Unique Function of Buckwheat in the Seed Mixture of **Rotational Crops** Suqi Liu Department of Agriculture and Land, PEI **Christine Noronha** Agriculture and Agri-Food Canada

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Cover Crop Mixture Effects on Maize, Soybean, and Wheat Yield in Rotation



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Mitchell C. Hunter,* Meagan E. Schipanski, Macdonald H. Burgess, James C. LaChance, Brosi A. Bradley, Mary E. Barbercheck, Jason P. Kaye, and David A. Mortensen

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Functiona

Journal of Ap

Journal of Applied Ecc

Denise M. Finne

¹Department of Biolo Ecosystem Science a

High biomass	2000 X 0
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m High C/IN ratio	cover
crc	crop
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prc	. Our
m -Soil C accumulation	tions
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accumulation without compromising viold	1

ccumulation—without compromising yield.

Expected benefits for the species in the mixture:

- Improving Soil health
- Combating Soil-borne pests



Potential Candidate: **Buckwheat**

Buckwheat (BW) Function Pros Cons

- Control wireworms
- Control dampingoff and root rot
- Control weeds
- Green manure
- P scavenger
- Attract beneficial insects

- Not frost tolerate
- Prone to white mold
- Allelopathic Effects



--Feng et al. 2015



Search text, DOI, authors, etc.

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Exudation of Allelopathic Substances in Buckwheat (Fagopyrum esculentum Moench)

Jana Kalinova, Nadezda Vrchotova and Jan Triska



Allelopathy of buckwheat: Assessment of allelopathic potential of extract of aerial parts of buckwheat and identification of fagomine and other related alkaloids as allelochemicals

Zahida Iqbal 🔀, Syuntaro Hiradate, Akio Noda, Sei-Ichi Isojima, Yoshiharu Fujii

First published:03 April 2006 | https://doi.org/10.1046/j.1445-6664.2002.00055.x | Citations: 36

Allelopathic Effects of BW on Four Common Rotation Crops





- Penetrate compacted soil
- Add organic matter to worn-out soils
- Suppress nematodes

- Strong taproot to break through compacted layers
- A legume that provides added nitrogen

Allelopathic Effects of BW on Four Common Rotation Crops



- Extract zinc from the soil
- Break up compacted soil.
- Attract pollinators and beneficials.
- Scavenge up to 200 lbs of residual N/A/yr
- Weed suppression
- Soil protection
- Attracts very few insect pest

Experimental Design

- Plants were seeded at field seeding rate
- Eight treatments:

SGS; SGS+BW; AF; AF+BW; SF; SF+BW; RG; RG+BW

# of Seed	SGS	AF	SF	RG
With BW	9	12	3	45
Without BW	18	24	6	90



Surface Area: 0.1 m²

SGS	SGS	SGS	SGS	SGS	SGS
SGS	SGS	SGS	SGS	SGS	SGS
SGS	SGS	SGS	SGS	SGS	SGS

BW	SGS	BW	SGS	BW	SGS
SGS	BW	SGS	BW	SGS	BW
BW	SGS	BW	SGS	BW	SGS

Experimental Design

- Four repetitions for each treatment
- Plants were collected in 2 months
- Five parameters were evaluated:
 - Germination rate
 - Fresh shoot length
 - Fresh shoot weight
 - Fresh root length
 - Fresh root weight



Germination Rate (%)



Germination Rate of Different Crops With (50%) or Without Buckwheat Presenting

Fresh Shoot Length



Buckwheat impacts on the shoot length of other crops

Fresh Shoot Weight



Buckwheat impacts on the fresh shoot weight of other crops

Fresh Root Length



Buckwheat impacts on the root length of other crops

Fresh Root Weight



Buckwheat impacts on the root weight of other crops

Allelopathic Effects of BW on Four Common Rotation Crops



Sunflower Sorghum Alfalfa Ryegrass Sudangrass

50% Buckwheat + 50% Selected Crop

• Is germination rate affected by BW? YES

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- Is crop biomass affected? **YES**
- Is root density affected? YES



Wireworm Control

Allelopathic effects



70 🗖 April 29th June 16th 60 🛯 Aug 16th 50 40 30 20 10 0 Blank Buckwheat Barley Clover

Wireworm Food Preference

--- Study results in 2018

WW's Response to BW at Different Proportions of the Seed Mixture





Experiment Design:

- 5 treatments
- 3 or 4 repetitions for each treatment
 - First bioassay: small sized larvae (n=300)
 - Second bioassay: all sized larvae (n=400)
- 20 WWs were released in each box at seeding time.
- Soil were collected and checked in 2 months
- Two major parameters of wireworms were evaluated:
 - --- Mortality --- Body weight

WW's Response to BW at Different Proportions of the Seed Mixture

Treatments	T 1	Т2	T 3	T 4	T 5
Buckwheat	100%	50%	35%	20%	0
Other Crop	0	12.50%	16.25%	20%	25%
Rep.	3/4	3/4	3/4	3/4	3/4
# of WW	60/80	60/80	60/80	60/80	60/80
# of Seed	T 1	T 2	Т3	T 4	T 5
Buckwheat	20	10	7	4	0
SGS	0	3	3	4	5
Alfalfa	0	3	4	5	6
Sunflower	0	1	1	1	2
Ryegrass	0	11	15	18	23

Wireworm Mortality (n=700)



Increased Percentage of WWs' Body Weight (n=300)



Increased Percentage of WWs' Body Weight (n=700)



WW's Response to BW at Different Proportions of the Seed Mixture

Buckwheat at **20%** of the seed mixture produced **comparable wireworm control activity** to 100% BW

Allelopathic Effects of 20% BW on Four Rotational Crops

- Two Treatments:
 - ---Crop mixture with BW (20%) ---Crop mixture without BW
- Four repetitions for each treatment
- Plants were collected in 2 month
- Five parameters were evaluated:
 - Germination rate
 - Fresh shoot length
 - Fresh shoot weight
 - Fresh root length
 - Fresh root weight



Germination Rate (%)



Fresh Shoot Length



Fresh Shoot Weight



Fresh Root Length



Fresh Root Weight



Allelopathic Effects of BW at 20% on Other Crops



Sorghum Sudangrass



Alfalfa

Allelopathic Effects of BW at 20% on Other Crops





Sunflower



50% BW Presented

20% BW Presented

BW plant exudates conducted different functions on certain crops at different concentrations ???

Conclusions

- BW significantly scaled down the growth rate of SGS, AF, SF, and RG when planted at half-half ratio.
- BW at 20% of the seed mixture produced comparable wireworm control activity to 100% BW.
- The growth rates of SGS, AF, and SF weren't significantly inhibited by BW at 20% of the seed mixture, while the growth of RG was stimulated.

All results were obtained under the greenhouse condition.

On-farm trials are required to verify the results.

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