

Agroforestry system: opportunities and constraints of tree-crop interactions

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Council for agricultural research and Economics Research Centre
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Midas

MARGINAL LANDS, INDUSTRIAL CROPS
AND INNOVATIVE BIO-BASED VALUE CHAINS



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CREA-IT experimental agroforestry field

CREA-IT experimental field was born from a conversion of poplar (Clone AF-48) Medium Rotation Forestry (MRF), for bioenergy production.

The initial characteristic was (a):

Plants spacing → 3m between the row
And 1 m among the plants

Last harvesting → 02/2022

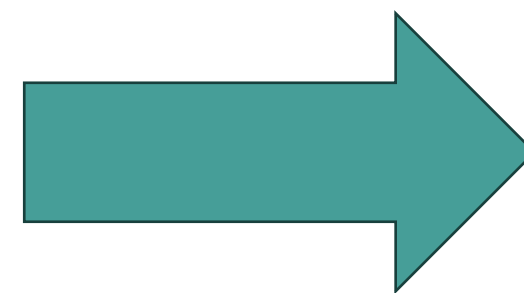
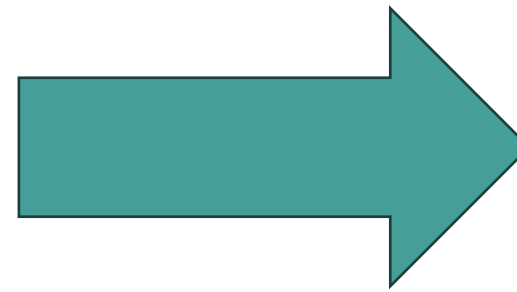
Age → 12Y

After alternating removal of a coppice (b):

Plants spacing → 6 m between the row
And 1 m among the plants

Last harvesting → 02/2022

Age → 12Y



CREA-IT experimental agroforestry field

During all the mechanical phases the machine's performance was studied to evaluate the interaction of agroforestry systems on the mechanical phases compared to traditional cultural system

The mechanical phases were:

During the first step conversion, extraction and the transport of the stumps



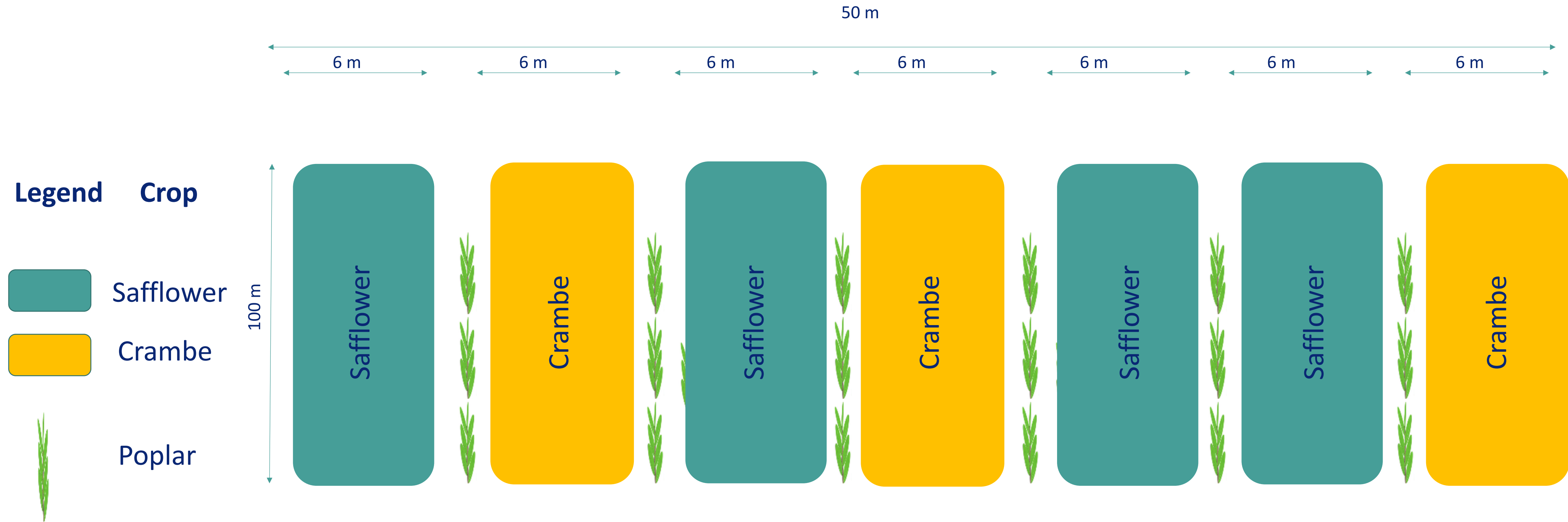
Second step with soil tillage and the sowing



The last one step, the harvesting



Trial layout



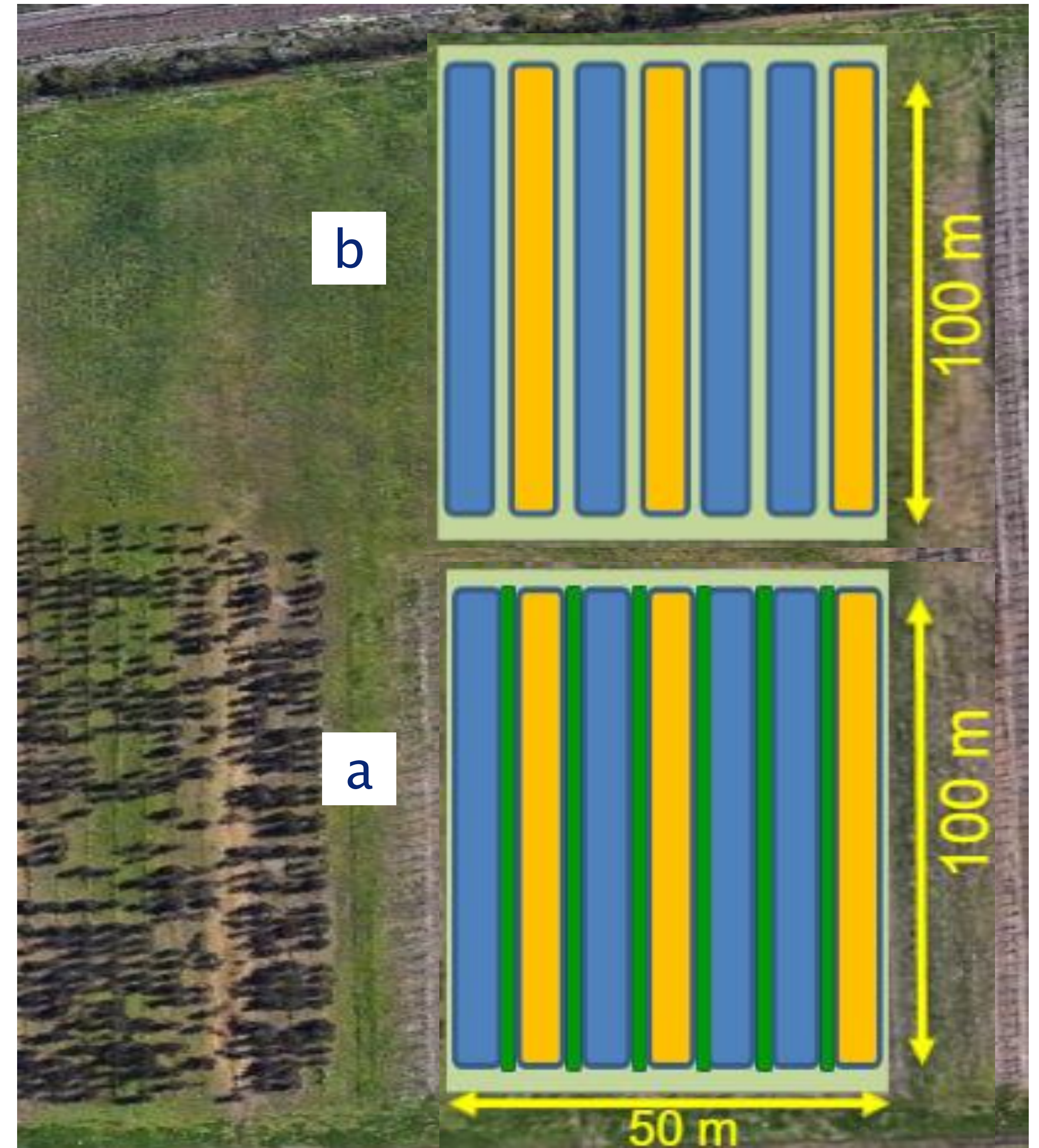
Total surface of Agroforestry experimental field= 100m x 50m

1st Year of experimental agroforestry field

During the first year, the study was focused on the two cultivated oilseed species, *Carthamus tinctorius L.* And *Crambe abyssinica*.

To well understand the influence of the trees on the grass crops, another field with the same characteristic was implemented next to the agroforestry field.

Legend	Crop
	Safflower
	Crambe
	Poplar



1st Year of experimental agroforestry field

The crop management was the same in the two fields.

Soil preparation was carried out in the autumn, with deep tillage using a ripper and superficial chisel tillage before seeding.

A fertilization was performed before sowing using Diammonium Phosphate (18 % N, 46 % P₂O₅) and Urea fertilizers (46 % N).

The sowing was performed during the last week of March 2023

The seeding rate was 25-30 kg ha⁻¹ with a final layout of 3 cm of distance between the seedlings and 14 cm between the rows.

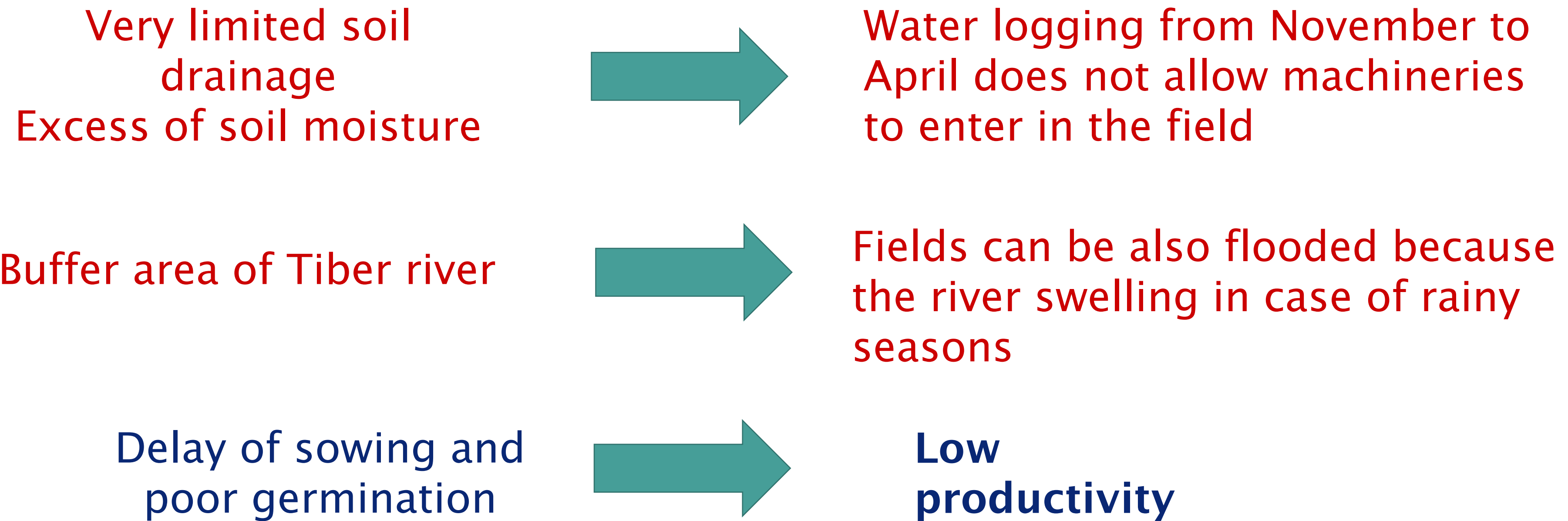


Sampling

- The sampling was carried out during all phenological phases of the crops.
- 6 squared sample plots for the two crops of 1 m² each were randomly established in the two fields in order to assess the amount of the whole epigeous biomass.
- In particular, the number of plants for each sample, potential seed yield (PSY), dry weight (DW) and moisture content were evaluated.
- 6 poplar coppice were harvested to a total biomass evaluation.
- Dry weight and moisture content were estimated according to EN ISO 18134-2:2017

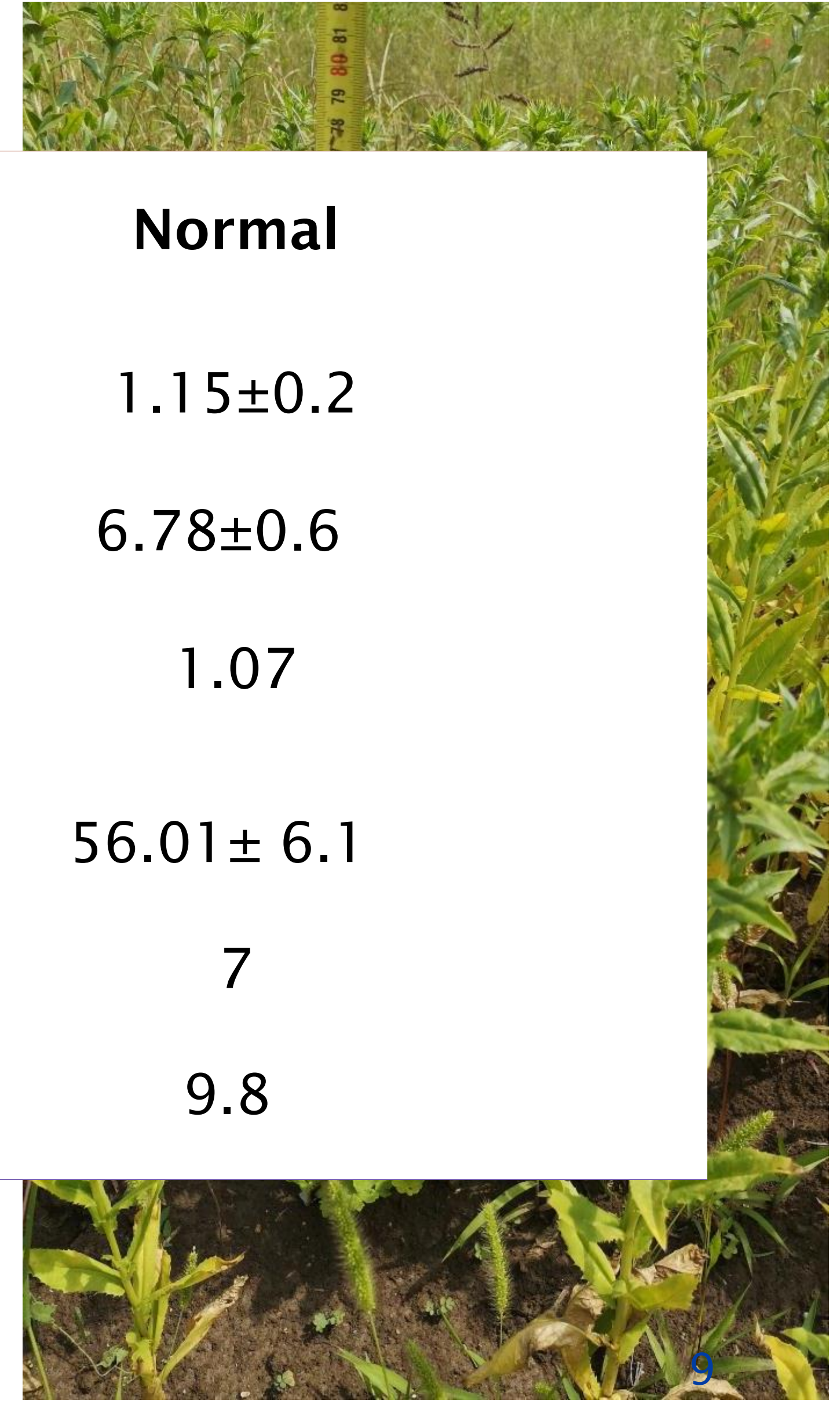
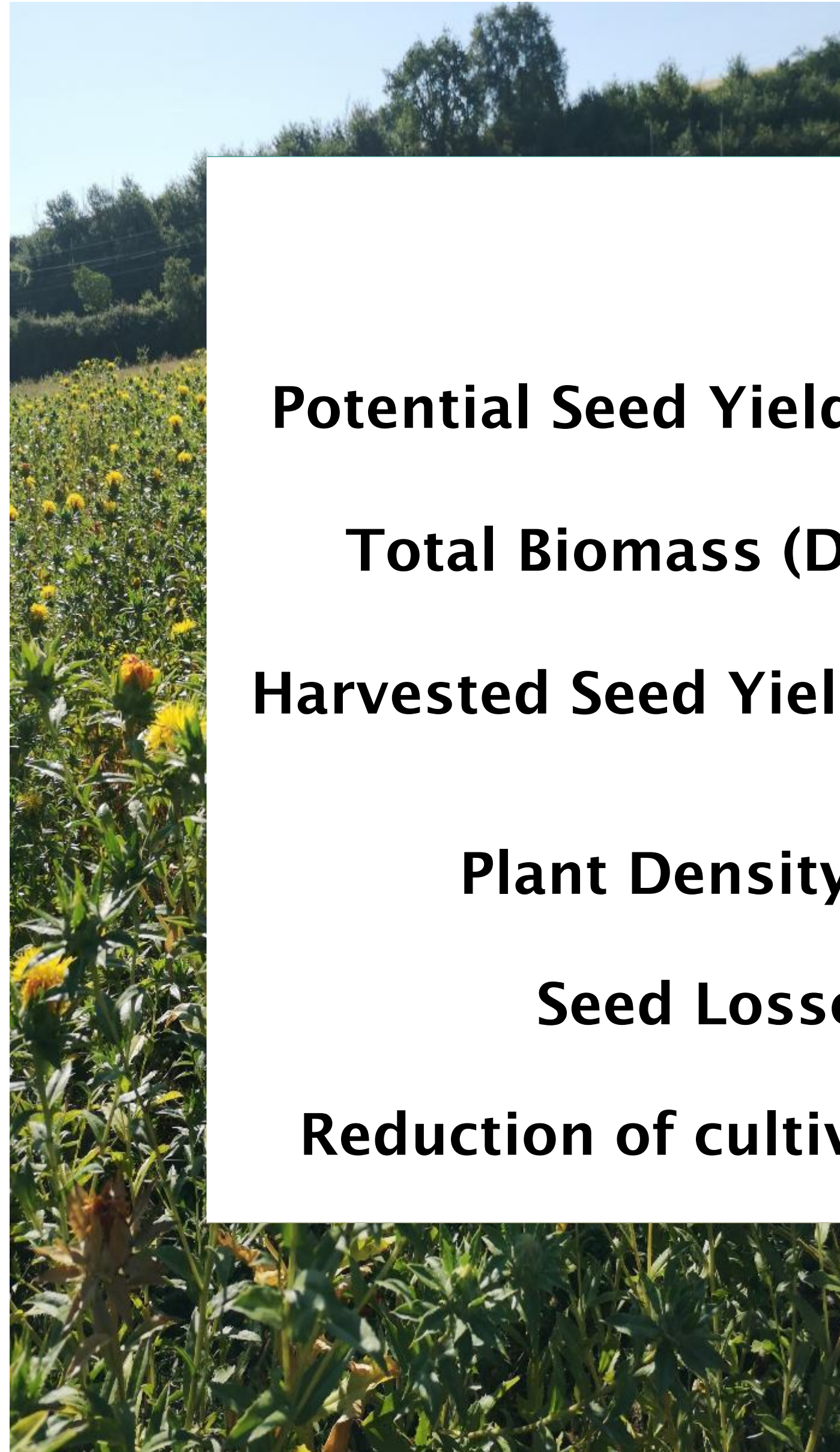


Marginality factor



↳ Clay loam soil (sand 21%, silt 44%, clay 35%)

Safflower Results



	Agroforestry	Normal
Potential Seed Yield (DM Mg ha⁻¹)	1.06±0.3	1.15±0.2
Total Biomass (DM Mg ha⁻¹)	6.32±2.7	6.78±0.6
Harvested Seed Yield (DM Mg ha⁻¹)	1.0	1.07
Plant Density (n m⁻²)	52.60±5.5	56.01± 6.1
Seed Losses (%)	8	7
Reduction of cultivated area (%)	11.4	9.8

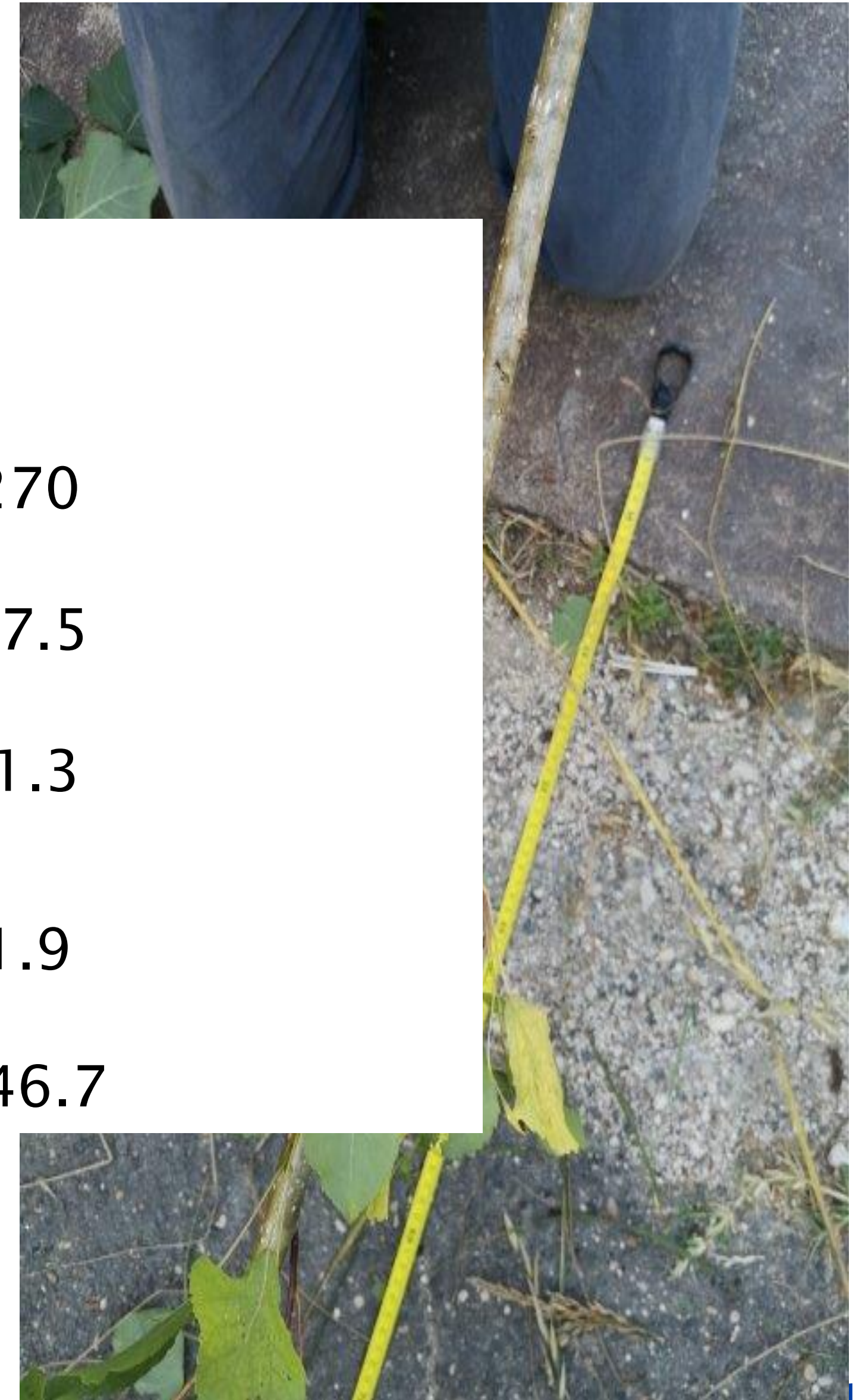


Crambe Results



	Agroforestry	Normal
Potential Seed Yield (DM Mg ha⁻¹)	0.76±0.2	0.95±0.3
Total Biomass (DM Mg ha⁻¹)	2.37±0.7	3.85±0.6
Harvested Seed Yield (DM Mg ha⁻¹)	0.67	0.89
Plant Density (n m⁻²)	52.60±5.5	66.01± 6.1
Seed Losses (%)	8	9
Reduction of cultivated area (%)	15.8	11.6





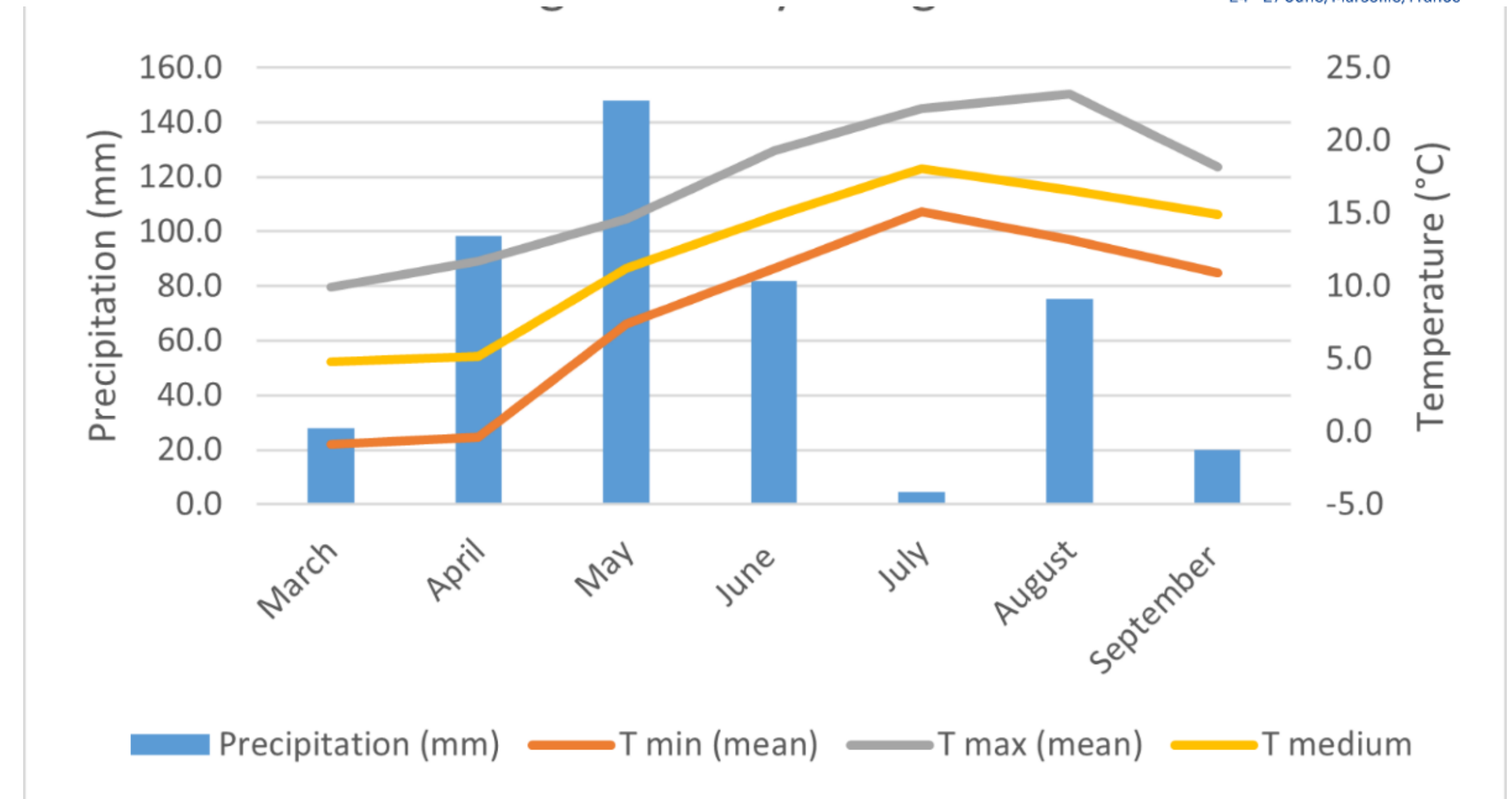
Poplar 2023 (Dry matter)

Total N° of the coppice	270
Medium coppice weight (kg)	17.5
Medium n° of shoots for coppice	21.3
Medium diameter (cm)	1.9
Medium height (cm)	246.7



Conclusions

- At the agricultural point of view, there weren't significant differences between crops cultivated in intercropping than the normal field
- The abundant rainfall of the past year has led to a strong water logging effect of the cultivated area.
- Water logging effect has led to reduced productions with an inversely proportional relationship between productivity and water logging areas
- The growth rate of poplar plantations in agroforestry is the same of the dedicated plantation
- **If we consider the ecosystem services, Agroforestry field can represent one of the better choice with compromise at the environment, productive and economic point of view**





Thank you



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