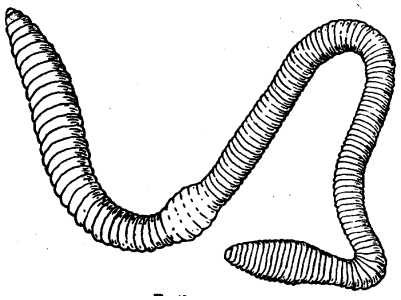
RUTGERS COOPERATIVE EXTENSION AT THE NEW JERSEY AGRICULTURAL EXPERIMENT STATION

PLANT & PEST ADVISORY

VEGETABLE CROPS EDITION $1.50 APRIL 17, 2002



INSIDE

Digging for Dirt on Earthworms

Reprinted from Journal of Natural Resources Life Science Education, Vol. 30, 2001.

Ever wonder why there are not native Canadian earthworms? It turns out the last Ice Age wiped out any native species in Canada. Also of interest is that the sightless and earless earthworms avoid hungry birds by sensing the vibrations of the birds on the surface. And, earthworms can freeze solid and still live, as long as the freeze occurs slowly.

While the feats and fortitude of earthworms may seem trivial to some people, they are serious business in farming. Eileen Kladivko is a soil physicist in Purdue's Department of Agronomy. Kladivko became interested in earthworms after seeing the benefits such annelids had on soil tilth and friability. She receives several calls each year from farmers asking about the benefits of earthworms in agriculture.

Hard-Working Worms

Earthworms are sometimes called *nature's plow* due to their ability to tunnel through the soil. Shallow-dwelling species - redworms, greyworms, fishworms, among others - create shallow, random burrows near the soil surface, burrowing about 3 feet per week. Nightcrawlers dig vertical burrows that can reach 6 feet or more into the soil. Field populations can run as high as half-a-million earthworms per acre, tunneling 250 miles each week, says Dennis Linden, soil scientist with USDA's Agricultural Research Service in St. Paul, MN.

The shallow tunnels create space for air and water in the soil, while the vertical burrows improve drainage and water infiltration.

Earthworms also eat organic matter and plant residue in the soil, excreting it in more usable forms. Their excrement is rich in phosphorus, potassium, calcium, magnesium, iron, and sulfur; they also convert mineralized forms of nitrogen, phosphorus, and potassium into more soluble, readily available forms for plant uptake.

As they feed on crop residues, worms distribute nutrients and humus through the soil profile and mix organic and inorganic soil components, says Kladivko. That's why soils with active worm populations tend to exhibit greater moisture-holding capacity, better soil structure, and more stable pH.

In his research, Linden is looking at yet another benefit that annelids provide: carbon sequestration. By taking organic matter underground, the worms keep carbon from releasing into the atmosphere, where it would bind with oxygen to form carbon dioxide.

SEE WORMS ON PAGE 2

WORMS FROM PAGE 1

Worm Preservation

With all of that free labor, it pays to give earthworms a boost. Here are some pointers from the experts: 1) leave plenty of surface residue; 2) reduce tillage; 3) apply ample fertilizer, especially manures and sewage sludges; and 4) choose your soil insecticide carefully.

Planting Worms?

The agronomic benefits earthworms deliver beg the question of whether growers should seed their fields with earthworms. Kladivko says the answer is usually no.

"It's not something that I can as yet recommend," she says. "I tried it in 14 different fields. It worked in a couple of fields and didn't work in others. The cost is maybe a couple of hundred dollars an acre and is a one-time thing, so I might consider it if I had a field that should have nightcrawlers but doesn't."

She says most inquiries come from no-till and low-till farmers. "I think that's the result of two things. One is that when growers switch to no-till, they're aware that they should see more earthworms. And if they don't, they call me," she says. "The second is that when they switch to no-till or minimum tillage, they become more interested in soil tilth and how earthworms can help."

Rather than seeding fields with nightcrawlers, Kladivko recommends that growers work to provide the conditions under which nightcrawlers flourish. Those include leaving plenty of residue above ground, reducing tillage, and rotating occasionally into legumes like soybean or alfalfa.

If you do choose to seed your fields, you should do it only with nightcrawlers, says Kladivko. "Shallow-dwelling worms will be there already if the conditions are right. And if the conditions aren't right, nothing you can do will keep those worms there."

Rounding up Nightcrawlers

To seed your fields, you'll need to harvest some nightcrawlers. The worms are active in late spring and late fall; they can be found above ground after heavy rains. Recruit some neighborhood kids to help you. Then seed them in waterways or directly into fields with plenty of residue. Mark those areas carefully. Then come back periodically over the next year or two and look for the distinctive mounds of earth that nightcrawlers build.

Such practices are common in a few areas of the world, says Kladivko. Most notably, New Zealand farmers transplant sod from worm-rich pasture into other pasture, which is especially conducive to earthworms because it is not tilled.

For more information on earthworms, contact your county extension office.

Submitted by Joseph R. Heckman, Ph.D., Specialist in Soil Fertility. ❑

Earthworm Trivia

1. In a recent experiment on a farm in California, soil with worm castings increased tomato production by 10%, and soil with both worms and castings produced 33% more tomatoes than soil with no amendments.

2. Studies at the School of Agriculture in Switzerland's Ebenrain-Sissach revealed that worm castings had seven times as much available nitrogen as the surrounding soil, and an average of 2 to 4.5 times as much available potassium.

3. The life expectancy of earthworms is generally 4 to 8 years.

4. Earthworms are an excellent source of nutritional protein, comparing favorably to dried soya meal and fish meal. Such a food product would be prohibitively expensive to produce. Fortunately.

5. Earthworm burrows increase water infiltration, and earthworms also increase moisture-holding capacity by increasing water-stable aggregates in the soil. Some burrows have been found to travel as deep as 50 inches below the soil surface.

6. Earthworms are active in the spring and fall; during the summer and winter, they escape extreme temperatures by burrowing deeply or by entering resting states, which are similar to hibernation.

7. Pyrethroids, such as Force insecticide, are harmless to earthworms under field conditions.

8. An acre of well-fertilized, low-lying pasture can support one million worms. Many no-till crop fields are home to half-a-million worms per acre.

9. No, earthworms do not come to the surface after heavy rains to avoid drowning. The surface water and high relative humidity keeps them from dehydrating, and being above ground makes it easier for them to mate and migrate.

10. To encourage earthworm populations, experts recommend that growers reduce tillage, leave plenty of surface residue, and apply ample fertilizer.

Pest Notes

Gerald M. Ghidiu, Ph.D., Specialist in Entomology

✔ **General:** Cooler temperatures with sporadic rainfall (moisture) followed by warm days are usually favorable factors for **seed corn and root maggots**. Temperatures will again become cooler in the next week, according to weather predications.

The adult flies deposit eggs in the soil at the base of the plant, and warm soil temperatures speed up their development. With adequate moisture, a high percentage of the eggs will hatch and maggots will survive, feeding on the roots of the crop.

Growers should be aware that the potential for serious maggot damage is very high. Protect the seeds and seedlings with adequate maggot management materials. Preventative treatments are the only sure method of maggot management because once the maggots enter the root, nothing can be done to reduce or cure the damage.

✔ **Seed Maggots:** Seeds attacked by these maggots may fail to sprout, or may appear very weak after they do sprout. Although injury is most severe in cold wet springs, and on land that is rich in organic matter, damage may occur in any crop, and damage symptoms will show up much quicker during dry spells because the young plant cannot get enough water from the soil.

Current seed treatments are generally effective against **seed maggots**. Special seed treatments containing chlorpyrifos (Lorsban), diazinon, permethrin and imidacloprid have been especially effective against seed maggots in many trials. Several seed treatments are also available as planter-box treatments, which allows growers to apply as they seed. And several seed treatments, such as those containing imidacloprid, are only available as commercially treated seed. See the **Root Maggot** section below for more information. And always refer to the specific label for each crop to determine availability of seed treatments for that crop.

✔ **Root Maggots:** These maggots attack the small roots and rootlets, destroying smaller roots and creating tunnels in the larger roots. Plants become off-color, wilt, and look like they need watering. Heavily attacked plants often die or appear to rot as disease organisms enter the root.

In most crops, diazinon is labeled, and in some crops, chlorpyrifos (Lorsban) is labeled. These materials have proven to be superior to other treatments in various tests. Also, the use of Admire 2F (imidacloprid) in the furrow at planting time for insects such as **flea beetles** and **aphids** will significantly reduce the maggot population. ❑

Farmer Leadership Alliance - Regenerating Small Family Farms

The Rodale Institute is looking for "a few good farmers" in Pennsylvania, New Jersey and Maryland to take part in a farmer-led farmer leadership alliance, through a grant funded by the USDA/IFAFS (Initiative for Future Agriculture and Food Systems). Working with us, you will explore ways to increase farm profits, minimize debt, and find answers to other key farm issues—all while helping to improve the environment. You'll learn about cutting edge research on regenerative agriculture, and find ways to combat problems like weed control and pest management. You'll learn about finding new markets and better ways to sell your product. And you'll be learning not only from us, but also from other farmers who have their own success stories to share.

We've taken into consideration your schedules and busiest times of the day, month and year. We will continue to be mindful of your busy lives, but ask that you attend just 6 meetings a year. Most meetings will be in your region.

So, if you see yourself as a good farm manager and community leader who enjoys learning and trying new things, please call me for details!

Michelle Frain
Regenerative Agriculture Coordinator
The Rodale Institute
610-683-1401
michelle.frain@rodaleinst.org

Nonconventional Soil Additives

Joseph R. Heckman, Ph.D., Specialist in Soil Fertility

Growers often ask Extension about the effectiveness of numerous products that may be promoted as soil conditioners, nutrient sources used in a nonconventional manner, wetting agents and surfactants, biological inoculants and activators, plant stimulants and growth regulators, or nonconventional fertility concepts. To provide information about such products, the North Central Regional Soil Test Working Group (NCR-103) has compiled a publication on "Nonconventional Soil Additives: Products, Companies, Ingredients, and Claims." Paper copies or CD versions of the publication are available from:

University of Wisconsin-Madison
Department of Soil Science
1525 Observatory Drive
Madison, WI 53706-1299

The publication is also posted on the Web, and it may be downloaded from http://www.soils.wisc.edu/extension/. ❑

Potash Terminology and Facts

Reprinted from Agri-Briefs, from the Agronomists of the Potash & Phosphate Institute, Winter 2001-2002, No.7.

Ever wonder where the term potash originated? Of course, potash is now commonly used in reference to potassium fertilizers. But, in colonial days it referred to a crude potassium carbonate salt that was produced by leaching wood ashes and drying or evaporating the leachate in iron pots...hence pot ash. Early settlers used this salt as a source of potassium fertilizer and for soap and glass making, wool scouring, and cloth dyeing. In fact, the first patent issued in the US was for a process to extract potash from wood ashes.

In fertilizer terminology, potash refers to potassium oxide, or K_2O. For example, a fertilizer with 0-0-60 analysis will contain 60 percent K_2O equivalent by weight. This is somewhat confusing since the fertilizer material doesn't actually contain K_2O, and plants do not take up K_2O. It's simply the standard that has been adopted and used for some time now. Occasionally, in scientific literature, percent potassium is used instead of percent K_2O. To convert potassium to K_2O, multiply by 1.2; multiply K_2O by 0.83 to convert to potassium.

Potash fertilizers range from 20 to 62 percent K_2O. They are all water-soluble and therefore agronomically effective. They consist of potassium in combination with chloride, sulfate, nitrate, and other elements. Common potash fertilizer sources include,

- Muriate of potash (MOP), or potassium chloride* (KCl)
- Sulfate of potash (SOP), or potassium sulfate (K_2SO_4)
- Sulfate of potash magnesia, or potassium-magnesium sulfate (K_2SO_4 $2Mg\ SO_4$)
- Saltpeter*, or potassium nitrate (KNO_3)

In addition to potassium, these fertilizers provide other needed nutrients. For example, MOP contains 60 to 62 percent K_2O and about 45 percent chloride. Sulfate of potash contains 50 to 53 percent K_2O and about 18 percent sulfur. Sulfate of potash magnesia contains 20 to 22 percent K_2O and sulfur and 10 to 11 percent magnesium. Potassium nitrate contains 44 percent K_2O and 13 percent nitrogen.

Muriate of potash is by far the most commonly used of the potash fertilizer sources. It comes in red, white, and colors in between. The question is sometimes asked, "Does the color of MOP make a difference in its agronomic effectiveness?" The answer is an emphatic *No*. Some crops may be sensitive to the chloride in MOP. Therefore, SOP or potassium nitrate may be the best source for crops such as potatoes, tobacco, fruit trees and others with low tolerance to chloride. Sulfate of potash magnesia is routinely used wherever there is a need for at least two of the three nutrients in that material.

Potassium is a major essential nutrient in crop production. Where it is deficient in the soil or where crop demands during specific growth stages exceed the soil's ability to supply adequate potassium, it must be supplemented through fertilization. All potassium fertilizers are agronomically effective and in most cases will perform similarly. Crop sensitivities, the need for accompanying nutrients, and market availability are factors that should be considered when selecting the best source for a specific situation.

*generally not acceptable fertilizer material for organic production.

Submitted by Joseph R. Heckman, Ph.D., Specialist in Soil Fertility. ❑

Weekly Weather Summary

Keith Arnesen, Ph.D., Agricultural Meteorologist

Temperatures averaged much above normal. Extremes were 80 degrees at Hammonton and Downstown on the 15th and 28 degrees at Charlotteburg on the 12th. Weekly rainfall averaged 1.11 inches north, 0.30 inches central, and 0.57 inches south. The heaviest 24 hour total reported was 1.17 inches at Newton on the 14th to 15th. Estimated soil moisture, in percent of field capacity, this past week averaged 91 percent north, 78 percent central and 71 percent south. Four inch soil temperatures averaged 48 degrees north, 51 degrees central and 52 degrees south.

The following table contains meteorological information since the start of the growing season March first. The table is updated each Monday and the following is an explanation for each column.

Week=total rainfall for the previous 7 days ending Monday morning
Total=total rainfall since March 1st
Dep=departure from normal of rainfall since March 1st. A negative sign indicates below normal and no sign indicates above normal.
Mx=highest temperature for that 7 day period
Mn=lowest temperature for that 7 day period
Avg=average temperature for that 7 day period
Dep=departure from normal of the average temperature for that 7 day period
Total=total number of growing degree units since march 1st
Dep=departure from normal of growing degree units
%fc=percent of field capacity (soil moisture)

Weather Summary for the Week Ending 8 am Monday 4/15/ 2

	RAINFALL			TEMPERATURE				GDD BASE50		MON
WEATHER STATIONS	WEEK	TOTAL	DEP	MX	MN	AVG	DEP	TOT	DEP	%FC
BELVIDERE BRIDGE	1.44	5.72	-.08	75	32	54.	4	63	63	100
CANOE BROOK	.64	5.24	-1.30	78	31	54.	5	84	84	93
CHARLOTTEBURG	1.16	5.60	-.67	76	28	51.	4	41	41	98
FLEMINGTON	.63	5.76	-.44	77	37	57.	7	91	91	88
LONG VALLEY	1.16	5.43	-1.17	72	30	52.	4	47	47	100
NEWTON	1.63	4.51	-1.00	76	34	53.	5	59	59	100
FREEHOLD	.19	5.00	-1.29	78	41	58.	7	116	115	75
LONG BRANCH	.35	5.53	-.99	78	40	57.	7	76	76	65
NEW BRUNSWICK	.15	4.85	-1.08	75	39	57.	6	99	97	84
PEMBERTON	missing									
TOMS RIVER	.43	6.81	.55	79	31	56.	6	112	112	72
TRENTON	.40	4.66	-1.04	76	35	57.	5	107	98	76
CAPE MAY COURT HOUSE	.72	6.54	1.00	73	37	57.	5	113	107	59
DOWNSTOWN	.56	5.15	-.55	80	30	57.	4	106	96	71
GLASSBORO	.22	5.08	-.90	79	37	59.	7	122	113	60
HAMMONTON	.55	5.36	-.42	80	30	57.	5	117	108	63
POMONA	.71	6.72	1.08	76	35	56.	5	109	107	82
SEABROOK	.72	5.16	.13	78	40	60.	7	128	116	71
ATLANTIC CITY MARINA	.49	5.82	.55	62	46	55.	3	73	68	74
SOUTH HARRISON	.44	5.09	-.40	77	34	58	NA	122	NA	NA

WES KLINE — GDD BASE 40 PINEY HOLLOW
Last Week 37 (Ending 4/8/02)
This Week 118 (Ending 4/15/02)

Rutgers Cooperative Extension - NJAES
U.S. DEPARTMENT OF AGRICULTURE
Rutgers -The State University of New Jersey

Plant & Pest Advisory
18 College Farm Road
Cook College
New Brunswick, N.J. 08901-8551

PLANT & PEST ADVISORY

VEGETABLE CROPS EDITION CONTRIBUTORS

Rutgers Cooperative Extension Specialists
David Drake, Ph.D., Wildlife Managment
Stephen A. Garrison, Ph.D., Vegetable Crops
Gerald M. Ghidiu, Ph.D., Vegetable Entomology
George Hamilton, Ph.D., Pest Management
Joseph R. Heckman, Ph.D., Soil Fertility
Stephen A. Johnston, Ph.D., Plant Pathology
Bradley A. Majek, Ph.D., Weed Science
Rutgers Cooperative Extension County Agricultural Agents
Atlantic, Richard W. VanVranken (609-625-0056)
Burlington, Raymond J. Samulis (609-265-5050)
Cape May, Russell Blair (609-465-5115)
Cumberland, Wesley Kline, Ph.D. (856-451-2800)
Gloucester, Michelle Infante-Casella (856-307-6450)
Hunterdon, Winfred P. Cowgill, Jr. (908-788-1338)
Mercer, Daniel Kluchinski (609-989-6830)
Middlesex, William T. Hlubik (732-745-3443)
Monmouth, Bill Sciarappa, Ph.D. (732-431-7260)
Morris, Peter J. Nitzsche (973-285-8300)
Salem, Peter R. Probasco (856-769-0090)
Warren, William H. Tietjen (908-475-6505)
Vegetable IPM Program (732-932-9802)
Joseph Ingerson-Mahar, Vegetable IPM Coordinator
Kristian E. Holmstrom, IPM Program Associate
Sarah Walker, IPM Program Associate
Newsletter Production
Jack Rabin, Associate Director for Farm Services, NJAES
Cindy Rovins, Crop Managment Communications Editor

Pesticide User Responsibility: Use pesticides safely and follow instructions on labels. The pesticide user is reponsible for proper use, storage and disposal, residues on crops, and damage caused by drift. For specific labels, special local-needs label 24(c) registration, or section 18 exemption, contact RCE in your County.

Use of Trade Names: No discrimination or endorsement is intended in the use of trade names in this publication. In some instances a compound may be sold under different trade names and may vary as to label clearances.

For back issues, visit our web site at: www.rce.rutgers.edu/pubs/plantandpestadvisory/