



MLHD online

Manual for the herbicide dose calculation module

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This manual describes how to use of the MLHD calculation module for users from outside the Netherlands, and gives background information on the method, the meaning of readings with MLHD-meters, weeds in MLHD online, a list of herbicides compatible with MLHD and descriptions of the MLHD-meters. In time, MLHD online will be translated for use in other countries.

MLHD dose advices can only be applied effectively when conditions are favourable for herbicides. If unfavourable, higher doses should be applied.

CONTENTS

| | Pag. |
|--|-------------|
| Introduction | 3 |
| Carrying out the MLHD method | 4 |
| MLHD online | 7 |
| Weed sensitivity table | |
| 8 | |
| Fill in table | 12 |
| Appendices | |
| 1. List of herbicides compatible with MLHD | 15 |
| 2. Meaning of readings of MLHD-meters | 16 |
| 3. Latin and Dutch names in MLHD online / Sensitivity tables . | 17 |
| 4a. Manual PS1-meter | 19 |
| 4b. Manual PPM-meter | 21 |

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Introduction

MLHD is short for Minimum Lethal Herbicide Dose. MLHD is a new concept within chemical weed control. It supports effective weed control while herbicide doses are kept at minimum effective levels (minimum lethal doses). Herbicides principally compatible with MLHD are given in Appendix 1. The MLHD concept consists of two main components:

- The recommendation of a minimum lethal dose based on weed species and development stage of weeds, and properties of the herbicide or herbicides. Fine tuning of this dose has to be done by the user to account for local weather and crop effects is done just prior to spraying.
- The prediction of the herbicide effect shortly after spraying by means of an MLHD-meter. By doing photosynthesis measurements with an MLHD-meter, the level of control can be predicted days before this can be seen by eye. This information is then used to support decisions on possible next weed control practices.

The strength of MLHD comes from the combination of the two components. Firstly, the minimum herbicide dose is attuned to the weed situation present on the field. Then, shortly after spraying of this dose, the MLHD-meter is used to determine if the weed control will be effective or not. One can argue that spraying of doses less than label doses have a risk. Before the efficacy of a treatment can be seen and evaluated by eye, a week or more will have passed. If the weed control effect is too small, the weeds will have grown in this period and are more difficult to control. To avoid the risk of insufficient control, doses with a safety margin are applied. The possibility to predict the herbicide effect with the MLHD-meter makes it possible to spray reduced (minimum) doses without taking unnecessary risks.

Field studies have shown that the MLHD method can lead to a considerable saving of 30 % of herbicide use (see e.g. publication in EWRS proceedings of Kempenaar et al, 2002). Besides the saving on herbicides, there are other advantages of the MLHD method:

- The possibility to predict if a weed will die shortly after treatment gives trust in reduced doses and 'peace of mind'.
- The MLHD-meter can be used to determine if the herbicide has an effect on the photosynthesis of the crop. Reduced doses may give lesser adverse effects on the photosynthesis than label recommendations.
- Sometimes crop plants are sensitive to the herbicide (for instance metribuzin in potatoes, ioxynil and bentazone in onions). With the MLHD-meter, recovery of the crop from an herbicide treatment can be determined.
- One can argue that reduced herbicide doses stimulate resistance development. Less sensitive weed species can be identified with MLHD-measurements.

The MLHD method is ready for use in practice for herbicides that inhibit photosynthesis and a few other modes of action (see Appendix 1). Research at Plant Research International is ongoing to make the method applicable to more herbicides. Practical experience with the MLHD method is available for potatoes, sugar beets, onions, maize, wheat and some flower bulbs and vegetable crops.

The use of MLHD method takes a little more time than label use of herbicides. Firstly, a good estimate of the weed situation on the field is required (important weed species and stages have to be known). Next, the user has to choose an herbicide or an herbicide mixture that can control the weeds on his field. The method helps to make this choice. MLHD-measurements take some time (circa 1-2 hours per herbicide application per field of 5-10 ha) and requires some accuracy.

The "dose calculation part" of the MLHD method can be addressed via MLHD online (www.mlhd.nl). Best results with MLHD are obtained when this system is used. The system is available only in Dutch. This manual contains a summary of the system. It describes how to use the MLHD method when you do not have access to the internet. Besides, it gives background information on the meaning of readings of the MLHD-meters, a list of herbicides compatible with MLHD, weed information and a description of the MLHD-meter.

Carrying out the MLHD method

In the next paragraphs the use of the MLHD method is explained, with references to MLHD online. Hereafter, the six main steps in the MLHD method are described. The dose advices of MLHD are meant for photosynthesis inhibiting herbicides used as post emergence herbicides to control annual weeds and one year perennial weeds in arable crops.

1. Inventory of the weeds

As a first step, you make **observations** of the weeds present on the field or in the crop. The occurring weed species are noted and development stages of important species are assessed. Observations are done on at least five and preferably on ten or more representative places (2 x 2 m) on the field.

The weed inventory should be done in practical way:

- Often, the user knows which weeds occur on the field and are most problematic. Weeds that hardly occur or that are never a problem can be disregarded.
- In general, the user will pay most attention to problematic weed species.
- A personal consideration has to be made regarding desired level of weed control. Which weed species and stages do you want to control? Do you want to control all occurring weeds or do you focus on a particular weed? The advantage of the latter is that you probably can apply a smaller dose, the disadvantage is that some weeds will survive the treatment. This might be acceptable in some situations. The user has to decide on which weeds to focus the treatment. MLHD online can be used to compare different strategies.

2. Choice of herbicide

The user should then select an herbicide or herbicide mixture that is suited to control the weeds on the field. To support this decision, MLHD uses **sensitivity tables**.

A user with no access to MLHD online either has to obtain information on sensitivity of his weeds for herbicides from local information sources, or uses information of appendix 5. Per herbicide or herbicide mixture you can read in MLHD online the sensitivity of weeds for the herbicides (+++ is highly sensitive, ++ is normal sensitive, + is little sensitive, and – is not sensitive). From efficacy point of view, you should choose an herbicide or herbicide mixture that gives many +++ or ++ for the weeds you want to control. Other considerations are costs and environmental effects of the herbicides. Always check the text on the label (or other legal prescriptions) before you apply an herbicide.

3. Calculation of MLHD dose

The minimum dose to control the weeds can be read in the MLHD dose tables (see MLHD online or appendices in some documents (Manual PPM and PS1 and specific Research reports) that can be obtained via Plant Research International or found on www.mlhd.nl). A weed stage and sensitivity class dependent dose can be taken from these tables. If a weed is very sensitive for the herbicide treatment (+++) the user will receive a different dose recommendation than for a weed that is normal (++) or little sensitive (+). To make a good decision you can view a number of different situations and compare before making a final decision. As mentioned earlier, the user should obtain information on sensitivity of weeds for herbicides to make proper decisions.

If mixtures of two or more photosynthesis inhibiting herbicides are used, and data on sensitivity of weeds to this mixture is lacking, you normally can select doses from the ++ or +++ column of the individual herbicides.

4. Final decision on timing and dosing: spraying moment and carrying out a treatment

A final decision on the dose and timing of herbicide treatment still has to be made, and should take into application technology, weather conditions and use of additives (oil, etc.). When MLHD doses are applied, good technical performance (no drift, equal distribution) is very important and conditions should be favourable for herbicide activity. The user has to increase the MLHD dose by 25 to 50 %, or sometimes 100 % if conditions are unfavourable. Specific recommendations to account for weather or spray technology are given in Appendix 3 underneath each table.

You can use the GEWIS program (www.opticrop.nl) to evaluate weather effects on optimal time of spraying and efficacy. When GEWIS predicts 'green situations' and the GEWIS calculated relative dose reduction is > 1.6, MLHD recommendations are safe to be used. Further research is needed to link MLHD and GEWIS one to one. If you do not have a system like GEWIS, you have to evaluate yourself if conditions are favourable, moderate, poor or very poor for efficacy of the herbicide you use (adjustment factors are given below each table).

5. Determining effect by using the MLHD-meter

Two to three days after the treatment, the effect of a photosynthesis inhibiting herbicide can first be accurately assessed (predicted) with an MLHD meter. Per field and treatment, MLHD-measurements should be taken from minimally 10 weed plants of each of the 3 – 5 most important weed species. Measurements can also give useful information on residual effects on weeds much later after treatment, e.g. weeks after application of a soil herbicide, or just on the day of a next herbicide treatment.

Two types of MLHD meters are available, a PPM-meter and a PS1-meter:

- PPM-meter (manufacturer and distribution: Ears)

PPM means Plant Photosynthesis Meter. The PPM-meter is used in relation to MLHD since 1995 (see Appendix 4). The PPM-meter measures the fluorescence of the plant tissue under investigation (e.g. weed leaves, in the case of MLHD the youngest measurable leaf). Measurements with a PPM-meter should be done at least in a 'kind of shade', shielded from direct sunlight, because readings will be affected by ambient light conditions. To minimise this effect of ambient light, plants are best taken inside in a room with constant low light intensity, (lamps should be switched off, and complete darkness is not required). If measurements are done in the field, plants should always be shielded from direct sunlight (good moments for measurements are cloudy days, or moments before sun rise and after sun set).

The PPM-meter gives readings on a scale from 0 (no photosynthesis at all) to 80 (completely healthy). As a threshold value, a reading lower than 20 predicts that the weed is likely to die if it has been treated with a Photosynthesis inhibiting herbicide (see appendix 2). Values between 70-80 indicate healthy plants.

When leaves are small, several leaves should be measured at the same time. Single small leaves (< 1 cm², or width < 5 mm) tend to give 5 to 10 % smaller values than larger leaves.

- PS1-meter (manufacturer: Rometron, distribution: Agrifirm)

PS1 means Photosystem 1. The PS1-meter is used in relation to MLHD since 2002. The PS1-meter measures absorption of light by plant tissue clipped in the meter (e.g., weed leaves, for MLHD the youngest measurable leaf should be measured). Measurements can be done in the field; the readings are not affected by surrounding light when the leaf clip is closed.

The PS1-meter gives readings on a scale from 0 (no damage to photosystem 1 at all, completely healthy) to 100 (all photosystems 1 are blocked, no photosynthesis at all). As a threshold value, a reading higher than 80 predicts that the weed is very likely to die if it has been treated with a Photosynthesis inhibiting herbicide 2 days before or more (see appendix 2).

There may be variation in readings between different leaves of a plant and between plants. It is therefore important to standardize measurements (always measure the youngest leaf that fits into the clip, and to do measurements on 10 or more plants per important weed species and stage).

6. Continuation

The MLHD-measurements predict if weeds will be controlled sufficiently or not, and, if an additional treatment is needed or not. In the latter case, the readings can be used to adjust (reduce) the dose of a next herbicide treatment. Normally when MLHD dose recommendations are used under the conditions they are made for (optimal weather conditions and good spray technology), the measurements will show that the treatment was successful and that a high level of control will be achieved.

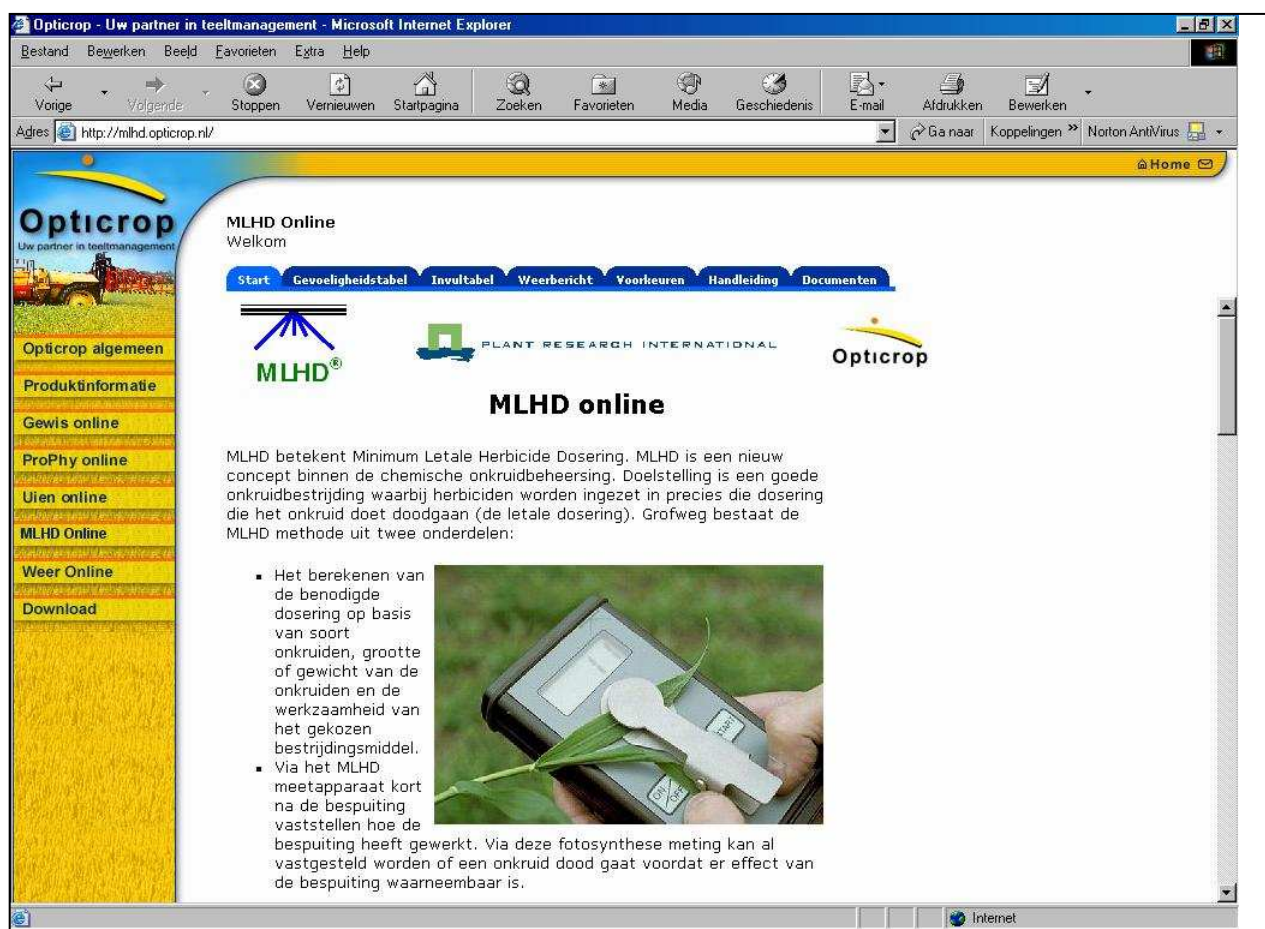
If you expect new flushes of weeds, and new control is required (e.g. when the canopy of the crop has not covered the soil completely yet), you have to determine the right moment for a next treatment. At that moment, **the MLHD-steps 1 to 5 should be repeated**. When a next treatment is carried out, it is an option (and advised) to redo the MLHD measurements shortly before the treatment, to see if the residual effect on the weeds has significantly changed. Also, this measurement can be used to see if the effect of the herbicide on the crop has disappeared. Readings are translated into doses recommendations by consulting the information in appendix 2.

MLHD online

MLHD online is a module on the Internet that supports the use of the MLHD method. The underlying weed sensitivity tables, dose tables, calculation rules are available in an automated system. The MLHD module can be found on the following Internet address: <http://www.mlhd.nl>.

MLHD online contains herbicides that are registered in the Netherlands. Some of these herbicides are internationally used, but this is not always the case. Besides that, % active ingredient(s) may differ. At this moment, it is possible to consult MLHD online for dose advises on products used outside the Netherlands, but the user has to do some additional work (compare similarity between the Dutch product in MLHD and his product).

At entry the user sees the under mentioned welcome screen (in Dutch). In this screen you can find general information on the MLHD-method and a disclaimer. In English, this disclaimer states: The use of any and all information in this manual will be done at one's own risk. Opticrop B.V. and Plant Research International B.V. cannot be held responsible in any form or way for direct or indirect damages that may result from the use of information or advises from this manual.



By way of the guidance tags the user sees the main components of the program:

- Start (Start)
- Gevoeligheidstabel (Sensitivity table)
- Invultabel (Fill in table)
- Weerbericht (Weather forecast)
- Voorkeuren (Preferences)
- Handleiding (Manual)
- Documenten (Documents)

The guidance tags always remain visible, so that the user can navigate easily through the program. The main components are explained more fully further on. Here we suffice with a short introduction:

- There are two ways to obtain MLHD advises: by way of “Gevoeligheidstabel” (Sensitivity table) and by way of “Invultabel” (Fill in table). The first method, gives a table with the sensitivity of weeds for the different herbicides in that crop. When you click on the link, you can look at the MLHD advice for that herbicide-weed combination. This method is especially suitable to support the choice of herbicide. By

way of the "Invultabel" (Fill in table) you can look at MLHD advises per herbicide for several weed species at once. With this you can easily compare herbicide use in different strategies.

- The guidance tag "Weerbericht" (Weather forecast) leads you to the regional weather forecast, including radar images (Online weather).
- The program works with a rather long list of weeds. Because not all the weeds are of importance to the user, you can by way of the guidance tag "Voorkeuren" (Preferences) compose your own list. Shortening the list will make the program more conveniently arranged to you. Per crop the program contains all herbicides and combinations of herbicides for which the MLHD method can be used at present as well as some important herbicides for which no threshold values of PPM-meters are know (yet). As for the weeds, you can also set your own list of herbicides so that using the program becomes more clearly structured. For translations of weed names, see appendix.
- By way of the guidance tag "Handleiding" (Manual) you can view online the further explanation of the MLHD method in general and the use of the program.
- Under "Documenten" (Documents) you will find a number of reports regarding MLHD (e.g. this Manual).

Sensitivity table

First, you choose the crop for which you want to view the sensitivity table ("aardappelen" (potatoes), "bieten" (beets), "maïs" (maize), "uien" (onions)). Choose the crop "Algemeen" (General) for photosynthesis inhibiting herbicides used in other crops (e.g. leek, carrots, strawberries, flower bulbs). After this, you get to see a general information sheet followed by a weed sensitivity table (see figure below). By double clicking on the link, or by selecting a weed herbicide combination and then pressing "Naar tabel" (To the table), you will go to the Dose advisory screen. Latin names of weeds in MLHD online are found in the appendix.

| | Betanal Progress Of | Betanal Trio Of | Bogt 1 | Fenmedifam + Safari + Hulpstof | Fenmedifam ylb. | Goltix T Of | Goltix Wg | Pyramin Df |
|------------------------------------|---------------------|-----------------|--------|--------------------------------|-----------------|-------------|-----------|------------|
| Akkerdistel | - | - | - | - | - | - | - | - |
| Ereprijs | +++ | +++ | +++ | + | +++ | +++ | ++ | ++ |
| Kamille | + | ++ | ++ | +++ | - | ++ | ++ | ++ |
| Kleefkruid | +++ | +++ | +++ | +++ | + | +++ | + | - |
| Melqanzevoet | +++ | +++ | +++ | + | +++ | +++ | ++ | ++ |
| Muur | +++ | +++ | +++ | + | +++ | +++ | ++ | ++ |
| Perzikkruid | +++ | +++ | +++ | +++ | + | +++ | ++ | ++ |
| Zwaluwtong | +++ | ++ | ++ | + | +++ | ++ | + | +++ |
| Zwarte Nachtschade | ++ | +++ | +++ | +++ | + | +++ | +++ | ++ |

In the sensitivity table you can see how sensitive weeds are for particular herbicides (varying from "-" not sensitive, "+" little sensitive "++" normal sensitive, to "+++" very sensitive). With this table you can determine which herbicide or which combination is most suitable to control the on your field occurring weed species. Select a herbicide or herbicide mixture with many +++ or ++ for the weeds you want to control.

Click on the herbicide names for background information on the herbicides (content, use instructions, environmental effects etc). Click on the weed names for a description of the weed including pictures. Here you can find Latin names of the weeds (which is of interest for people who do not know Dutch weed names).

| Onkruidstadium (uiterste) | Gewicht/plantje (gr) | Melganzevoet +++ | ++ | + | - |
|--|----------------------|------------------|------|------|---|
| kiemlobben gestrekt | 0.02 | 1.00 | 1.00 | 1.04 | X |
| 1 blaadje | 0.04 | 1.29 | 1.61 | 2.26 | X |
| 2 blaadjes (hoogte ca 2cm) | 0.07 | 2.40 | 2.50 | 2.50 | X |
| 4 blaadjes (eerste uitloper bij grassen) | 0.1 | 2.50 | 2.50 | 2.50 | X |
| 6 blaadjes (hoogte ca. 5cm) | 0.2 | 2.50 | 2.50 | 2.50 | X |
| 8 blaadjes (3 uitlopers bij grassen, >> 5cm) | 0.4 | 2.50 | 2.50 | 2.50 | X |

- Het advies is gericht op dosering van Betanal Trio in een LDS.
- Avadex BW (1 l/ha) kan toegevoegd worden tegen kleeftkruid.
- Lontrel 100 (0.3-0.5 l/ha) kan toegevoegd worden tegen o.a. distels.
- Voor bestrijding van grassen, zie advisering aangaande specifieke grassenmiddelen.

PPM meting:

of PS1 meting:

corrigeer dosering

Middel info

Onkruid info

Venster sluiten

In the advisory screen you see the advised doses of the chosen herbicide (in above mentioned example: Betanal Trio Of in sugar beet) for the different weed stages. The yellow column shows the chosen weed (in this case: "melganzevoet" (fat-hen) (*Chenopodium album*)).

- In the first instance, the yellow column is the most important. In this column, you see which dose is necessary to control the weed differentiated for development stages. In the other columns you can read which dose is necessary for other weeds (which are in this case less sensitive).
- At the bottom of the table, additional information and/or tips are mentioned. At this point, you can also view information by way of the buttons "Middel informatie" (Herbicide information) and "Onkruid informatie" (Weed information).
- If you have carried out a measurement with the MLHD meter, you can fill in the value at the bottom. Dependent of the type of meter you choose the fill in field "PPM" or "PS1". After you have entered your data, you click on the button "Corrigeer dosering" (Correct dose). The advisory table will then be recalculated. An explanatory text appears at the top. In undermentioned example a PS1 value is filled in of 65-80. Indicated is that the treatment has had a good effect, that only a very small number of weeds may survive the treatment, and that an additional treatment is probably not necessary. Because it is expected that a few weeds escape from the treatment, the dose table can be used if a treatment is applied any how.

Dosering bepaald voor een vervolgbespuiting op basis van een PS1 meting van van 65 tot 80

Als de bespuiting 2 of meer dagen geleden is uitgevoerd, is het te verwachten resultaat: **goed**.

Het vervolgadvis is dan ook: **Enkele ontsnappers mogelijk, aanvullende bestrijding hoeft niet**.

Raadpleeg onderstaande tabel voor de te hanteren dosering bij een eventuele vervolgbespuiting.

| Onkruidstadium (uiterste) | Gewicht/plantje (gr) | melganzevoet +++ | ++ | + | - |
|--|----------------------|------------------|------|------|---|
| kiemlobben gestrekt | 0.02 | 1.00 | 1.00 | 1.00 | X |
| 1 blaadje | 0.04 | 1.00 | 1.00 | 1.00 | X |
| 2 blaadjes (hoogte ca 2cm) | 0.07 | 1.00 | 1.00 | 1.05 | X |
| 4 blaadjes (eerste uitloper bij grassen) | 0.1 | 1.00 | 1.11 | 1.56 | X |
| 6 blaadjes (hoogte ca. 5cm) | 0.2 | 1.91 | 2.38 | 2.50 | X |
| 8 blaadjes (3 uitlopers bij grassen, >> 5cm) | 0.4 | 2.50 | 2.50 | 2.50 | X |

Herbicide information

http://mlhd.opticrop.nl/midinfo/data/11152.html - Microsoft Internet Explorer

Afdrukken Venster sluiten



Middel informatie

Algemene informatie BETANAL TRIO OF

| | |
|--------------------|--|
| Toelatingsnummer: | 11152 |
| Toelatinghouder: | Bayer CropScience B.V. (Mijdrecht) |
| Samenstelling: | metamitron/ethofumesaat/fenmedifam (153/51/51 g/l) |
| Gevaar aanduiding: | inwerkend zuur met onderschrift "bijtend" |
| Formulering: | vloeistof |
| Werking: | herbicide |

Toepassing

- Suiker- en voederbieten

Omdat niet alle onkruiden gelijktijdig kiemen, is een gedeelde toepassing noodzakelijk. De na-opkomstbehandelingen uitvoeren op jonge onkruiden, in het kiemplantstadium. Zijn de onkruiden door omstandigheden groter, dan de dosering verhogen tot maximaal 100%.

De 1e bespuiting op onkruiden in het kiemplantstadium, nog voor echte blaadjes aanwezig zijn. Vaak valt dit tijdstip samen met de opkomst van de bieten.

Dosering: 2 l/ha.

De 2e en volgende behandelingen: De toepassing herhalen op niet volledig bestreden onkruiden of op nieuw kiemend onkruid. Afhankelijk van de omstandigheden is dit telkens ongeveer 7-10 dagen na de voorgaande behandeling. De dosering moet worden verhoogd als de onkruiden al 2 echte blaadjes hebben of bij moeilijk te bestrijden onkruiden zoals kleeftkruid en veelknopigen.

Doosering: 3-4 l/ha.

Gebruiksaanwijzing

Het is een breed werkend herbicide met enige bodemwerking voor toepassing op jonge onkruiden tijdens en na de opkomst van de bieten. De meeste eenjarige zaadonkruiden worden goed bestreden mits deze nog klein zijn op het moment van toepassing. Het middel verspuiten in 200-300 l water per ha met een middelfijne druppel. Spuit op een gezond gewas dat niet is verzwakt door insecten, stuifschade, nachtvorst en dergelijke. Spuit evenmin bij scherp zonnig weer. Voeg geen olie, andere herbiciden of insecticiden toe. Bij een nateelt van wintergraan eerst een kerende grondbewerking uitvoeren om schade door residuen te voorkomen.

Wettelijk Gebruiks Voorschrift

Toestaan is uitsluitend het gebruik als onkruidbestrijdingsmiddel in de teelt van suiker- en voederbieten.

At several positions within MLHD online you can view background information on herbicides. At the top you find general information on the herbicide (admission number, active ingredients, contents, formula and herbicide type). After this, the label text (application, use instructions, legal use directions etc.) is shown. At the bottom the environmental effects are mentioned (in Dutch: Milieu meetlat informatie).

http://mlhd.opticrop.nl/midinfo/data/11152.html - Microsoft Internet Explorer

Milieu

niet toegestaan in grondwaterbeschermingsgebieden op grondsoorten met minder dan 2% organische stof en minder dan 10% afslibbaar

Opslag

> 0 °C

Milieu meetlat informatie BETANAL TRIO OF

| | |
|-------------------|-----------------|
| Dosering: | 4 l/ha of kg/ha |
| Drift: | 1 % |
| Org.stof gehalte: | 10% |

Toegepast in het voorjaar.

Milieubelastingspunten:

| | |
|-------------|--------|
| Waterleven: | 28,0 |
| Bodemleven: | 8,0 |
| Grondwater: | 1720,0 |

Weed information (see also appendix 3)


Echte kamille - Microsoft Internet Explorer

Afdrukken Venster sluiten


Echte kamille

Matricaria recutita

Hoewel er veel soorten kamille zijn, is de echte kamille gemakkelijk te herkennen. Al bij de kieming is te zien dat zij fijne blaadjes heeft. Een ander duidelijk herkenningsteken zijn de gele bolle bloemhoofdjes waarvan het hart meestal hol is. De witte lintbloempjes hangen 's avonds en 's nachts neer. De echte kamille bloeit van mei tot september; per plant ontstaan 5.000-40.000 zaden. Zij is eenjarig en kiemt zowel in het voorjaar als in de herfst. Zij groeit rechtop en wordt 30 à 80 cm hoog. Echte kamille houdt van vruchtbare, vaak nogal zware en soms kalkarme grond, waarvan de structuur - bijvoorbeeld door dichtslibbing - niet zo best is. Zij kiemt zeer oppervlakkig ongeveer tot een 1/2 cm diep. Zij hoorde oorspronkelijk thuis in Zuid- en Oost-Europa, maar komt nu ook in ons land overal voor. Echte kamille is voor de akkerbouwer een lastig onkruid. Wanneer het in het voorjaar massaal tot ontwikkeling komt, droogt de grond onder de plant moeilijk op. Deze composiet is een van de oude artsenkruiden en nog steeds gezocht om haar genezende kwaliteiten. Drogen we de bloemhoofdjes met hun etherische, heilzame blauwe olie, dan zijn ze geschikt voor gebruik als huismiddeltje. Beroemd is de kamillethee, vooral gebruikt bij koorts en als spoelmiddel bij tandvleesontstekingen, maar ook bekend om haar heilzame invloed bij bloedingen en de laxerende werking. Een aftreksel van kamille werd gebruikt bij pijnlijke ogen en op ruwe handen heeft kamillewater een verzachtende invloed.



De naam kamille is een verbastering van de voormalige Latijnse soortnaam Chamomilla. Het predikaat 'echte' draagt de plant ter onderscheiding van de valse kamille. Deze laatste behoort niet tot het geslacht *Matricaria*, maar tot *Anthemis*. De Latijnse geslachtsnaam *Matricaria* komt van *mater* (moeder, kraamvrouw); dit duidt op het gebruik tijdens de bevalling.



At several positions within MLHD online you can view background information on weeds. You see a description of the weed and one or more pictures.

Zwarte nachtschade - Microsoft Internet Explorer

Afdrukken Venster sluiten

Zwarte nachtschade

Solanum nigrum


De zwarte nachtschade is zoals veel *Solanum*-soorten overal op de wereld vertegenwoordigd. De nachtschadefamilie omvat zeer veel bekende cultuurplanten zoals tabak, aardappel, tomaat en paprika. Veel leden van deze familie en ook de zwarte nachtschade, bevatten een wat geheimzinnige stof, die hen vroeger een plaatsje bezorgde temidden van de 'magische planten'. In aardappelspruiten komt bijvoorbeeld het vergif 'solanine' voor. Sommige leden van de nachtschadefamilie - het bilzekruid bijvoorbeeld - hebben een bedwelmende invloed, vandaar de bijnaam 'heksenkruid'. De zwarte nachtschade zien we vaak op alle vruchtbare en voedselrijke grond, dus in tuinen en op akkerland. Zij is eenjarig en kiemt pas na half mei, omdat de grond eerst op temperatuur moet zijn. Voor nachtvorst is zij bijzonder gevoelig; één koude herfstnacht en zij kan al bevroren zijn. Op voedselrijke grond kan de zwarte nachtschade tamelijk snel groeien en vrij omvangrijk worden. Zij wordt ongeveer 60 cm hoog. De bladeren zitten verspreid aan de vertakte stengels, waaraan tevens de bloemtrosjes komen. De bloempjes lijken veel op die van de aardappel: wit met een gelig hartje. De bloeitijd



Fill in table

At the option “Invultabel” (Fill in table) you choose at the top of the screen crop and herbicide. After this, you can fill in data for maximally 3 weeds at once:

MLHD Online
Welkom W. Nugteren



Start **Gevoeligheidstabel** **Invultabel** Weerbericht Voorkeuren Handleiding Documenten

Kies hier eerst een gewas en een middel: Aardappelen Sencor Wg + Basagran i

| Onkruid | Kamille i | Zwaluw tong i | Zwarte Nachtschade i |
|--------------|--|--|---|
| Gevoeligheid | +++ | ++ | +++ |
| Stadium | 2 blaadjes | 4 blaadjes | kiemlobben gestrekt |
| Gewicht | <input type="text"/> gram | <input type="text"/> gram | <input type="text"/> gram |
| PPM | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| of PS1 | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| MLHD advies | 0.12 Tabel | 0.22 Tabel | 0.03 Tabel |
| | <input type="button" value="Rekenen"/> | <input type="button" value="Rekenen"/> | <input type="button" value="Rekenen"/> |

Mogelijke dosering voor Sencor Wg + Basagran: 0.03 tot 0.25

- Het advies is gericht op gebruik van Sencor WG en Basagran in een LDS. Bij de dosering van Sencor WG en Basagran het doseringsadvies overnemen uit de ‘++ kolom’, met een maximum van 0,15 l/ha voor Basagran en 0.25 kg/ha voor Sencor. Let op rasgevoeligheid van aardappelen voor deze middelen.
- De werking kan versterkt worden door toevoeging van MCPA of Titus. De combinaties hebben echter ook beperkingen, zie hiervoor specifieke advisering aangaande deze combinaties.
- Voor bestrijding van grassen, zie advisering aangaande specifieke grassenmiddelen.

Of course, you will especially fill in the problematic weeds in this screen, either because they are abundant, or because they have become (too) large. Choose per block the weed and the development stage or weight, and then click on the button “Rekenen” (Calculate) to determine the MLHD dose.

In above mentioned example you see that the herbicide combination Sencor+Basagran will have a good to very good effect on the selected weeds “kamille “ (camomile) and “zwarte nachtschade” (black nightshade): the species are very sensitive to normal sensitive to the herbicides. For the “kamille “, the MLHD is 0.12 kg/ha Sencor and 0.12 l/ha Basagran. For the “zwarte nachtschade”, this is 0.03 kg/ha and l/ha, respectively. The weed “zwaluw tong” (black bindweed) with 4 leaves is less sensitive, and requires a higher a dose (MLHD is of 0.22 kg/ha and l/ha, respectively). Following the comparison, you decide which dose that you are going to apply. In general this will be the highest dose found in the tables.

In this screen, you can also fill in (per weed) the MLHD-measurement. If you then click on the button “Rekenen” (Calculate), the adjusted advised dose is showed.

By way of the link "Tabel" (Table) you go to the extensive MLHD advisory table for the chosen combination of herbicide and weed. This advisory table is identical to the one that can be viewed via the sensitivity table route (see example on previous page).

By way of the blue information-buttons you can also view the “Middel informatie” (Herbicide information) and “Onkruid informatie” (Weed information) here.

Weather forecast

By way of the guidance tag "Weerbericht" (weather forecast) you are directed to the module Online weather. There, you will find a current regional weather forecast for the Netherlands. The opening screen shows the Dutch weather forecast: click on a region and at the bottom on a period of the day for which you want to view the weather forecast.

Opticrop online weer
Welkom

Algemeen | **Verwachting** | Weerstation | Radarbeelden

Avond

Overwegend bewolkt en wat regen of motregen. In de avond meer regen.

| Regio Midden | | | | | |
|--------------|----|----|----|----|----|
| Dag | VR | ZA | ZO | MA | DI |
| Zon % | 50 | 60 | 50 | 40 | 50 |
| Neerslag % | 20 | 10 | 40 | 50 | 30 |
| Neerslag mm | 0 | 0 | 3 | 2 | 1 |
| Min °C | 12 | 11 | 14 | 14 | 14 |
| Max °C | 19 | 21 | 24 | 22 | 21 |
| Wind | W | NW | Z | ZW | NW |
| Kracht | 4 | 3 | 3 | 3 | 3 |

Bron: Weerbureau HWS

Middag | **Avond** | Nacht | Ochtend

By way of the guidance tag "Verwachting" (Expectations) you see a detailed weather forecast (per 3 hours) for the Netherlands for the coming 5 days including graphical images. By way of "Radarbeelden" (Radar images) you see the images of the shower radar for the passed and coming hours.

Opticrop online weer
Welkom W. Nugteren

Algemeen | **Verwachting** | Weerstation | Radarbeelden

Opticrop


- Snelwegen (→)
- Spoorwegen (→)
- Grenzen
- Kustlijn
- Sectoren
- Langzaam
- Normaal
- Snel
- Herhalen
- Motregen/sneeuw
- Lichte neerslag
- Matige neerslag
- Zware neerslag
- Zware buien
- Wolkbreuk

19:15 19-06-2003

Preferences

By way of the guidance tag "Voorkeuren" (Preferences) you can make a selection (per crop) of the weeds and herbicides that are important to you within MLHD online. If you only choose the weeds that occur on your field and the herbicide/ herbicide combinations that you use, you can shorten the list considerably. The program will then be more conveniently arranged. At the top, first choose the crop and choose if you want to select weeds or herbicides. Then, select the weeds/ herbicides and click on the button "Opslaan" (Save) to save the selection. By way of "Alles" (Everything) and "Niets" (Nothing) you can select all weeds/ herbicides at once or delete all selections.

MLHD Online
Welkom **W. Nugteren**



Start
Gevoeligheidstabel
Invultabel
Weerbericht
Voorkeuren
Handleiding
Documenten

Instellen voorkeurslijst: Onkruiden

Gewas: Aardappelen Laad lijst

Geef in dit formulier aan voor welke onkruiden u advies wilt bij Aardappelen

| | | |
|--|---|--|
| <input type="checkbox"/> Aardappelopslag | <input checked="" type="checkbox"/> Akkerdistel | <input type="checkbox"/> Akkermelkdistel |
| <input type="checkbox"/> Akkermunt | <input type="checkbox"/> Akkerviooltje | <input type="checkbox"/> Akkerwinde |
| <input type="checkbox"/> Bingelkruid | <input type="checkbox"/> Cichoreiopslag | <input type="checkbox"/> Driedelig Tandzaad |
| <input type="checkbox"/> Duist | <input type="checkbox"/> Duivekervel | <input type="checkbox"/> Duizendknoop |
| <input checked="" type="checkbox"/> Ereprijs | <input type="checkbox"/> Gele Ganzebloem | <input type="checkbox"/> Gladvingergras |
| <input type="checkbox"/> Graanopslag | <input type="checkbox"/> Groene Naalbaar | <input type="checkbox"/> Guichelheil |
| <input type="checkbox"/> Haagwinde | <input type="checkbox"/> Hanepoot | <input type="checkbox"/> Hennepnetel |
| <input checked="" type="checkbox"/> Herderstasie | <input type="checkbox"/> Herik | <input type="checkbox"/> Hoenderbeet |
| <input type="checkbox"/> Hondspeterselie | <input checked="" type="checkbox"/> Kamille | <input checked="" type="checkbox"/> Kleefkruid |
| <input type="checkbox"/> Klein Hoefblad | <input type="checkbox"/> Klein Kruiskruid | <input type="checkbox"/> Kleine Brandnetel |
| <input type="checkbox"/> Knopkruid | <input type="checkbox"/> Koolzaad | <input type="checkbox"/> Kroontieskruid |
| <input type="checkbox"/> Kweek | <input type="checkbox"/> Melden | <input type="checkbox"/> Melganzevoet |

MLHD Online
Welkom **W. Nugteren**



Start
Gevoeligheidstabel
Invultabel
Weerbericht
Voorkeuren
Handleiding
Documenten

Instellen voorkeurslijst: Onkruiden

Gewas: Mais Laad lijst

Geef in dit formulier aan welke voor welke middelen u advies wilt bij Mais

| | | |
|---|---|--|
| <input checked="" type="checkbox"/> Agrichem Bentazon-terbutylazin | <input checked="" type="checkbox"/> Bropyr+terbutylazin | <input checked="" type="checkbox"/> Callisto |
| <input checked="" type="checkbox"/> Laddok N | <input checked="" type="checkbox"/> Lido Sc | <input checked="" type="checkbox"/> Litarol+pyridaat+terbutylazin |
| <input checked="" type="checkbox"/> Mikado | <input checked="" type="checkbox"/> Mikado/callisto + (bropyr+terbutylazin) | <input checked="" type="checkbox"/> Mikado/callisto + Agrichem Bentaz.-terbut. |
| <input checked="" type="checkbox"/> Mikado/callisto + Laddok N | <input checked="" type="checkbox"/> Mikado/callisto + Lido Sc | <input checked="" type="checkbox"/> Mikado/callisto + Samson/milagro |
| <input checked="" type="checkbox"/> Milagro | <input checked="" type="checkbox"/> Samson 4sc | <input checked="" type="checkbox"/> Samson/milagro + (bropyr+terbutylazin) |
| <input checked="" type="checkbox"/> Samson/milagro + Agrichem Bentaz.-terbut. | <input checked="" type="checkbox"/> Samson/milagro + Laddok N | <input checked="" type="checkbox"/> Samson/milagro + Lido Sc |

Alles
Niets
Opslaan

Appendix 1 List of herbicides compatible with MLHD

Photosynthesis inhibitors affect the photosynthesis process of plants shortly (hours) after application. This can be measured with MLHD-meters; for contact mode of action herbicides within 2 days after application, and for soil mode of action after emergence of the weeds. Herbicides from the group of photosynthesis inhibitors are mentioned hereafter.

Plants treated with triketones and certain amino acid production inhibitors (glyphosate, glufosinate ammonium) will also show an effect on the photosynthesis process in the plant within days after treatment. The effect can be measured with MLHD-meters too. The meaning of the readings differ a little from those of PS-inhibitors (threshold values will be published soon).

| Herbicide group | Subgroup | Active ingredients | Trade names (most common ones) | |
|--|---------------------|----------------------|--------------------------------|--------------------|
| Photosystem II inhibitors HRAC group C1 | Phenyl-carbamates | Phenmedipham | Betanal | |
| | | Desmedipham | | |
| | Triazines | Triazines | Chloridazon | Pyramin |
| | | | Terbutylazine | Gardoprim, Lido SC |
| | | | Ametryne | Gesapax |
| | | | Atrazine | Gesaprim |
| | | | Cyanazine | Bladex |
| | | | Prometryn | Gesagard |
| | | | Propazine | Milogard |
| | | | Simazine | Gesatop |
| | | | Terbumeton | Caragard |
| | | | Terbutryne | Igran, Terbutrex |
| | | | Trietazine | Remtal |
| | Triazines | Triazines | Metribuzin | Sencor |
| | | | Hexazinone | Velpar |
| Metamitron | | | Goltix | |
| Uracils | Uracils | Bromacil | Hyvar | |
| | | Lenacil | Venzar | |
| | | Terbacil | Sinbar | |
| Photosystem II inhibitors HRAC group C2 | Amides | Propanil | Surcopur | |
| | Ureas | Ureas | Chlorotoluron | Dicuran |
| | | | Dimefuron | Pradone |
| | | | Diuron | Karmex |
| | | | Fluometuron | Cotoran |
| | | | Isoproturon | Arelon |
| | | | Linuron/monolinuron | Afalon, Aresin |
| | | | Methabenzthiazuron | Tribunil |
| | | | Metobromuron | Patoran |
| | | | Metoxuron | Dosanex, Purivel |
| | | | Neburon | Kloben |
| Tebuthiuron | Spike | | | |
| Photosystem II inhibitors HRAC group C2 | Benzothiadiazinones | Bentazone | Basagran | |
| | | Bentazone + atrazine | Laddok N | |
| | Nitriles | Bromoxynil | Litarol | |
| | | loxynil | Actril | |
| | Phenyl-pyridazines | Pyridate | Lentagran | |
| Photosystem I inhibitors HRAC group D | Bipyridyliums | Diquat | Reglone | |
| | | Paraquat | Gramoxone | |

Appendix 2 Meaning of readings of MLHD-meters

Since 2002 there are 2 types of MLHD-meters in use: a PS1-meter and a PPM-meter. The meters are explained in appendix 4. Because the scale of the readings of the PPM-meter is exactly the opposite of the PS1-meter, you have to be careful that you fill in correctly in MLHD online. The PPM-meter gives readings on a scale from 0 (no photosynthesis at all) to 80 (completely healthy). As a threshold value, a reading lower than 20 predicts that the weed is likely to die if treated with a Photosynthesis inhibiting herbicide. The PS1-meter gives readings on a scale from 0 (no damage to photosystem 1, completely healthy) to 100 (all photosystems 1 are blocked, no photosynthesis at all). As a threshold value, a reading higher than 80 predicts that the weed is very likely to die if treated with a photosynthesis inhibiting herbicide.

In MLHD online you can enter your readings in 5 classes to obtain dose advices. The ranges of readings falling into particular classes are shown hereafter. The meaning of readings per class are given too (they apply for annual weeds and one year old perennial weeds). Additional treatments are required if readings are in the classes 2, 3, 4 and 5 depending on weed density and crop development stage.

| Class | Range PPM-readings | Range PS1-readings | Predicted effect on weeds |
|-------|--------------------|--------------------|---|
| 1 | < 15 | > 80 | > 99 % control |
| 2 | 15-20 | 65-80 | > 90 % control, additional treatment if crop is still 'open' |
| 3 | 20-35 | 50-65 | Moderate effect (growth reduction), additional treatment required |
| 4 | 35-50 | 30-50 | Small effect, additional treatment |
| 5 | > 50 | < 30 | Hardly any effect, additional treatment |

If readings fall into a particular class, a next treatment with a PS-inhibiting herbicide can be reduced by a certain percentage. The reduction percentage depends on crop development stage, weed density and dose. Precise dose advices can be obtained from MLHD online. If you do not have access, a user can use the following reduction percentages, and apply this on the doses given in Appendix 3 (do never apply less than the minimum dose given in the table):

Class 1: no additional treatment needed

Class 2: 30 – 50 % reduction

Class 3: 10 – 30 % reduction

Class 4: 0 – 10 % reduction

Class 5: no reduction

The reduction percentages also apply for next treatments of weeds that emerged from a soil treated with a PS-inhibiting soil herbicide.

| PPM-range | PS1-range | Predicted effect on crop |
|-----------|-----------|---|
| > 60 | 0-15 | No effect |
| 50-60 | 15-30 | Small effect (temporary reduction of photosynthesis by about 20 %) |
| 35-50 | 30-50 | Moderate effect (temporary reduction of photosynthesis by about 40 %) ¹⁾ |
| < 35 | > 50 | Large effect (temporary reduction of photosynthesis by > 40 %) ¹⁾ |

¹⁾ Attainable crop yield will be lower if the readings remain at this level for a week or more.

Appendix 3 Latin and Dutch names of weeds plus some sensitivity tables

Dose advises are species dependent. Sensitivity tables for weeds and herbicides tested under Dutch conditions are available in MLHD online. Hereafter a list of weeds in MLHD online is given (Latin name, Dutch name and pest indicator names according to industry standard).

| Latin name | Pest indicator | Dutch name in MLHD online |
|---------------------------------------|----------------|---------------------------|
| <i>Solanum tuberosum</i> (volunteers) | SOLTUB | Aardappelopslag |
| <i>Cirsium arvense</i> | CIRARB | Akkerdistel |
| <i>Sonchus arvensis</i> | SONARB | Akkermelkdistel |
| <i>Mentha arvensis</i> | MENARB | Akkermunt |
| <i>Calystegia sepium</i> | CAGSEB | Haagwinde |
| <i>Tussilago farfara</i> | TUSFAB | klein hoefblad |
| <i>Elymus repens</i> | AGRREB | Kweek |
| <i>Stachys palustris</i> | STAPAB | Moerasandoorn |
| <i>Equisetum</i> species | EQUSSB | paardestaart |
| <i>Polygonum amphibium</i> | POLAMB | veenwortel |
| <i>Alopecurus myosuroides</i> | ALOMYB | duist |
| <i>Digitaria ischaemum</i> | DIGISB | gladvingergras |
| <i>Triticum</i> (volunteers) | | graanopslag |
| <i>Setaria viridis</i> | SETVIB | groene naalbaar |
| <i>Echinochloa crus-gali</i> | ECHCGB | hanepoot |
| <i>Lolium</i> species | | raagrassen |
| <i>Poa annua</i> | POAANB | straatgras |
| <i>Avena fatua</i> | | wilde haver |
| <i>Apera spica-venti</i> | APESVB | windhalm |
| <i>Viola arvensis</i> | VIOARB | akkerviooltje |
| <i>Mercurialis annua</i> | MERANB | bingelkruid |
| <i>Bidens tripartita</i> | BIDTRB | driedelig tandzaad |
| <i>Fumaria officinalis</i> | | duivekervel |
| <i>Polygonum</i> species | | duizendknoop species |
| <i>Veronica</i> species | VERSSV | ereprijs |
| <i>Chrysanthemum segetum</i> | CHYSEB | gele ganzebloem |
| <i>Anagallis arvensis</i> | | guichelheil |
| <i>Galeopsis tetrahit</i> | | hennepnetel |
| <i>Capsella bursa</i> | CAPBPB | herderstasje |
| <i>Sinapis arvensis</i> | SINARB | herik |
| <i>Lamium amplexicaule</i> | LAMAMB | hoenderbeet |
| <i>Aethusa cynapium</i> | AETCYB | hondspeterselie |
| <i>Matricaria</i> species | MATSSV | kamille |
| <i>Galium aparine</i> | GALAPB | kleefkruid |
| <i>Senecio vulgare</i> | SENVUB | klein kruiskruid |
| <i>Urtica urens</i> | URTURB | kleine brandnetel |
| <i>Galinsoga parviflora</i> | GASPAB | knopkruid |
| <i>Brassica napus</i> | BRSNNB | koolzaad |
| <i>Euphorbia helioscopia</i> | EPHHEB | kroontjeskruid |
| <i>Atriplex</i> species | ATXSSB | melden |
| <i>Chenopodium album</i> | CHEALB | melganzevoet |
| <i>Stellaria media</i> | STEMEB | muur |
| <i>Geranium</i> species | | ooievaarsbek |
| <i>Lamium purpureum</i> | LAMPUB | paarse dovenetel |
| <i>Amaranthus retroflexus</i> | AMAREB | papegaaiekruid |
| <i>Polygonum persicaria</i> | POLPEB | perzikkruid |
| <i>Spergula arvensis</i> | SPRARB | spurrie |
| <i>Polygonum aviculare</i> | POLAVB | varkensgras |

| | | |
|--------------------------------|--------|--------------------|
| Bidens tripartitus | | veerdelig tandzaad |
| Myosotis spp. | MYOSSB | vergeet-mij-niet |
| Polygonum hydropiper | POLHYB | waterpeper |
| Thlaspi arvense | THLARB | witte krodde |
| Polygonum convolvulus | POLCOB | zwaluwtong |
| Solanum nigrum | SOLNIB | zwarte nachtschade |
| Convolvulus arvensis | CONARB | akkerwinde |
| Cichorium intybus (volunteers) | UNKN | cichoreiopslag |
| Atriplex patula | ATXSSB | uitstaande melde |

The PS1-meter is developed by ATO B.V. for use in the MLHD-method. The PS1-meter is manufactured by Rometron in the Netherlands, and distributed by Agrifirm, the Netherlands.

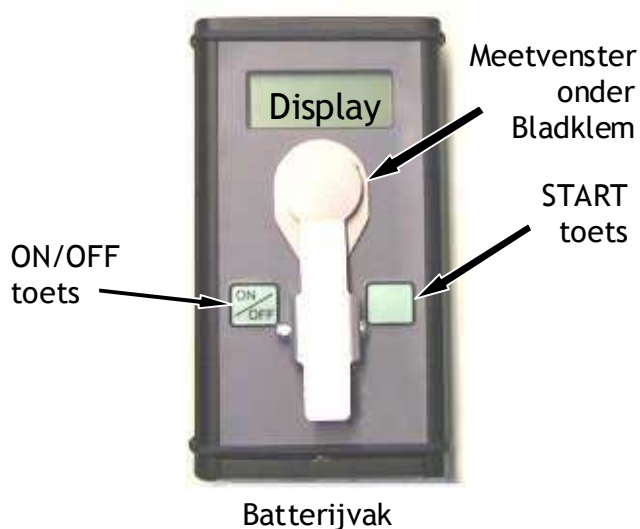
PS1 means Photosystem 1. The PS1-meter measures the absorption of light by the plant tissue under investigation (e.g. weed leaves, in the case of MLHD the youngest measurable leaf). Measurements can be done in the field, the reading is not affected by surrounding light when the leaf clip is closed.

The PS1-meter gives readings on a scale from 0 (no damage to photosystem 1, completely healthy) to 100 (all photosystems 1 are blocked, no photosynthesis at all). As a threshold value, a reading higher than 80 predicts that the weed will die if treated with a photosynthesis inhibiting herbicide. Pay attention: the minimal value for an effective treatment differs between herbicide groups, and can be affected by climatic factors and plant size. To use the MLHD-meter responsibly, some experience is required.



Operation PS1-meter

- Switch on the device by pressing the ON/OFF button.
- After a short test the device is ready to use; 'rdy' (ready) appears in the display.
- Place the leaf with the upper side against the "meetvenster" (measuring window) in the "bladklem" (clip) (do not measure the underside of the leaf, this results in a less accurate measurement).
- Press the START button.
- After a measurement of 3 seconds the value appears in the display. Do not touch the leaf and the clip during the measurement. This is an extremely sensitive measurement and the smallest movement of the leaf under the clip can influence the measurement.
- Interpret the result. De meter measures the effect of the herbicide on the plant, expressed in percentage damage. A high value signifies a large effect.
- Switch off the device by pressing again on the ON/OFF button.
- The device switches off itself when it is not used for 3 minutes.
- If leaves are wet, remove the moist from the leaves before measuring
- If weeds are too small (e.g. when leaves are 1-2 mm wide), place several leaves in the "bladklem" (clip).



Maintenance

The PS1-meter is splash waterproof (IP65). When not in use, store the meter in a dry environment. The glass measuring window has to be cleaned regularly. For this, use a clean, slightly moist cloth. For persistent dirt, you can use a small amount of alcohol or spirit. Never use refined petrol or other solvents.

When the battery gets empty the indicator 'LOBAT' appears in the display. Dependent of the type of battery used, you can still measure for a considerable period of time until the device switches off itself and the battery has to be replaced. Use a screwdriver to open the battery compartment. Pay attention to the polarity of the newly connected battery.

Technical details

| | |
|----------------------|---|
| Housing: | Aluminium, splash waterproof according to IP65. |
| Dimensions: | LxWxD = 147x85x35 (D=52mm including leaf clip) |
| Weight: | 275-gram including battery. |
| Feed: | 9 Volt block battery, alkaline or rechargeable. |
| Energy use: | an alkaline battery is good for approximately 2000 measurements. |
| Poweroff function: | The device switches off itself when it is not used for ± 3 minutes. |
| Measuring principle: | light induced absorption change in photosystem 1 (Licensed PS1 technique) |
| Sensor: | combination of LED's and photodiodes under measuring window of toughened glass. |

More information:

Agrifirm (distributor PS1-meter)

| | |
|-----------------|-------------------------------|
| Contact person: | A. Venhuizen |
| Address: | Noordeinde 31, 7941 AS Meppel |
| Tel.: | + 31 622 97 8077 |
| Fax: | + 31 522 268 930 |

Plant Research International (developer MLHD)

| | |
|-----------------|---------------------------------|
| Contact person: | C. Kempenaar |
| Address: | P.O. Box 16, 6700 AA Wageningen |
| Tel.: | + 31 317 475 701 |
| Fax: | + 31 317 423 110 |
| Email: | corne.kempenaar@wur.nl |

ATO (principles of PS1-meter)

| | |
|-----------------|----------------------------|
| Contact person: | R. van den Boogaard |
| Email: | riki.vandenboogaard@wur.nl |

The PPM-meter is a product of the firm EARS in Delft. PPM is short for Plant Photosynthesis Meter. The meter operates on the basis of measurements on fluorescence of plants. The scale ranges from approximately 80 (no growth inhibiting) to 0 (no growth).



The energy for photosynthesis is provided by light that is intercepted by the chlorophyll of the plant. When a photon (light part) is absorbed, an electron in the antenna is shot into a higher orbit (excited). This state only lasts for a short period of time and can be ended in 3 ways:

1. The electron takes part in the photosynthesis reaction
2. The electron falls back and releases a photon (fluorescence)
3. The electron falls back and releases heat

These 3 possibilities together correspond with 100% of the absorbed light. The fraction of the absorbed light that is used for photosynthesis is called the photosynthesis yield (F_p). The part that is released again is called the fluorescence yield. The photosynthesis yield is determined by the PPM out of the fluorescence yield. The fluorescence yield is very low, less than 1%. Measuring this is very hard and is successfully realised in PPM. The PPM contains a red light source. This light source is weak, so that the plant is not influenced and is modulated (7200 Hz) so that it can be differentiated from ambient light. The light source stimulates fluorescence in the plant that is measured by a photo diode.

The device carries out 2 measurements within 1 second, starting with the chlorophyll-fluorescence in ambient light (F). After this a strong light is switched on that completely saturates the leaf with light so that photosynthesis is blocked. Through this, the fluorescence rises in a short time to a maximum value (F_M). The PPM now calculates the photosynthesis yield with $F_p = 1 - F/F_M$, and presents this to the user. The complete measurement only takes one push on a button. The photosynthesis yield depends on the intensity of the ambient light. This yield is the highest in the (near) dark, namely 70-80%. Herbicides that act on photosynthesis inhibit photosynthesis. Through this the PPM measured photosynthesis yield decreases in a very short time to very low values, in general less 15%.

More information:

EARS

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The Netherlands
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Fax: + 31 15 262 3857
Email: ears@ears.nl
Internet: www.ears.nl