International Herbage Seed Group

Newsletter

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IHSG

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Editor's note: While those of you in the southern hemisphere are headed towards harvest, we are experiencing rather cold temperatures as we head full force into our winter months in Oregon. The recent crop year was warmer and dryer than average which resulted in lower yields and a tough planting season. But, we have now received quite a bit of rain and are all hopeful that we are turning the corner and headed into a productive year for our herbage seed species. In this issue, we focus on several very interesting research updates and also reports from workshops related to herbage seed production in both the southern and northern hemispheres. I encourage you all to review the information provided from our colleagues in Argentina who are making plans for the 9th IHSG International Conference in Pergamino, Argentina in October of 2017. This is issue 53 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.

Contents

Presidents Column

I write this column for the 53rd Newsletter from Kathmandu, Nepal where John Hampton and I will be running a train-the-trainers course in seed production for a village based seed production programme being developed by the Nepal Agriculture Research Council and Lincoln Universities Seed Research Centre and funded by the New Zealand Aid Programme.

John Hampton and I were keynote speakers at the 23rd International Grasslands Congress (IGC) in New Dehli during late November. We have few members in India, but they have a large number of researchers doing seed production research, especially on forage crops and native grasses. I have taken to asking seed researchers I meet if they know about IHSG, because I continue to meet people who are involved in seed research that do not know about us. The IGC incoming President, Ray Smith of University of Kentucky is happy to provide a link on their website to IHSG. If members see opportunities to promote the IHSG, especially to seed researchers who are members please encourage them to visit our website and to join.

In October I gave a keynote address on "seed quality and yield" at the 5th International Forage Breeding Symposium in Buenos Aires. There I met a number of South American researchers who have an interest in seed production, or were breeders looking at seed issues, such as Andrea Tomas and her work on seed shattering in *Panicum*.

Two seed slogans worth using when you think of presentations to funders; "*seeds are the delivery vehicle for new plant genetics*" and "*food security is based on seed security*". I am surprised that many research policy people are pushing the genomic tools approach without thinking about how new traits will be incorporated into cultivars or how seed will be produced. It is with a sorry heart for me that in our own research organization our co-newsletter editor Jason Trethewey has been told there is no room for his seed research skills. I wish him all the best as he starts the hunt for new employment.

Plans for the nest IHSG Conference in Pergamino, Argentina in October 2017 are progressing well (see this Newsletter for details) and watch our website for more information. We will be calling for papers in October 2016. Best wished for the New Year, Christmas and those in the southern hemisphere a good harvest.

Phil Rolston, President IHSG

International Herbage Seed Conference

23-26 October, 2017
Pergamino, Buenos Aires, ARGENTINA

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), New Zealand, 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, with an attempt to bridge the gap between temperate and tropical seed research.

The 9th IHSG Conference will meet in Pergamino, Argentina from October 23 to 26, 2017 at the UNNOBA main campus. With the ambition 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. After the conference, a tour will be offered to show Argentina´s herbage seed production to international researchers and workers involved in seed topics.

Abstracts for the following areas of research are welcome for submission:

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.**

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

Fall Applications of Herbicides on Creeping Red Fescue Seed Fields for Control of Group 2 Resistant Narrow-leaved hawk's-beard

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2 Agriculture and Agri-Food Canada, Beaverlodge Research Farm, AB
3. Peace Region Forage Seed Association, Dawson Creek, BC

Introduction

Growers in the Peace River Region of Canada have reported increasing presence of narrow-leaved hawk's-beard (*Crepis tectorum)* in creeping red fescue seed fields (Figure 1). Narrow-leaved hawk's-beard is not a new weed to the Peace Region and grass seed growers are very familiar with it. Narrow-leaved hawk's-beard can grow as an annual or winter-annual. Seedlings that emerge prior to mid-July grow as summer annuals while those that germinate after mid-July behave as winter annuals. Winter annual plants are difficult to control with spring applications of herbicides on creeping red fescue seed fields since herbicides are applied the last two weeks of May. At this time narrow-leaved hawk's-beard plants have large rosettes, are beginning to bolt and are very difficult to control with most herbicides. Previous studies have shown fall herbicide applications provide much better and more consistent control over spring applications. Trials were conducted over a three year period to evaluate the control of narrow-leaved hawk's-beard with fall applied herbicides in creeping red fescue seed fields. Results from the trials proved very interesting.

Figure1. Narrow-leaved hawk's-beard in creeping red fescue seed field.

Methods

Three trials were conducted from 2011 to 2013 on creeping red fescue seed fields in the Beaverlodge, AB and Hythe, AB area. The sites were Beaverlodge-2010/11, Hythe 2011/12 and Hythe 2012/13. All sites had uniform populations of narrow-leaved hawk's-beard plants which were in the seedling to rosette stage at time of herbicide application. Experimental design for each study was a randomized complete block design with four replications and plots were 2m x 10m in size. Herbicides were applied with a hand held plot sprayer, calibrated to deliver 100 l/ha of water at 270 kPa. Nine herbicide treatments (Table 1) were applied on September 23/2010 (Beaverlodge), September 28/2011 (Hythe) and September 20/2012 (Hythe). Visual weed control ratings (percent control) were conducted the following spring.

Table 1. Canadian trade names, active ingredients, and rates of herbicide treatments applied in the fall on creeping red fescue seed to control narrow-leaved hawk's-beard.

Canadian Trade Name	**Active Ingredient**	**A.I. Rate Kg/ha**
Ally	metsulfuron methyl Agral 90	0.0045 0.2% v/v
Spectrum	florasulam clopyralid MCPA ester	0.005 0.075 0.560
Prestige	fluroxypyr clopyralid MCPA ester	0.144 0.100 0.560
Express	tribenuron-methyl Agral 90	0.0075 0.2% v/v
Frontline 2,4-D	florasulam 2,4-D ester	0.005 0.560
2,4-D ester	2,4-D ester	0.560
Express+2,4-D	tribenuron-methyl 2,4-D ester Agral 90	0.0075 0.408 0.2% v/v
Frontline XL	florasulam MCPA ester	0.005 0.420
Curtail M	clopyralid MCPA ester	0.100 0.560

Results

Percent visual control ratings conducted on narrow-leaved hawk's –beard plants the spring following fall herbicide applications proved to be very interesting at all three sites, in all three years. Fall applications of Prestige, Curtail M, Frontline 2,4-D and 2,4-D ester alone provided excellent control of narrow-leaved hawk's-beard in all three years (Table 2). Spectrum and Frontline XL provided satisfactory control. Ally and Express applied alone did not provide any control of narrow-leaved hawk's-beard (Figure 2). Previous studies had shown fall applied Ally to be very effective at controlling narrow-leaved hawk's-beard.

Table 2. Visual percent control ratings of narrow-leaved hawk's-beard the year following FALL applied herbicides on creeping red fescue seed stands.

Treatment	Beaverlodge 2010/11 June 22/2011	Hythe 2011/12 July 20/2012	Hythe 2012/13 July 20/2012	Average of All 3 Years
Check	0	0	0	0
Ally	0	0	0	0
Spectrum	100	84	97	94
Prestige	100	90	100	97
Express	0	0	0	0
Frontline 2,4-D	100	88	99	96
2,4-D ester	100	96	99	98
Express+2,4-D	100	76	88	88
Frontline XL	100	81	75	85
Curtail M	100	95	100	98

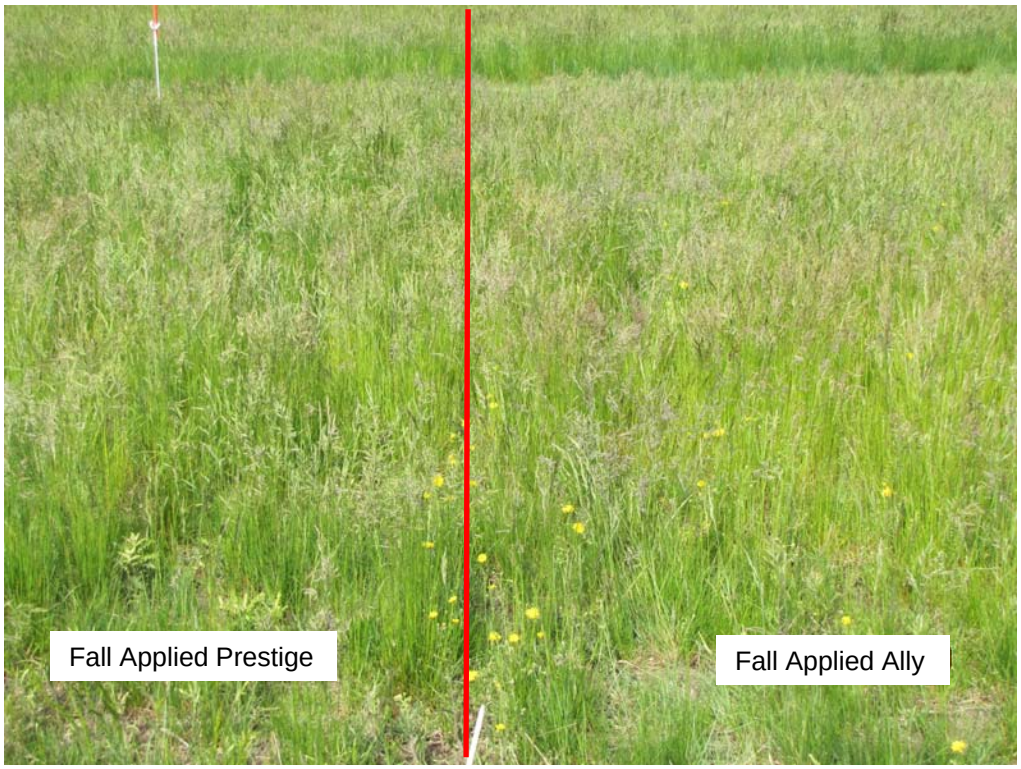

Figure 2. Effects of fall applied Prestige and Ally on narrow-leaved hawk's beard control, Beaverlodge, 2011.

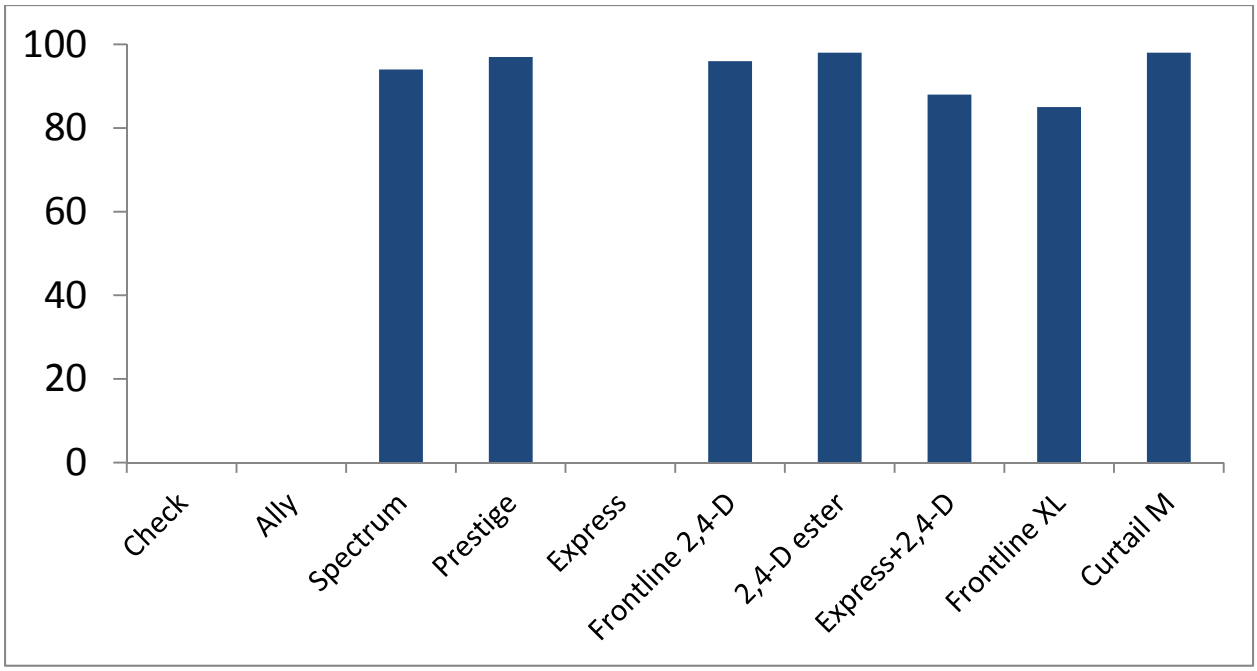

Figure 3. Visual % control of narrow-leaved hawk's-beard (group 2 resistant plants) following the application of fall applied herbicides in creeping red fescue seed fields (Average of 3 trials).

Conclusions

Results from this three year study showed fall applications of Curtail M, Pestige, Frontline 2,4-D and 2,4-D ester effectively controlled narrow-leaved hawk's-beard plants. The study also identified the presence of narrow-leaved hawk's-beard populations resistant to Group 2 herbicides such as Ally, Express and Refine SG. Group 2 herbicides are used on seedling and established creeping red fescue seed fields throughout the Peace River Region. Growers must be aware of this issue and should rotate among different herbicide groups to prevent the appearance of additional herbicide resistant weeds.

Acknowledgements:

- Cooperation of seed growers in the Beaverlodge and Hythe area.
- Technical assistance of Pat Gansevles, AAFC. Association and Agri-Innovation Program/Agriculture and Agri-Food Canada
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Kentucky Bluegrass Seed Production in Oregon

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Oregon is recognized as one of the world's major production areas of cool-season forage and turf grass seed. Collectively, Oregon's Willamette Valley produces almost two-thirds of the total production of cool-season grasses in the United States and the area is often referred to as the "grass seed capital of the world". Interestingly, Oregon ranks 3rd in the U.S. for Kentucky bluegrass seed production and, since the early 1990s, all commercial acreage has been grown east of the Cascade Mountains. In 2014, the farm-gate value of Oregon-grown Kentucky bluegrass seed was approx. $23.5 million USD in which 8.2 million kg were produced on 5,343 ha. Kentucky bluegrass seed is primarily used as a turf grass in the temperate climate areas of the U.S. and around the globe.

Kentucky bluegrass (*Poa pratensis* L.) seed is primarily produced in 3 diverse areas of Oregon including: the Grande Ronde Valley near La Grande in northeastern Oregon (GRV); the Madras and Culver areas in central Oregon (CO); and the Lower Umatilla Basin near Hermiston in the southern portion of the Columbia Basin(LUB). The GRV and CO areas accounted for 84% of harvested acres in 2014. Environmental characteristics and production practices vary across these irrigated cropping systems.

Grande Ronde Valley - northeastern Oregon: The valley is located in northern range of the Blue Mountains and lies at 800 to 975 m above sea level. Evapotranspiration rates range from 35 – 46 m/growing season. Soil textures range from sandy loam to silt loam soils with 2 – 4% soil organic matter. Irrigation water sources include shallow/deep wells and surface water (Grande Ronde River, Catherine Creek) generated by spring snowmelt from the nearby mountains. Typical crop rotations include Kentucky bluegrass or fine fescue (4-6 years), winter wheat (1-3 years), followed by peppermint (5-8 years). Other annual rotational crops in this system may include sugar beets, certified seed potatoes, canola/sunflower seed crops, spring grains, legume seed (alfalfa, red clover), and, recently, field corn and soybean (limited acreage).

Madras and Culver areas - Central Oregon: Soil textures range from loam to sandy loam soils with soil organic matter levels <2%. The production area lies at 550 to 850 m above sea level with evapotranspiration ranging from 35-48 cm/growing season. Typical rotations include Kentucky bluegrass (4 years), small grains, peppermint, alfalfa, sugar beet seed, and vegetable seed (e.g. carrot, radish, garlic).

Lower Umatilla Basin - southern portion of the Columbia Basin: Soil textures range from sand to loamy sand with 0.5 – 2% soil organic matter. The LUB lies at 60 to 450 m above sea level and has the highest evapotranspiration rates of the 3 production areas ranging from 46-64 cm/growing season. Kentucky bluegrass is often grown in the LUB as an annual crop in rotation with many other crops such as wheat, field corn (seed & grain), potatoes, onions, and other vegetable crops.

New stands of KBG are typically planted in late summer in CO and the LUB and spring in the GRV. Regardless of planting date, it takes a full year of establishment before the new stands produce a seed

crop with exception for early plantings in the LUB. Seed harvest begins with swathing when the panicles reach 18-20% moisture then combine harvesting the seed after 5-10 days drying time. Clean seed yield typically ranges from 900 to 1,800 kg/ha with the highest yield potential peaking in the 2nd and 3rd seed harvest year. KBG straw residue is prized as a livestock feed material so the straw is typically baled and removed immediately after seed harvest to ready the field for further post-harvest residue management techniques if needed. After baling, most fields are propane-flame burned to remove any remaining residue left after baling, further reduce stubble height, recycle nutrients and sanitize the field.

Historically, the standard post-harvest residue management technique was to open burn fields with full straw loads (0.8 to 1.6 metric tons/ha). Prior research conducted by OSU in all major grass seed species and production regions of Oregon has shown that alternative residue management strategies can maintain seed yield and quality in the absence of open field burning when straw removal is thorough and stubble height is reduced (Chastain et al. 1997). Since the late 90s, growers in the GRV have voluntarily reduced reliance upon open field burning by adopting the bale + propane flame strategy on the majority of Kentucky bluegrass acres harvested annually but at a higher cost of production and receiving little economic return from straw bales.

Extension and Research Activities:

Although differences exist for environmental conditions, production practices and crop development and pest management challenges are similar across the production areas including fungal disease (ergot), insects (billbug spp.) and winter annual grass weeds (downy brome). To address such challenges, a team of OSU and USDA-ARS research and Extension faculty have been working together to develop IPM tools, develop/disseminate new scientific knowledge and facilitate implementation of new and effective management practices within the industry.

Ergot (*Claviceps purpurea*) is a very important fungal disease in Kentucky bluegrass and has been a research priority over the last 4 years due to the potential of the disease to cause significant economic loss. The goal is to develop new IPM tools and ergot management strategies as we learn more about disease biology and epidemiology in Kentucky bluegrass and perennial ryegrass. The team has several projects currently underway including: development of a predictive model for onset of ergot based on degree days, development of a disease model based on environmental parameters including temperature and soil moisture conditions, investigating the role of insects in secondary spread of ergot, evaluating Kentucky bluegrass and perennial ryegrass cultivars for ergot resistance, improving efficacy of foliar fungicide applications, and evaluating new fungicide chemistries and application strategies. The team is actively engaged in molecular biology research in efforts to develop a molecular detection protocol to improve ergot detection in the field, understand the genetic variability of ergot isolates from Kentucky bluegrass and perennial ryegrass, and to track the spread of ergot by way of insect vectors. This past year, the team developed and deployed a weekly/bi-weekly electronic newsletter, coined the *Ergot Alert Newsletter*, to provide producers with timely information on ergot spore production and crop phenology.


Burkhard spore trap in the Grande Ronde Valley of northeastern Oregon commercial Kentucky bluegrass field (left) and developing ergot sclerotia in Kentucky bluegrass floret on 18 June 2015 (right).

Two *Sphenophorus* (Coleoptera: Curculionidae) spp. including the Denver billbug (*S. cicatristriatus*) and the bluegrass billbug (*S. parvulus*) can cause significant economic damage to Kentucky bluegrass in the GRV and CO, however, they are not an issue in the LUB. Collaborative research efforts (Rondon, et al) are underway determine species-specific phenology in both production areas and develop effective IPM tactics for management. Phenology models have been developed for the pests but we are still trying to develop more efficient monitoring techniques. For example, this season a linear pitfall trap design was adapted and deployed in a commercial field. The design proved to be a very effective; however, further modification is needed to facilitate rapid deployment and adequate coverage in the field.

Currently, only two moderately effective active ingredients (bifenthrin and chlorpyrifos) are registered for billbug management in grass seed production in Oregon. Additional research is needed to identify new insecticide chemistries which are specific to *Sphenophorus* spp. and are alternatives to chlorpyrifos. Time is of the essence given that the U.S. EPA is currently reviewing a proposal to revoke all crop residue tolerances of chlorpyrifos. A preliminary study (was conducted to evaluate two strains of entomopathogenic nematodes (*Steinernema carpocapsae, Heterorhabditis bacteriophora*) and a myco-insecticide (*Beauvaria bassiana* strain GHA), however, results were inconclusive under field conditions and estimated cost of nematode treatments are not economically feasible for commercial application.


Denver billbug (*Sphenophorus cicatristriatus*) damage to Kentucky bluegrass (top), adult (bottom left).

Linear pitfall trap design installed in Kentucky bluegrass field (left), collection container with mesh drainage system inside irrigation valve box.

Downy brome (*Bromus tectorum*) is the most problematic winter annual grass weed in established Kentucky bluegrass seed production, however, rattail fescue (*Vulpia myuros*) can also be problematic. In cooperation with the OSU Weed Science and Oregon Seed Council research programs, two un-registered products are being screened in northeastern Oregon Kentucky bluegrass and fine fescue production to evaluate crop safety potential, application timing and weed control potential. One of the herbicides, Fierce® (flumioxazin + pyroxasulfone) by Valent, is currently in the IR-4 minor use crop pesticide registration program and due to its' potential fit in Oregon grass seed herbicide programs it is anticipated to receive registration in 2017-18. Alion® (indaziflam) by Bayer CropScience, is in the early screening stages to determine how it may fit as well, but time will tell if a registration will be forthcoming. The remaining trials were designed to investigate application timing combinations of currently registered herbicides (pre-emergence, early-mid-late post emergence) for improved downy brome control and pre-emergence control of rattail fescue. Results will be published in the 2015 OSU Seed Research Report.

2015 Danish Seed Grower Conference

11-12 November, Middelfart, Denmark

Svend Tveden-Nyborg, Aarhus University

"*There were five peas in one pod; the peas were green and the pod was green, and so they believed that the whole world was green – and that was absolutely right!*" begins Hans Christian Andersen's fairy tale "Five peas from a pod". Had he lived 200 years later he could well have been inspired from the talks from the latest seed conference that took place close to his birth place in Odense, Denmark.

Over 100 growers, consultants, and scientists from New Zealand, United States, France and Denmark discussed seed production for two days. The conference, organized by the Danish Seed Council, Aarhus University and SEGES, and with a main focus on Danish seed production, laid ear to many interesting discussions (mostly in Danish) in which conditions from around the globe were discussed and compared covering politics, machinery, resistance, latest research developments, pollination, and future goals.

It was a very unique opportunity for professionals with seed production at heart to share their knowledge and skills with one another, and from the sound of the conference room and the surrounding venue all aspects of seed production were indeed discussed among the participants, from the first presentation to the closing remarks.

Thor Gunnar Kofoed, chairman of the Danish Seed Council opened the conference (left) and IHSG members Nicole Anderson (Oregon) and Nick Pyke (New Zealand), along with Anne Gayraud (France), answered audience questions on seed production conditions in three major seed production areas.

From a knowledge dissemination and learning perspective the conference was a vivid example of how important live events are for knowledge flow between professions with varying backgrounds (e.g. farmers, consultants, and scientists). At conference events people with a targeted interest elaborate through discussions on specific topics of interest allowing knowledge dissemination to have both reach and impact (Bell et al., 2009; Feder & Slade, 1984; Monge et al., 2008). Scientific / technical information which is usually explicitly stored in report or peer-reviewed journals are traditionally difficult to articulate to tacit knowledge usage due to challenges with deciphering written information into useful knowledge (Ingram, 2008). However, when the specialists presented their knowledge verbally the transformation from written information to useful knowledge had already taken place (Duguid, 2005), and by listening to

the discussions it was quite clear that the participants were not afraid to ask questions to each other across various boundaries like academia, professions, and geography. From early morning to midnight all aspects of seed production around the globe were discussed among farmers and scientist, from political issues and international differences in chemical restrictions to production methods, machinery, and the usual bragging about who are the best seed producers…

"For me it was a desire to illustrate current knowledge and practice from around the entire seed producing world – this way the seed growers would be able to take note and carry useful new knowledge back to their operations management. The interaction between the contributors was closer than I had anticipated, but in return this provided the effect that all participants felt at home with the presentations.

As acting chairperson, it was remarkable to witness the vigilance and attention that the participants provided all presentations from the beginning to the end. This can only take place if the contributors' take-home-messages go straight to the heart of the participants.

The only critical comment I have on the conference was that perhaps too few international participants were able to take part in the discussions (language barrier) and thus to carry these even further out into an international context. Having said this, I must conclude that it was probably one of the best seed conferences I have ever attended – this must be due to the fact that the choice of content and contributors was spot on.", Thor Gunnar Kofoed (farmer and chairman of the Danish Seed Council).

"It is fantastic to work in an arena, where seed growers, consultants and advisers, scientists and politicians can meet each other for a good dialogue – and to top it all off with participants from the three most significant seed producing geographical areas (ed: United States, Denmark and New Zealand). There are common challenges that need thorough investigation, but there is a lot of original ideas and innovation in all aspects of the production." Birte Boelt (Danish researcher).

"Results from New Zealand and Oregon show that the optimal nitrogen application rate in e.g. perennial ryegrass does not vary much between New Zealand, Oregon and Denmark. Danish seed growers produce seeds under strict nitrogen restrictions; similar restrictions are apparently under way in New Zealand, while in Oregon it is still left to each seed grower to decide how much nitrogen must be added." René Gislum (Danish researcher).

"I commend the organizers of the Danish Seed Conference for making an impressive effort to bring researchers and seed producers together from the three major seed production areas of the world. It is not common that we all sit in one room together, especially with seed growers and crop advisors interacting. There is opportunity for continued cross-collaboration in research and educational activities, as evidenced by the many common threads heard in the conference presentations and debates. While many noted that there are big gains still to be made to further increase seed yields it was encouraging to see that there are many good people working towards that common goal", Nicole Anderson (American researcher).

"I found the Danish seed conference a great opportunity to network with researchers, advisers and farmers from Denmark, USA, France and New Zealand where I made some new contacts in the arable industry from around different parts of the world.

I thought there were some really good presentations during the conference which included some common themes between different seed producing areas and created some good interaction during the duration of the conference between participants.", Shane Butler (NZ consultant).

All in all the conference was successful in sharing knowledge and skills among professional from across the globe, and if anyone missed out on this year's seed conference in Denmark, one has only to wait another two to three years for the next Danish seed conference to take place.

Another Hans Christian Andersen fairy tale – of the two farmers "Little Claus and big Claus" – could very well have been written on the basis of contributions from the late seed conference. From the very opening comparisons were made across the room discussing which area was the better place to producing seeds; to which all participants agreed that they were all the World's best seed growers.

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Ingram, J. (2008). Are farmers in England equipped to meet the knowledge challenge of sustainable soil management? An analysis of farmer and advisor views. *Journal of Environmental Management, 86*(1), 214-228. doi: 10.1016/j.jenvman.2006.12.036

Monge, M., Hartwich, F., & Halgin, D. (2008). *How change agents and social capital influence the adoption of innovations among small farmers: Evidence from social networks in rural Bolivia*: Intl Food Policy Res Inst.

5th International Symposium of Forage Breeding

Buenos Aires 19-21 November 2015

Phil Rolston, AgResearch NZ and IHSG President

The Symposium had 200 participants, mostly from South America with strong support from various US groups and AgriBio (Victoria, Australia), a small Kazak and Kiwi contingent. The meeting was held in the National Bank (Banco de la Nacion Argentina) a magnificent building constructed in 1890 and opposite the famous "Pink House" – Presidential Building (remember Eva Peron *"Don't cry for me Argentina*" reputedly song from the balcony of this building).

The sessions included:

1. Genetic resources and novel species;
2. Breeding and managing symbiosis;
3. Overcoming abiotic stresses;
4. Biotic stress and disease tolerance;
5. Forage yield, forage quality and nutritive value;
6. Reproductive systems and breeding;
7. Seed quality and yield and pasture establishment;
8. Towards whole genome selection;
9. New traits and technologies in forage breeding

If seeds are the delivery vehicle of new plant and endophyte genetics, then as seed production agronomists we also need to understand how rapidly plant breeding processes are changing and associated with genomics the push into rapid phenotyping systems; with the Victoria, Australian groups (e.g. AgriBio group led by German Spandenberg) being one of the leading groups in this area; e.g. "Omics for outcomes-incorporating novel technologies in forage breeding" by Kevin Smith (Melbourne University) as an example.

The importance of tropical forages in the region was well highlighted by the many papers and posters from Brazilian and Argentinian researchers; e.g. the large amount of work on *Brachiaria* work by EMBRAPA (Brazil) and CIAT (e.g. Margret Worthington, Colombia). Brazil has 120 m ha of tropical pastures, mostly sown in *Brachiaria*. Forage seed production in Brazil is grown on 150,000 ha producing 45,000 MT seed (87% *Brachiaria* and 12% *Panicum*); mostly harvested by sweeping seed from the ground. There is also good work being done in *Papalum* species by Carlos Acuna *et. al.* (Corrientes, Argentina) and *Panicum* by Andrea Tomas (INTA, Argentina).

The seed speakers were Phil Rolston (AgResearch, NZ) "Seed quality and yield-temperate forages"; Andrea Tomas "Seed shattering in warm seasons grasses: potential use of breeding to overcome it"; and Lucas Garro and Gentos colleagues (Pergamino, Argentina) "Potential yield and seed processing methods of *Bromus auleticus*". There was a message to breeders to not forget seed yield/seed quality and that seed shattering was one attribute worthy of attention.

23rd International Grasslands Congress

New Delhi 20-24 November 2015

Phil Rolston, AgResearch NZ and IHSG President

The IGC New Delhi was attended by 650 participants from 47 countries, with half of the attendees being from India. Seed research was given its own session "Seed production, storage, availability and quality", with the session chaired by former IHSG President Prof John Hampton (New Zealand) with Dr. Rajendra Prassad (India). There were 6 oral papers and 16 posters with a seed theme. The two key note papers were, "Quality seed production and effective marketing systems for the development of grasslands" (Phil Rolston) and "Forage seed quality- dormancy testing, standards and quarantine (John Hampton). The oral papers included seed shattering (Piotr Golinski) and "morphological diversity of diaspores in some grasses of the Punjab, India" by AS Soodan a PhD student. This paper was supported by great pictures and was a valuable refresher for anyone wanting to improve their understanding of the anatomy of seed structures (diaspores). A must read for any students as well as older researchers needing a refresher 101 course!! The papers will be posted on the IGC website (www.igc.org).

India has a strong seed research effort with 26 scientists in ICAR (Indian Council of Agriculture Research) with the directorate of Seed Research led by Dr. Rajendra Prassad, based at Kushmaur, Mau (see www.seedres.in) and members of the IGFRI (Indian Grassland and Fodder Research Institute) within the ICAR. One Indian seed company Almadar Seeds is producing both annual and perennial alfalfa and supplies seeds of its locally developed annual alfalfa for sowing 15,000 ha annually.

There is a huge demand for seed of tropical species that is not being met. Kenya has 1 million small dairy farmers looking for forage options, of which the *Brachiaria* species are very promising. India has many millions of small dairy farmers in a wide range of climatic zones whom have demands for forages.

Several strong themes emerged from the papers and presentations.

1. Seed supply of suitable species (mostly local adapted species) is a constraint on the rehabilitation of grasslands;
2. In the developing countries with grassland and small holder livestock (especially India and east Africa) seed quality is a major limitation, especially in grass species where seed dormancy and immature seeds are common;
3. Both CIAT (International Centre for Tropical Agriculture) and ILRI (International Livestock Research Institute) have strong programmes on forages that are being limited by seed supply.

The next IGC will be in Nairobi, Kenya in 2019 and the chair of the organizing committee Dr. David Miano Mwangi indicated to me that he wants seed research papers as a section in that conference.

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