



COVER CROP MIXTURES IN CORN AND WHEAT ON TOPOGRAPHICALLY VARIABLE TERRAIN



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Introduction

- The use of cover crops in row crop systems, including corn-soybean-wheat rotations, increases overall plant diversity and has the potential to reduce soil erosion and enhance soil health, influence weed management, and improve environmental sustainability of the cropping system.
- Mixtures of cover crop species may deliver multiple ecosystem services compared with a single cover crop species.
- However, the benefits from cover crop mixtures to soil and cropping system sustainability will depend on cover crop species establishment and biomass which, in turn, may be influenced by field topography.

Objective:

Assess performance of two cover crop mixtures:

- winter-hardy (WH) and**
- winter-intolerant (WK)**

at three contrasting topographical positions:

- depressions (foot and toe slopes),**
- steep slope (back slopes and shoulders), and**
- summits**

In two edaphically and environmentally contrasting geographical locations:

- Southwest Michigan, USA and**
- Central Ukraine.**

Methods

Field studies



Studied periods:

Michigan
2016 and 2017

Ukraine
2017 and 2018

Main crops:

Corn – the cover crop mixtures were inter-seeded into corn at the V5-V6 growth stage

Winter wheat – the cover crop mixtures were seeded after wheat harvest in early August



Data collection:

Cover crop and weed biomass:

In fall after corn harvest (WK, WH, and control)

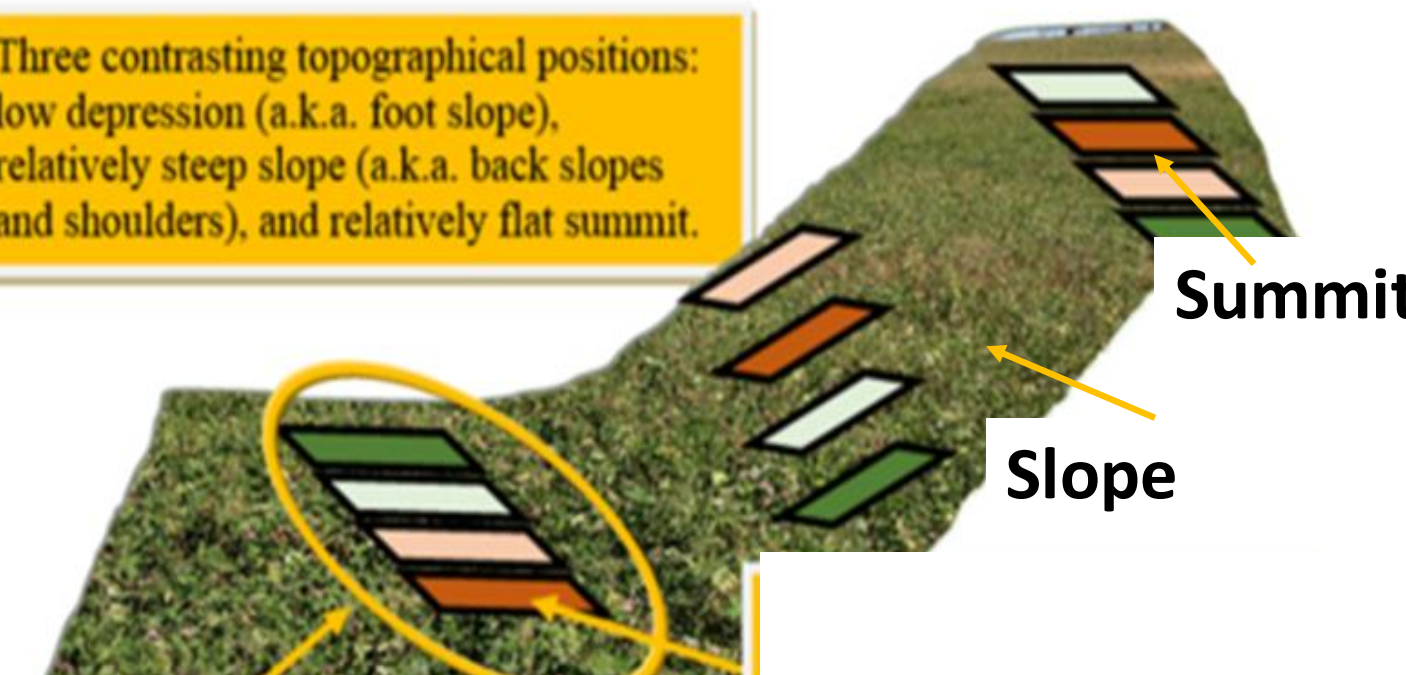
In early spring (WH and control only)

Corn yield



Experimental design

Three contrasting topographical positions: low depression (a.k.a. foot slope), relatively steep slope (a.k.a. back slopes and shoulders), and relatively flat summit.

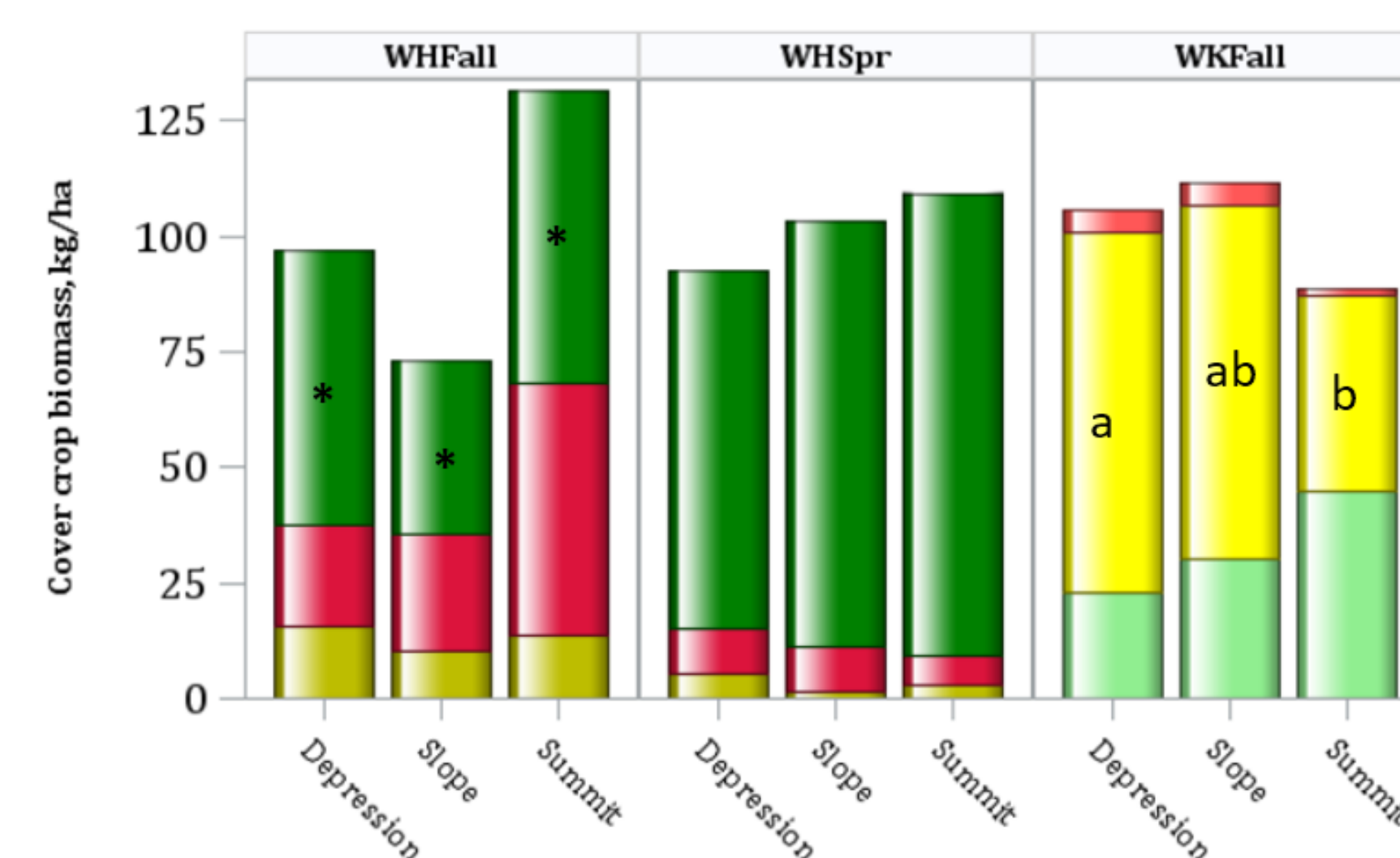


Topography: Depression



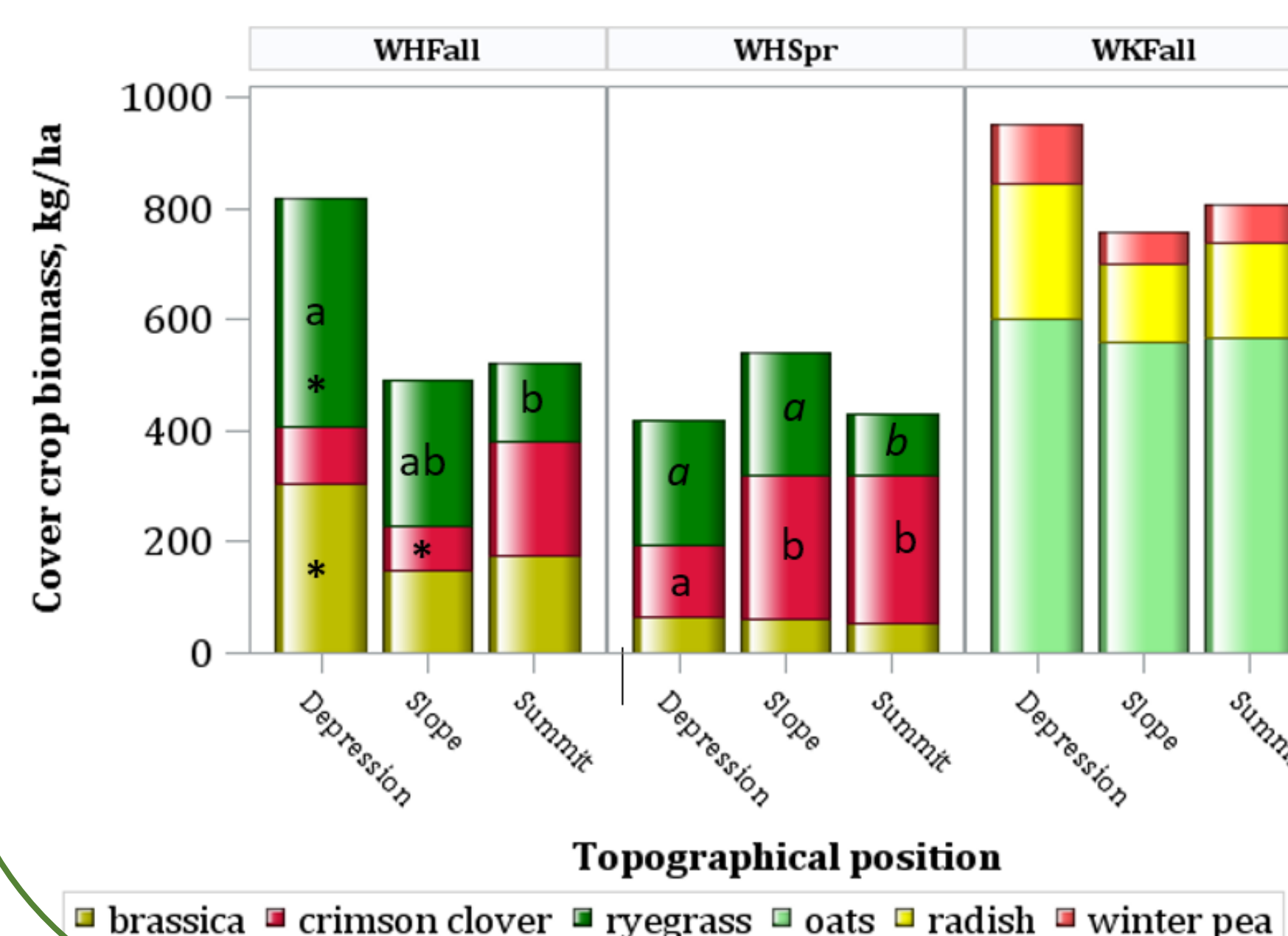
Results: cover crop biomass

Inter-seeded in corn



Letters mark significant differences among topographical positions ($p < 0.05$), stars mark significant differences between Fall and Spring biomass in WH mixture.

After winter wheat



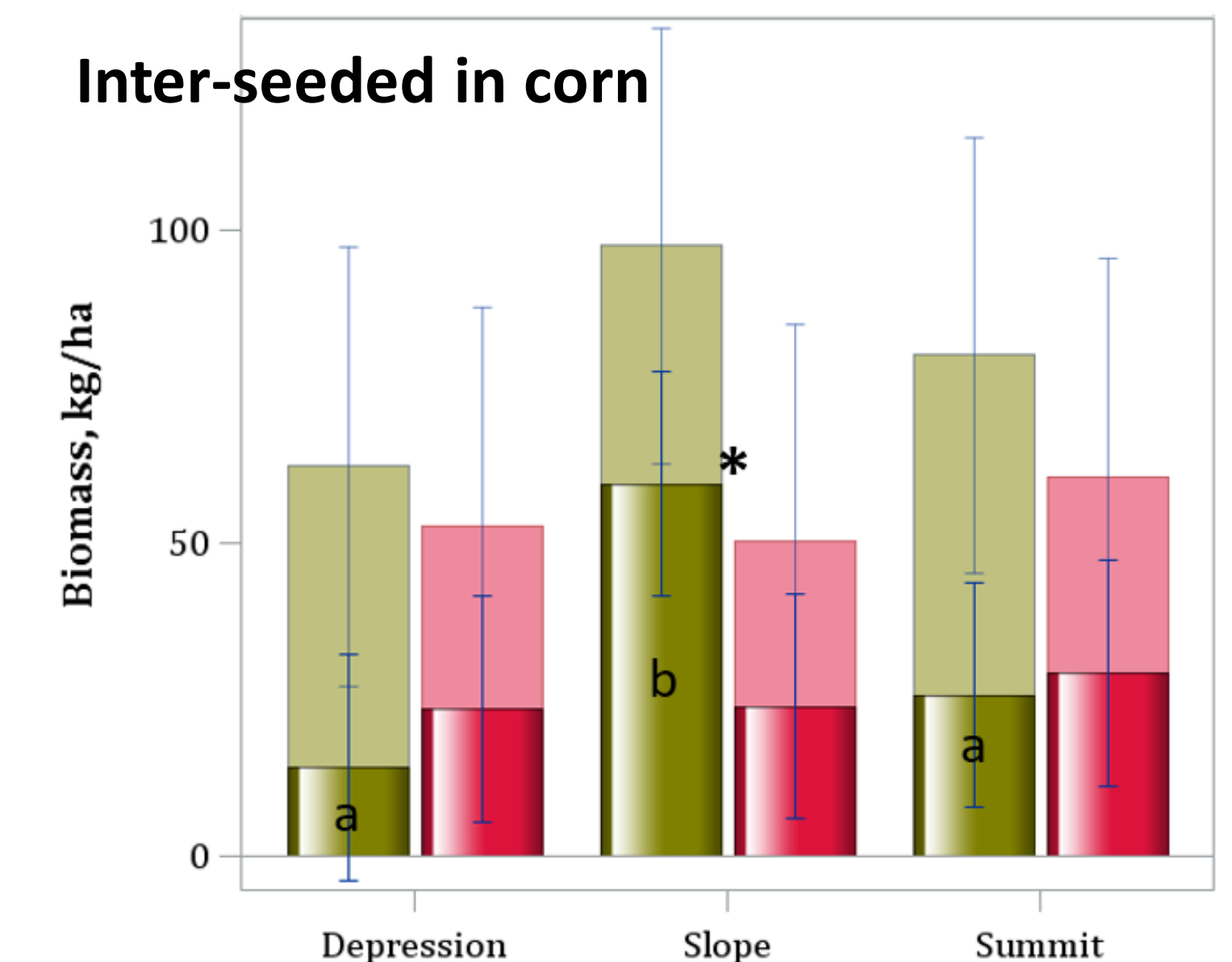
- Cover crop biomass of both WH and WK mixtures was ~10 times lower when inter-seeded in corn as compared to cover crop seeding after wheat.
- Tillage radish biomass inter-seeded in corn was greater in the depression compared with the summit.
- Annual ryegrass seeded after winter wheat had greater biomass in the depression compared with the summit; crimson clover survival was greater on the slopes and summits compared with the depression.

Acknowledgements

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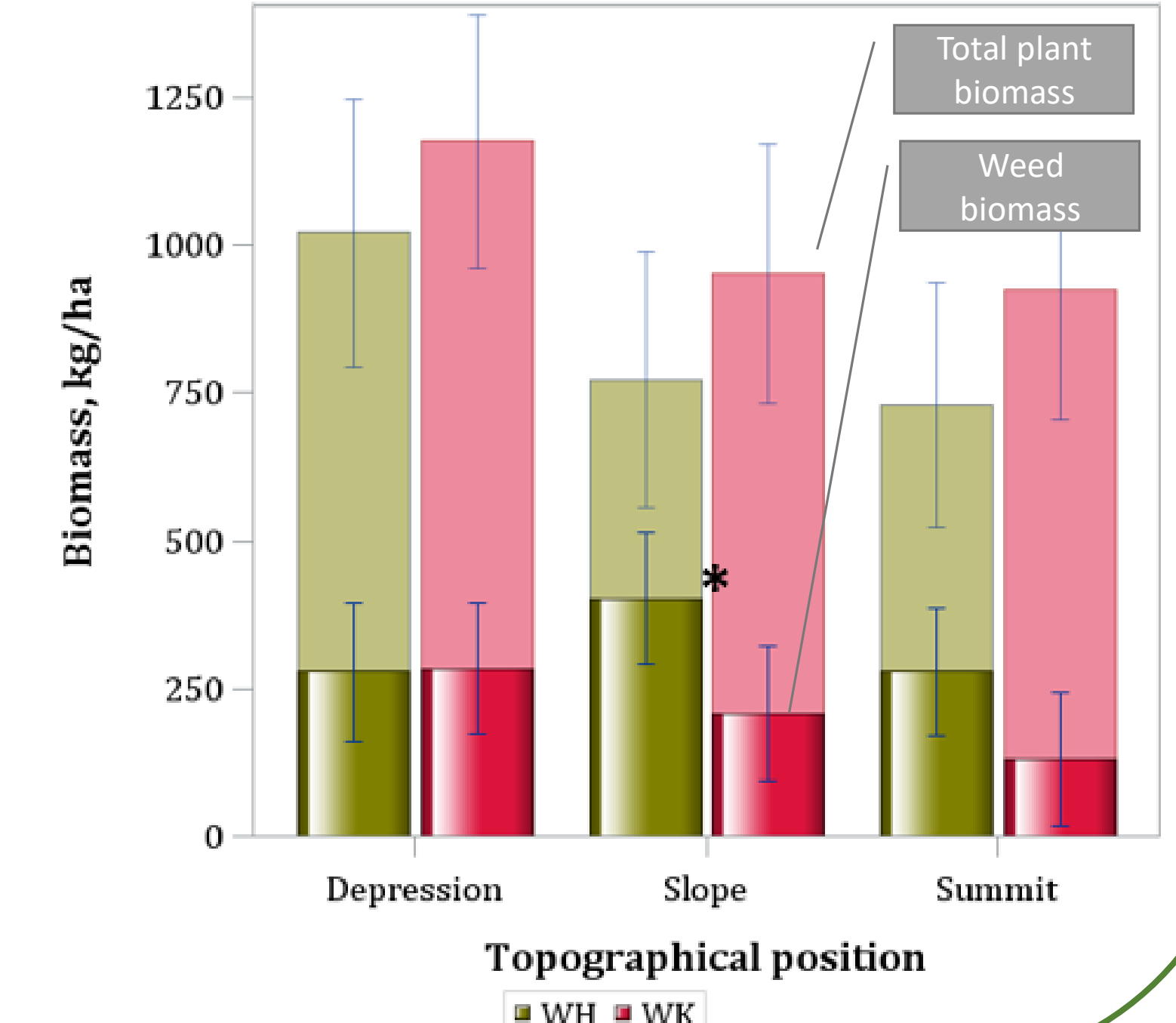
Results: weed biomass

Letters mark significant differences among topographical positions ($p < 0.05$), stars mark significant differences between WH and WK mixtures.

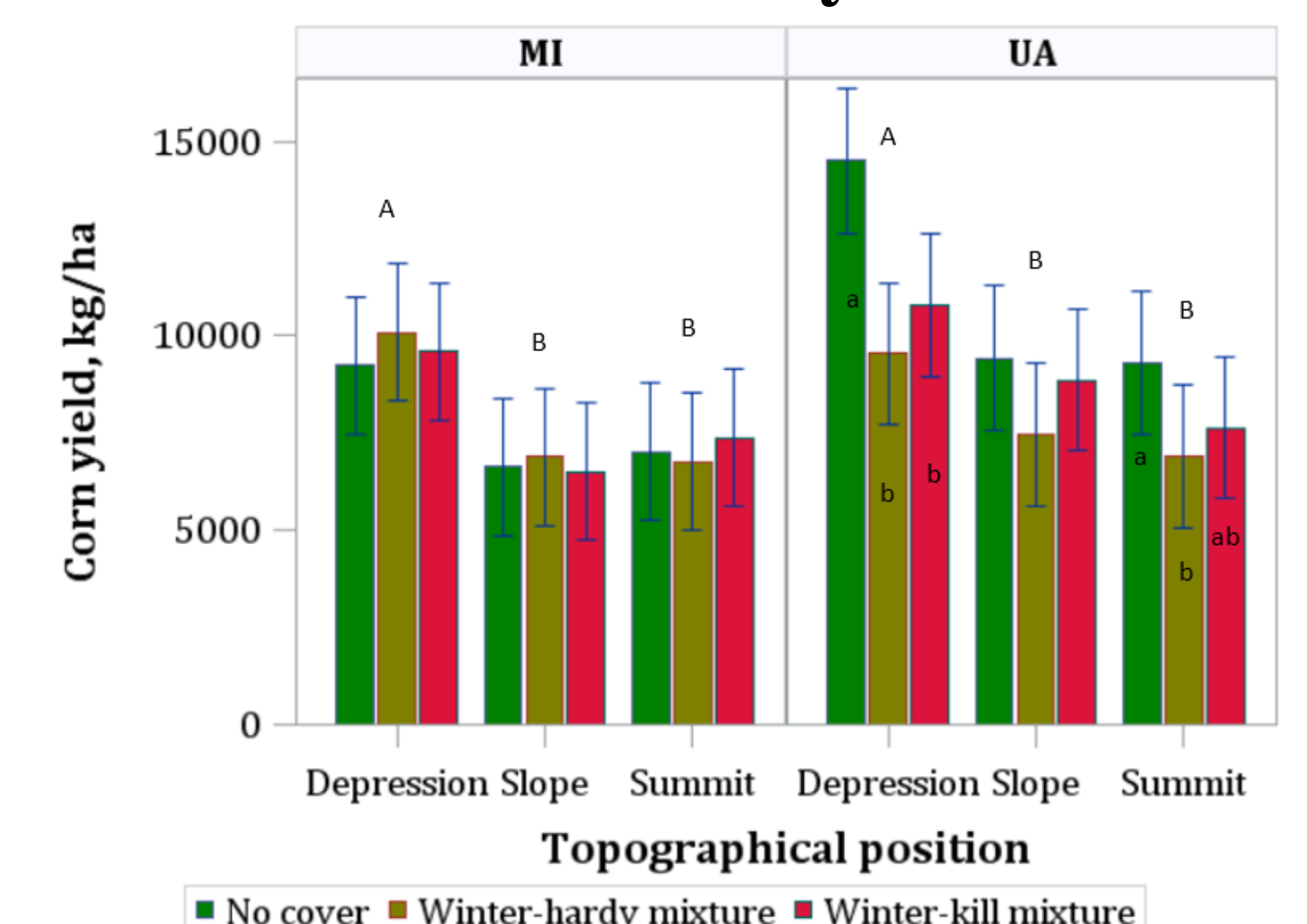


- Weed biomass in the WK mixture was not influenced by topography.
- Weed biomass in the WH mixture was greater on the slopes compared with the depression and summit when inter-seeded in corn.
- Weeds were ~40-60% of the total biomass in corn inter-seeded systems, and 20-40% in after wheat planted systems.

After winter wheat



Results: corn yields



Uppercase letters mark significant differences among topographies, across all treatments. Lowercase letters mark significant differences among the cover crop systems within topographical positions ($p < 0.05$).

- Presence of cover crops negatively affected corn yields at Ukrainian but not at Michigan sites. The yield reduction in UA was particularly severe in 2017, when the cover crop mixtures were planted earlier than optimal.

Conclusions

- Cover crop mixtures seeded after winter wheat in August had much greater biomass in late fall compared with cover crops inter-seeded in corn in late June.
- Competition for light and soil moisture reduced cover crop establishment and growth in corn and resulted in absence of the expected depression>slope~summit biomass gradient, with the exception of tillage radish in the WK treatment.
- Cover crop mixtures planted after winter wheat provided good weed suppression.
- In drier summer environments (as in Ukraine), inter-seeding of WH and WK cover crops in corn reduced yield in the topographical depressions.