EFFECT OF NEW BROAD SPECTRUM FUNGICIDE AMISTAR ON SOIL MICROORGANISMS IN FIELD CONDITIONS

By

Osman, A. G., Kalinin[1], V. A., Emtsev[2], V.T[3]., Bikov, K. V[3].

1- Environmental and Natural Resources Research Institute, National Center for Research, Khartoum, Sudan.
2- Department of Chemical Plant Protection, Moscow Agricultural Academy, Moscow, Russia.
3- Department of Chemical Plant Protection, Moscow Agricultural Academy, Moscow, Russia.

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ABSTRACT

A field experiment was conducted at the Demonstration Farm of Moscow Agricultural Academy in 1999 to investigate the effect of the fungicide Amistar (active ingredient - azoxystrobin) on soil microorganisms where potato plants were double sprayed by azoxystrobin (0.72L/ha). The fungicide inhibited soil fungi by up to 30% within the period of 35 days however, it did not render conspicuous effect on soil microorganisms that use organic or mineral forms of nitrogen, but stimulated the growth of actinomycetes and soil microorganisms capable of growing on poor media.

The residual quantities of azoxystrobin in potato were not marked. Under these conditions small quantity of azoxystrobin was found in soil (0.26mg/kg) that degraded by 98.2% in 47 days.

الملخص:

أجريت تجربة حقلية في عام 1999 في المزرعة التجريبية لأكاديمية موسكو للعلوم الزراعية لدراسة أثر المبيد الفطري أميستار (المادة الفعالة.. أزوكسيستروبين) على الأحياء الدقيقة في التربة حيث تم رش نباتات البطاطس مرتين بمبيد الأميستار بواقع (0.72 لتر/هكتار). أثر المبيد سلباً على نمو فطريات التربة بنسبة 30% خلال 35 يوماً. ببنما كان أثره السلبي طفيفاً على مجموعات الأحياء الدقيقة التي تستخدم النيتروجين العضوي والمعدني أما بالنسبة للأكتينوميتسيتات ومجموعة الميكروبات القادرة على النمو في الأوساط الفقيرة فقد أثر المبيد إيجاباً على نموها.

لم يلاحظ وجود أثر متبقي للمبيد في درنات البطاطس. أما في التربة فكانت الكمية المتبقية من المبيد (0.26 ملجم/كجم). وفي خلال 47 يوماً تحللت هذه الكمية بواقع 98.2%.

INTRODUCTION

A big portion of pesticides used in agriculture fall in the soil and affects soil micro organisms. At the same time the soil becomes a source of pollution for fodder and nutritional products. Soil micro organisms play an important role in elements cycles, biological processes and soil fertility. The direct effect of pesticides on soil microorganisms appears as a change on their numbers and species.

There are many publications about the effect of pesticides on soil microorganisms. When assessing effects of pesticides on soil microorganisms, fungicides were found to have the larger inhibition effect (Kruglov, 1991). Abdel Mallek *et. al*., (1992, 1997) found that Benlate and Captan inhibited the growth and spore formation of *Alternaria alternaria*, *Cochliobolus sativus*, *Fusarium moniliforme*, *Fusarium oxysporum* and *Drechslera halode.*

Suleman (1983) found that Simazine and Atrazine inhibted the growth of organic and mineral nitrogen users in addition to Actinomyectes and Mycoba-cterium.

Where as they stimulated the growth of Arthrobacter, Micromo-nospora, Nocardia and Bactoderma.

It was found that degradation rates of pesticides in plants were higher than in the soil and depends on many factors (Petrova, 1988). Many members of different groups of soil microorganisms (Bacteria, Fungi, Actinomycetes and Algae) isolated from the soil are capable to degrade pesticides (Golovleva, 1992: Novaka *et. al*., 1997).

Amistar is a new broad-spectrum fungicide. It is produced by (Zeneca), United Kingdom. Amistar is now examined over the entire world as a fungic-ide against different plant pathogens on different crops (Pilling and Mearl, 1996). This fungicide hinders respiration process by inhibiting the electron passage from cytochrome B to cytochrome C. (Tomlin, 1997: Robert, 1998).

MATERIALS AND METHODS

Fungicide Amistar was obtained from the Department of Chemical Plant Protection, Moscow Agricultural Academy. The field experiment was conducted in the Demonstration Farm of Moscow Agricultural Academy, during 1999 cropping season. The soil was podzolic containing 0.06% total nitrogen, 320 ppm P_2O_5, 155 meq/l K_2O, 4.3% humus, and pH value of 6.3.

The land was prepared by deep ploughing, harrowing and levelling and was then ridged and divided into plots 5x4m each. Two seed potato were placed in a hole at the depth of 8-10 cm, with 35 cm spacing (between holes) and 70 cm (between ridges). Potato plants were double sprayed by 25% of fungicide Amistar, at 3 and 6 weeks after sowing. The dose of fungicide was 0.72 L/ha. Soil samples were taken from the depth of 0-10 cm at 1, 12, 22, 35 and 47 days after second spraying to determine the residual quantities of Azoxystrobin. Plant samples were taken at the same periods for the same purpose. Microbial counts were carried out for each sample as follows: Fungi on Czapeks dox agar media at the third day from culturing, microorganisms capable of growing on poor media (Nitrate Agar) at the 7^{th} day after culturing, users of organic forms of nitrogen on meat peptone agar at the 4^{th} day after culturing, and users of mineral forms of nitrogen and Actinomycetes on starch ammonium agar at the 10^{th} day after culturing at 28^{o}C (Tepper *et al*., 1993).

The residual quantities of azoxystrobin were determined using gas liquid chromatography, under the following conditions: Chromatograph: water associates (USA), detector U/V: wavelength 225nm, gas flow: 1.0ml/min, retention time: 8.85-9.17 min, column: stainless steel 25 cm x 406 mm, (i.d): 50% acetonitrile onchromosorb RPC 18, and attenuation = 0.0025.

RESULTS AND DISCUSSION

Effect of Azoxystrobin on Soil Fungi: The results showed that the field dose of azoxystrobin inhibited the growth of soil fungi gradually by time (Table 1). These results coincided with the content of azoxystrobin in soil (Fig. 1). Abdel Malek *et. al*., (1992, 1997) found that fungicides belated and captain inhibited the growth and spore formation of five species of fungi.

Table (1): Effect of Azoxystrobin on Soil Fungi

Treatments	Days after second processing							
	1		12		22		35	
	Total number x 1000/g dry soil	Inhibtion %	Total number X 1000/g dry soil	Inhibtion %	Total number x 1000/g dry soil	Inhibtion %	Total number x 1000/g dry soil	Inhibtion %
Control	137	0	283	0	261	0	238	0

Fungicide	63	61.3	172	39.2	175	33	174	26.9

Effect of Azoxystrobin on Users of Organic and Mineral forms of Nitrogen and Actinomycetes: The findings indicated that there was slight inhibition effect of azoxystrobin (not high than 10%) on these two groups of soil microorganisms (Table 2, 3). On the other hand, this fungicide stimulated the growth of Actinomycetes, especially at the 12th day after the second processing (Table 3). Suleman (1983) found that herbicides simazine and atrazine inhibited the growth of organic and mineral nitrogen users in addition to actinomycetes and mycobacterim.

Table (2): Effect of Azoxystrobin on Numbers of Organic Nitrogen Users

Treatments	Days after second processing							
	1		12		22		35	
	Total number x 1000/g dry soil	Inhibtion %	Total number X 1000/g dry soil	Inhibtion %	Total number x 1000/g dry soil	Inhibtion %	Total number x 1000/g dry soil	Inhibtion %
Control	149000	0	153000	0	147000	0	1018000	0
Fungicide	142000	4.7	137000	10.5	136000	7.5	934000	8.3

Table (3): Effect of Azoxystrobin on Numbers of Mineral Nitrogen Users and Actionmycetes

Treatments	**Total number of all Microorganisms X 1000/g dry soil**	**Inhibition or Increment %**	**Number of Actinomycetes X 1000/g dry soil**	**Inhibition or Increment %**	**% of Actinomycetes to total number of all Microorganisms**
I day after second proccessing					
Control	202000	0	31000	0	15.3
Fungicide	189000	-* 6.4	42000	+35.5	22.2
12 day after second proccessing					
Control	160000	0	18000	0	10.8
Fungicide	150000	9.6	42000	+133.3	28.0
22 day after second proccessing					
Control	192000	0	44160	0	23.0
Fungicide	184000	-4.2	45312	+2.6	24.6
35day after second proccessing					
Control	8336000	0	104200	0	12.5
Fungicide	822000	-1.4	102600	-1.5	12.5

* - Inhibition, - + Increment

Effect of Azoxystrobin on Soil Microorganisms Capable of Growing on Poor Media (Nitrate Agar): The results showed that the total count of this group was increased by 11.8%, 15.6%, 49.4% and 85.7% at 1. 12. 22 and 35 days after the second processing in comparison with the untreated control, respectively (Table 4). The increment in total number of treated microorganisms over control was mainly due to increase of Mycobacterium numbers. The portion of Mycob-acterium from total count of this group at 12 days after the last processing was 88.2%. The total count of Arthrobacter and Micromonospora was considerably lower in comparison with the total count of Mycrobacterium.

The absolute number of *Nocardia* was increased from 435000/g dry soil at the first day after the second processing to 2592000/g dry soil at 22 day after last processing. At 35 days after the last processing Nocardia was not observed (Table 4). Simazine and atrazine herbicides were previously reported to stimulate the growth of Arthrobacter, Nocardia, Micromonospora and Bactoderma (Suleman, 1983).

Table (4): Effect of Azoxystrobin on Soil Microorganisms Capable to Grow on Poor Media (Nitrate Agar)

Treatments	**Total number of all Microorganisms**		**Mycobacterium**		**Arthrobacter**		**Micromonospora**		**Nocardia**	
	X1000/g Dry soil	% (of control)	X1000/g Dry soil	% *	X1000/g Dry soil	% *	X1000/g Dry soil	% *	X1000/g Dry soil	% *

I day after second proccessing										
Control	21888	100.0	19440	88.8	576	2.6	1152	5.3	720	3.3
Fungicide	24480	111.8	22320	91.3	432	1.7	1296	5.3	432	1.7
12 day after second proccessing										
Control	29520	100.0	26928	91.2	720	2.5	1008	3.4	864	2.9
Fungicide	34128	115.6	30096	88.2	1008	2.9	1152	3.4	1872	5.5
22 day after second proccessing										
Control	38736	100.0	36432	94.0	576	1.5	1152	3.0	576576	1.5
Fungicide	75312	194.4	70416	93.5	720	1.0	1584	2.1	2592	3.4
35 day after second proccessing										
Control	30240	100.0	30240	100.0	0	0	0	0	0	0
Fungicide	56160	185.7	54720	97.4	288	0.5	1152	2.1	0	0

% * Out of total number of microorganisms in corresponding treatment.

The Residual Quantities of Azoxystrobin in the Soil and Potato Plants: The results showed that the concentration of Azoxystrobin in the soil was 0.26 mg/kg at first day after second processing of potato plants (Fig. 1). At 12 days after last processing its concentration in the soil was decreased by 42.6% and after 22.35 and 47 days by 85.8%, 91.2%, and 98.2%, respectively. At harvest of potato plants there were only traces of azoxystrobin in the soil.

At first day after second processing the concentration of azoxystrobin in the leaves of potato plants was I mg/kg (Fig. 2). Then the concentration was deceased by 85.4%, 75.4% and 99.4% at 12.22,35 days after second processing, respectvely. Two weeks before harvesting, in the leaves of potato plants there were only traces of azoxystrobin. At 47th day after second processing the residuals of azoxystrobin in potato were not observed. These findings are in agreement with other reports (Pilling and Mearl, 1996).

The field dose of azoxystrobin (1 mg/kg dry soil) generally inhibited the soil fungi, slightly decreased the growth of users of organic and mineral forms of nitrogen and stimulated the growth of actionmycetes and microo-rganisms capable of growing on poor media (Nitrate Agar).

At harvest there were only traces of azoxystrobin in the soil, and in the leaves of potato plants. Azoxystrobin in potato was not observed.

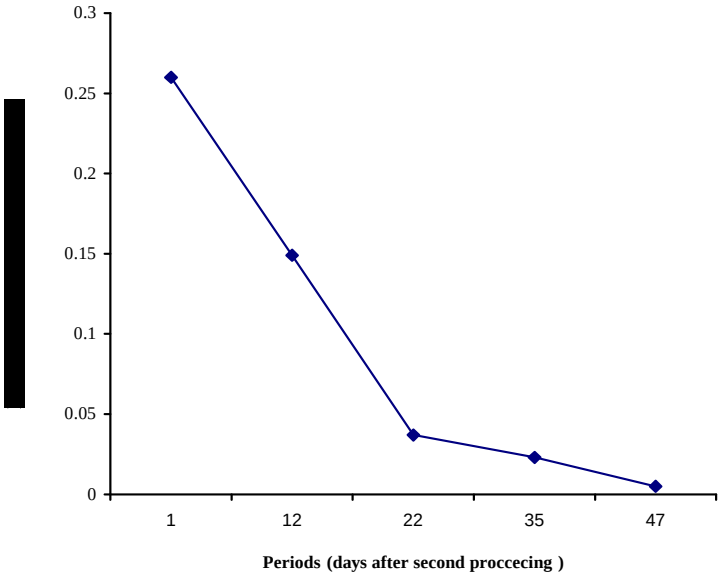

Fig. (1): Degradation of Azoxystrobin in the Soil

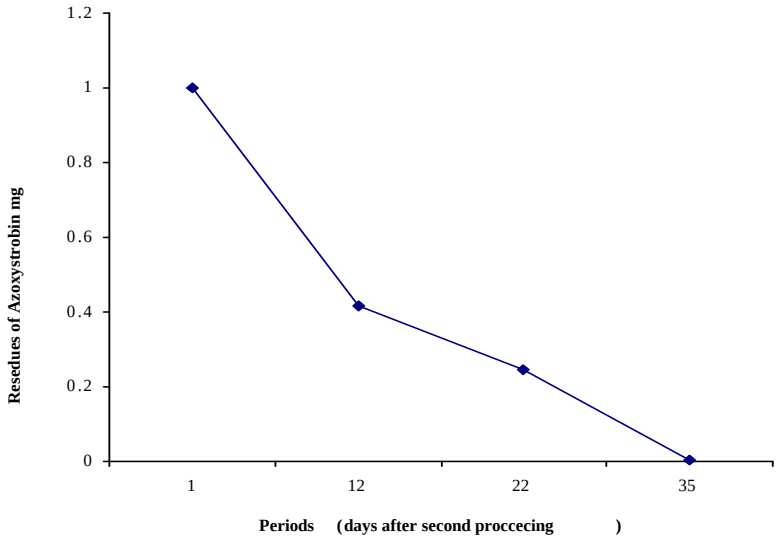

Fig. (2): Degradation of Azoxystrobin in Potato Leaves

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