The Importance of Soil Fumigation: Peanuts

June 2013
Leonard Gianessi
Key Points

- Fumigation is the most effective treatment for black rot and nematodes.
- Fumigation increases peanut production by 1000 pounds per acre.
- Fumigation is a key factor sustaining peanut production.

Technical Summary

In 2011, farmers in Virginia and North Carolina harvested 352 million pounds of peanuts with a value of $112 million from 98,000 acres (3600 pounds/A). Virginia and North Carolina are the northernmost states growing peanuts in the U.S. with the majority of the crop (90%) produced in hotter southeast and southwest states (GA/FL/AL/TX).

The disease known as cylindrocladium black rot (CBR) grows best in cool soils and is a major problem in the Virginia and North Carolina peanut regions. CBR is caused by the soil-inhabiting fungus, *Cylindrocladium parasiticum* (prior to 1989, the causal organism was called *Cylindrocladium crotalariae*). The pathogen can infect and rot any below ground portion of the plant including roots, pegs and pods. Infected roots die and turn black. Frequently, the entire root system is destroyed. Entire pods may turn black and rot [2]. The pathogenic fungus may survive several years in the soil without a host crop. Infected plants appear stunted with yellow foliage that wilts on hot days. These plants may collapse and die. Small reddish-orange fruiting bodies of the pathogen are clearly visible in dense clusters on stems, pegs and pods. Seeds that are not rotted often are covered with cinnamon brown speckles. At first, spores are forcibly discharged, but later the remaining spores are exuded in a viscous ooze. Disease incidences in excess of 80% and yield losses of 50% or more have occurred. Yield losses in fields with a history of CBR problems can range from 1000 to 3000 pounds/A in years of excess rain [3].

CBR of peanut was first observed in Georgia in 1965. Soon thereafter it was recovered in other peanut-producing areas of the United States, Japan, India and Australia [1]. CBR was found in all peanut-producing counties of Virginia and North Carolina by 1976 [2]. The disease has been a cause of major concern because of its widespread occurrence and chronic threat to peanut production in these states.

The soil fumigant, metam sodium (Vapam, Sectagon), was first recognized in 1981 to have commercial value for control of CBR in Virginia. Field tests in Virginia indicated that metam sodium increased the yield of a CBR-susceptible variety by 1012 pounds/A (+28%) and increased the yield of a cultivar with partial resistance by 620 pounds/A (+15%) [8]. Metam sodium applied 8- to 10-inches under rows at least two weeks prior to planting has been the standard recommendation for control of CBR since 1985 [12]. Metam sodium use also reduces populations of nematodes in the soil.

Nematodes are prevalent in all peanut fields in Virginia and North Carolina [3]. Fumigation with metam sodium is the most effective means for control of high populations of plant parasitic nematodes [5]. Experiments in Virginia determined that metam sodium reduced populations of juvenile root knot nematodes by 90% [9].
Metam sodium use has greatly reduced yield loss due to CBR and nematodes. Currently, it is estimated that only 2% of Virginia’s potential peanut yield is lost to CBR with a further 2% lost to nematodes [9].

Several strategies have been developed to manage CBR in problem fields. Resistant cultivars and cultural practices provide only limited disease control. A cultural method for CBR control is to delay planting since soil temperatures are likely to be warmer and less favorable for growth of the fungus. However, late planting can place the crop at risk from frost damage in the fall and reduced yield and quality due to less than optimum maturity.

Varieties of peanuts with partial resistance to CBR show an increased yield with metam sodium treatment in heavily infested fields. In Virginia, peanut growers are faced with very high disease pressure because a significant amount of southeast Virginia farmland has produced peanuts since the late 1800’s in short rotations thus allowing for buildup of disease organisms [7]. Long rotations help to reduce the amount of fungus in the soil. A combination of fumigation and planting a resistant cultivar is recommended for fields that have a history of 10% or greater CBR incidence in prior peanut crops.

Proline fungicide (prothioconazole) applied to the seed furrow at planting followed by 2 or three foliar sprays has demonstrated partial control of CBR [12]. Propulse fungicide (prothioconazole + fluopyram) (currently unregistered) applied to the seed furrow provides CBR control equivalent to metam but yields were lower probably due to a reduction in nematode control [12]. Nematode populations were twice as high in Propulse treatments than in metam sodium treatments [9]. Peanut yields were 21% greater in the metam sodium treatment than in the Proline or Propulse treatments [9].

Fields with CBR problems often have nematode problems which are controlled by metam but not by an in-furrow fungicide [12]. Metam sodium continues to be the best treatment for CBR control in fields with nematode problems and a history of yield losses to CBR in the previous peanut crop [3][10].

A recent experiment in Virginia with a biological control for nematodes (NemOut) showed no increase in yield in comparison to the untreated check while the use of metam sodium increased peanut yield by 47% [11]. (NemOut contains the fungus Paecilomyces lilacinus strain 251 which is primarily an egg parasite).

The importance of metam sodium for nematode control recently increased with the withdrawal of aldicarb, an effective nematicide, which had been widely-used in peanut production.

Traditionally, approximately 75% of the peanut acreage in Virginia and 45% in North Carolina has been treated annually for control of CBR and nematodes [17] [15]. Fumigation with metam sodium costs about $30/A [13].

The North Carolina Peanut Growers Association and the North Carolina Cooperative Extension Service recognizes the highest yielding peanut producers each year. 61% of this group of farmers fumigated with metam sodium for CBR control from 2001 through 2007 [6].
Under provisions of the 2002 Farm Bill, the market value of Virginia-type peanuts fell 41% from $600/ton to the current loan rate of $355/ton. In addition, the oversupply of peanuts in U.S. and world markets has limited the number of contracts. These conditions were compounded by greater foreign competition in world markets, and as a result, the planted acres of peanuts in Virginia dropped from 58,000 in 2002 to the current level of 16,000 acres. These changes have created a crisis for sustaining a peanut industry in Virginia since many growers were either forced to sell off equipment and grow other crops or stop farming completely [13]. In order to have a sustainable peanut industry, the production of peanuts must stabilize at levels necessary to maintain the infrastructure for marketing, delivering and processing the crop [14]. Top yielding peanut producers in Virginia use metam sodium because it adds about 1000 pounds of production per acre [4].

The EPA recently concluded that “Thus, the main benefit of metam sodium is that it permits cultivation of peanuts that would otherwise not be economically viable. …a large proportion of peanut acreage in the North Carolina-Virginia region depends on metam sodium simply to make production economically viable.” [16].

At a cost of $30/A and a return of $320/A (1000LBS@$0.32/LB), metam usage in peanut production in Virginia and North Carolina delivers a return of $10 per $1 spent.
References