



International Herbage Seed Group

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IHSG

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Grasses – more than just seed production!

Editor's note: 2011! The start of another decade. I hope everyone is well and that your research is providing just as many answers as questions. After sowing this year's trials the Southern hemisphere is preparing for the winter while in the North, the summer brings the harvest. This issue of the IHSG newsletter has a focus on alternative uses of grasses including articles on novel endophytes as bird deterrents and re-vegetation in Europe. This is issue number 45 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 <http://www.ihsg.org/>. Please continue to send articles, updates or short papers to your area contact person to be included in future newsletters.

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President's Column

Welcome to the 45th edition of the IHSG newsletter. Let me start with posing a question: Do you remind yourself to encourage young people to study agriculture? Pointing to the importance of producing healthy food and feed crops? Why is that? Because we see a still decreasing number of students in agricultural universities and in particular because this issue of the newsletter remind us, that some of the people we considered 'being there forever' have retired.

Bill Young and John Hart, Oregon State University, retired December 2010. Bill Young was appointed Assistant Professor and Extension Seed Production Specialist at Oregon State University (OSU) in 1989 following the retirement of Dr. Chilcote and Dr. Youngberg, and in 1991 he was the organizer of the 2nd International Herbage Seed Conference in Corvallis, Oregon. In particular there is one occasion, which stands clear in my memory: Coming back from a field trip the IHSG-busses got caught in a traffic jam. Bill got out, made everybody else come to a complete stop and soon after the IHSG-busses could pass.

Bill was the IHSG president in 2001-2005, and he introduced our first electronic newsletter (issue 35) and established the homepage. Bill will hold a half time position through to December 2013. During this time he will be preparing resource material for the future Extension staff in Oregon. Dear Bill, thank you for your commitment to the IHSG and I trust, that you by now enjoy the pleasure of working part time without concerns regarding 'who is doing the other part'.

As an Extension soil Specialist John Hart has been involved in the international collaboration on nitrogen management strategies between Oregon, New Zealand and European countries. It has been very encouraging to see, how knowledge and resources have been put together in an attempt to help seed growers internationally to meet the requirements of environmental regulation and public concern.

Inside this newsletter you'll find a detailed description of the achievements of Michael Hare in establishing a tropical pasture seed production in Thailand. I have been to the field with Michael, visiting the women who were hand harvesting grass seed and experiencing how he was running this small seed business, which now comprises more than 850 seed growing families in Thailand and provides more than 100 tonnes of seed for the use in south-east Asia. No doubt, this has significant implications to the households and future prospects of these families. Congratulations, Michael, by the award as Tropical Grassland Society Fellow, 2010.

In the previous issue of the newsletter I invited IHSG-members to send information on different uses of grasses and legumes. We have received two exciting examples: The use of grass/endophyte associations with the aim to reduce bird strikes on airfields in New Zealand, and developing seed production of local populations of grasses for ecological restoration in mountain areas of Norway. I hope these two very interesting examples will stimulate more to come.

Let me finish by reminding us all to encourage young people to study agriculture – and preferably: Herbage seed production! There are lots of challenges and good stories to be told.

President
Birte Boelt

End of an Era



**58 yrs of service to OSU
and the seed industry**



Dr William C. Young III

Dr John M. Hart

The retirement of Bill Young and John Hart in December 2010 marked the end of a combined 58 yr of service at Oregon State University. With emphasis on seed production, crop nutrient management and agronomy extension, Bill and John have worked to provide growers with economic and environmentally sustainable management practices.

Bill started his professional career at OSU in 1978 as research assistant in the Department of Crop Science. During those years he completed his MSc (Seed Production) and PhD (Plant Physiology). In 1989 he was appointed Assistant Professor and Extension Seed Production Specialist. Although researching field burning alternatives has played a significant role in Bill's research and extension program, he was also much involved with investigations on the use plant growth regulators in seed crops, nitrogen fertilizer management, effect of row-spraying and grazing seed fields, using minimum tillage cropping systems, and other agronomic practices related to small seeded grass and legume seed production. Bill has edited OSU's annual Seed Production Research Report for the past 22 years and served as the IHSG President from 2001 to 2005. Bill is not "riding off into the sunset" as he continues to hold a half-time position through 2013 helping to prepare resource materials to assist future extension staff.

John began at OSU in 1984 as a Visiting Associate Professor. In 1985, John was appointed Assistant Professor and Extension Soil Specialist, which he continued until his retirement in 2010. Answering the nutrient management questions of 1) how much to apply, 2) when to apply, 3) what source to apply, and 4) what method to apply nutrients has been John's extension program for 20 years. Emphasis is on timing of nutrient application since application preceding crop need leads to efficient nutrient use. Oregon producers grow many crops of local significance but not important nationally. Consequently, little nutrient management information exists for carrot seed, cranberries, rhubarb, peppermint, grass seed, hops, Christmas Trees, broccoli, cauliflower, and other "small acreage" crops. John says that "for all crops, finding people with similar interests, such as the IHSG, is rewarding, helpful, and productive"

Everyone involved in the IHSG congratulates you both on your careers and applauds your commitment to IHSG, agronomy and the seed industry as a whole.

Michael D. Hare

Tropical Grassland Society Fellow 2010

Michael Hare has been awarded Fellow of the Tropical Grassland Society of Australia 2010. Involved in research and development in tropical and temperate pastures in Thailand and New Zealand for almost 40 years his work on seed production has played a significant role in the establishment and utilisation of tropical pastures in south-east Asia.

Growing up on the family beef and sheep hill farm at Wanganui, New Zealand, Michael completed a Diploma of Agriculture in 1972 and a Diploma of Valuation and Farm Management in 1973 from Lincoln College, Canterbury. He went to north-east Thailand in 1974 as a New Zealand Volunteer. In 1976, Michael transferred to the Thailand Department of Livestock Development at Khon Kaen, where he was employed by New Zealand Foreign Affairs as the Seed Production Adviser in tropical pasture grasses and legumes, working with Alan Robertson. Michael supervised the large-scale production of Verano stylo seed by more than 1600 farmers in 16 provinces, a village-based system pioneered by Max Shelton and colleagues at Khon Kaen University. The project became the largest source of pasture grass and legume seed in Thailand, expanding from 10 tonnes of Townsville stylo seed in 1976 to nearly 95 tonnes from 16 varieties of legumes and grasses in 1980. Michael returned to New Zealand and completed a Post-graduate Diploma in 1981 and a Master of Agricultural Science with First Class Honours in Plant Science in 1983 at Lincoln College. Michael began 10 years of research work with the Grasslands Division of DSIR based in Palmerston North, New Zealand. There he worked under Phil Rolston on all aspects of grass seed production including flowering, seed development, tillering, plant development, plant density, harvesting



techniques, time of sowing date, closing date, growth regulators, and fertiliser application in a range of temperate species. Michael gained his Ph.D 1992 on tall fescue seed production from Massey University, New Zealand and returned to Thailand in 1994, where he accepted a job at Ubon Ratchathani University. Michael conducted a pasture research program to improve dairy

production funded by the Thailand Research Fund, commencing in 1995. Trials involving pasture evaluation and seed research were conducted at 17 sites in 3 provinces in north-east Thailand and the project finished in 2007. Two new cultivars (Ubon paspalum and Ubon stylo) were released to industry from this project. The University honoured Michael with a special professorship in 2006, granted by his Majesty the King of Thailand. In 2007, Michael became head of Ubon Forage Seeds, a commercial arm of the Faculty of Agriculture, funded by a Mexican Seed Company, Grupo Papalotla. The main species are Mulato II hybrid brachiaria, Purple guinea, Mombasa guinea, Ubon paspalum and Ubon stylo. Seed is exported to countries in Asia, Central America, South America and the Pacific. They are the only group in all of Asia (Middle East to Japan) that exports tropical forage seeds. The seed program is expanding rapidly with more than 850 farming families under contract to hand-harvest in excess of 100 tonnes of seed in 2010. The targets in 2011 are for 260 tonnes of seed. Michael is a permanent resident of Thailand hoping to continue working on tropical forage seeds for as long as he is able (at least another 20 years). Michael Hare is a worthy Fellow of the Tropical Grassland Society of Australia Inc.

The potential of specialty endophyte-infected grasses for the aviation industry

Chris Pennell and Phil Rolston
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Bird strike on airfields and surrounding lands commonly involves birds that feed on herbage cover or insects living there. *Neotyphodium* endophytic fungi that live in mutualistic associations with grasses such as ryegrass (*Lolium*) and fescues (*Festuca*) produce a number of alkaloids that reduce insect pest numbers and herbivore feeding. This knowledge has been exploited to produce a novel product as one of many tools to combat the increasing problem of bird strike on or near airfields. It is known that the alkaloid ergovaline produced by endophytes in both perennial ryegrass (*L. perenne*) and tall fescue (*F. arundinacea*) not only reduces the number of insects but can also reduce feeding of Canada geese (*Branta canadensis*) (Pennell & Rolston 2003; Pennell *et al.* 2010) by inducing avoidance behaviour. Another major group of alkaloids, called lolines, produced by the fescue endophyte *N. coenophialum* but not in ryegrass associations, acts on a number of insect pests (Schardl *et al.* 2007; Popay *et al.* 2009).

Initial concept testing of wild type endophytes was carried out in 2000 with plots over two years with two separate gaggles of Canada geese to evaluate learned avoidance response to selected grass/endophyte associations that contain high levels of ergot alkaloids. A large area of Jackal AR601 was sown in 2008 for the Auckland International Airport domestic runway development. This area is being monitored for birds. Interim results between February and July 2010 have shown a considerable reduction in bird numbers (Fig 1)

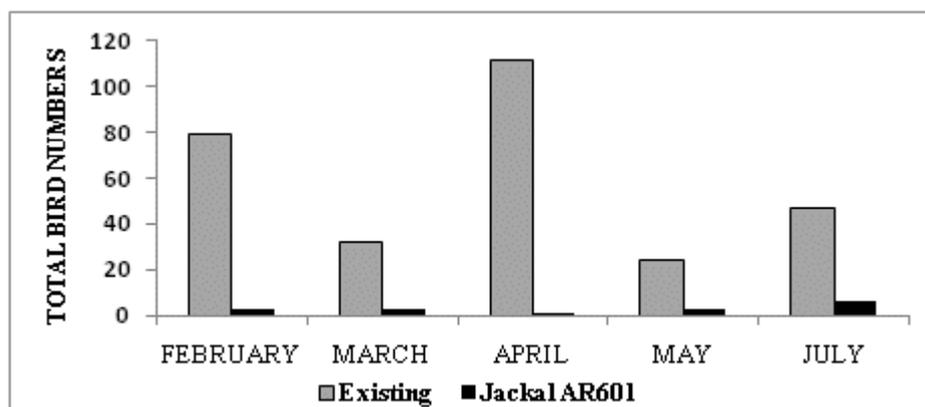


Fig. 1. Total bird visits to Jackal AR601 endophyte compared with existing grasses at Auckland Airport

During 2009/10 three international airports in New Zealand established areas with Jackal and there are encouraging signs that they have fewer birds. Seed production is now being undertaken to supply seed during 2011 year. As more airports take up this technology and more bird data obtained, we may be able to compare actual bird strike numbers pre and post the establishment of the Jackal AR601

Pennell CGL, Rolston MP 2003. Effect of grass-endophyte associations on feeding of Canada geese (*Branta canadensis*). *Proc N Z Grassland Assoc* 65: 239-244

Pennell CGL, Rolston MP, De Bonth A, Simpson WR, Hume DE 2010 Development of a bird deterrent fungal endophyte in turf tall fescue. *NZ J Agric Res* 53: 145-150

Popay AJ, Tapper BA, Podmore C. 2009. Endophyte-infected meadow fescue and loline alkaloids affect Argentine stem weevil larvae. *NZ Plant Protection* 62: 19-27

Schardl, CL, Grossman, RB, Nagabhyru, P, Faulkner, JR, Mallik UP 2007. Loline alkaloids: Currencies of mutualism. *Phytochemistry* 68: 980-996.

Seed production of local populations for ecological restoration in Norwegian mountain areas

Trygve S. Aamlid
Bioforsk
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With approximately 600 growers and a total acreage of 3500 ha, herbage seed is not a big commodity in Norway. A safe supply of adapted, winter-hardy cultivars of timothy, meadow fescue, red clover, white clover, Kentucky bluegrass, smooth brome grass and other species is, however, extremely important for the Norwegian dairy, beef and sheep industries. Seed production of amenity grasses has, so far, been very limited, supplying less than 10% of the annual consumption of 7-800 tonnes of fine fescue, Kentucky bluegrass, bentgrass and ryegrass seed. While 2% of Norway is forest and only 3% arable land, 'nature' occupies almost 70%. Most of this is mountains, i.e. areas above the tree-line which in Norway varies from almost 900 m a.s.l. in the south east to less than 50 m a.s.l. in the very north (70-71°N).

New legislation on biodiversity

In 2009, the Norwegian Parliament passed the 'Nature Diversity Act'. This new legislation is cross-sectorial as it covers all kinds of human interventions in 'natural areas'. Among other regulations, the Act prohibits the introduction of alien organisms into 'nature'. Alien organisms are defined as 'species, subspecies or populations, introduced outside its natural distribution area'. As for amenity grasses commonly used for revegetation purposes, an important implication of the Act is that it prohibits the use of seed of *Lolium perenne*, *Festuca trahyphylla* (hard fescue), *F.rubra* ssp. *commutata* (Chewings fescue) and *F.rubra* ssp. *litoralis* (slender creeping red fescue) in natural areas (agriculture and gardens/lawns not included), since none of these species are native to Norwegian mountains. Moreover, the requirement to site-specific seed means that a population collected in one region of the country should not be transferred to another region unless it can be verified that the genetic constitution is the same in the two areas.

In response to these requirements of the 'Nature Diversity Act', the R&D project 'FJELLFRØ' (directly translated 'MOUNTAIN SEED') was initiated by a regional seed grower association and Bioforsk in 2007. Funded by 'Innovation Norway', which is the Norwegian Government's most important instrument to stimulate new industries and enterprises, the principal objective of the project is to develop multiplication of site-specific seed for revegetation into a new enterprise for Norwegian seed growers. Subgoals are (1) to collect parent material of site-specific plants in mountain regions, (2) to multiply this parent material by seed, (3) to develop seed production techniques and communicate this knowledge to seed growers, and (4) to establish demonstration trials with site-specific seed in conjunction with ecological restoration / revegetation projects. Besides Innovation Norway, the Norwegian Defense Estates Agency, the Norwegian Water Resources and Energy Directorate, and Statkraft (Norway's biggest hydroelectric company) have also contributed to the project as they are among the main users of this kind of seed.

Collection

To fulfill the first subgoal, during the first project years, a professor of botany from one of the Norwegian university colleges and some others visited Alpine regions in Norway and collected seed of more than 200 populations of about 30 species. Most emphasis was put on perennial grasses such as *Agrostis mertensii*, *Anthoxanthum oderatum* ssp. *alpinum*, *Avenella flexuosa*, *Festua ovina*, *Luzula frigida*, *Phleum alpinum*, and *Poa alpina*.

Two generation multiplication

According to subgoal 2, seed is being multiplied over two generations. First generation crops are established by raising plants in nurseries and transplanting them onto field beds covered by black plastic to avoid weed contamination. Most of these first generation crops are located at Bioforsk Experimental Farm Landvik in SE Norway (58°20'N, 10 m a.s.l.) (photo 1). The areas of these first-generation fields have varied from 12 to 800 m² (mean 131 m²) and seed yields from 15 g to 25 kg (mean 2.6 kg).



Photo 1. First generation seed multiplication at Bioforsk Landvik. From left to right: *Poa alpina*, *Luzula frigida*, *Avenella flexuosa*. Photo: Trygve S. Aamlid.

Second generation seed production is contracted to about ten seed growers in Telemark, SE Norway. The first commercial seed harvest year was 2010, in which eight crops with a total acreage of 5.7 ha were harvested with a total seed yield of close to 3 tonnes. In 2011, we expect a total seed yield of 5-6 tonnes from about 13 ha. The annual requirement for site-specific seed to restoration above the treeline has been stipulated to 20-30 tonnes. Most of this seed will be used in conjunction with military installations, hydro-power or wind-power plants, roads and railways, but there is also an increasing marked for revegetation of ski-slopes, natural areas around mountain cabins and turf-roofs (photo 2).



Photo 2. Turf roofs are common in Norway. Photo: Trygve S. Aamlid

Challenges in seed production

Of the species that we have in production so far, *Festuca ovina* and *Poa alpina* seem to be relatively easy with seed yields sometimes exceeding 1000 kg/ha (photo 3). *Phleum alpinum*, which we expected to be easy based on our long experience with seed production of forage timothy (*Phleum pratense*), has been our biggest disappointment as it gives seed yields of only 100-120 kg/ha. While the seed yield capacity of Alpine and Arctic populations of *F. ovina* and *P. alpina* seem to be unaffected across a wide range of latitudes and altitudes, *Phleum alpinum* seed crops in lowland areas are often heavily infected by rusts and other diseases and therefore require at least two application of fungicide per year. For some of the species, we may also run into problems with the flower induction requirements as the growing season in the main seed production area in SE Norway starts in mid-April at a much shorter photoperiod than the Arctic and Alpine populations are used to. As northern mountain grasses usually differentiate apices in autumn and develop very rapidly in spring, the most important period for seed harvest is in late June, i.e. one 5-7 weeks earlier than for most other seed crops. For *Phleum alpinum* we are now starting parallel experiments at various latitudes (58-71°N) and altitudes (0-550 m a.s.l) in Norway to find the optimal location for seed production of populations originating at various sites.



Photo 3. Seed harvest of second generation seed crop of *Poa alpina*. This crop was only 0.1 ha, but produced more than 100 kg seed. Photo: Arne Svalastog

Most Arctic and Alpine species are very slow in establishment and therefore vulnerable to competition from weeds, especially in the sowing year. So far, all seed crops have been established in a pure stand without cover crop. Most growers plant their seed crops in early June after a chemical spring fallow, and we have conducted a number of pot and field trials to evaluating the selectivity of various graminicides (photo 4). Our biggest problem is *Poa annua*.



Photo 4. Pot experiment evaluating selectivity of graminicides in *Poa alpina*, *Phleum alpinum*, *Avenella flexuosa* and *Luzula frigida*. Photo: Kirsten S. Tørresen.

AFLP to establish seed transfer zones

While the Nature Diversity Act requires the use of site specific seed in each individual restoration project, it is still an open question what is site-specific and not. For example, can populations of *Festuca ovina* from one mountain region be used for restoration in another region 500 km apart ? To answer such questions and establish seed transfer zones for each individual species, geneticists / molecular biologists in Bioforsk and at the Norwegian University of Life Science are now starting a follow-up project using AFLP to study the spatial variability in genetic structure for most of the species that we are working with. At present we are multiplying seed of 5-10 separate populations of each species at rather small acreages (average contract size is less than 1 ha), and it would all become much more efficient if some of the populations could be amalgamated without any risk for loss of biodiversity. Therefore, we look forward to results of the genetic studies which will be finished by the end of 2012.

Dates to remember

Workshop 2013 & 8th IHSG Conference 2015

Phil Rolston suggests you mark these dates in your calendar:

International Grasslands Congress (IGC) Sydney 15 – 19 September 2013. There is a proposed seed section at the IGC and as we have done in the past the IHSG will link to this with a post conference workshop in New Zealand.

IHSG Workshop , New Zealand 21-24 September 2013. The IHSG will hold a workshop in New Zealand in September 2013. We have formed a local organizing committee at Lincoln with many familiar faces from the “kiwi” contingent attending the Dallas 7th IHSG as members. There are several daily flights from Sydney to Christchurch. The Workshop will be based in the heart of the seed growing area about 80 km south of Christchurch.

8th IHSG Conference (early June 2015). At Dallas Bill Young expressed an interest for a future IHSC to be held in South America. Also the Gansu Province (China) delegation offered Lanzhou City as the next venue for our conference. Phil Rolston visited Lanzhou University in early June this year and met with Prof. Wang Yan Rong and her team. They have good conference venue facilities and the University has plenty of experience in hosting International Conferences. The Endophyte Conference will be there in 2012. There are good options for an excellent post conference field trip into the main seed growing area of China, the Hexi Corridor. Lanzhou City represents the Chinese end of the Silk Road which heads west through the Hexi Corridor. I think this will be an excellent venue for our next full conference.

The IHSG members will vote in 2013 to confirm the venue for the next conference. I invite all potential candidates for the next IHSC to send further information. This information should be available before the next workshop in New Zealand 2013.

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