

## FORECASTING THE OCCURRENCE OF *Sclerotinia sclerotiorum* (Lib.) De Bary (ROOT ROT) IN SUNFLOWERS AND ITS APPLICATION

Hua Zhi Fu<sup>1</sup>, Wand Quan<sup>1</sup>, Lu Xue Mean<sup>1</sup>, Zhang Qui Gun<sup>2</sup>

<sup>1</sup>Jilin University of Agriculture

<sup>2</sup>Agrotechnique Station of Ha La Hai village of Nong An county

### SUMMARY

*Sclerotinia sclerotiorum* (Lib.) de Bary is a facultative parasite to which the cultivated sunflower is highly sensitive. The fungus attacks the root, stem and leaves, head discs and seeds, causing root rot, stem rot and head rot forms, respectively. According to the survey, the root rot and head rot were the major forms in China. In Jilin Province, the root rot was more serious, in Nong An county (in 37 fields) the incidence was between 0 and 17.5% over 5 years, i.e., the average incidence was 5.13%, which was related to the amount of sclerotia in seeds and soils. For economic purpose of controlling the diseases, forecasting is important.

This paper reports the results of studying the root rot forecast and its application.

**Key words:** Sunflower, *Sclerotinia sclerotiorum*, root rot forecast.

### MATERIALS AND METHODS

1. An isolate of *S. sclerotiorum* from sunflower was cultivated at 25°C in 250 flasks on autoclaved wheat grains. After 20-25 days, there formed sclerotia which were similar in size. Before sowing, the sclerotia were spread onto and mixed with soil, in the amounts of 0, 3, 6, 12, 24, 46/30 x 40 x 10 cm (0, 0.25, 0.5, 1, 2, 4 sclerotia/dm<sup>3</sup>, respectively). Individual plants of a susceptible variety San Do Mea (from Seed Company of Chan Lin County, Jilin Province) and a tolerant variety Sunbred Br. 277 (from Northrup King, U.S.A.) were then sown in. Each experiment had 12 plots, each plot was 10.5 m<sup>2</sup> (2.1 x 5 m), and included 30 plants with 70 cm row spacing and 50 cm plant spacing. The experiment design was a system of randomized blocks in six replications, normal management. Disease incidence and yield were recorded separately on 20th September. Linear regression between disease incidence and sclerotia was calculated and an economic threshold according to the relation between the yield and sclerotia was made.

2. In 1990, at Ha La Hai and Chen Jia Tuo villages, Nong An county, we investigated sclerotia in ten sunflower fields. In each location, 5 sites were randomly chosen (each site 20 x 20 x 20 cm) and sclerotia collected from 0-3, 3-5, 5-10, 10-15, 15-20 cm below soil surface by wet sieving. Linear regression was used to forecast the disease incidence of *Sclerotinia* root rot. The forecast was compared with the actual disease incidence on 21-22th September.

Linear regression was also used to verify the data of four sunflower fields established in 1986 in Nong An county.

## RESULTS

1. The incidence of the root rot form of *S. sclerotiorum* on sunflowers was positively related with the number of sclerotia. The correlation coefficient was significant (San Do Mea,  $r = 0.974$ ; Sunbred Br. 277,  $r = 0.992$ ).

Linear regression was  $y = 3.513 + 0.703x \pm 3.3$  (San Do Mea) and  $y = 0.729 + 0.324x \pm 0.828$  (Sunbred Br. 277)

Table 1. Relationships between *Sclerotia* disease incidence and yield

Sclerotia number/dm <sup>3</sup>	Susceptible variety (San Do Mea)				Tolerant variety (Sunbred Br. 277)			
	Total plants	Mean disease inc.	Mean yield kg/20 plants	Compared with no sclerotia decrease (5)	Total plants	Mean disease inc.	Mean yield kg/20 plants	Compared with no sclerotia decrease (%)
0	197	0	8.48a	—	178	0	1.67a	—
0.25	183	6.01	7.78ab	8.25	157	3.08	1.57ab	5.99
0.5	192	6.25	7.59ab	10.50	151	2.46	1.59ab	4.79
1.0	164	16.46	6.97bc	17.81	177	4.11	1.57ab	5.99
2.0	169	22.49	6.92bc	30.19	163	8.53	1.46bc	12.57
4.0	159	35.22	5.06cd	40.33	141	16.36	1.38c	13.37

Table 2. Disease incidence forecasted and actual data

Field no.	Location	Sclerotia /dm <sup>3</sup>	Disease incidence	
			Forecasted	Actual
1.	Wang Gen shan (Ha La Hai village)	2.1	7.989±3.3	8.15
2.	Wang Hua chun (Ha La Hai village)	0.1	3.58±3.3	0
3.	Huang Jin yui (Ha La Hai village)	0.15	3.618±3.3	1.75
4.	Huang Jin yui (Ha La Hai village)	0.15	3.618±3.3	2.25
5.	Wang Fa (Ha La Hai village)	0	3.513±3.3	0
6.	Wang shi Rang (Ha La Hai village)	0	3.513±3.3	0
7.	Gao Dai Chun (Chen Jia Tuo village)	2.35	5.165±3.3	9.44
8.	Gao Dai Chun (Chen Jia Tuo village)	1.05	4.25±3.3	6.68
9.	Shi Ye Mien (Chen Jia Tuo village)	0.3	3.72±3.3	0.75
10.	Hao Yin Fu (Chen Jia Tuo village)	1.25	4.34±3.3	8.0

Table 3. The 1986 records of disease incidence compared with the data calculated from linear regression

Field no.	Location	Sclerotia /dm <sup>3</sup>	Disease incidence	
			Actual	Forecasted
1.	Yin Men Jun (Ha La Hai village)	3.84	9.54	6.213±3.3
2.	He Gen San (Ha La Hai village)	0.928	4.70	4.165±3.3
3.	Wang Fa (Ha La Hai village)	0.341	2.13	3.75±3.3
4.	He Gen San (Ha La Hai village)	0.0	0.05	3.51±3.3

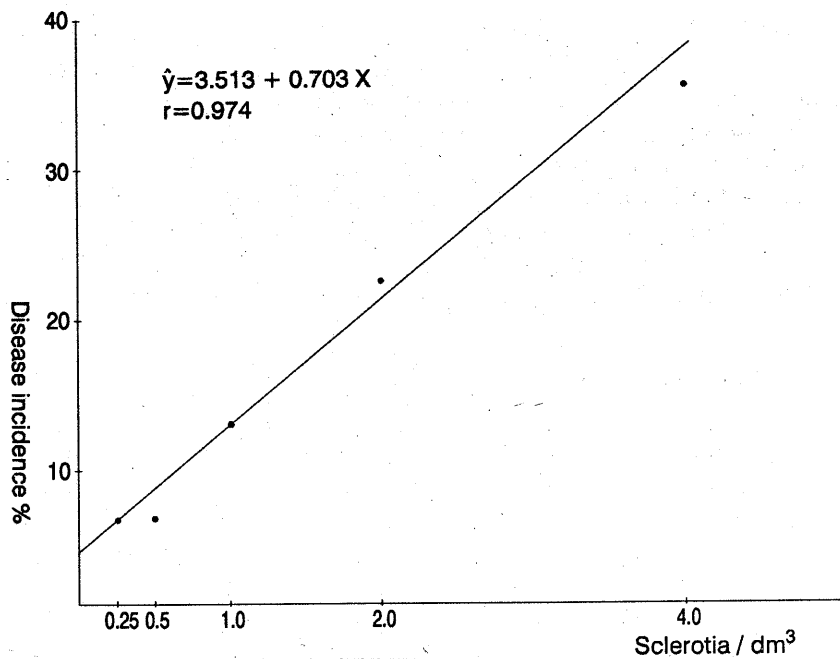


Fig. 1 - Relationship between disease incidence of the susceptible variety and sclerotia/dm<sup>3</sup>.

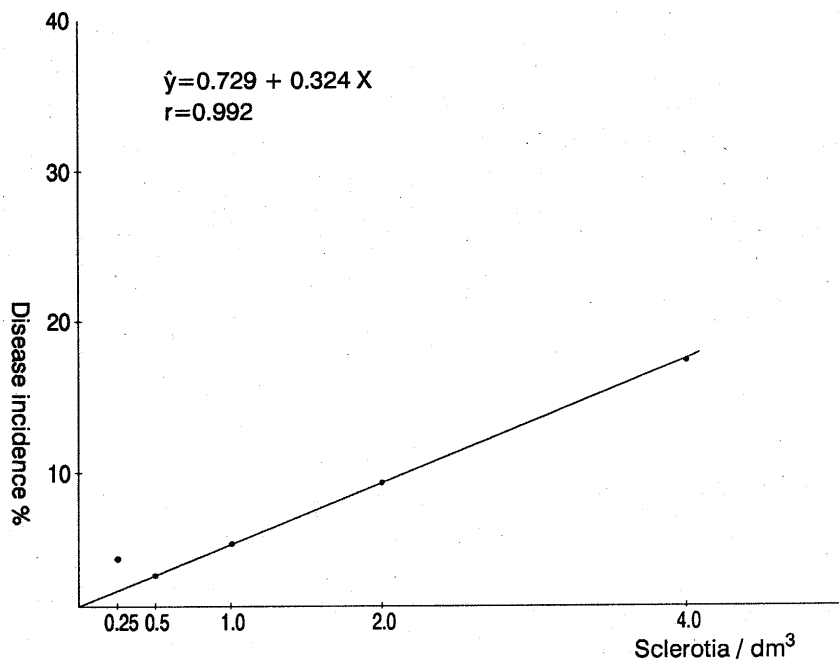


Fig. 2 - Relationship between disease incidence of the tolerant variety and sclerotia/dm<sup>3</sup>.

Yield decrease in San Do Mea reached 40.33% when the the number of sclerotia reached  $4/\text{dm}^3$ , while in Sunbred Br. 277 the decrease was only 17.37%. At the same time, the susceptible variety decreased the yield significantly at the sclerotia number of  $1/\text{dm}^3$  and the tolerant variety at  $2/\text{dm}^3$ . It is their economic threshold (Table 1).

## 2. Applying linear regression for forecast

The application of the linear regression to the results obtained in ten different sunflower fields for the forecast of root rot disease incidence showed that all forecasted data were in good correspondence with the actual situation (Table 2).

Used on the 1986 records, the correspondence was again evident (Table 3).

## DISCUSSION

1. It is obvious that the number of sclerotia within 0-10 cm below the soil surface represents the major part of the total amount of sclerotia in the field (87.98% in 1986, 81.6% in 1990). So it was concluded that we can use the sclerotia number within 0-10 cm soil for forecast. Yakytkin et al. (1988) used the sclerotia number within 0-5 cm soil layer but they disregarded too many sclerotia. According to our 1990 data for 10 sunflower fields, they would lose 44.88% of the sclerotia actually present. Undoubtedly, it would influence the accuracy of the result. Holley and Nelson (1986) used the sclerotia number within 16.5 cm below the soil surface; although the accuracy was high, additional investments in time and work made their approach uneconomic.

2. The yield of sunflower significantly decreased when the amount of sclerotia reached  $1.0/\text{dm}^3$ . It was in full agreement with the results of Yakytkin et al. and similar with Holley's result. But it is the economic threshold of susceptible varieties only; for tolerant varieties, the sclerotia level should be  $2.0/\text{dm}^3$ .

3. The application of linear regression,  $y=3.513+0.703x+3.3$ , for the forecast of the disease incidence of root rot in the susceptible varieties showed that the forecasted data were in good agreement with the actual situation and they can be applied in the field. If sclerotia amount reached or went over the economic threshold, the seeds should be chemically treated, to decrease the losses caused by *Sclerotinia* root rot.

## REFERENCES

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**PRONOSTICO DE LA INCIDENCIA DE LA PODREDUMBRE DE RAIZ (*Sclerotinia Scelerotiorum* Lib) DE BARY EN GIRASOL Y SU APLICACION**

**RESUMEN**

*Sclerotinia Scelerotiorum* es un parásito facultativo al cual es muy sensible el girasol. El hongo ataca la raíz, tallo, hojas, capítulo y semillas causando podredumbres en cada uno de ellos. De acuerdo con la prospección las podredumbres de capítulo y raíz fueron las mas frecuentes en China. En la provincia de Jilin, de podredumbre de raíz fue la mas importante en el condado de Nong An en 37 campos con una incidencia entre 0 y 17.5% y media 5.13% durante cinco años. Esta incidencia estuvo relacionada con la cantidad de esclerocios en las semillas y suelo.

**PRÉVISION DES ATTAQUES RACINAIRES SE *Sclerotinia sclerotiorum* (LIB.) DE BARY CHEZ LE TOURNESOL ET SON APPLICATION**

**RESUMÉ**

*Sclerotinia Scelerotiorum* (Lib.) De Bary est un parasite facultatif auquel le tournesol cultivé est très sensible. Le champignon attaque la racine, la tige, les feuilles, les capitules et les graines, entraînant leur pourriture. Les formes d'attaque sur racine et sur capitule sont les plus fréquentes en Chine. Dans la province de Jilin la pourriture de la racine a été la plus grave, dans la région de Nong An (37 champs étudiés): l'incidence a été de 0 à 17.5% sur 5 ans, ce qui correspond à une moyenne de 5.13% en relation avec la quantité de sclérotos dans les graines et dans le sol.

Pour l'objectif économique de centrale des maidies, la prédiction est importante. Cet article présente les résultats d'étude de prédiction de la pourriture racinaire et son application.