View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Directory of Open Access Journals

Зборник Матице српске за природне науке / Proc. Nat. Sci, Matica Srpska Novi Sad, № 110, 123—127, 2006

UDC 633.63:581.148]:632.25(495.3)

Dimitros A. Karadimos[1], *J. T. Tsialtas*[2], *N. Maslaris*[3], *D. Papakosta*[4]

Hellenic Sugar Industry SA
[1] Larissa factory, Department of Plant Protection, 411 10 Larissa, Hellas
[2] Larissa factory, Department of Experimentation, 411 10 Larissa, Hellas
[3] Head of Agricultural Services, 34 Mitropoleos Street
541 10 Thessaloniki, Hellas
[4] Aristotle University of Thessaloniki, Faculty of Agriculture
Lab. of Agronomy, 541 24 Thessaloniki, Hellas

ROOT ROT DISEASES OF SUGAR BEET (*BETA VULGARIS* L.) AS AFFECTED BY DEFOLIATION INTENSITY*

ABSTRACT: The aim of this work was to study the effect of sugar beet re-growth after water stress defoliation on root rots of three cultivars (Europa, Rival, Corsica), which were spring sown in Thessaly, central Greece, for two growing seasons (2003—04). At the beginning of July, sugar beets were subjected to water deficit with irrigation withholding. A month later, three defoliation levels (control — C, moderate — MD, severe — SD) and irrigation were applied. Thus, sugar beets were forced to re-grow and three harvests (15, 30 and 40 days after defoliation — DAD) were conducted. Rotted roots per hectare were counted and pathogens were identified. Data were analyzed as a four-factor randomized complete block design with years, defoliation levels, sampling times and cultivars as main factors. The number of rotted roots was increased with the defoliation level and was significantly higher for SD sugar beets (3748 roots ha^{-1}). No significant differences were found between C and MD treatments (1543 and 2116 roots ha^{-1}, respectively). Rival was the most susceptible cultivar to root rots. Sugar beets were more susceptible to rotting 15 and 40 DAD (2778 and 2998 roots ha^{-1}). The causal agents of root rots were the fungi, *Fusarium* spp., *Rhizopus stolonifer*, *Macrophomina phaseolina* and *Rhizoctonia solani*.

KEY WORDS: defoliation, re-growth, root rot diseases, sugar beet

INTRODUCTION

Sugar beet is the main cash crop for central and northern Greece. In Thessaly plains, sugar beet crop covers the acreage of 10.000 ha. In Thessaly, sugar beet crop productivity is limited by water stress. Drought will become a

* The paper was presented at the first scientific meeting IV INTERNATIONAL SYMPOSIUM ON SUGAR BEET Protection held from 26—28 september 2005 in Novi Sad.

serious restrictive factor of sugar beet growth in numerous areas in Europe (Jones et al., 2003). In Greece, water deficit occurs in July and August when evapo-transpiration exceeds water inputs. Supplementary irrigation is provided in order to bridge the gap between needs and input but this is often inevitable due to shortage of irrigating water.

Sudden and erratic rainfalls or restoration of irrigation water supply enforce sugar beets to re-grow with detrimental effects on qualitative and quantitative traits of sugar beet roots (Muro et al., 1998). From field observations, sugar beets defoliated by water stress, which are then forced to re-grow show an increasing susceptibility to root rotting after water supply restoration. Thus, the aim of this work was to study the effects and to identify the soil pathogens responsible for root rots which appear after irrigation restoration in three cultivars of sugar beet subjected to drought stress.

METHODS AND MATERIALS

Three sugar beet cultivars (Europa-van der Have, Rilland, The Netherlands, Rival-SES EUROPE NV/SA, Tienen, Belgium, Corsica-Maribo, Danisco Seed, Holefy, Denmark) were established in a randomized complete block design, with four replications, in Amfithea farm of Hellenic Sugar Industry SA (39° 43' N, 22° 28' E, 76 m). Seeding was conducted on 17 April 2003 and on 18 March 2004 and seeds were drilled with Hege 80 machine at 45 cm between rows and 8.1 cm on a row. After seedling emergence, plants were thinned by hand. Sugar beets were provided a total of 150 kg N ha^{-1} (as basal and top-dressing), 75 kg P_2O_5 ha^{-1} and 75 kg K_2O ha^{-1}. Full protection against pests and pathogens was supplied by spraying.

In order to be subjected to drought stress, sugar beets were left without irrigation for about a month (during July). Then, three defoliation treatments (control — C, moderate defoliation — MD, severe defoliation — SD) were applied by hand. At MD treatment, half of the foliage was removed while at SD treatment only the meristems left. Then, irrigation (~70 mm) was applied in order to achieve the foliage re-growth. Three samplings (15, 30 and 40 Days after Defoliation — DAD) were taken in order to study quantitative and qualitative sugar beet traits. In each sampling, two rows (7 m long, 6.3 m^2) were harvested by hand and the total and rotted root numbers were determined. Rotted roots were collected and pathogens were isolated using acidified PDA media. The pathogens were examined using a binocular light microscope. Fungal hyphae, fruiting bodies and spores were used for the identification of the parasitic fungi.

The data of rotted roots were subjected to analysis of variance (ANOVA) as a randomized complete block design with four main factors (years, defoliation levels, sampling times, cultivars). For the analysis, MSTAT-C (version 1.41, Crop and Soil Sciences Department, Michigan State University, USA), statistical package was used and results were compared by LSD test.

RESULTS AND DISCUSSION

No significant differences between main factors were found concerning the total root number (data not shown). Table 1 presents ANOVA for rotted root number. Rotted root number was not significantly affected by years and was marginally insignificant (P=0.055) regarding cultivars. Rival proved to be the most susceptible cultivar to root rots (3021 roots ha^{-1}), followed by Corsica (2668 roots ha^{-1}) which had no significant differences comparing to Europa (1719 roots ha^{-1}). However, a significant Year and Cultivar interaction was evident (Table 1). In 2003, Corsica and Rival preoved to be more susceptible to rotting but in 2004, this was evident for Europa and Corsica. It is well established by field observations that sugar beet cultivars show different reaction to root rots caused by soil fungi.

Table 1. Analysis of Variance (ANOVA) of rotted root number. Where df = degrees of freedom, ns = not significant, * = P

Source of variation	df	*F*	Significance
Block	3	3.29	ns
Years (Y)	1	3.91	ns
Defoliation level (D)	2	7.86	**
Y x D	2	4.21	*
Sampling times (S)	2	3.51	*
Y x S	2	5.11	**
D x S	4	1.60	ns
Y x D x S	4	1.34	ns
Cultivar (C)	2	2.95	ns
Y x C	2	10.91	***
D x C	4	1.82	ns
Y x D x C	4	3.06	*
S x C	4	0.26	ns
Y x S x C	4	0.49	ns
D x S x C	8	0.30	ns
Y x D x S x C	8	1.11	ns
CV (%)		134.53	

Defoliation level and sampling times had a significant impact on root rots. Although MD had no effect on root rots compared to C treatment (2116 and 1543 roots ha^{-1}, respectively), SD significantly increased root susceptibility to rots (Figure 1). A possible explanation for this is that SD plants had osmotically accumulated water in their roots after irrigation, without having an active transpiration surface to limit root water content. Increased root water content and availability are factors promoting root susceptibility to rots (Agrios, 1988).

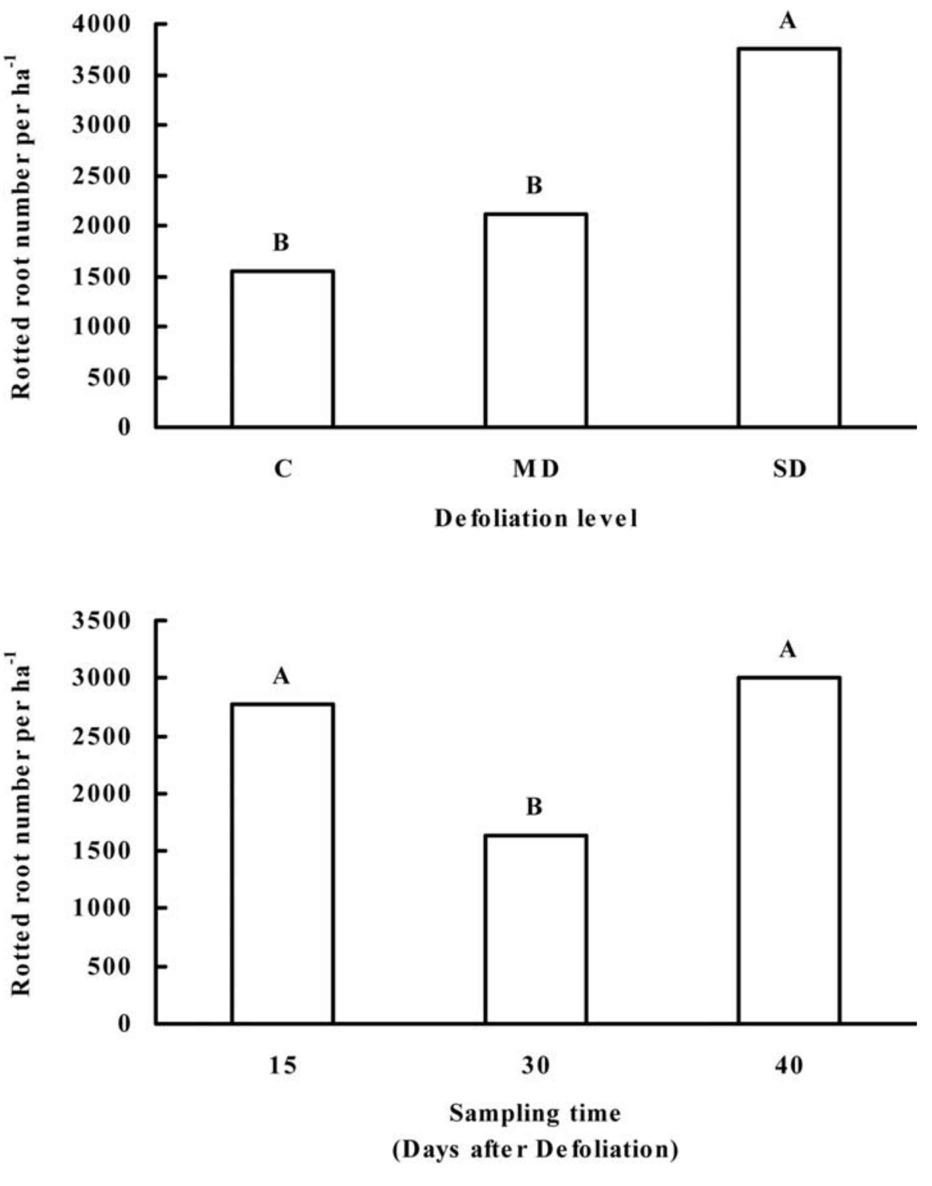

Figure 1. Rotted root number as affected by defoliation level and sampling time

Time of root sampling had a significant effect on rotted root, number being higher at early and late sampling (2778 and 2998 roots ha^{-1}, respectively), while 30 DAD rotted root number was the lowest (1632 roots ha^{-1}) (Figure 1).

Soil fungi identified to cause root rots were *Fusarium* spp., *Rhizopus stolonifer*, *Macrophomina phaseolina* and *Rhizoctonia solani.* All the isolated fungal species correlated with stressed, weakened or injured sugar beets (Hull 1960, Schneider and Whitney, 1986).

REFERENCES

A g r i o s, G. N. (1988): *Environmental effects on infectious plant disease development*, 147—155. In: GN Agrios Eds., *Plant Pathology*, Ed 3, Academic Press, New York, pp 147—155.

H u l l, R. (1960): *Root diseases*. In: R. Hull Eds., *Sugar Beet Diseases*, Bulletin No. 142. Ministry of Agriculture, Fisheries and Food, London, pp 41—52.

J o n e s, P. D., L i s t e r, D. H., J a g g a r d, K. W., P i d g e o n, J. D. (2003): *Future climate impact on the productivity of sugar beet (Beta vulgaris L.) in Europe*, Climatic Change 58: 93—108.

M u r o, J., I r i g o y e n, I., L a m s f u s, C. (1998): *Defoliation timing and severity in sugar beet*, Agronomy Journal 90: 800—804.

S c h n e i d e r, C. L., W h i t n e y, E. D. (1986): *Root diseases caused by fungi*. In: ED Whitney, JE Duffus, Eds. *Compendium of Beet Diseases and Insects*. APS Press, St. Paul, pp 15—21.

УТИЦАЈ ДЕФОЛИЈАЦИЈЕ ШЕЋЕРНЕ РЕПЕ (*BETA VULGARIS* L.) НА ТРУЛЕЖ КОРЕНА

Димитрос А. Карадимос[1], Ј. Т. Циалтас[2], Н. Масларис[3], Д. Папакоста[4]
Грчка индустрија шећера д.д.
[1] Фабрика Лариса, Одељење за заштиту биља, 41110 Лариса, Грчка
[2] Фабрика Лариса, Огледно одељење, 41110 Лариса, Грчка
[3] Главна пољопривредна служба, 34 Митрополеос, 54110 Солун, Грчка
[4] Солунски универзитет Аристотел, Пољопривредни факултет, Пољопривредна лабораторија, 54124 Солун, Грчка

Резиме

Циљ овог рада био је да се испита ефекат ретровегетације након опадања лишћа услед водног стреса на трулеж корена три комерцијалне сорте (Еуропа, Ривал, Корсика) које су током пролећа сејане у Тесалији (централна Грчка) током две вегетације (2003—2004). Почетком јула шећерна репа је подвргнута дефициту воде обустављањем наводњавања. Месец дана касније примењена су три нивоа опадања лишћа (контролно, умерено, јако), а наводњавањем прскалицама обезбеђено је око 70 mm воде. Шећерна репа је била присиљена на ретровегетацију. Изведена су и три вађења (15, 30 и 40 дана након опадања лишћа). Избројано је труло корење по ha и идентификовани су патогени. Подаци су анализирани у четворофакторијалном случајном блок-систему са годинама, сортама, нивоима опадања лишћа и вађењем корена као основним факторима. Број трулих корена се повећао са нивоом опадања лишћа и био је значајно већи за шећерну репу са јако опалим лишћем (3748 roots ha^{-1}). Између контроле и умереног опадања лишћа није нађена никаква значајна разлика (1543 и 2116 корена ha^{-1}). Ривал је била најосетљивија сорта (3021 корена ha^{-1}) затим Корсика (2668 корена ha^{-1}) која није имала никакву значајну разлику у односу на Еуропу (1719 корена ha^{-1}). Шећерна репа је била осетљивија на трулеж при вађењу корена 15. и 40. дана након опадања лишћа (2778 и 2998 корена ha^{-1}), док је код 30 дана након опадања лишћа забележен мањи број трулог корена (1632 корена ha^{-1}). Проузроковачи трулежи корена биле су гљиве, *Fusarium* spp., *Rhizopus stolonifer*, *Macrophomina phaseolina* и *Rhizoctonia solani*.