Alfalfa to get back into planetary boundaries

2025 world alfalfa congress
FRANCE REIMS-CHÂLONS

Physiology and Genetics

Dejan Sokolović

Young researcher session

FROM 03 › TO 06 nov. 2025

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Genetic Characterization and Breeding for Creeping Root Architecture in Alfalfa

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Spreading Alfalfa

- Rhizomatous
  - Many rhizomes reaching far distance from original crown producing multiple shoots
  - Minimal rooting from rhizomes
- Creeping-root
  - Adventitious shoots arise from root tissue
  - “Plantlets” can survive independent of original plant, and have developed roots

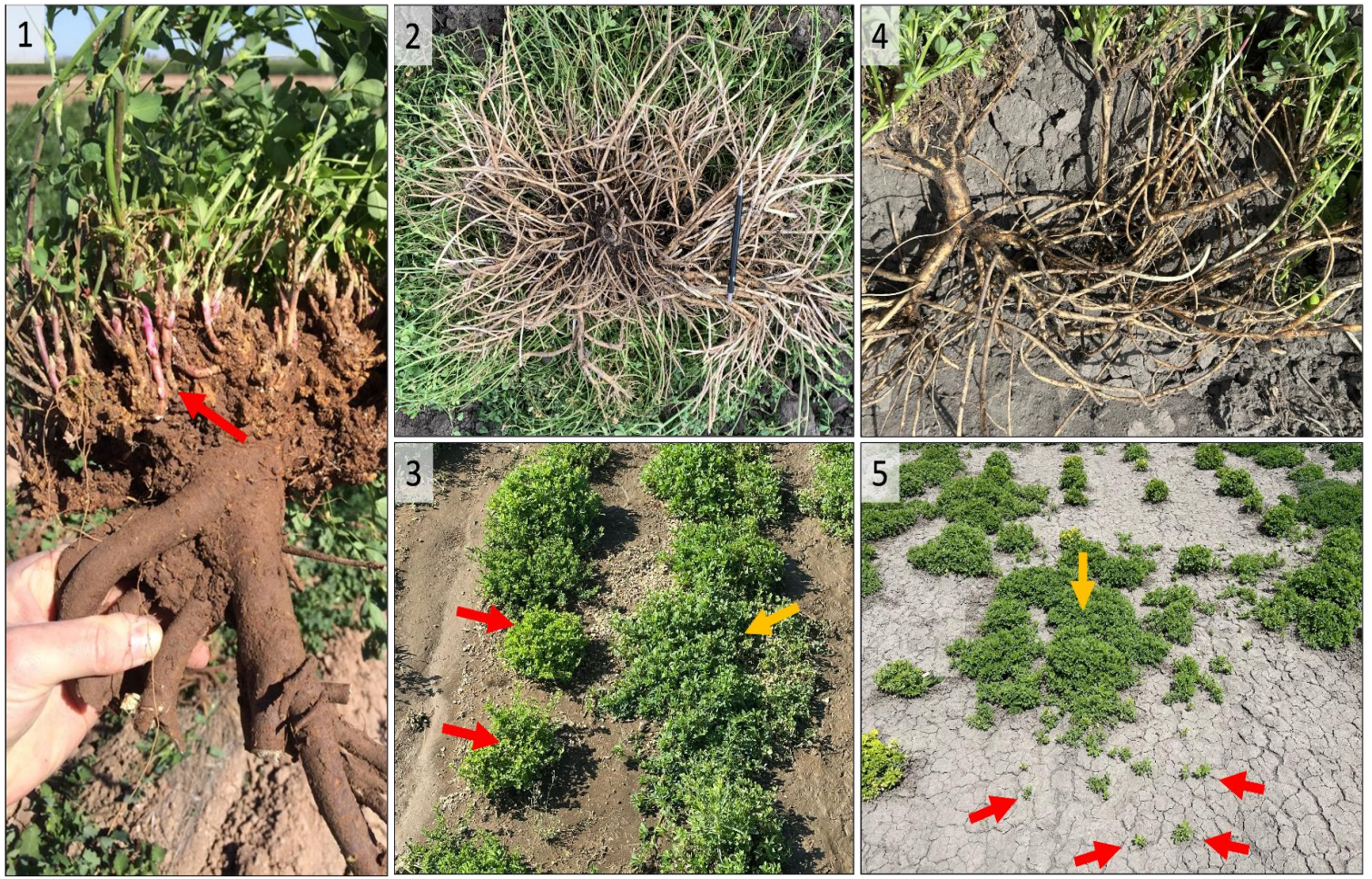
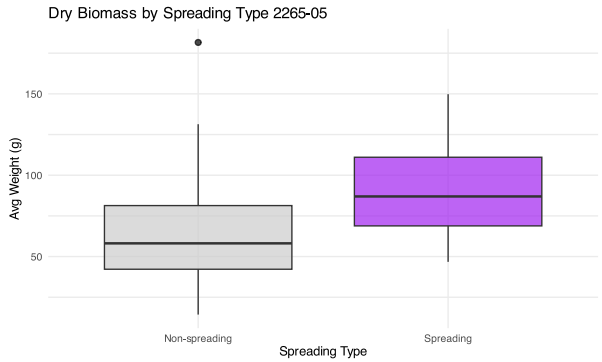


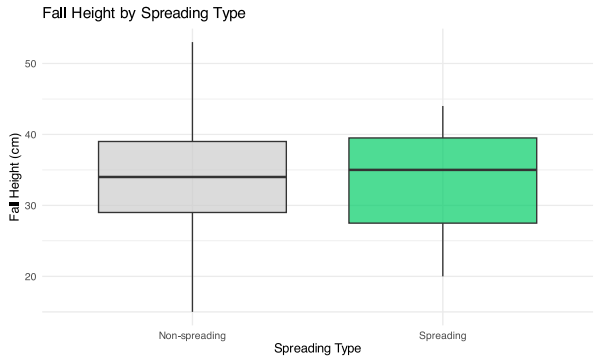
Figure 1. (1) Typical alfalfa plant. (2) Plant spreading by rhizomes. (3) (3) Non-spreading (e.g., red arrow) and rhizomatous spreading (yellow arrow) siblings in the field. (4) Creeping-rooted plant. (5) New plantlets (red arrows) far from the original creeping-rooted plant (yellow arrow). *(All photos: C. Brummer)*

Preliminary Data

- Rhizomes
- Rhizomatous plants have significantly higher biomass



- Creeping Root
- Similar fall height across F2 population



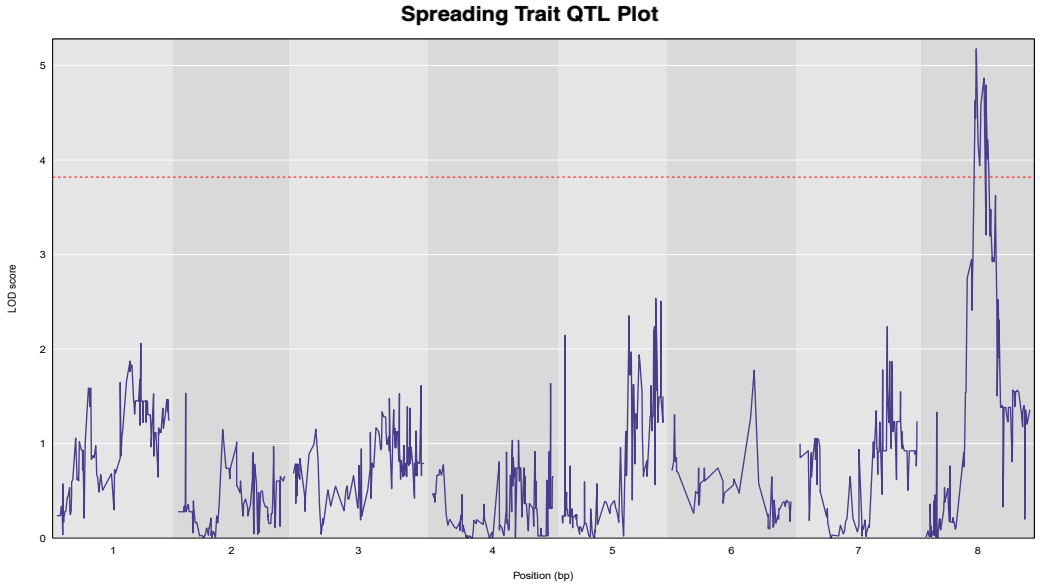


Figure 2. QTL plot of diploid F2 population. Significance threshold represented by red dashed line at LOD=3.91 (α=0.05). One significant peak (LOD=5.2) apparent on Chromosome 8 between 40 and 60 Mbp.

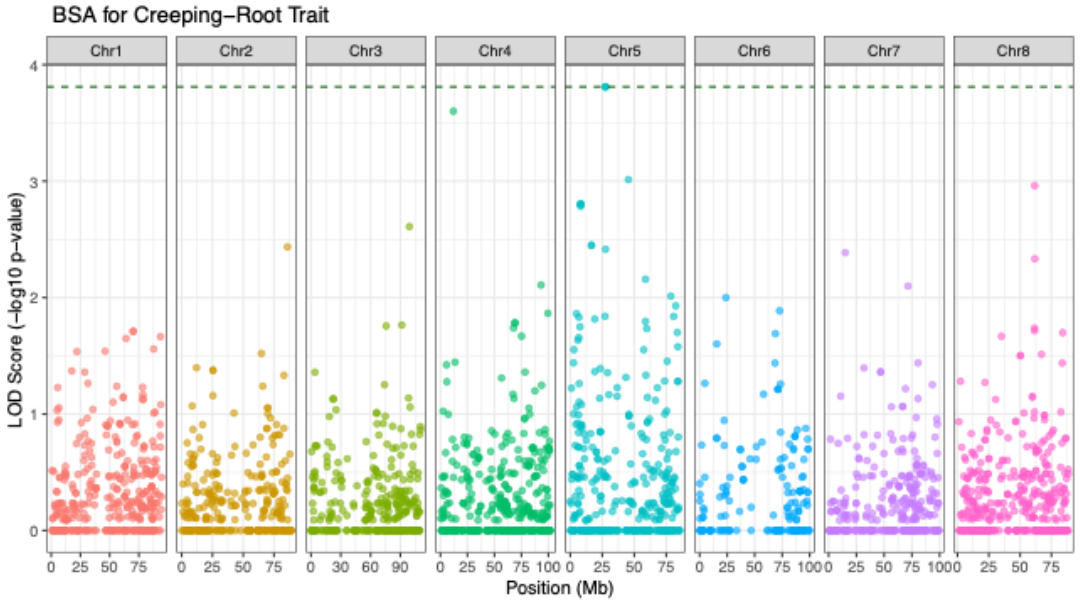


Figure 3. Significance threshold represented by green dashed line at LOD=3.81 (α=0.05). One significant marker (LOD= was identified located on Chromosome 5 at ~25 Mbp.

Next Steps

- Results are preliminary and based off a visual score for presence or absence of spread
- Evaluation of a multi-location clonal trial (spanning ~10° latitude) to assess genotype-by-environment interactions of multiple spreading genotypes
- Generation of WGS of spreading genotypes to map quantitative trait loci (QTL) for the spreading trait and develop markers
- Development of nondormant spreading germplasm

Table 1. List of primary alfalfa genotypes used in this project.

Genotype	Origin	Ploidy	Spread Type	Subsp.	Comments
DCA1	PI	2x	None	caerulea	Non-spreading parent in genetic mapping populations; fully sequenced genome
DFL2	PI	2x	Rhizomes	falcata	Parent in genetic mapping populations; fully sequenced genome
CR2516	PI	2x	Rhizomes	falcata	From spreading alfalfa field trial
CR2515	PI	2x	Roots	falcata	Recently identified, using in crosses
A803T-3	Cult	4x	None	sativa	Nondormant genotype used in genetic mapping and breeding populations
106-2	PI	4x	Rhizomes	varia	Parent in UCAL2255
74-1b	PI	4x	Roots	falcata	Used in genetic mapping and breeding populations
23-1	PI	4x	Roots	varia	Parent in UCAL2250
80-1b	PI	4x	Roots	varia	Parent in UCAL2250, 2255
2341,43,45	Cult	4x	Roots	sativa	From semidormant cultivar in salinity trial at Westside REC