A Step by Step Risk Analysis (SRA) Used for Planning Sprays Against Powdery Mildew (OiDiag-System)

Schrittweise Risikoanalyse zur Planung der Spritzungen gegen den Echten Mehltau (OiDiag)

L'analyse du risque graduellement pour la planification des pulverisations contre l'oidium (OiDag)

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Working step by Step

SRA means a lock-step system for planning sprays, which uses modelling calculations over small periods only. Each modelling step should be followed by a spray and a period of visual control. In principle, the calculation of the second step is independent from the first step. Gehmann et al. (1988), Kast (1989) and Kassemeyer (1991) propose simular systems against downy mildew.

Such a system is worthless for scientific use, because in contrast to comprehensive multicycle models calculating the present status from initial inoculum and apparent infection rate, such a primitive one cycle system is very tolerant to wrong inputs. On the other hand such an error-tolerant system is predestined for the practical use by winegrowers especially in regions with different microclimates. A SRA-system with its error tolerance should also be favorable to be used against powdery mildew because a lot of factors influencing the epidemic are only partly understood (e.g. the effects of rainfall) and or they are important but difficult to measure (e.g. the initial inoculum) or difficult to evaluate. (e.g. effects of varity, N-supply, soil cultivation, vigour, training system, quality of foliage treatment and the effect of vine protection)

The OiDiag-System

Using a SRA-System for powdery mildew the winegrower has to make two different decisions :

- i): the time of the first spray and
- ii) the intervals for the following sprays.

In our region the first findings of powdery mildew depend on the absolute minimum (= a) in the winter before, as descibed by Hill (1990) and the disease severity of the last year (= a). The factor is valued from 0 (= no disease) to 5 (= damaged grapes in some vineyards). These correlations are used to predict for the initial step of an Oidium-spray-program, the time of the first spray. From data, collected in Weinsberg since 1953, for a and d we calculated the following regression for the julian date, when first symptoms were found on susceptible varieties: X = 184 - 11 x d + 2.6 x a. This equation has a coeffcient of determination of 30 %. Susceptible varieties should be sprayed about ten days before this date. For less susceptible varieties the winegrower should use this equation taking into acount his application-strategy up to now. If "X" of the present year gives a value earlier or later than in the year before, he should start spraying earlier or later using the difference of the x-values.

The following sprays in a SRA-System should be closer together in periods with conditions (temperature, humidity, rain and leafwetness) very suitable for powdery mildew and the periods should be longer if weather conditions are unfavourable.

The influence of temperature has been investigated very exactly (Delp 1954, Sall 1980, Chellemi and Marois 1991). The influcnce of humidity is less clear. In contrary to older reports based on field observations Delp (1954) and Thoma (1974) did not find significant effects of humidity from 40 % up on the germination of conidium. But Thoma (1974) could find increasing spore production with increasing humidity. The effect of changing humidity also stays unclear. Under field conditions we observed an extreme spread of powdery mildew in periods with extremely changing humidity (high pressure periods or weather sitiuations with higher likelihood of thunder storms). We found higher disease pressure in sites, where humidity increases very quickly during the night (valleys, hollows, vineyards near forests or lakes). The effects of rainfall and leaf-wetness are also only partly understood.

As a base to calculate the distance between the sprays in a step by step system we developped the OiDiag-program. This program roughly calculates an index (0 - 100) for the favourable weather conditions over the last two weeks. The programme uses temperature (daily average = t), the number for humid hours without leaf-wetness (=h1), Rh% >70 =1, Rh% >60= 0.5 and a count (=h2) for hours of leaf-wetness at days with more than 1 mm rainfall.

$t = -0.64 + 0.11\, t - 0.0025 t^2$

$h1 =$ hours/24

$h2 =$ hours/factor1

The programme calculates an index for each day

$X_i = (t \times h1) \times \text{factor2} - h2$

As default values for factor1 we use 3.0, for factor2 3.5. These factors makes it possible for users to adapt the programming to specific situations. Only average values for the last 14 X_i (im) and the difference between the average for the last week (i1) and the week before the last (i2) are printed out for the user.

A calculation of the actual trend is computed from the difference of i1 and i2. If i2 - i1 is greater than 15 "decreasing index" is printed out. Based on the average for the last 14 days (im) and the trend (i2 - il) we give the following recommendations (tab 1):

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Tab. 1: Recommendations for spray intervals
Tab. 1: Empfehlungen für Applikationsintervalle
Tab. 1: Recommodations pour les intervalles de pulverisation

im (mean index)	trend	interval
0-20	decreasing	no spray
0-20	steady	long
0-20	increasing	medium
21-40	decreasing	long
21-40	steady	long
21-40	increasing	medium
41-60	decreasing	long
41-60	steady	medium
41-60	increasing	short
> 60	decreasing	short
> 60	steady	short
> 60	increasing	short

The recommended intervals in days for susceptible varieties depend on the active ingredients (tab 2). In the period from prebloom to berries like pellets the intervals should be 2 days shorter.

Tab 2: Spray intervals in days for the use of different plant treatment products
Tab. 2: Applikationsintervalle beim Gebrauch verschiedener Pflanzenschutzmittel
Tab. 2: Intervalles de pulverisation utilisants des protectants differents

		days for		
product	**active ingredient**	**short**	**medium**	**long**
Sulfur WP	Sulfur 80 %	7	12	15
Bayleton spezial	Triadimefon	8	12	17
Rubigan	Fenarimol	12	14	18
Topas EC	Penconazol	12	15	20
Folicur E	Dichlofluamid + Tebuconazol	14	16	21

The system described above was tested in Weinsberg in 1992 and 1993. Three sprays in 1992 and four sprays in 1993 using Fenarimol or Penconazol had the same effect as 6 sprays using Penconazol. This system has not yet been tested in other regions.

Literature:

Chellemi, D. O.; Marois, J. J. (1991): Sporulation of Uncinula necator on grape leaves as influenced by temperature and cultivar. Phytopathology **81**, 197 - 201

DELP, C. J. (1954): Effect of temperature and humidity on grape powdery mildew fungus. Phytopathology **44**, 615 - 626

Gehmann, K; Staudt, F:; Grossmann, F. (1988): Reduzierte Spritzprogramme im Weinbau zur Bekämpfung der Rebenperonospora. Der Deutsche Weinbau **43**, 490 - 491

Hill, G. K (1990): The influence of annual wheather patterns on epidemics of Uncinula necator in Rheinhessen. Vitic. Enol.Sci **45**, 43 - 46

Kassemeyer, H.-H. (1991): Plasmopara-Prognose mit einem elektronischen Warngerät. In: Neue Erkenntnisse zur Plasmopara-Prognose Rd.: Staatl. Weinbauinstitut Freiburg

Kast, W. K (1989): Strategien zur Verminderung der Zahl der Peronosporaspritzungen. Der Deutsche Weinbau **44**, 259 - 262

Sall, M A. (1980): Epidemiology of grape powdery mildew: a model. Phytopathology 70, 338 - 342

Thoma, N. (1974): These (resume), Fac. Agron. Inst. Agron. N. Balcesne, Bucurest (ref.: Bulit, J.; Lafon, R.: Powdery Mildew of the Vine. ed. Spencer, D. M.: The Powdery Mildews, Academic Press 1978