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Disease occurrence and yield relations in some varieties of *Poa pratensis*

Sygdomsforekomst og udbytterelationer hos nogle sorter af engrapgræs (Poa pratensis)

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Summary

The purpose of these investigations was to examine the relations between disease occurrence, control of fungal diseases and yield relations in nine varieties of *Poa pratensis*. The experiments were carried out at the experimental stations Rønhave and Roskilde 1987-89.

At Roskilde, varying occurrence of mildew, *Erysiphe graminis*, wood poa rust, *Puccinia brachypodii var. poae-nemoralis*, and melting out, *Drechslera poae*, were found in the nine varieties. The disease level in the varieties Ikone and Delft was in the second harvest year 17.5% and 25%, respectively, and in Trampas a rust level was found of 17.5% in the first harvest year. However, the disease level was generally low. At Rønhave, only sporadic disease occurrence was observed.

Even though the fungicide treatment was efficient at Roskilde, it only proved profitable in a few cases, as opposed to Rønhave, in spite of the very low disease level observed there.

Based on these investigations, it will be very difficult to advise on disease control in the various varieties of *Poa pratensis*.

Key words: *Poa pratensis*, disease occurrence, *Erysiphe graminis*, *Puccinia brachypodii var. poae-nemoralis*, *Drechslera poae*, varieties, yield.

Resumé

Det var formålet med disse undersøgelser at undersøge relationer mellem sygdomsforekomst, svampebekæmpelse og udbytterelationer hos ni sorter af engrapgræs. Forsøgene var udlagt ved Rønhave og Roskilde forsøgsstationer i årene 1987-89.

Ved Roskilde blev der i de ni sorter fundet varierende angreb af meldug, engrapgræsrust og rød øjeplet. De stærkeste angreb af meldug blev observeret i sorterne Ikone og Delft i 2. høstår med henholdsvis 17,5 pct. og 25 pct., og hos Trampas var der et rustangreb på 17,5 pct. i det

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første høstår. Generelt var sygdomsangrebet dog lavt i de andre sorter. Ved Rønhave var der kun sporadisk forekommende sygdomsangreb.

Selv om fungicidbehandling var effektiv ved Roskilde, var der kun i få tilfælde en økonomisk fordel ved svampebekæmpelsen. Dette var modsat ved Rønhave på trods af det meget lave sygdomsangreb.

På baggrund af disse undersøgelser vil det være yderst vanskeligt at rådgive om sygdomsbekæmpelse hos forskellige sorter af engrapgræs.

Nøgleord: Engrapgræs, *Poa pratensis*, meldug, engrapgræsrust, rød øjeplet, sorter, udbytte.

Introduction

When growing grass for seed, it is important to know the diseases which occur in the different varieties, as well as the resistance conditions. The resistance of the varieties can be evaluated both by means of virulence tests and by field evaluations. The latter has been used in this investigation. Furthermore, it is important to have knowledge about the influence of the fungicide applications on the yielding capacity of the varieties, with and without pathogenes. Such knowledge can reduce the use of routine sprayings and consequently the use of chemicals.

In an attempt to procure more knowledge about these relations, trials were carried out at the Danish Institute of Plant and Soil Science in varieties of *Poa pratensis* with and without fungicide application.

All the varieties have been tested at the Danish Institute of Plant and Soil Science.

Materials and methods

Table 1. Varieties of *Poa pratensis*, year of experiment and publication numbers

Varitry	Year of experiment	Publication No.	
1. Erte	1971-77	1461	(5)
2. Delft	1971-77	1461	(5)
3. Balin	1971-77	1461	(5)
4. Arina Dasas	1959-64	748	(1)
5. Connie	1980-83	1776	(6)
6. Ikone	1985-89	23 and 39	(7,8)
7. Sobra	1972-75	1330	(4)
8. Trampas	1972-75	1330	(4)
9. Primo	1985-87	23	(7)

The varieties 1-4 are field types and varieties 5-9 are lawn types. However, variety no. 6, Ikone, has been approved both for field grass and lawn grass. All the varieties are grown for seed production in Denmark.

The trials were carried out both at Roskilde and at Rønhave experimental stations and at both locations, the experiments were established in both 1987 and 1988. Both 1st and 2nd years grass seed was harvested. The first sowing at Rønhave in 1987 was also treated according to the trial conditions and harvested as a 3rd year crop in 1990. The grass seed was sown in the spring in thinly sown spring barley, which was moderately fertilized and relatively early harvested to avoid waste of seed. The grass seed was sown at the rate of 7 kg/ha.

The varieties were sown in four blocks and with plots randomly distributed within each block. In every second block, the fungal diseases were controlled with propiconazole 125 g/l and tridemorph 350 g/l (Tilt turbo 1 l/ha) applied at the beginning of stem elongation, which was on average 11 May. The variety Erte was sown as guard plots between the blocks.

Each year, the trials were fertilized with a total of 120 kg nitrogen per ha (60 kg in the autumn and 60 kg in the spring) which was applied, on average, on 25 September and 7 March, respectively. The varieties were swathed individually according to date of maturity.

After swathing, the varieties were threshed with a combine harvester. A plot size of 20-25 m^2 netto was used.

Disease assessments

Disease assessments were carried out in the various plots once or twice during the growth season. Only assessments with highest disease occurrence have been included in this survey.

Table 2. Seed yield, yield increase and disease occurrence in *Poa pratensis* sown 1987 at Roskilde

Variety	Untreated yield kg/ha Seed growing year		Yield increase for fungicide application kg/ha Seed growing year		% occurrence*) Mildew Seed growing year		Rust Seed growing year		Melting out Seed growing year	
	1(88)	2(89)	1(88)	2(89)	1(88)	2(89)	1(88)	2(89)	1(88)	2(89)
1. Erte	647	741	20	–11	t(0)	t(0)	t(0)	0(0)	t(t)	0(0)
2. Delft	1037	918	–34	2	5(0)	25(0)	t(0)	0(0)	t(t)	t(t)
3. Balin	887	793	34	–57	0.2(t)	5(0)	t(t)	t(0)	t(t)	0.2(0.2)
4. Arina	948	803	99	–18	0.1(t)	0.8(0)	t(0)	0(0)	t(t)	0.2(0.4)
5. Connie	1272	995	–131	–83	0.1(0)	t(0)	0.1(0)	0(0)	t(t)	0(0)
6. Ikone	1104	954	–57	–60	7(t)	17.5(2.5)	0(t)	0(0)	0(t)	0(0)
7. Sobra	1079	821	–94	58	t(0)	0.4(0)	t(0)	0(0)	2.6(0.4)	1(1)
8. Trampas	1057	1076	–21	13	0(0)	0(0)	17.5(t)	2.6(0.3)	0(0)	0(t)
9. Primo	1549	1209	–299	–37	t(0)	1.7(0)	t(t)	0(0)	t(t)	0.3(t)

*) Assessed: 13/6-1988 and 7/6-1989 ( ) disease occurrence after fungicide application. t =trace

The assessment has been stated as disease index at approximately four places in the plot. The disease index has appeared by evaluating the per cent attacked plants and per cent attacked leaves, and afterwards by multiplying these two values and dividing by 100. The disease index is expressed in terms of per cent disease. Systematic disease assessments were only carried out at Roskilde as the other disease occurrence at Rønhave was very low.

Results

Disease occurrence

During the three years in which diseases were assessed, mildew, *Erysiphe graminis,* rust, *Pucci-*

Table3. Seed yield, yield increase and disease occurrence in *Poa pratensis* sown 1988 at Roskilde

Variety	Untreated yield kg/ha Seed growing year		Yield increase for fungicide application kg/ha Seed growing year		% occurrence*) Mildew Seed growing year		Rust Seed growing year		Melting out Seed growing year	
	1(89)	2(90)	1(89)	2(90)	1(89)	2(90)	1(89)	2(90)	1(89)	2(90)
1. Erte	1207	987	133	74	0.5	0	5	5	0	0
2. Delft	1184	1302	–18	9	5	0	0	5	0	5
3. Balin	1262	991	–31	118	1	0	5	0	0	5
4. Arina	1244	1126	–39	–136	0.3	0	0	0	0	0
5. Connie	1205	1483	–55	–212	0	0	5	0	5	5
6. Ikone	1252	1147	–92	–89	3	0	0	5	0	0
7. Sobra	1283	972	16	53	2.5	0	0	0	0	5
8. Trampas	1048	1058	–36	49	0	0	1	0.1	0	5
9. Primo	1515	1695	–99	–137	5	0	5	0	0	0

*) Assessed: 7/6-1989 and 6/6-1990.

nia brachypodii, var. poae-nemoralis, and melting-out, *Drechslera poae,* were observed in varying levels of occurrence dependent on year, variety and location.

The control of mildew and rust specially in varieties with high disease level was very efficient (Table 2). With the low occurrence of melting-out in all years it was difficult to see any effect.

Variations among varieties (Roskilde)

Of the nine varieties, none was totally healthy in the three harvest years 1988, 89 and 90. In the first sowing in 1987 Delft and Ikone had the largest infestation of mildew and Trampas had the largest infestation of rust. Melting-out could be observed in limited levels in most varieties in 1988 and 1989. In 1990, several of the varieties had a disease index of 5%, which should be considered as low level (Table 3).

Relations between disease control and yield increases

Table 2 and 3 show yield in untreated and yield increase for control of fungi in plots sown in 1987 and 1988. In one particular case with a rust level of 17.5%, a negative yield increase was observed when control was carried out. In another variety with an occurrence of mildew in 25% a yield increase of only 2 kg was obtained by control. Only in few cases was there an economic benefit from fungicide application.

At Rønhave, the disease level during the three years of experiment was extremely low. In almost all plots, the yield increases were positive. No relations between disease occurrence and yield increases were found at Rønhave either. In all cases approximately 30 kg seed/ha is covering the costs of treatment.

Number of plants

The number of plants was assessed in the year of sowing after harvest of the cover crop, and in the seed-growing years in the spring. The small variations in the figures were of no importance for the development and yielding capacity of the seed grass. The figures are therefore not presented.

Number of fertile tillers

The number of fertile tillers was counted on 0.25 m^2/plot. The mean result for the first and second seed-growing year, respectively, appears in Table 4. In all the varieties, the number of fertile tillers/plot unit increased from the first to the second seed growing year. The biggest increase was found in the variety Trampas, which doubled the number.

Plant height

The plant height was measured after booting. The result, as an average of both seed-growing years, is shown in Table 4.

Large variations among the varieties were

Table 4. Number af fertile tillers/m^2, plant height in cm, lodging at harvest and seed weight. Mean figures with different letters indicate significance at 5% level (Duncan test)

Variety	No. of fertile tillers/m^2		Height in cm	Lodging at harvest*)	Seed weight,mg
Seed growing year	1	2	1+2	1+2	1+2
No. of trials	4	4	8	3	8
1. Erte	1241 c	1711 d	88 a	2.3 b	0.26 e
2. Delft	1520 b	2158 c	73 d	0.7 d	0.37 b
3. Balin	1199 c	1661 d	86 a	2.8 b	0.31 c
4. Arina Dasas	1597 b	1879 cd	81 b	2.4 b	0.31 c
5. Connie	2338 a	3505 a	37 g	1.3 c	0.32 c
6. Ikone	1387 bc	1893 cd	77 c	3.3 a	0.29 d
7. Sobra	1541 b	1758 cd	76 c	2.5 b	0.31 c
8. Trampas	1361 bc	2706 b	45 f	1.0 cd	0.36 b
9. Primo	2478 a	2597 b	66 e	1.4 c	0.40 a

*) 0 = no lodging, 10 = total lodging

Table 5. Seed yield and yield increases in *Poa pratensis* sown at Rønhave in 1987

Variety	Untreated, yield kg/ha Seed growing year			Yield increases for fungicide application, kg/ha Seed growing year		
	1(88)	2(89)	3(90)	1(88)	2(89)	3(90)
1. Erte	502	1008	444	109	73	0
2. Delft	591	1411	509	115	190	97
3. Balin	646	1486	449	150	148	101
4. Arina	810	1414	518	–25	150	63
5. Connie	650	1349	502	53	225	87
6. Ikone	593	1458	335	15	60	72
7. Sobra	650	1408	465	92	229	107
8. Trampas	512	1369	549	23	45	45
9. Primo	893	1715	476	111	44	43

found. The field types had on an average longer straws than the lawn types. Connie and Trampas had very short straws.

Lodging

Lodging was only of importance in three experiments and the mean figures from these experiments appearing in Table 4 also show large variations among the varieties.

Seed weight

The results of the seed weight determinations in terms of mean values of both seed-growing years are also shown in Table 4. As was the case with the plant height and lodging, the seed weight also shows large variations among the varieties.

Seed yield

Yield in Tables 2, 3, 5 and 6 is written as 100% clean seeds with 13% water content.

Table 2 and 3 show the yield for untreated grass and yield increase for control of fungi at Roskilde in the two seed-growing years with sowing in 1987 and 1988. Only in a few cases was there an economic benefit from fungicide application. At Rønhave, fungicide application (Table 5 and 6) turned out to be profitable in most cases. In all cases, approximately 30 kg seed/ha covered the costs of treatment.

Table 6. Seed yield and yield increases in *Poa pratensis* sown at Rønhave in 1988

Variety	Untreated, yield kg/ha Seed growing year		Yield increases for fungicide application, kg/ha Seed growing year	
	1(89)	2(90)	1(89)	2(90)
1. Erte	548	597	4	68
2. Delft	679	855	27	170
3. Balin	601	785	39	–17
4. Arina	856	820	–86	4
5. Connie	613	805	–51	173
6. Ikone	646	648	–41	191
7. Sobra	727	942	–46	–139
8. Trampas	502	857	93	124
9. Primo	875	841	10	294

Discussion

The present results are not in accordance with results obtained in experiments carried out in the years 1984-1987 (10). The reason may be that in some of those experiments, two fungicide treatments were carried out. Further it is concluded that control of melting-out is not profitable (10). In the present experiments, only one early treatment was carried out. The single treatment was performed in the 2nd week of May at the beginning of stem elongation.

Dutch experiments (2,3) with control of rust in *Poa pratensis* concluded that there were no relations between the occurrence of rust and yield. However, no negative yield increases were found.

Fungicide treatment at Roskilde gave in some varieties in one year a negative yield increase and in the next year a positive yield increase. As opposed to Roskilde, positive yield increases were found after most sprayings at Rønhave, even though the disease level was very low. However, a possible explanation of these variations can be the presence of saprophytic fungi such a *Alternaria* and *Cladosporium.* It was for instance demonstrated by *Smedegård* and *Tolstrup* (9) that a reduction of the number of saprophytic fungi by means of fungicide treatments of barley may result in important yield increases, even though no leaf pathogens are present. In these experiments the presence of these fungi have not been examined, this being the reason why the variations between varieties, years and locations cannot be interpreted based on these experiments.

Conclusion

These experiments show that in some cases a profitable yield increase can be obtained by spraying the nine varieties *Poa pratensis* with an efficient fungicide, irrespective of disease level. Based on these experiments, there will be an uncertainty of economic benefit with fungicidal treatment.

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