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## MANAGEMENT OF APHIDS IN SPINACH

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In Virginia, spinach can be a profitable crop to grow and is harvested in the spring and the fall. Aphids, especially the green peach aphid (GPA), *Myzus persicae* Sulzer (see Figure), can be major pests to spinach production. Aphids feed on plant sap and can reduce plant vigor if densities are high enough. However, more importantly from a management standpoint is the potential for crop contamination. Aphid populations on leaves can build up to high numbers, and most buyers will reject spinach contaminated with >15 % insect matter.

All aphids have a tremendous reproductive potential. Under adequate environmental conditions, they are capable of reproducing in the absence of males for multiple, overlapping generations. This type of reproduction is termed parthenogenesis, and the aphids of these generations are literally born pregnant. In the absence of an adequate food source or adverse weather, aphids will produce mating males and females. This type of female will lay eggs, which remain dormant until conditions improve. The relatively mild winters and abundant winter weed populations; however, enable GPA to produce parthenogenetically year round in southeastern Virginia.

There are a number of natural enemies of GPA that help to keep population levels in check. These include parasitic wasps as well as insect predators, such as ladybird beetles, and larvae of syrphid flies and lacewings. These beneficial insects, however, are not active during the cooler seasons, whereas GPA will continue to feed and reproduce. Reproduction is slower in cool weather; nevertheless, populations exceed economic levels in the late fall of most years.

A common problem that occurs in spinach is when GPA populations build up and become infected by fungal pathogens and parasitoids. Although these pathogens and parasitoids are effective biocontrol agents, the aphid corpses, or "mummies", adhere tightly to the leaves and are even harder to remove than the live insects. Therefore, chemical control is often used before aphid populations build up to high numbers.

Chemical control is not without its problems. Because of the high reproduction, the potential for the development of insecticide resistance is great, and many insecticides not only are ineffective against the GPA but also may actually flare the population by killing the beneficial predators and parasitoids.

Prior to 1995 on the Eastern Shore, the GPA had developed resistance to all materials labeled for spinach, including the organophosphates dimethoate, diazinon, and methyl parathion, as well as the carbamate methomyl, and the organochlorine endosulfan.

Imidacloprid (Provado 1.6F, Bayer CropScience) belongs to the neonicotinoid class of chemistry, and studies conducted in commercial spinach fields near the ESAREC at Painter, VA in 1995 and 1996 demonstrated the efficacy of this material.

Imidacloprid, the active ingredient of Provado 1.6F, functions as an acetylcholine antagonist in the nervous system of the target insect. This material was approved for use on spinach in Virginia under a section 18 emergency use exemption in the fall of 1995 and by the end of that same year received a full federal label. The companion soil product with the same active ingredient, Admire 2F, also received a federal label on spinach.

Another promising new chemistry, pymetrozine, was also investigated in these studies. Pymetrozine is a feeding inhibitor that causes the aphids to withdraw their feeding stylets and starve to death. Although somewhat slower acting, pymetrozine provided GPA control statistically equal to that of Provado 1.6F in the 1995 (Table 1) and 1996 fall spinach studies (data not shown). A single application was made on 31 Oct in the 1995 study. In both years of these studies, Provado 1.6F and pymetrozine provided significantly greater GPA control than in the untreated check and the other treatments, all of which had unacceptable numbers of live aphids and aphid mummies.

Last year (2002), pymetrozine received a full label for use on spinach at the rate tested in the 1995 study, and is marketed as Fulfill (Syngenta). These two compounds with different modes of action provide spinach growers with effective tools for GPA control and resistance management. They are narrow spectrum in activity, and thus fit well into an IPM program.



Fig. 1. Aphid Infestation on Spinach Leaf

Table 1: Results of 1995 GPA study in spinach

Treatment	Rate	Mean no. GPA/10 leaves	
		Live (6 Nov)	Mummies (13 Nov)
Provado 1.6F	3.75 fl oz	12.33 d	16.00 b
Pymetrozine 50% *	2.75 oz	29.67 d	56.00 b
Methyl Parathion 4E	32.00 fl oz	173.00 b	222.00 a
Diazinon 4EC	16.00 fl oz	107.00 c	258.67 a
Dimethoate 4EC	8.00 fl oz	105.33 c	269.67 a
Check		229.33 a	233.00 a
Pr > F		0.0001	0.0113
LSD		40.02	131.44

Means in a column with a letter in common are not significantly different (P > 0.05, LSD).  
 \* Now labeled and marketed as Fulfill.

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