THE COMBINED EFFECT OF ULTRASOUND AND FUNGICIDES ON THE INFECTEDNESS OF SUNFLOWER SEEDS

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SUMMARY

We have used ultrasound of 22-25 kHz with its effect of increasing the diffusion and permeability and vacuum infiltration to get the suitable fungicides into the multi-infected sunflower hybrid NK-254 to treat it.

The seedling-ability was 86 % and the degrees of infection were as follows: Alternaria s.p. 38 % ; Botrytis 14 % ; Sclerotinia 17 %. The effectiveness of the four different fungicides were increased by the both physical methods. In the case of "Kelosild FW" we have achieved total immunity from infection and in our field-experiments this also effected a lasting immunity.

Both methods are fungicide-saving and environment protecting and the stability of sunflower growing can be increased.

Introduction

It is well-known in the professional literature that the sunflower has many dangerous fungal diseases. Their common feature is that they are spread by the seeds or by infecting the sowing area.

For this reason the ways of protection against them are breeding for resistant species and effective dressing of sowing seeds. We wished to increase the effectiveness of the dressing by the selection of fungicides and by getting the latter one under the achenia of seeding with the help of ultrasound and vacuum infiltration.

Our difficulties were increased by the fact that the sunflower fungal diseases often occur - as in our case - together so this environment saving and fungicide saving treatment has an important role which was made possible in our tests by the physical methods mentioned and which we have earlier got favourable results with (Nagy,Ratkos 1986; Ratkos,Nagy 1986; Nagy,Ratkos 1987.).

It is well-known, that as a result of the ultrasonic treatment,the changes within the specific ultrastructure depending on the intensity,duration and the characteristics of biological material may be stimulative or destructive, therefore they can limit the vital activity and may have a lethal effect. However, ultrasound doses that are lethal for fungal infections may also destroy the ability of sunflower seeds to germinate. On the other hand, if irradiation is carried out in a solution of the appropriate fungicide it is generally sufficient to apply doses in the stimulative range. (Heimann 1954; Jaenichen-Heimann 1955.)

resulted in infection-free seeds (Figure 5).

In addition to this, the ultrasound irradiation increased while the vacuum infiltration decreased the seedling scale by a few percent. We have compared our results with the ones obtained in the traditional dressing namely shaking method. We have found that the treatment with Kelokarb 80 Wp (1 % concentration) gives nearly the same result regarding the degree of infection as the 2,5 kg/ton dose used experimentally and carried out in the traditional way.

Therefore, the previous method gives about 45 % fungicide-saving. The scale is nearly the same at vacuum infiltration of 0,7-0,8 % concentration (Table 3).

More favourable parameters can be achieved regarding the fungicide saving in the case of Kelosild FW, if we take into account that for the same result we have to use 30 % concentration when applying the traditional treatment (performed for 30 minutes).

The ultrasonic treatment is, however, faster than the traditional one (2,5-5 minutes) and its stimulation effect on the seedling can also be shown (Table 4).

On the other hand - as mentioned before - vacuum infiltration can be put fungicides against the seeds through the cracks of achenia which will not lose it during drying and field plantation. Because of these both applied methods can be considered as environment-protecting.

We have extented our tests with field experiments as well, which have proved the advantage of this method.

Seeds treated ultrasonically in 0,2 % Kelosild FW for 5 and 10 minutes resulted in more favourable shooting, earlier flowering and compared to the 41,8 % oil content of the control they had 48 % and 49,3 % respectively.

Most probably due to the high fungicide absorption (30 % excess

weight) the vacuum treatment resulted in later flowering and on the average gave 37,9 % oil content only (Table 5).

On seeds treated by ultrasound and vacuum in our field experiment no infection could be found until 13 August which is a significant result - compared to the 20 % degree of infection of our control at the same time. Sunflowers treated with ultrasound and vacuum infiltration have shown minimal degree of infection at later stages,too (Table 6).

Discussion

The above treatment methods are more successful and more economical than the traditional methods.

Indeed, the stimulative effect of ultrasound - according to our experiment - resulted in a more intensive growing in the seedling stage, more favourable seedling scale, healthier sunflowers and an increase of oil content.

It can be shown that both methods have fungicide-saving and environment protecting features. It can be stated in general,that:

1./ According to our laboratory experiment the Kelosild FW can be used with much more success against the Alternaria with ultrasonic or vacuum infiltration treatment.

2./ The ultrasonic treatment was more efficient than the traditional in each case because:

   a/ it increases the seedling precentage

   b/ it increases the oil content

   c/ the saving in fungicides is about 45 % at the Kelokarb and in case of Kelosild the saving in fungicides is the multiple of this.

3./ Both methods are fungicide-saving and environment-protecting because the agent is not sprayed all over but stays in the seeds.

4./ More infection-resistant plants were developed and with the halp of vacuum infiltration:

a/ In accordance with our experiment fungicide equal to 30 % of the original weight of seeds can be pressed against the seeds through the cracks of achenia, from which they cannot get into the environment or soil.

b/ The effectiveness of fungicides are increased by this method of dressing.

c/ Its only disadvantage apart from obstructing slightly the germination is the decreasing of oil content.

Finally we note that at the moment we have no comparable datas to the industrial dressing methods currently used. However, we have mentioned, that in the case of Kelosild we have got the same effect after half an hour of shaking and with a 30 % concentration of fungicide, which represent a far more (appr.50-100 times) wastage of fungicide than in the case of 1 % concentration combined with the ultrasonic treatment, and in addition the latter one is faster and can be done continuously.

The above methods in our opinion can be carried out in industrial size as well. For industrial purpose ultrasonic tanks of several cubic metre volume are used. The vacuum infiltration can also be done in a suitably extractable, large volumed, pressure resistant tank.

Acknowledgement

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Table 1.

NK 254 Sunflower hybrid

Fungoids	Degree of infection (%)
Alternaria sp.	88
Botrytis cinerea	14
Sclerotinia sp.	17
Aspergillus sp.	4.5
Penicillium sp.	1.5
Total degree of infection	125 %
Germination per cent	85 %

Table 2.

Treating solution used in the experiment

Solution	agents	concentration used in physical dressing	doses used in traditional dressing
AGROCIT	50 % benomil	0.15 % 0.4 % 0.7 % 1.0 %	100 g/100 kg
DITHANE M-45	80 % mankoceb	0.2 % 0.5 % 0.8 % 1.0 %	100 g/100 kg
KELOKARB 80 WP	50 % Zn-Mn-oxikino-lat-dimetil-ditiokarbamat	0.2 % 0.5 % 0.8 % 1.0 %	200 g/100 kg
KELOSILD FW	20 % Zn-Mn-oxikino-lat-dimetil-ditiokarbamat + 10 % karben-dazim	0.2 % 0.5 % 0.8 % 1.0 %	1 : 3 dilution scale

The result of the traditional dressing and the ones combined with physical handling

Table 3.

Treatment combination of solution	Doses x g/100 kg	Degree of infection %					Total degree of infection	Total degree of infection in the percentage of controll	Germination	
		Alternaria sp.	Botrytis c.	Sclerotinia	Penicillium sp.	Aspergillus sp.			%	in the % of controll
1.Controll	-	88	14	17	1.5	4.5	125	100	86	100
2.Traditional										
Agrocit+Dithane M-45	100g+100g	14.5	-	1.5	-	3	19	15.2	90.5	105.2
Kelokarb 80 WP	200 g	3	-	-	-	2.5	5.5	4.4	91	105.8
Kelosild FW	1:3	0.5	-	-	-	-	0.5	0.4	92.5	107.5
3.Ultrasonic										
Agrocit+Dithane M-45	1% + 1%	9	-	2.5	1.5	-	13	10.4	92	106.9
Kelokarb 80 WP	1 %	2.5	-	-	-	-	2.5	2.0	93	108.1
Kelosild FW	1 %	-	-	-	-	-	-	-	95	110.4
4.Vacuum										
Agrocit+Dithane M-45	1% + 1%	9.5	-	-	-	-	9.5	7.6	84	97.6
Kelokarb 80 WP	1 %	1	-	-	-	-	1	0.8	84	97.6
Kelosild FW	0.8 %	-	-	-	-	-	-	-	85	98.8

The combined effect of Kelosild FW ultrasonic treatment and vacuum infiltration (10 minutes) on the germination per cent and the degree of infection of seeds in the function of concentration

Table 4.

No.	Concentration	Degree of inf. %		Total degree of infection %	Total degree of infection in the precentage of controll	Germination	
		Alternaria sp.	other			%	in the % of controll
1.	Controll	88	37	125	100	86	100
2.	0.5 %	1.5	-	1.5	1.2	87.5	101.7
3.	0.8 %	-	-	-	-	84	97.6
4.	1 %	-	-	-	-	81.5	94.7

The growing dynamics of plants sprouted out of seeds and treated in Kelosild FW (0.2 %) solution with physical methods

Table 5.

Treatment	No.of leaves		Height of plants			Blossoming %					Oil %
	V.20.	V.29.	max.	min.	average	VII.14.	VII.15.	VII.17.	VII.18.	VII.21	
1.Soaked for 30 minutes	2-4	6	180	80	122	30.30	48.48	63.63	66.66	75.75	41.8
2.Ultrasonic (5 min.)	2-4	4-6	165	80	124 v	14.81	23.62	37.03	48.14	70.37	48.0
3.Ultrasonic (10 min.)	2-4	6	215	34	132	26.66	35.71	56.66	63.33	86.66	49.3
4.Vacuum (10 min.)	2-4	2-4	131	62	105	21.42	35.71	50.00	53.57	60.71	37.9

The percentage appearance of infection on plants sprouted out of treated seeds (field experiment)

Table 6.

Treatment	VII. 17.		VIII.13.				VIII. 22.			
	foot infection	leaf inf.	foot inf.	leaf inf.	crown inf.	total inf.	foot inf.	leaf inf.	crown inf.	total inf.
1.Soaked for 30 minutes	0	0	20.00	0	0	20.00	26.67	0	13.33	40.00
2.Ultrasonic (5 min.)	0	0	3.57	0	3.57	7.14	7.14	7.15	17.85	32.14
3.Ultrasonic (10 min.)	0	0	0	0	0	0	3.70	0	7.47	11.11
4.Vacuum (10 min.)	0	0	0	0	0	0	6.67	0	13.33	20.00

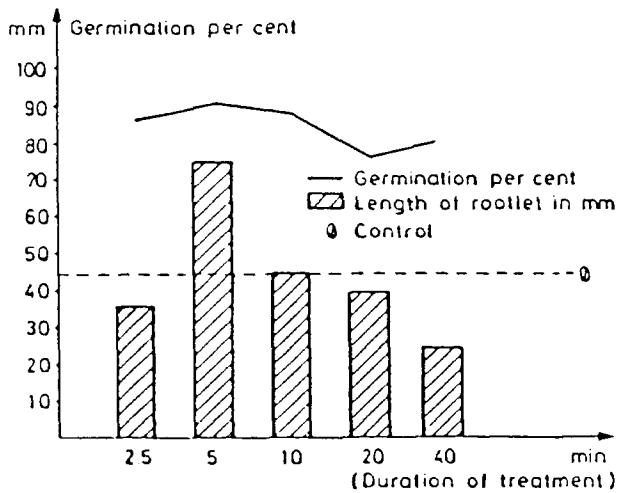

Fig. 1. Effect of ultrasonic treatment on the germination of sunflowers and on the size of the rootlet depending on the duration of treatment

Effect of Agrocit (1 %) Dithane M-45 (1 %) Combination and physical treatment on the degree of infection and germination of seeds.

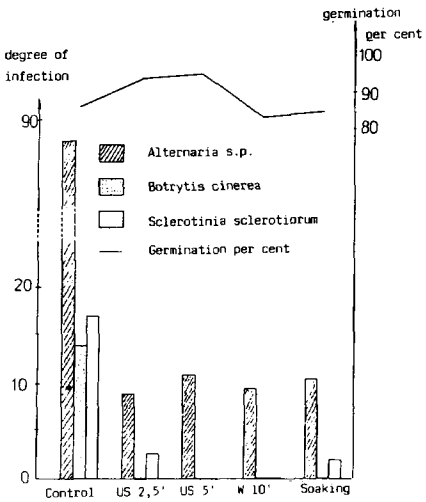

Fig.2.

Effect of Kelokarb 80 WP (1 %) and the physical treatment on the degree of infection and germination of seeds.

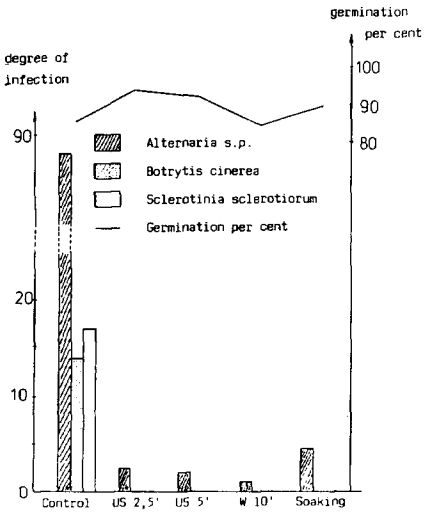

Fig.3.

Effect of Kelosild FW (0,5 %) and physical treatment on the degree of infection and germination of seeds.

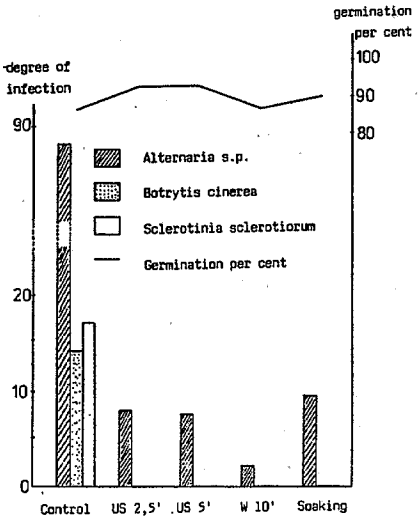

Fig.4.

Effect of Kelosild FW (1 %) and the physical treatment on the degree of infection and germination of seeds.

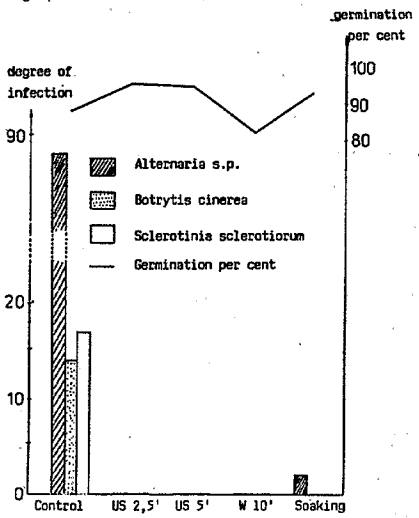

Fig.5.

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