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GOOD AGRICULTURAL PRACTICE (GAP) OF GLASSHOUSE LETTUCE IN THE NETHERLANDS

Registration during 1995 - 1998

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1. INTRODUCTION

Since 1995 glasshouse lettuce growers committed themselves to grow lettuce according to the Good Agricultural Practice (GAP; Anonymous, 1995). Growers executed soil analysis which included a fertilization advice. The advice was based on the fertilization schemes provided by the Information and Knowledge Centre (Anonymous, 1994). Data of the soil analysis and fertilizer supply were registered. Some general data were registered as well e.g. type of lettuce, water supply and water quality, cleaning of glass, soil type, area of the cultivation.

In 1995 the growers in the east and south of the Netherlands registered the data per cropping period. In the western part this was registered per period of 4 weeks. After 1996 the registration was for all growers per period of 4 weeks. The auctions collected the registration sheets. In August 1998 the data were put into a spread sheet by the Research Station for Floriculture and Glasshouse Vegetables in Naaldwijk to make an overview and to draw conclusions.

The registration covers all aspects of fertilization. However, in this report only the N fertilization and CI level in the soil are examined, since this is important for the nitrate content of the lettuce.

Of some growers the nitrate content of the lettuce was supplied by the Stichting Milieubewuste Teelt (Environment-Conscious-Cultivation). Of these growers soil analysis, N advice, N supply and nitrate in lettuce were examined.

2. SPREAD OF THE REGISTRATION

The registration covers the winters 1995/1996, 1996/1997 and 1997/1998. The total

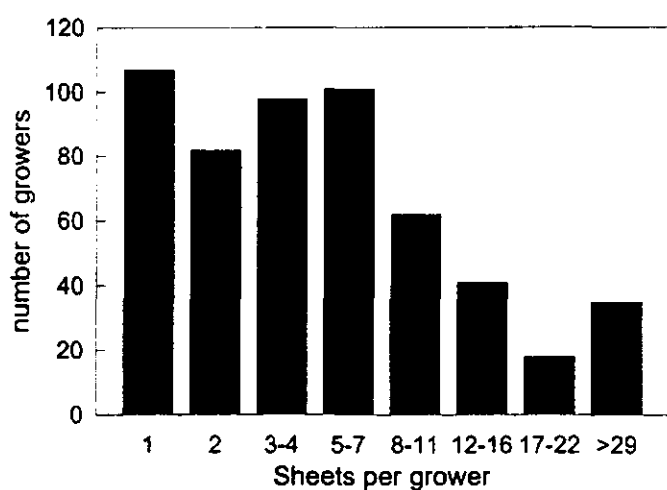


Figure 1 - Distribution of the number of sheets per grower.

number of sheets is 3800 from 544 different growers. The total number of growers in 1998 is 510. That means that all or almost all growers did a registration ones or several times. The distribution of the number of sheets per grower is given in figure 1. For example 107 growers produced one sheet and 37 growers produced more than 29 sheets per grower. The distribution for the winter 1997/1998 per period of 4 weeks is given in figure 2. The highest amount of sheets was delivered in periods 11, 12 and 13 of 1997.

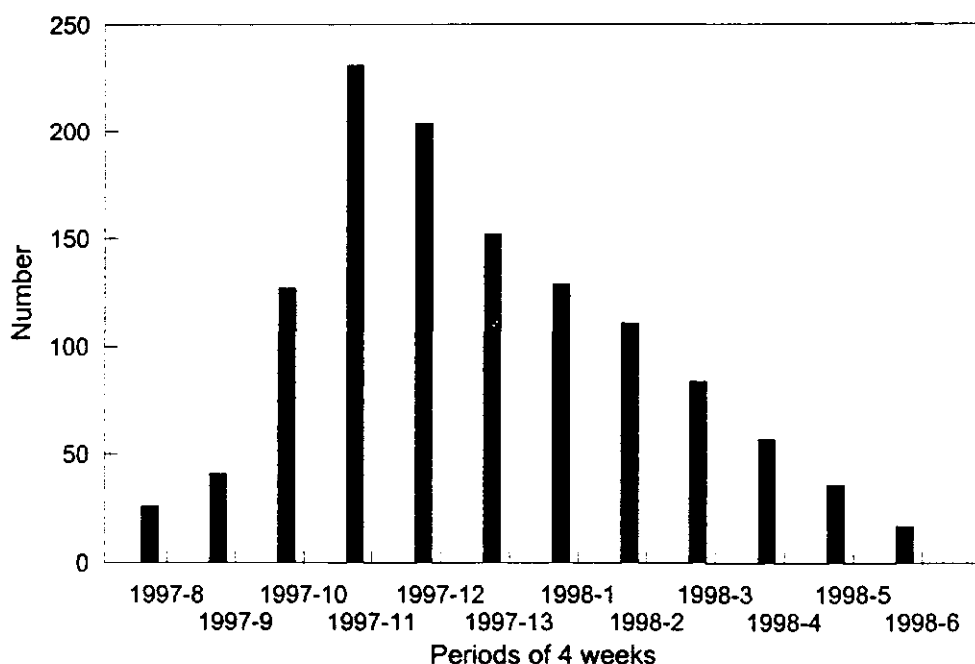


Figure 2 - Number of sheets per period of 4 weeks in the winter 1997/1998

The registration covers a total area of 407 ha in 3 years. That means an area 135 ha per year. Averaged over these 3 years the total area is estimated at 400 ha. That means that the registration covers an area of about one third of the total glasshouse lettuce area.

3. SOIL ANALYSIS AND NITROGEN ADVICE

Soil analysis is executed before each planting. Soil is extracted with water in the 1:2 volume extract (Sonneveld and Van den Ende, 1971). Nitrogen advice is calculated from the $\text{NH}_4 + \text{NO}_3$ content in the 1:2 soil volume extract. The target level of the sum of $\text{NH}_4 + \text{NO}_3$ is 4 mmol/l for lettuce lighter than 250 g per head with a planting time between 15 September and 15 March. If this level is reached or the sum is higher than 4 mmol/l, then the N advice is zero. If it is lower than the target, the N advice can be calculated to reach the target by the formula that a supply of 100 kg N per ha gives an increase of the N level in the 1:2 volume extract of 1.79 mmol/l. The N advice is for that

particular planting only. After harvest of that planting a new soil analysis is performed and the N advice is calculated again. NH_4 is in most cases <0.1 mmol/l. The distribution of the NO_3 concentrations (number of values = 2876) in the soil extracts is given in figure 3. Most soil samples had a NO_3 content below 4 mmol/l.

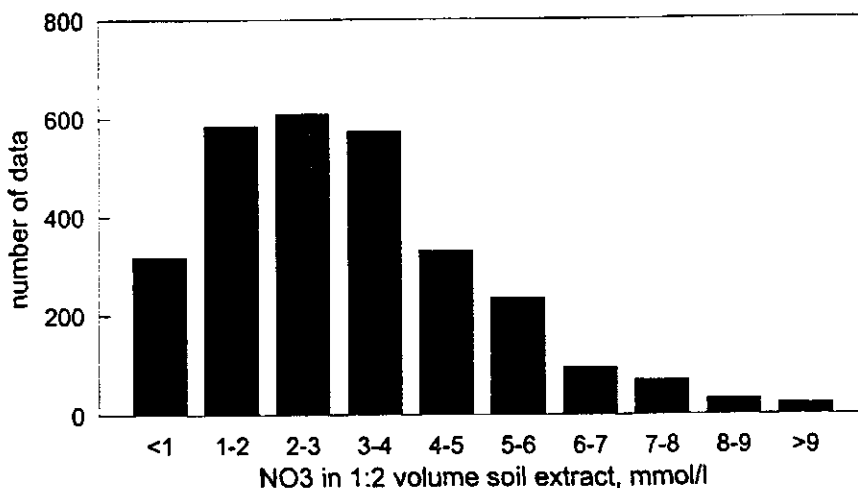


Figure 3 - Distribution of nitrate in soil extracts before planting

In the winter period the Cl target level in the 1:2 volume extract is 2 mmol/l. The distribution (number of values = 1411) of the Cl levels in the soil extracts is given in figure 4. The Cl levels are far lower than the target.

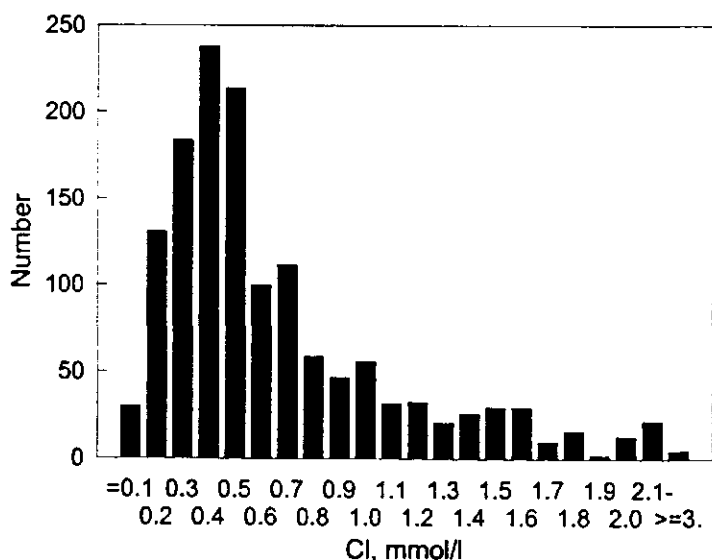


Figure 4 - Cl levels in soil extract before planting

The N advice, calculated from the $\text{NH}_4 + \text{NO}_3$ to reach the target, is given in figure 5 (number of values = 2876). The N advice of about 1000 samples is lower than 20 kg/ha.

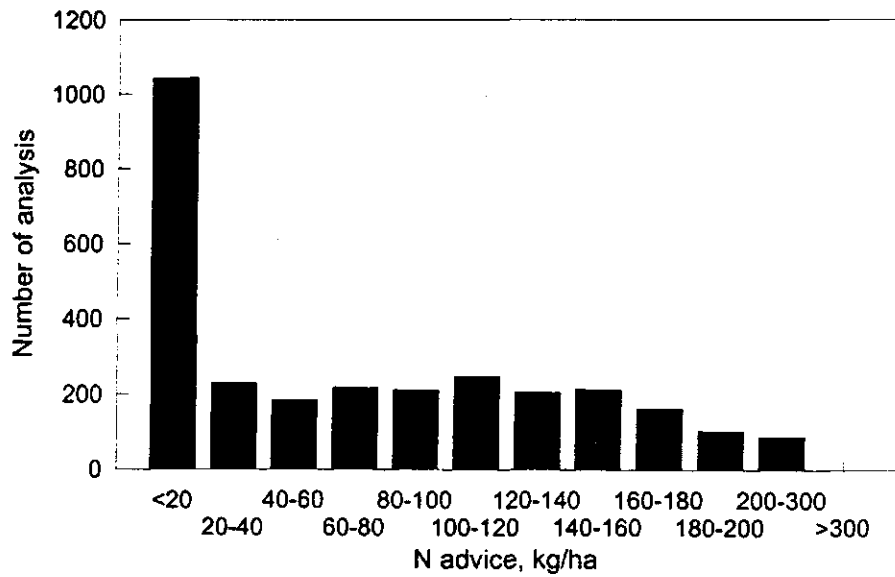


Figure 5 - N advice based on soil analysis

4. NITROGEN SUPPLY

Distribution of the actual supplied N as a base dressing (supply before planting) is given in figure 6. About 1000 times the supply of N is < 20 kg/ha.

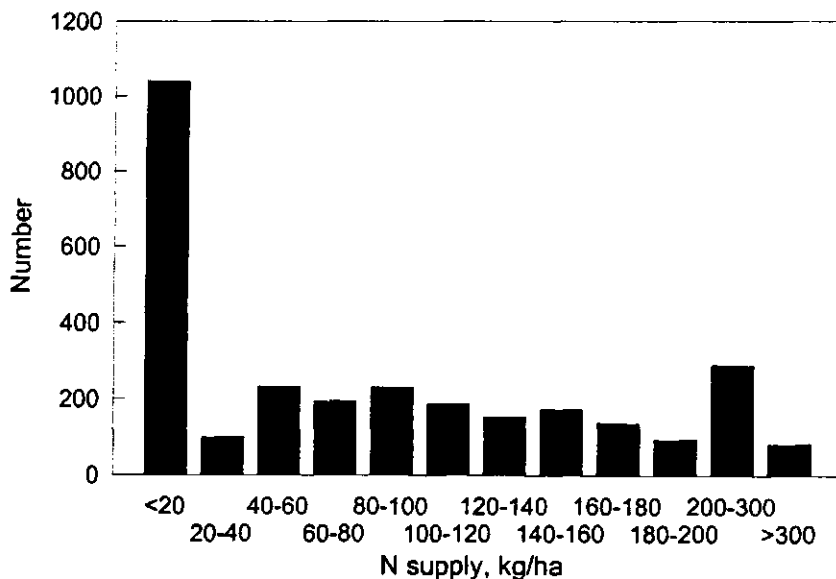


Figure 6 - Distribution of actual N supply as base fertilizer.

As base fertilizers about 50 different types were being used, with the main: 12-10-18 (N-P₂O₅-K₂O), lime, calciumnitrate, ammonium nitrate, potassium nitrate, potassium sulphate, magnesium nitrate, magnesium sulphate, ammonium nitrate, triple superphosphate, potassium chloride, and different compound NPK fertilizers.

The top up supply has not been calculated. The amount is very low as compared to the base dressing. During the growing period most growers do not use a fertilizer any more. Some of them use a top up fertilizer which is always a soluble one, e.g. potassium nitrate, mono ammonium phosphate, magnesium sulphate, calciumnitrate, potassium sulphate, potassium phosphate, or a compound NPK fertilizer.

5. NITRATE IN LETTUCE OF A SELECTION OF GROWERS

The sheets of the GAP registration do not contain the nitrate content in the crop since in many cases the sheets have to be supplied to the auction when the cropping period is not finished yet (the sheets were collected after each period of 4 weeks). Therefore, from the MBT the nitrate levels of some at random selected growers were asked. Both

with the soil analysis, the N advice and N supply the data are given in Appendix 1. It was found to be difficult to follow one growing cycle, one batch of a grower. That means that the data given in Appendix 1 are not connected to each other. It gives only an idea.

6. CONCLUSION

During winters 1995/1996, 1996/1997 and 1997/1998 a total of 3800 GAP registration sheets were delivered to the auctions. All growers filled in one or more sheets. However, this covers only about one third of the total area of lettuce under glass.

The distribution of N fertilizer supply in general was close to the distribution of the N advice, calculated from the soil analysis. However, it was extremely difficult to follow one growing cycle of a grower, together with the nitrate levels at harvest. This was caused by the fact that the sheets were filled in per period of 4 weeks and unfortunately not per growing cycle.

In order to check whether the GAP rules were followed by individual growers the collection of data have to be per growing cycle.

Growers have to reach higher CI levels in the soil than actually has been found.

LITERATURE

Anonymous, 1995. Teeltrecept voor de beheersing van het nitraatgehalte in kropsla geteeld onder glas (Culture recipe for the control of the nitrate content in glasshouse lettuce). Landelijke glasslacommissie van de Federatie van Nederlandse Tuinbouwstudiegroepen, NTS-Nederland en Boerenbond België.

Anonymous, 1994. Bemestingsadviesbasis Glastuinbouw, 1994 - 1995. (Fertilization schemes for glasshouse crops, 1994 - 1995) Information and Knowledge Centre. Aalsmeer/Naaldwijk.

Sonneveld, C. and J. Van den Ende, 1971. Soil analysis by means of a 1:2 volume extract. Plant and Soil 35, 505 - 516.

Appendix 1 - Soil analysis, N advice, N supply and NO₃ in lettuce of a selection of growers

Number	Soil water extract,mmo/l		N-advice kg/ha	N supply kg/ha	N top up kg/ha	NO ₃ plant mg/kg	Date of sampling
	NH ₄	NO ₃					
1	0.1	5	0	270	0	4300	11-Dec-96
2	0.1	0.3	201	5	0	3300	04-Apr-97
3	0.1	3.1	51	62	0	4000	19-Mar-98
4	0.7	0.3	168	176	0	3400	12-Dec-97
5	0.1	0.1	218	239	46	4600	12-Jan-98
6	0.1	3.8	6	330	16	3800	23-Mar-98
7	0.1	0.5	190	202	0	4100	02-Feb-98
8	0.1	1.5	134	54	0	2700	10-Nov-97
9	0.1	1	162	154	80	4100	10-Feb-98
10	0.1	0.6	184	209	24	3800	04-Feb-98
11	0.1	1.7	128	60	0	3300	01-Dec-97
12	0.1	3.6	17	176	0	3300	15-Mar-98
13	0.1	2.9	56	42	0	4200	25-Nov-97
14	0.1	7.6	0	132	58	4000	29-Dec-97
15	0.1	2.8	61	132	0	3900	21-Jan-98
16	0.1	3.4	28	88	34	3600	10-Nov-97
17	0.1	1.6	128	344	0	4400	23-Dec-96
18	0.1	1	162	0	0	4300	29-Nov-95
19	0.1	3.7	11	109	0	3000	27-Mar-98
20	0.1	3.7	11	110	0	4700	05-Jan-98
21	0.2	3.8	0	81	16	3400	02-Apr-97
22	0.1	1.7	123	0	0	2300	19-May-98
23	0.1	8.9	0	0	0	5300	09-Dec-96
24	0.9	3.7	0	36	0	3000	10-Oct-95
25	0.9	4.3	0	0	0	3100	28-Oct-97
26	0.1	5.3	0	66	0	3600	27-Dec-96
27	0.1	2.2	95	234	26	3800	09-Dec-97
28	0.1	0	223	198	0	4100	03-Dec-97
29	0.1	4.2	0	136	7	4100	20-Jan-98