Developing spray induced gene silencing to trigger resistance against Orthotospovirus tomatomaculae on peanut.

Sudeep Bag, Saritha R.K., and Albert Culbreath

Department of Plant Pathology

UGA Tifton

Utilizing RNA interference (RNAi) mechanisms within plants, RNAi-based resistance or vaccination technology aims to safeguard plants against viral infections. Previous research has demonstrated that double-stranded RNAs (dsRNAs) targeting viral sequences can trigger RNAi-mediated defense mechanisms when applied directly to plants. These strategies have exhibited encouraging outcomes in disrupting the infection of various viruses including potyviruses, bromoviruses, tobamoviruses, and potexviruses.

Tomato spotted wilt virus (TSWV), a member of the Orthotospovirus genus within the Tospoviridae family, is a significant contributor to substantial crop yield reductions across various crops in tropical and subtropical areas. Recognized as one of the top ten economically impactful viruses globally, TSWV exhibits a broad host spectrum, having been documented in over 1000 species spanning 85 families. Its transmission occurs persistently through thrips vectors.

TSWV infection is a major concern in the US. It has caused several devastating effects in pepper, tobacco and peanut crops in different states of the US in the past. Appropriate breeding programs and IPM have reduced the yield loss significantly. Still yield loss does exist and has been a burden on farmers' income. The main source of burden is TSWV infection. Therefore, we intend to devise a strategy to reduce the crop loss even further. A very recent study from our group as well as from other groups has specifically demonstrated that application of exogenous dsRNA targeting the TSWV genome has provided promising results in controlling TSWV infection in model plants as well as in commercial crops. Using this rationale, we wish to exploit the dsRNA mediated “RNAi-based virus resistance” to confer resistance against TSWV infection in multiple corps including peanut, tobacco, tomato and pepper.

Based on our preliminary study we have found that dsRNA treatments had positive influence on controlling TSWV infection and visible variations in ability to control TSWV observed in the approaches. Preventive approach gave better results in controlling TSWV than the curative approach. Still the coinoculation approach (dsRNA+virus together) plants are better if we compare both curative and preventive approaches. Our preliminary study hints us on the idea that treating the crops with dsRNA before the onset of viral infection could help in mitigating the yield loss.

Ongoing Research and future plan.

As we now know that the dsRNA is successfully inducing host resistance against TSWV on tobacco. The current focus is to test the nanoparticles to deliver the dsRNA to the plants. Investigating the stability of nanoparticle-dsRNA complex in the host, interaction between the nanoparticle-dsRNA and release of dsRNA within the plant tissue. Stability of the complex in rain and UV radiation. **Further experiments are ongoing on analysing the nanopartical and its efficacy to deliver the dsRNA.**

We have initiated work on spraying the nanoparticle bound dsRNA using spray gun. This is very preliminary study for endgoal to develop sprayable product to manage spottedwilt.