Rapid Diagnostic Tests for Greenhouse and Nursery Crop Monitoring

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http://osufacts.okstate.edu

Although rapid diagnostic tests have been available for a number of years, they have not been fully utilized by Oklahoma producers. These tests allow for fast and accurate disease diagnostics in greenhouse, nursery and field settings. Few materials are required and the rapid results can be used to guide management decisions, including selection of the appropriate chemical for disease control.

Advantages

Rapid

Plants exhibiting suspicious symptoms (Figure 1) can be tested on-site with diagnostic test kits. Results are available in 5 minutes to 30 minutes. If the sample is sent to a plant diagnostic laboratory, delivery alone may take two days or more.

Accurate

The results are highly accurate for symptomatic plant material. In some cases, the test will detect the listed organism, as well as closely related pathogens. This will be indicated on the kit instructions.

If screening asymptomatic plants, it is suggested to send plant material to a diagnostic plant laboratory, since the rapid tests may not detect the pathogen in asymptomatic plants.

Simple

The tests do not require any specialized training or experience. All materials are included in the test kit, except commonly available supplies including paper towels, scissors and a blunt object (such as a marker).

Safety

The test materials are safe and non-hazardous. They can be stored in the refrigerator until needed.

Wide selection

Rapid test kits are available for a large number of plant pathogens. Table 1 (page 5) lists the more common plant pathogens in greenhouses and nurseries that can be tested with rapid tests. A list of U.S. suppliers is shown in Table 2 (page 6). Contact the suppliers or visit their websites for complete lists of rapid tests.

Good shelf life

Tests can be purchased in small (5 to 10) or large (25 to 50) quantities. Shelf-life is one year or more, if properly stored in the refrigerator. Desiccant packets are included to keep materials dry, so do not remove them from the test kits.

Figure 1. On-site diagnostic kits can be used to rapidly test suspicious symptoms in greenhouse and nursery crops.

Low cost

Cost is $10 to $20 per test (including shipping), depending on the exact test and supplier. Shipping costs to the diagnostic plant laboratory or time taken to drive to an Extension office generally cost more.

Disadvantages

Interpretation of results

If a test yields a positive result, the kits do not provide management recommendations. Consult the local county Extension office, Extension Specialist, or chemical representative for guidance.

Results are pathogen specific

The tests only provide a positive or negative result for a single pathogen. If the results are negative, the grower may need to test for additional organisms. Contact a plant diagnostic laboratory if additional testing is needed.

Tests are not available for all pathogens

Table 1 is an abbreviated list of tests available from U.S. suppliers (as of June 2015). Additional tests are in development, so continue to review supplier catalogs.

Basic instructions for using a rapid test

Select plant tissue

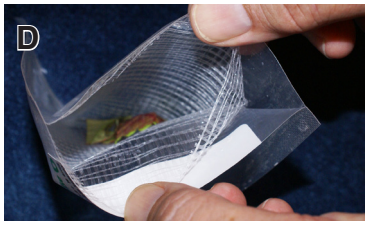
Symptomatic plant tissue is preferred (A and B). Samples can be cut or torn from several plants or plant parts. If roots are used, rinse roots in water to remove soil or potting mix and blot dry on paper towels.

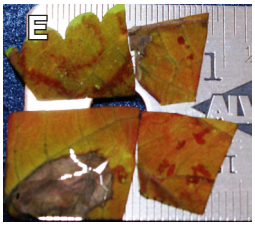
Open bag (if necessary)

Plastic extraction bags are included with the kit. Some kits include bags pre-filled with extraction buffer. These filled bags must be opened with scissors (C). Hold the bag upright so that the sample buffer does not leak from the bag.

Place plant tissue in bag

Open sample bag. If two layers of plastic mesh are present, be sure to insert the plant tissue in between the layers (D). Add roughly one (1) square inch of plant tissue (E). Do not use too much plant tissue or the test may not work properly.





Add buffer (if necessary)

Follow kit instructions and add the appropriate amount of buffer to the bag (F). Some companies provide pre-filled bags.

Extract sample

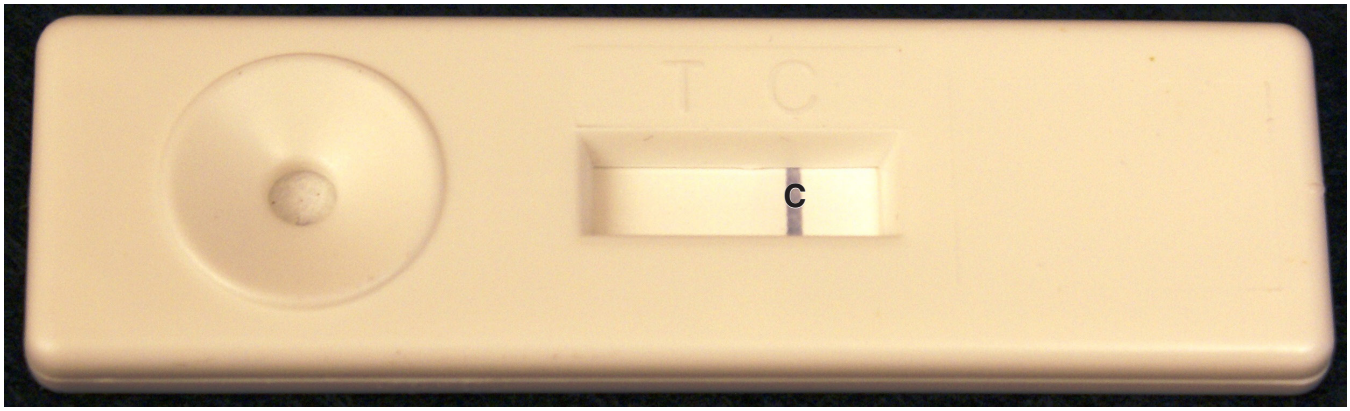
Rub a blunt object (ie. pen or marker) across the mesh until the plant tissue is macerated and a green-brown liquid fills the bag (G and H).

Test the sample

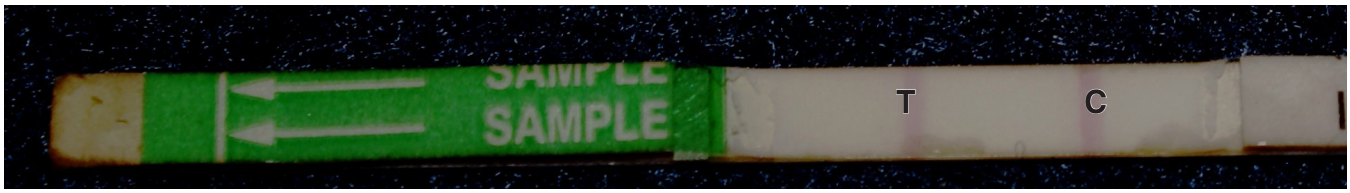
Strips or cartridges for specific pathogens are included with the test kit. Allow strips, cartridges and extract solution to warm to room temperature before running the test. ***Strip method:*** The extract solution may be poured into a clean container such as a drinking cup or the strip may be directly inserted into the bag (I and J). Be sure to insert strips in the proper direction and do not insert above the maximum fill line. ***Cartridge method:*** Deposit the indicated amount of extract onto the test spot (K).

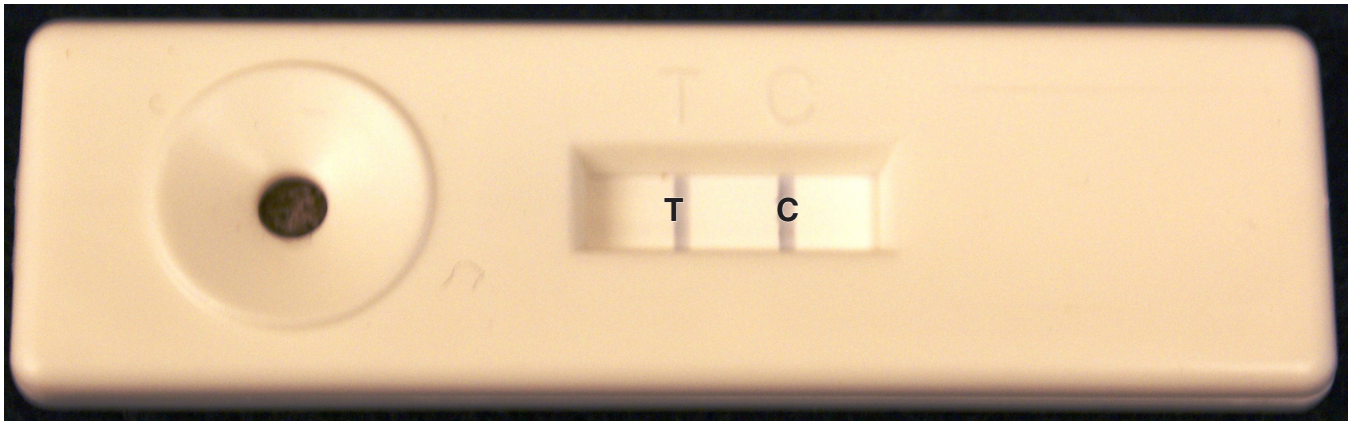
Interpretation of results

Wait the indicated amount of time and examine the test strip or cartridge. If there is only one line (C- control line) this indicates the test worked properly, but the result is negative.

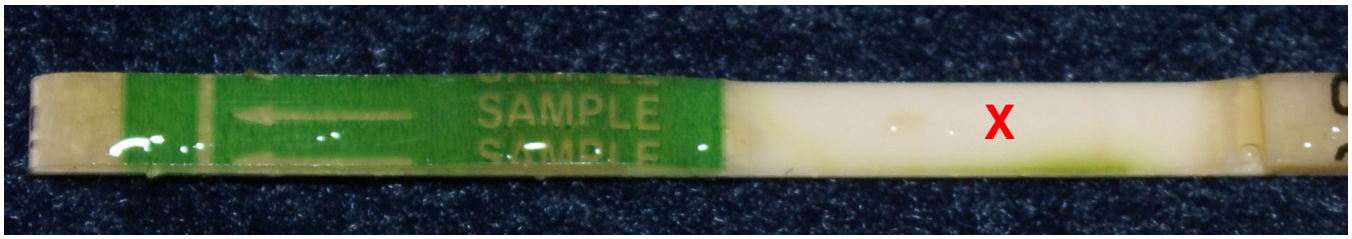


If two lines are present (T-test line and C-control line), the test worked properly and the sample is positive for the tested pathogen.





If no lines are present, the test is invalid and the user should visit the troubleshooting guidelines listed below and included with the test kit.

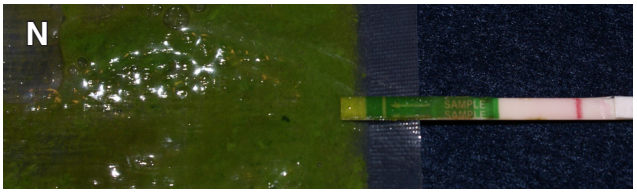


Troubleshooting

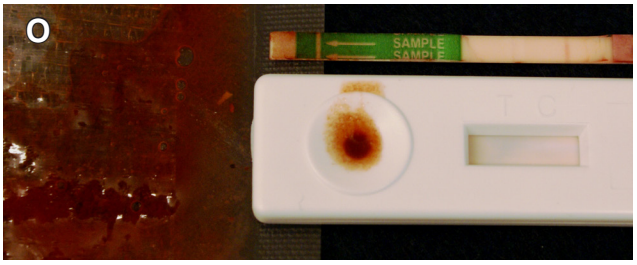
If the test malfunctioned, please review the specific kit instructions for troubleshooting. The most common errors are listed below.

1. **Control line did not develop.** This may occur if the sample was inserted too deep in the sample extract (L and M). This invalidates the results, so the test should be repeated.

2. **Extract does not move into the strip or moves very slow.** In most cases, this occurs because too much plant tissue was used. The extract may be thick and viscous (N). Some plants have naturally viscous sap and this interferes with the extract moving through the paper. Rerun the test using less plant tissue or dilute the extract with additional extract buffer. Another cause may be that cold buffer was used in the test. Therefore, always warm kit supplies to room temperature before running the test.



3. **Green or pigmented test line develops.** The test line should be a pink-purple color. If the test line appears green, it should not be considered a positive result. It is likely too much plant material was used or the plant sap is viscous. Rerun the test using less plant tissue or dilute extract with additional extract buffer. Do not test orange, red, purple fruits without contacting the company (O). No reaction or false positive bands may appear.



4. **Test or control line is weak (faded).** Verify that the kit has been used before the expiration date. It is possible that the test materials were left open too long and they absorbed moisture. Therefore, keep kit components closed and stored in the refrigerator between uses. A faded, weak T-test line may also indicate that the pathogen titer (concentration) is low in the plant (P).

5. **Other concerns.** If other unusual results occur, contact a product representative. They will trouble shoot the problem, but the sample may need to be forwarded to a plant diagnostic laboratory for additional testing.

Table 1. Abbreviated list of rapid, on-site diagnostic tests for greenhouse and nursery growers.*

Disease	*Hosts*	*Pathogen*	*Testing formats*
Bacterial blight	Geranium, Pelargonium	*Xanthomonas campestris* pv. *pelargonii*	Agristrip, ImmunoStrip®, SPOT√CHECK-LF™
Bacterial wilt	Geranium, tomato, potato	*Ralstonia solanacearum*	Agristrip, EXPRESS™, ImmunoStrip®
Calibrachoa mottle	Calibrachoa, Petunia	Calibrachoa mottle virus (CbMV)	ImmunoStrip®
Cucumber mosaic	Many	Cucumber mosaic virus (CMV)	Agristrip, ImmunoStrip®, SPOT√CHECK-LF™
Fire blight	*Rosaceae* (apple, pear and related)	*Erwinia amylovora*	Agristrip, SPOT√CHECK-LF™
Hosta virus	Hosta spp.	Hosta Virus X (HVX)	ImmunoStrip®
Impatiens necrotic spot	Many ornamentals	Impatiens Necrotic Spot Virus (INSV)	Agristrip, ImmunoStrip®
Pepino mosaic	Tomato, basil	Pepino Mosaic Virus (PepMV)	Agristrip, ImmunoStrip®, SPOT√CHECK-LF™
Phytophthora diseases	Many	*Phytophthora* spp.	ALERT-LF™, ImmunoStrip®
Pythium diseases	Many	*Pythium* spp.	ALERT-LF™
Potyvirus group	Many	Potyvirus group viruses	ImmunoStrip®
Rhizoctonia diseases	Many	*Rhizoctonia* spp.	ALERT-LF™
Tobacco mosaic	Many	Tobacco Mosaic Virus (TMV)	Agristrip, ImmunoStrip®,
Tomato mosaic	Many	Tomato Mosaic Virus (ToMV)	Agristrip, SPOT√CHECK-LF™
Tomato spotted wilt	Many ornamentals	Tomato Spotted Wilt Virus (TSWV)	Agristrip, ImmunoStrip®, SPOT√CHECK-LF™

*Contact supplier or view their websites for a complete list of products.

Table 2. List of US Suppliers of rapid test kits.*

Sources	*Rapid Test Format*
Agdia Inc. 52642 County Road 1 Elkhart, IN 46514 Phone: 800-622-4342 Email: info@agdia.com Website: www.agdia.com	ImmunoStrip®
bioWORLD PO Box 888 Dublin, OH 43017 Phone: 614-792-8680 Email: customerservice@bio-world.com Website: www.bio-world.com	ALERT-LF™ EXPRESS™ SPOT√CHECK-LF™
Eurofins STA Labs-California (distributor of Bioreba Ag products) 7240 Holsclaw Road Gilroy, CA 95020 Phone: 800-426-9124 Email: bioreba@eurofinsus.com Website: www.stalabs.com	Agristrip
Target Specialty Products (distributor of Agdia ImmunoStrip® products) 220 NW 67th Street Oklahoma City, OK 73116 Phone: 800-522-9701 Email: sylvia.kenmuir@target-specialty.com Website: www.target-specialty.com	ImmunoStrip®

*Other suppliers may be available

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Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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