

The same trend was observed in the last five years in the case of certified area of small-seeded legumes (Figure 4). In 2012, the total area of this group of legumes grown for seeds reached the level of 1,000 ha. Over the next four years the area was increasing steadily to achieve 3,814 ha in 2016. More than 95% of total certified surface of small-seeded legumes belongs to red clover. This species is most important legume in seed production in Poland. The particular region of red clover seed crops cultivation in South-Eastern Poland in regarding to site conditions, pollinators occurrence and traditions of seed growers. The effect of increasing area of legume seed production in the period 2012-2016 was directly determined by increasing seed production of red clover. The remaining small-seeded legumes growing for seeds in the last years in Poland are white clover, sand lucerne (*Medicago x varia*), sainfoin and others. The total area of seed fields of listed above legume species in Poland reached max. 50 ha each in the last years. In 2016, the new interesting phenomenon in small-seeded legumes production is the emergence of lucerne (*Medicago sativa*) cultivation. With an area of ca. 100 ha, Polish growers have started to reproduce two cultivars ('Frigos' and 'Ulstar') under local conditions. Until now Poland imported all the lucerne seeds needed for forage production from abroad.

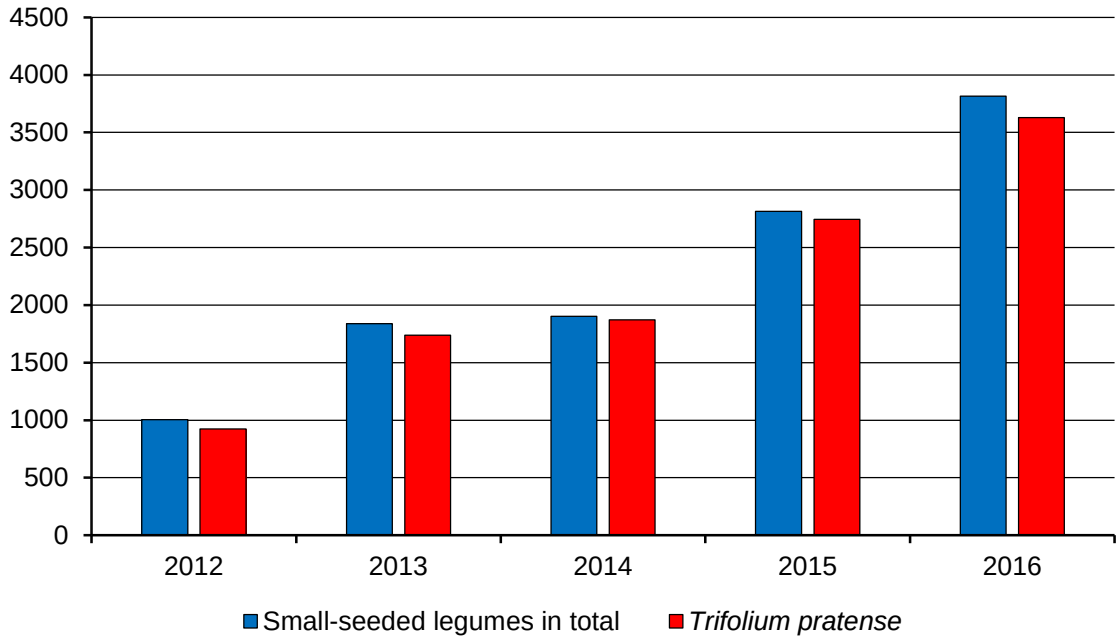

Figure 4. Area of certified legume plantations in the years 2012-2016 in Poland (ha)

Importance of cultivars in reproduction

Seeds production is directly linked with cultivars. Profitability of seed grass production is strongly affected by cultivar factors as capability to produce generative shoots, inflorescence structure, the course of maturation process and seed shedding (Goliński 1996, Goliński et al. 2005). Grass and legume cultivars are characterized by high specificity of seed yield. A high seed-yielding cultivar makes their cultivation more cost-effective and profitable for farmers (Goliński 1997). According to data of MIPHSI (2016) in Poland 150 grass and 28 legumes cultivars were reproduced (Table 1). The highest numbers of cultivars occurred in species with the highest share in total area of seed production, dominated in grasses by perennial ryegrass – 42 and in small-seeded legumes by red clover – 19. Additionally, in Table 1 the number of cultivars registered in 2016 on Polish National List of Agricultural Plant Varieties (RCCT 2016)

are presented. Generally, the number of reproduced cultivars within given species is lower than registered on the national list. However, in the case of westerwolds and Italian ryegrass as well as red clover the number of propagated cultivars was higher than registered on the list. It means that in Poland the seed companies sign contracts with seed growers for the reproduction not only of domestic but also foreign cultivars registered in EU's common catalogue. This is a new consideration indicating the interest of seed industry in developing of seed market in Poland in regard to valuable site properties and economic conditions of forage seed production.

Table 1. The number of reproduced cultivars of grass and small-seeded legumes in comparison to registered on the Polish National List in Poland in 2016

Species	Reproduced	Registered
Grasses		
Lolium perenne – perennial ryegrass	42	75
Lolium westerwoldicum – westerwolds ryegrass	16	6
Lolium multiflorum – Italian ryegrass	16	13
Lolium hybridum – hybrid ryegrass	6	6
Festuca arundinacea – tall fescue	7	11
Festuca pratensis – meadow fescue	10	16
Festuca rubra – red fescue	21	37
Dactylis glomerata – cocksfoot	7	12
Phleum pratense – timothy	10	15
Poa pratensis – smooth-stalked meadow grass	9	23
other grass species	6	13
Small-seeded legumes		
Trifolium pratense – red clover	19	11
Trifolium repens – white clover	2	7
Medicago sativa – lucerne	2	18
Medicago x varia – sand lucerne	2	2
other small-seeded legume species	3	5

From among 150 grass and 28 legumes cultivars used for seed production some are crucial in the forage seed production in Poland. In Table 2 the most important grass and small-seeded legumes cultivars in 2016 with certified area above 500 ha are presented. All cultivars are from domestic origin and were registered on Polish national list apart of 'Suez' of red clover. The lead cultivar is 'Bokser' of perennial ryegrass with surface area of 2,930 ha. Other grass cultivars belong to ryegrass species and to red fescue – 'Adio'. In legume seed production dominating cultivars belong to red clover. Some of those cultivars are very old, like 'Turtetra' – present for 40 years on the seed market. Also 'Naki', 'Adio', 'Dajana' and 'Suez' are characterized by long life on the registration list and still high interest on the seed market.

Majority of the grass and legume seed fields are established on private farms. The field size of the most popular cultivars grown for seeds do not exceed 10 ha. The exceptions are 'Nadzieja' cv. of hybrid ryegrass and 'Suez' cv. of red clover, which average area of fields amounted to ca. 49 ha and ca. 42 ha, respectively. This means that the reproduction of this cultivars occurred in large size farms specialised in seed production.

Table 2. Seed production of most important grass and small-seeded legumes cultivars in Poland in 2016

Cultivar	Species	Registered in national list since (year)	Certified area (ha)	No. of plantations	Average area of seed plantation (ha)
Grasses					
Bokser	*Lolium perenne*	2005	2930	336	8.72
Mowestra	*Lolium westerwoldicum*	2013	1817	395	4.60
Naki	*Lolium perenne*	1981	1122	123	9.12
Turtetra	*Lolium multiflorum*	1975	1010	347	2.91
Adio	*Festuca rubra*	1997	650	265	2.45
Nadzieja	*Lolium hybridum*	2006	585	12	48.75
Kajana	*Lolium westerwoldicum*	2013	545	92	5.92
Legumes					
Rozeta	*Trifolium pratense*	2000	962	275	3.50
Dajana	*Trifolium pratense*	1994	709	237	3.00
Suez	*Trifolium pratense*	1994*	544	13	41.85

* registered in national list of Czech Republic

Results of field inspection

One of the most important aspects of the forage seed production are results of the field inspection of grass and legume plantations. According to data of MIPHSI (2016) in Table 3 the percentage of disqualificated area of seed plantations of grass and small-seeded legumes in Poland in last three years are presented. The disqualification rates differ between species and over the years. The average percentage of disqualificated area of seed plantations of grass and small-seeded legumes in multiyear perspective (not only presented in the Table 3) was ranging from 4.0% to 6.0%. In 2016 an unusual situation occurred. The disqualification rate reached the level of 12.5% for grasses and 11.8% for legumes. This is the consequence of disqualification during field inspections of many plantations of ryegrass and red clover, species with the highest share in total seed production. An explanation of this phenomenon, apart from undesirable weather conditions occurring in different part of Poland, could be an introduction to the market of unexperienced or new farmers in the seed cultivation of many grass and legume cultivars. Because their poor knowledge and lack of experience, a lot of plantations do not receive positive evaluation during field inspections. It may also indicate that some grass species and red clover growing for seeds are profitable option for farmers looking for the best utilisation of land resources.

Table 3. Percentage of grass and small-seeded legumes seed fields disqualified in Poland in 2014-2016 (%) at field inspection

Species	Percentage (%) of disqualified area		
	2014	2015	2016
Grasses			
Dactylis glomerata	17.5	4.0	14.8
Festuca arundinacea	9.5	0.6	12.6
Festuca pratensis	24.0	16.8	16.3
Festuca rubra	4.9	7.5	6.8
Lolium hybridum	4.5	7.8	26.1
Lolium multiflorum	1.6	2.9	20.4
Lolium perenne	3.5	5.9	14.8
Lolium westerwoldicum	0.3	2.1	2.5
Phleum pratense	7.0	18.2	6.2
Average total grass species	4.0	6.2	12.5
Legumes			
Medicago sativa	0.0	0.0	1.4
Medicago varia	53.5	0.0	9.1
Trifolium pratense	6.0	5.3	12.0
Trifolium repens	70.0	13.0	7.6
Average total legume species	6.7	5.3	11.8

Final remarks

The future of Polish herbage seed production is promising. In the last 3-4 years, the area of certified seed grass and legume crops has steadily increased. The main species are perennial ryegrass and red clover. Polish bred cultivars dominate domestic forage seed production. In 2016 the disqualification rate was considerably higher (ca. 12%) compared to previous years, which may be a result of new unexperienced seed growers entering the market to pursue grass and legume seed production as an economically viable option of agriculture activity.

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Developing Sustainable Animal Fodder and Seed Production Systems in several districts of Nepal

Keith Armstrong, John Hampton, Dinesh Pariyar, Kishor Shrestha, Sunita Sanjyal, Phil Rolston and John Stevens[1]

[1]See end of article for author information.

Background

Fodder is most scarce across Nepal in winter and early spring, resulting in poor animal productivity, a significant contributing factor to rural poverty. To secure feed for their animals, farmers traditionally gathered low quality dry fodders during winter (the dry season) and scarce fresh natural grasses in summer (the wet season).

The mostly low quality fodder was collected from common lands and forests, (which have come under increasing pressure through population growth), and supplemented with crop stubble (dry straw from wheat and rice crops), and expensive fortified meals. This included feeding scarce food grain to draft animals in spring to enable land cultivation.

Animal health, fertility and production remained low, and human labour inputs remained high. Research by the Nepal Agriculture Research Council (NARC) and the Department of Livestock Services (DLS) highlighted the link between fodder scarcity and rural poverty. Lifestyles for farmers, especially women who did most of the animal husbandry work, and their families, were unlikely to improve until fodder and seed scarcity issues were addressed, and workloads reduced.

Participatory Developments Activity undertaken and completed

With support from FAO (2003–2005) and New Zealand (from 2008), together with NARC and DLS, a series of participatory extension projects were developed to build technical capacity and familiarisation with fodder technology packages for high quality on-farm winter and summer fodder crop production. Intensive training and mentoring was provided to six clusters of farmers (50 farmers per cluster, mostly women) in six district across Nepal, three each in the lowland and mid hills respectively.

The project extension package was specifically developed and implemented to:

- Rapidly improve the sustainable quantity and quality of winter (oats, annual clovers, annual ryegrass) and summer (teosinte, sorghum) on-farm farm fodder production
- Improve milk production, animal health and animal fertility
- Lower milk production costs, by reducing reliance on the high-cost feeds required to supplement low quality fodders gathered largely from common land and forest sources
- Lower labour inputs, particularly for women householders who did most of the animal husbandry work, by encouraging farmers to change from fodder gathering to becoming skilled on-farm producers of high quality fodder crops.
- Liaison with and training provided to milk collectors and processors to prepare for an expansion of milk volume

- Provide on-farm demonstrations, intensive training and mentoring to clusters of farmers to promote replication of the fodder technologies to neighbors and surrounding communities.

Economic and social impacts

The successful adoption of the new on-farm fodder production technologies improved the quality and quantity of animal fodder fed to their livestock and substantially increased per animal milk productivity. It reduced animal production (milk) costs. It improved animal fertility, animal health, and productivity for all animals.

It reduced daily animal husbandry workloads, for women especially, by 50%. It encouraged diversification of effort into other income-generating activities, substantially improving household incomes by an average of 400%. It led to improved family diets and health, greater socialization and gender equality within families and communities, and better access to resources for their children's education, thus contributing to improved lifestyles.

There was a rapid uptake of the fodder technologies by neighboring farmers totaling many thousands of rural householders in and around where the project activities took place.

But the demand for on-farm fodder also created additional demands on the fodder seed supply chain. There was a strong need to resolve the ongoing fodder seed quality, volume, and timeliness of supply issues, along with the lack of fit-for-purpose varieties, especially for cool season crops.

Improving the quality and volume of fodder seeds is the current challenge

Improving the seed supply chain is the next significant activity in this series of development activities. 'Cool Season Crop Improvement Programme for Nepal' is a project underway to improve the sustainable supply of cool season fodder seeds while continuing to improve farmers fodder crop production skills.

The project, which is jointly funded by the New Zealand Ministry of Foreign Affairs and Trade, NARC, and DLS, involves the Seed Research Centre, Lincoln University, New Zealand as the international consultants supporting NARC and DLS. Last year the Nepal team visited the seeds project developed in Thailand by Dr. Michael Hare and colleagues at Ubon Ratchathani to understand the issues of establishing a village based seed production project.

The project's capacity building activities include (i) on-farm training and demonstration to improve soil cultivation and seeding techniques to make more efficient use of seed, water, fertilizer, and compost, and to improve on-farm post-harvest seed processing and seed storage systems, (ii) synchronizing NARC and DLS seed research farms and small farmers' seed production activities to accelerate the supply of genetically pure seeds, (iii) increase and decentralize the production of foundation fodder seed, (iv) encourage greater use of seed certification, and (v) implement a seed quality assurance system to ensure a better functioning seed chain with greater capacity to supply higher volumes of quality fodder seed in the market.

Conclusion

In 2015 a further substantial increase in fodder crop yields was achieved by participating farmers in all districts, along with a 32% additional increase in per animal milk yield. Achieving the required improvements in the genetic quality and timely supply of traded fodder seeds is expected to take a little longer to achieve. The current project will continue until 2019. Our goal is for the current project activities to directly benefit 5500 households by 2018, indirectly benefit 20,000 households by 2020, and 200,000 households by 2025, including providing an operational model for wider application as part of the exit strategy.

Cool Season Crop Improvement Programme for Nepal is led by Professor John Hampton, Director of the Lincoln Univ. Seed Research Centre (john.hampton@lincoln.ac.nz) with assistance from:

(i) Keith Armstrong, Director, Global Oats Ltd, NZ (keith@globaloats.co.nz);
(ii) Professor Phil Rolston, Deputy Director of the Seed Research Centre (phil.rolston@agresearch.co.nz); and
(iii) Dr John Stevens, Director, Flexiseeder Ltd, NZ (stevensj@flexiseeder.com).

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The poverty trap: long hours each day spent collecting mostly low quality feed some distance from home. This series of projects sought to change this practice and has done so successfully. In Nepal animals and crops are inextricably linked. Encouraging farmers to produce all season high quality fodder close to home released their economic and social entrepreneurial skills, dramatically improving their economic security and lifestyles.

On-farm fodder production, rather than continuing as fodder gatherers, reduced farmers' daily workloads by more than 50%, making their farming lives, especially for women and their children, more enjoyable. The improvement in animal (milk) production along with released time and capacity to commit to other enterprises contributed to an average increase of 400% in household incomes.

Improving animal nutrition for existing livestock and reducing farmers' workloads is the key toward alleviating rural poverty. A feed deficit of 36% + means few animals reach their full productive potential.

Community field visits: Farmers inspecting their winter oat forage crops with members of the project team. These 'crop walks' and discussions around managing all-season fodder crops were unique and highly valued learning experiences for farmers and the project team members.

Community based testing and evaluating new fodder cultivars.

Reducing hand labour inputs: Improving fodder crop management systems and labour efficiency through the development and/or adoption of low cost technologies by improving and mechanizing post-harvest seed processing systems to replace hand winnowing.

Reducing hand labour inputs: by improving soil cultivation systems especially for terraced fields, using light mechanized systems.

Reducing hand labour inputs: by improving seed sowing including through mechanising and redesigning seed sowing equipment to improve

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