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Asian Soybean Rust – Frequently Asked Questions II: Identification, Biology, and Ecology

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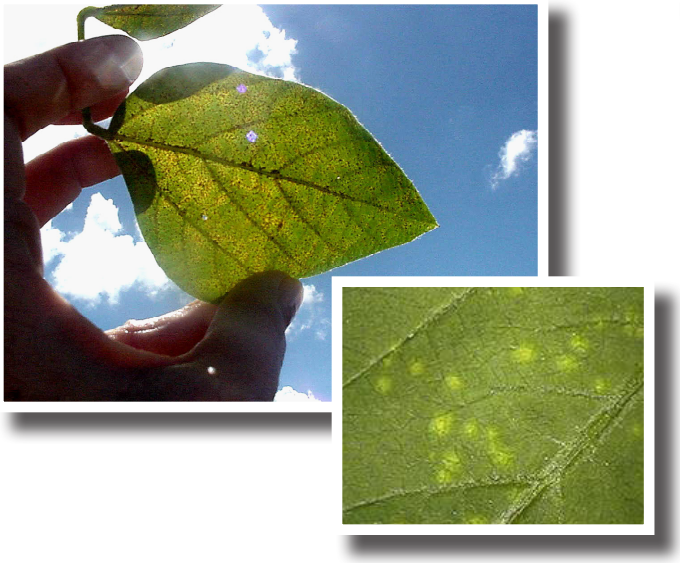
What does the Asian soybean rust (ASR) look like?

The first symptoms usually appear as pinpoint-size lesions on the upper leaf surface of the lower leaves of the plant. These early lesions may first appear as yellow flecks and with age turn tan to brown or red-brown. The lesions may be angular or circular and may cluster near leaf veins.



As the disease progresses, lesions may be numerous. Pustules form, mostly on the lower leaf surface on soybeans. These pustules erupt to release urediniospores through circular holes, which when examined with a hand lens, resemble microscopic volcanoes. The urediniospores may be powdery and tan or lightly pigmented. Lesions and pustules may also develop on petioles, stems, and pods. Chlorosis or mottling on leaves may also be associated with lesion development.

As the soybean matures and sets pods, ASR spreads rapidly. Lesions can be found on petioles, pods, and stems, but are most abundant on leaves.

Especially at the early stages, it is easy to confuse soybean rust symptoms with the symptoms of three other soybean leaf diseases: **brown spot** caused by the fungus, *Septoria glycines*, **bacterial pustule** caused by *Xanthomonas axonopodis pv. glycine*s, and **bacterial blight** (also called **angular leaf spot**) caused by *Pseudomonas savastanoi pv. glycinea*.

See the disease identification section of the Virginia Soybean Rust website at *http://www.ppws.vt.edu/ipm/soybeanrust/id.htm* for more detailed descriptions of symptoms and other look-a-like soybean diseases.

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How does Asian soybean rust affect soybeans?

When ASR colonizes soybean plants, leaves turn yellow and premature defoliation occurs. Premature defoliation results in decreased pod production, seed fill, and/or smaller seed size. ASR can progress very rapidly and defoliate a soybean plant within four to six weeks after the initial infection.

The yield loss due to defoliation will depend on the developmental stage of the soybean. The most critical stages for maintaining leaf area are the late pod (R4) to full seed (R6) developmental stages. For instance, complete defoliation during early seed formation (R5) could reduce yield more than 75 percent. There will be progressively less yield loss at earlier (R1-R4) or later stages (R6). Only after the soybean plant reaches physiological maturity (R7) will defoliation cause no yield loss.

Does ASR affect any other crops grown in the United States?

Some common leguminous crop plants and weeds are also hosts, including yellow sweet clover (*Melilotus officinalis*), vetch (*Vicia dasycarpa*), medic (*Medicago arborea*), lupine (*Lupinus hirsutus*), green and kidney beans (*Phaseolus vulgaris*), and lima and butter beans (*Phaseolus lunatus*).

Of most concern may be the snap bean (*Phaseolus vulgaris*) industry on Virginia's Eastern Shore and in other parts of Virginia. Although the snap bean is listed as a host species of ASR, the snap bean is not as susceptible as the soybean. According to observations by researchers on snap beans and soybeans in South Africa, it is very difficult to find ASR in fields of snap beans, even when adjacent soybean fields are severely diseased. However, some snap bean cultivars are more susceptible than others.

Corn and other grain crops, alfalfa, cotton, and peanuts are not hosts to ASR.

Are there soybean cultivars with resistance to ASR?

Currently, there are no soybean cultivars with acceptable levels of resistance to ASR. A commercial soybean cultivar for use in the United States is probably five to ten years away. The good news is that much groundwork has been done. Partial resistance and yield stability are likely to be the most effective resistance strategies. Planting cultivars with resistance to rust pathogens has been very successful in managing rust in wheat and corn and is expected to be similarly successful with ASR.

Why do I need to know the development stages of soybeans?

Soybean development is classified as vegetative or reproductive. Vegetative stages are designated numerically as V1, V2, V3, through V(n), which refers to the number of fully developed nodes on the main stem. Reproductive stages are divided into flowering (R1, R2), pod development (R3, R4), seed development (R5, R6), and maturity (R7, R8). Details on soybean development stages can be found at *http://www.ppws.vt.edu/ipm/soybeanrust/index.htm*. The developmental stage of the soybean crop is used to determine whether or not the crop is at risk from ASR.

Fungicide application is not recommended during vegetative growth stages. From the R1 through R6 reproductive stages, soybeans are at risk (i.e. yield loss will occur). The most critical period of plant development in terms of yield is the late pod (R4) through seed development (R5 and early R6) stages. Any stress during these stages can greatly reduce yield.

How does the soybean developmental stage affect ASR management?

Fungicides are not recommended during the vegetative stages. If the risk of rust is high during flowering (R1) through seed development (R6), fungicide applications will be recommended.

Why aren't soybean seedlings at risk to ASR?

The seedling-stage soybean is susceptible to ASR; however, the fungus does not develop and sporulate as readily as it does once the soybean enters the reproductive stages.

Is the soybean more susceptible to ASR in later reproductive stages?

The developmental stage has little to do with the susceptibility of the soybean to ASR; ASR can infect seedling-stage soybeans. However, ASR does not develop and sporulate as rapidly on soybeans in the vegetative stages as on soybeans in the reproductive stages.

Therefore, fungicide application will not be cost effective and not be recommended until the soybean begins to bloom (R1). In 2005, ASR incidence and severity progressively increased as the crop aged.

Why does ASR usually appear on the lower leaves first?

The lower leaves experience longer periods of leaf wetness, higher humidity, less exposure to UV light, and cooler temperatures during the day and warmer temperatures during the night. All of these factors favor rust development. However, climatic conditions in Virginia make it likely that other areas of the plant will experience six to eight hours of leaf wetness and the optimal temperatures for ASR development.

Rust also tends to develop more rapidly on older leaves. Therefore, leaves originating from the lower part of the main stem will likely show more disease than leaves from branches, regardless of their vertical position in the canopy. Therefore, scouting efforts should be focused on the lower leaves originating from the main stem.

Will dry weather affect the disease?

ASR spores are produced rapidly in large quantities under favorable environmental conditions (i.e. temperatures between 59 to 82°F and free moisture). Dry weather can greatly inhibit disease development due to lack of free moisture. ASR needs a minimum of six hours of leaf wetness to sporulate.

Other ASR Resources:

Asian Soybean Rust website at Virginia Tech – *http://www.ppws.vt.edu/ipm/soybeanrust/index.htm*

USDA Soybean Rust Tracking site – *http://www.sbrusa.net/*

North American Plant Disease Forecast Center – *http://www.ces.ncsu.edu/depts/pp/soybeanrust/*

The Southern Plant Diagnostic Network – *http://spdn.ifas.ufl.edu/soybean_rust.htm*

Related Publications

Asian Soybean Rust – Frequently Asked Questions I: Background and General Information, Virginia Cooperative Extension publication 450-301

Asian Soybean Rust – Frequently Asked Questions III: Control with Fungicides, Virginia Cooperative Extension publication 450-303

Asian Soybean Rust – Frequently Asked Questions IV: Cropping Systems and Cultural Practices, Virginia Cooperative Extension publication 450-304

Asian Soybean Rust – Frequently Asked Questions V: Monitoring, Tracking, and Scouting, Virginia Cooperative Extension publication 450-305

Asian Soybean Rust – Frequently Asked Questions VI: Sprayer and Nozzle Technology, Virginia Cooperative Extension publication 450-306

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