

Efficacy of different mechanical impacts on weed growth







Background

- Very diverse equipment for mechanical weed control
- Recent innovations (camera-steering, digital analysing)
- often insufficient control effects
- Herbicide problems in conventional cropping systems
- New technical options for the future (e.g. robots)
- data on systematic effects are not available

Material & Methods (Test A)

- Pot experiments in greenhouse (2015-2016)
- Treatments: pulling, cutting and spilling
- Growth effects on 18 weed species
- Interactions with soil moisture (dry/wet)
- Data: aboveground biomass, control efficacy



Results (Test A)

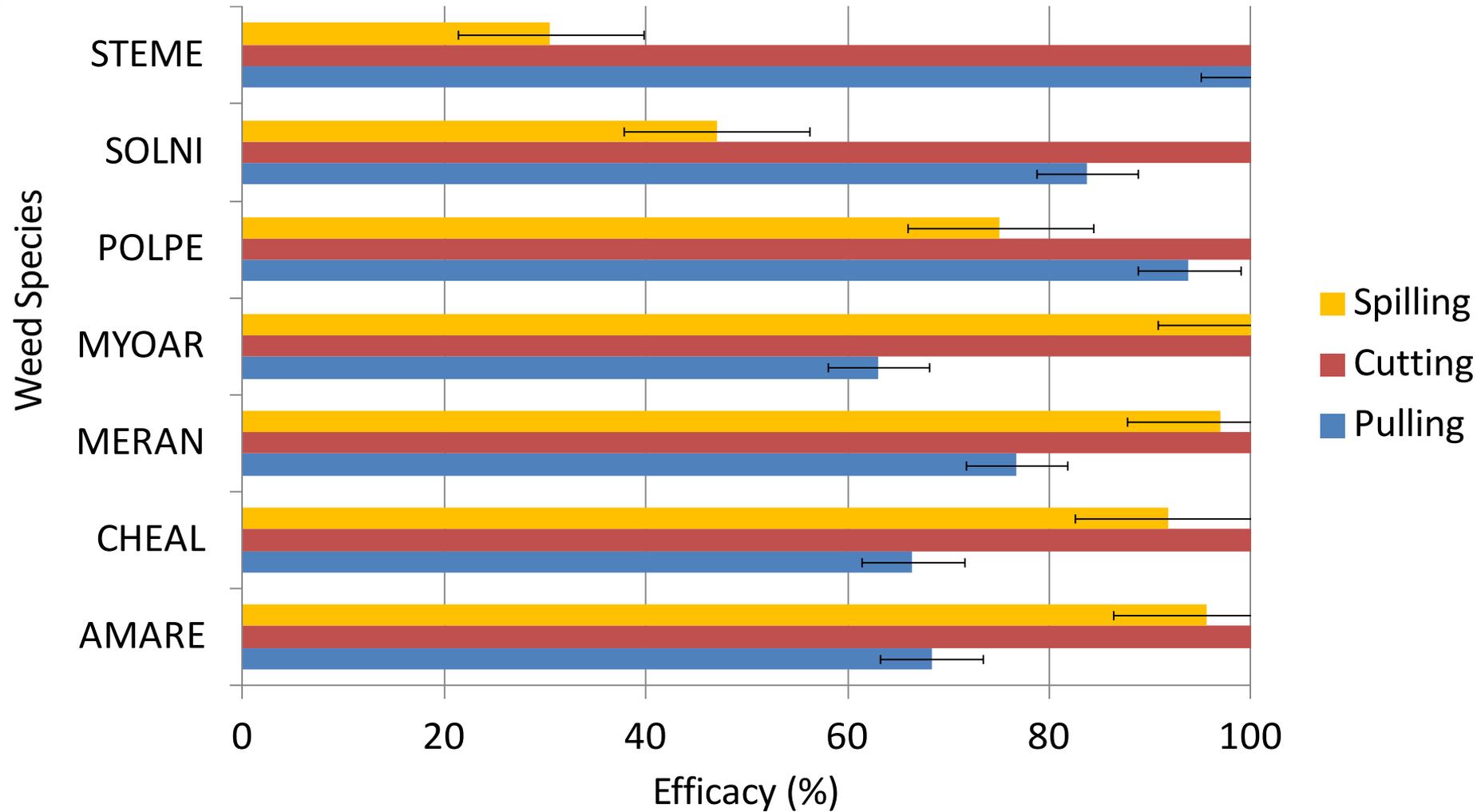
Control level (%), mean values of 18 weed species:

Soil	Spilling	Cutting	Pulling
Wet	73	100	72
Dry	85	100	99

Cutting is highly effective but has to be precisely:

Soil	Cutting <u>above</u> soil surface	Cutting <u>at</u> soil surface	Cutting <u>below</u> soil surface
Wet	60	100	44
Dry	68	100	67

Results (Test A)



Material & Methods (Test B)

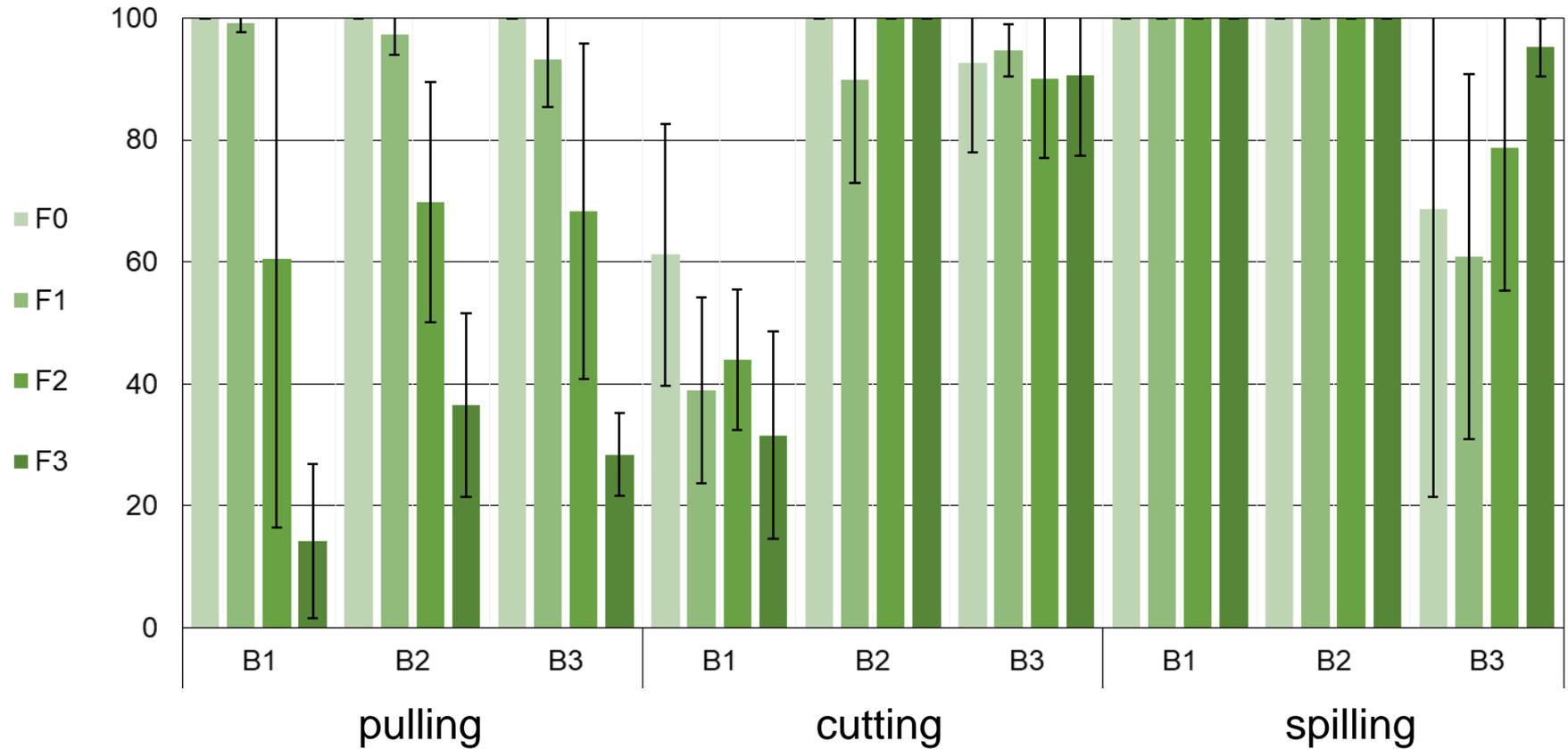
- Pot experiments in greenhouse (2018)
- Test of 2 grass weed species:
Alopecurus myosuroides and *Apera spica-venti*
- Treatments: pulling, cutting and spilling (same as before)
- Water supply: F0 = 10 DAT without watering
F1 = 3 DAT without watering
F2 = 2 DAT without watering
F3 = watering shortly after treatment
- Growth stage: B1 = BBCH 11-12 (1-2 leaves)
B2 = BBCH 13-21 (begin of tillering)
B3 = BBCH 29-30 (end of tillering)
- Data: aboveground biomass, control efficacy

Control efficacy (ANOVA)

	ALOMY	APESV
Main effects (p-values)		
A) Mechanical impact	0,000	0,000
B) Growth stage	0,000	0,013
C) Soil moisture	0,000	0,000
Interactions (p-values)		
A x B	0,000	0,020
A x C	0,000	0,000

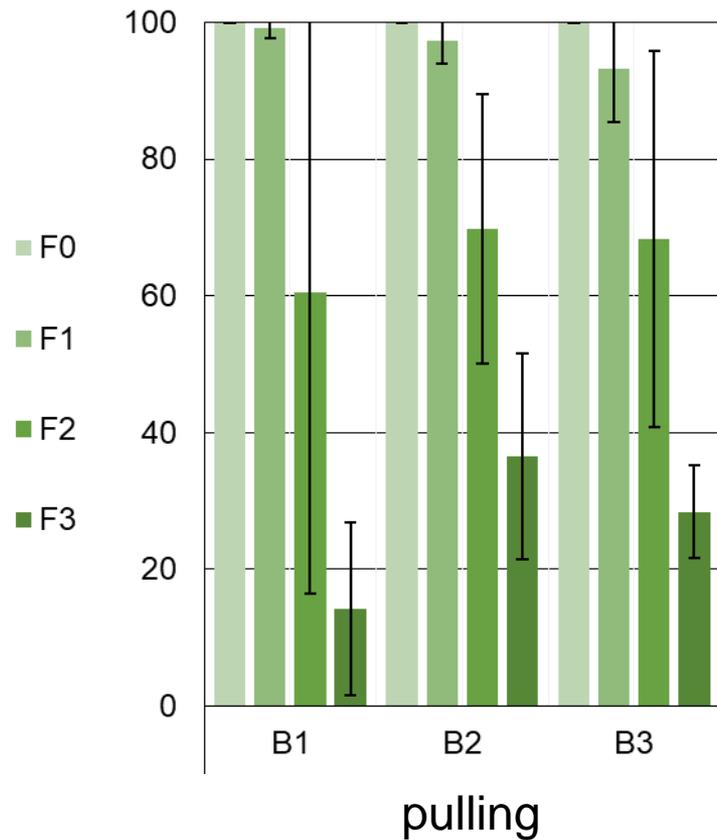
Results for black-grass

% reduction of fresh weight

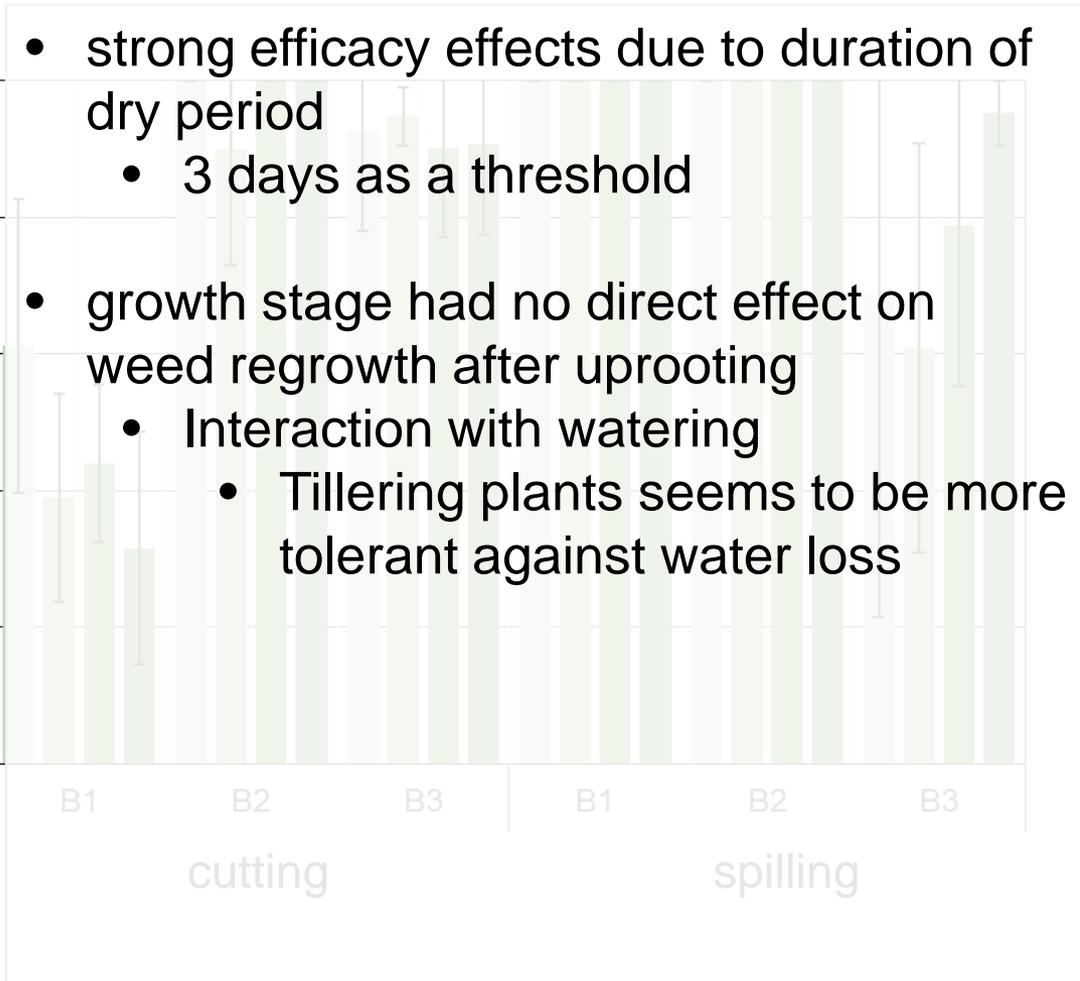


Results for black-grass: pulling

% reduction of fresh weight

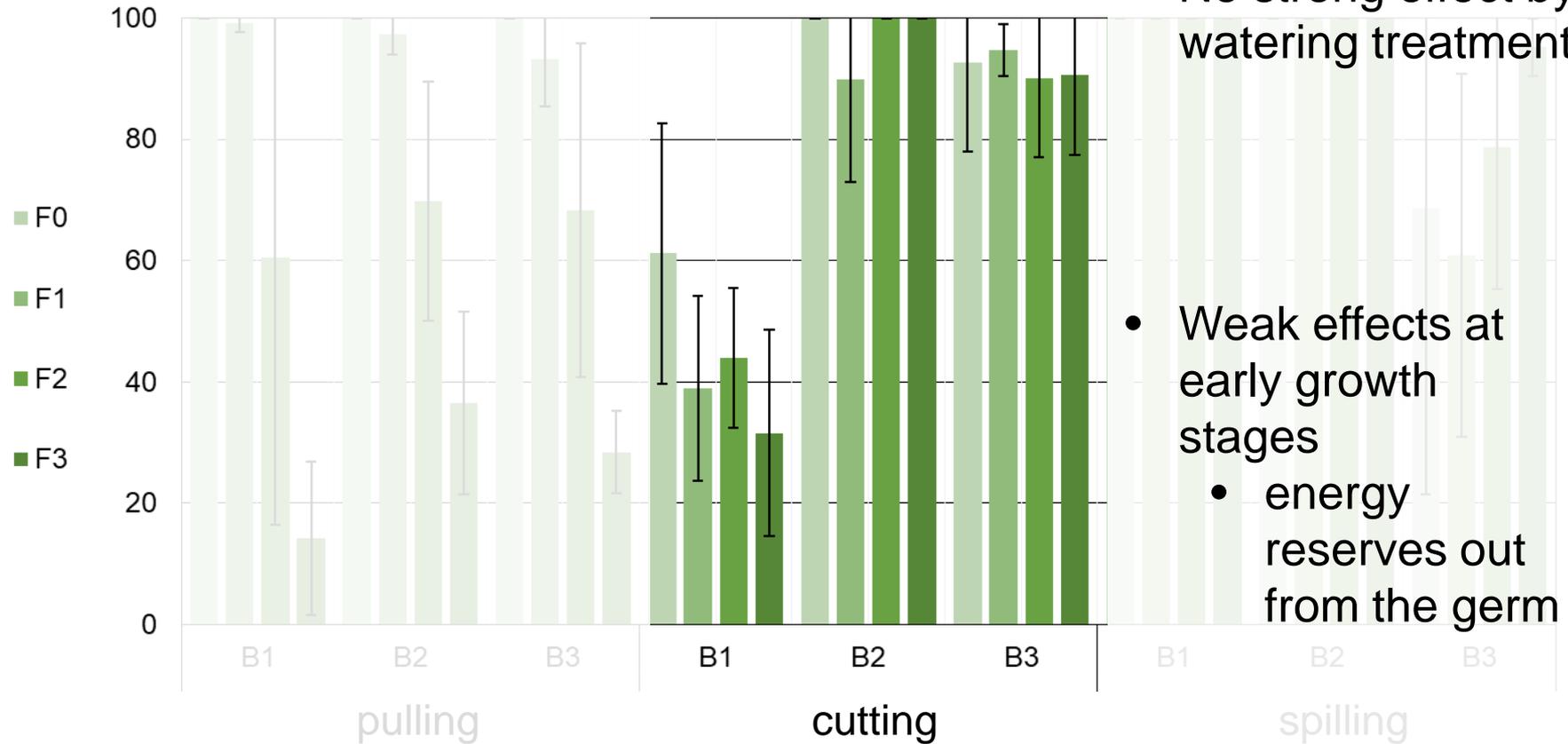


- strong efficacy effects due to duration of dry period
 - 3 days as a threshold
- growth stage had no direct effect on weed regrowth after uprooting
 - Interaction with watering
 - Tillering plants seems to be more tolerant against water loss



Results for black-grass: cutting

% reduction of fresh weight

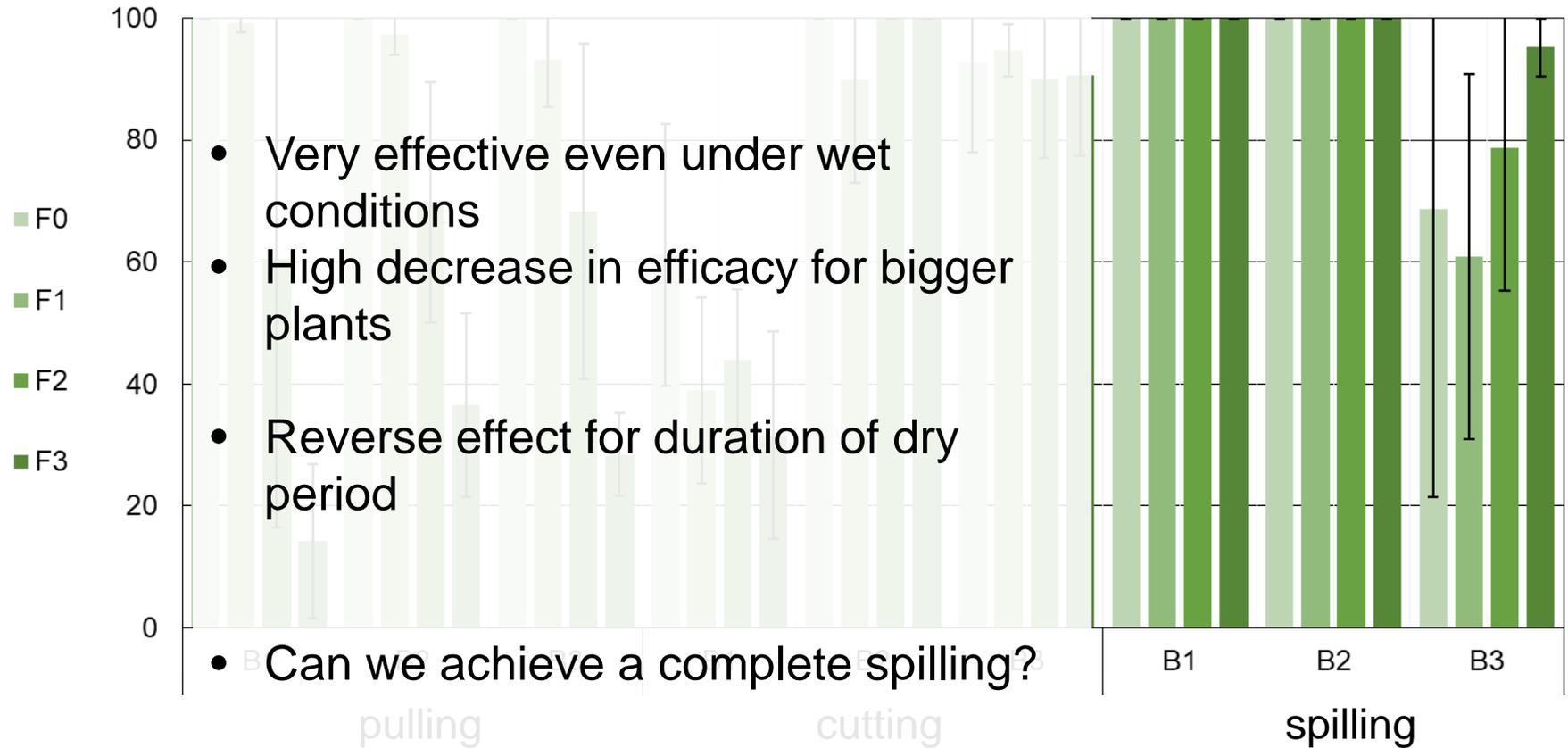


- No strong effect by watering treatment

- Weak effects at early growth stages
 - energy reserves out from the germ

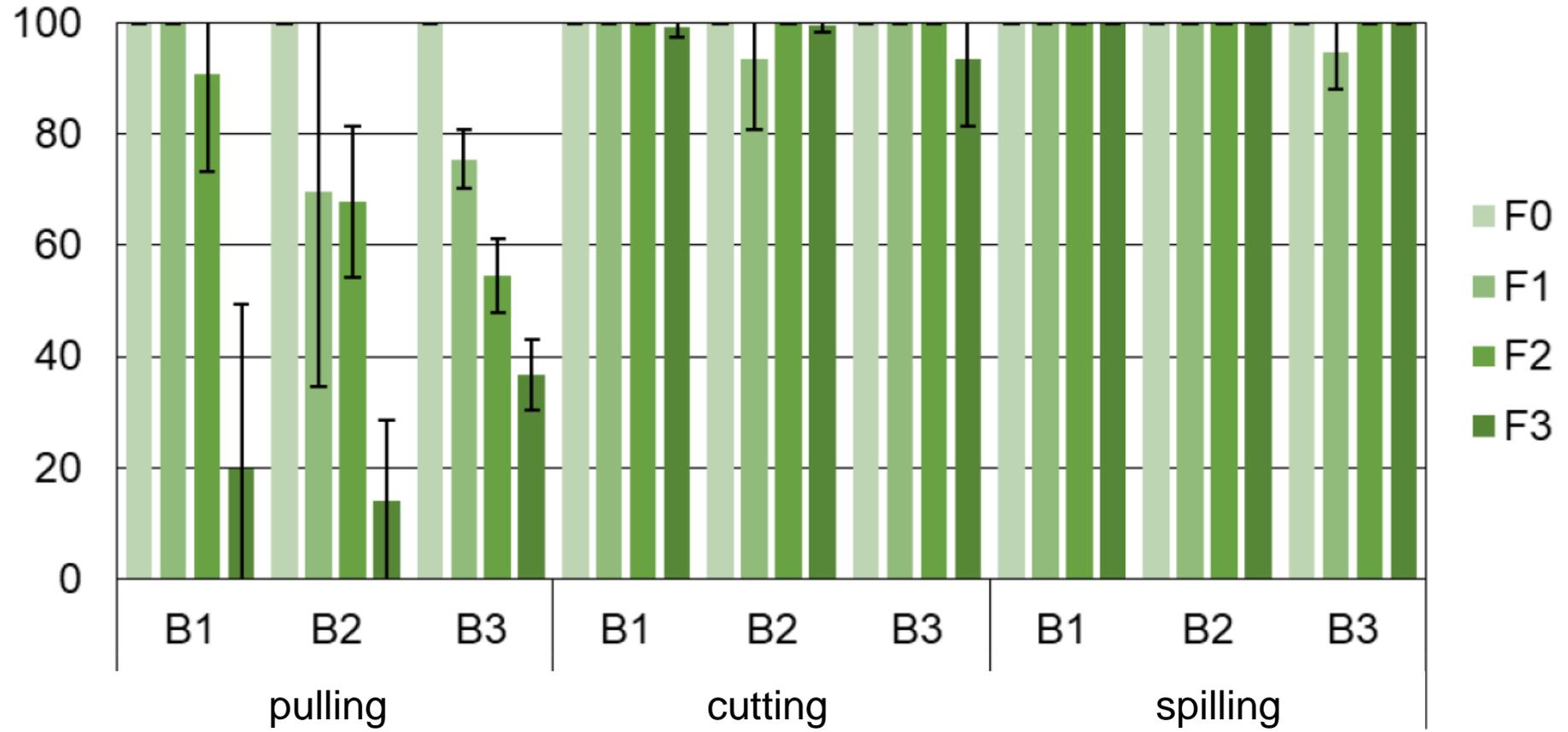
Results for black-grass: spilling

% reduction of fresh weight



Results for silky bent

% reduction of fresh weight



Summary

- The overall efficient method was cutting - even under conditions of wet soil and greater plants
- Beside dicots, also grass weeds, can be efficiently controlled by mechanical methods
- Adaption of mechanical weeders to the situation in the field important for a good weeding efficacy
 - Wet conditions: spilling
 - Dry conditions: pulling
 - Big weeds: cutting
- The findings indicate new options for mechanical control
- Development of weed-specific-knowledge for reaction on mechanical impacts seems promising

Prospects

If robots will work with cutters this ...

- results in better control effects for a wide range of weeds
- works without moving of soil
- avoids erosion by minimum impact and low energy input
- allows late weed removal (with benefits for biodiversity)



Thanks for your attention!

