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**Economic and Environmental Influence of No-Till and Cover Crops on Dryland Cotton
Production**

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*Selected Poster prepared for presentation at the 2020 Agricultural & Applied Economics
Association Annual Meeting, Kansas City, MO
July 26-28, 2020*

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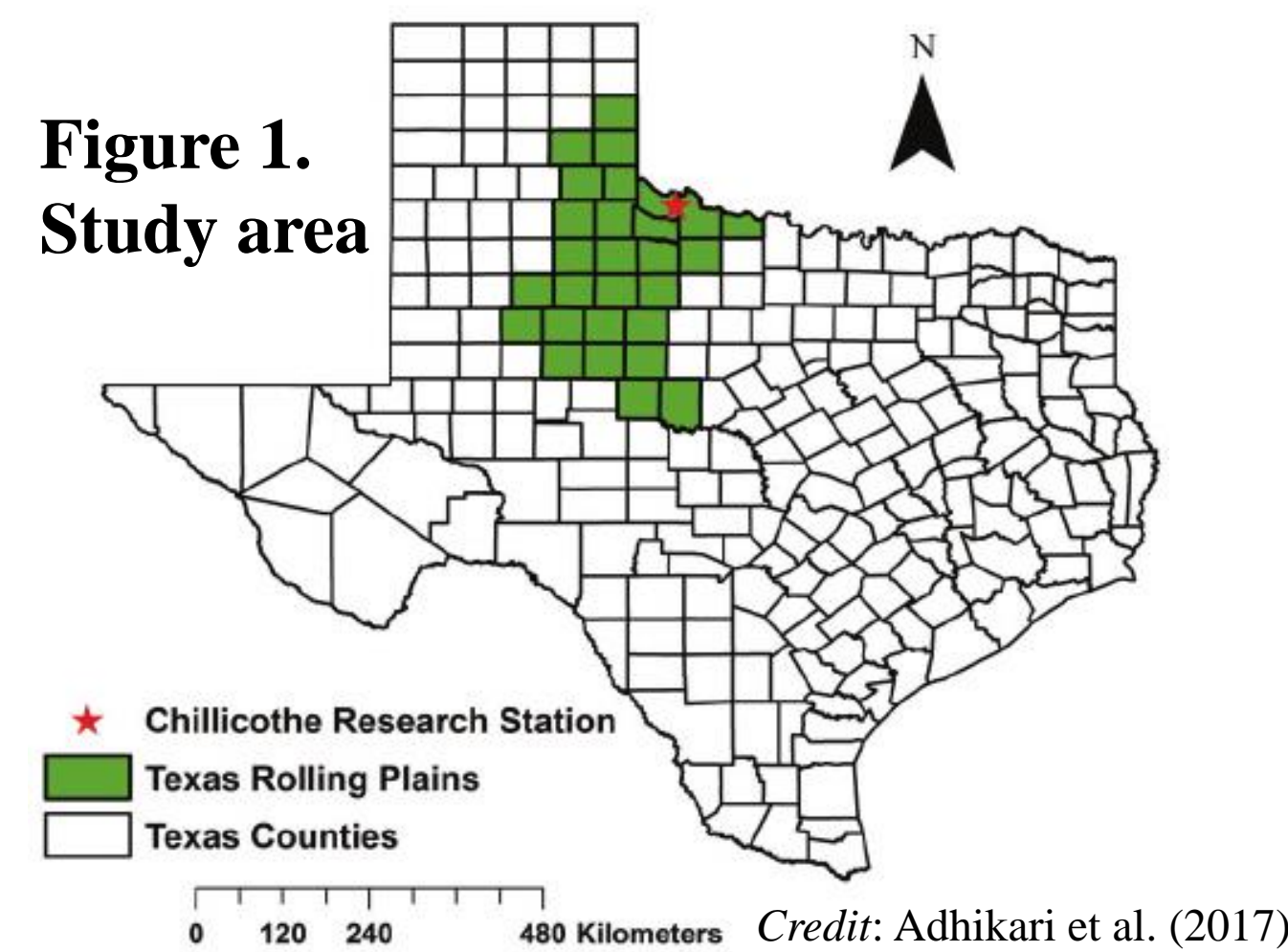
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Background and Objectives

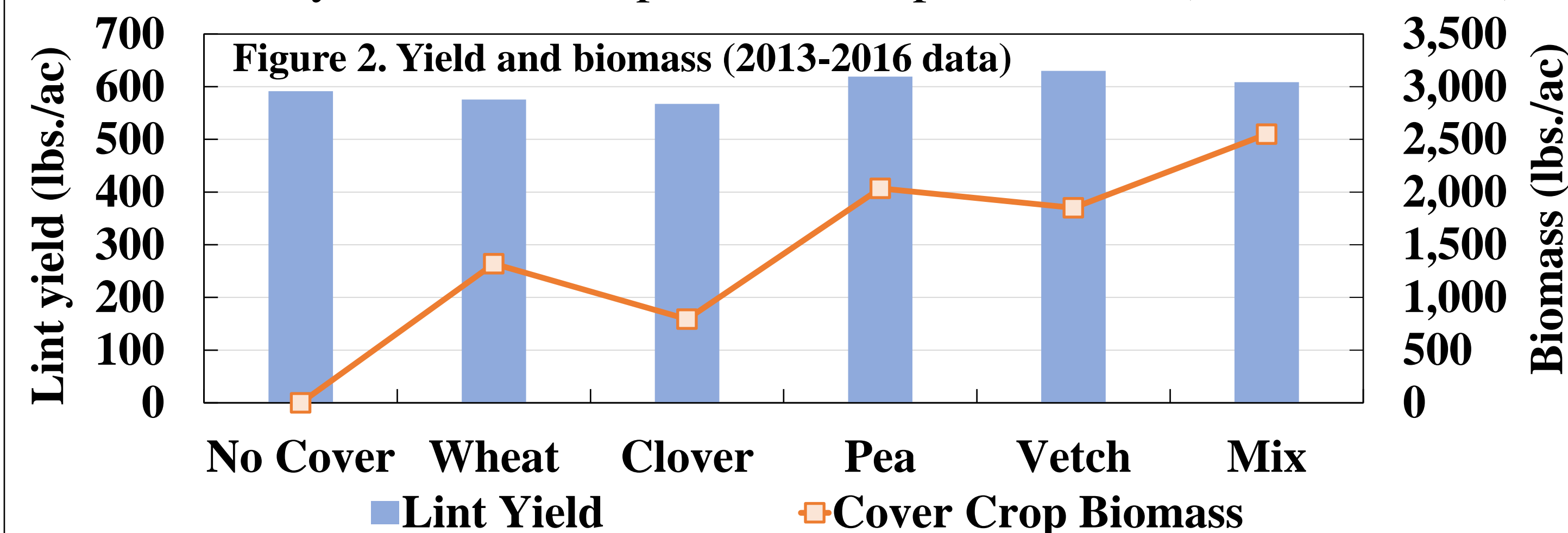
- Benefits of cover crops: curtail soil erosion, improve soil health with organic matter and nutrients, increase crop yield and farm income.
- Low cover crop adoption rate in the semiarid Southern Great Plains.
- Insignificant crop yield and farm profit from adopting cover crops.
- This study evaluates economic and environmental influence of multiple cover crops in Texas Rolling Plains dryland cotton systems.

Data and Methods

- Location: Texas A&M Chillicothe Research Station.
- Cotton systems: dryland, continuous, no-till; 2013-2016.
- Treatments** (DeLaune et al, 2020):
 - 1) No cover crop
 - 2) Winter wheat
 - 3) Crimson clover
 - 4) Austrian winter pea
 - 5) Hairy vetch
 - 6) Cover crop mixture



- Data: Lint yield, cover crop biomass, input use, etc. (Fan et al. 2019)

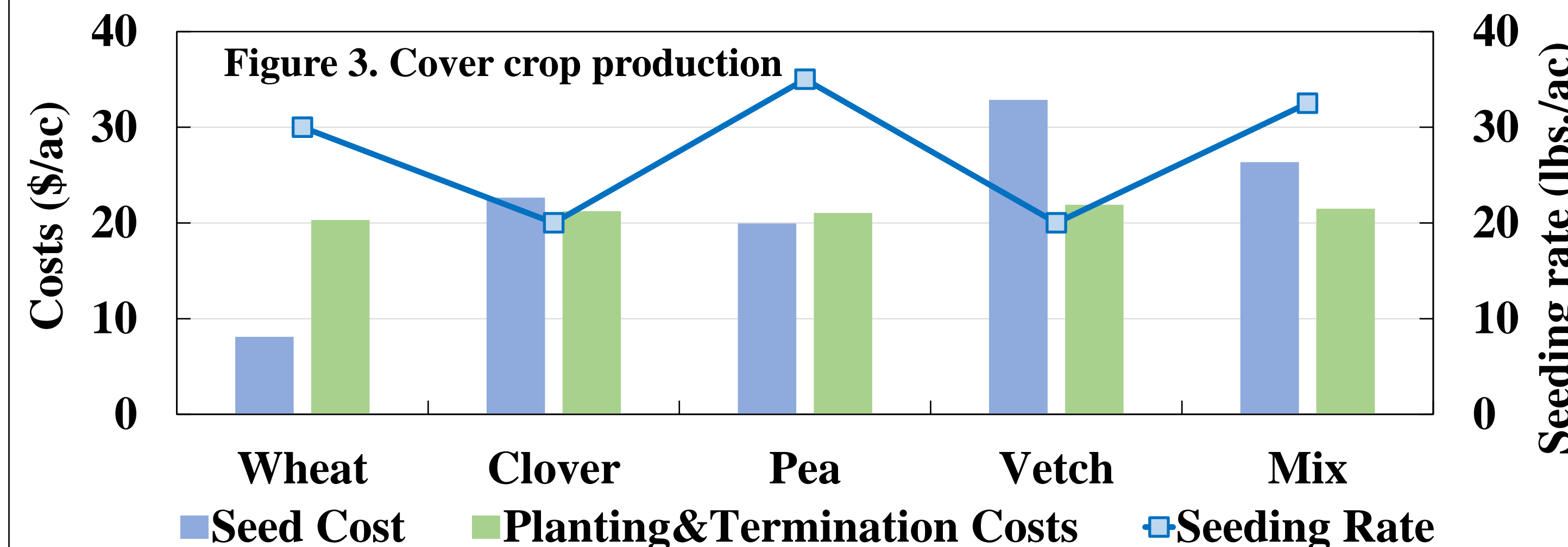


Simulation and Estimation Approach

- Utility maximization: $\max U = f(\text{farm income, soil health, environment})$
- Net present value (NPV): $NPV = \sum_{t=0}^n [NR_t / (1+r)^t]$, $NR_t = \text{Total Revenue}_t - \text{Total Cost}_t$
- Baseline scenario: No cover crop; Simulation time: $n = 30$ years
- Simulation based on a cover crop decision support tool—*Economic Analysis of Cover Crops* (Cartwright and Kirwan, 2015).

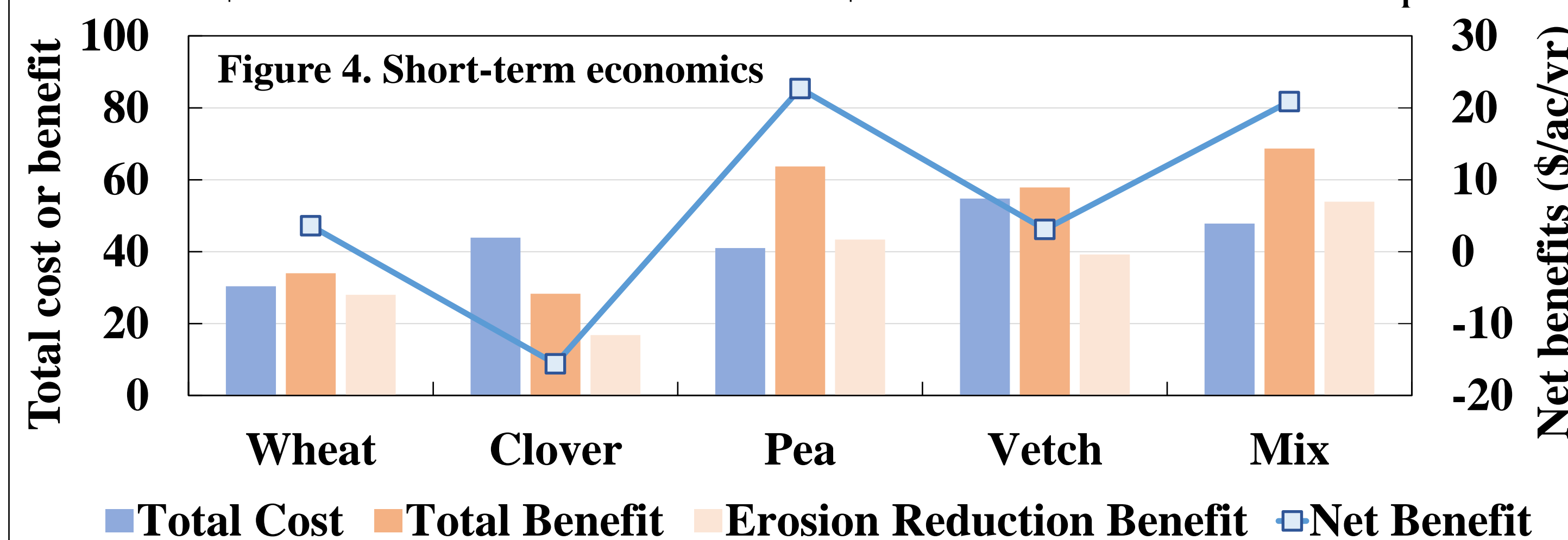
Model Parameters

Table 1. Model parameters	Wheat	Clover	Pea	Vetch	Mix
Reduction in N purchase (lbs./ac)	0	10	26	23	16
Erosion reduction (ton/ac)	4	2.4	6.2	5.6	7.7
Yield change relative to no cover crop scenario (%)	-2.7	-4.1	4.7	6.5	2.9
Years to increase SOC by 1%	15	18	12	12	11



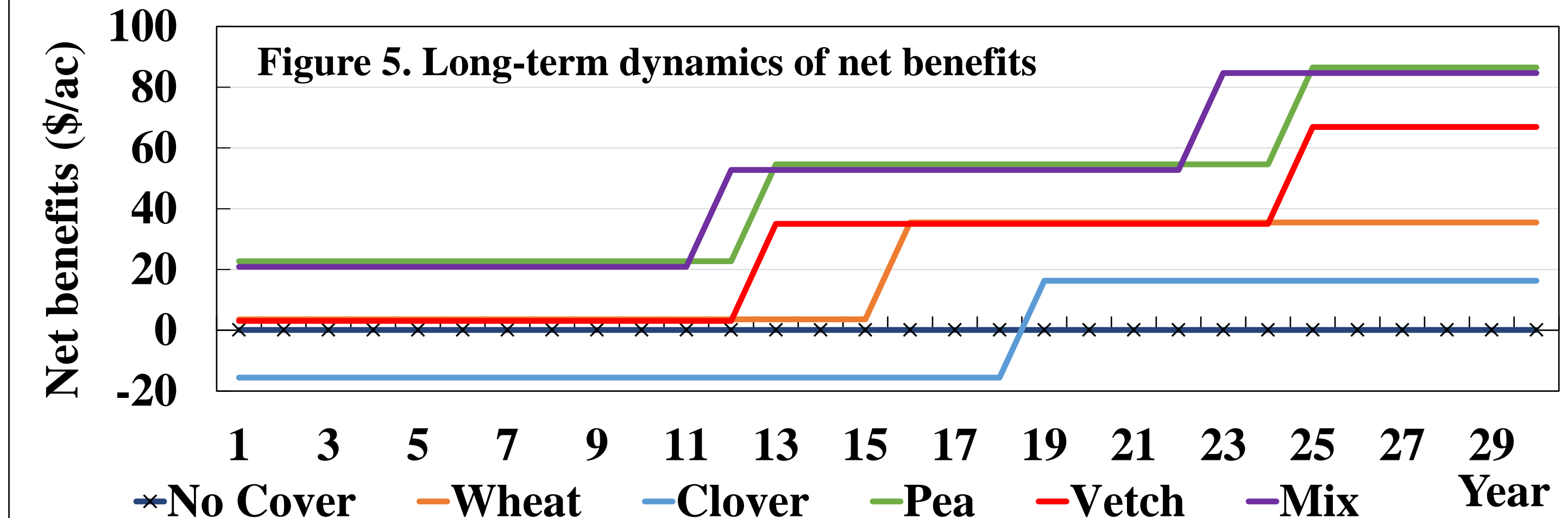
Results – Short Term Economic Results

- Both short- and long-term evaluations are conducted relative to the no cover crop scenario.
- Variable costs include expenses on tillage, seed, fertilizer, chemical, fuel, repair and maintenance, labor, irrigation, insurance, interest, harvest, and ginning. Fixed costs include all machinery depreciation.
- Relative to no cover, adding wheat cover crop increases production cost by \$30/ac, while crimson clover, Austrian winter pea, hairy vetch, and mixed cover crops increase costs by \$41-\$55/ac.
- Relative to no cover, the erosion reduction benefits range from \$17/ac for crimson clover to \$54/ac for mixed cover crops.
- Relative to no cover, the net benefits of adding cover crops range from -\$16/ac for crimson clover to \$23/ac for Austrian winter pea.

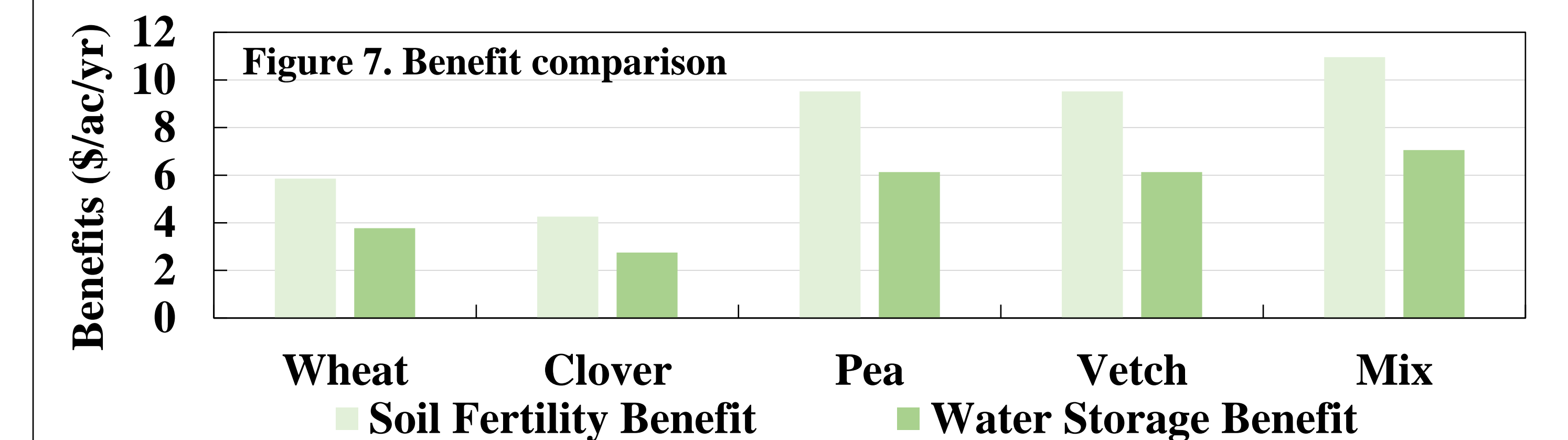
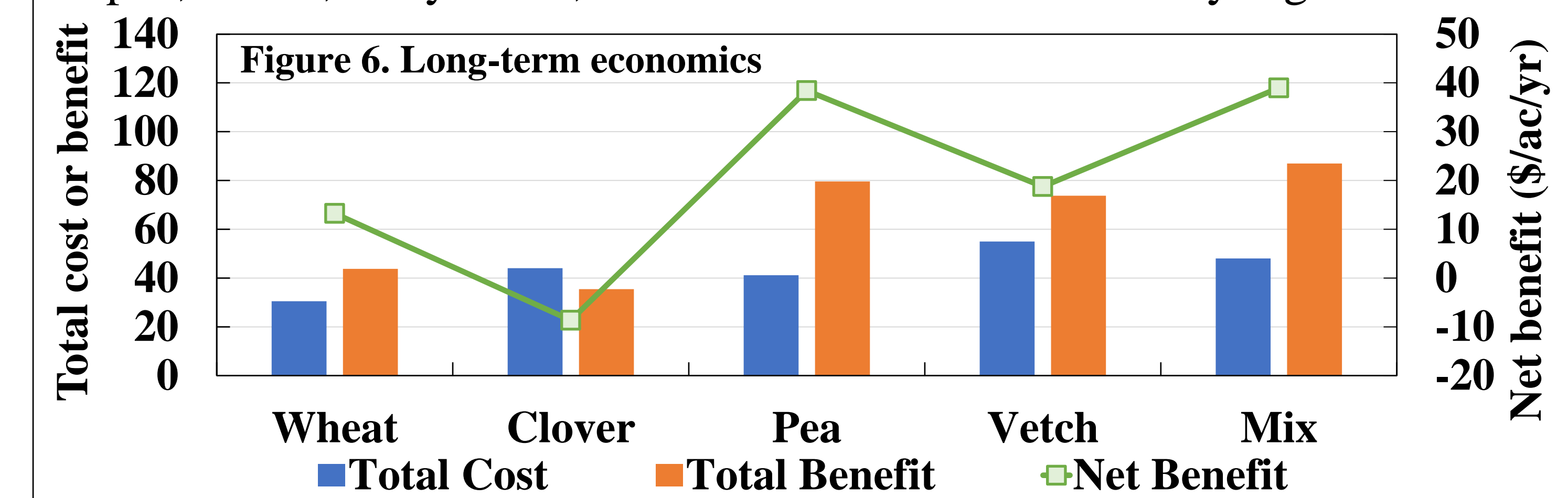


Long Term Economic Results

- The 30-year economic results show dynamic changes following soil organic matter changes (see Table 1) primarily due to different biomass amounts of the cover crops.
- In the long term, compared to no cover crop, wheat increases the annual cost by \$31/ac, and other cover crops increase the costs from \$41/ac (Austrian winter pea) to \$55/ac (hairy vetch) (see Figure 6)



- The long-term annual total benefit of crimson clover is lowest (\$35/ac) due to low biomass amount. The annual benefits of other cover crops range from \$44/ac (winter wheat) to \$87/ac (cover crop mixture).
- The long-term net benefits of adding cover crops are -\$9/ac for clover and range from \$13/ac for wheat to \$38/ac for pea and \$39/ac for mix.
- The soil fertility and water storage benefits are consistently low for crimson clover (\$4.26/ac and \$2.75/ac, respectively). Austrian winter pea, wheat, hairy vetch, and mixed cover have similarly high benefits.



Conclusion

- Cover crops do not affect short-term cotton yield. Different biomass amounts influence soil biophysical characteristics over years and the benefits of erosion reduction, soil fertility and water storage vary.
- In a short term, positive net benefits are observed for cover crops other than crimson clover, ranging from \$4/ac (wheat) to \$23/ac (mixture).
- In a long term, the positive net benefits range from \$13/ac (wheat) to \$39/ac (mixture).

References

- DeLaune, P.B., Mubvumba, P., Fan, Y. and Bevers, S., 2020. Agronomic and economic impacts of cover crops in Texas Rolling Plains cotton. *Agrosystems, Geosciences & Environment*, 3(1), pp: e20027.
- Fan, Y., DeLaune, P.B., Mubvumba, P., Kimura, E. and Park, S.C. 2019. Economics of no-till and cover crops in Texas Rolling Plains dryland cotton. *AgriLife Extension Publication*, pp: 1-13. www.agrilifebookstore.org/product-p/esc-062.htm
- Cartwright, L. and Kirwan, B. 2015. *Economic Analysis of Cover Crops*. Version 2.1, Released 10/20/2014. www.sites.google.com/site/kscovercrops/economics

Acknowledgements

Supported by the USDA Agricultural Research Service Initiative-Ogallala Aquifer Program (FY2018-FY2020), NRCS-CIG Program, ASA-ASF Program, and Cotton Incorporated Project No. 20-566TX. Yubing Fan is grateful to support from Center Director Dr. Richard Vierling.