Soil fatigue: characterizing the phenomenon and developing a mitigating cultivation protocol

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What is soil fatigue?

Soil fatigue is a term, describing a gradual decrease in production on agricultural lands due to deterioration of soil fertility, associated with Intensive monoculture agricultural practices.

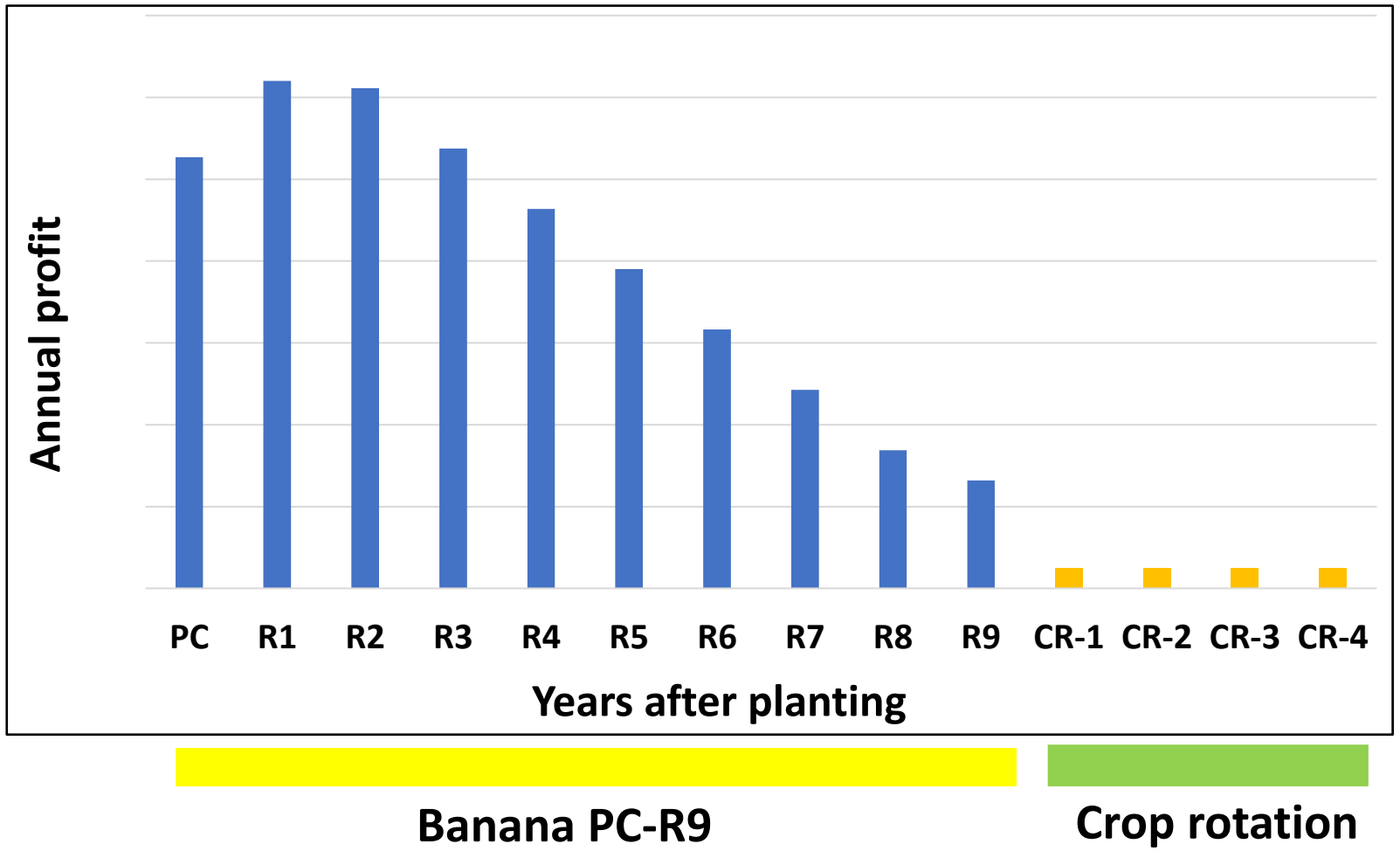
Potential causes of soil fatigue

Physical: soil compaction and reduced levels of available oxygen.

Chemical: change in soil pH, accumulation of salts and other deleterious elements/and or depletion of essential elements, disinfectants and root exudates.

Biological: unbalanced soil biodiversity - buildup of plant pathogens and/or reduction of beneficial organisms.

Soil fatigue causes rapid yield decline



Studying soil fatigue in pot systems

Microbiome analysis for the detection of underlying microorganisms (with Dr. Dror Mintz, ARO, Israel)

Testing 'short-term double row' cultivation protocol to mitigate the effect of soil fatigue

Photo: Ariel Zer-Aviv

Principles of the 'short-term double row' cultivation protocol

1. Plants are planted in double-spaced double rows. Plant number per hectare is equal to that using the standard single-row cultivation protocol.

2. Odd double rows are planted; even double rows are free of banana, hence avoiding the development of soil fatigue.

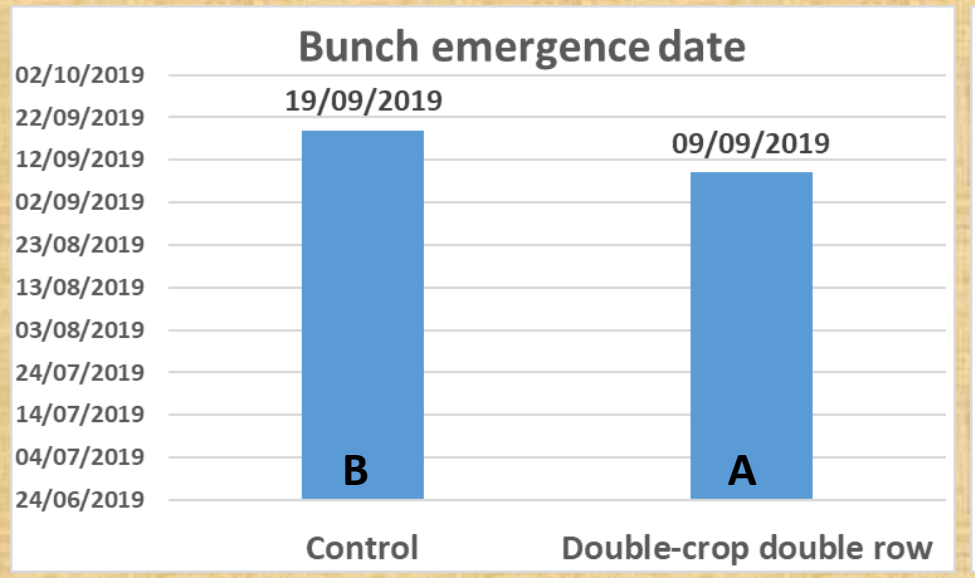
3. A rotation, every 1/2/3/4 crop cycles, between the odd and even double rows is tested.

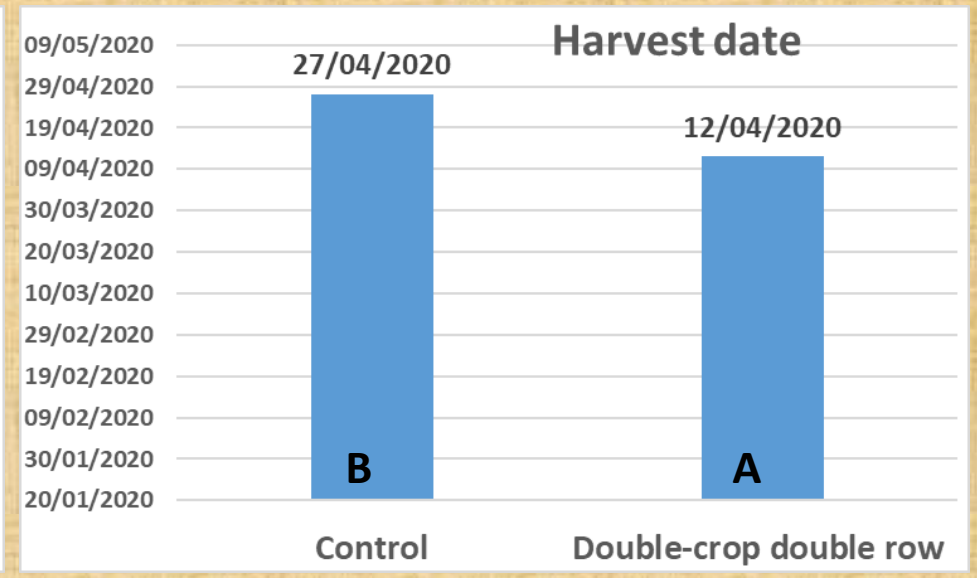
Plantation development, April 2019-June 2020

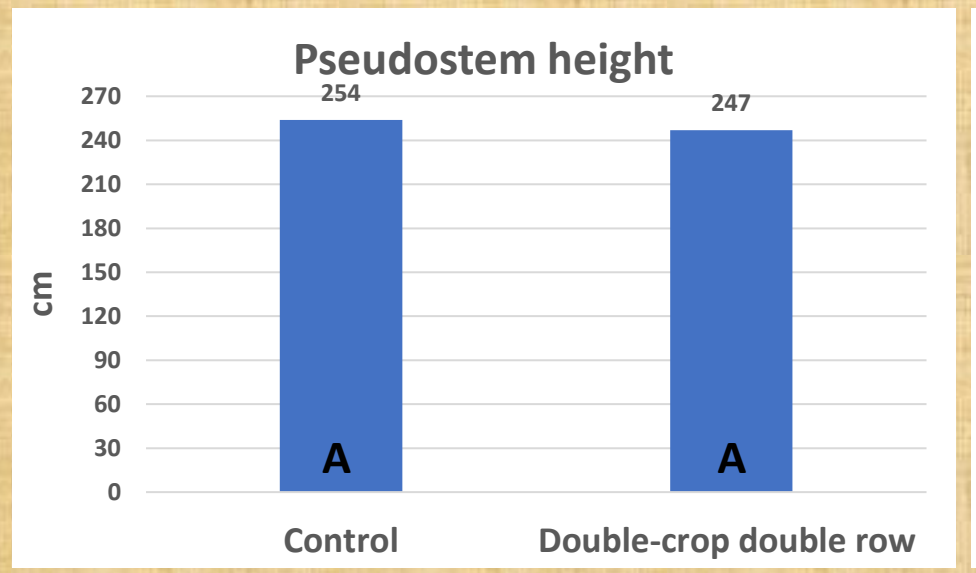
Industry standard-single row

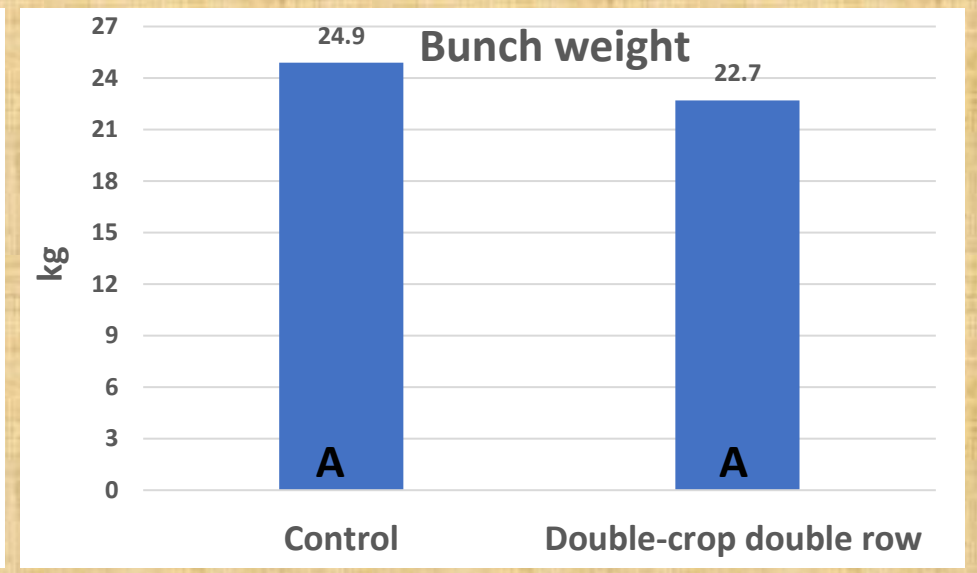
Short-term (single-crop) double row

Horticultural performance - PC

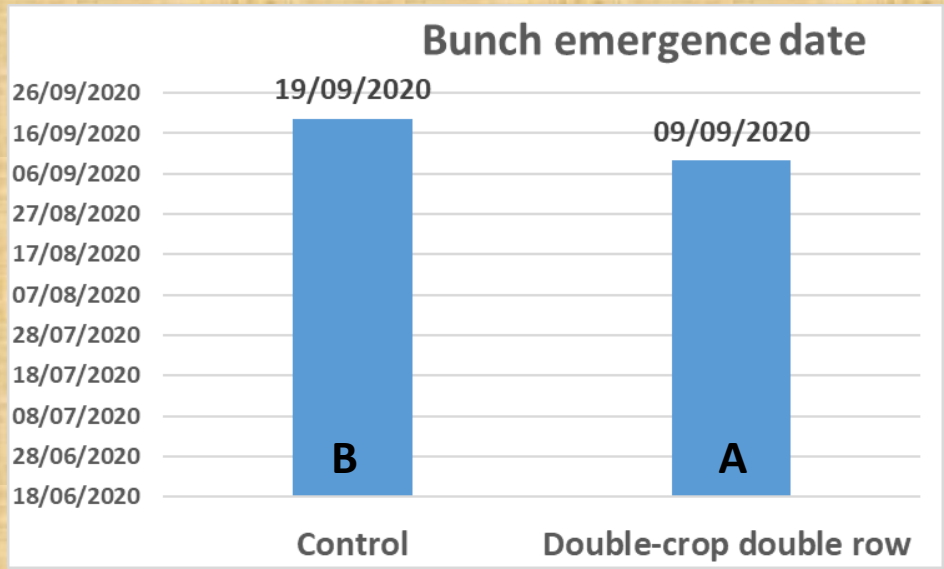


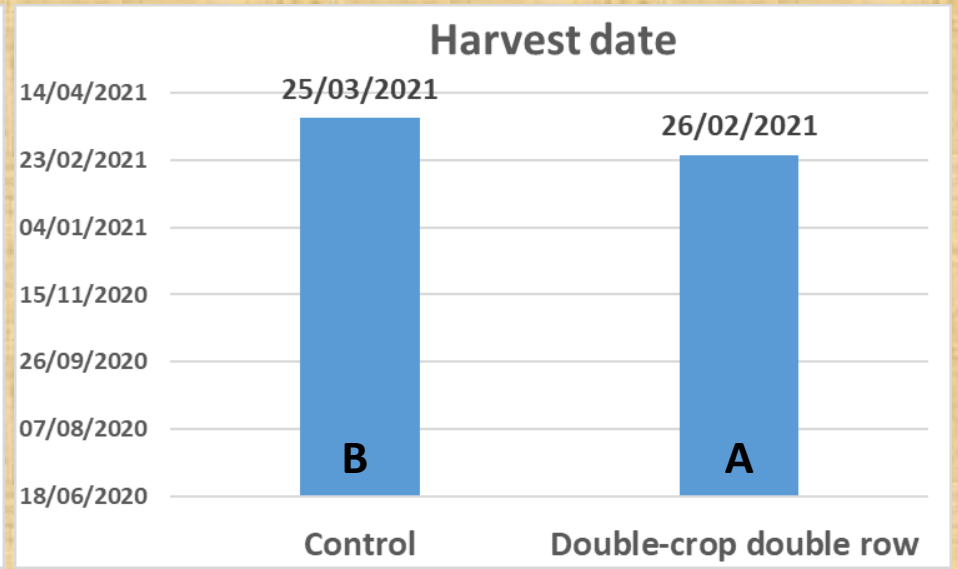


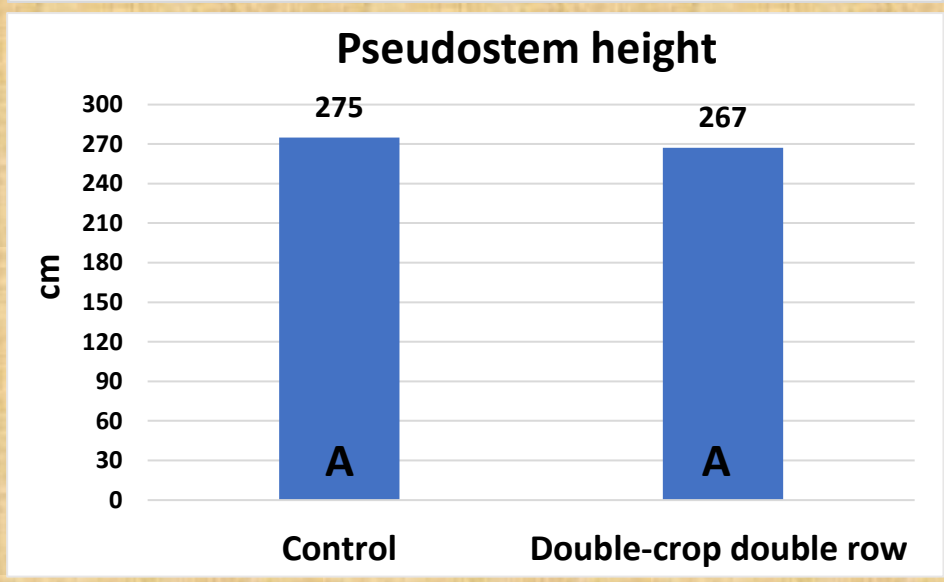


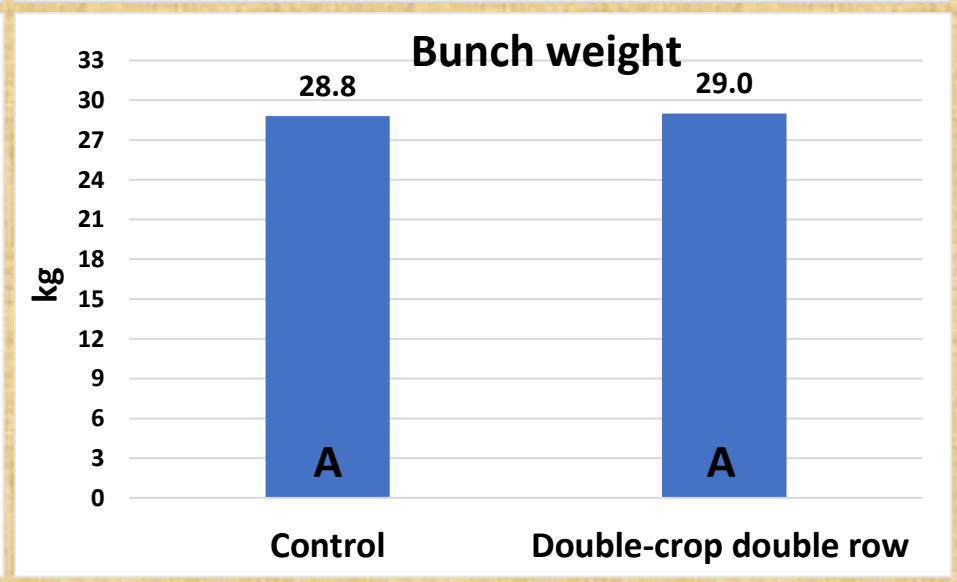


Horticultural performance - R1







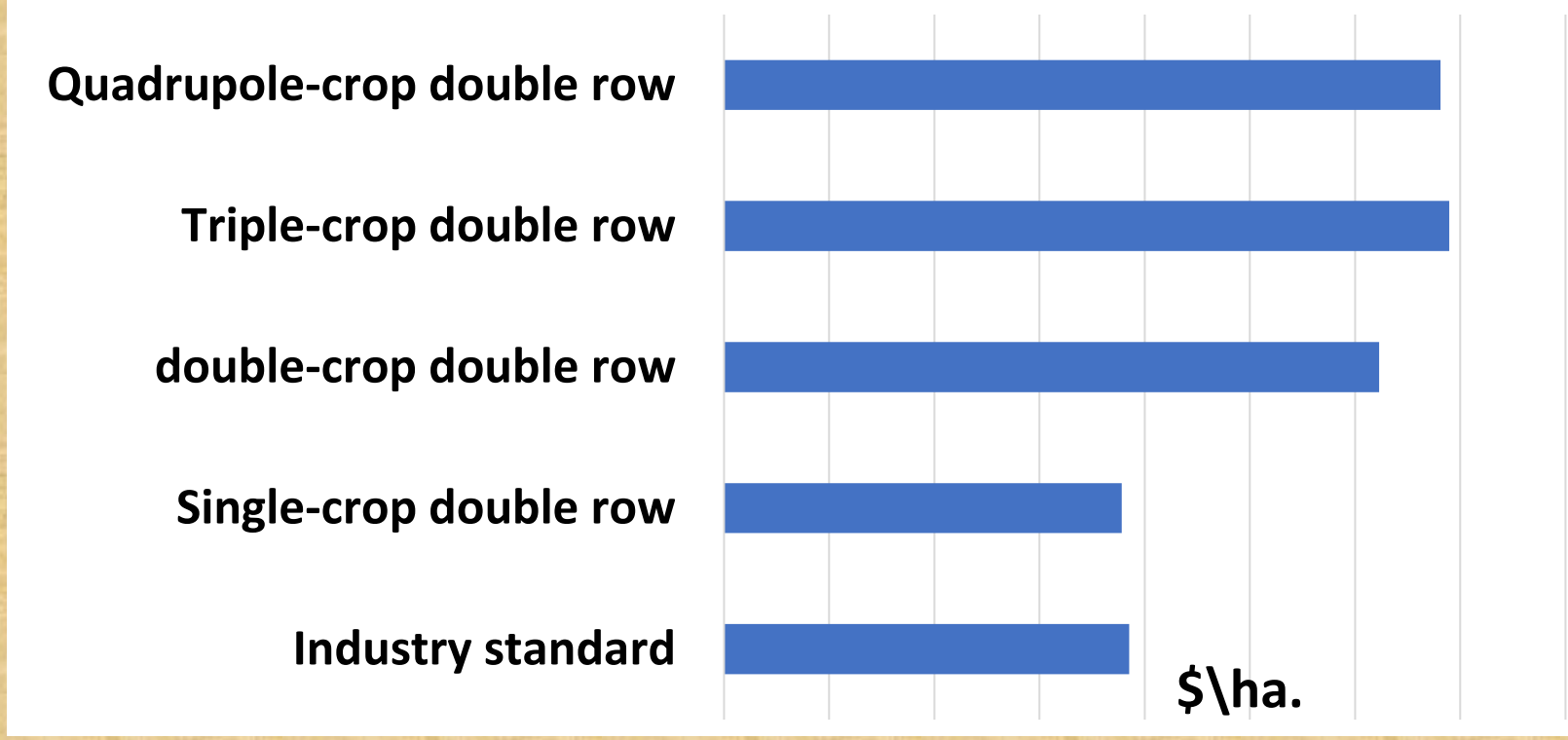


'Short-term double row': expected benefits

1. Substantial mitigation of the effects of soil fatigue, high and stable yields for many years.
2. Reduced production costs in terms of manpower.
3. Improved fruit quality.
4. Intercropping.
5. Mechanization-propping, harvesting, etc.

Expected long-term profitability: 'short-term double row' vs. standard cultivation

Expected accumulated 14 years profit: '1/2/3/4-cycle double row' vs. standard cultivation



Summary

- A cultivation protocol designated ‘short-term double row’ was developed to mitigate soil fatigue in Israel.

- The expected profitability of single- cycle was insufficient, due to high planting costs. However, extended short-term cycles (double, triple- and quadruple-crop cycles) are very promising. Evaluation is ongoing (for at least 14 years).

Acknowledgements

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