

Effect of cultural practices in managing soil insect pests of tuber crops

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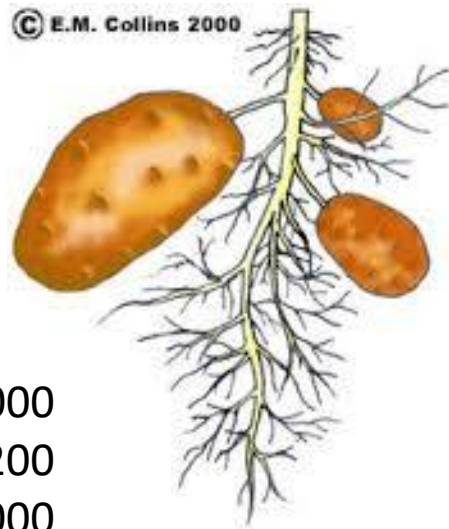
Tuber Tuber Tuber
Breakfast Lunch and Dinner,
Grow Tuber Grow More
Save for the future in your store.

Images and data information on various crops and insects on this presentation were collected from online sources

The author respectfully acknowledge the contribution of those sources

What are tuber crops

Tubers: Enlarged structures in some plant species used as storage organs for nutrients. : potato and Yam



Stem tuber



Root tuber

Global production
>105 million metric tons each
year

95% are grown in developing
countries

Sweet potato is one of the
five most important crops in
40 developing countries
besides rice, wheat, maize,
and cassava

Quantity (tonnes)

1. China	72 040 000
2. Russian Fed.	36 784 200
3. India	26 280 000
4. United States	20 373 267
5. Ukraine	19 102 300
6. Poland	11 791 072
7. Germany	11 643 769
8. Belarus	8 743 976
9. Netherlands	7 200 000
10. France	6 271 000

Common root and tuber crops

- Cassava
- Sweet potato
- Potato
- Beet
- Carrot
- Turnip
- Radish
- Yam
- Ginger
- Taro



Cassava



Sweet potato



Potato



Beet



Carrot



Turnip



Radish



Yam



Ginger



Taro

Use of tuber crops

- 55% of roots and tuber production is consumed as food;
- The remainder is used as animal feed or in the production of starch.

- Rank as staple

- food

	Crop	Rank	Crop
• 1	Wheat	5	Barley
• 2	Maize	6	Cassava
• 3	rice	7	Sweet potato
• 4	Potato		

-

Characteristics of Root and Tuber Crops

Characteristics	Cassava	Potatoes	Sweet Potatoes	Taro	Yam
Growth period (mo.)	9-24	3-7	3-8	6-18	8-11
Annual or perennial	per.	ann.	Per.	per.	ann.
Optimal rainfall (cm)	100-150	50-75	75-100	250	115
Optimal temperature (°C)	25-29	15-18	>24	21-27	30
Drought resistance	yes	no	yes	no	yes
Optimal pH	5-6	5.5-6.0	5.6-6.6	5.5-6.5	n. A.
Fertility requirement	low	high	low	high	high
Organic matter requirement	low	high	low	high	high
Growable on swampy, water-logged soil	no	no	no	yes	no
Planting material	stem	tubers	vine cutting	corms/ cormels	tubers
Storage time in ground	long	short	long	moderate	long
Postharvest storage life	short	long	short	variable	long

Insect pests of tuber crops

- Cucumber Beetles (rootworms)
- Flea Beetles
- Sweet Potato Aphids
- Sweet Potato Armyworms
- Sweet Potato Cutworms
- Sweet Potato Foliage Feeding Insects
- Sweet Potato Hornworm
- Sweet Potato Insect Pests
- Sweet Potato Loopers
- Sweet Potato Soil Insects
- Sweet Potato Thrips
- Sweet Potato Tortoise Beetles
- Sweet Potato Weevil
- Sweet Potato Whiteflies
- Whitefringed Beetles
- White Grubs
- Wireworms

Sweet potato weevil
Leaf hoppers



Cucumber beetle



Flea beetle



Potato aphid



Yellow striped armyworm



SP cutworm



SP hornworm



Cab looper



Thrips



SPW



SPW



Whitefringed beetle



White grubs



Wireworm

Sweet potato weevil, *Cylas formicarius* (Fabricius) (Coleoptera: Brentidae)



Global production
>105 million metric tons each year.
95% are grown in developing countries.
Sweet potato is one of the five most important crops in 40 developing countries.

Adult longevity: about 30 days
Life cycle: 35 – 40 days in summer
5 – 8 generations a year
75- 90 eggs/female

Egg: 5-12 days
1st inst.: 8-16 ,,
2nd inst.:12-21 ,,
3rd inst.:15-26 ,,

Host plants: Convolvulaceae
Primary host: Sweet potato
Others: Railroad vine *Ipomoea pes-caprae*
Morning glory *Ipomoea pandurata*

Female lays eggs in roots and stems in a small cavity made by her mouth parts

Planting materials and management of SPW

- Avoid using vines with SPW infestation. Planting vines with weevil infestation is equivalent to buying weevil to infest sweet potato. Using weevil free vines is the first step of managing SPW
- Younger vines are less infested than the older ones.
- Plant sweet potato away from the previously infested field or fields with previous history of weevil infestation.
- Destroy alternate *Ipomoea* hosts from the boarder of the fields.



Ipomoea pes-caprae

Time, Temperature and Topography

- High temperature increases growth rate and severity of SPW outbreak
- Population abundance is generally higher in high lands (>1992 meters above the sea level) than in the low lands (up to 1814 meters above the sea level)
- Weevil infestation is higher in August – Nov. planting than June – July planting.
- Weevil population can be reduced by proper planning of planting and harvesting time.
- SPW damage is less in the wet season than in the dry season.
- Frequent irrigation reduces cracks on the surface which prevents weevil to reach target roots.

Multi cropping

Two or more crops in the same time or in a sequence in a same land

- a. Increases soil richness, e.g. increase organic matter,.
- b. Increases richness in foliar insect species, e.g. predator, natural enemies, etc.
- c. Reduces soil pathogen, e.g. nematodes, diseases, etc.
- d. Decreases soil compactness
- e. Increases aeration in soil

Intercropping



Mixed intercropping



Row intercropping



Strip cropping



Relay cropping

Intercropping

- Mixed cropping reduces weevil abundance as compare to single cropping planting sweet potato
- Inter cropping sweet potato with colocacia, rice or cowpea resulted in up to **tenfold reduction** in SPW infestation.
- Effective crop rotation resulted in significant reduction of SPW adults as compared to monoculture.
- Plant no host crops at the boarder to prevent direct entry from outside



Tarul plant



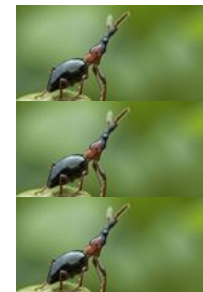
Rice



SPotato



Cowpea



Proper sanitation and SPW management



Figure showing harvesting of sweet potato

Harvested field



Left over potatoes with insect damage



Destroy infested roots immediately after harvesting potatoes. These roots serve as a healthy ground for rapid increase of SPW for future infestation.

Land preparation

- Land preparation is important in destroying residual populations of SPW.
- Soil should be turned 6-12 inches deep.
- Prepare ground by thoroughly turning soil which disposes SPW adults and larvae to the sunlight and predators.
- All volunteer weeds and debris should be completely destroyed. SPW adults use them as their hiding shelter.
- Plant proper cover crop in the land before planting SP. It improves soil aggregate stability, reduce surface crusting, add active organic matter to soil and fix nitrogen.
- Irrigate SP routinely to avoid cracking of soil surface



Deep ploughing



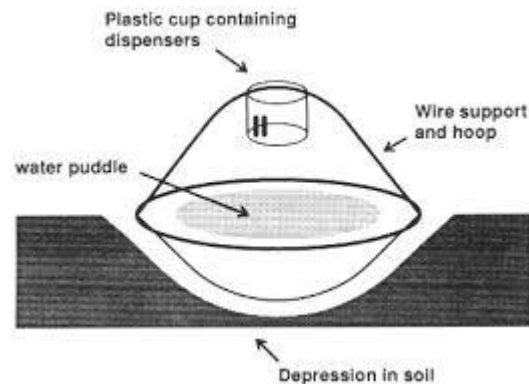
Cover crop



Overhead irrigation

Monitoring for SPW adults

- Pheromone traps show great promise for monitoring of adult population density.
- The sex pheromone also shows great potential for mating disruption and mass trapping.
- Pheromone traps can be used to reduce population abundance of SPW.



Monitoring sweet potato weevil



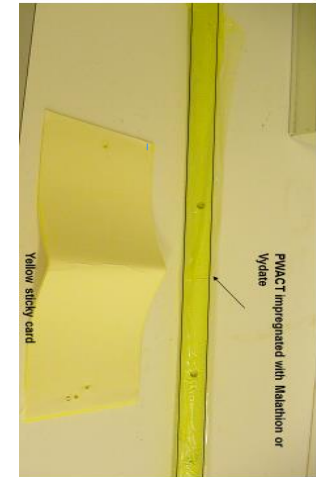
Yellow sticky card



Black light trap



Pitfall trap



Attract and kill tube

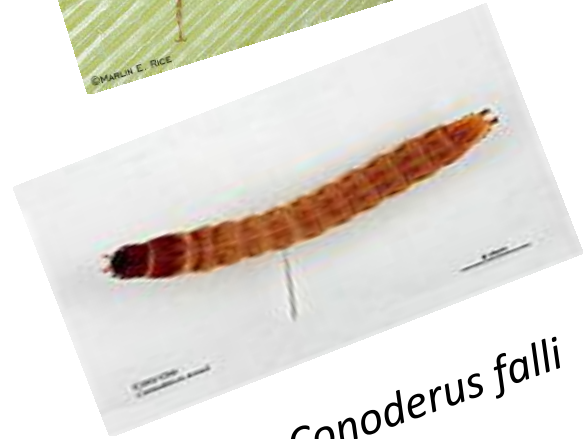
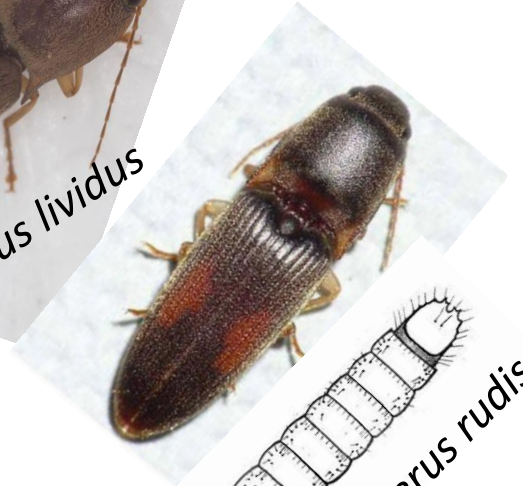
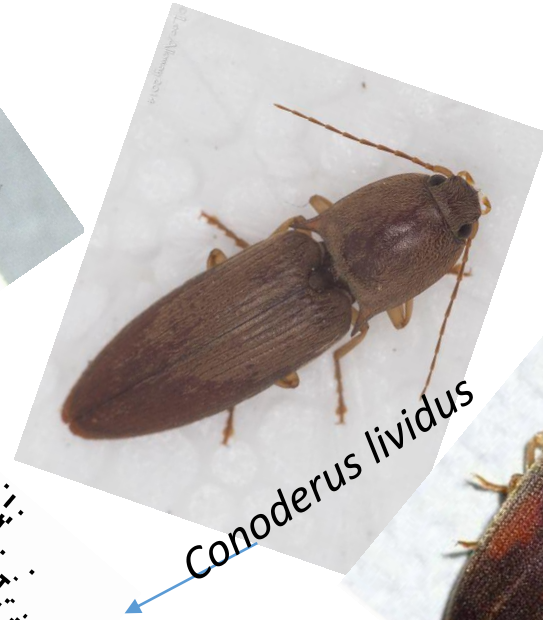
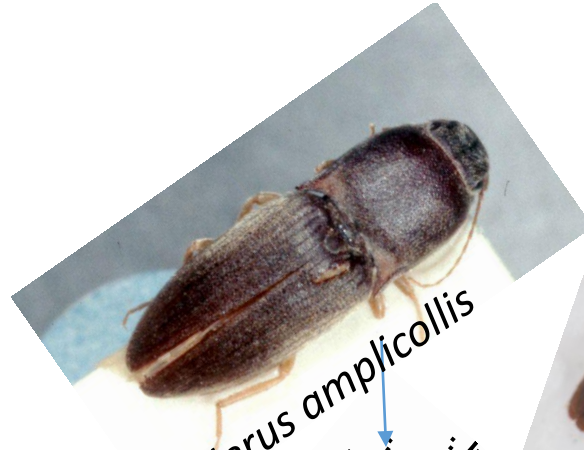
Wireworms, pests of tuber and root crops

Scientific name	Lifecycle	Preferred Hosts	Soil type
<i>Conoderus falli</i>	1.5-2.0 yr.	Potato, corn	Organic soil
<i>Conoderus amplicollis</i>	2.0	Potato, corn	Organic soil
<i>C. lividus</i>	2.0		Organic soil
<i>C. scissus</i>	2.0	Peanut, potato	Sandy soil
<i>C. rudis</i>	3.0 mo	Weeds, potato	Organic soil
<i>Melanotus communis</i>	2.0 yr.	Potato, cane	Organic soil
<i>Glyphonyx bimarginatus</i>	3.0 - 6.0 mo	Sweet corn	Organic soil

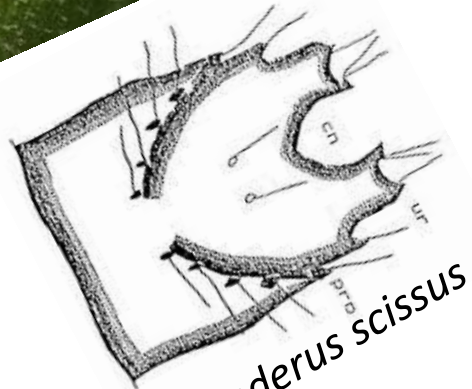


Corn wireworm

Wireworms



Conoderus falli

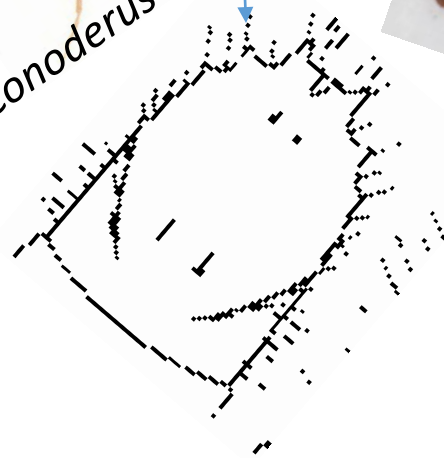


Conoderus scissus

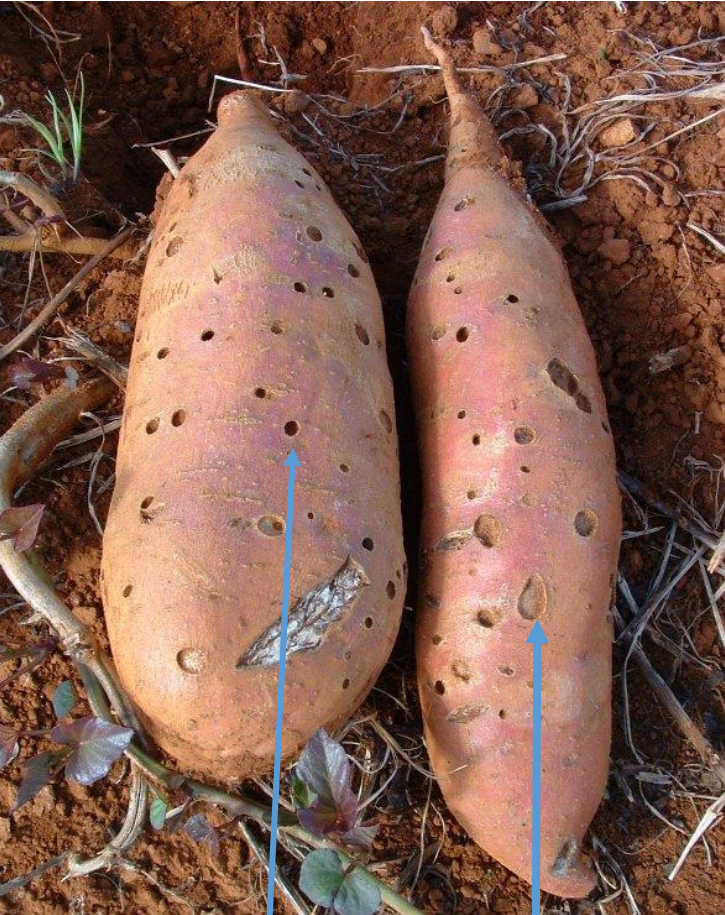
Conoderus amplicollis

Conoderus lividus

Conoderus rudis



Soil insect damage on sweet potato roots



New holes

Healed holes

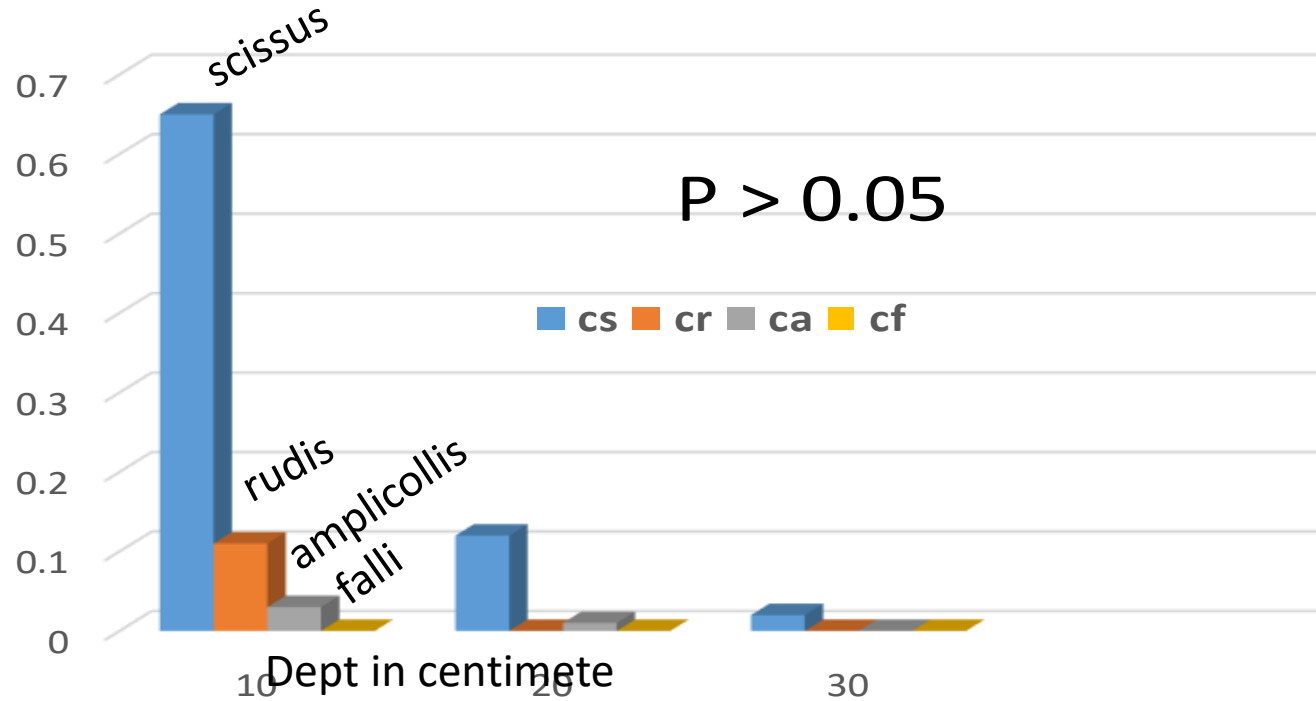


Systema damage

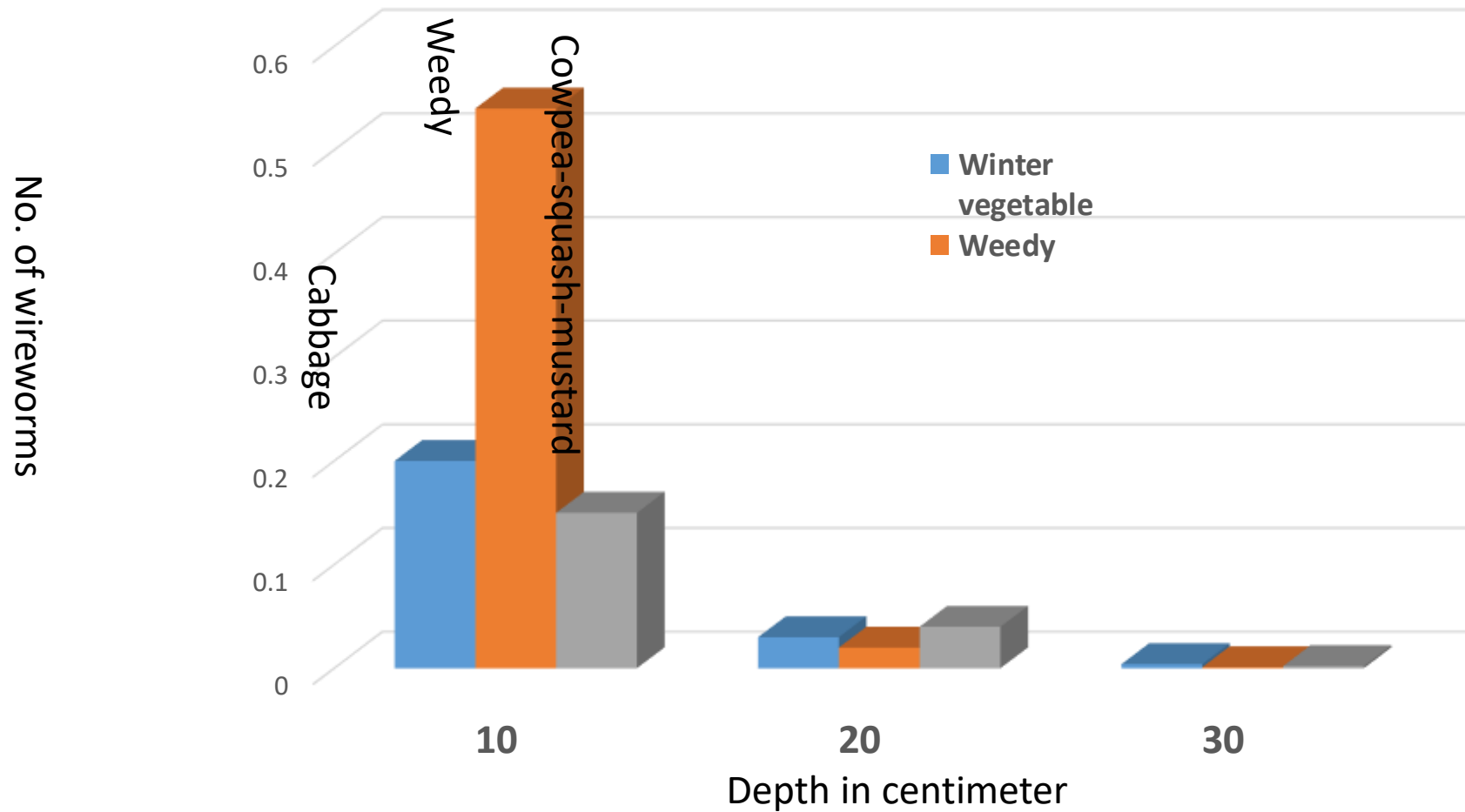
Whitegrub damage

Abundance of wireworm species at different depths

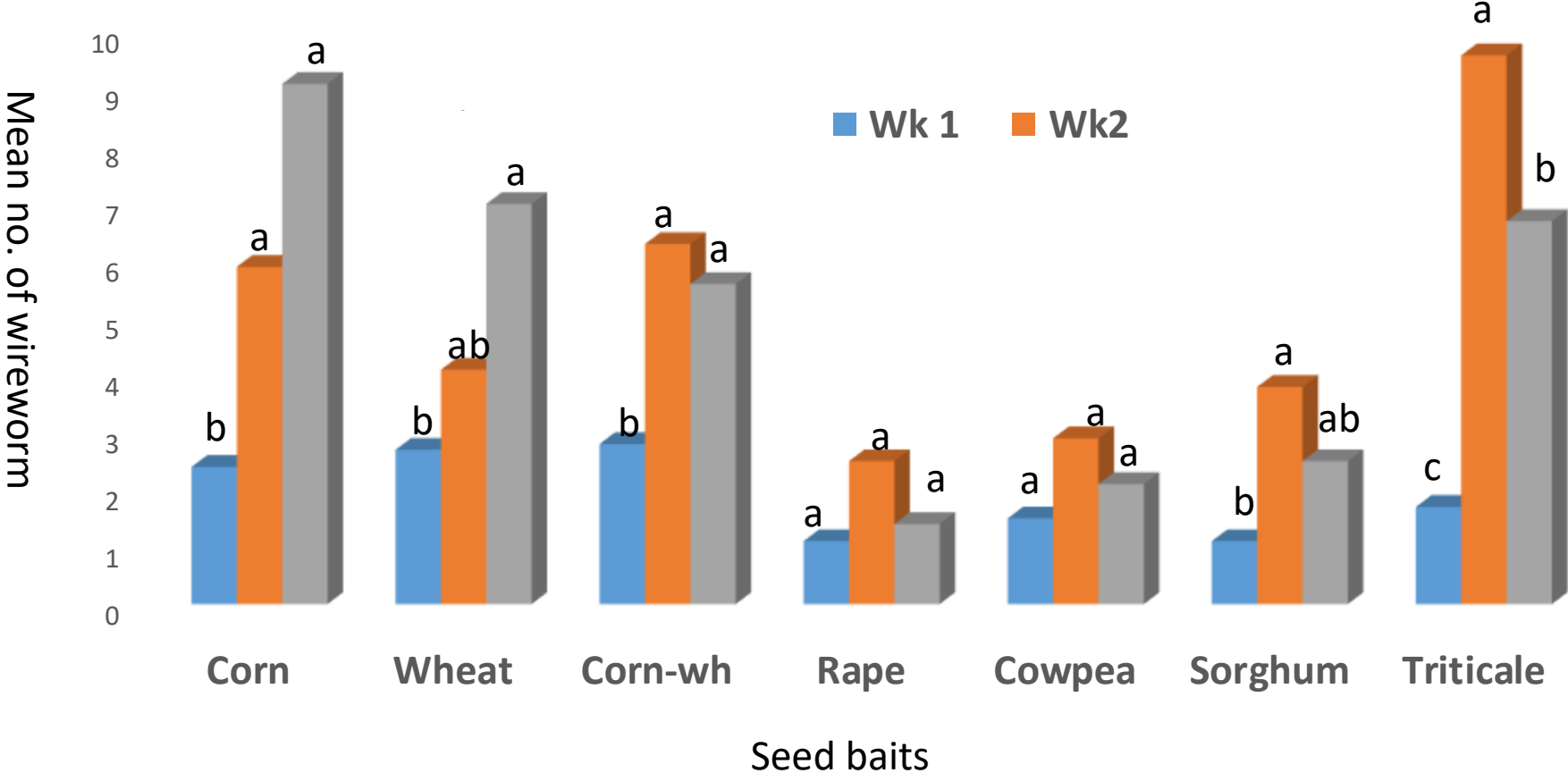
Field was planted to sweet potato for the last two seasons



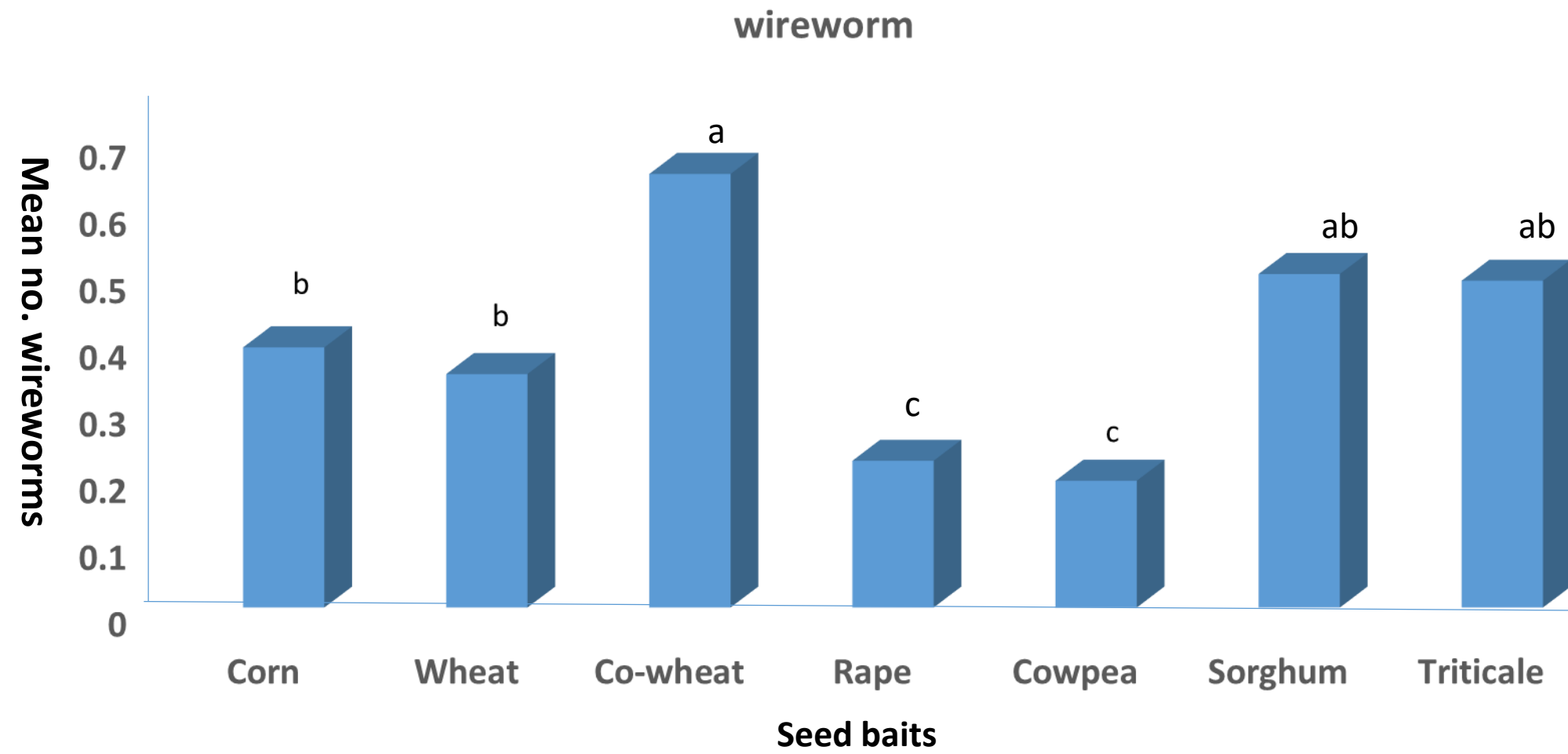
Previous crop and wireworm abundance



The field was weedy before planting sweet potato



Field 1: Planted to winter vegetables
Field 2: Weedy field
Field 3: Cowpea – sorghum – mustard rotation



White grub

- Common names: May beetles, June beetles, Japanese beetle
- Phyllophaga spp.
- 100 different spp.



Life cycle

- 1-4 years
- Females oviposits 15-20 eggs.
- Eggs are laid 1-8 inches deep in the soil
- Eggs hatch out into young larvae in about three weeks and feed on roots. Larvae feed actively all through the summer and become inactive in Autumn. In spring, larvae migrate to the root area and feed on roots and tubers.

Management

- Late spring or early autumn ploughing destroys larvae, pupae and adults.
- Ploughing exposes development stages to predators
- Ploughing must occur before the larvae migrate below the plow depth.



Fallow and weedy land become good breeding ground

White grub



Deep ploughing
Summer ploughing



a



b

Cutworm: *Agrotis ipsilon* (Hufnagel)



Egg stage: 3-6 days; 1200-1900 eggs

Larvae: 32-38 days; 5-9 instars

Pupa: 12 – 20 days

Life cycle: 35 – 60 days

2-4 generations



Cutworm damage to potato

Rootworm damage



Rootworm damage



Conclusion

- Information on the biology of pests and crops are very important in developing a successful cultural practice.
- Use proper monitoring method before planting sweet potato to understand abundance of the pest population.
- Use young and clean vine cuttings to avoid rapid build up of SPW populations.
- Know the previous pest history of the field.
- Prepare land thoroughly by plowing 6-8 inches deep.

Thanks!



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