ECONOMICAL METHODS FOR CONTROLLING DODDER IN TOMATOES

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Dodder, a parasitic plant, is often considered a disease rather than a flowering plant (Dodder is included in the Encyclopedia of Plant Pathology!). Germinating dodder seeds emerge as rootless, long yellow-orange thread-like leafless stems. The thread-like seedling coils around the host stem, adheres to it by adhesive discs, penetrates its tissue and vascular system via haustoria, and exploits the host by withdrawing nutrients and water. The part of the seedling in contact with the soil dies soon after haustoria formation. Dodder infests many broadleaf crops. Dodder is estimated to be present in about 30,000 acres of tomatoes in California, in addition to parasitizing many rotational crops including alfalfa, asparagus, carrot, onion, safflower, sugarbeet and melon (Ashton and Santana 1976). Dodder also infests many broadleaf weeds. New shoots are continuously produced, forming new attachments to the same plant and allowing attack of neighboring plants. Thus, the vigor of the host plant is lowered and crop production is dramatically reduced. Dodder that is not controlled can reduce tomato yields by over 75% and produce thousands of seed that can remain viable for up to 20 years.

Dodder control can be achieved by avoidance, hand removal, resistant tomato varieties, and herbicides. None of these methods work 100% of the time, but all offer some hope for managing this native, parasitic weed. Another complicating factor is that several dodder species are involved, with field dodder (*Cuscuta pentagona*) being the most common. Field dodder populations have also been observed to vary in virulence and susceptibility to treatment. Thus, an integrated approach to managing dodder will be needed.

Fluctuations in soil moisture and temperature near the soil surface may initiate dormancy breaking of buried dodder seed (Hutchison and Ashton 1979). Temperatures during the spring and early summer months are ideal for dodder emergence. However, dodder emergence in field trials was observed to cease in early to mid May, despite temperatures in the optimum range for germination and emergence (Hutchison and Ashton 1980). We have confirmed these observations in several tomato fields. Thus, a way to avoid major dodder infestations is to plant after the mid-May. Late planting can reduce dodder infestation, but that is not always practical due to cannery delivery dates. Some growers have utilized transplants in order to plant late, but still deliver tomatoes within the delivery time frame.

Due to the absence of roots, dodder seedlings (before attachment to the crop) are easy to control by light and shallow cultivation. In addition, tillage may hasten drying the soil surface, thus preventing further dodder germination and emergence. Complete dodder removal can only be achieved with the destruction of the infested crop plants. Removal by hand crews, of the tomatoes with dodder attached, remains a viable but expensive option, when infestations are small. When infestations are extensive, hand removal would be prohibitively expensive, not to mention the loss in the tomato stand. Hand removal is often done when dodder is first detected to prevent spread and seed production. In a trial area, farm workers were observed to remove dodder approximately 90% of the time. The remaining 10% was generally missed, because it was too small to

be easily detected. If a hand crew can be sent back through a field about 15 to 21 days after the first hand weeding, the remaining dodder plants can be removed prior to any dodder seed production. Plants with attached dodder do not need to be removed from the field unless they have viable seed. Dodder can reattach to a new host if left in close proximity to living tomato plants, but if the plants that are hoed are moved 6 or more inches from the remaining tomato plants, the dodder will not be able to reach a new host.

Biological control has not been effective in California. United AgriProducts has been developing a disease organism (*Alternaria destruens*), specific to dodder. This organism has been effective against certain dodder species in craneberry production systems. In field tests of this organism, it has not been effective under California conditions, due to the dry climate and possibly the different dodder species.

Dodder resistant tomato varieties continue to be a viable option for preventing dodder infestation. Thus far, four Heinz varieties have been shown to be dodder resistant – H9492, H9553, H9992, and H 9888. Heinz seed has also advertised that 2 other varieties are also resistant to dodder infestation – H1100 and H1400. Some dodder is able to attach and survive on these varieties, but generally, tomato yields are not reduced and dodder seed production is very low or non-existent. Heinz 9492 was originally developed to be resistant to bacterial canker. Thus, the mechanism of disease resistance may be what prevents dodder growth.

The preemergent herbicides used in tomatoes are not effective in preventing dodder germination or attachment to tomato plants. Metam sodium controls many weeds prior to vegetable planting, but hard seeded species, such as dodder are not affected. Trifluralin controls dodder well in alfalfa, but the incorporation of the herbicide in tomatoes, allows dodder seed near the soil surface to escape control. Layby herbicides, such as Tillam or Treflan, are applied too late to control attached dodder.

The nature of attachment and association between host and parasite requires a highly selective herbicide to destroy the attached dodder without crop damage. Matrix (rimsulfuron) has been shown in studies conducted by Bob Mullen in San Joaquin County, to suppress dodder, particularly when split applications are used (Mullen et al. 1998). Further studies have shown that treatments made soon after dodder attachment were more effective than applications made after dodder became well established. Herbimax was the most effective surfactant for control of dodder with Matrix. However, the control achieved by the best Matrix treatments was only about 50%. Even when Matrix rates were increased to 2X the current label rate, dodder still survived. By the end of the season, dodder growth in the best Matrix plots was still extensive, indicating that Matrix alone is not providing adequate control.

Sandea (halosulfuron), like Matrix, suppresses dodder for a short time, but dodder growth quickly resumes. Maverick (sulfosulfuron) is an herbicide developed by Monsanto and used in winter wheat (except California). In field and greenhouse studies, we found processing tomatoes to be fairly tolerant of sulfosulfuron and we were able to achieve fair to very good dodder control. In greenhouse studies conducted in Israel, sulfosulfuron treatments resulted in 100% post-attachment control of dodder. Tomato tolerance to herbicides may be due to reduced herbicide absorption, reduced translocation within the plant, or metabolism of the herbicide. Any of these processes would also reduce the amount of herbicide reaching the dodder. Since dodder, in a sense, is just another stem on a tomato plant, we believe that some tomato injury may be necessary to

achieve dodder control with herbicides. Thus, higher rates may be needed, regardless of the herbicide used.

The primary means of dodder spread from field to field is on equipment. As more custom operations are performed, the chances for dodder spread increase. T prevent the spread of dodder (and other diseases), wash equipment after leaving an infested tomato field, before entering another. If new dodder patches are detected, eradication of these patches should be done before they have a chance to produce seeds. Patches can be removed by hand removal, spraying both host and parasite, with a contact herbicide or by searing with a flame-throwing torch or hand burner.

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