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1. Introduction

Common weed control methods on pavements are chemical control (herbicides), brushing, flaming, mowing and hot water treatment (Kempenaar *et al.*, 2006; Kempenaar & Vermeulen, 2006; Kortenhoff *et al.*, 2001). Managers of pavements often choose for herbicide weed control on pavements because this method is most cost-effective and most easy to use. Four out of five municipalities in the Netherlands applied in 2001 herbicides on pavements (Ekkes *et al.*, 2002; Kempenaar & Spijker, 2004). If we look at pavements on industrial sites, (air)ports and railroads, this ratio is even higher. Today, glyphosate is the mostly used herbicide on pavements in the Netherlands.

An important side effect of herbicide use on pavements is runoff to surface waters, where the chemicals may adversely affect ecology and/or drinking water production. Herbicide concentrations in main rivers in the Netherlands sometimes exceed the drinking water threshold, adversely affecting drinking water production in the Netherlands because much of the drinking water in the Netherlands is produced from surface waters of the main rivers. The drinking water threshold concentration is 0.1 µg per litre per individual pesticide and 0.5 µg per litre for all pesticides. The eco-toxicological threshold (MPC or EQS) is seldom exceeded. The maximum permissible concentration (MPC) of glyphosate in surface water in the Netherlands, which is the Dutch eco-toxicological threshold for this compound, is 77 µg per litre (*e.g.* Withagen *et al.*, 2004). The physical chemical properties of glyphosate (high solubility in water, high sorption to soil particles) make the compound very sensitive to surface runoff while it hardly leaches to groundwater (Luijendijk *et al.*, 2003; Ramwell & Hollis, 2003, Beltman *et al.*, 2001). In a risk evaluation study of Saft & Staats (2002), a runoff factor for herbicides on pavements of 50% is used. When applied with restrictions of the SWEEP system (see www.dob-verhardingen.nl or www.weedcontrol.eu), the runoff can be reduced below 10% (average 2%, max 5.7%). At this level, side affects of herbicide weed control are in the same order as those of the non chemical methods (Kempenaar & Saft, 2006; Van Dijk *et al.*, 2006).

To meet objectives for drinking water and EU water frame work, professionals that apply herbicides on pavements should give high priority to good, and if possible selective application technology, minimization of herbicide doses, and optimal weather conditions (see e.g. guidelines of SWEEP system). During the last 15 years, much progress has been made with selective application technology for herbicide use on pavements (Kempenaar & Leemans, 2005). Spray equipment that only spray on spots where weeds grow by using weed sensors, are now available. These technologies allow reductions in herbicide use on pavements of more than 50% compared to strip or band spraying. Today in the Netherlands, herbicides on pavements can only be sprayed with selective application technology by law.

In this report a study on selective herbicide application technology is presented. An improved model of the Weed IT sensor operated sprayer was tested. Observations were done in 3 experiments on spray volume and dose - effect relationships of the new machine in comparison with an older model. The study was carried in cooperation with Kamps de Wild in Zevenaar, NL. The work linked with the 2006 R&D program for sustainable weed control on pavements of the Dutch Ministry of Agriculture.

2. Materials and methods

2.1 Experimental locations and weed flora

The experiments were carried out on two locations. Experiments 1 and 2 were carried out on an industrial site in the city of Wageningen in the Netherlands (the former IMAG site). Experiment 2 was repeated on an extensively used road of an industrial site in Duiven, The Netherlands. Experiments 1 and 2 started in May 2006, experiment 3 (the repetition of experiment 2) in June 2006.

Each experimental location was an extensively used pavement with joints. The pavements were brick stones or concrete blocks; the length of joints was circa 15 m per m^2. Weed infestation of the pavements was moderate to severe; soil cover by weeds ranged locally from less than 1% to more than 70%. The height of weeds ranged from a few cm to 25 cm. Dominant weed species are shown in Table 1. Images of weed infestations and pavements are given in Figure 1 for experiments 1 and 2 and Figure 2 for experiment 3.

Table 1. Dominant weeds species in the experiments (Dutch names between ( )).

Experiment	Dominant weed species
1	*Holcus spp*. (Witbol), *Poa annua* (Straatgras), *Taraxacum officinale* (Paardebloem), *Plantago major* (Grote weegbree), *Bellis perennis* (Madeliefje)
2	*Holcus spp*. (Witbol), *Poa annua* (Straatgras), *Taraxacum officinale* (Paardebloem), *Plantago major* (Grote weegbree), *Bellis perennis* (Madeliefje)
3	*Poa annua* (Straatgras) and *Plantago* species (Weegbreesoorten)

Figure 1. Images of weed infestations in experiments 1 and 2.

Figure 2. Overview of experiment 3. Plots were laid out on the weedy part (left side) of the pavement.

2.2 Weed IT sprayers

Two models of Weed IT were tested. A new model, Weed IT 2006 MKII, was compared with the standard model of 2005, Weed IT I-100 In experiments 2 and 3, only the new model was tested. The machines are shown in Figure 3.

Figure 3. The new Weed IT 2006 MKII model (left) and the standard Weed IT I-100 model (right).

Weed IT is a brand name for sensor operated sprayers. Weed IT uses fluorescence technology to detect weeds on pavements. Nozzles are opened when signalled by a sensor. This technology allows a reduction of more than 50% in herbicide use on pavements compared to swath treatment / band spraying (Kempenaar & Leemans, 2005).

The new Weed IT model differs from the standard model in several aspects amongst which improved sensing technology, more nozzles per m of spray boom and a speed dependent spray volume adjustment system. Some properties of two models of Weed IT and how they were set in the experiments are shown in Table 2. More details of the sprayers can be obtained from the distributor Kamps de Wild in Zevenaar or the Manufacturer Rometron in

Doorwerth. Figure 4 shows an overview of the nozzles and dosing system of the new Weed IT model. The Dosatron dosing system can be set to inject the herbicide in the spray solution in a concentration ranging from 0,8% to 5.5%.

Table 2. Properties and settings of Weed IT sprayers.

	Weed IT sprayer	
	Model I-100	Model 2006 MKII
Number of nozzles per m spray boom	5	12.5
Sensing-spray width per nozzle (cm)	20	8
Spray pressure (bar)	2	2
Type of nozzle	TP 40001 ^{E}	TP 400067 ^{E}
Spray volume per nozzle 5-6 km per h (l/ha) *	150	105
Spray volume per nozzle 8 km per h (l/ha) *	105	105
Speed dependent adjustment of spray volume	active 2 – 6 km/h	active 1,5 – 12 km/h
Rate of operation	5 – 6 km/h	5 – 6 km/h

* *When all nozzles are open, the spray volume is a little higher due to overlap of spray cones. For the 2006 model spray volume on strip basis is 120-130 l/ha when all nozzles are open.*

Figure 4. Sprayer hardware of the Weed IT 2006 MKII, with a nozzle sensor unit every 8 cm. On bottom row, pictures of spray release sampling with plastic bags over each nozzles.

2.3 Spray release by Weed IT models (experiment 1)

Spray release was tested on six pavement strips and one grassland strip of 30 m length each. Date of experimentation was 16 May 2006 (between 9.00 and 12.00; weather conditions, see DOB-fax in Appendix). The six strips differed in mean soil cover by weeds. They were selected on the basis of a homogenous distribution of a certain level of weeds in the strip. Mean soil cover per strip was assessed by eye and by image analysis. The latter data are presented in this report. Mean soil cover by weeds in a strip was determined by taking 2 digital images (see Figure 5) with a standard digital camera at representative positions in the strip. The green pixels ratio per image was determined with a modified ImageJ image analysis module. Mean soil cover per strip was 0.5, 0.6, 1, 2, 5 or 13% soil cover by weeds. In addition a grassland strip with 95% soil cover by green biomass was tested. Figure 5 shows how the green surface area (the green pixelsl) is visualized by ImageJ in black and white.

Spray releases were collected and weighed per nozzle per run over a strip. This measurement was done two times per strip. For this purpose, a large number of plastic bags with known net weights were available. The bags were connected to the nozzle holders before each run using rubber spanners in a way that total spray release per nozzle was deposited in the bag. After each run, the gross weight of the bags was determined. The bags could contain up to 150 ml of spray liquid. Correspondence between mean spray release per strip of 30 m by 1 m, and mean soil cover by weeds as determined by ImageJ image analysis program was studied with regression analysis.

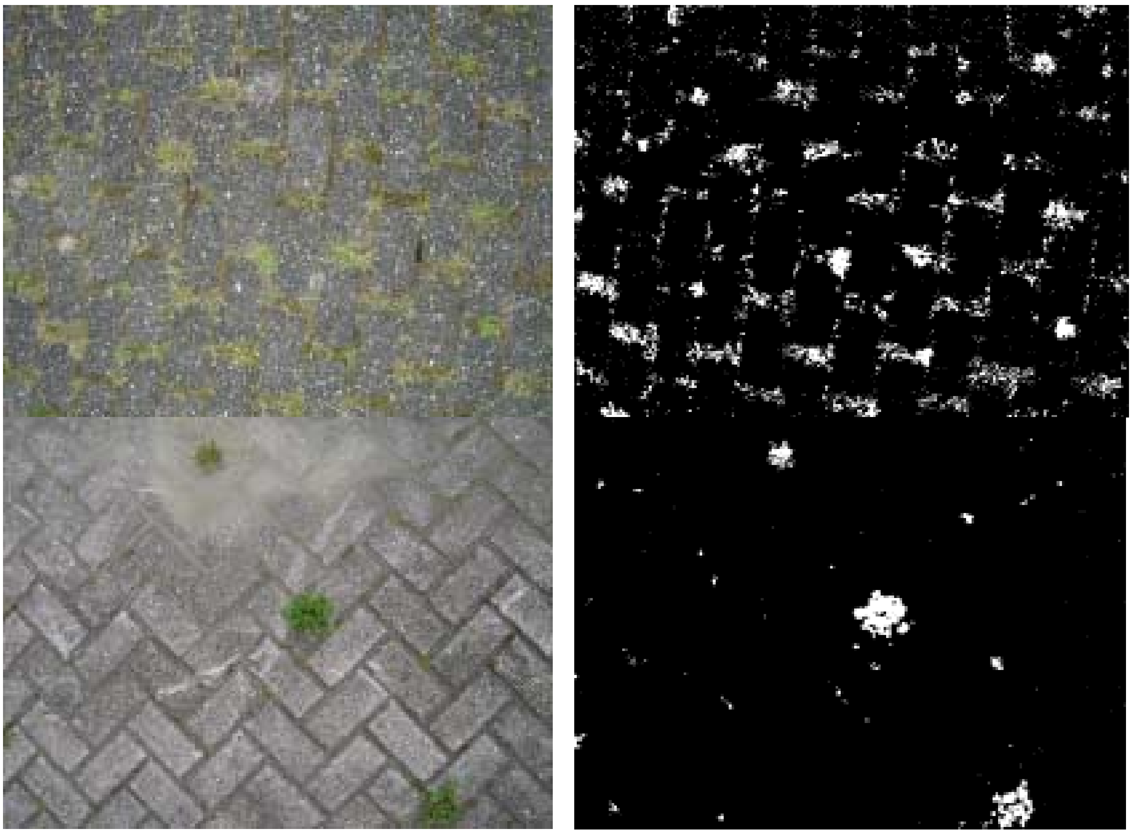

Figure 5. Two more images of weed infestations in experiment 1 and black and white images made by ImageJ analysis program.

2.4 Dose response experiments

Two dose response experiments were carried out with the new Weed IT model in Wageningen in May-June 2006 (experiment 2 in this report) and Duiven in June-July 2006 (experiment 3).

In the first dose response experiment (experiment 2), plots were laid out in four blocks. Each block had six plots with each a net area of 5 by 1 m (length x width). Six herbicide doses were tested within each block: 0, 0.8, 1.4, 1.7, 2.0 and 2.4 l/ha Roundup Evolution (a.i. glyphosate 360 g/l). The six doses were randomly divided over the six plots per block. On strips adjacent to the experimental field, doses of 3.0 l/ha and 2 times 0.8 l/ha Roundup Evolution® were tested. The plots of experiment 2 were sprayed on May 16, 2006, between 12.00 and 14.00. Air temperature was 18-20 °C, relative humidity was 70 - 80% and the sky was cloudy (see DOB-fax in appendix). The dose recommendation of Roundup Evolution on the fax was 1.75%. In some plots on this field, a few bricks were sudsided causing lstrong movement of the machine on these spots while spraying.

The second dose response experiment (experiment 3 in this report) had seven in stead of six experimental doses: 0, 0.8, 1.4, 1.7, 2.0, 2.4 and 3 l/ha Roundup Evolution. There were two blocks with each seven plots, and the seven experimental doses were randomly divided over the seven plots in each block. The plots of experiment 3 were sprayed on June 15, 2006, between 10.00 and 12.00. Air temperature was 17-19 °C, relative humidity was > 90% and the sky was cloudy (see DOB-fax in appendix). During June 5 and after application, some precipitation (< 1 mm of water) fell on the experimental field. The dose recommendation of Roundup Evolution on the DOB-fax was 1.25%.

The Weed IT model 2006 MKII was used to apply the herbicides at settings shown in Table 2. Doses were set with the Dosatron system. Important weed species on the fields are shown in Table 1. The weed flora in experiment 2 was quite diverse with an estimated average soil cover by the weeds of 10%. In experiment 3, *Poa annua* was the dominant species and soil cover by this species was in the order of 10 to 20%.

Observations on weed control

The response of the weeds to the herbicide treatments in experiment 2 and 3 was evaluated by visual assessments. Table 3 shows the scale that was used in the assessments. The scale is differentiated to 'time of observation'. The first assessment was done one week after treatment (column 2 of Table 3) at a time plant mortality had not yet occurred, but symptoms were visible. During the second and final assessment, 2 to 4 weeks after herbicide application, biomass reduction of the weeds relative to untreated was estimated (column 3 of Table 3).

Table 3. Scale for evaluation of response of weeds to glyphosate.

Class	One week after treatment	Two to four weeks after treatment
0	No response	No reduction compared to untreated
1	Intermediate	5% reduction of weed biomass
2	Very light reaction	10% reduction of weed biomass
3	Intermediate	20% reduction of weed biomass
4	Light reaction	35% reduction of weed biomass
5	Intermediate	50% reduction of weed biomass
6	Moderate reaction	65% reduction of weed biomass
7	Intermediate	80% reduction of weed biomass
8	Strong reaction	90% reduction of weed biomass
9	Intermediate	95% reduction of weed biomass
10	All plants have died	100% reduction of biomass

3. Results and discussion

3.1 Spray release by Weed IT models

Figure 6a shows mean spray releases per unit of area for experiment 1 and the two Weed IT models tested. The 2006 model of Weed IT (MKII) sprayed significantly less per ha than the standard model of 2005. In the range of practical weed infestation (soil cover 2 to 10%, see Figure 6b), the old model sprayed 40 to 120 litres spray volume per ha while the new 2006 model 20 to 40 l per ha. The reduction in spray release of the new model compared to the old model was between 50 and 80%, depending on mean soil cover by weeds. An average reduction of 69% was observed.

Logarithmic functions were used to model the relation between soil cover and spray release per unit of surface area. The functions and corresponding curves are shown in Figures 6a and 6b too. The curves visualize the difference in spray release between the two sprayers. The difference is a result of an improved sensor – nozzle system (5 or 12.5 sensors - nozzles per m spray boom, precision is more than doubled) and improved operation software for individual sensors – nozzles (yes or no speed adjustment for dosing. The coefficient of variation of spray releases of the different nozzles was 4% for the 2006 model and 9% for the 2005 model. At high soil cover levels (see 95% points in Figure 6a), the spray releases at strip or swath basis were a little higher than the settings in Table 2 (105 and 150 l/ha). This higher spay volume of about 10% is the result of overlap of spray cones when all nozzles are open.

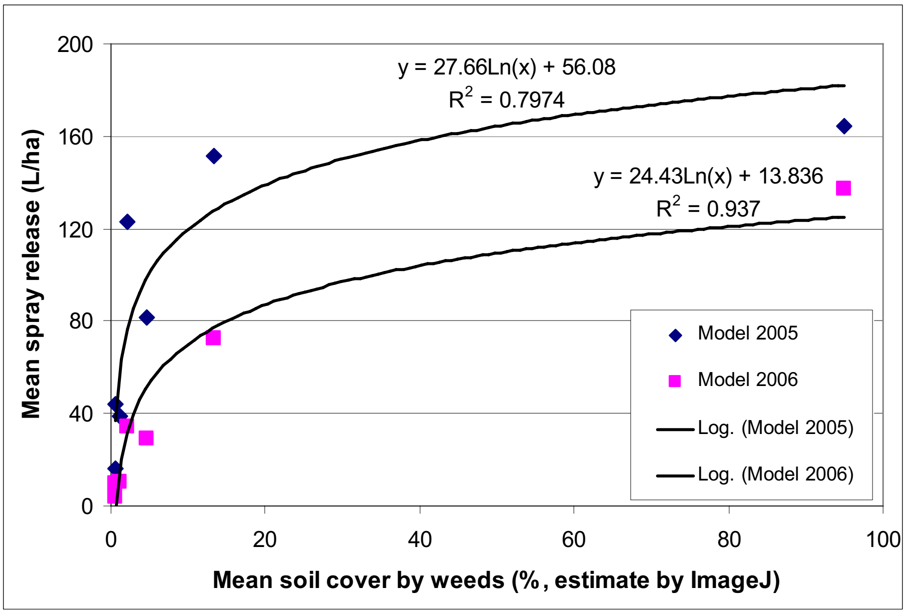

Figure 6a. Relation between soil cover by weeds and spray release of two models of Weed IT sprayers in experiment 1 in Wageningen (16 May, 2006).

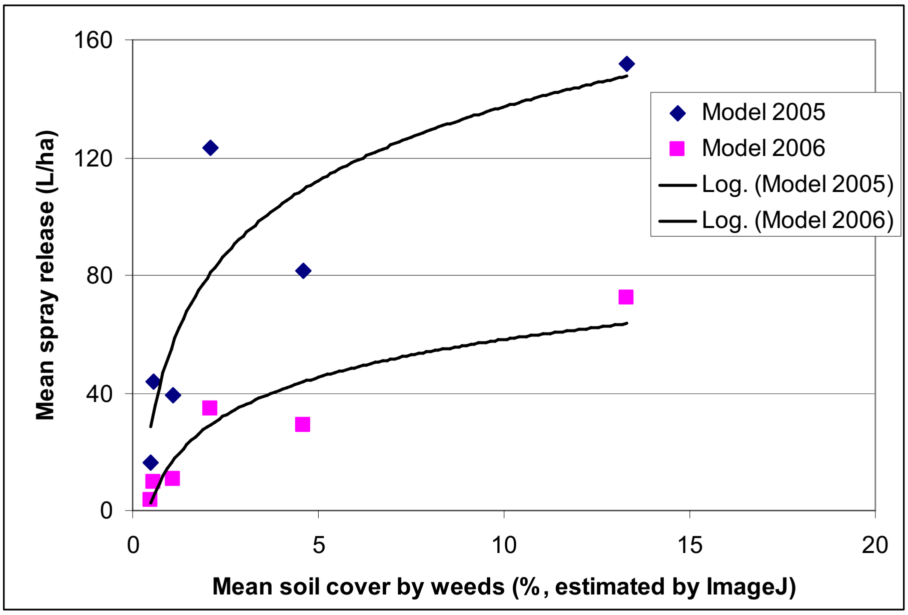

Figure 6b. *Relation between soil cover by weeds and spray release of two models of Weed IT sprayers in experiment 1 in Wageningen (16 May, 2006) in the range of practical weed infestations.*

3.2 Dose response experiments Roundup Evolution applied and Weed IT

The dose response experiment in Wageningen (experiment 2) showed a large and significant effect of herbicide application (treated versus untreated), but only a small effect of herbicide dose. At the lowest dose tested (0.8 l Roundup Evolution/ha), the effect on the weed flora was already quite big for both observation dates at 7 and 27 days after treatment (see Table 4). Effects were only a little bigger at higher doses. The highest dose tested (2.5 l/ha) did not yield complete control. There were no significant effects of doses on the responses of the weed flora at 7 or 27 days after treatment according to an LSD-test (P=0.05).

We expected a stronger dose response relation then the one we observed in experiment 2. Absence of a strong relation may be the result of some unevenness (holes and bumps) of the pavement, causing sudden strong movements of the spray boom during spraying, which could have caused less and uneven herbicide deposition on weeds. This suggests that the new Weed IT model is programmed and calibrated too narrow for uneven pavements.

Because of the weak dose response relation in experiment 2, the experiment was repeated in Duiven on a more even pavement (experiment 3). Despite the absence of a strong dose response relation and absence of complete control at the highest dose tested in experiment 2, the following aspects can still be concluded:

- *Poa annua* was the most sensitive weed species in the experiment (> 95% control at 1.5 l/ha).
- *Holcus spp.*, *Plantago major*, *Bellis perennis* showed high levels of at 2.1 l/ha.
- *Festuca, Trifolium* and *Taraxacum spp.* required a dose > 2.4 l/ha to be killed.
- Complete control was obtained on strips adjacent to the experiment at doses of 3.2 l/ha and two times 0.8 l/ha.
- The dose recommendation on the DOB-fax of May 16 probably would have been effective in this situation (2.6 l/ha, which is 1.75% and 150 l spray volume per ha).

The doses presented in this report apply to strip application / band spraying of Roundup evolution and a sprayer set to spray of 105 l spray volume per ha. However, selective spot spraying was done on the experimental field. The actual spray volume in experiment 2 was between 40 and 80 l spray volume per ha depending on variation in weed density in the plots.

Table 4. Response of weed flora to Round Evolution in experiment 2 in Wageningen. Day of treatment was 16 May 2006. The weed response classification is explained in Table 3. Mean response of 4 replicates are shown. Means per column are significant different according to an LSD-test when they are followed by a different letter.

Treatment		Response of weeds / weed control	
(Set point	Dosatron (%) - Dose (l/ha)	May 23	June 12
0	- 0	0 b	0 b
0.8	- 0.8	6.8 a	8.4 a
1.4	- 1.5	6.5 a	8.8 a
1.7	- 1.8	6.3 a	8.5 a
2.0	- 2.1	7.3 a	8.8 a
2.4	- 2.5	7.8 a	9.0 a
Extra observations			
3.0	- 3.2	8.0	10
2 x 0.8	- 2 x 0.8	9.0	10

In experiment 3, the dose response relation was stronger than in experiment 2 (compare columns 2 of Tables 4 and 5). The effect of dose was larger in experiment 3 than in experiment 2 at 7 days after treatment. The dose effect relation was less obvious at the last observation date. At 14 days after treatment, five of six herbicide doses showed 100% control. *P. annua*, the dominant species on the field, was controlled at doses of 1.5 l/ha and higher. The dose recommendation on the DOB-fax of June 15 probably would have been effective in this situation (1.9 l/ha, which is 1.25% and 150 l spray volume per ha). The dose recommendation on the fax did not account for the fact that the dominant species on the field was relatively much sensitive to Roundup evolution.

Table 5. Response of weed flora to Round Evolution in experiment 3 in Duiven. Day of treatment was 15 June 2006. The weed response classification is explained in Table 3. Mean response of 2 replicates are shown.

Treatment		Response of weed / weed control	
(Set point	Dosatron (%) - Dose (l/ha)	June 22	June 29
0	- 0	0	0
0.8	- 0.8	4.5	8
1.4	- 1.5	5.5	10
1.7	- 1.8	6.0	10
2.0	- 2.1	7.0	10
2.4	- 2.5	7.5	10
3.0	- 3.2	8.0	10

Observations in practice

The new Weed IT model was tested in practical situations in 2006 by two weed control contractors in the south west of the Netherlands (personal communications Roel de Jonge). Preliminary results showed that reductions in herbicide use at the level of municipalities can be 40 to 60% compared to the 2005 Weed IT model, depending on how intensively the spray lance was used. These reductions are in line with the observation in this report that on average a reduction of 69% is possible. In the practical situations, the average Roundup evolution use was estimated to be 0.35 to 0.5 l/ha, which is more than 50% less than the dose cap of the DOB-system (www.dob-verhardingen.nl).

4. Summary and conclusions

Two models of Weed IT (standard I-100 2005 model and new MKII 2006 model) were tested on spray volume and dose response relationships for weed control on pavements. The experiments were done on extensively used pavements. Weed IT uses sensor technology for weed detection to spray only on places where weeds grow. The sensors are connected to spray nozzles on a 1 to 1.25 m wide spray boom.

The new MKII 2006 Weed IT model differed in several aspects from the 2005 model:

- improved sensing technology,
- more nozzles per m of spray boom (12.5 per m in stead of 5),
- spray volume adjustment over wider range of speed.

Because the precision of the sensor-nozzle system was more than doubled, we expected a substantial reduction in spray volume and herbicide use.

The new 2006 model of Weed IT (MKII) sprayed significantly less per ha than the 2005 model. In practice, Weed IT sprayers are used when soil cover of pavements by weeds is 2 to 10%. The 2005 model sprayed 40 to 120 litres spray volume per ha, the new 2006 model sprayed 20 to 40 l per ha. The reduction in spray release of the new model compared to the old model was between 50 and 80%, depending on mean soil cover by weeds. An average reduction of 69% was calculated, in line with more than doubled precision of the new Weed IT.

Weed species, weather and quality of the pavement had effects on efficacy in the dose response experiments. Under optimal conditions, a setting between 0.8 and 1.5 l Roundup evolution gave a good result (in reality the dose on the field was more than 50% less because of sensor spraying on weeds). In the other experiment, the minimum effective dose was higher, mainly due to here and there unevenness (subsided bricks) of the pavement. A setting of 1.5 to 2 l Roundup evolution per ha of the new Weed IT seems appropriate for a good effect in standard situations. A user of the Weed IT has to adjust this dose setting for local conditions (species and weather) and driving speed.

From this study, we conclude that the new Weed IT technology can contribute to a further reduction in herbicide use on pavements. This reduction may be up to 50% compared to current standard practice herbicide weed control, depending on weed density, optimal use of the technology and additional use of a spray lance in combination with the new technology. When the new Weed IT MKII is used on uneven pavements causing, or at a relatively high speed, it may loose some efficacy. Under practical situations, the new Weed IT model has shown an average use of 0.35 to 0.5 l Roundup evolution per ha per work round of weed control at the level of large areas (> 10 ha) within municipalities. These doses are much less than the dose cap of 1 l/ha of the DOB-system (www.dob-verhardingen.nl). The new technology therefore provides a new tool for achieving national and EU objectives (water frame work directive) for reduction of herbicide use and improvement of the quality of surface waters.

5. Nederlandse samenvatting (Summary in Dutch)

In 2006 is een onderzoek gedaan aan de vernieuwde Weed IT (MKII) spuitapparatuur voor selectieve onkruidbestrijding op verhardingen. De nieuwe machine is vergeleken met een standaard 2005 Weed IT model wat betreft spuitvolume en effectiviteit. Drie experimenten werden uitgevoerd op elementverhardingen op 2 locaties in Gelderland. Weed IT gebruikt sensortechnologie om onkruiden op verhardingen te detecteren en vervolgens alleen op die plaatsen herbiciden te spuiten. De sensoren sturen spuitdoppen aan die op 1 tot 1,25 m brede spuitbomen gemonteerd zijn. Van het 2005 model was al bekend dat het een reductie in middelgebruik van meer dan 50% kan geven t.o.v. strokenbespuitingen.

Het nieuwe MKII Weed IT model verschilt op de volgende punten van het oude 2005 model:

- verbeterde sensortechnologie,
- meer sensoren en spuitdoppen per meter spuitboom (12,5 i.p.v. 5),
- afstellingwijze/correctie spuitvolume op/voor rijsnelheid.

De verwachting was dat de nieuwe Weed IT substantieel minder middel zou verspuit per oppervlakte-eenheid omdat de precisie van het sensor-nozzlesysteem meer dan verdubbeld is.

Het nieuwe 2006 Weed IT model verspoot inderdaad significant minder spuitvloeistof dan het oude 2005 model. Meestal wordt een Weed IT in de praktijk ingezet bij onkruidbezettingen van 2 tot 10% bodembedekking door onkruid. In dit gebied verspoot het 2005 model 40 tot 120 liter spuitvloeistof per ha waar het nieuwe model 20 tot 40 liter per ha verspoot. Dit is een reductie van 50 tot 80% (gemiddeld 69%). De reductie bleek afhankelijk van de mate van onkruidbezetting; hoe kleiner de bezetting, hoe groter het reductiepercentage.

Uit de twee effectiviteitproeven met het nieuwe 2006 Weed IT model bleek een significant effect van aanwezige onkruidsoorten, weer en ondergrond op de effectiviteit. In de proef met gunstige omstandigheden lag de minimum effectieve dosering op het instellingsniveau tussen 1 en 1,5 l Roundup evolution per ha (in werkelijkheid werd er pleksgewijs gespoten waardoor gebruik op hectarebasis lager ligt (> 50% lager)). In de andere proef lag de minimum effectieve dosering hoger vanwege vooral plaatselijke oneffenheden van de verharding, waardoor de machine soms te veel schokte en er daardoor op die plekken te veel variatie in dosering was. Op basis van de proeven en praktijkervaringen lijkt een basisinstelling van het nieuwe 2006 Weed IT model op 1,5 tot 2 l Roundup evolution per ha voldoende effectief. Bijstelling van de dosering op basis van onkruidsoorten, rijsnelheid en weer (zie DOB-fax) dient door de uitvoerder ter plekke gedaan te worden. In de toekomst wordt dit alleen maar belangrijker om aan gebruik- en milieunormen te voldoen.

Op basis van de waarnemingen in het onderzoek en enige praktijkervaringen concluderen we dat de nieuwe 2006 MKII Weed IT technologie een bijdrage kan gaan leveren aan verduurzaming van onkruidbeheer op verhardingen. Een verdere halvering van middelengebruik t.o.v. gangbare sensorgestuurde spuittechnieken lijkt mogelijk. Het uiteindelijke reductiepotentieel zal in de praktijk bepaald worden door de onkruidbezetting, goede instelling van de apparatuur en eventueel gebruik van spuitlans. In praktijktesten in 2006 werden doseringen met goed resultaat behaald bij 0,35 tot 0,5 l Roundup evolution per ha per werkronde op het niveau van grote werkeenheden binnen enkele gemeenten. Dergelijke doseringen zijn ruim lager dan het doseringsmaximum per werkronde in het DOB-systeem (www.dob-verhardingen.nl). De kansen die de nieuwe Weed IT technologie biedt om het middelgebruik op verhardingen te verminderen, sluiten aan bij nationale en internationale doelen (zie EU-kaderrichtlijnwater, Barometer Duurzaam terreinbeheer en OVO-advies 2006) om middelgebruik en milieueffecten te verminderen.

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Appendix

DOB-faxes with weather and glyphosate use information for 16 May and 16 June 2006

For more information on the faxes, see www.dob-verhardingen.nl.

DOB weerfax

DUURZAAM ONKRUIDBEHEER OP VERHARDINGEN

Opgesteld: Dinsdag 16 mei 2006 05:48
Regio: Veluwe

Weersverwachting korte termijn:

Datum / Tijd	uur	16 mei 6	9	12	15	18	21	17 mei 0	3	6
Temperatuur 1.50 m	°C	14	15	17	19	19	17	13	10	10
Temperatuur 0.10 m	°C	12	14	19	21	20	17	13	9	8
Bladnat	/uur	●●●	○○○	○○○	○○○	○○○	○○○	○○○	●●●	●●●
Neerslag	mm	0.2	0.1	0	0	0	0	0	0	0
Neerslagkans	%	50	30	10	10	10	10	20	10	10
Windrichting		ZW	ZW	WZW	WZW	WNW	NW	N	O	ZO
Windsnelheid	m/s	3	4	4	4	4	3	1	1	1

Bladnat: ● gewas is nat ○ gewas is droog

Spuitomstandigheden Roundup Evolution:

Datum / Tijd	uur	16 mei 6	9	12	15	18	21	17 mei 0	3	6
Werking		+	+	+	0	0	+	+	+	+
Uitvoering		--	+	++	+	++	++	++	--	--
Dosering (% oplossing)		-	1.75	1.75	2.00	2.00	1.50	1.25	-	-

Weersverwachting lange termijn:

Datum		Din 16 mei	Woe 17 mei	Don 18 mei	Vry 19 mei	Zat 20 mei
Weer						
Temp. 1.50 m. min/max	°C	13 / 19	10 / 23	14 / 19	13 / 18	11 / 15
Temp. 0.10 m. min/max	°C	12 / 21	9 / 24	12 / 20	12 / 18	10 / 17
Bladnat	/3 uur	●●●○○○○○	○●●○○○○○	○●●○○○○○	○○○○○○○○	○○○○○○○○
Neerslag	mm	1	0	4	2	3
Neerslagkans	%	50	30	40	30	40
Windrichting		OZO / NW	N / ZW	ZZO / WZW	ZZW / WZW	N / WNW
Windsnelheid min/max	m/s	1 / 4	1 / 3	3 / 6	3 / 7	2 / 4

REGIONAAL WEEROVERZICHT
Het is vandaag alles behalve stralend zonnig, maar het blijft wel vrijwel overal droog. Zo nu en dan weet de zon wel door te breken. Er waait een matige westelijke wind en het kwik stijgt naar rond 20 graden. Vanavond zwakt de wind af, verder verandert er weinig. Het blijft half tot zwaar bewolkt, later in de nacht worden de opklaringen wat breder. De temperatuur daalt naar 9 à 10 graden en er kan een enkele mistbank worden gevormd.

LANGE TERMIJN VERWACHTING
Woensdag overdag zitten we net tussen storingen in. Overdag blijft het droog en vooral in de ochtend is het vrij zonnig. Het wordt vrij warm, op veel plaatsen 21 tot 23 graden. 's Middags neemt de bewolking toe en 's avonds en de nacht daarop gaat er buiige regen vallen, soms ook met onweer. Donderdag overdag klaart het op. Wel waait er dan een matige tot krachtige zuidwester en met 17 tot 21 graden is het iets koeler. Vrijdag vallen er een paar buien en wordt de zuidwester aan zee zelfs hard, misschien stormachtig, 7 à 8 Bft. In het weekeinde luwt de wind sterk. Het blijft wel wisselvallig met enkele buien en het kwik valt terug naar 15 tot 19 graden.

DOB weerfax

DUURZAAM ONKRUIDBEHEER OP VERHARDINGEN

Opgesteld: **Donderdag 15 jun 2006 05:47**
Regio: **Veluwe**

Weersverwachting korte termijn:

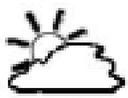
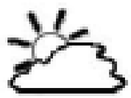
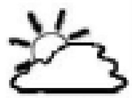
Datum Tijd	uur	15 jun 6	9	12	15	18	21	16 jun 0	3	6
Temperatuur 1.50 m.	°C	13	14	16	19	19	18	14	12	11
Temperatuur 0.10 m.	°C	11	13	18	22	21	18	14	11	10
Bladnat	/uur	●●●	●●●	○○○	○○○	○○○	○○○	●●●	●●●	●●●
Neerslag	mm	1	1	0.8	0.7	1	0.9	0.3	0.2	0.1
Neerslagkans	%	60	50	50	50	40	30	20	20	20
Windrichting		NNO	ONO	NNO	NNO	N	NNW	NW	W	WNW
Windsnelheid	m/s	3	3	3	3	4	3	2	2	2

Bladnat: • gewas is nat ○ gewas is droog

Spuitomstandigheden Roundup Evolution:

Datum Tijd	uur	15 jun 6	9	12	15	18	21	16 jun 0	3	6
Werking		- -	0	++	+	+	+	-	+	+
Uitvoering		- -	- -	- -	- -	- -	+	- -	- -	- -
Dosering (% oplossing)		-	-	-	-	-	1.25	-	-	-

Weersverwachting lange termijn:

Datum		Don 15 jun	Vry 16 jun	Zat 17 jun	Zon 18 jun	Maa 19 jun
Weer						
Temp. 1.50 m. min/max	°C	13 / 19	11 / 19	11 / 18	13 / 23	14 / 25
Temp. 0.10 m. min/max	°C	11 / 22	10 / 22	10 / 20	12 / 26	13 / 28
Bladnat	/3 uur	●●●●○○○○	●●●●○○○○	●●●●○○○○	○●●●○○○○	○●●○○○○○
Neerslag	mm	8	1	7	0	1
Neerslagkans	%	60	30	60	20	20
Windrichting		N / NNW	W / NW	W / NNW	N / NNW	N / NNW
Windsnelheid min/max	m/s	2 / 4	2 / 3	1 / 4	1 / 3	1 / 3

REGIONAAL WEEROVERZICHT
Wolkenvelden overheersen vandaag, maar af en toe breekt de zon door. Geregeld trekken buiengebieden over de regio. De temperatuur stijgt naar ongeveer 19 graden bij een zwakke tot matige noord- tot noordoostenwind. In de loop van de avond trekken de laatste buien naar het noordoosten weg. Het blijft de rest van de avond en de nacht droog. Het koelt af tot 10 graden.

LANGE TERMIJN VERWACHTING
Vrijdag valt een enkele bui in het noorden. De temperatuur stijgt naar 18 tot 22 graden. Zaterdag kan er in het hele binnenland wel een enkele bui vallen. Zondag tot en met dinsdag is er een afwisseling van wolkenvelden en zonnige perioden. In de middag komt nu en dan een regen- of onweersbui tot ontwikkeling. De temperatuur stijgt naar 22 tot 26 graden op zondag en maandag. Dinsdag wordt het 28 graden in het midden en zuiden van het land.