



## Cover page

- Name: Valentin D. Picasso
- Subject title of the research fellowship: “Intermediate wheatgrass – developing a resilient perennial grain and forage crop for Sweden”
- Theme and number: “managing natural capital” (#1)
- Host institution: Swedish University of Agricultural Sciences (SLU)
- Host collaborator name: Elisabet Nadeau
- Fellowship dates: 22/08/2022- 13/02/2023 (25 weeks)
- I consent that this report is posted on the Co-operative Research Programme’s website.



## 1. What were the objectives of the research project? Why is the research project important?

Developing perennial grain and forage systems can transform the relationship between humans and the environment by providing food and other ecosystem services like carbon sequestration, nutrient retention, and biodiversity habitat. Intermediate wheatgrass (IWG) is the first perennial grain and forage crop in the world. Sweden and US have pioneered IWG research. However, if Sweden is to become a major IWG producer farmers' issues need to be investigated, including harvesting, forage value, grain yield, and germplasm adaptation. It is also necessary to explore the motivations and barriers from farmers, industries, consumers, and policy makers for expanding IWG. This fellowship will focus on developing a transdisciplinary international team of natural and social scientists, farmers, and industry partners to assist the transition to sustainable and commercially feasible IWG systems in Europe.

Before a large transition to perennial cereal crops can materialize, more research is needed on improved breeding and management of perennial grain and forage crops. Basic agronomic practices, such as optimal harvest systems, intercropping with legume species, and adaptation of germplasm to different cropping systems are not developed for northern Europe, including Sweden. Farmers who are currently growing IWG in the USA identified knowledge gaps on harvest and establishment methods, organic management guidelines, and persistence of grain yields over time (Lanker et al., 2018). The first aim of this project is to initiate research on best management practices for IWG perennial grain and forage in order to properly integrate it into Swedish crop and livestock systems. Furthermore, good ideas are not always adopted, especially if they challenge powerful interests and deep path dependency. In order to successfully achieve a “perennial revolution” in agricultural systems, the second aim of this project is to understand the social, economic, and political opportunities and barriers for a widespread adoption of novel perennial grain and forage crops.

## 2. Were the objectives of the fellowship achieved?

The objectives were achieved. A transdisciplinary international team of natural and social scientists, farmers, and industry partners was convened, to assist the transition to sustainable and commercially feasible IWG systems in Europe. As a result, two research grants were submitted (and awarded) on this topic, and an international conference was held in Sweden.

Research on best management practices for IWG perennial grain and forage was initiated in multiple experimental stations from SLU, near Skara, Alnarp, Uppsala, and Umeå. This research will continue over at least three years with funding from the research grants awarded. Research on the social, economic, and political opportunities and barriers for a widespread adoption of novel perennial grain and forage crops is ongoing in collaboration with Lund University.

## 3. What were the major achievements of the fellowship? (up to three)

1. Two research projects were written, submitted and granted as a result of this fellowship: VIKING (Nordforsk) and Intermediate wheatgrass (SLF).

- VIKING: The project Validating the Introduction of Kernza Intermediate wheatgrass in the Nordic-Baltic region was submitted and funded by Nordforsk ([www.nordforsk.org/](http://www.nordforsk.org/)). This is a 4-year project, led by the Swedish University of Agricultural Sciences (SLU) with co-applicants from Norway, Finland, Denmark, Estonia, Lithuania, and the USA. The aim of this project is to develop a strong research platform for perennial cereal production systems in the Scandinavian and Baltic countries. The platform will deliver scientific knowledge serving stakeholders along the entire value chain, from policy makers and authorities, through advisors and extension services to individual farmers and representatives from the food industry. The project will research the adaptation and potential of grain and forage production and quality of Kernza across the Nordic and Baltic region. Our research will test a range of agronomic management questions including benefits of intercropping with legumes, optimal N fertilisation, and optimal harvest schedule for forage, and climate impact. Grain and forage quality will be assessed to inform on the potential and suitable usages of the products. We will engage an international network of diverse stakeholders





including farmers, food industry, advisors, and policy makers to explore the feasibility of this new crop in the region. Field experiments and demonstration sites will serve as inspiration and information transfer places. More specifically, our objectives are to establish field experiments in each of the partner and collaborating countries in order to assess the productivity, the winter hardiness, and climate impact, under different management regimes and in relation to local growing conditions. The knowledge and experiences will be shared with other researchers and non-academic stakeholders, with special attention to the Scandinavian and Baltic countries.

- The SLF (Swedish farmers' foundation for agricultural research) project titled: "Alternative perennial forage in dairy, beef, and lamb production in a changing climate" was submitted and granted. Climate change is increasing the frequency and intensity of droughts and excessive rainfall, which challenge forage production for livestock industry. Intermediate wheatgrass, a grass resistant to both drought and heavy rainfall, has recently been introduced in Sweden as a perennial forage and grain crop. The aim of the project is to develop recommendations for nitrogen (N) fertilisation level, harvest timing and silage conservation of IWG for optimum forage yield and feed value for agricultural production animals. The goal is to demonstrate competitive forage yields while the feed quality is adapted to the animals' needs. Experiments are being established in Rådde, Umeå, Alnarp, and Uppsala to study Kernza intermediate wheatgrass forage potential in the distinct Swedish environments.

2. The "Perennial grains in Europe" international conference was organized and held in Lund, Sweden, December 5-6, 2022, as a result of this fellowship. This conference brought researchers and farmers from Sweden, France, Denmark, UK, Poland, Ukraine, and the USA to share research results and discuss strategies for collaboration on perennial grains research across Europe. Presentations, workshop, and discussions were oriented to developing a network and future grant proposals.

3. Several presentations from the fellow in Sweden (Skara, Uppsala, Lund) and other European countries (Poland, France, Germany) were delivered, sharing research results on Intermediate wheatgrass perennial grain and forage cropping systems.

#### **4. Will there be any follow-up work?**

Several scientific publications are being prepared as a result of this fellowship:

- Nadeau, Hallin, Picasso. Nutritional value of the forage from intermediate wheatgrass harvested at different maturity stages. *Acta Agriculturae Scandinavica*. In preparation
- Picasso, Nadeau, Parsons, Gelata, et al. Forage nutritive value of a wide range of accessions of red clover in Sweden. *Agronomy Journal*. In preparation

Also, a literature review and analyses of forage research in Scandinavia is being prepared and will be published as a report soon.

Also, new research projects emerged and there will be grant proposals submitted within the coming months regarding perennial grains and forages in Europe.

#### **5. How might the results of your research project be important for helping develop regional, national or international agro-food, fisheries or forestry policies and, or practices, or be beneficial for society?**

There is international awareness that agriculture needs to become more sustainable and resilient to climate change. Policies in Europe are seeking to promote climate change mitigation actions, increase biodiversity, soil health, and water quality. The development of perennial grain cropping systems has the potential to become an important component of these actions. This fellowship was fundamental to expand the research on perennial grains in Sweden and Europe. The consolidation of an international and interdisciplinary team of researchers and stakeholders to study and explore the potential of perennial grains in Europe was a major outcome that will help develop policies and benefit society in the long term.





## 6. How was this research relevant to:

- The objectives of the CRP? This research strengthened scientific knowledge in agricultural science of perennial cropping systems and provided relevant scientific information and advice that will inform future policy decisions related to the expansion of perennial grain and forage systems in the agricultural landscapes.
- The CRP research theme? This research contributed to theme 1 (“managing natural capital”) through integrated agricultural production systems, because if successful, intermediate wheatgrass grain and forage systems will be a pathway for sustainable intensification of agricultural production in both plant and animal systems, providing grain for humans and forage for livestock, while conserving soil and water, fixing carbon, and providing habitat for biodiversity. Overall, a diversity of efficient, productive and environmentally sustainable agricultural systems will be required to meet food security challenges.

## 7. Satisfaction

- Did your fellowship conform to your expectations? Yes.
- Will the OECD Co-operative Research Programme fellowship increase directly or indirectly your career opportunities? It increased directly my career opportunities by multiplying my academic and professional connections in Sweden and across Europe. It also showed me a different academic environment and the opportunities of collaborating with colleagues in Europe.
- Did you encounter any practical problems? No. Everything was very smooth.
- Please suggest any improvements in the Fellowship Programme. My main suggestion is increasing the advertising about this programme. It is an excellent program, but it is not widely advertised in the USA in my opinion.

## 8. Advertising the Co-operative Research Programme

- How did you learn about the Co-operative Research Programme? A colleague at my University, who had been a fellow some years ago, recommended this program.
- What would you suggest to make it more “visible”? Emails are effective. I never received an email about this program directly, only through previous fellows. Also, maybe advertising in international conferences may be a good option for increasing visibility.
- Are there any issues you would like to record? No.