MATKAKERTOMUS

osallistumisesta Euroopan Maataloustieteellisen Yhteisön 12. kongressiin
12th Congress of the European Society for Agronomy (ESA12)
20.-24.8.2012 Helsingissä

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Paikka ja osallistujamäärä

Helsingin yliopisto, pääkampus Fabianinkatu 33. Läsnä oli 280 osallistujaa 35 maasta. Kongressissa pidettiin 125 esitystä 26 sessiossa ja postereita oli esillä 158. Esitelmistä 15 oli pyydettyjä keynote-esityksiä. Konferenssin kotisivut: www.esa12.fi

Teema *Agriculture at the extremes* eli Maataloutta äärirajoilla.

Kongressijulkaisu

Vain sähköinen yhteenveto, saatavilla www.esa12.fi > Abstracts
University of Helsinki, Department of Agricultural Sciences Publication Series Vol 14.

Seuraavat kongressit

Debrecen, Unkari 2014
Edinburgh, Skotlanti 2016

Kongressin keskeisin anti nurmitutkimuksen näkökulmasta

Nurmitutkimus itsessään oli varsin pienessä roolissa ESA12:ssa. Parhaiten nurmituotannon ja muun kasvinviljelyn tutkimus näyttivät kohtaavan luomututkimuksessa. Kongressin loppupuheenvuoroissa nostettiinkin esille ajatus yhteistyön tiivistämisestä mm. European Grassland Federationin (EGF) kanssa. Todettiin, ettei kasviagronomien jakautuminen kahteen tai useampaan järjestöön edistä tutkimuksen kaipaamaa koheesiota ja isojen kokonaisuuksien hallintaa. Nurmien vähäinen huomiointi kasvinsuojelututkimuksissa sekä laaja-alaisiksi tarkoitetuissa malleissa (mm. maaperä- ja maankäyttömallit, jopa ilmastomallit) pisti silmään, mikä viittaa yhteistyön tiivistämistarpeeseen.

Yksi kongressin teemaksi artikkelien tarjoamisvaiheessa asetettu ja abstraktien perusteella suosituimmista aiheista oli yield gap eli satoerokuilu (satopotentiaalin ja todellisen sadon erotus). Satoerojen suuruudet, syyt ja merkitys olisi selvitettävä myös suomalaisessa nurmituotannossa.

LIITTEET

ESA12 ohjelma

PAKARINEN, K., HYRKÄS, M. 2012. Effect of the mother tiller type in the first cut on the leaf appearance of regrowth tillers in timothy.

PAKARINEN, K., HYRKÄS, M., JUUTINEN, E. 2012. Development and validation of practical methods for the determination of dry matter yield in grass silage swards.

Matkaraportti

Maanantai 20.8.2012

Maanantain avaussessiossa kuulimme Suomen maatalousministeri Jari Koskisen sekä Helsingin yliopiston Maa- ja metsätieteellisen laitoksen professori Juha Heleniuksen ja johtajan Jarmo Jugan puheenvuorot. Avaussessiossa myös esiteltiin ja avattiin keskustelu siitä, tulisiko ESA12-kongressin antaa tarkentava huomautus tai julistus, jossa asiantuntijoina uudelleenmääriteltäisiin CAP-uudistuksen toimenpiteitä.

Iltapäivän sessioissa oli useita yleisagronomisia puheenvuoroja, joissa pääosin käsiteltiin muita kuin nurmikasveja, mutta joiden keskeinen sisältö olisi helposti sovellettavissa myös nurmitutkimukseen. Esimerkiksi *G. Slafer* (abstrakti 142-1Keynote) pohti ansiokkaasti vehnän satoerokuilun syitä sekä sitä, tulisiko keskittyä satopotentiaalin nostoon (esim. jalostuksella) vai paikkaamaan satoerokuilua. Hänen mielestään jälkimmäiseen voi keskittyä, jos todelliset sadot jäävät alle 50 prosenttiin satopotentiaalista. Satopotentiaalin kasvattaminen sinänsä kasvattaa myös todellisia satoja.

M. Pampolino (142-4) oli omassa työssään erotellut satoerokuilun useampaan faasiin (maksimipotentiaali – korkein käytännön potentiaali – tyypillinen käytännön potentiaali – todellinen saavutettu sato), joita tarkastelemalla on mahdollista pureutua yksityiskohtaisemmin satoerokuilun syihin ja satoaleneman todennäköisyyteen.

Lisäksi kuulijoille hahmotettiin mm. maan orgaanisen aineksen tärkeyttä maan sadontuottopotentiaalin ylläpidossa (*S. Zingore*, 142-5).

Tiistai 21.8.2012

Tiistai oli täysi konferenssipäivä. Nurmien kannalta aamupäivän anti oli vähäinen lukuunottamatta *S. Médiènen* (221-2) selvitystä nurmien rikkakasvipitoisuuteen ja lajistorikkauteen vaikuttavista tekijöistä. Riittävät N-varat rajoittavat rikkakasvien osuutta, sillä ne häviävät N-lannoitukseen paremmin reagoiville viljelykasveille. Samasta syystä niukissa typpioloissa kannattaisi siten suosia nurmipalkokasveja, joiden kilpailukyky riittää rikkakasveja vastaan. Järkeenkäyvältä vaikutti myös havainto, että rikkalajisto muuttuu eniten ensimmäisen nurmivuoden aikana/jälkeen ja viljelijän tulisi osata tarkkailla tätä vaihetta.

Itselleni mielenkiintoisiksi muiksi aiheiksi kohosivat *N. Antenin* (211-1) pohdinta syistä, miksi kasvit eivät yllä maksimipotentiaaliinsa (kasvien olosuhdeplastisuus ja adaptaatio estävät) sekä *B. Fayaudin* (211-4) esitys sekakasvustojen aikaisen kehityksen kilpailueduista (itämisvaiheessa siemenkoko ja versomisvaiheessa ravinnetila ratkaisevat menestyksen).

Iltapäivällä seurasin mielenkiinnolla muutamaa nurmiin ja rehuntuotantoon liittyvää esitelmää. *F. Fogelberg* (232-3) kertoi soijapavun viljelyn olevan jo (suotuisissa oloissa) mahdollista Etelä-Ruotsissa. *V. Jokela* (232-4) kertoi timotein vernalisaation vaikutuksista sen kylmänkestävyyteen ja kasvustorakenteen muodostukseen; tulokset olivat jo tuttuja NURFYS-hankkeen tiimoilta. *R. Gislum* (242-5) vertaili englanninraiheinän siementuotannon potentiaalia Tanskassa ja Uudessa Seelannissa:

Tanskassa kompastuskiveksi on muodostunut liian tiukka N-lannoitusraja, joka rajoittaa siementuotannon potentiaalia jonkin verran.

Keskiviikko 22.8.2012

Keskiviikko oli varattu kokonaisuudessaan mid-conference-retkille, joiden oli tarkoitus esitellä suomalaista maataloutta pohjoisen äärirajoilla. En voinut valita pidempiä retkiä kustannussyistä, joten osallistuin Viikkiin suuntautuneelle retkelle.

Viikissä näimme mm. biohiilikokeen sekä erilaisia esikasvikokeita. Näistä mielenkiintoinen oli havainto, että tattari saattaa vähentää juolavehnän esiintymistä viljelykierrossa seuraavina vuosina. Biohiilikokeesta totesimme, että käyttömäärät kokeessa olivat olleet mahdolliseen tarpeeseen nähden sen verran pieniä, ettei eroja käsittelyiden välille juuri näyttänyt syntyvän. Käyttömäärien tulisi ehkä olla niin suuria, että levitys olisi hidasta ja rahtikulut kalliita; onko biohiili siten ratkaisu mm. orgaanisen aineksen lisäämisessä vai toimisiko esim. nurmi viljelykierrossa jopa paremmin?

Retken parasta antia oli vilkas keskustelu lounaalla ja bussissa vieressä istuneen australialaisen maataloushallinnon virkanaisen kanssa. Hän kertoi seuraavansa EU:ssa käytävää maatalouspoliittista keskustelua ihastuksella: Australiassa tuotannon luonnonmukaisuuden sekä yleisen ekologisen ja eettisen kestävyyden arvo on jäämässä kustannustehokkuusjahdin ja pelkän taloudellisen kannattavuuden parantamisen jalkoihin nykyisellä poliittisella kaudella. Tämä avasi silmiäni sille, että EU:ssa asioita katsotaan varsin vihreästä näkökulmasta jopa tavanomaisessa tuotannossa.

Torstai 23.8.2012

Torstai oli jälleen täysi konferenssipäivä. Aamupäivän esitelmistä keskustelua herätti *M. Benoitin* (411-1) retrospektiivinen tutkimus viljelykalentereiden (ts. viljelytoimenpiteiden ajallisen ajoittumisen) muuttumisesta sekä tämän tiedon tallentamisen heikkouksista: meidän on huomattavasti epävarmempaa todentaa mm. ilmastonmuutoksen vaikutuksia, ellemme kerää ja tallenna mennyttä ja tämänhetkistä viljelykäytäntödataa huolellisemmin. Ajattelu sopii myös nurmituotantoon: viimeistään nyt olisi erittäin aiheellista kerätä lähimenneisyyden viljelyhistoriatietoa käytännön maatiloilta, sillä keskuudessamme löytyy vielä viljelijöitä, jotka ovat itse eläneet suuren nurmirehutuotannon vallankumouksen ja joillakin heistä on ehkä edelleen tallessa arvokasta tilastotietoa viljelytöistä, tuotantopanoskäytöstä ja satotasoista.

J-L. Durand (411-2) selvitti Ranskassa tehtävää tutkimusta nurmien ilmastomuutokseen sopeutumisesta. Hän näki, että tarvitsemme ainakin kolmenlaista monimuotoisuutta nurmituotantoon, jotta sopeutuminen ilmastonmuutokseen olisi optimaalista: viljelykiertojen monipuolistaminen, kylvetyn nurmialan lisäys sekä kylvettyjen nurmilajien monimuotoisuus.

Kasvifysiologian osalta aamupäivällä tuli pari omaa pohdintaa herättänyttä esitystä. *I. Tokatlidis* (411-3) mainitsi, että saman lajin tai tyypin (maissi)lajikkeet voivat olla joko kasvustotiheyden suhteen neutraaleja tai riippuvaisia pyrkiessään maksimisatoon. Onko asia näin myös nurmikasvien eri lajeilla? Koska suomalaisten nurmien ehkä suurin satopotentiaalin täyttymisen este on heikko tiheys, voisiko tästä johtaa käytännön

parannuskeinoja esim. suosittelemalla viljelijöitä sekoittamaan samaan siemenseokseen paitsi eri lajeja, myös harkiten useita saman lajin lajikkeita?

Vedenpuutestressiä käsiteltiin myös torstaiaamupäivällä. *P. Kettlewell* (421-3) esitti, että esimerkiksi kalvon muodostavat ruiskutteet toimivat kyllä estäen kosteuden haihtumista lehtien pinnoilta kuivuusstressin aikana, mutta heikentävät ikävä kyllä samalla lehtien yhteyttämistehokkuutta niin, että nettokasvulisää ei saada.

Iltapäivän alkuun osuivat molempien omien postereiden (P2-16, P2-63) esittelyt. Näistä erityisesti nurmen sadon mittaukseen keskittyvä posteri herätti keskustelua. Kritiikkiä tuli havaintoaineiston vähyydestä ekstrapoloinnin molemmissa päissä (matala kasvusto – korkea kasvusto), mutta muuten malli koettiin mielenkiintoiseksi. Emoversovaikutuksia selvittävä posteri oli sijoitettu erittäin ikävään paikkaa neljännessä kerroksessa, missä ei juuri liikkunut väkeä.

Loppuiltapäivällä seuraamani esitelmät keskittyivät tuotannon erilaisiin jalanjälkilaskelmiin. Esimerkiksi *P. Pointereau* (433-1Keynote) kyseenalaisti sen, tiedämmekö oikeasti, mitä mittareita on järkevää laskea ja esittää. Hän esitti, että maan rakenne (sen vastustus muokattaessa) on tulevaisuuden matalaenergisessä maanviljelyssä avainasemassa, ja osoitti useiden laskelmien perusteella, että luonnonmukainen ja low-input-maatalous on energiatehokkaampaa kuin huippusatoja tavoitteleva tehomaatalous, kun panokset lasketaan esimerkiksi tuotettua energiasisältöä kohti. *H. Pulkkinen* (443-1) esitteli Suomessa kehitettyä mallia arvioida kivennäismaiden typpikaasupäästöjä. *P. Goglio* (443-3) korosti, että maan orgaanisen aineksen ja typen dynamiikan huomioiminen laskelmissa voi olla monimutkaista.

Perjantai 24.8.2012

Konferenssin päätöspäivän aamu keskittyi kasvitieteiden omiikkaan. Oli virkistävää kuulla, että kasvinjalostus ei ole menossa pelkän genomisen valinnan suuntaan, vaan että aitoa, yksityiskohtaista fenomiikkaa vielä tarvitaan (*F. Tardieu* 521-1Keynote). Fenotyyppaukseen on kuitenkin jo tarjolla (sekä myöhemmin varmasti tulossa) uutta teknologista apua mm. uuden sensoritekniikan kautta. Tällöin kerättävät datamassat ovat suuria ja fenotyyppaajan keskeiseksi osaamisalueeksi tuleekin ”kohinan” poistaminen ja todellisten havaintojen esiinkaivaminen datamassoista.

Aamupäivän sessiossa käsiteltiin myös sitä, onko jonkin ominaisuuden stabiilius vai plastisuus tärkeämpi ominaisuus uuden lajikkeen menestymisen kannalta.

Päätössessiossa kuultiin arvokas puheenvuoro maailman ruokaturvan tärkeydestä (*J.D.H. Keatinge*). Istunnossa myös viimeisteltiin EU:lle annettavaa tarkentavaa julistusta, jossa määriteltiin CAP-uudistukseen ehdotettujen toimenpiteiden toimivuutta ja esitettiin kasviagronomisesti parempia toimintatapoja.

SCIENTIFIC PROGRAMME

Monday 20 August 2012

08:00	**Registration (every day)**	
10:00	**Opening session: Main auditorium (Iso Juhlasali), 2nd floor** Welcome: Fred Stoddard, President, ESA	
10:15	Jari Koskinen, Minister of Agriculture & Forestry, Finland	
10:45	Juha Helenius, deputy dean, Faculty of Agriculture & Forestry, University of Helsinki	
11:00	Jarmo Juga, head, Department of Agricultural Sciences, University of Helsinki	
11:15	Discussion document: A proposed declaration from the ESA Congress on the need for crop rotations to be properly recognized in the CAP. Discussion to be continued in the closing plenary.	
11:45	Other conference "housekeeping" business	
12:00	**Lunch**	
	Crop Modelling **Chair: Hartmut Stützel (Germany)** **Small auditorium (Small auditorium), 4th floor**	**Soils and soil-plant-(microbe) interactions** **Chair: Kristina Lindström (Finland)** **Hall 1, 2nd floor**
13:30	Böttcher, Ulf. Parameterisation of a phenological model of winter oilseed rape. ***131-1***	**Keynote:** Kirkegaard, John. Soil-plant interactions and Australia's conservation farming revolution: sense, nonsense and roots to success. ***132-1K***
13:45	Brunel-Muguet, Sophie. Sink strength for S as a major parameter to model vegetative growth in oilseed rape (*Brassica napus* L.) under contrasting sulfur (S) supplies, ***131-2***	
14:00	Neukam, Dorothee. A new approach for calculating stomatal resistance of wheat as a step towards dynamic simulation of canopy temperature. ***131-3***	Bertrand, Michel. WORMDYN : a dynamical model to predict earthworm populations and communities dynamics. ***132-3***
14:15	Vos, Jan. Explaining the yield advantage of wheat-maize intercropping from plant responses to available space using functional- structural plant modelling. ***131-4***	Manici, Luisa M. Exploitation of natural resources to increase soil health: BIO-INCROP, a project on organic fruit tree cropping systems. ***132-4***
14:30	Stella, Tommaso. A new generation of SUCROS-type models: an example for WOFOST and rice simulations. ***131-6***	Denoroy, Pascal. Change for 16 years of P status along soil profile in a French podzol in relation with different P fertilization under irrigated maize production. ***132-5***
14:45	Soufizadeh, Saeid. Developing algorithms for modelling the dynamics of N balance in maize in a gene-to-phenotype context. ***131-5***	Hussain, Qaiser. Methanogen archaeal and methanotroph bacterial communities dynamics in response to rice cultivars and linkage to CH_4 flux. ***132-2***
15:00	**Coffee**	

Monday 20 August 2012 continued

	Crop and systems modelling 1 **Chair: Niels Anten (Netherlands)** **Small auditorium, 4th floor**	**Yield gap assessment and reduction** **Chair: John Kirkegaard (Australia)** **Hall 1, 2nd floor**
15:30	Bassu, Simona. Uncertainties in Maize Crop Model Responses to Climate Factors. ***141-1***	**Keynote:** Slafer, Gustavo. Matching growth of wheat production and demand: shall we further increase yield potential or close the gap with actual yields? ***142-1K***
15:45	Maiorano, Andrea. Comparison of modelling approaches to simulate the phenology of agricultural insect pests under future climate scenarios***. 141-2***	
16:00	**Keynote:** Donatelli, Marcello. Estimating impact assessment and adaptation strategies under climate scenarios for crops in Europe. ***141-3K***	Van Wart, Justin. Review of agroecozones for use in yield gap analysis. ***142-2***
16:15		Hochman, Zvi. Yield Gap Analysis – what is the required spatial and temporal resolution for agronomic relevance? ***142-3***
16:30	Asseng, Senthold. A comparison of 27 wheat crop models for climate change impact: The AgMIP Wheat pilot study. ***141-4***	Pampolino, Mirasol. Yield gap reduction using Nutrient Expert recommendations for maize and wheat in Asia. ***142-4***
16:45	van Bussel, Lenny. Testing extrapolation domains of weather stations for modeling maize yields at continental and global scales. ***141-5***	Zingore, Shamie. Assessment of nutrient-induced maize yield gaps in smallholder systems in Africa. ***142-5***
17:00 – 18:00	ESA executive meeting (Hall 16) / Installation of posters in foyers	
18:15 – 20:00	University reception / Vice Rector, Professor Jukka Kola Lehtisali, 2nd floor	

Tuesday 21 August 2012

	Crop and systems modelling 2 Chair: Marcello Donatelli (Italy) Small auditorium, 4th floor	**Sustainable bioenergy cropping 1. Chair: Olaf Christen (Germany) Main auditorium, 2nd floor**
09:00	Anten, Niels. Why plants are not optimal for maximum production: a game theoretical analysis of plant traits. ***211-1***	**Keynote:** Thrän, Daniela. Sustainable bioenergy cropping. ***212-1K***
09:15	Nendel, Claas. The simulation of winter wheat yields in Thuringia, Germany, using meteorological data with different spatial resolution. ***211-2***	
09:30	Kupisch, Moritz. Analysis and modeling of spatio-temporal patterns of CO_2 and H_2O fluxes at leaf and canopy scale in crop fields. ***211-3***	Prade, Thomas. Industrial hemp (C*annabis sativa* L.) — a high-yielding energy crop. ***212-2***
09:45	Fayaud, Benoit. Early growth in intercrops: an experimental and simulation approach for a range of species under different sowing conditions. ***211-4***	Kenedy Etone, Epie. Intercropping Jerusalem artichoke (*Helianthus tuberosus* L.) with legumes for energy purpose. ***212-3***
10:00	Wallach, Daniel. Assessing the uncertainty in model-based evaluation of irrigation strategies. ***211-5***	Popp, József. The increasing competition for biomass. ***212-4***
10:15		Gaile, Zinta. Maize hybrids for biogas production in conditions of Latvia. ***212-5***
10:30	**Coffee**	
	Crop protection, allelopathy, and pesticide reduction 1 Chair: Heikki Hokkanen (Finland) Small auditorium, 4th floor	**Sustainable bioenergy cropping 2 Chair: Hannu Mikkola (Finland) Main auditorium, 2nd floor**
11:00	**Keynote:** Albajes, Ramon. Ecological footprint of agriculture and crop protection: analyzing environmental impacts of crop protection methods within an integrated framework. ***221-1K***	Christen, Olaf. Crop rotation affect GHG-balances and energy-balances of oilseed rape. ***222-1***
11:15		Ferchaud, Fabien. Water drainage and nitrate leaching under contrasted biomass crops. ***222-2***
11:30	Médiène, Safia. Temporary grasslands impact weed abundance and diversity. ***221-2***	Marrou, Helene. Producing food and electricity in the same system: experimental evidence of agrivoltaic system potential. ***222-3***
11:45	Doisy, Diana. Grassland canopies limit the replenishment of weed seed bank during seed rain. ***221-3***	Mastrorilli, Marcello. Sorghum productivity as a consequence of limited and waste water irrigation in Southern Italy. ***222-4***
12:00	Leclerc, Melen. An epidemiological modelling framework to help agronomists defining crop protection strategies – the risk of *R. solani* in sugar beet using biofumigation. ***221-4***	Dufossé, Karine. Effects of the removal of a 20-year old Miscanthus stand on GHG emissions, soil nitrate and carbon stocks. ***222-5***
12:15	Ruza, Antons. Development of winter wheat root and crown rot depending on soil tillage system and pre-crops. ***221-5***	Beaudoin, Nicolas. Dynamics of nitrogen uptake and remobilisation in *Miscanthus* x *giganteus* using ^{15}N-labelled fertilizer tracing. ***222-6***
	Lunch Foyers: Poster session 1	

Tuesday 21 August 2012 continued

	Crop protection, allelopathy, and pesticide reduction 2 **Chair: Sari Peltonen (Finland)** **Small auditorium, 4th floor**	**Crop adaptation to high latitudes** **Chair: Brian Fowler (Canada)** **Main auditorium, 2nd floor**
14:30	Valantin-Morison, Muriel. Sustainability performances of innovative cropping management systems for winter oil seed rape in multi-location trials. ***231-1***	**Keynote:** Peltonen-Sainio, Pirjo. Coping with the special features of the extreme northern corner of crop production. ***232-1K***
14:45	Métral, Raphaël. How to design and experiment new cropping systems with low pesticide inputs for perennial crops : framework development and application to vineyards. ***231-2***	
15:00	Fortino, Gabriele. Adapting DEXiPM model for *ex post* assessment of the sustainability of innovative cropping systems. ***231-3***	Nkurunziza, Libère. Model-based cultivar testing with genotype parameters and weather conditions. ***232-2***
15:15	Bankina, Biruta. Possibilities of integrated disease management for winter barley in Latvia. ***231-5***	Fogelberg, Fredrik. Introduction of soya bean (*Glycine max*) cropping to Sweden. ***232-3***
15:30	Duchovskiene, Laisvune. Control of the most widely spread cabbage pest in white cabbages. ***231-6***	Jokela, Venla. Effects of vernalization on freezing tolerance and canopy structure of timothy (*Phleum pratense* L.). ***232-4***
15:45	Discussion	Angulo, Carlos. Effects of weather data resolution on crop yield simulations when using different models – A case study in Finland. ***232-5***
16:00	**Coffee**	
	Field biodiversity **Chair: Muriel Valantin-Morison (France)** **Small auditorium, 4th floor**	**Resource use efficiency** **Chair: Roxana Savin (Spain)** **Main auditorium, 2nd floor**
16:30	Herzog, Felix. Biodiversity indicators for European farms. ***241-1***	**Keynote:** Foulkes, M. John. Increasing the efficiency of water and nutrient use of crops by exploitation of novel germplasm, traits and technologies. ***242-1K***
16:45	Bockstaller, Christian. Assessing the pollination value of field margin flora by means of a predictive indicator. ***241-2***	
17:00	**Keynote:** Ekbom, Barbara. How field biodiversity can enhance ecosystem services. ***241-3K***	Brunel-Muguet, Sophie. Effects of shading on biomass production and N-dynamics in winter oilseed rape (*Brassica napus* L.). ***242-2***
17:15		Gislum, Rene. The use of seed and straw N concentration to estimate NUE in perennial ryegrass for seed production – a case study from Denmark and New Zealand. ***242-5***
17:30	Wolfrum, Sebastian. Cost-efficiency of measuring earthworm diversity in a German case study at farm-scale: lessons for application in monitoring and agricultural practice. ***241-4***	Discussion
17:45	Lüscher, Gisela. Plant, earthworm, spider and bee diversity in agricultural fields of grazing and field crop farming systems in eight regions across Europe. ***241-5***	
18:00 – 19:30	Helsinki city reception Pohjoisesplanadi 11-13, one block south of the conference building	

Wednesday 22 August 2012

	Field trips and modelling course
	Free evening / Helsinki Festival

FIELD TRIPS

All depart from Senate Square at 0900 Wednesday 22 August. Don't be late, as Finns expect punctuality! There are soft drinks and light snacks available on the buses and every trip includes lunch. All tickets for trips 1 and 2 have been sold. Tickets for trip 3 may still be bought from the registration desk on Monday.

1. Mixed farming and organic systems, Mikkeli region, South Savo.

First stop is the mixed livestock and arable farm of Jari Leppä near Pertunmaa (http://www.antinmaentila.fi.) You will stop for a grand buffet lunch at Tertin Kartano (http://www.tertinkartano.fi). Near Juva, you will visit Ali Ronkainen's organic farm (http://www.hayrila.fi). The return journey will take a different route through Kouvola. Expected return time around 9 p.m.

2. Visit to Agrifood Research Finland MTT and Boreal Plant Breeding, Jokioinen.

The first stop is Boreal Plant Breeding Ltd (http://www.boreal.fi/), who will provide coffee before you are shown around the facilities and the field experiments. Lunch will be in the Ometta restaurant on MTT land. After lunch, the group will visit the field experiments of MTT (http://portal.mtt.fi) to see aspects of crop cultivation in Nordic conditions and experiments on crop protection for crop rotation and conservation tillage measures. On the return journey, if time permits, you will stop at a farm in Hyvinkää where nutrient recycling is practiced. Expected return time around 8 p.m.

3. Visit to the University of Helsinki's campus at Viikki.

You will see some of the facilities of the Department of Agricultural Sciences, including experiments on biochar, allelopathy, rotations, and intercropping. We will go for a walk through the arboretum and natural area on the edge of Viikki Bay. Lunch at Gardenia, (http://www.gardenia-helsinki.fi/lounaslista.htm) where there is also a tropical greenhouse. Expected return time 1.30 p.m.

Modelling course

Auditorium II, near the Main auditorium

Thursday 23 August 2012

08:00 – 08:45	**The Worldwide "Farming Systems Design" initiative. Chair: Jacques Wéry (France) Main auditorium, 2nd floor**		
	Crop stress response 1 Chair: Krystyna Rykaczewska (Poland) Small auditorium, 4th floor	**Legume-supported rotations 1. Chair: Donal Murphy-Bokern (Germany) Hall 1, 2nd floor**	**Farming systems design 1. Chair: Jacques Wéry (France) Main auditorium, 2nd floor**
09:00	Benoît, Marc. Global climate changes and local changes in cropping systems: cropping system calendar changes in Lorraine (France) due to climate changes. ***411-1***	Justes, Eric. Cover crops are worthwhile in grain legume based rotation to valorise the biological N_2 fixation and concomitantly maintain soil fertility. ***412-1***	**Keynote:** Tittonell, Pablo. Supporting design and co-innovation in farming systems - Actors, agroecological knowledge and landscape functions. ***413-1K***
09:15	Durand, Jean-Louis. CLIMAGIE: A French INRA project to adapt grasslands to climate change. ***411-2***	Baddeley, John. Assessing the role of cereal-legume intercrops in low-input rotational cropping systems. ***412-2***	
09:30	Tokatlidis, Ioannis. Adapting maize crop to climatic changes. ***411-3***	**Keynote:** Watson, Christine. Legume-supported crop rotations: A European perspective. ***412-3K***	Stobart, Ron. Farming systems research; evaluation of current practice and the development of novel approaches within UK systems. ***413-2***
09:45	Oosterhuis, Derrick. Heat stress-induced limitations to reproductive success in cotton. ***411-4***		Nesme, Thomas. Phosphorus flows, mineral fertilizer use and agricultural production systems: a regional perspective for France. ***413-3***
10:00	Khazaei, Hamid. Leaf temperature as a promising tool for evaluating drought adaptation in faba bean (*Vicia faba* L.). ***411-5***	Reckling, Moritz. Assessing the economic and agronomic potential of legume-supported crop rotations across Europe using a crop rotation generator. ***412-4***	Nowak, Benjamin. To what extent does organic farming depend on artificial fertilizers? ***413-4***
10:15	Discussion	Pelzer, Elise. Combining high yields and margins and low environmental impacts is possible with cereal-legume mixture. ***412-5***	Colbach, Nathalie. Changing agricultural practices modifies the species and trait composition of the weed flora. A simulation study using a cropping system model. ***413-5***
10:30	**Coffee**		

Thursday 23 August 2012 continued

	Crop stress response 2. **Chair: José Paulo de Melo e Abreu (Portugal)** **Small auditorium, 4th floor**	**Legume-supported rotations 2.** **Chair: Jaume Lloveras (Spain)** **Hall 1, 2nd floor**	**Farming systems design 2.** **Chair: Pablo Tittonell (Netherlands)** **Main auditorium, 2nd floor**
11:00	**Keynote:** Fowler, D. Brian. Low-temperature stress in cereals: know the land - know your crop. ***421-1K***	Pappa, Valentini. Nitrous oxide emissions of legume based agricultural systems in Europe. ***422-1***	Keskitalo, Marjo. Diversification of crop production through crop rotations. ***423-1***
11:15		Iannetta, Pietro. A nitrogen-budget analysis of legume supported cropping systems from across Europe. ***422-4***	Xiao, Ying. Modeling the spatial distribution of cropping systems at a large regional scale: a case of crop sequence patterns in France between 1992 and 2003. ***423-2***
11:30	Pecio, Alicja. Selection of spring barley lines with respect to drought stress resistance. ***421-2***	Mikic, Aleksandar. Modelling mutual annual legume intercrops for forage production. ***422-5***	Lopez-Ridaura, Santiago. Participatory design and evaluation of durum wheat - legume intercropping systems in Camargue, South of France. ***423-3***
11:45	Kettlewell, Peter. Mitigating drought stress in wheat with polymer sprays. ***421-3***	Cupina, Branko. Field pea companion crop in sainfoin establishment. ***422-6***	Thiollet-Scholtus, Marie. Farming system design explain successful or unsuccessful vineyards, a global method. ***423-4***
12:00	Siebert, Stefan. Impact of heat stress, drought and wetness on crop yield anomalies in Germany. ***421-5***	Discussion	Merot, Anne. Up-scaling from field to farm scale: analysis of the conversion pathways to organic farming to support farmers Application to vineyard systems. ***423-5***
12:15	Mohammady, Shahram. Inheritance of carbon isotope discrimination in wheat (*Triticum aestivum* L.). ***421-4***		Perrin, Aurélie. Agronomical analysis of Life-Cycle Impact Assessment (LCIA) variability for different horticultural cropping systems at regional scale. ***423-6***
12:30	**Lunch** **Foyers: Poster session 2**		

Thursday 23 August 2012 continued

	Crop stress response and mitigation. Chair: Mervi Seppänen (Finland) Small auditorium, 4th floor	**Cropping systems design. Chair: Evelin Loit (Estonia) Hall 1, 2nd floor**	**Energy efficiency and environmental impacts of cropping systems 1. Chair: Marc Benoît (France) Main auditorium, 2nd floor**
14:30	Bandiera, Marianna. Roots as interface between crops and metal-polluted soils in phytoremediation. ***431-1***	Bedoussac, Laurent. Is intercropping an efficient solution to design low input systems? ***432-1***	**Keynote:** Pointereau, Philippe. Energy efficiency in cropping, including tillage systems. ***433-1K***
14:45	Bertholdsson, Nils-Ove. Use of leaf fluorescence and hydroponics for screening of waterlogging tolerance in barley. ***431-2***	Landé, Nathalie. Multi-targeted assessment of reduced tillage cropping systems for the close future in European agriculture. ***432-2***	
15:00	Schillinger, William. Winter wheat seedling emergence from the world's deepest sowing depths. ***431-3***	Wery, Jacques. Indicating processes and performances of agrosystems : a framework based on a conceptual model and its use in vineyards fields. ***432-3***	Topp, Kairsty. An assessment of UK agriculture: emergy analysis. ***433-2***
15:15	**Keynote:** Villalobos, Francisco. Avenues for improving the productivity of irrigation at different scales. ***431-5K***	van der Werf, Wopke. Effectiveness of intercropping for plant disease suppression – a meta-analysis. ***432-4***	Sattari, Sheida. Residual soil phosphorus substantially decreases global P fertilizer requirements. ***433-4***
15:30		Colnenne-David, Caroline. New cropping systems under environmental constraints: First results of ex post assessment. ***432-5***	Burchill, William. Nitrous oxide emissions from white clover based grassland used for dairy production under moist maritime climatic conditions. ***433-5***
15:45	Zavareh, Mohsen. Exogenous applied nitric oxide alleviates salt-induced oxidative stress in rice (*Oryza sativa* L.). ***431-4***	Biau, Anna. Effect of residue management and nitrogen fertilization on maize production. ***432-6***	Vasenev, Ivan. Agroecosystem land quality and services analysis at the Central region of European territory of Russia. ***433-3***
16:00	**Coffee**		

Thursday 23 August 2012 continued

	Modelling in changing environments. **Chair: Jouko Kleemola** **Small auditorium, 4th floor**	**Management of novel crops, including cover/catch-crop systems.** **Chair: Elizabeth Stockdale (UK)** **Hall 1, 2nd floor**	**Energy efficiency and environmental impacts of cropping systems 2.** **Chair: Felix Herzog (Switzerland)** **Main auditorium, 2nd floor**
16:30	de Melo e Abreu, José Paulo. Predicting olive phenology in Portugal in a warming climate. ***441-1***	Justes, Eric. Simulation of catch crop efficiency to decrease nitrate leaching under various French pedoclimatic conditions using the STICS soil-crop model. ***442-2***	Pulkkinen, Hannele. Climate impacts of Finnish crops – a national method to estimate nitrous oxide emissions. ***443-1***
16:45	Cappelli, Giovanni. Simulation of climate change impacts on rice yield and pre-harvest quality in Latin America. ***441-2***	Vos, Jan. Challenges in developing tef (*Eragrostis tef* (Zucc.) Trotter) for temperate climates. ***442-3***	Fischer, Jenny. On-farm evaluation of nitrogen leaching rates from organic crop rotations under consideration of the previous crop, with special emphasis on legumes. ***443-2***
17:00	Delmotte, Sylvestre. Transition toward organic agriculture: using an agent-based model to assess with farmers possible trajectories of conversion. ***441-3***	Florio, Giulia. Production of *Arundo donax* L. and *Miscanthus* x *giganteus* Greef et Deu. to obtain second generation ethanol in two Italian environments. ***442-4***	Goglio, Pietro. Contribution analysis of reactive Nitrogen to N fertilizer application impacts in two different cropping system managements. ***443-3***
17:15	Bergez, Jacques-Eric. Record: an integrated platform for agro-ecosystems study. ***441-4***	Manderscheid, Remy. Free air CO_2 enrichment effects on canopy development and biomass production of different sorghum-genotypes as compared to maize. ***442-5***	Kersebaum, Kurt Christian. Model based assessment of agri-environmental measure effects concerning the reduction of nitrogen pollution regarding the Water Framework Directive. ***443-4***
17:30	Ben Touhami, Haythem. Bayesian calibration of the Pasture Simulation Model (PaSim) to simulate Swiss grasslands under climate extremes. ***441-5***	Fauquet-Alekhine-Pavlovskaya, Elena. Agronomic test of fenugreek as alternative crop. ***442-1***	Bienkowski, Jerzy Franciszek. The importance of changes in dietary habits of Poland's inhabitants in reducing greenhouse gas emissions. ***443-5***
19:00 – 24:00	Conference dinner: Ravintola Sipuli Kanavaranta 7, about 500 m east of the conference building		

Friday 24 August 2012

09:00 – 10:00	**ESA general assembly. Main auditorium. Chair: Jacques Wéry (France)**	
10:00	**Coffee**	
	Omics in crop sciences. Chair: John Foulkes (UK) Small auditorium, 4th floor	**Farming systems design 3. Chair: Christine Watson (UK) Main auditorium**
10:30	**Keynote:** Tardieu, Francois. Plant Phenotyping, a new field and opportunity for crop scientists. ***521-1K***	Rossing, Walter. Designing research projects for impact on stakeholders: an analysis of the co-innovation approach in EULACIAS. ***522-1***
10:45		Birman, Delphine. Using local knowledge to assess ecological services in complex agricultural system at the landscape level. ***522-2***
11:00	Singh, Jaswinder. Barley genomics with maize Ac/Ds transposons. ***521-2***	Groot, Jeroen. The COMPASS framework – Navigating agricultural landscapes for science-based innovation. ***522-3***
11:15	Uppal, Rajneet. Effect of wheat dwarfing alleles on grain yield and quality. ***521-4***	Mandryk, Maryia. Assessing farmers' objectives: implications for adaptation. ***522-4***
11:30	Al-swedi, Fadil. Micro propagation and genetic transformation in *Brassica oleracea* var. *botrytis*. ***521-5***	Debolini, Marta. Factors affecting soil organic matter conservation in Mediterranean hilly cropping systems: a case study on 43 cropping systems in Tuscany (Italy). ***522-5***
11:45		Murphy-Bokern, Donal. The agri-environmental implications of food choices. ***522-6***
12:00	**Lunch**	
	Closing plenary session: Main auditorium Chair: Fred Stoddard (Finland)	
13:00	**Keynote:** Keatinge, J.D.H (Dyno). Climate uncertainty: What response is needed from vegetable agronomists worldwide?	
13:30	ESA future activities Division 1: Plant system biology; the cultivated plant in the field. Division 2: Field scale agroecology; the cultivated field as an ecosystem. Division 3: Cropping systems at the farm, regional and global scales; the cropping system in its embedding system Interactions with other groups such as Farming Systems Design	
14:15	Finalizing the proposed declaration from the ESA Congress on the need for crop rotations to be properly recognized in the CAP.	
14:45	Final words from the retiring president. Fred Stoddard. Welcome to the next congress. András Nábradi (Hungary). Farewell	

Effect of the mother tiller type in the first cut on the leaf appearance of regrowth tillers in timothy

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Keywords development, leaf appearance, *Phleum pratense* L., regrowth

Introduction

Timothy (*Phleum pratense* L.) is a common forage species in the boreal areas. In silage swards, individual tillers are defoliated at several developmental stages, since the herbage is allowed to grow longer than in pasture swards. This can lead to variation in the growth processes during regrowth. The processes of primary growth of grasses are relatively well documented, but for the regrowth, the most important developmental events are not described in same precision. In our study, we aimed to clarify the processes of summer regrowth in the tiller level in timothy grown for silage. We hypothesized that the developmental stage of the tiller during the first cut (i.e. mother tiller type) affects the development of its regrowth tillers. Here, we report results for phyllochron and the number of living leaves per tiller.

Materials and methods

This study was conducted on two typically managed field experiments with timothy (cv. Tammisto II) in three replicates during 2006 – 2009 at MTT Agrifood Research Finland, Maaninka. Levels of N, P and K fertilization were typical to the region and no irrigation or plant protection was used. Each year, cuts were taken in late June and in late August. The effective temperature sum above 0ºC (ºCd) in regrowth was calculated using ºCd of first cut as zero point. Each year, tillers for measurements in the regrowth were marked before the first cut and for taking the effect of mother tiller type into account, they were determined as A) vegetative (VEG): pseudostem and leaves; B) elongating vegetative (ELONG): leaves and true stem; C) generative (GEN): leaves, true stem and an inflorescence. Regrowth of tillers was measured approximately once a week for 8–10 weeks. Data was used for calculating the maximum number of living leaves per tiller and the phyllochron, and the effect of mother tiller type on these parameters was analyzed having year, tiller type and year × tiller type –interaction as fixed effects using the Mixed procedure of SAS 9.2.

Results and Discussion

As the regrowth habit of timothy is clonal, the tillers in the same plant have similar genetic performance (Doust, 2007). Nevertheless, the mother tiller effect was clear only for the maximum number of living leaves per tiller, as VEG and GEN mother tillers promoted the maximum leaf number in the regrowth tillers and differed from ELONG mother tillers (Table 1). For GEN this could be explained either by inherited superiority or larger carbohydrate reserves, while for VEG by the intactness and rapid recovery of the apical meristems after the cut. Compared to grazing experiments (Lardner *et al.* 2002), the average numbers of living leaves per tiller and the variation in their count were greater in this study, which is perhaps because we observed the regrowth for a longer time.

There was no effect of mother tillers on phyllochron i.e. leaf appearance rate, although we have found that the total tiller appearance and survival rate after the cut can be promoted by ELONG and GEN mother tillers (Pakarinen *et al.*, 2011). In contrast to tillering in regrowth, leaf appearance may be more strongly regulated by environmental conditions.

Conclusions

The number of living leaves per tiller in the regrowth of timothy was promoted by both vegetative and generative mother tillers compared to elongating vegetative mother tillers. Phyllochron was affected more by environmental conditions than the type of mother tiller.

References

Doust, A. N. 2007. Grass architecture: genetic and environmental control of branching. Current Opinion in Plant biology 10: 21-25.

Lardner, H., Wright, S., Cohen, R. 2002. Leaf development of eight grass species following grazing. Canadian Journal of Plant Science 82:747-750.

Pakarinen, K., Virkajärvi, P., Hyrkäs, M. 2011. The developmental stage of the tiller in the first cut predicts the success of regrowth tillers in timothy and tall fescue. Proceedings of the British Grassland Society 10th Research Conference pp. 17-18.

Table 1. Effect of the type of mother tiller (vegetative, VEG; elongating vegetative, ELONG; generative, GEN) on the maximum number of living leaves per tiller and phyllochron of regrowth tillers in timothy during four growing seasons.

Type of mother tiller	Regrowth year	Maximum number of living leaves per tiller in regrowth	Phyllochron (°C) in regrowth	*n*
VEG	2006	4.8	167	8
	2007	3.0	154	2
	2008	3.7	135	3
	2009	4.0	178	1
	weighted mean	***4.2***	***159***	
ELONG	2006	.	.	0
	2007	3.5	138	4
	2008	2.8	127	4
	2009	4.1	129	11
	weighted mean	***3.7***	***130***	
GEN	2006	.	.	0
	2007	5.0	122	7
	2008	4.6	114	5
	2009	4.6	136	11
	weighted mean	***4.7***	***127***	
	SEM	4.64	34.9	
	***p*-values**			
	year	0.16	0.43	
	tiller type	**0.006**	0.20	
	year × tiller type	0.50	0.83	

Effect of the mother tiller type in the first cut on the leaf appearance of regrowth tillers in timothy

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Introduction

- In silage swards, individual tillers are defoliated at several developmental stages in contrast to pastures, possibly leading to variation in the growth processes during regrowth
- We aimed to clarify the processes of regrowth in the tiller level in timothy grown for silage
  - Hypothesis: the developmental stage of the tiller during the first cut (i.e. mother tiller type) affects the development of its regrowth tillers

Materials and Methods

- Two typically managed field experiments with timothy (*Phleum pratense* L., cv. Tammisto II) at MTT Agrifood Research Finland, Maaninka (63° 10'N, 27° 18'E) during 2006–2009
- Each year, cuts were taken in late June and in late August
- Effective temperature sum above 0°C (°Cd) in regrowth calculated using °Cd of first cut as zero point
- Tillers for measurements in the regrowth were marked before the first cut and for taking the effect of mother tiller type into account, they were determined as
  - vegetative (VEG): pseudostem and leaves
  - elongating vegetative (ELONG): leaves and true stem
  - generative (GEN): leaves, true stem and an inflorescence
- Regrowth of tillers was measured approximately once a week for 8–10 weeks

Results and Discussion

- Maximum number of living leaves per tiller was affected by mother tiller type (p 0.006**) as VEG and GEN mother tillers promoted the maximum leaf number in the regrowth of their daughter tillers (Figure 1.)
  - In daughter tillers of a GEN mother, this could happen because of inherited superiority or larger carbohydrate reserves
  - In daughter tillers of a VEG mother, this might be because of the intactness and rapid recovery of the apical meristems after the cut

- Phyllochron (i.e. leaf appearance) was not affected by mother tiller type, and may be more strongly regulated by environmental conditions than by genotype

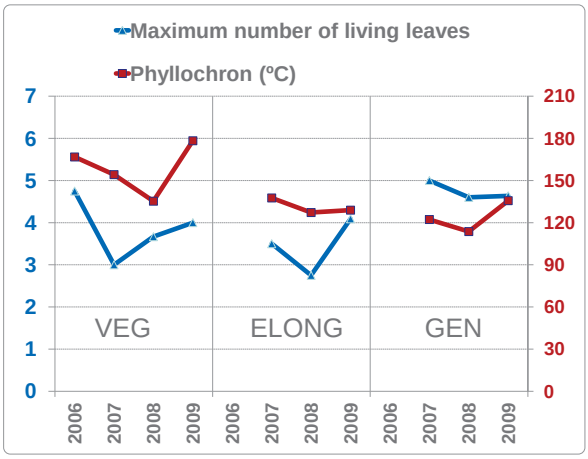

Figure 1. Effect of the type of mother tiller (vegetative, VEG; elongating vegetative, ELONG; generative, GEN) on the maximum number of living leaves per tiller and phyllochron of regrowth tillers in timothy during four growing seasons.

Conclusions

- **The number of living leaves per tiller in the regrowth of timothy was promoted by both vegetative and generative mother tillers compared to elongating vegetative mother tillers.**
- **Phyllochron was affected more by environmental conditions than the type of mother tiller.**

Development and validation of practical methods for the determination of dry matter yield in grass silage swards

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Keywords: dry matter yield, methods of measuring, silage stage, sward

Introduction

Information of dry matter yield (DMY) would give the farmer a conception of yield potential of the whole farm and of each plot. In the long run, it could aid the farmer to find sites with weak performance, so that the use of input goods (e.g. fertilizers, seed) and more pronounced improvements may be allocated optimally. Weighing the harvested material is an accurate method to determine DMY, but does not allow for information on DMY of standing swards and is seldom site-specific.

Tools like disk meter, capacitance meter and sward stick are available for on-field determination of DMY. Primarily they are designed and satisfactorily validated for pastures. None of these tools can measure DMY of lodged, low-density or highly stem containing swards accurately. In aftermath vegetation they can give reliable results. (Virkajärvi, 1999.)

The aim of this study in KARPE-project was to prepare an easy-to-apply and practical methodology which can produce a satisfactory result about DMY in timothy-meadow fescue swards at silage stage.

Materials and Methods

The study comprised of four phases: A) testing of several methods under field and experimental plot conditions; B) evaluation of the practicability and the accuracy of these methods in determining DMY; C) preparation of a methodology based on the best methods; D) validation of the new methodology.

During phase A, the methods tested in timothy-meadow fescue swards were: photography of the sward; measurement of the average stretched total height (cm); visual observation of density and lodging; determination of the volume of herbage per defined area (dm^3 m^{-2}); sampling with a cutting frame, weighing and drying of the herbage. In phase B, the most practicable and rapid methods were chosen based on experiences of the workers and, evaluated for accuracy in determining DMY by (e.g. analysis of regression). In phase C, a data set (n = 202) of average stretched total height and DMY from nine different plot-scale experiments was used to create a regression model (regression of random coefficients, Proc MIXED in SAS 9.2). For the farm-scale model, the level of DMY was slightly decreased and the effect of sward density was incorporated into the model. For phase D, the preliminary methodology was tested for accuracy under field conditions.

Results and Discussion

From the methods tested in phase A, sampling with a cutting frame, weighing and determining of DM content was found to be an accurate but laborious method. The average stretched total height explained well the DMY (Figure 1a), especially in the first harvest, and the measurement was easy enough to perform on farm conditions. Other methods were not accurate for DMY determination.

The farm-scale model with the integrated effect of density and the lower DMY level (Figure 1b) proved to be sufficiently accurate under real on-farm conditions. A guideline based on this methodology was published in the Internet to be available for farmers.

It is assumed that in the future, attributable to new environmental legislation, farmers will be obligated to calculate the nutrient cycles and nutrient use efficiencies of swards for each field plot in detail. The information of DMY is a key factor to do this accurately. We are developing the model for better accuracy and the guideline produced in KARPE-project may act as one tool to determine DMY of standing swards.

Conclusions

Combining the measurement of average stretched total height and the density of the sward had a good correlation with dry matter yield, especially during the first harvest of timothy-meadow fescue silage swards. In addition, these measurements were easy to perform under farm conditions. A guideline based on this methodology was created, validated and published for practical use.

References

Virkajärvi, P. 1999. Comparison of three indirect methods for prediction of herbage mass on timothy-meadow fescue pastures. *Acta Agriculturae Scandinavica, Section B Soil and Plant Science* 49:75–81.

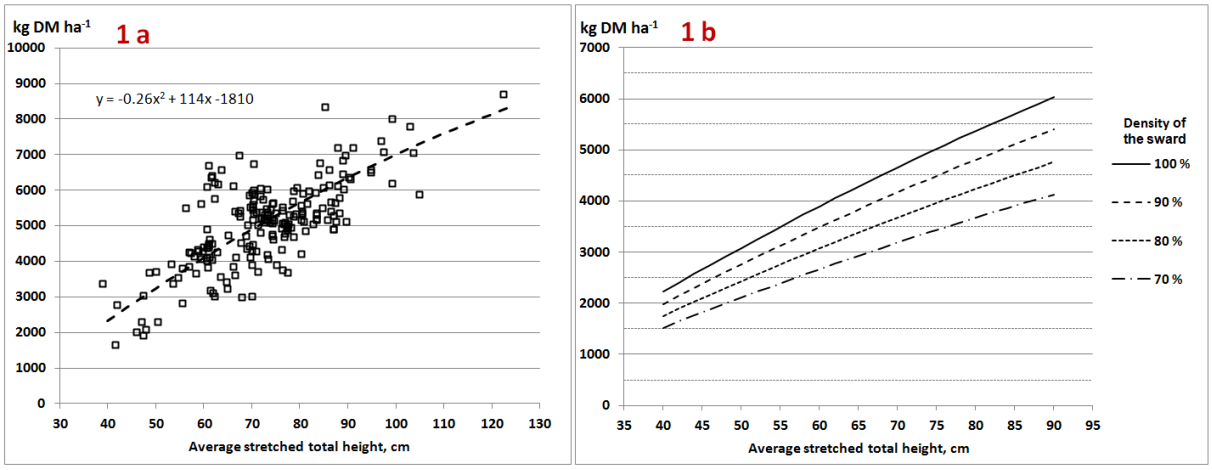

Figure 1a. Relations of average stretched total height (cm) and dry matter (DM) yield (kg DM ha^{-1}) in timothy-meadow fescue swards in experimental plots. **1b**. The modified model for practical farm-scale use.

Development and validation of practical methods for the determination of dry matter yield in grass silage swards

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Introduction

- Information of dry matter yield (DMY) gives a farmer a conception of yield potential of the whole farm and of each field plot
- Most measuring tools do not work well in lodged, low-density or highly stem containing swards
- Aim of this study in KARPE-project: to prepare an easy-to-apply and practical methodology for DMY measurement for timothy-meadow fescue swards at silage stage

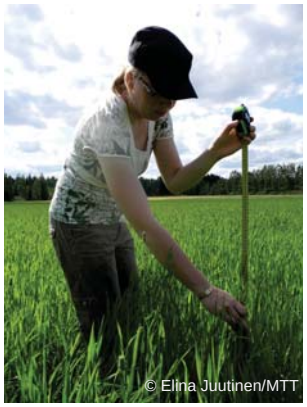
Materials and Methods

A) Testing of several methods under field and experimental plot conditions
- photography of the sward
- measurement of the average stretched total height (cm)
- visual observation of density and lodging
- determination of the volume of herbage per defined area ($dm^3\ m^{-2}$)
- sampling with a cutting frame, weighing and drying of the herbage

B) Evaluation of practicability and accuracy of the methods in determining DMY

C) Preparation of a methodology based on the best methods

D) Validation of the new methodology



Results and Discussion

- Best rated methods according to their accuracy and practicability
  - Measurement of the average stretched total height (cm) – accurate and practicable
  - Sampling with a cutting frame, weighing and drying of the herbage – accurate, but laborious
  - Others were not accurate enough

- **Regression model (Figure 1a):** Relations of average stretched total height and DMY with a data set ($n = 202$)

- **Farm-scale model (Figure 1b):** Regression model with the effect of density and the lower DMY level
  - Proved to be sufficiently accurate under real on-farm conditions
  - An advisory guideline created and published for use at www.mtt.fi/artturi

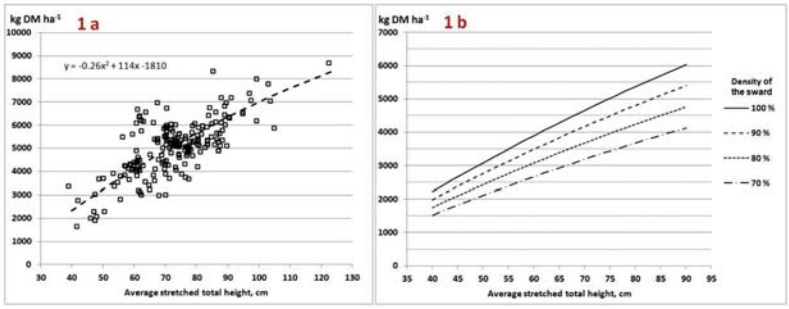


Figure 1a. Relations of average stretched total height (cm) and dry matter (DM) yield (kg DM ha^{-1}) in timothy-meadow fescue swards in experimental plots. **1b.** The modified model for practical farm-scale use.

- In the future, farmers may be obligated to calculate the nutrient cycles and nutrient efficiencies of each field plot. The information of DMY is a key factor to do this accurately. The guideline produced in KARPE-project may act as one tool to determine DMY of standing swards.

Conclusions

- Combining the measurement of average stretched total height and the density of the sward had a good correlation with dry matter yield, especially during the first harvest of timothy-meadow fescue silage swards. In addition, these measurements were easy to perform under farm conditions.
- A guideline based on this methodology was created, validated and published for practical use.

KARPE-project and this study was financed by the EU Rural Development Programme for Mainland Finland, www.rural.fi

The European Agricultural Fund for Rural Development: Europe investing in rural areas

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