De Bortoli Wines
Yarra Valley Vineyards

Using Biological farming practices to grow the best grapes efficiently, safely and sustainably

Soil Management using Biological Farming Techniques

What is Biological farming?

Why we implement it on our farms

How we utilise and encourage organisms to work for us to improve soil health and vine health

Outcomes since implementation in spring 2008

What is Biological Farming?

Biological Farming is seeking a biological remedy before we consider a physical or chemical approach.

We amend our systems to enable living organisms to alter a situation to our desired state.

We monitor as best we can the impact of Biological farming.

Soil Biology

Microbiology

Bacteria

Fungi

Protozoa

Nematodes

Macrobiology

Worms

Ants

Grubs

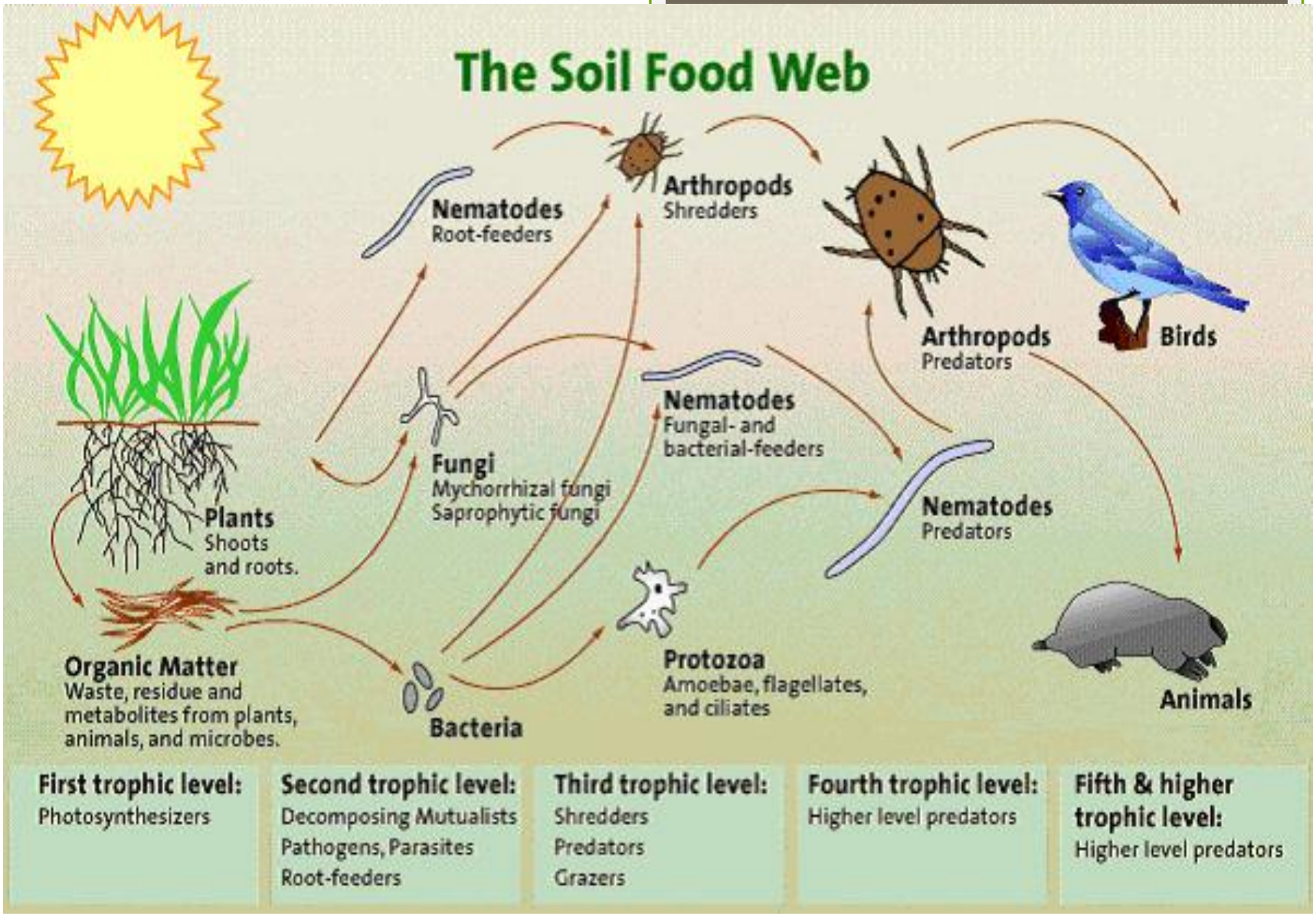
Plants

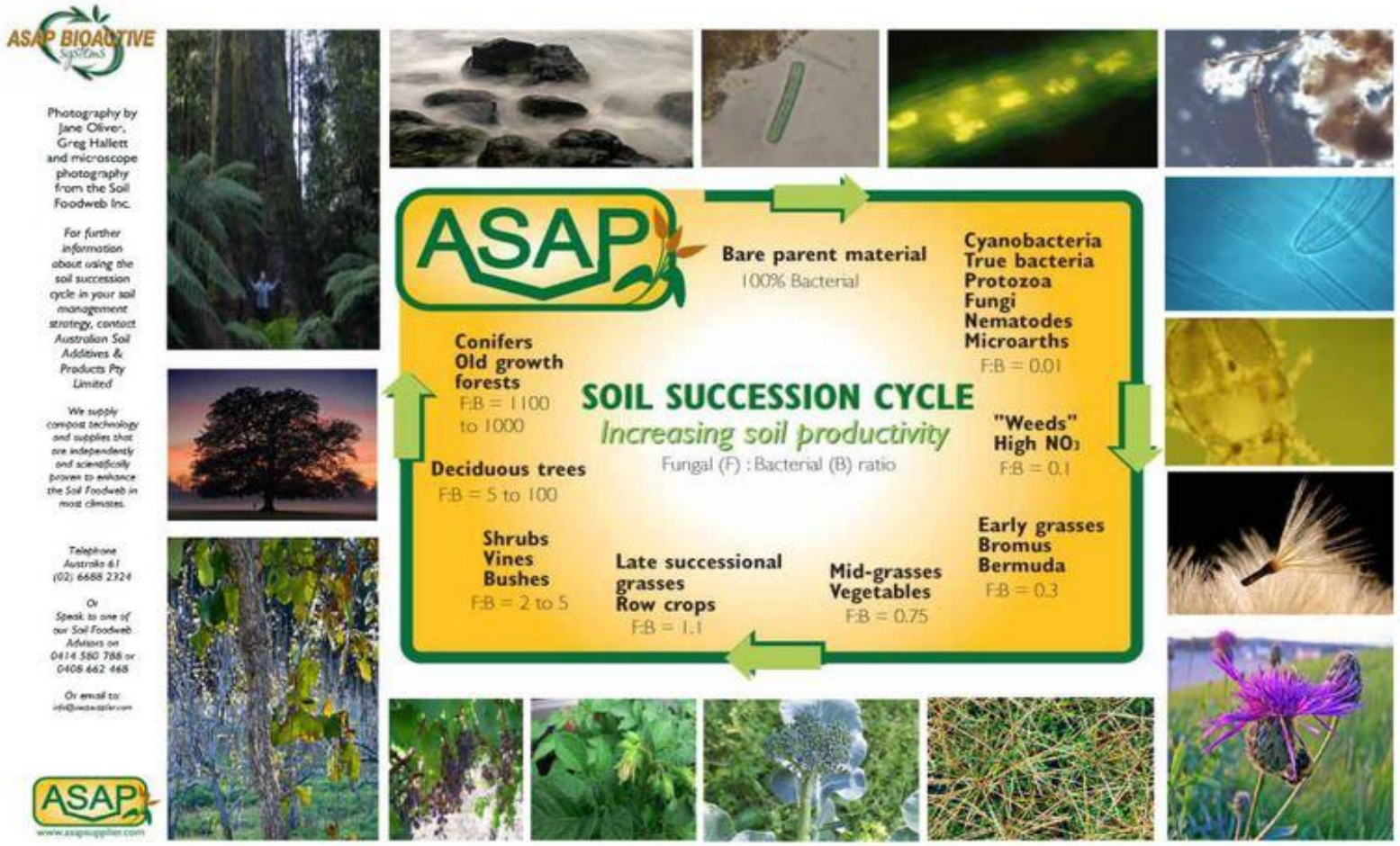
Why do we use biology to manage soil characteristics?

We considered the ecosystems where wild vines grow naturally

What was our farms natural system, and what state is it in now?

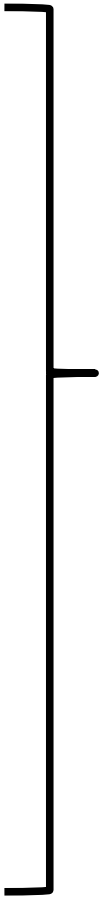
How can we best reconcile the differences between the natural system and our agriculture system to allow each vine to best express its wine characteristics


The Soil Food Web
Nematodes
Root-feeders
Arthropods
Shredders
Arthropods
Predators
Birds
Nematodes
Fungal- and
bacterial-feeders
Fungi
Mychorrhizal fungi
Saprophytic fungi
Plants
Shoots
and roots.
Nematodes
Predators
Organic Matter
Waste, residue and
metabolites from plants,
animals, and microbes.
Bacteria
Protozoa
Amoebae, flagellates,
and ciliates
Animals
First trophic level:
Photosynthesizers
Second trophic level:
Decomposing Mutualists
Pathogens, Parasites
Root-feeders
Third trophic level:
Shredders
Predators
Grazers
Fourth trophic level:
Higher level predators
Fifth & higher
trophic level:
Higher level predators


ASAP BIOACTIVE Systems
Photography by Jane Oliver, Greg Hallett and microscope photography from the Soil Foodweb Inc.
For further information about using the soil succession cycle in your soil management strategy, contact Australian Soil Additives & Products Pty Limited
We supply compost technology and supplies that are independently and scientifically proven to enhance the Soil Foodweb in most climates.
Telephone Australia 61 (02) 6688 2324
Or Speak to one of our Soil Foodweb Advisors on 0414 580 788 or 0408 662 668
Or email to:
ASAP
www.asapsupplier.com
ASAP
Bare parent material
100% Bacterial
Cyanobacteria
True bacteria
Protozoa
Fungi
Nematodes
Microarths
F:B = 0.01
Conifers
Old growth forests
F:B = 1100 to 1000
SOIL SUCCESSION CYCLE
Increasing soil productivity
Fungal (F) : Bacterial (B) ratio
"Weeds"
High NO3
F:B = 0.1
Deciduous trees
F:B = 5 to 100
Shrubs
Vines
Bushes
F:B = 2 to 5
Late successional grasses
Row crops
F:B = 1.1
Mid-grasses
Vegetables
F:B = 0.75
Early grasses
Bromus
Bermuda
F:B = 0.3

What dictates the default state of an ecosystem?

Geology
Soil Type
Temperature range
Rainfall
Seasonality
Topography
Aspect



Biology types and forms are selected based on system parameters

How we encourage soil biology to grow better grapes

We create the best physical environment possible for desired biology growth

We start at the bottom of the food chain

We push the system via inoculum and food sources

We create symbiotic relationships wherever possible

We try to minimise acts that destroy the desired biology

Soil Physical State

Structure

Porosity

Water movement and retention

Reduce compaction

Permanent vegetation coverage

Minimal cultivation


TRIMA
Rebound


5

Compaction minimisation

Controlled traffic rows

Doing more than one operation

Double row equipment

Over row equipment

Soil Puffer

Inoculum and Food sources

Compost

Compost Tea

Bacterial Foods

Fungal Foods

Protozoa

Nematodes

Earthworms

Compost

We try to make a fungal compost

We primarily use plant materials

Recipe is 25% Grape marc (high N), 15% Hay (med C:N ratio) and 60% Wood chips (High C)

We let the temp get to 65 degrees and then turn it so it has enough O_2

We turn until the temp stops climbing to 65 degrees this usually takes 10-16 weeks


CENTER 305 DATA LOGGER THERMOMETER
63.8 °C
m-d h:m
05-14 16:27
MAX MIN
SETUP
REL
HOLD
CLOCK
INTV
REC
°C/°F
RANGE -200°C ~ 1370°C
-328°F ~ 2498°F
POWER-UP OPTIONS
HOLD + Disable AUTO OFF
REC + Erase MEMORY

Cost of Making Compost

Grape Marc	$0	25%	$0
Hay	$0 to $10	15%	$1.50
Wood chips	$8 to $14	60%	$8.50
Making Piles			$2.50
Turning Piles			$0.50
Total for 1 M cubed of Compost =			$13.00

Compost Tea

Uses biology in Compost and encourages that biology to multiply in a liquid phase

Must have adequate oxygen levels to allow anerobic organisms to dominate

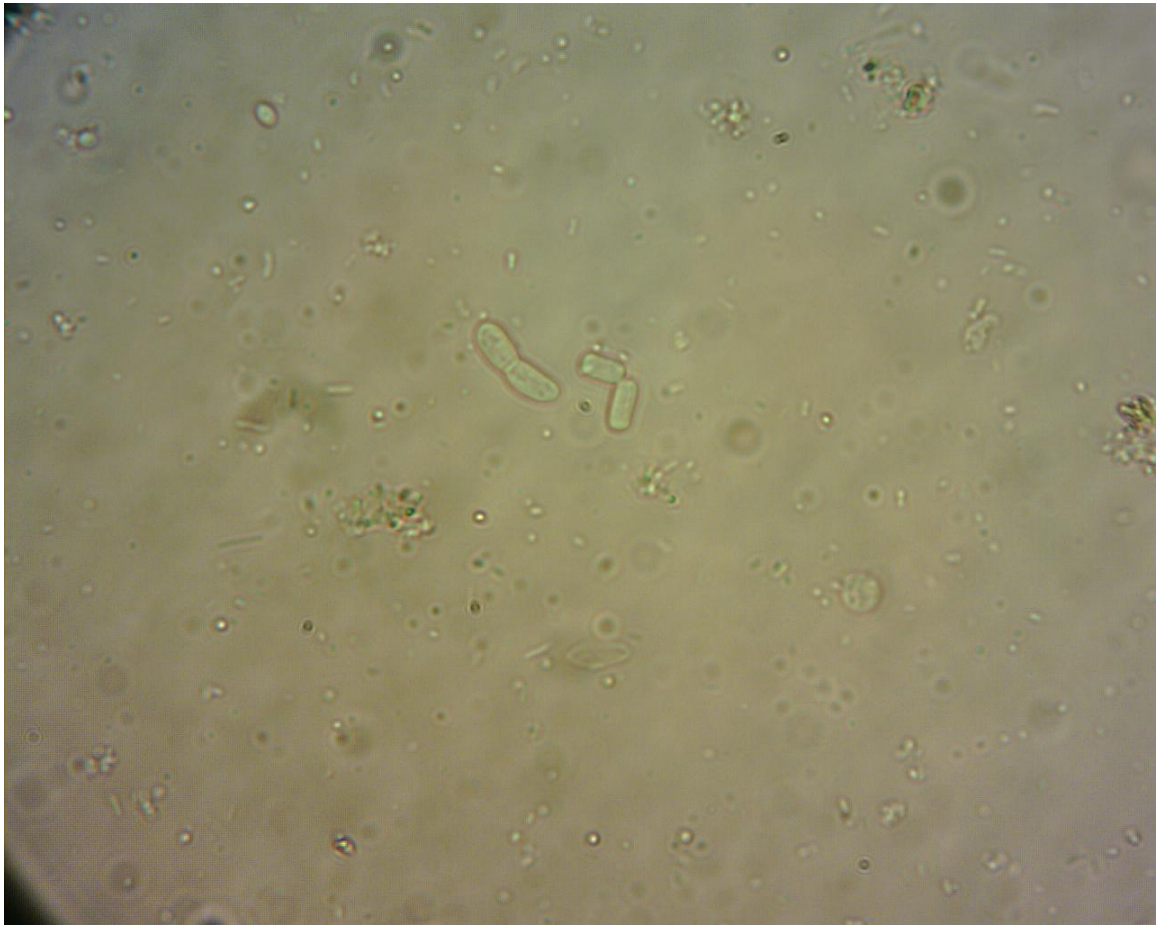
Must add foods for organisms

Can brew at ambient or elevated temps up to about 32 degrees

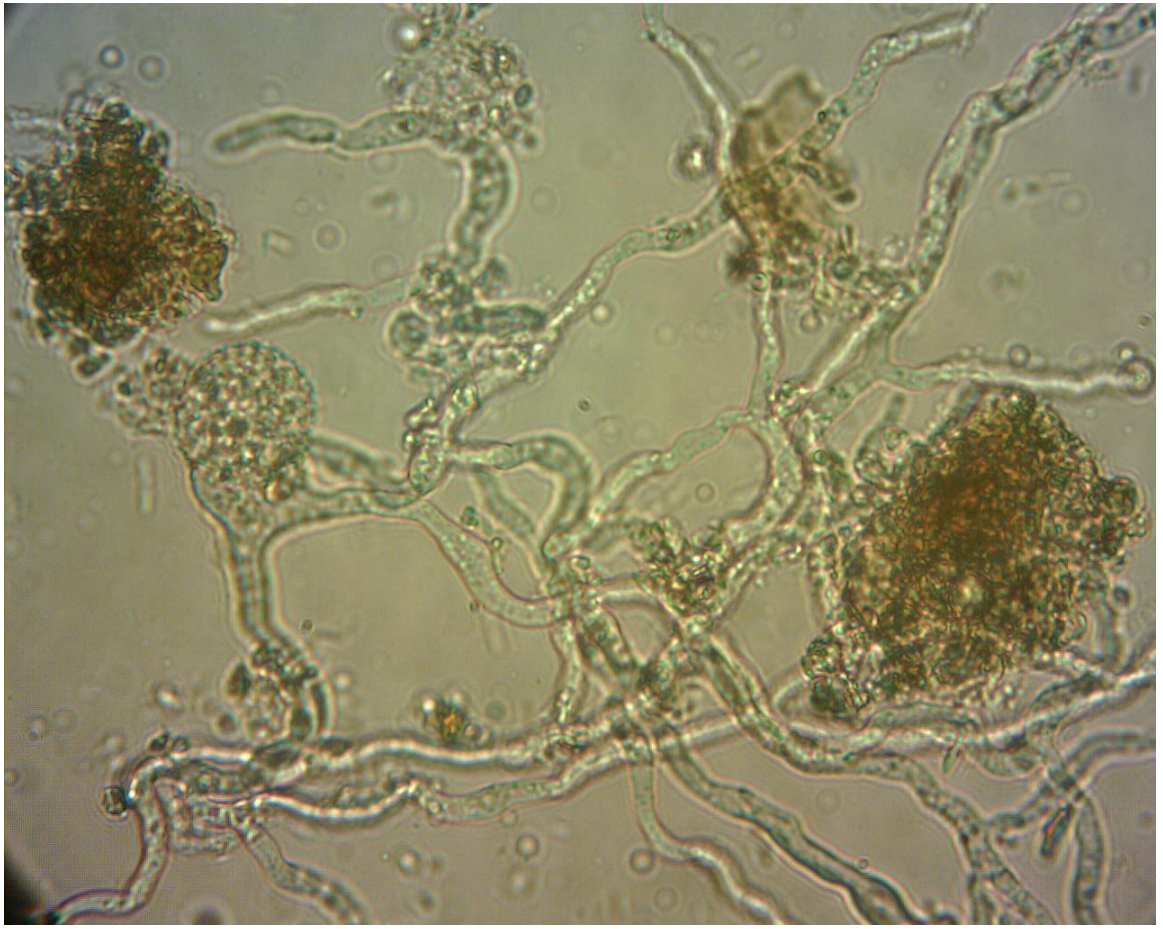
Compost Tea Recipe & Cost

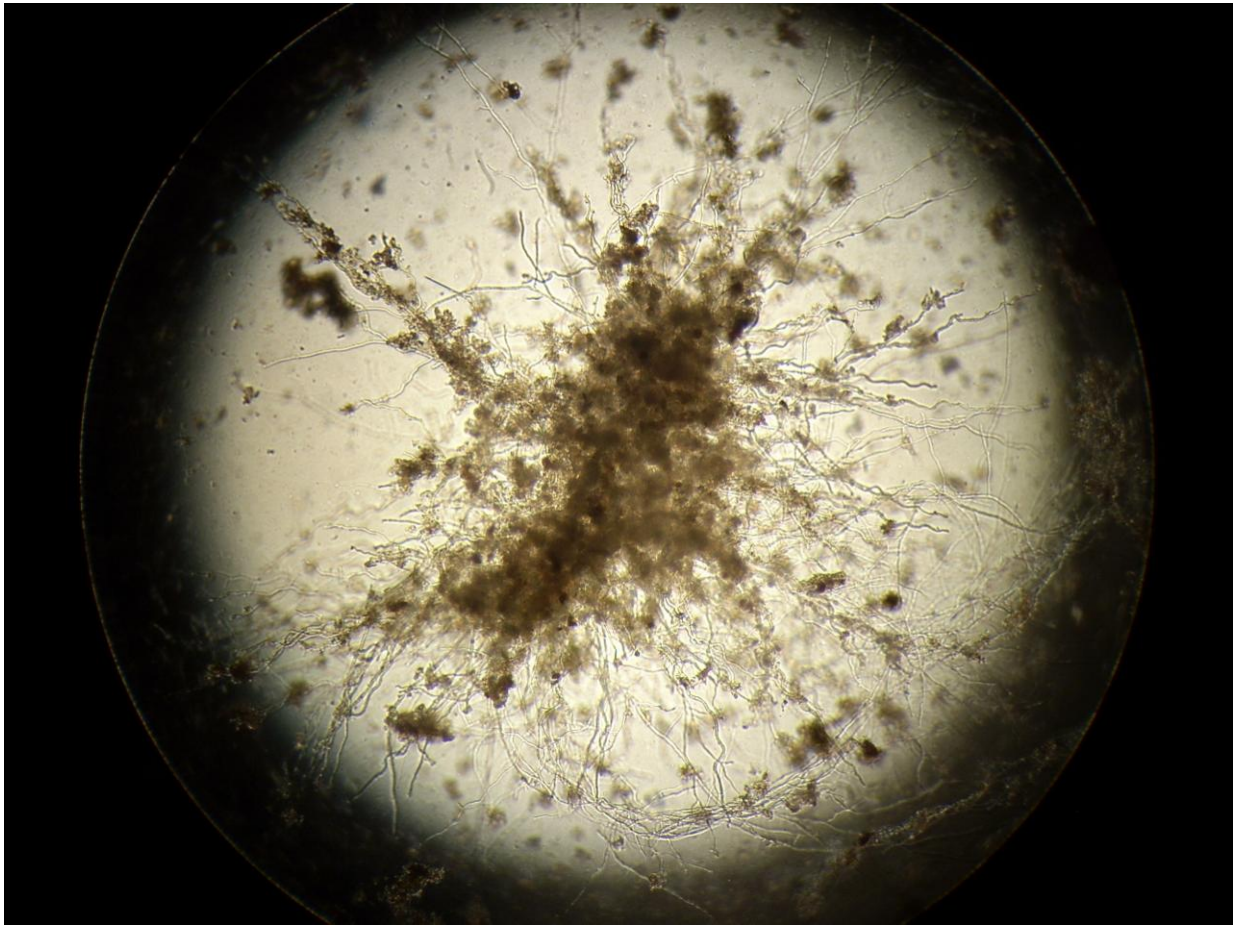
20L of compost	For 1000L	$0
4 handfuls of forest fungi		$0
3L of Kelp food		$36
3L of Fish food		$30
400ml of Aloe Vera juice		$4
Power 24 to 48 hours		$10

Total is $80 for 1000L (8 cents a L)

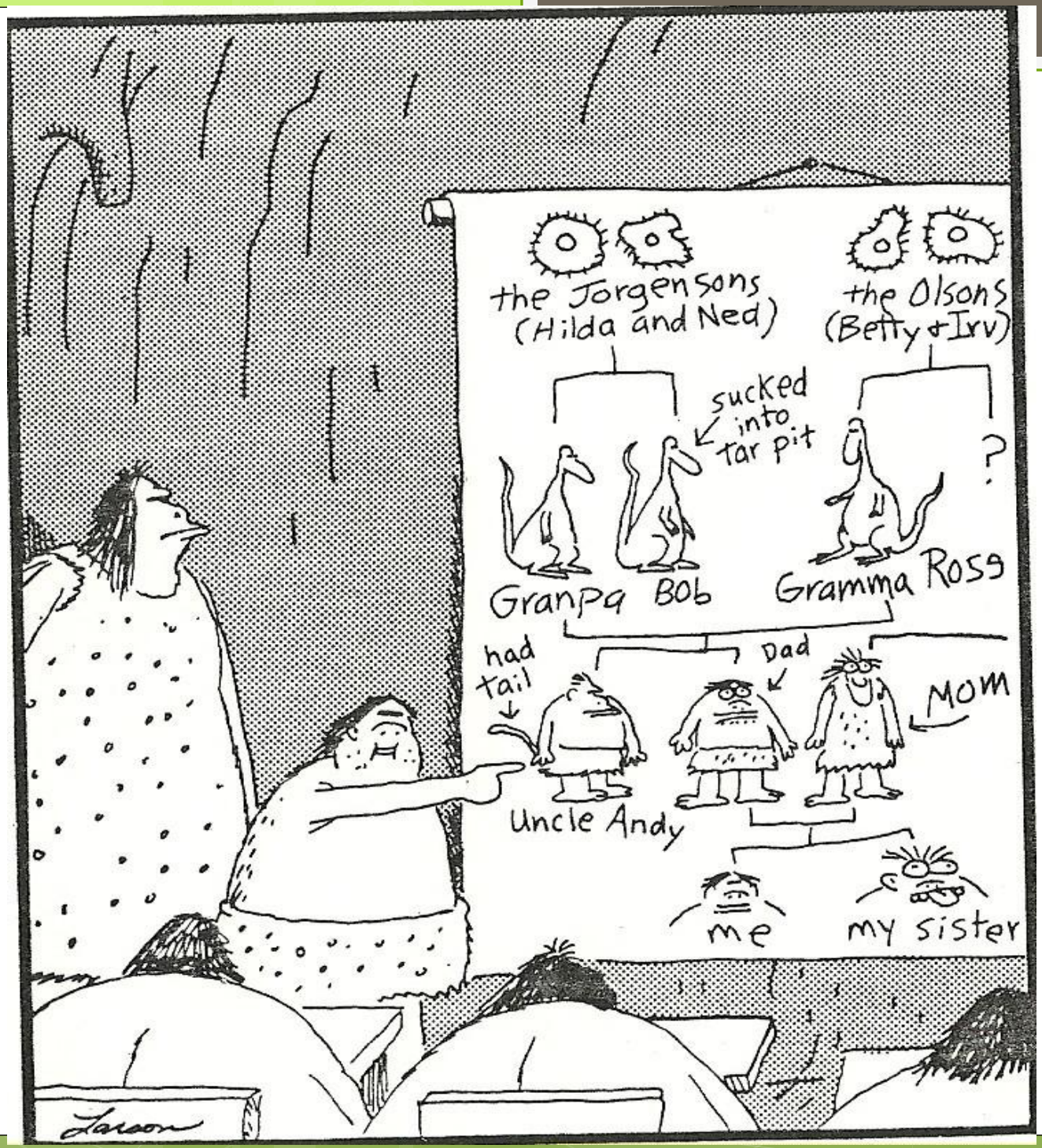



Fungi 40 hour tea
2009/08/25 12:35:59
Mag : 400






Apowersoft Video Downloader for
Trial Version


the Jorgensons (Hilda and Ned)
the Olsons (Betty + Irv)
sucked into tar pit
?
Granpa Bob
Gramma Ross
had tail
Dad
MOM
Uncle Andy
me
my sister
Larson

Compost tea application

40L Tea/Ha	$3.20
5L Kelp	$20
5L Fish	$9
Total Cost $/Ha	$32.20


ZCB-683

The Theory

Bacteria have a C:N ratio of 5C molecules to 1N molecule. Protozoa Flagelates consume bacteria, but their natural state is 30C:1N molecule so to get 30C they consume 6 bacteria but have excess of 5N. The extra N is expelled as NH4. For other nutrients such as Ca, P, K they are expelled in chelated form, plant available but not leachable.

Protozoa consume 10000 bacteria a day in good conditions releasing 8000N molecules. This equates to 7ng per cm cubed of root soil per day, plants only require 0.2ng of N per day. Excess N is used by bacteria in healthy soils for growth, so the N in healthy soils stays in living organisms and no N is lost from the system.

Tracking changes & outcomes

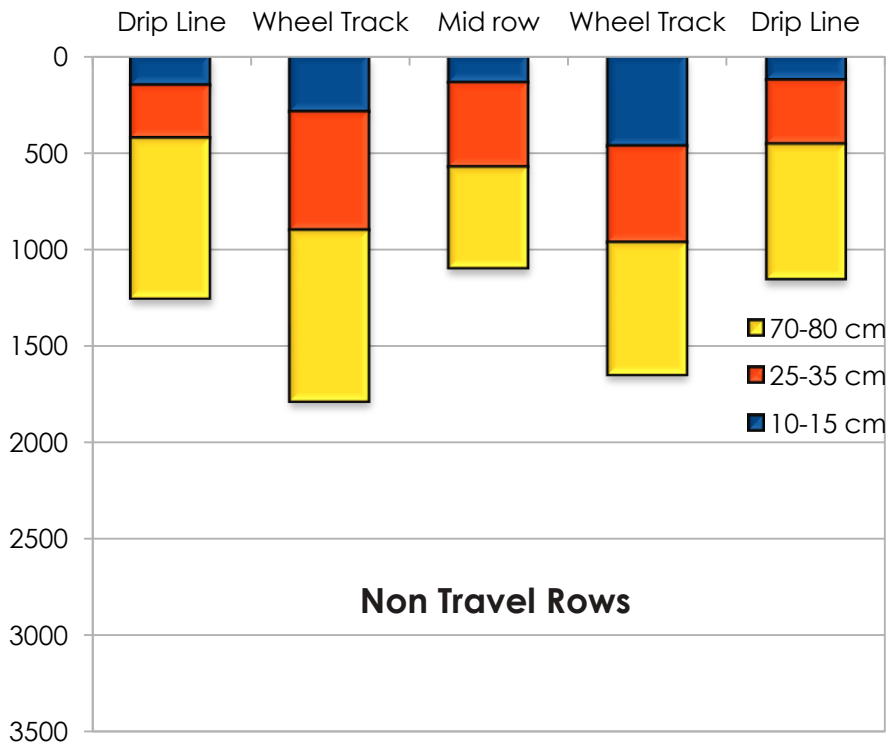
Soil physical, biological and chemical properties

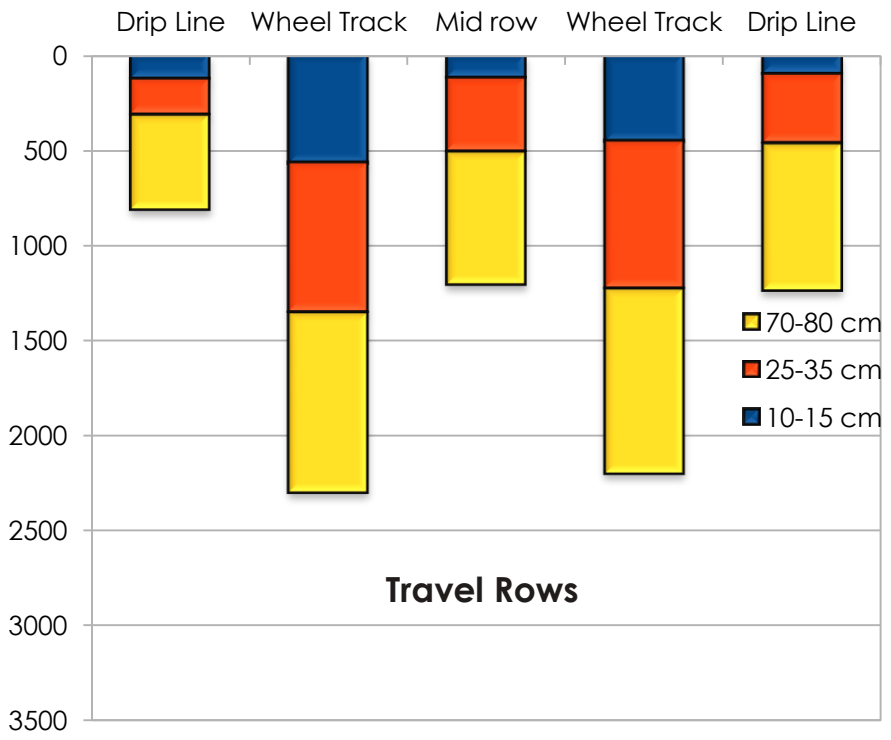
Vine health and petiole nutrients

Try to identify trends that have occurred

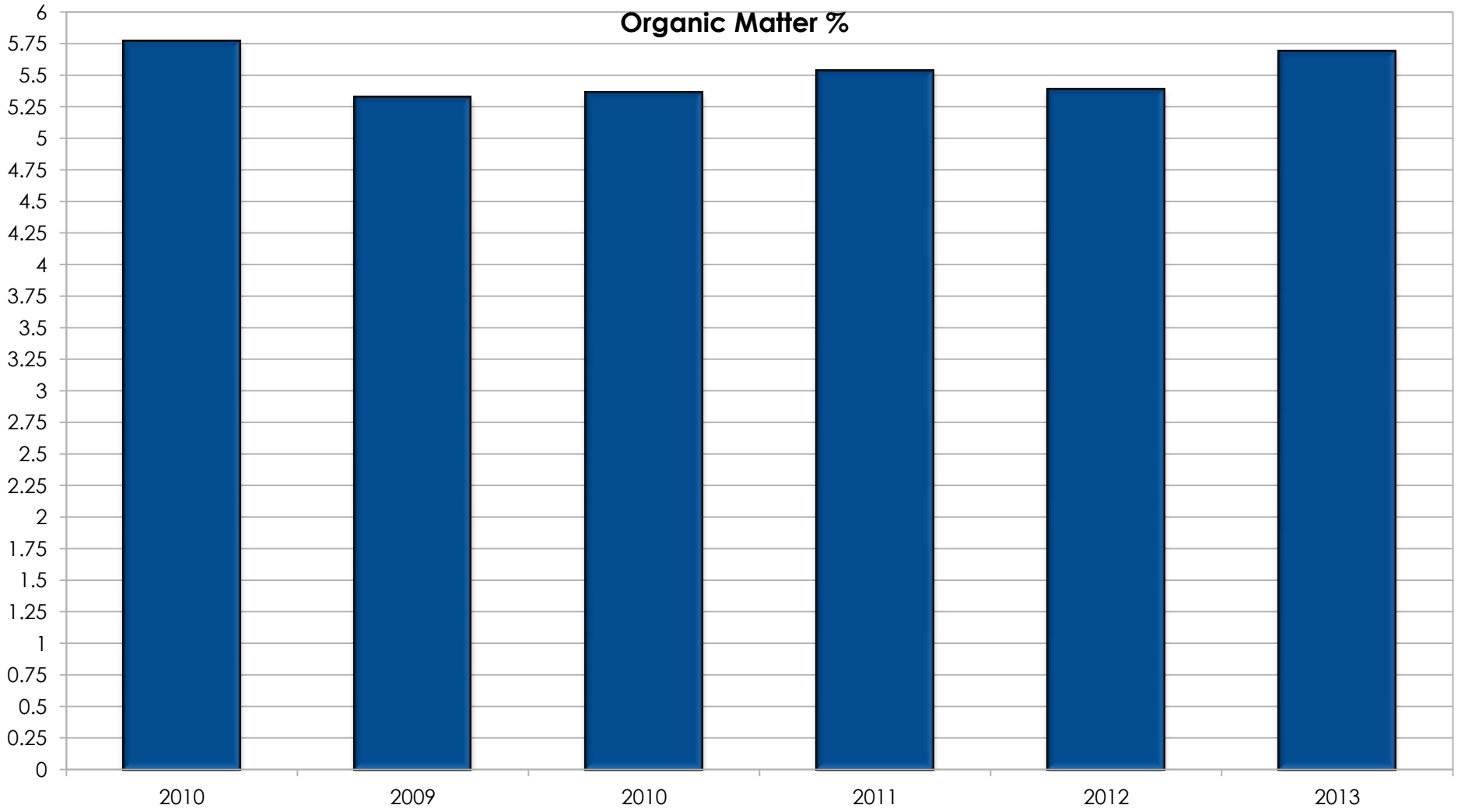
Same blocks, same time of year, same sampling method, same lab

Compaction

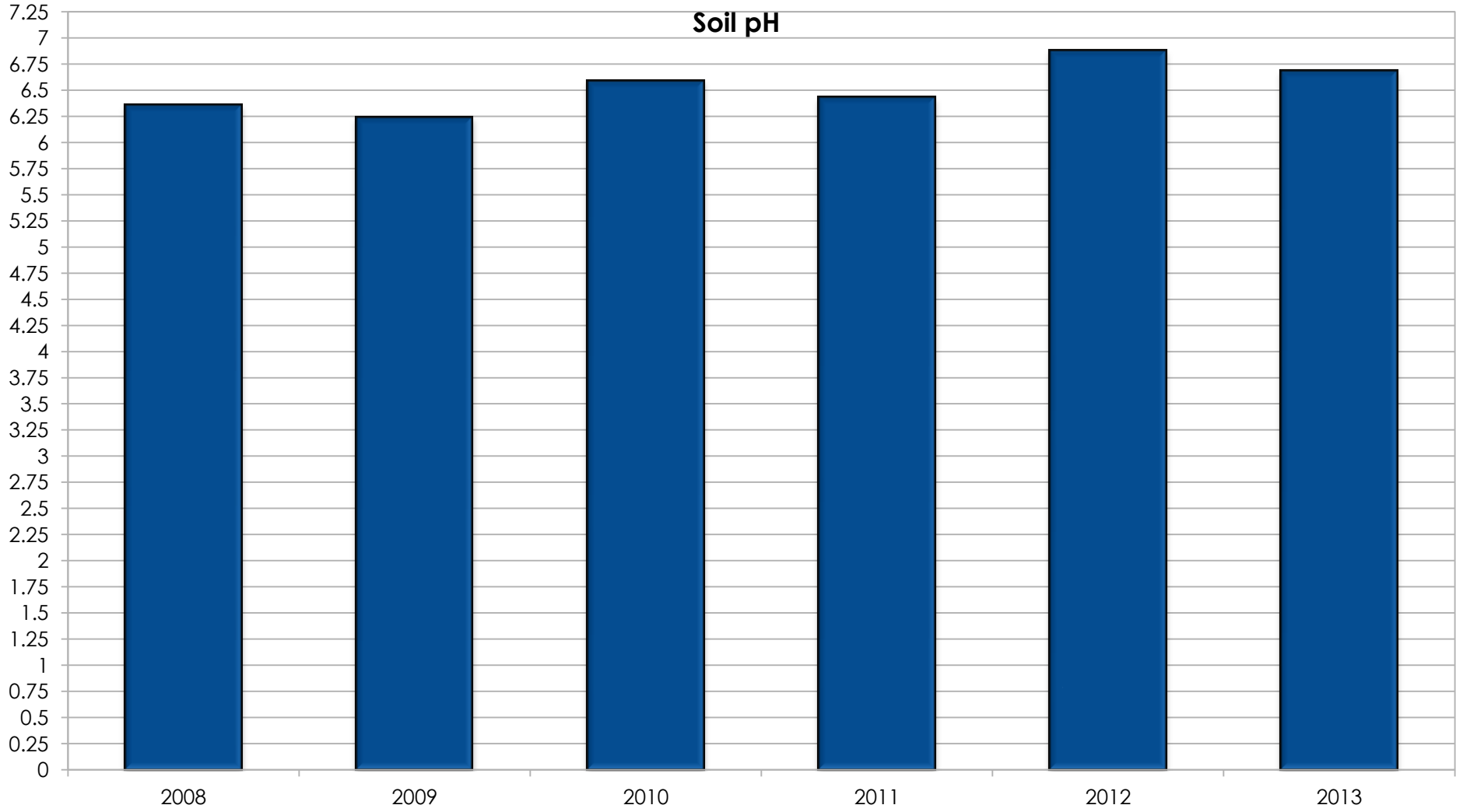

Drip Line
Wheel Track
Mid row
Wheel Track
Drip Line
0
500
1000
1500
2000
2500
3000
3500
70-80 cm
25-35 cm
10-15 cm
Non Travel Rows


Drip Line
Wheel Track
Mid row
Wheel Track
Drip Line
0
500
1000
1500
2000
2500
3000
3500
70-80 cm
25-35 cm
10-15 cm
Travel Rows

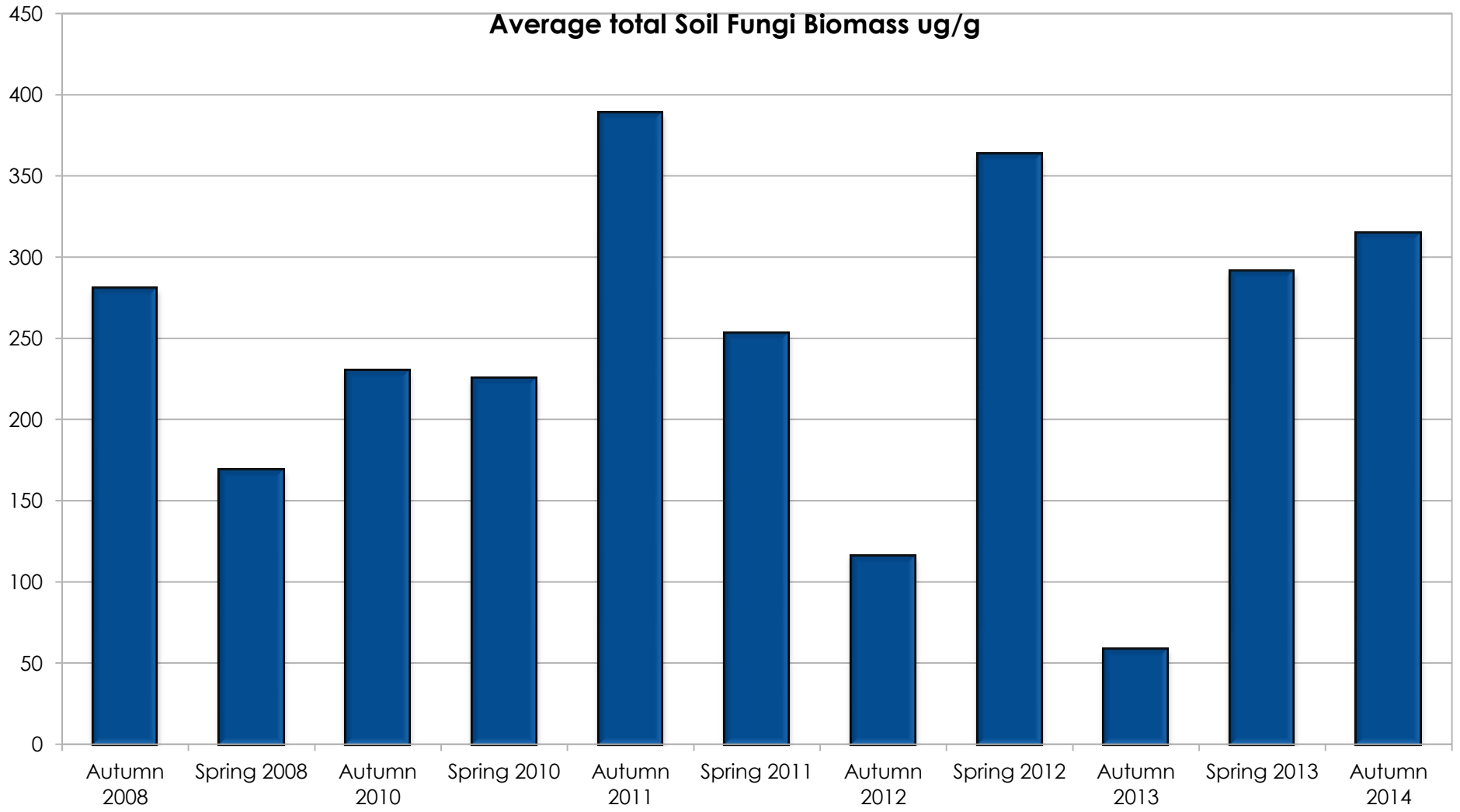
Organic matter



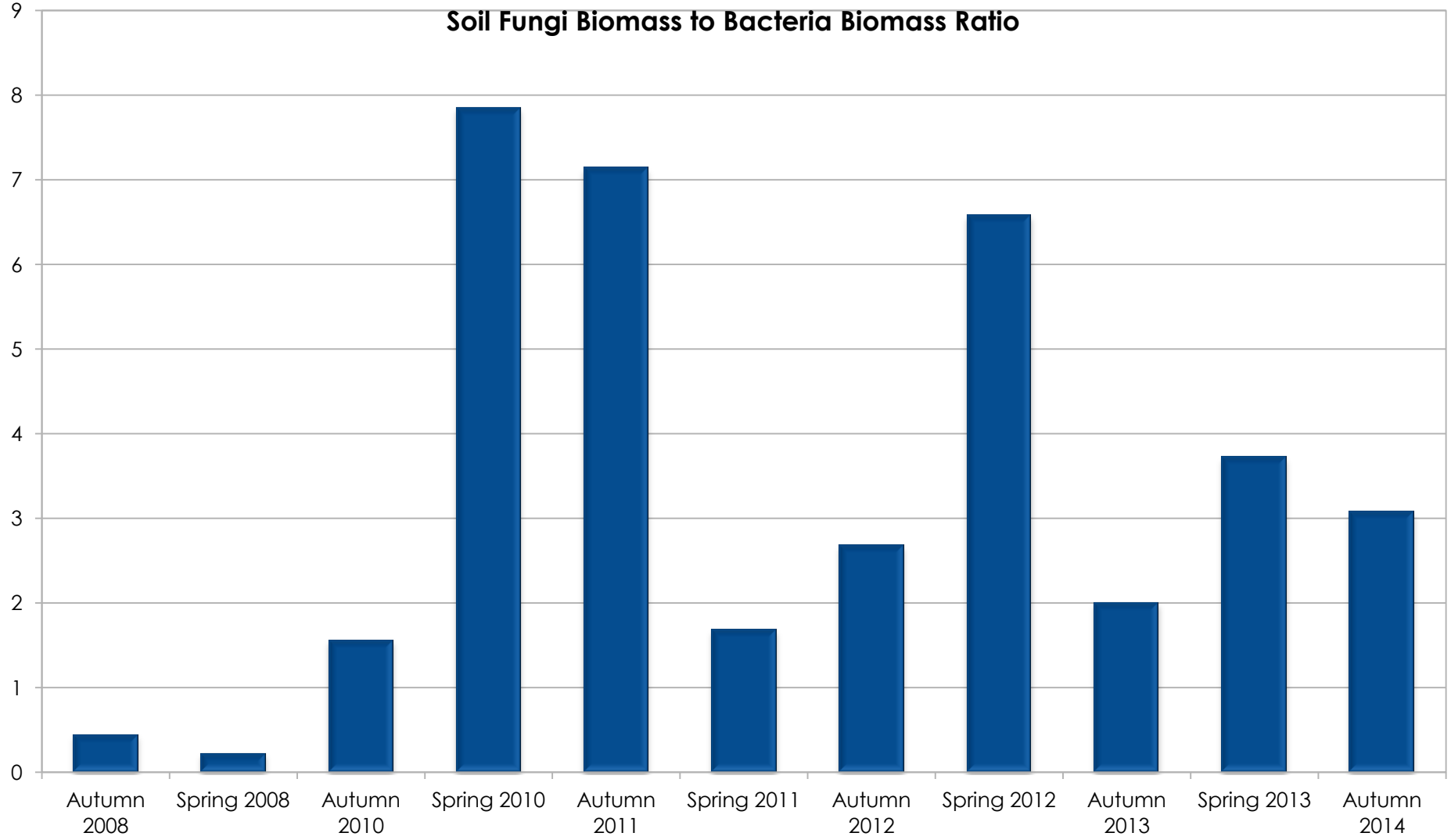
pH


Soil pH
7.25
7
6.75
6.5
6.25
6
5.75
5.5
5.25
5
4.75
4.5
4.25
4
3.75
3.5
3.25
3
2.75
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
2008
2009
2010
2011
2012
2013

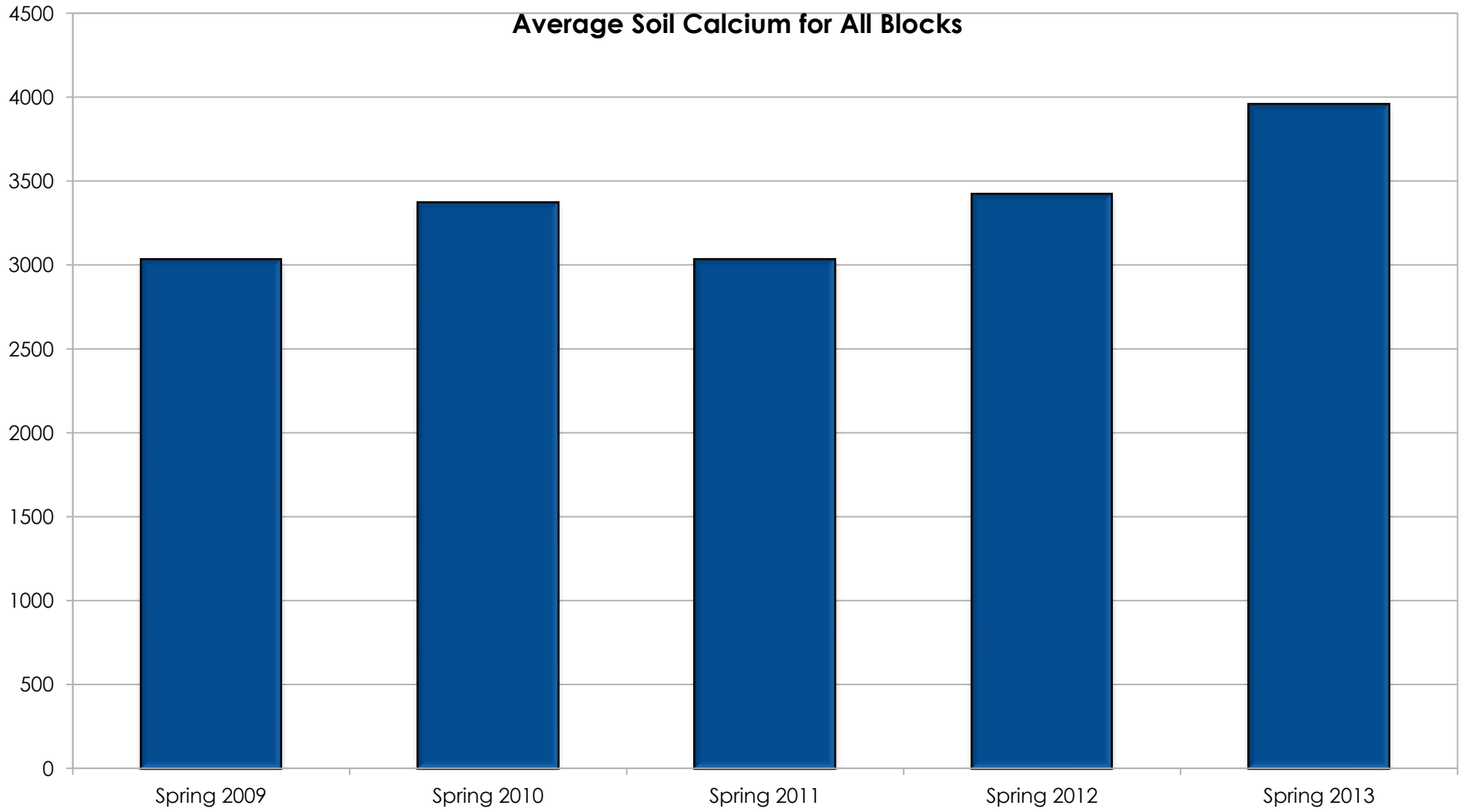
Soil Fungi Biomass



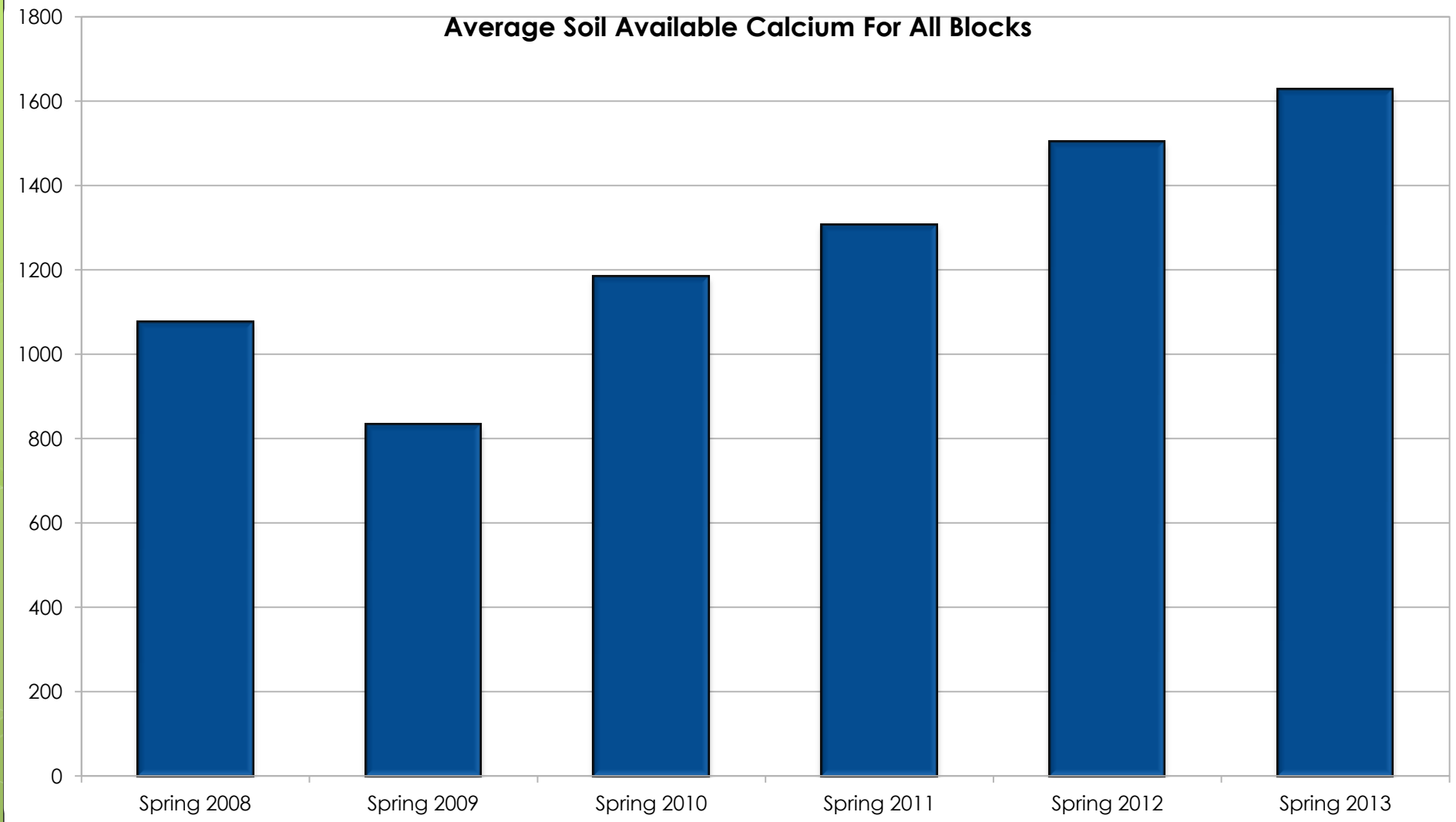
Soil fungi biomass to Bacteria biomass ratio



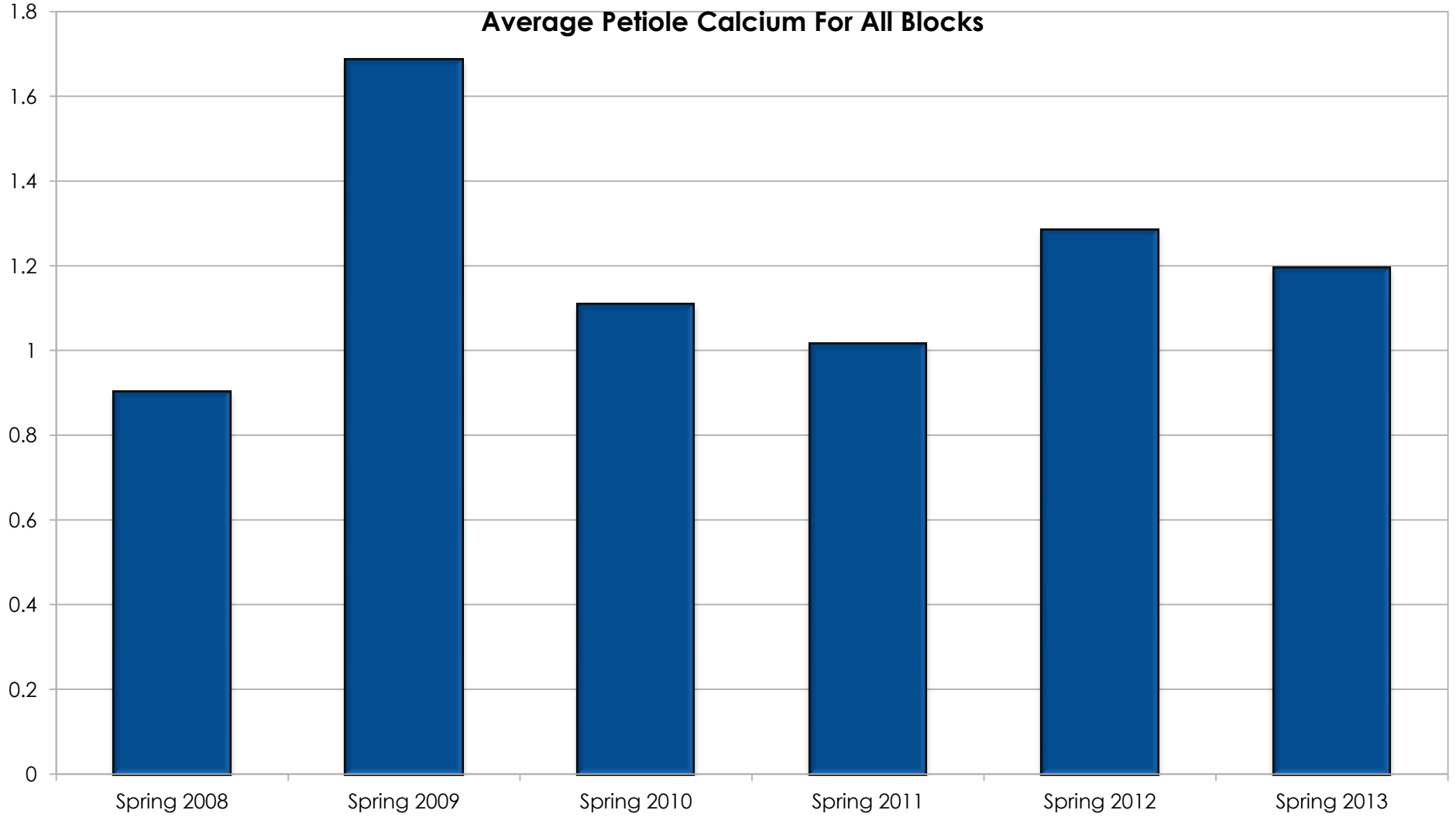
Total Soil Ca



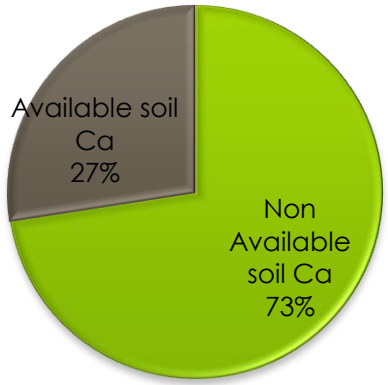
Soil Available Ca



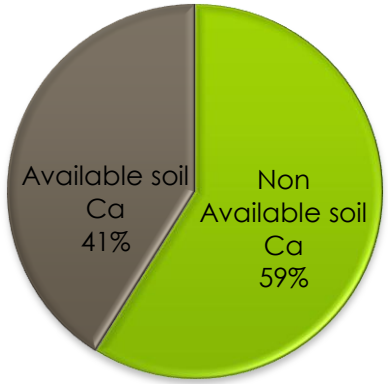
Petiole Ca


Average Petiole Calcium For All Blocks
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Spring 2008
Spring 2009
Spring 2010
Spring 2011
Spring 2012
Spring 2013

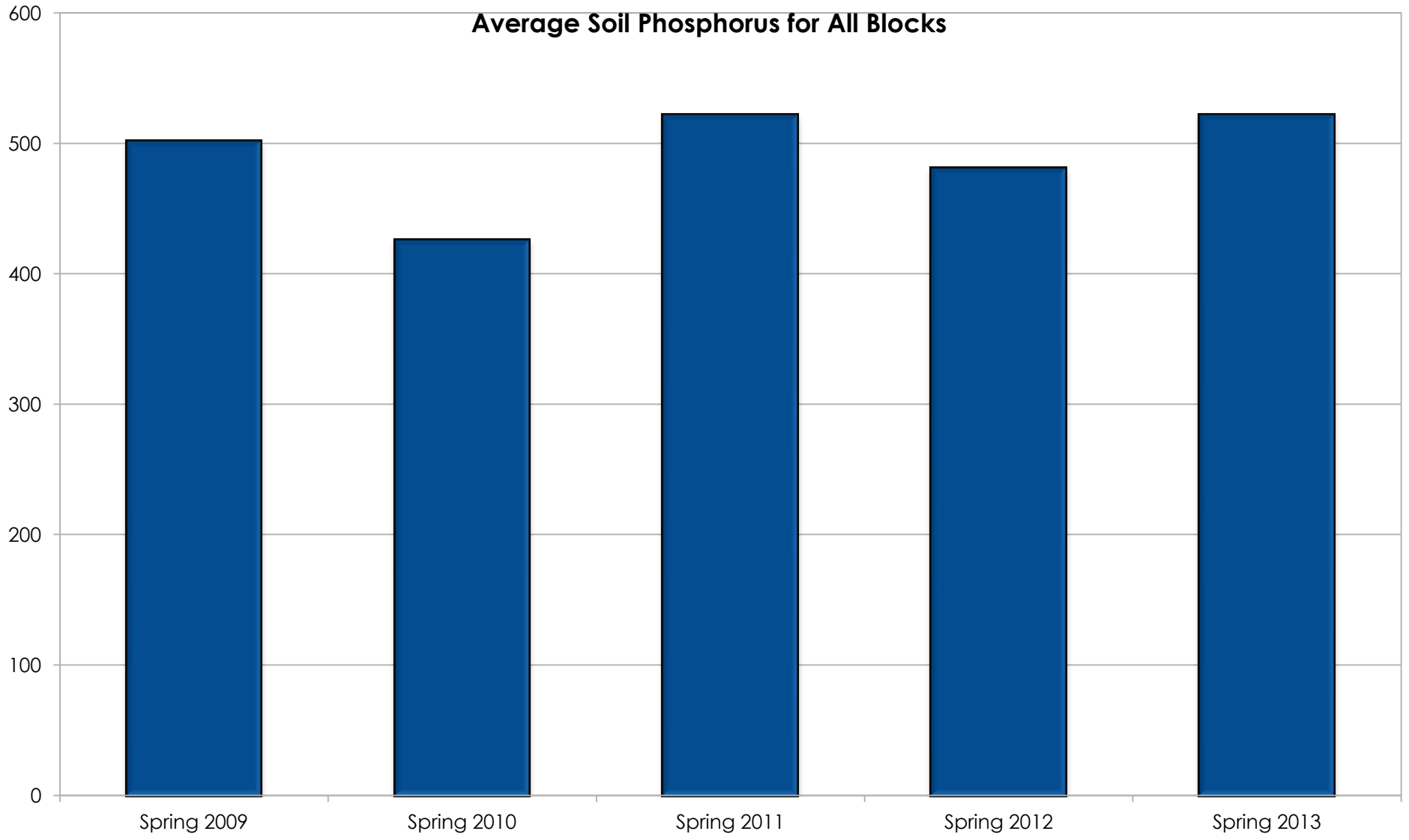
Spring 2009



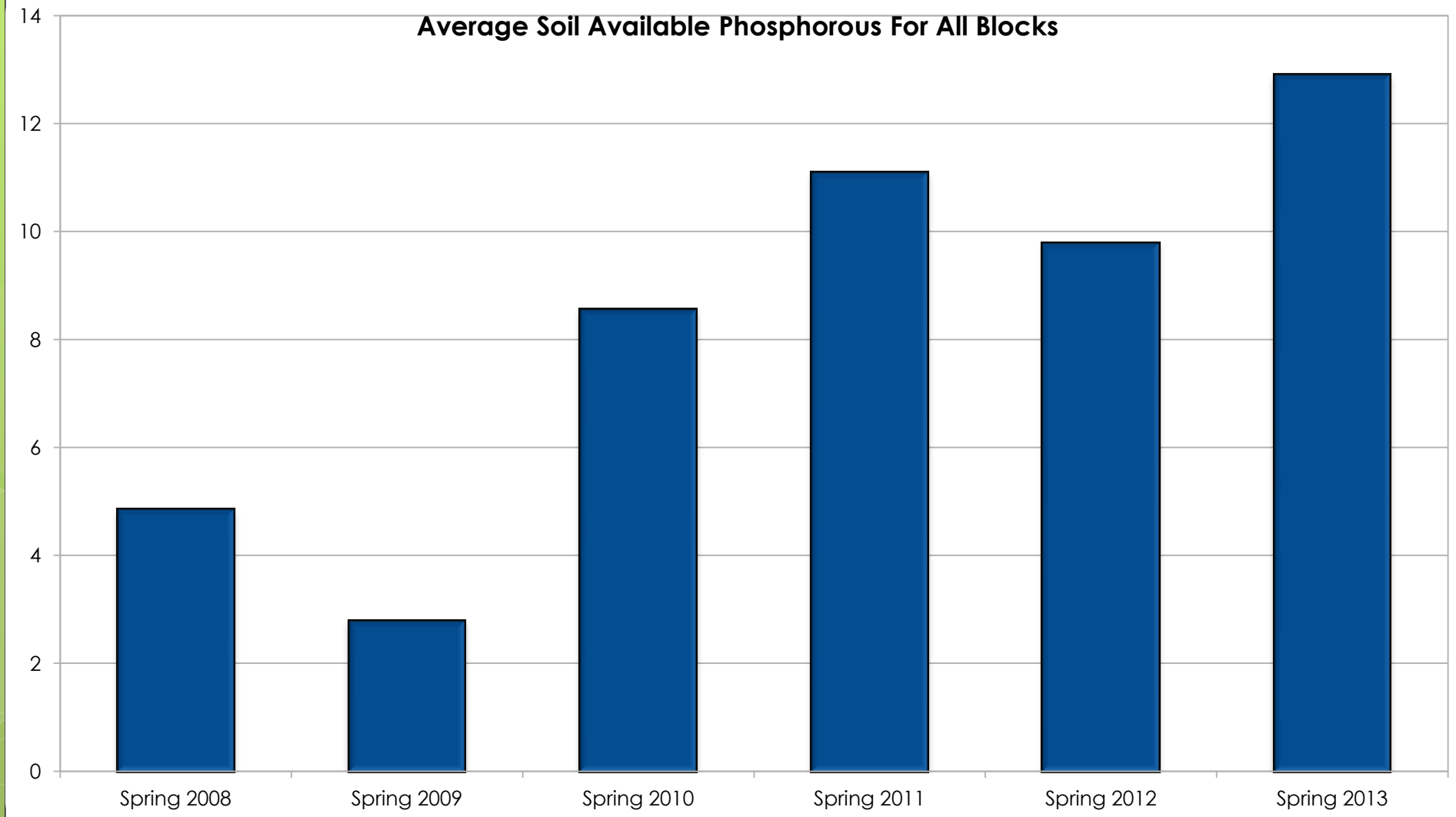
Spring 2013



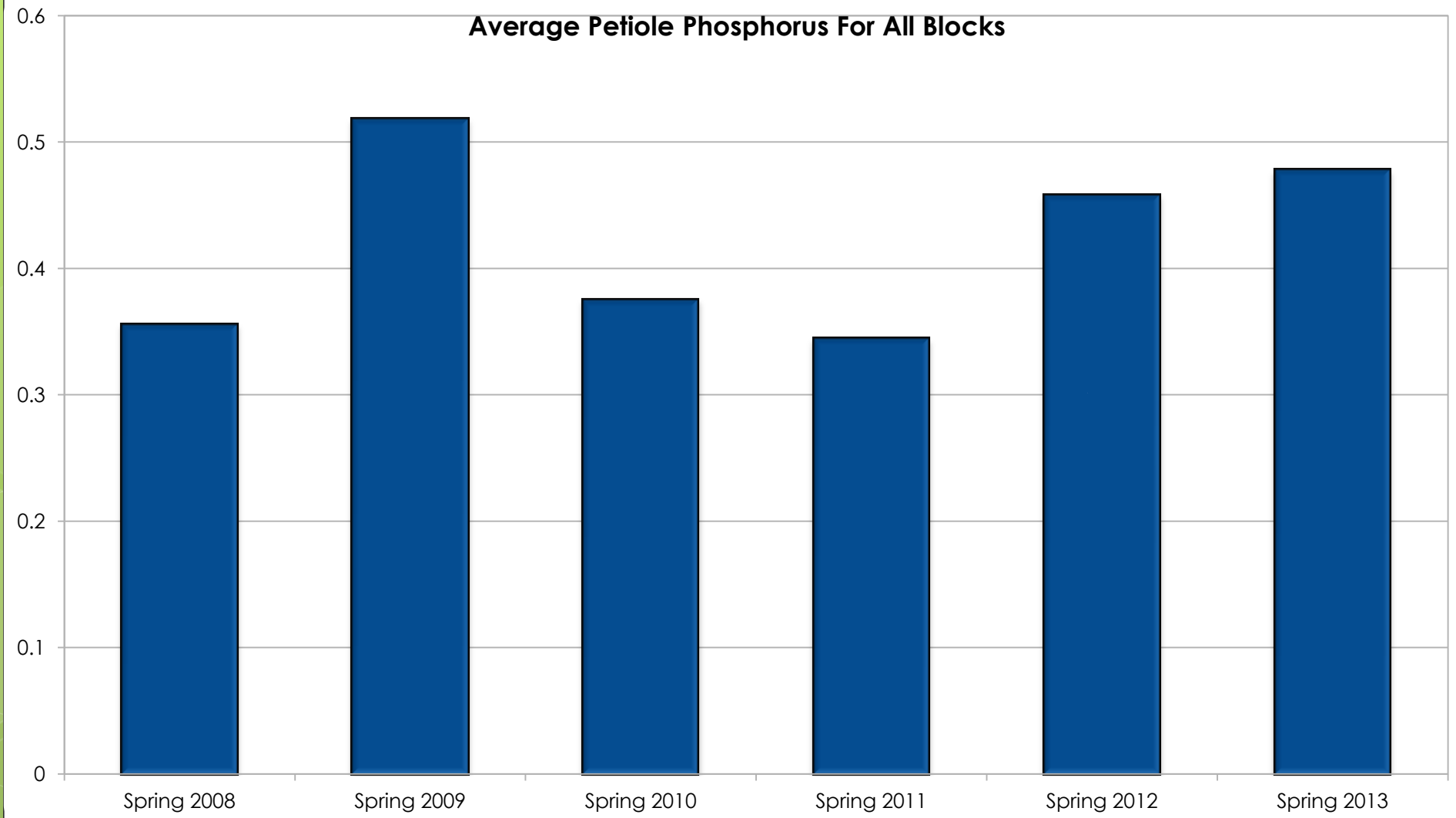
Total Soil P

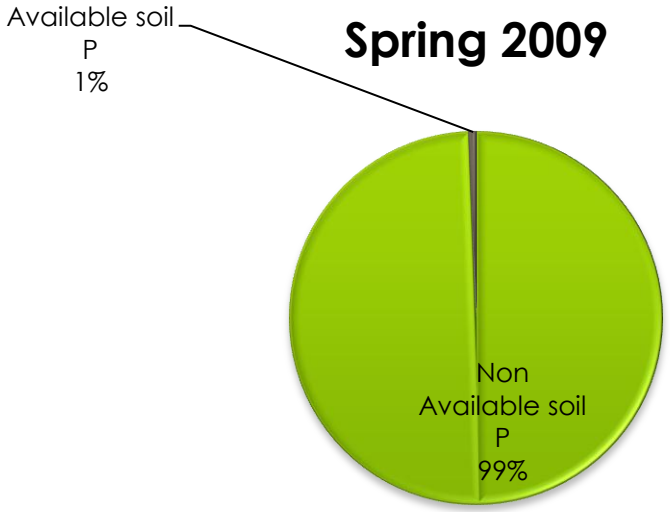

Average Soil Phosphorus for All Blocks
600
500
400
300
200
100
0
Spring 2009
Spring 2010
Spring 2011
Spring 2012
Spring 2013

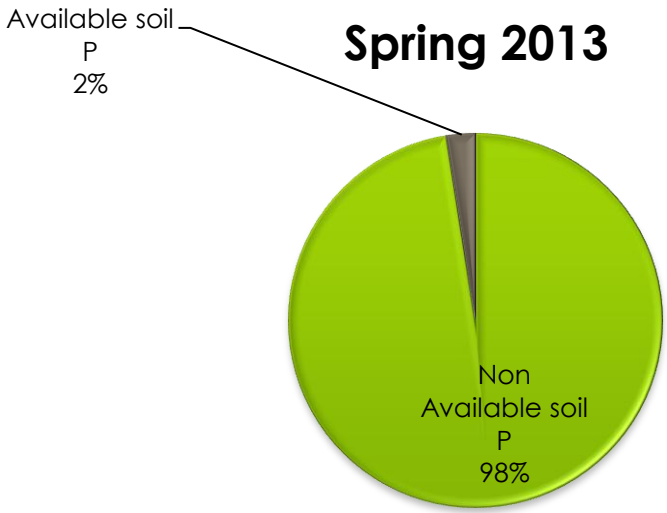
Soil available P



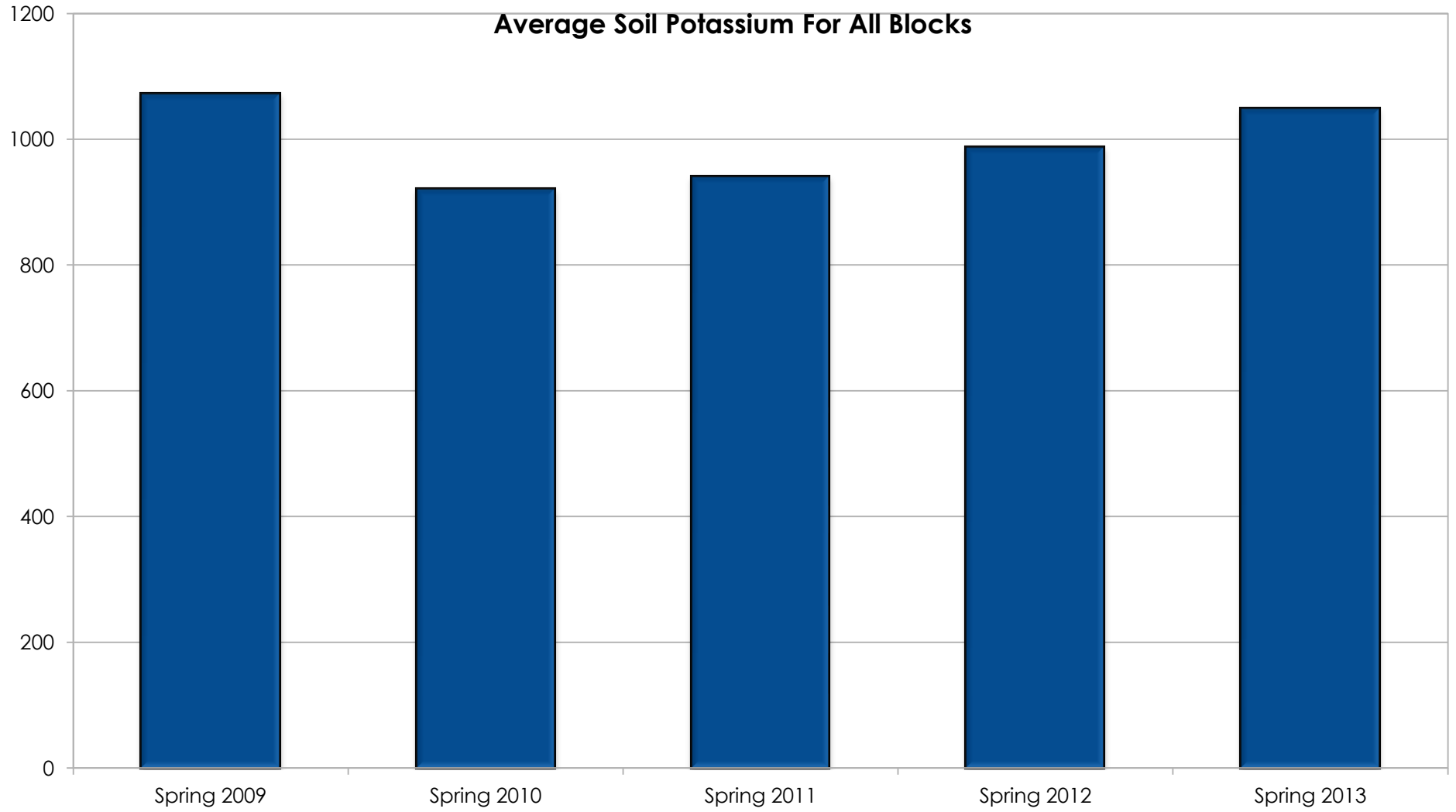
Petiole P


Average Petiole Phosphorus For All Blocks
0.6
0.5
0.4
0.3
0.2
0.1
0
Spring 2008
Spring 2009
Spring 2010
Spring 2011
Spring 2012
Spring 2013

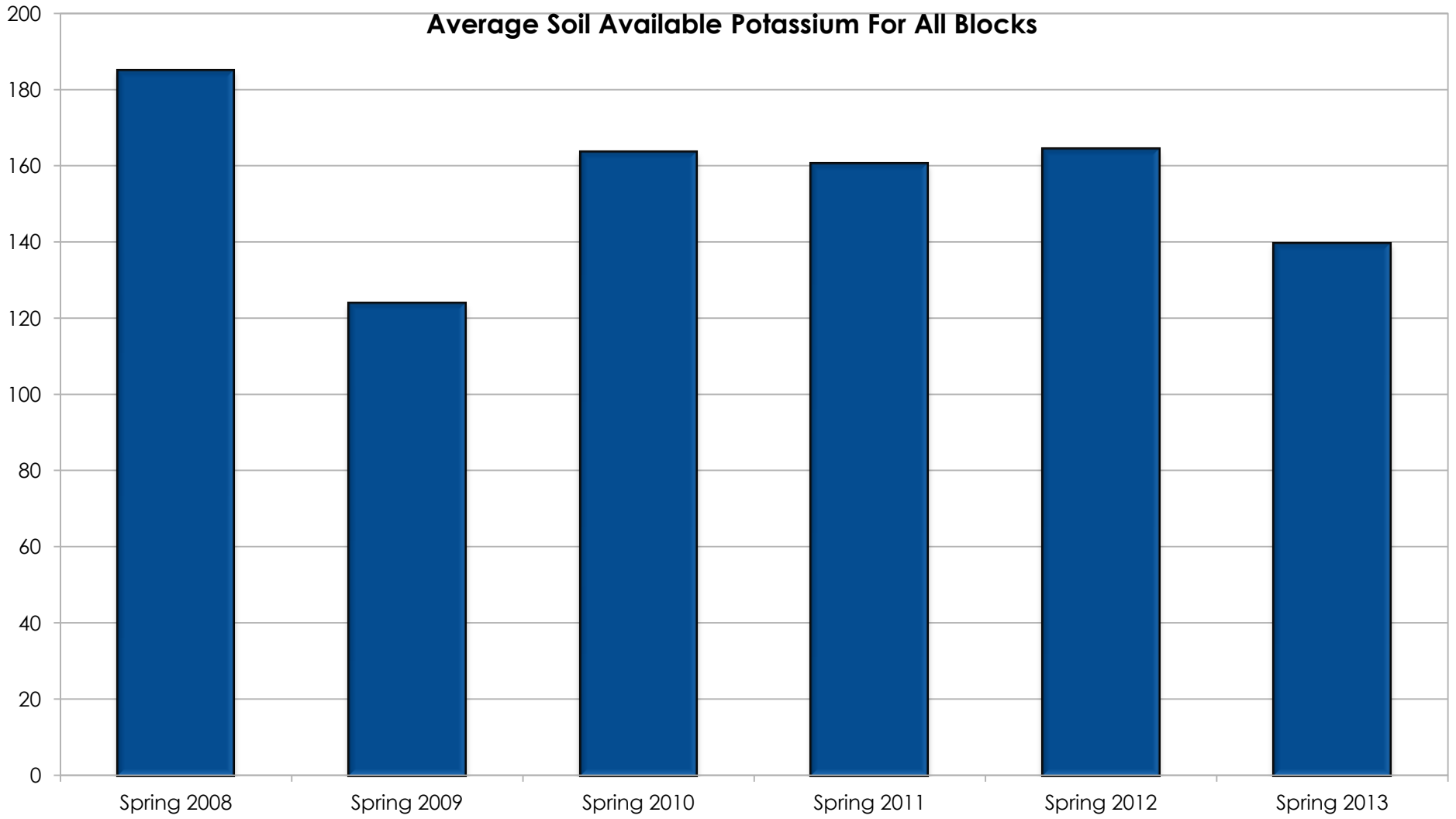

Spring 2009
Available soil P 1%
Non Available soil P 99%


Spring 2013
Available soil P 2%
Non Available soil P 98%

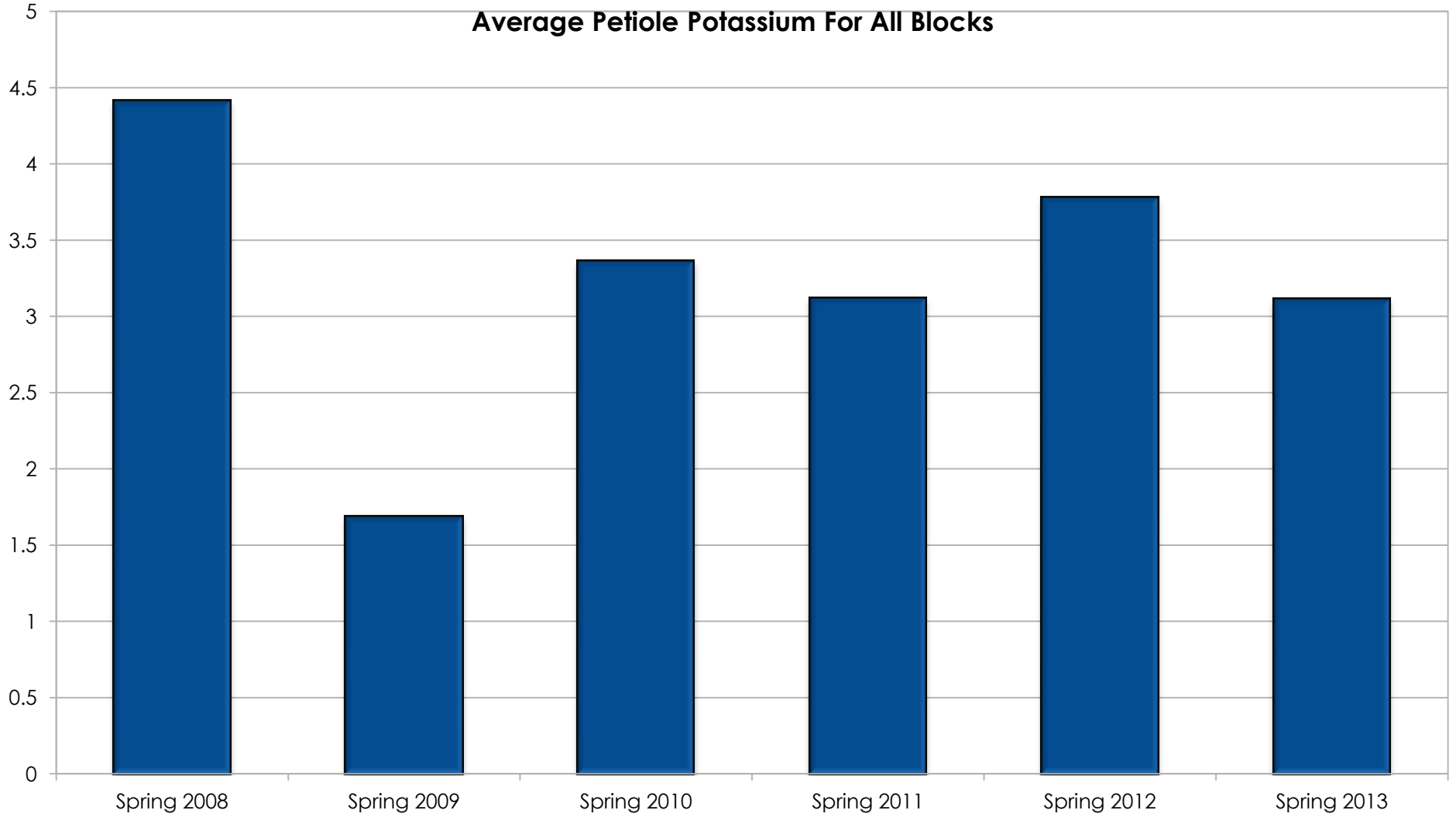
Total Soil K

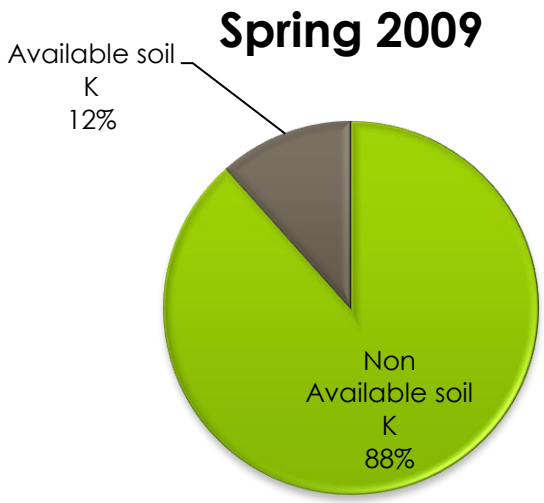

Average Soil Potassium For All Blocks
1200
1000
800
600
400
200
0
Spring 2009
Spring 2010
Spring 2011
Spring 2012
Spring 2013

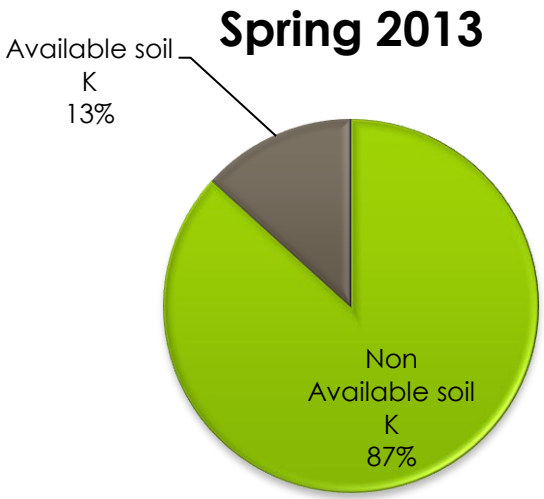
Soil Available K



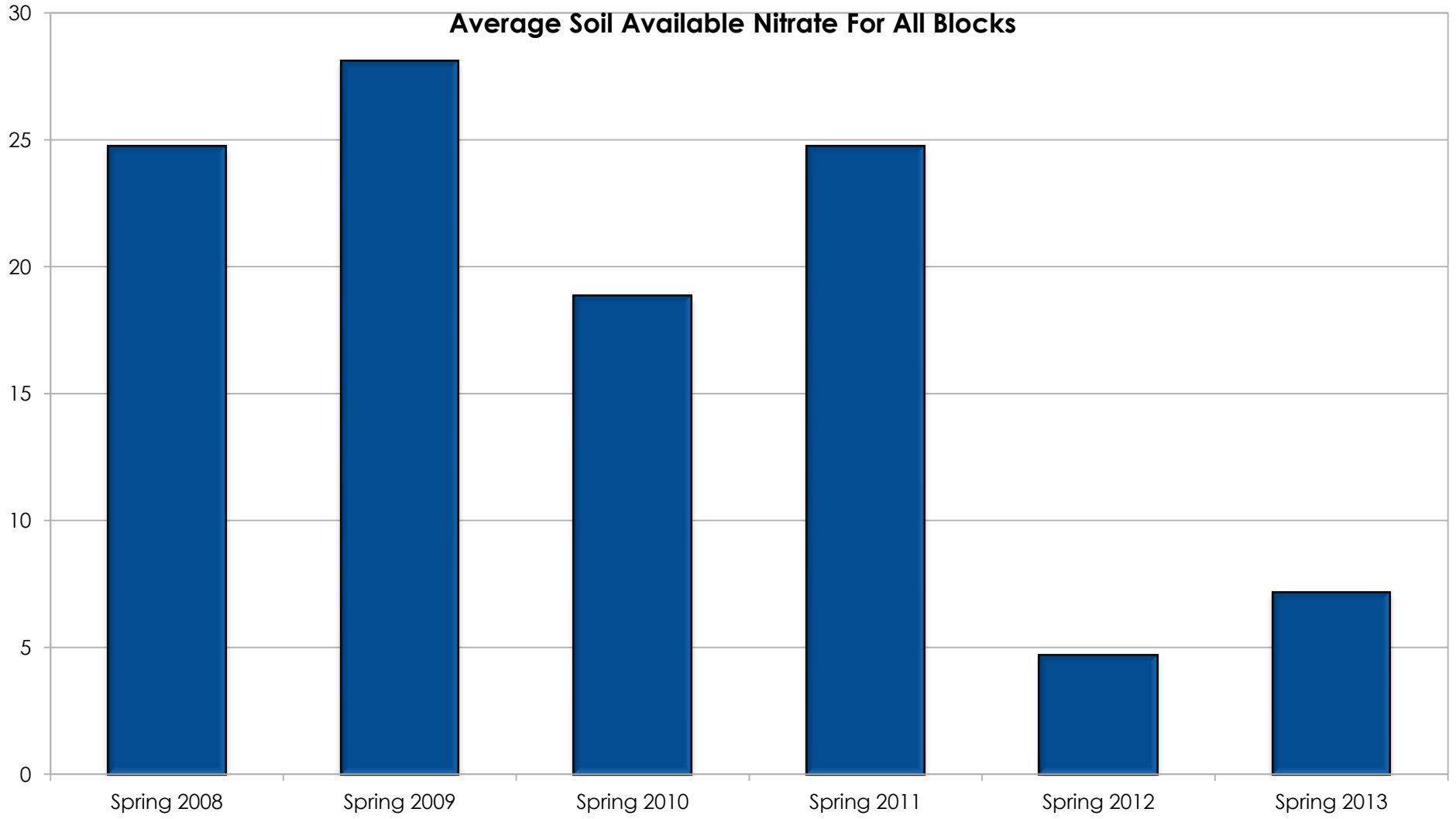
Petiole K


Average Petiole Potassium For All Blocks
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Spring 2008
Spring 2009
Spring 2010
Spring 2011
Spring 2012
Spring 2013

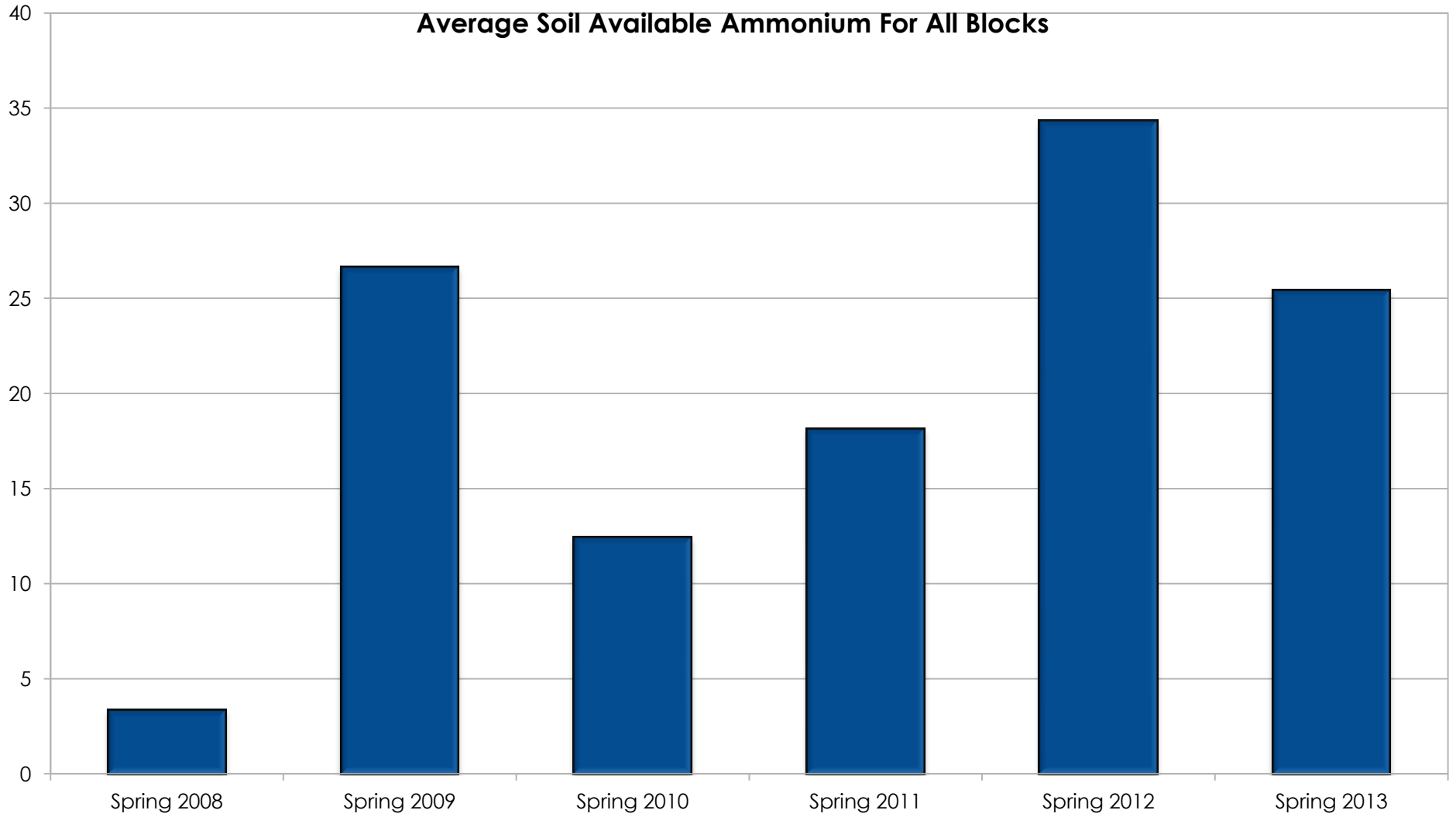

Spring 2009
Available soil K 12%
Non Available soil K 88%


Spring 2013
Available soil K 13%
Non Available soil K 87%

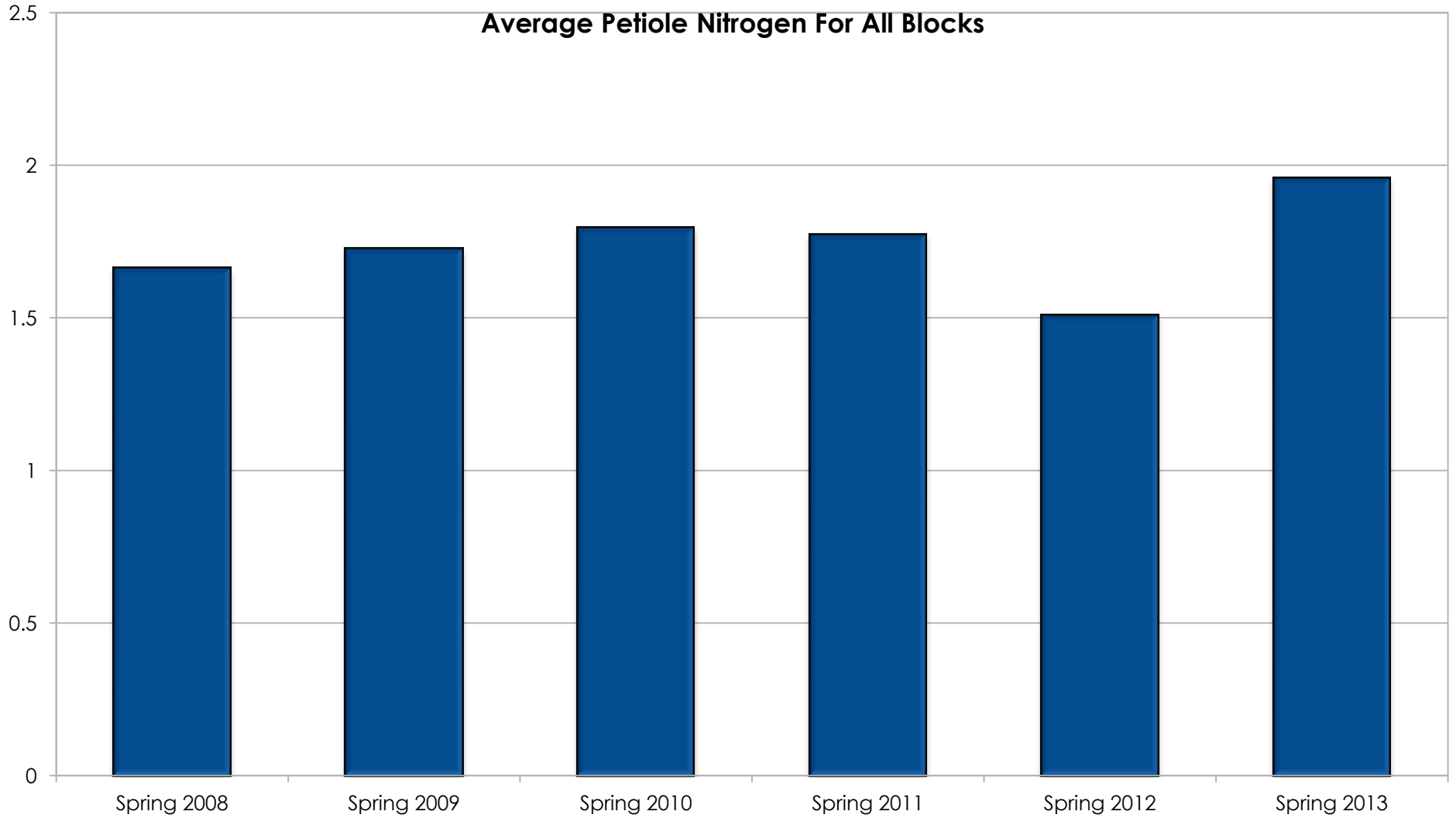
Soil Available Nitrate



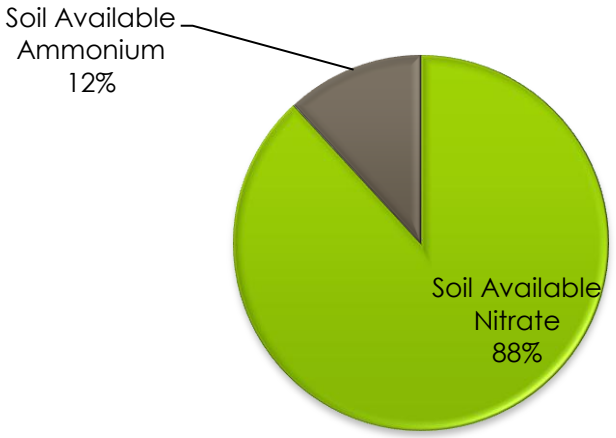
Soil Available Ammonium



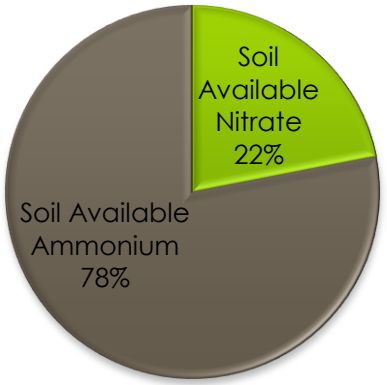
Petiole N


Average Petiole Nitrogen For All Blocks
2.5
2
1.5
1
0.5
0
Spring 2008
Spring 2009
Spring 2010
Spring 2011
Spring 2012
Spring 2013

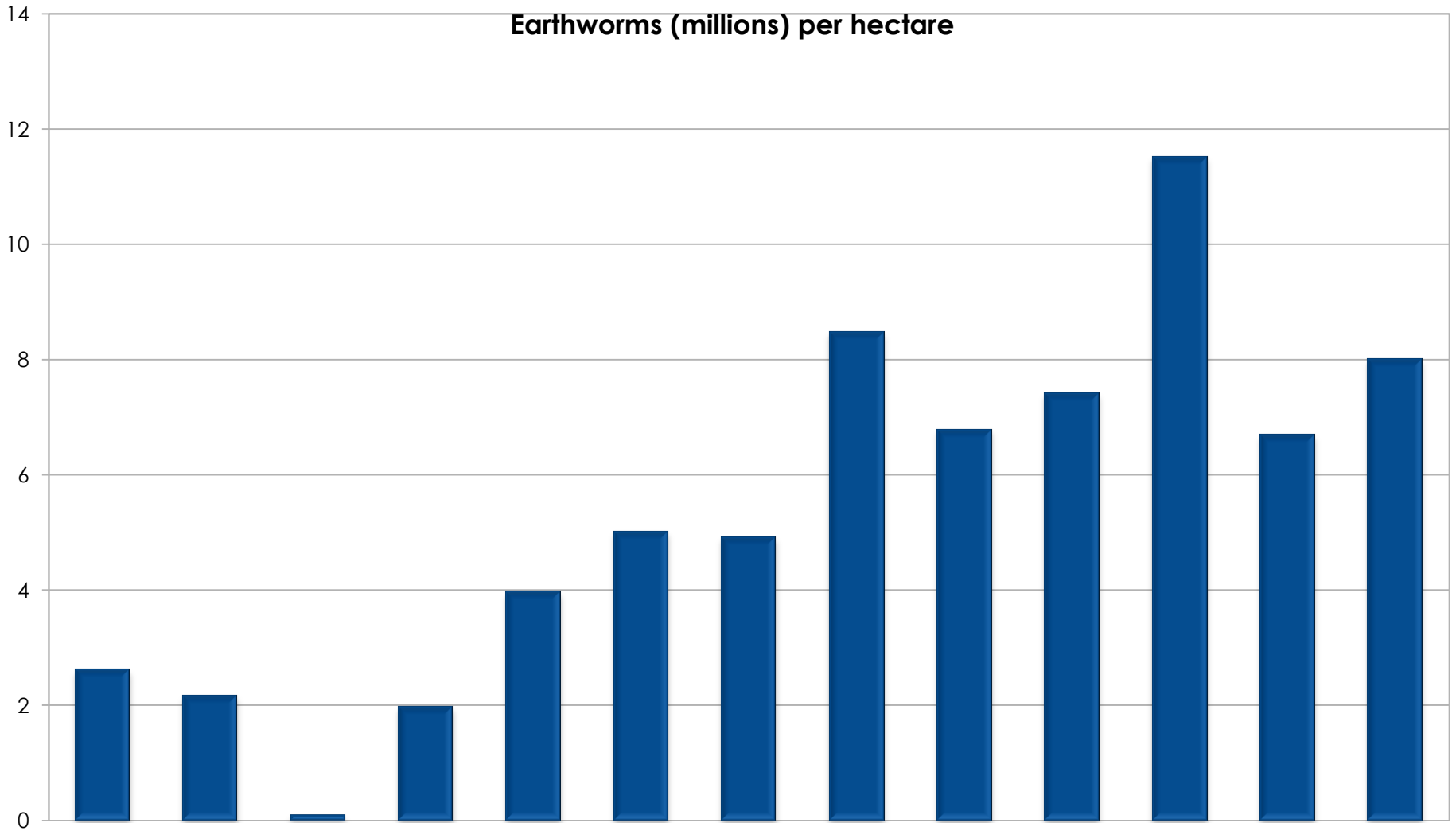
Soil Available N Spring 2008



Soil Available N Spring 2013



Earthworms Mil/Ha



Vine Balance

We monitor internode length

We monitor cane length for mm per infloresence

We monitor cane length and mass in mm per gram

D3 Sauv Blanc

Replanted after 25% was burnt in 2009

Flat Alluvial soil

Duplex soil with heavy clay and sodic sub soil

Water logs very easily

Compaction layer at 40 to 50cm

We have used soil aerator and banded compost under vine at 1m3/20m of row

D3 Sauv blanc	2009	2013/14
Organic Matter	4.9	6.8
Soil pH	5.84	6.23
Earthworms	0	65
Soil Fungi Biomass	216	236
Fungi:Bacteria	0.16	2.31
Total Na	182	113
Soil Avail Na	153	63
Petiole Na	0.04	0.03
Total Ca	2215	2929
Soil Avail Ca	874	1002
Petiole Ca	0.81	0.84
Total P	250	442
Soil Avail P	0.5	8.7
Petiole P	0.16	0.31
Total K	975	1560
Soil Avail K	98	324
Petiole K	5.54	4.26
Soil Avail NO3	29.7	6.7
Soil Avail NH4	20.4	23
Petiole N	1.33	2.62

Things we are still working on:

- Using biology on foliage to protect against downy and powdery mildews
- Establishing permanent undervine plants
- Increasing the length and activity of soil biology in the spring and autumn
- Improving nematode diversity and numbers
- Improving mycorrhiza establishment


TOBEN
DO YOU HAVE ANYTHING IN A NICE REISLING?