

# アセタミプリド錠剤の各種施用法によるキュウリ寄生ワタアブラムシに対する効力

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Original Article

# Efficacy of Acetamiprid Tablet against Cotton Aphid on Cucumber by Various Application Methods

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Efficacy of acetamiprid tablet against the cotton aphid on cucumber by various soil application methods was investigated compared to that of its granule applied under the same conditions. Acetamiprid tablet weighed 0.15 g including 20 mg active ingredient at 1 tablet/plant and controlled-release 2% granule at the dosage of 1 g/plant showed excellent efficacy when they were applied at the center of planting hole, similarly to the granule applied uniformly. The comparison between the efficacy in row application of tablet and soil surface application of granule suggested the efficacy of both applications became insufficient as the distance between the foot of seedling and application site became longer. Such a tendency was more remarkable with row application of the tablet than with soil surface application of granule. The tablet exhibited excellent efficacy at the dosage of 1 tablet/plant by being applied both at the foot of plant in nursery pot before transplanting to the field and at the center of the planting hole. Besides, efficacy of different sizes of tablet including same amount of acetamiprid was investigated by planting hole application. There was a tendency that tablet exhibited longer lasting activity as it became larger as far as the weight of 0.15, 0.3 and 0.6 g. With soil surface application the tendency of efficacy was reversed compared to that with planting hole application.

*Key words:* acetamiprid, tablet, granule, cotton aphid, cucumber.

## INTRODUCTION

Acetamiprid, (*E*)-*N*<sup>1</sup>[(6-chloro-3-pyridyl)methyl]-*N*<sup>2</sup>-cyano-*N*<sup>1</sup>-methylacetamide, is a novel insecticide invented by Nippon Soda Co., Ltd. The compound has excellent biological properties as an insecticide. Acetamiprid has a broad insecticidal spectrum and possesses an excellent systemic activity against aphids and the diamondback moth.<sup>1–5)</sup> In the previous reports, acetamiprid 2% granule exhibited practicability against the diamondback moth, *Plutella xylostella*, the green peach aphid, *Myzus persicae* and the cotton aphid, *Aphis gossypii*. The granule was designed to improve efficacy against the diamondback moth, and was also effective against aphids.<sup>6–8)</sup> The granule revealed to exhibit excellent efficacy. Tablet was formulated to improve the way of application and the biological property of the

granule. As tablet is treated in one spot unlike granule, active ingredient acetamiprid released from the formulation is supposed to move in a narrower space than granule. There seemed to be a possibility that acetamiprid was absorbed efficiently by plants. Besides, tablet seemed to be labor-saving because it does not need to be weighed. The formulation is convenient for treatment of plants such as cucumber, eggplant, tomato, cabbage and so on, that are transplanted one by one. The cotton aphid infests a broad range of crop plants and is a serious pest. Therefore, the efficacy of acetamiprid tablet against the cotton aphid on cucumber by various soil application methods was investigated.

## MATERIALS AND METHODS

### 1. Chemical

Tablet including 20 mg acetamiprid was formulated at Haibara Agricultural Research Laboratory of Nippon Soda Co., Ltd. Tablet was formulated to the weight of

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0.15, 0.3 and 0.6 g including 20 mg active ingredient. The tablet is composed of polyvinyl alcohol, which is water-soluble high polymer, and acetamiprid. The tablet formulation is designed so that the release of acetamiprid is controlled and movement in the soil is inhibited.<sup>9)</sup> The controlled-release granule including 2% acetamiprid was also formulated as the previous paper.<sup>10)</sup> Benfuracarb (Oncol® 5% Granule) and acephate (Orthene® 5% Granule) were purchased from commercial source. These formulations were used for the trials.

## 2. Insects

The cotton aphid, *Aphis gossypii*, naturally occurred in the field and the plastic house in Haibara Agricultural Research Laboratory, were tested. Before and after the tablet and the granule were applied, the number of both adults and nymphs of the aphid was counted periodically.

## 3. Efficacy of Acetamiprid Tablet by Planting Hole Application

Two-leaf stage seedlings of cucumber which were raised in a 9 cm diameter plastic pot stuffed with Fujisawa soil, which was clay loam containing 7.2% organic matter, were provided. The tablet weighed 0.15 g including 20 mg acetamiprid and controlled-release granule including 2% acetamiprid were used for the experiment. The trial was conducted in Fujisawa soil field inside the plastic house. The tablet was applied at the center of the planting hole and the granule was applied uniformly in the hole, which was dug 10 cm in diameter and 5 cm deep, or at the center of the hole. The watering was regulated to 10 mm/day for 30 min. The number of aphids infested on 2 cucumbers was counted on 10, 14, 21 and 28 days after the application. Each test was replicated 3 times. The experiment was conducted at Haibara Agricultural Research Laboratory in July 1991.

## 4. Comparison of Acetamiprid Tablet with Row Application and Granule with Soil Surface Application

Provided seedlings, tablet and 2% granule were the same with the former trial. With row application, tablet was applied just below the surface of row at 5, 10 and 20 cm apart from the foot of cucumber after the seedling was transplanted. In case of soil surface application, the granule was applied on a circle with the radius of 5, 10 and 20 cm from the foot of cucumber. The experiment conditions were as described previously.

## 5. Efficacy of Acetamiprid Tablet and Granule by Nursery Pot and Planting Hole Applications

Provided seedlings, tablet and 2% granule as those in the same as those in the former trial. With planting hole

application, the tablet was applied at the center of a planting hole, which was dug 10 cm in diameter and 5 cm deep, and granule was also at the center of the hole. With nursery pot application, the tablet was applied at the foot of seedling planted in plastic pot. After applying the tablet, the seedling was transplanted to the field in the plastic house. The experiments were carried out as described previously.

## 6. Efficacy of Acetamiprid in Some Tablet Formulations by Planting Hole and Soil Surface Applications

Two- to 3-leaf stage seedlings of cucumber raised in a 9 cm diameter plastic pot stuffed with Fujisawa soil were prepared for the experiment. These seedlings were transplanted to the field in the plastic house. Some formulations of acetamiprid tablet and controlled-release 2% granule was used for the trial. Planting hole and soil surface applications were adapted for the experiment. With planting hole application, the tablet and the granules were applied at the center of the planting hole, which was dug 10 cm in diameter and 5 cm deep. In case of soil surface application, the tablet was applied at 5 cm apart from the foot of cucumber after the seedling was transplanted and the granule was applied uniformly on a circle with the radius of 10 cm from the foot. The watering was regulated at 10 mm/day for 30 min. Number of aphids infested on two seedlings of cucumber was counted on 7, 14, 21 and 28 days after the application. The experiment was conducted at Haibara Agricultural Research Laboratory in May 1992.

## RESULTS AND DISCUSSION

### 1. Comparison of Acetamiprid Tablet and Granule by Planting Hole Application

Acetamiprid tablet weighed 0.15 g including 20 mg active ingredient per plant and controlled-releasing 2% granule at the dosage of 1 g/plant showed excellent efficacy when being applied at the center of planting hole even 28 days after the application. There was no difference between the efficacy by those treatments and that of the granule being applied uniformly in planting hole. The efficacy of acetamiprid by three experimental designs was superior to that of benfuracarb 5% granule being applied uniformly in planting hole at 2 g/plant as shown in Fig. 1. From the results of this trial, it was considered that the acetamiprid tablet showed excellent efficacy by being applied at the center of hole, similarly to the application of granule, as high as the efficacy of granule being applied uniformly at the hole. It was supposed that there was a possibility for the tablet to improve the pesticidal property of the granule. Therefore the efficacy of tablet against the cotton aphid on cucumber was investigated in some application methods.

## 2. Efficacy of Acetamiprid Tablet with Row Application and Granule by Soil Surface Application

Acetamiprid tablet weighing 0.15 g per plant, which was applied on the row at 5 cm from the foot of seedling, showed excellent efficacy 28 days after the application and was, however, insufficient when being applied at 10 and 20 cm from the seedling. On the other hand, the

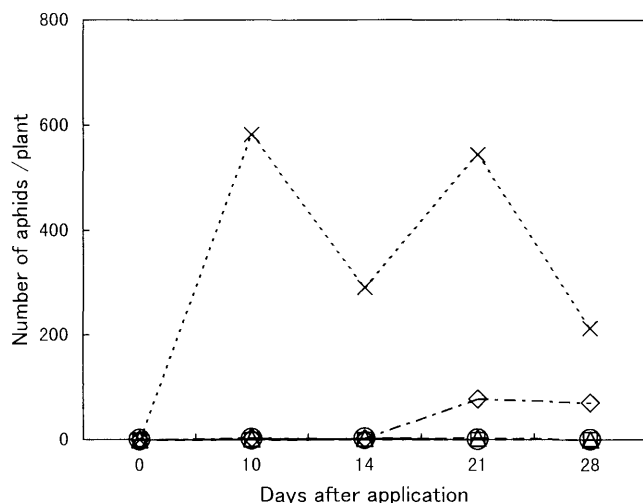


Fig. 1 Efficacy of acetamiprid tablet and granule against the cotton aphid on cucumber by planting hole application.

- : acetamiprid tablet, 1/plant, application A.
- : acetamiprid 2% G, 1 g/plant, application B.
- △: acetamiprid 2% G, 1 g/plant, application C.
- ◇: benfuracarb 5% G, 2 g/plant, application C.
- ×: untreated control.

Application A: applied tablet at the center of a planting hole.

Application B: applied granule at the center of a planting hole.

Application C: applied granule uniformly in a planting hole.

granule showed good results with soil surface application being applied on a circle with the radius of 5 and 10 cm around the foot of seedling and not in the case of being applied at 20 cm around the seedling. The comparison of the efficacy between row application of tablet and soil surface application of 2% granule suggested the efficacy of both application methods became inferior as the distance between the foot of seedling and application site became longer. Such a tendency was more remarkable with row application of the tablets than with soil surface application of the granule. These results suggest that it is advantageous for the applications of tablet to be made at the foot of the plant (Table 1).

## 3. Comparison of Efficacy of Acetamiprid Tablet and Granule by Nursery Pot and Planting Hole Applications

Efficacy in nursery pot application was compared with that in planting hole application. Acetamiprid tablet exhibited excellent efficacy at the dosage of 1 tablet/plant by being applied at the foot of potted plant before transplanting to the field, and its efficacy was as high as that in the case of being applied at the center of the planting hole. There was no difference between the efficacy of tablet and that of granule being applied at the center of the planting hole. From these results it can be said that nursery pot application and planting hole application at the center of hole with tablet elicit excellent activity of acetamiprid (Table 2).

## 4. Comparison of Acetamiprid Tablet Formulations by Planting Hole and Soil Surface Applications

Efficacy of tablet of different sizes including the same amount, 20 mg, of acetamiprid against the cotton aphid by planting hole and soil surface applications was inves-

Table 1 Efficacy of acetamiprid tablet and granule against the cotton aphid on cucumber by soil surface and row applications.

Formulations	Applications	Number of aphids/plant			
		10	14	21	28 (days)
Tablet*	Row A	2.8	3.5	1.3	0
	Row B	418.0	867.5	717.0	288.0
	Row C	140.0	226.0	384.8	350.0
2% Granule	Soil surface A	0.3	3.5	0	0
	Soil surface B	0.3	0	17.8	6.5
	Soil surface C	235.8	530.3	567.5	228.0
Untreated		582.0	290.5	543.3	212.8

Row A: applied tablet (1/plant) on the row at 5 cm from the foot of seedling. Row B: applied tablet (1/plant) on the row at 10 cm from the foot of seedling. Row C: applied tablet (1/plant) on the row at 20 cm from the foot of seedling. Soil surface A: applied granule (1 g/plant) on a circle with the radius of 5 cm around the foot of seedling. Soil surface B: applied granule (1 g/plant) on a circle with the radius of 10 cm around the foot of seedling. Soil surface C: applied granule (1 g/plant) on a circle with the radius of 20 cm around the foot of seedling. \*: Tablet weighed 0.15 g including 20 mg acetamiprid.

Table 2 Efficacy of acetamiprid tablet against the cotton aphid on cucumber by nursery pot and planting hole applications.

Formulations	Application method	Dosage	Number of aphids/plant			
			10	14	21	28 (days)
Acetamiprid Tablet*	Nursery pot	1/plant	2.0	0	1.0	0
Acetamiprid Tablet*	Planting hole A	1/plant	1.5	1.8	0	0
Acetamiprid 2% Granule	Planting hole B	1 g/plant	1.3	2.0	3.0	0
Benfuracarb 5% Granule	Planting hole B	2 g/plant	3.0	1.0	77.3	70.5
Untreated			582.0	290.5	543.3	212.8

Planting hole application A: applied tablet at the center of a planting hole. Planting hole application B: applied granule uniformly in a planting hole. \*: Tablet weighed 0.15 g including 20 mg acetamiprid.

Table 3 Efficacy of acetamiprid tablet formulations against the cotton aphid on cucumber by planting hole application.

Formulations	Dosage g/plant	Number of aphids/plant			
		7	14	21	28 (days)
Acetamiprid Tablet*	0.15	0	0	0	7.7
	0.3	0	0	0	1.2
	0.6	0	0	0	0
Acetamiprid 2% Granule	1	0	0	0	4.7
Acephate 5% Granule	2	0	0	1.0	6.8
Benfuracarb 5% Granule	2	0	0	0.2	14.7
Untreated		2.3	21.0	225.0	561.0

\*: One tablet including 20 mg acetamiprid.

tigated. Tablets of 0.15, 0.3 and 0.6 g respectively including 20 mg active ingredient were prepared. With planting hole application, 3 sorts of tablets exhibited excellent efficacy and there was a tendency that tablet exhibited longer lasting activity when it was larger as far as the weight of 0.15, 0.3 and 0.6 g per tablet (Table 3). In soil surface application, these 3 sorts of tablets showed good efficacy but the relation between efficacy and tablet size was reversed when compared to that in planting hole application (Table 4). Although the difference of efficacy was small, there was a tendency that, with the planting hole application, a larger tablet was advantageous for lasting activity and that, with the soil surface application, a smaller tablet was preferable for the activity.

From the above results it was ascertained that acetamiprid tablet exhibited excellent efficacy against the cotton aphid on cucumber by various application methods. The tablet was tested in planting hole, row, nursery pot and soil surface applications. The formulation weigh-

Table 4 Efficacy of acetamiprid tablet formulations against the cotton aphid on cucumber by soil surface application.

Formulations	Dosage	Number of aphids/plant			
		7	14	21	28(days)
Acetamiprid Tablet*	0.15	0.2	0	0	0
	0.3	1.0	0	0	4.7
	0.6	0	0	0	2.3
Acetamiprid 2% Granule	1	0	0	0	0.2
Acephate 5% Granule	2	0	0	2.5	36.0
Benfuracarb 5% Granule	2	0	2.3	28.7	69.2
Untreated		2.3	21.0	225.0	561.0

\*: One tablet including 20 mg acetamiprid.

ing 0.15 g including 20 mg acetamiprid at the dosage of 1/plant showed sufficient efficacy by the application methods mentioned above as well as 2% granules at the dosage of 1 g/plant applied at the center of planting hole or uniformly in planting hole. Besides, it was ascertained that a larger tablet was advantageous with planting hole application and that the relation was adverse with soil surface application as far as the weight of 0.15, 0.3 and 0.6 g per tablet. Since there was not obvious difference in efficacy between tablet and granule in our trials with the same applications, tablet was much convenient for us to handle in the treatment because it did not need to be weighed. Therefore it is concluded that the tablet is very useful for the control of the cotton aphid on cucumber and other crop plants.

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## 要 約

## アセタミプリド錠剤の各種施用法によるキュウリ寄生ワタアブラムシに対する効力

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アセタミプリド錠剤の各種土壤施用法によるキュウリ寄生ワタアブラムシに対する効力を粒剤と比較検討した。錠剤 (0.15 g 中アセタミプリド 20 mg 含む) 1 錠/株及び 2% 徐放性粒剤 1 g/株の植え穴中心部処理では処理 28 日後までワタアブラムシを低密度に抑えて、粒剤を植え穴に均一に処理した場合と同様に高い効力を示した。錠剤と粒剤の土壤表面処理では、株元から処理位置が 5, 10, 20 cm における効力を比較したところ、両製剤とも距離が短いほど効力が高く、この傾向は錠剤でより強かった。錠剤の育苗ポット株元処理と植え穴処理を比較検討したところ、植え穴処理と同様に優れた効力を示し、錠剤は薬剤を株元近くに処理する育苗ポット施用に適していた。次に、アセタミプリド 20 mg を含有する 0.15, 0.3 及び 0.6 g の錠剤を用いて植え穴処理および土壤表面処理による効力を調べたが、植え穴処理は錠剤が大きくなると残効性が優れ、土壤表面処理は逆の傾向が認められた。これらの結果から、錠剤は粒剤の効力および処理方法を改良できる可能性があると判断された。