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A NEW APPROACH TO THE CONTROL OF SPODOPTERA LITTORALIS BOIS. IN PEANUTS IN ISRAEL

by

I. Teich*

Pest and Diseases Division, Plant Protection Dep.

Ministry of Agriculture

INTRODUCTION

It was only recently that peanuts were introduced as a commercial crop in Israel. While no special difficulties with pests were encountered prior to the early fifties, with the increase of peanut and other irrigated crop areas, certain pests, in particular the Spodoptera littoralis, became troublesome to such an extent that control measures had to be undertaken. Farmers adopted a practice whereby preventive applications were made after each irrigation, eight to nine applications being made during a season. This practice aggravated the situation even more. As a result littoralis was not controlled and an upsurge of mite populations took place. The caterpillars of S, littoralis could not be reached by the insecticides as they were usually hidden in the soil or beneath the bushes.
Even when reached, they were "hard to kill" by DDT, carbaryl and other pesticides. Parathion and trichlorofon were more efficient, but lost their killing power too quickly. Thus, it was found that the continuous applications contributed to the extermination of the beneficial entomophagous fauna which, in turn, caused the upsurge of the mites.

It was noticed that littoralis caused a premature shedding of the foliage and weakening of the gynophores which, during harvest, broke off easily, leaving the nut in the ground.

Some farmers also claimed that repeated application with heavy machinery interfered a great deal with the normal growth of the plants, and particularly with the setting of the gynophores. It was therefore felt, that a different regime of pest control should be introduced to meet with the peanut pest problem in IsraeL

From repeated observations it was obvious that peanut bushes were not defoliated entirely by the caterpillars, but only the soft leaves were eaten and in jured. It was also evident that regardless of such injury to the soft top leaves, the yield of nuts, on many occasions, was not reduced.

It was therefore decided to investigate the situation; to find out when the larval attacks do not affect crop yields, what amount of defoliation the plant may withstand without reduction in the nut yield, and how such findings might be applied to the establishment of a good pest control regime. It was assumed that with the reduction in pesticide applications against Spodoptera caterpillars, the mite populations will return to their former natural balance.

It gives me pleasure to dedicate this paper to Prof. E. Rivnay who has shown much interest in the work on

METHODS

I The phenology of the peanut bushes was studied, with special attention to the gynophore formations and their fate, i.e., when they mature into nuts. Together with this, the phenology of Spodoptera in the peanut field was followed up and the type of its injury recorded.

II Experiments in which artificial injury similar to that of Spodoptera was made, were carried out during three years in three localities, Bet Dagan, Ma'apele and Mikveh Israel in order to ascertain how much loss of the yield is caused by defoliation (of the bushes). These experiments were done on two dates: the early treatment in mid July, when the Spodoptera attack was heavy, and the late treatment in mid August, when the new gynophores are of no economic importance being too close to the end of the season. The cutting was done with hand shears. The artificial injury to the plants was made in three degrees.

a) Heavy top cut. About 20 cm of the top were removed, leaving 30 cm high bushes. New growth was repeatedly cut, maintaining the original height till the end of the season.

b) Medium top cut. About 15 cm of the top were removed, leaving 35 cm high bushes, so maintained till the end of the season.

c) Light top cut. Slight removal of upper new growth maintaining 40 cm high bushes throughout the season.

These experiments were performed because damage by Spodoptera is never uniform and no exact appraisal of damage could be made. Control bushes were left untouched, and when attacked by Spodoptera larvae they were treated with poisoned bait.

III Peanut bushes were grown in large pots, in isolation, each protected by a wire mesh to prevent the entrance and escape of insects. On each plant a definite number of Spodoptera caterpillars, over 10 mm long, were introduced, the plants receiving 5, 7, 10 and 15 caterpillars, respectively. Three replicas were made with each number; when cannibalism occurred new larvae were introduced to maintain the original number.

RESULTS

Phenology

The study of the phenology of the peanut bush showed that the first gynophores appeared 35-50 days after they had been sown. The climax of the gynophores is about 80 days after the date of sowing. The gynophores which appeared after the middle of August were too close to the end of the season, and could not mature in the short time left. It is well known that of the 600 flowers in a bush, only 25% develop into gynophores of which 40-50 pods mature. Thus only gynophores which appear 60-70 days after the date of sowing mature into nuts.

Gynophores growing over 15 cm above the ground do not reach the ground and in the end dry up.

The number of caterpillars under one bush varied from one to ten, and seldom more than this number. On very heavy infestation, over 30 caterpillars were counted. These were found, as a rule, beneath the bush - or slightly in the soil, but their food consisted of the top layers of new soft leaves and occasionally a gynophore was eaten, or a nut in the ground injured.

Man-made injury

The results of the trials in which the tops of the plants were removed are presented in Tables 1, 2 and 3. It should be noticed that there was not much difference in the yields of plants the top-cut of which was medium or heavy.

Table 1 - Yields of plants whose tops were heavily cut early and late in the season. (The figures present the percentage of yields compared with control plants in 1966).

Locality	Early treatment			Late treatment		
	Pods	Seeds	Ley	Pods	Seeds	Ley
Bet Dagan	74	70	72	92	92	95
Ma'apele	89	87	83	97	98	80

Table 2 - Yields of plants whose tops were cut in three different degrees. (The figures present the percentage of yields compared with control plants in 1967).

Heavy Cut			Medium Cut			Slight Cut		
Pods	Seeds	Ley	Pods	Seeds	Ley	Pods	Seeds	Ley
67	64	70	65	63	81	93	96	100

Table 3 - A comparison in the yields of early and late treated plants (The figures present the percentage of yields compared with control plants in 1968).

Date of cutting	Heavy Cut			Medium Cut			Light Cut		
	Pods	Seeds	Ley	Pod	Seeds	Ley	Pods	Seeds	Ley
Early	80	84	73	77	80	87	82	90	84
Late	82	93	78	82	92	82	94	95	90

In both, the reduction in seed ranged from 13-37% less than in the yields of the control plants; the yield reduction in seed of plants where tops were slightly removed was 4-10%, in comparison with that of the control plants, which was statistically insignificant.

The difference between early and late cuts was small in the slightly cut plants but more pronounced in plants of medium or heavy top cuts. (Table 3).

The feeding experiments

The results of the feeding experiments with caterpillars reared in barrels showed that the amount of leaves consumed was not proportional to the number of larvae on each bush.

DISCUSSION

In order to see the effects of defoliation of peanut plants on the reduction in the yield of nuts, the cutting of the tops was far more severe than the defoliation by Spodoptera larvae. Only the slight top cut could be compared with injury by Spodoptera. It should also be born in mind, that not all the plants in the field are usually attacked by this pest, and that defoliation is not uniform; it depends upon the age of the caterpillars and their abundance. Furthermore, larvae usually nibble only parts of a leaf. From the study of the phenology of plant and pest it is evident that Spodoptera attacks are not continuous or complete, but rather sporadic.

From comparison with the damage caused by slight top cutting, it is also obvious that the loss in the yield of nuts which may be caused by Spodoptera larvae is insignificantly small. This suggests a reduction in the number of insecticide application and good timing of treatments that are necessary in accordance with the phenology of the plant and the pest.

For this purpose the growing season of the peanut plant was divided into three periods and for each a different threshold of application was formulated as follows:

Stage 1. The vegetative Period

This period lasts about 50 days, during May and June. As a rule the Spodoptera population, at this time of the year, is very low and no control measures are necessary. In years with mild winters and when the Spodoptera population is dense, the threshold of application should be about 20 caterpillars (larger than 10 mm each) for each 2-meter row.

State 2. Bloom and gynophore period.

Caterpillars, when present, nibble at the young foliage and occastionally (larger caterpillars) destroy both blossoms and gynophores which is more serious. The threshold of insecticidal activity during this period should be based on the amount of injury. The destruction of thirty gynophores per 2 meters of row calls for action.

Stage 3. Nut formation period.

The gynophores formed during this period are of no economic importance.

Destruction of foliage should be prevented. The bushes being large, 50 caterpillars (over 10 mm large) per two meter row should serve as threshold of insecticidal application. When the plants are severely attacked by the fungus Cercospora, 30 caterpillars should be the threshold.

FOOT NOTES

It is advisable that poisoned bait-bran containing 10% sodium fluosilicate be employed.

Inspections for establishing the thresholds should be made twice weekly; in each 50 dunam area (about 12 acre) about ten random sites in each two meter row should be inspected.

Repeated applications should be decided upon by the curve of infestation - an increase calls for repeated application, a decrease for relaxation.

Only larve about 10 mm should be considered.