Near Infrared Spectroscopy (NIRS) for Screening Sainfoin Germplasm

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INTRODUCTION:

Sainfoin (*Onobrychis viciifolia*) **is a valuable feed for horses, deer, elk, cows, sheep and goats – and it is an excellent nectar and pollen source for bees.[1]** Tannins are its active compounds that ensure that ruminants do not bloat when grazing sainfoin and that its protein is used efficiently.[2] Sainfoin tannins also act as nematicidal drugs against parasitic worms.[2] Moreover, research has shown that urinary nitrogen emissions are significantly reduced and this leads to less NO_x greenhouse gas emissions.[3] Sainfoin tannins may also have potential for reducing methane emissions from ruminants. **Here we report the development of NIRS calibrations for a sainfoin germplasm collection which is grown at NIAB as part of the European *HealthyHay* project.**

OBJECTIVE:
Develop a screening tool for rapidly quantifying the nutritional, botanical, biological parameters in this forage by NIRS.

MATERIAL AND METHODS

A Foss NIRSystems 5000 instrument was used to develop NIRS calibrations for sainfoin. The NIRS models used modified partial least squares (MPLS). The mathematical treatment consisted of derivative 1, gap 4, first smooth 4, second smooth 1 options. Calibrations are based on results from *HealthyHay* partners covering several parameters :

➤ **Nutritional parameters**: Kjeldahl nitrogen, dry matter, ash, neutral detergent fibre, acid detergent fibre, total water soluble carbohydrates, gross energy and condensed tannins.

➤ **Tannin properties**: thiolytic degradation (% prodelphinidin content, % *trans* units; mean polymer size) ; HCl-butanol tannin contents

➤ **Biological parameters**: *in vitro* gas production, enzymatic digestibility, nematicidal scores.

➤ **Botanical parameters**: Scores for survival, plant height and weight, stem thickness, colours of flowers, leaves and stems, lengths of inflorescence, leaves or stems, number leaflets and stems, regrowth vigour, habit, soil cover, flowering dates, *Fusarium* and mildew resistance.

Figure 1. Sainfoin NIR spectrum showing typical overtone and combination vibrations
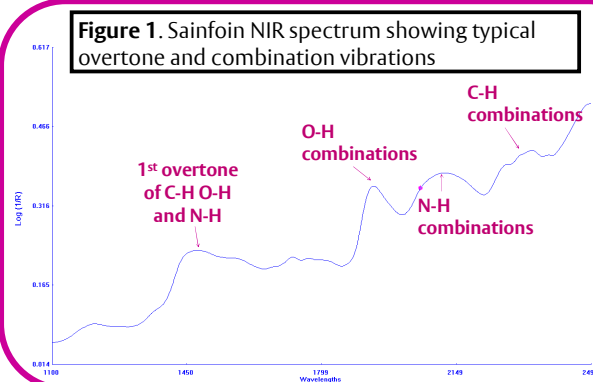
RESULTS

➤ **NIR equations were developed for tannin properties.**

➤ **NIRS can predict surprisingly different properties of sainfoin plants** (*e.g.* botanical parameters).

Figure 2: Measured and predicted tannin contents in the NIAB sainfoin germplasm collection
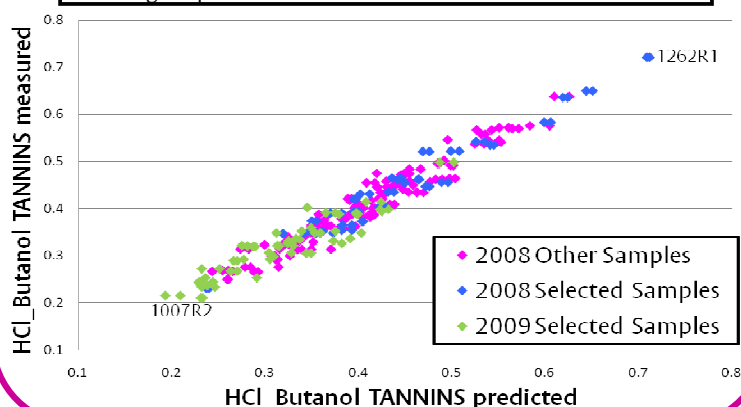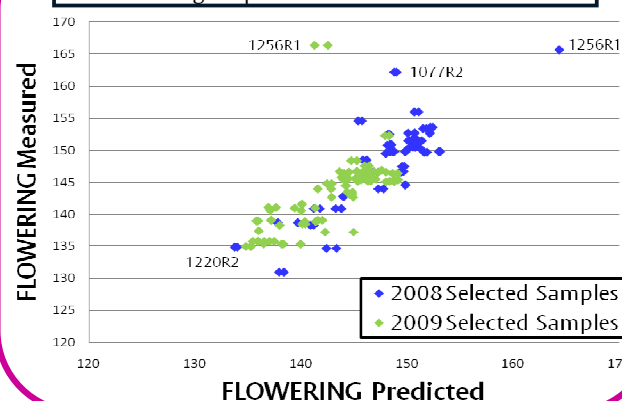

Figure 3: Measured and predicted flowering in the NIAB sainfoin germplasm collection

THE FUTURE

➤NIR instruments of 3 EU partners will be cloned. This will allow the NIR data and equations to be shared within the *HealthyHay* project.
➤Development of more robust sainfoin calibration equations will require analysis of more samples from different years and regions.

REFERENCES [1] Mueller-Harvey 2009 *Biologist* 56, 22-27.; [2] Mueller-Harvey 2006 *J Sci Food Agr* 86, 2010-2037; [3] Theodoridou *et al* 2010 *Anim Feed Sci Technol* (*accepted*)