



12/17
33

Good Agricultural Practice (GAP) in glasshouse lettuce and spinach cultivation in the Netherlands

Registration during 2000-2001

C. de Kreij



Applied Plant Research BV
Division Glasshouse Horticulture
August 2001

© 2001 Naaldwijk, Applied Plant Research B.V.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of Applied Plant Research.

Applied Plant Research cannot be held responsible for any injury sustained in using data from this publication.

The research is been financed by Board of Horticulture (Productschap Tuinbouw)

Applied Plant Research BV
Division Glasshouse Horticulture
P.O. Box 8,
2670 AA Naaldwijk
The Netherlands
Tel. +31 174 636700
Fax +31 174 636835
E-mail: C.de.Kreij@ppo.dlo.nl
Internet : www.ppo.dlo.nl

Table of contents

	page
1 Introduction.....	5
2 Spread of the registration.....	5
3 Soil analysis and nitrogen recommendation in lettuce.....	5
4 Nitrogen recommendation versus supply in lettuce.	7
5 Nitrate in lettuce	8
6 Nitrate in spinach.....	10
7 Conclusion and summary.....	11

1 Introduction

This report deals with the registration of Good Agricultural Practice (GAP) of lettuce and spinach during the period 2000-2001. The registration for lettuce was by lettuce growers delivering the product to the auction. The growers who sold the product without the help of the auctions (directly to traders and supermarkets = BVO) did not register. This is estimated to be 50 % of the lettuce. The growers delivered the sheets (example in the Annex) about 10 days before the expected harvest date, by fax to the auction *the Greenery* (with several locations) and to auction Zuid-Oost Nederland (ZON). With help of Certerra (Environment-Conscious-Cultivation) the heads were sampled on the nurseries. This sample was taken several days before the harvest and is different from sampling at selling date. Samples were analysed by TNO Nutrition and Food Research Institute. Nitrate contents were delivered to the auctions. When the nitrate contents were higher than the limits, then the grower was not allowed to sell the product. In 7 cases the product has been analysed a second time in the expectation that the nitrate content had fallen to acceptable values (lower than the limit). The Productschap Tuinbouw (Board of Horticulture) requested the Applied Plant Research – Division Glasshouse Horticulture (PPO) to process the data.

The registration of spinach was the nitrate content of the crop only by *the Greenery*. There were no registration sheets as in earlier years.

De Kreij and Van Winkel (2000) have reported earlier registration.

2 Spread of the registration

In total 1292 sheets for lettuce were delivered by 318 different growers, covering 246 ha. This is about 50 % of the total production of lettuce in the Netherlands (Van den Berg and Cadel, 2000). For the other 50 % there was no registration. The delivering of the sheets was as follows: 126 growers delivered one sheet, 91 growers 2-3 sheets, 50 growers 4-5 sheets and 56 growers more than 5 sheets per grower. Registration of lettuce contains harvesting dates between June 2000 and June 2001. In total 545 crops were analysed on nitrate content. Of these, seven crops were analysed twice.

The spinach nitrate content were in total 49 samples from the period October 2000 – June 2001.

3 Soil analysis and nitrogen recommendation in lettuce

Soil analysis is executed before each planting. Soil is extracted with water in the 1:2 volume extract (Sonneveld and Van den Ende, 1971). The distribution of electrical conductivity (EC), NO₃ and Cl levels are given in Figures 1, 2 and 3, respectively. To prevent glassiness in lettuce the EC in soil of winter grown lettuce should be high. The target values are related to soil type and range from 1.2 – 1.5 mS/cm. Most soils had an EC in the range 0.9 – 1.8 mS/cm, which is around the optimal values. Nitrate optimal values depend on planting date and expected weight at harvest (Van den Bos *et al.*, 1999) and range from 3.5 – 6 mmol/l. Most nitrate levels are between 0.6 – 6.0 mmol/l. Chloride optimal level is during winter grown lettuce at least 2 mmol/l. Mostly values are between 0 and 2.0 mmol/l. Still, most growers have too low Cl levels.

From the nitrate levels in the 1:2 volume water extract the optimal N fertilisation can be calculated (Van den Bos *et al.*, 1999). Target value for nitrate of 5 mmol/l is used and then the N-recommendation is:
 $5 - (\text{nitrate in soil analysis}) * 56$. An example with the nitrate content in the 1:2 volume extract = 3.0

mmol/l. The N-recommendation is $(5 - 3) * 56 = 112$ kg/ha. In Figure 4 the recommendation of the N fertilisation is given.

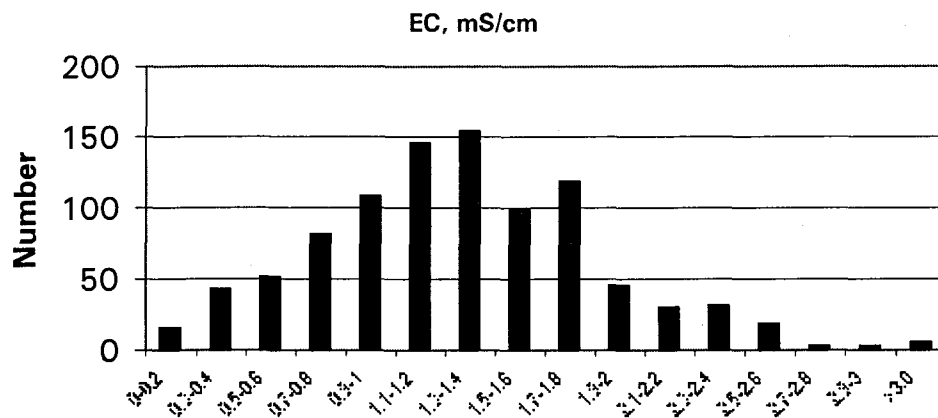


Figure 1. Distribution of EC in the 1:2 volume extract.

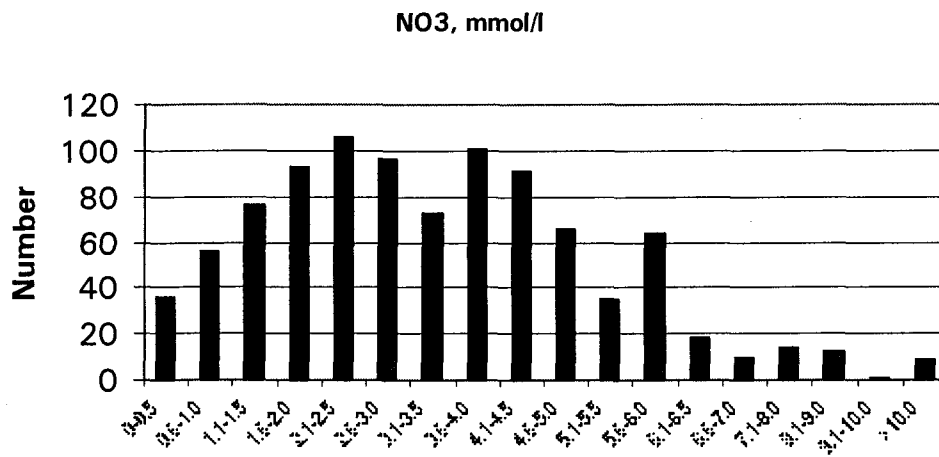


Figure 2. Distribution of nitrate in soil 1:2 volume extract

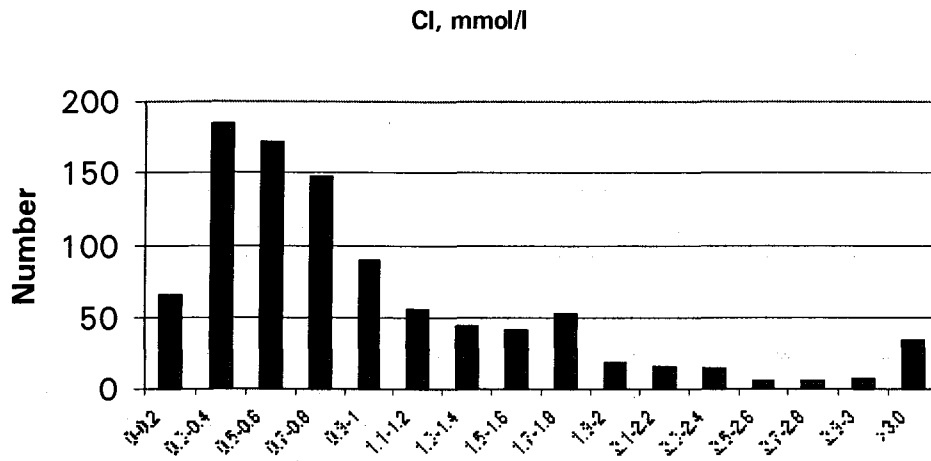


Figure 3. Distribution of chloride in soil 1:2 volume extract

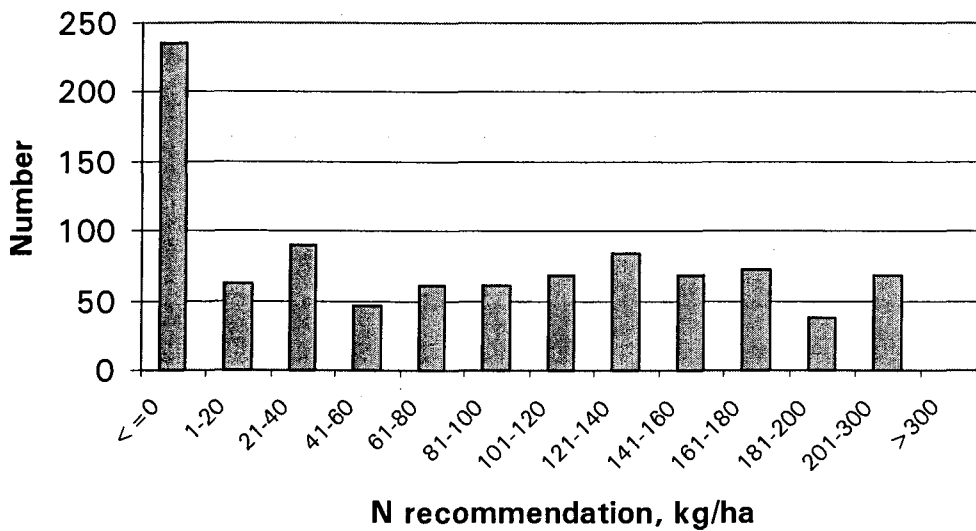


Figure 4. Recommendation of N fertilisation.

4 Nitrogen recommendation versus supply in lettuce.

The N recommendation has been calculated in Figure 4. The recommendation is related to the actual supply in Figure 5. The correlation between the recommendation and the supply is poor.

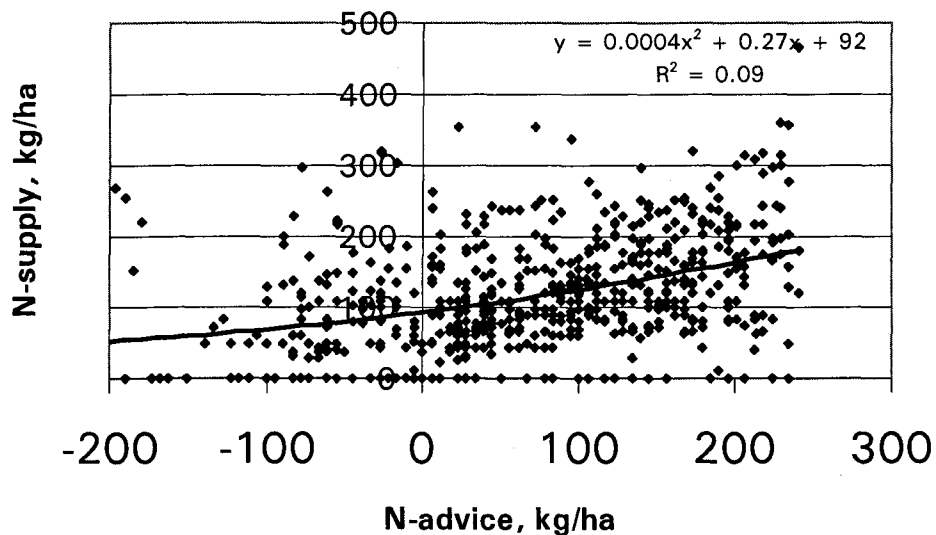


Figure 5. Nitrogen recommendation in relation to the N supply.

5 Nitrate in lettuce

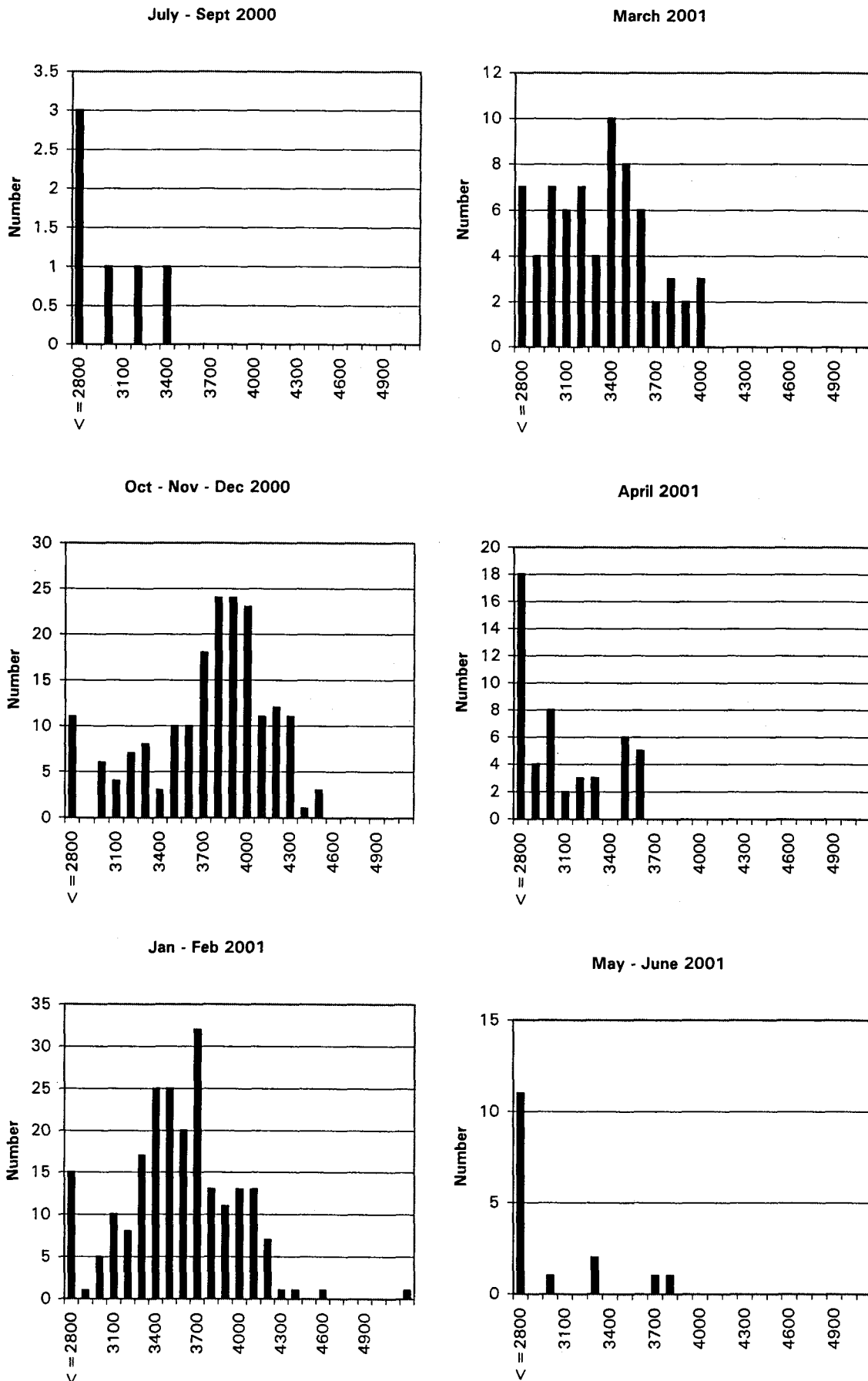
Nitrate in lettuce sampled at nurseries, several days before harvest, in relation to the month of sampling is given in Figure 6. In Table 1 a summary is given. In April – June 2001 13 of the 65 samples had a nitrate content equal to or higher than the limit. Since the contents were often equal to the limit, the nitrate contents can be considered as low. Also in the winter 2000 – 2001 the nitrate contents were low and lower than in other years. This is due to the higher radiation in the winter 2000 – 2001 than in other years. The solar radiation (measured outside in Naaldwijk with a Kipp solarimeter) was in the period from 19 December 2000 – 3 January 2001 on average $223 \text{ J.cm}^{-2}.\text{day}^{-1}$. The 29 years' average in the same period is $166 \text{ J.cm}^{-2}.\text{day}^{-1}$. That means that in 2000-2001 the radiation was 36 % higher than in an average year.

Table 1. Number of samples, number and fraction of samples equal to or exceeding the limit.

Sampling date	Number of samples	Samples equal to or higher than the limit		Nitrate limit, mg/kg
		Number	Fraction, %	
July-Sept 2000	6	0	0	3500
Oct-Nov-Dec 2000	186	3	2	4500
Jan-Feb 2001	219	2	1	4500
March 2001	69	0	0	4500
April 2001	49	11	22	3500
May-June 2001	16	2	13	3500

In 7 samples the nitrate content has been determined twice. The following data have been found. In 6 samples the second sampling gave a nitrate content 100 – 400 mg/kg lower than the first sampling. In 1 sample the second sampling had a 300 mg/kg higher content than the first sampling.

Figure 6. Distribution of nitrate in lettuce in mg/kg.



6 Nitrate in spinach.

In total 49 samples have been analysed between October 2000 – June 2001. All data are presented in

Figure 7. A summary is given in Table 2. A large fraction of the samples exceeded the EU limit, but not the NL limit.

Table 2. Nitrate in spinach.

	Sampling period	
	1 Nov 2000 – 31 March 2001 (Winter)	Oct. 2000 + April-June 2001 (Summer)
Number of samples	26	23
Equal to or higher than EU limit, number	22	9
Equal to or higher than EU limit, fraction, %	85	39
Equal to or higher than NL limit, number	2	2
Equal to or higher than NL limit, fraction, %	8	9
EU limit, mg/kg	3000	2500
NL limit, mg/kg	4500	3500

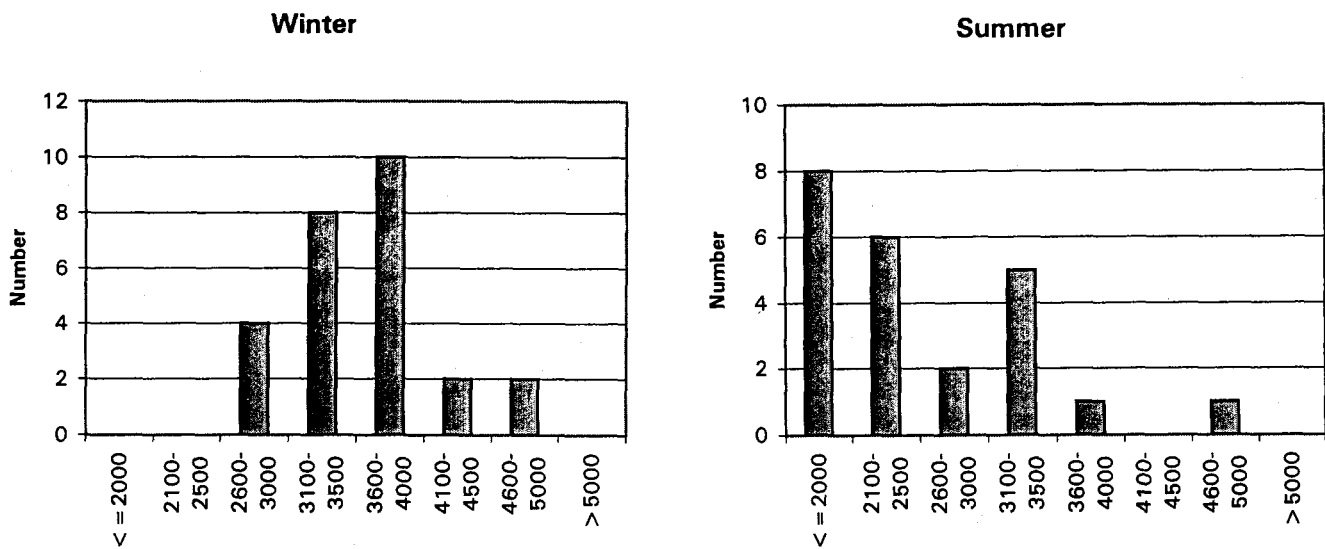


Figure 7. Distribution of nitrate contents in spinach, mg/kg.

7 Conclusion and summary

In the production period September 2000 – June 2001 glasshouse lettuce growers registered of 1292 crops for Good Agricultural Practice, covering 246 ha. This is estimated to be about 50 % of the area of glasshouse lettuce in the Netherlands. In 545 cases samples were taken on the field about 5 - 7 days before harvesting and the nitrate contents were analysed. Nitrate contents in the winter period (October – March) exceeded in 1 % the limit of 4500 mg/kg. Nitrate content were much lower than in earlier years, which is very likely to be the caused by more sunlight in the winter 2000-2001 than in earlier winters.

Lettuce growers determined the element contents of the soil before fertilisation and planting. From these data it can be concluded that the chloride (Cl) has to be increased.

The 26 spinach nitrate contents sampled in the winter period were in 85 and 8 % higher than the EU limit (3000 mg/kg) and the NL limit (4500 mg/kg), respectively. The 23 spinach nitrate contents sampled in the summer period were in 39 and 2 % higher than the EU limit (2500 mg/kg) and the NL limit (3500 mg/kg), respectively.

References

- De Kreijl, C. and A. van Winkel, 2000. Good Agricultural Practice in glasshouse lettuce and spinach cultivation in the Netherlands. Registration during 1998-2000
- Sonneveld, C. and J. van den Ende, 1971. Soil analysis by means of a 1:2 volume extract. *Plant and soil* 35: 505-516.
- Van den Berg, W. and W. Cadel, 2000. Cijfermatig overzicht krop- en ijsbergsla. (Data overview of butterhead lettuce and iceberg lettuce) PT rapport 2000-37
- Van den Bos, A.L., C. de Kreijl, and W. Voogt, 1999. Bemestingsadviesbasis Grond.

Sla-meldings- en GAP-formulier

nr. 181 | dd. 20/2/01 | 3.800

(hierboven niet invullen)

Naam t:

Adres:

Postcod:

Tuinadr:

Aanvoe:

MBT-nu:

Tel.: 30000000

Example of the registration.

in Zaaife/nr.: _____

151 X

Afdeling: 2 Ras: Oranlie Lous

Zaadatum: 20.02.01 Plantdatum: 14.02.01

Oppervlakte (m²): 1900 m²

Geplande 1e oogstdatum: 20-02-01

Geschat kropgewicht: 28 kg/100 stuks

Type sla: kropsla ijsbergsa anders:

Bemestingsonderzoek (Grondmonster) vóór- tijdens teelt

Monster-nummer	Monster-datum	EC	pH	NH ₄	K	Na	Ca	Mg	NO ₃	Cl	SO ₄	P
216299	21-02-2001	0.8	4.3	0.1	1.2	0.6	2.8	0.8	2.3	0.5	2.0	0.51

EC beregeningswater:



Bemesting

voorraadbemesting			bijbemesting		
meststof	kg/are of l/are	MBTcode	meststof	kg/are of l/are	MBTcode
MAS	3		1 kg kalksalpeter		
			1 kg kalie salpeter		

Totaal waterverbruik: 50 l/m²

Soort water: regenw. leidingw. omgekeerde osmose bronw. oppervlaktew. anders _____

Grondsoort: zand zand/zavel zavel zavel/klei klei veen löss anders: _____

Gewasbeschermingsregistratie (voor MBT-deelnemers)

Middel(en) hvh= hoeveelheid	1	2	3	4	5	6	7	8	GRS*)
Datum	hvh	hvh	hvh	hvh	hvh	hvh	hvh	hvh	
Totaal:									
gr of ml									
N-nummer									

*) toepassingsmethode G=gewasbehandeling R=ruimtebehandeling S=substraat-/grondbehandeling

Datum: 16-2-2001

Handtekening: _____

Sturen naar: Veiling ZON, kwaliteitscontroleteam t.a.v. Roland Welten.

post: postbus 8503 5970 AA Grubbenvorst

fax: 077-3239509

e-mail: roland.welten@veilingzon.nl