POTATO LEAFMINER – LESSONS FROM ISRAEL

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The potato leafminer, *Liriomyza huidrobrensis*, is a serious pest on potato and various vegetables in South Africa. It first appeared in the Sandveld region during the summer of 1999/2000 and subsequently spread to the rest of South Africa in the short period of only one year. The same leafminer first appeared in Israel in 1992.

Since then, the Gilat Experimental Station in Israel undertook several research projects in an effort to gain more information regarding this pest and its control. Here we look at results of a few of these projects. Neem, Azadirachta indica is a tall evergreen tree native to India, grown for its bark and resin. Oil extracts from its seeds (also known as neem) are used as an insecticide against several insect pests. Neem has a low contact toxicity and needs to be ingested by insects in order to be effective. Neem is also considered an organic insecticide, and is therefore more acceptable to environmentalists, and one of the few insecticides available to organic growers for control of leafminers. The neem-based insecticide, Neemix-45 (4.5% azadirachtin), was evaluated against the potato leafminer on bean plants. A surfactant (Agral 90; 0.01%) was added after which plant leaves were dipped.

A soil drench was also performed on the soil surrounding the plants.Leaf dipping: At 15 ppm,, neem prevented any adults from emerging leaves treated at least one day prior to infestation, and 97% of adults when leaves were treated and when larvae were in their first instar. However, the number of pupae that emerged did not differ from the untreated control. It is therefore important to note that damage may still occur. Although the cycle of the fly is broken. Neem will thus not be able to give satisfactory control, if a source of infestation is just outside or near a field.

Soil drench: Pupae emerged from plants in treated soils with all concentrations up to 10 ppm, but no adults succeeded in emerging from these pupae, even at the lowest dosage of 1 ppm when treated at least one day prior to infestation. When soils were treated after infestation, a few adults succeeded in occlusion; but when the dose was increased to 10 ppm, no adults emerged, even if soils were treated when larvae were in their first instar. It is important to note that damage to plants may still occur, but the cycle is broken at the pupal stage (no adults emerge). Because neem seems to break down quickly when exposed to ultraviolet light, it might have potential in drip irrigation systems. The latter, however, still needs to be investigated. Another drawback to neem-based insecticides is their cost; however, commercial companies are aggressively working on reducing costs and making this natural insecticide more widely available.

Timing application of insecticides
Currently there are four insecticides registered against the potato leafminer in South Africa namely: Agrimec (abamectin), Patron (cyromazine), Suntap (cartab hydrocvhloride) and Tracer (spinosad). They all penetrate leaf surfaces to kill the larvae (translaminar and/or systemic). Suntap also has good contact activity against the flies, while Tracer also suppresses adult flies to some extent by acting as a stomach poison. The question arises as to which insecticide should be applied at what time, and with how many repetitions. Syngenta has indicated that Agrimec is more effective on very young plants, and therefore they recommended applying it first. Alternations of the four registered insecticides within a spraying program are essential to prevent the development of resistance against them. A good rule-of-thumb to prevent development of resistance is one kind (mode of action, e.g. stomach poison, contact poison, etc.) of insecticide per pest generation. Exactly how such a program must look is still under discussion.

However, the above-mentioned recommendations from Syngenta and data from Israel regarding the longevity of abamectin and cyromazine within plants, can help farmers make these decisions. In Israel, abamectin (Vertimec, 18g/) and cyromazine (Trigard, 50g/) were tested at manufacturer's recommended dosages of 10.8g ai/ha and 75g ai/ha, respectively for their longevity in potato plants. One percent Ultrafine oil was added to Vertimec. These two products were compared statistically in potato fields. Based on extensive monitoring of the leafminer, it was known that adult populations start increasing dramatically at the beginning of spring (April in Israel). Both these insecticides were sprayed only once, a week before the majority of the larvae would have been pupating (a stage not vulnerable to insecticides). A single application of cyromazine effectively controlled the potato leafminer until harvest (42 days after application). Abamectin, however, was effective for only one week after application. Residue analysis confirmed that cyromazine remained active in the foliage, albeit at decreasing levels over time, for at least three weeks after application. Similar trials were performed in celery fields. It was found early initial treatments, when leafminer populations were still very low, would break the cycle and prevent build-up of large field populations.

Leaf growth dies as a result of leafminer damage.

Characteristic punctures (feeding marks) in which eggs are also laid.

Monitoring

Nowadays most farmers do not monitor for the potato leafminer. Their presence is unmistakable and they normally arrive in such large numbers and in such a short period of time that monitoring is unnecessary.

However, there are some cases where monitoring could be useful, e.g. in an area where they have not been introduced or where their numbers remain low for some reason. But which monitoring techniques are best and what can one learn from monitoring the adults in a field? Monitoring methods vary from counting live larvae, mines, and pupae, to rearing adults from foliage, catching adults with a vacuum sampler and trapping adults in either yellow water buckets or on yellow sticky boards. Experiments with sticky yellow traps (13 x 16 cm) showed that most flies get caught at plant height (30 to 50 cm above ground). The least number of flies were caught at 10 cm above ground. This is an indication that the flies do not hide like the potato tuber moth, but prefers the open canopy. Overall there were no differences between the number of males and females that were caught in the sticky traps. No significant differences occurred in fly numbers on traps placed vertically and traps placed horizontally (sticky side up). In time-related catches (diel activity), it was found that almost all flies (82%) were caught between 6 and 9 o'clock in the morning, with the most active hour between 6 and 7 am. It seems as if sunrise might be the primary stimulant for activity, while the flies become less active when temperature rises. The fact that fly activity is at its peak during the hour following sunrise, can be used to time the spraying of adulticides. Insecticides like Suntap and Tracer, which also kill the adults, will therefore presumably come into contact with more adults during this time and therefore be more effective. Additionally abamectin-based insecticides are broken-down by ultraviolet light and should only be applied in the early morning hours or late afternoon.

Parasitoids

From various sources it is clear that the presence of parasitoids in a field is the only way to keep the potato leafminer under natural control. Several parasitoids species are known to attack the potato leafminer, of which *Diglyphus isaea* is mentioned to be the most effective. But what is the effect of insecticides used against the leafminer on these parasitoids? The answer is not simple. A lot of studies on both abamectin and cyromazine have contradictory results. One must remember that the insecticides are developed to "poison" the leafminer larvae inside leaves, and that the parasitoids larvae again must feed on these poisoned and dying larvae. The parasitoids larva therefore may not be able to complete its life cycle under these circumstances. It is thus understandable that these chemicals may indirectly affect parasitoids. The contact action of different insecticides against *Diglyphus isaea* is currently being investigated by ARC-Roodeplaat.

For more information regarding the potato leafminer or for the possible inclusion of insecticides in our tests, contract Diedrich Visser or Anelia Steyn at (012) 841 9611.