Germination requirements to grow minor pulses in North Europe climates

Alicia Ayerdi Gotor, Soukeye Gadiaga

Germination requirements to grow minor pulses in North Europe climates

Alicia AYERDI GOTOR[1], Soukeye GADIAGA[2]

[1] UniLaSalle, AGHYLE équipe Beauvais UP2018.C101, 60026 Beauvais, France, alicia.ayerdi-gotor@unilasalle.fr

[2] UniLaSalle, 60026 Beauvais, France.

Introduction

Europe lacks of local vegetal proteins and is highly dependent on imported soybean. The changes on food habits with the vegan diet or just the reduction of meat consumption is increasing the demand on veggie alternatives and if possible local. Additionally since the 50'-60' the production area of pulses has been decreasing, now representing less than 25% (Fig 1, FAOSTAT 2021). Worldwide there is a great diversity on pulses which could be suitable for temperate climate. The objective of this study is to determine the feasibility of production of tropical pulses in temperate climate by a first evaluation of the minimal temperature to germinate as a first step to evaluate the potential sowing date.

Main hypothesis:

- Tropical pulses will germinate with temperatures over 10°C
- With a high temperatures the germination will be faster
- High temperatures will accelerate the growth of plantlets

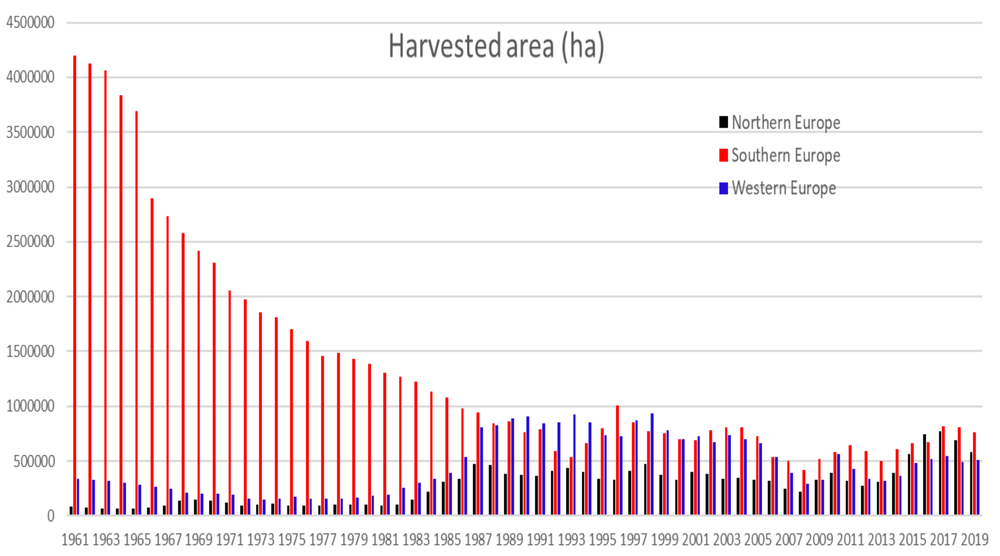

Fig 1. Evolution of harvested area (ha) in Europe between 1961 ad 2019 (FAOSTAT, 2021)

Materials and Methods

The germination of 6 minor pulses : Adzuki bean (*Vigna angularis*), Cowpea (*Vigna unguiculata*), Mung bean (*Vigna radiata*), Pigeon Pea (*Cajanus cajan*), Rice bean (*Vigna umbellata*), Scarlett Runner bean (*Phaseolus coccineus*) and chickpea (*Cicer arietinum*) was evaluated for 7 days in culture chambers at 5 temperatures: 5°C, 10°C, 15°C, 20°C and 25°C. Percentage of germinated seeds was done at 24, 48, 72, 96 and 192h hours after putting the seeds on watered bed. The radicle, hypocotyl and epicotyl lengths were measured in five representative plantlets at 3, 8 and 11 days after water imbibition. Final foliar area and total dry biomass was measured at the end of the experience.

Results

Pulses germination at different temperatures showed that at 5°C and 10°C there were no seed able to germinate of the considered species after 8 days. At 15°C Rice bean, Adzuki bean and Cowpea showed a slow germination capacity whereas it was the most suitable temperature for chickpea. Scarlett runner bean had germination problems more related to seed quality than for temperature problems. We can stablish that for the pulses studied the base temperature for germination is between 10 and 15°C.

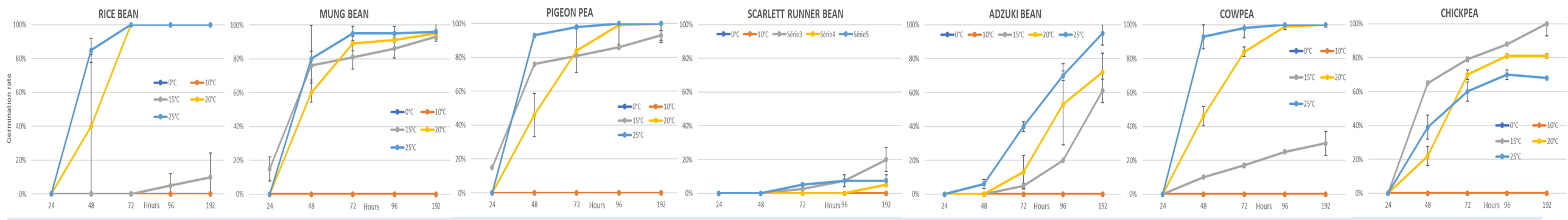

Fig 2. Germination (%) evolution of 7 pulses at 5 temperatures between 24 and 192 hours.

The measurements on the growth of plantlets at the 3 positive temperatures showed that at 15°C the growth is really slow the first 11 days for all the species but enough to ensure the installation of the crop in the target climatic areas of the North of France and Benelux where summers are quite cold. Other experimentation undertaken showed that once emerged plantlets can support temperatures under 5°C for short periods of time without damage.

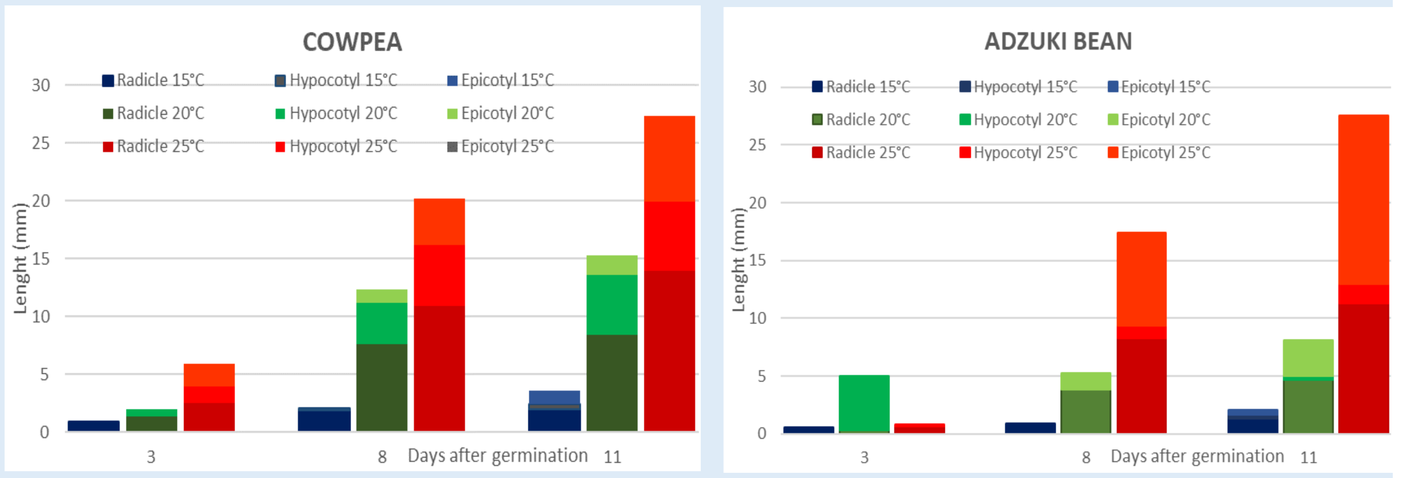

Fig 3. Growth of the different parts of the plantlets between 3 and 11 days at 3 temperatures (15°C – Blue; 20°C – Green. 25°C – Red)

Fig 4. Plantlets of 2 species (Top Left: Cowpea 25°C, Top Right: Mung bean 15°; Down Left Cowpea 15°C; Down Right: Mung bean 25°C) at their 8th day of germination

The foliar surface of 100 plantlets the 11th day varied from 209 cm² for Adzuki at 15°C (Tab. 1) to the foliar surface Scarlett runner bean growing at 25°C reaching 2329 cm². Chicken seed did not support temperatures above 20°C as grains melt after 5 days at this temperature, where the minor pulses supported those temperatures much better.

Tab. 1. Foliar and dry biomass of 100 plantlets at the 11th days of germination of 7 species of pulses

	Foliar surface 100 plantlets (cm²) at 11th day			Dry biomass 100 plantlets (g) at 11th day		
	15°C	20°C	25°C	15°C	20°C	25°C
Adzuki bean	209,26	173,00	359,17	0,94	0,48	2,42
Chickpea	322,00	232,83		3,22	15,20	
Cowpea	358,70	760,42	822,35	4,05	1,49	8,05
Mung bean	298,53	322,75	319,24	2,01	0,47	2,56
Pigeon pea		1282,86			11,17	
Rice bean		2329,83			24,50	
Scarlett			2384,83			28,16

Conclusions

According to those results, in Northern France it will be possible to sown this pulses the second decade of May as it's already the case for Soybean with an slow growth the first days. Next steps will be to evaluate the growing developing degrees necessary to reach the maturity and determine if in the regions of interest the sum could be cumulated before the rains come back in October.

This research was made thanks to the grant to the project CALEGE funded by the SFR Condorcet 2020