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nitrogen fertilization in outdoor vegetable growing

In addition to its relationship with soil and climate the optimal rate of nitrogen application depends on the crop. As the first-named factors have been extensively dealt with in connection with arable cropping (7) and as there is a clear analogy in this respect between arable cropping and outdoor vegetable growing we need only deal with the nitrogen requirement as related to type of crop.

How many vegetable crops there are is difficult to ascertain exactly. Crops are either important or unimportant according to turnover. A survey of the most important crops with a turnover in excess of 5 million guilders in the auction market is given in table 1.

Table 1 — Turnover of the most important crops in the auction market in 1960 in millions of guilders

lettuce	58.4*	spinach	9.9
Brussels sprouts	21.2	leek	8.9
cauliflower	20.2	gherkins	7.8
French beans	19.4	white cabbage	5.6
chicory	14.5	bunched carrots	5.3
endive	13.3	red cabbage	5.1
carrots	11.8	onions	5.1
asparagus	11.1		

*) An estimated half of this is grown as an outdoor crop; the remainder comes from glasshouses.

In the Netherlands nitrogen fertilization experiments with vegetables are not sufficient in number, scope or lay-out to allow well-founded conclusions to be drawn in respect of optimal nitrogen application. This can be concluded from the data in the stock-taking report of VAN DER BOON (1a). Since an accurate basis is lacking we have to assume that the

"Schelk", a kind of winter savoy cabbage, grown only in the neighbourhood of Maastricht

nitrogen fertilization of vegetable crops in the Netherlands is mainly based on practical experience. Information about this experience was obtained by means of an inquiry conducted by the author in the horticultural advisory districts (6). In table 2 data on the experimental fields from the stock-taking report and those on practical experience from the inquiry have been outlined and compared with data from foreign literature. In so far as it has been reported, the nitrogen fertilization has been subdivided into a basal dressing and a total one. The total application is the sum of the basal dressing and the top-dressing. Furthermore, in those cases in which a range was reported the average of this range has been taken.

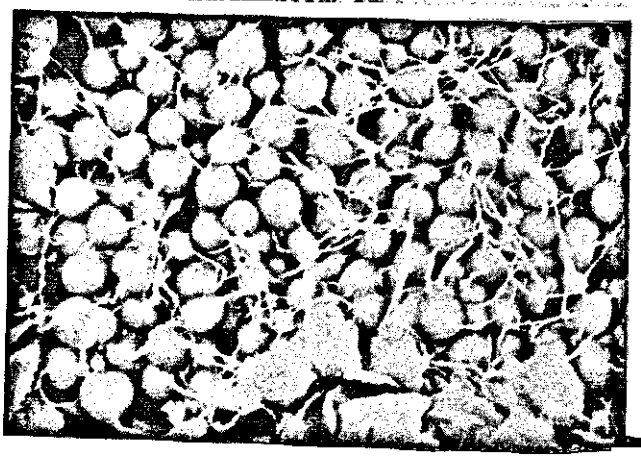
To facilitate the drawing of conclusions the different crops will be treated separately.

Early potatoes: the various statements do not differ much. Practical experience corresponds well with the experimental results.

Table 2 — Optimal nitrogen fertilization in kg nitrogen per ha of several vegetable crops

(according to various sources)

source →	*trial fields reported by Van der Boon (1a, b)*	*practical experience Roorda van Eysinga (6)*		*Gericke (3)*		*Ministry of Agric., Fish. Fd. (5)*		*Van Hove (4)*
crop	*total*	*basal*	*total*	*basal*	*total*	*basal*	*total*	*total*
early potatoes	160	120	140	50	100	150	150	187
endive	160	120	120	30	30	—	—	75
asparagus	—	0	100	—	—	0	80	120
gherkins	—	100	140	40	80	—	—	130
		60 Guntruud						
dwarf French beans	190	80	80	0	0	0	0	20
scarlet runners, French beans, Climbing French beans	—	80	80	20	20	0	0	20
peas	—	60	60	0	0	0	0	20
cauliflowers	200 early	140 spring	200	80	160	90	200	400
	200 late	120 summer	180					
		100 autumn	160					
kale	—	80	100	80	160	—	—	—
red cabbage	—	120 spring	160	80	160	35 spring	135 spring	305
		100	140 storage			100	100 winter	
							160 summer	
savoy cabbage	—	120 spring	160	80	160	35 spring	135 spring	318 sum.
		100	140 storage			100	100 winter	212 win.
							160 summer	
Brussels sprouts	—	80	140	80	160	90	180	50
white cabbage	240	120 spring	160			35 spring	135 spring	305
		100	140 storage	80	160	100	100 winter	
							160 summer	
beetroot	(275)	100	120 Chilean	45	90	60	?	—
leek	—	120	180	45	90	40	100	180
		100 winter						
rhubarb	—	160	200	—	—	75	200	150
scorzonera	—	0	60	—	—	—	—	96
celery	—	—	—	—	—	50	125	120
celeriac	300	120	160	45	90	—	—	(100)
cabbage lettuce	160	120	100	75	75	100	100	75
spinach	218	140 spring	160 spring	25	75	50	125	70 spring
		120	140					137 aut.
broad beans	—	80	100	0	0	0	0	—
onions (setts)	120	60	80	38	75	40	?	114
(from seed)	100 after potatoes							
	160 after chicory							
chicory	—	0	40	—	—	—	—	130
carrots	160	100	100	45	90	40	40	92
		80 bunched carrots						



Endive: according to experimental field data more nitrogen is needed than is applied in practice or according to foreign sources. It is probable that growers are unwilling to apply high rates of nitrogen for fear of encouraging marginal necrosis (see also under lettuce).

Asparagus: opinions are in good agreement.

Gherkin: With the vigorously growing variety Guntruud it is feared in practice that by applying more nitrogen growth will be ever more vigorous. Although this variety is mainly of local importance, further investigations appear desirable.

Beans: practical experience differs considerably from the standards indicated in experimental trials. According to the opinion of various authors (4) the nitrogen fixing bacteria in the root nodules ought to supply sufficient nitrogen.
Furthermore, the opinion prevails in practice that a high nitrogen dressing could lead to an excess of foliage, few pods and, moreover, might cause more rot. Another contradiction is in our opinion to be found in the fact that all beans receive about the same nitrogen treatment. It might be supposed that climbing French beans would need more nitrogen than dwarf French beans.

Peas: the general opinion is that peas need little or no nitrogen. This opinion is also held in agricultural circles.

Cabbage species: it is beyond doubt that cabbages require a lot of nitrogen. Perhaps a little more nitrogen should be applied in practice. Brussels sprouts are a special case in that too high a nitrogen dressing may result in poor quality (larger numbers of loose sprouts) (2). Further investigations are desirable.

Beetroot: According to the limited experimental field data more nitrogen should be applied than in the usual practice.

Leeks: these need ample nitrogen.

Rhubarb: this remarkable crop is supposed to need a lot of nitrogen.

Scorzonera: receives little nitrogen in practice.

Celeriac: needs a large nitrogen application. According to experimental field data growers still do not apply enough nitrogen. From experiments carried out by the author, but not yet published, 200 kg nitrogen per ha appeared to be optimal.

Lettuce: the statements agree well with each other, but according to experimental field data considerably more should be applied. As with endive there is apprehension among growers about encouraging marginal necrosis by giving too much nitrogen. It is debatable whether this fear is justified.

Spinach: receives a liberal nitrogen dressing in the Netherlands, which should probably be further increased.

Broad beans: little is known about this crop. In practice the rate of application is adjusted to suit climatic conditions.

Onions: opinions do not differ much and agree well with those in agriculture (7). Fertilizer could probably be applied somewhat more liberally in practice. An excess is undesirable, as susceptibility to fungous diseases will be stimulated.

Carrots: the general opinion is a moderate nitrogen fertilization. There is a tendency in practice to think that too much nitrogen will give rise to excessive foliage at the expense of the roots.

Chicory: receives little nitrogen in practice.

There is a noticeable fear of applying too

Left-hand page: *Leek, rhubarb and radish.* Right-hand page: *Lettuce and chicory*

Table 3 — Recommended nitrogen dressings in kg nitrogen per ha for outdoor vegetable growing

crop	*basal dressing*	*top-dressing*
early potatoes	100	60
endive	140	0
asparagus	0	100 (after harvest)
gherkin (Guntruud)	60	80
beans	120	(40)
peas	60	0
cabbages	100	100
Brussels sprouts	80	60
kale	100	(50)
beetroot	100	50 (Chilean)
leek	100	80
rhubarb	100	100
scorzonera	0	60
celeriac	100	100
spinach	120	80 (Chilean)
broad beans	80	0
onions (from seed)	100	0
onions (setts)	120	0
chicory	0	40
carrots	100 (60)	0 (40)

much nitrogen in the case of many crops, to wit: endive, gherkin (Guntruud), beans, Brussels sprouts, lettuce, onions and carrots. Scorzonera and chicory receive still less nitrogen, but in these cases the available experimental data indicate little or no nitrogen.

For several crops from the first group (not onions for instance) the experimental field results indicate the importance of larger applications. With regard to the desirability of further investigations we will have to look for crops in this group. The stock-taking report of VAN DER BOON (1a) clearly shows that more investigations are desirable. There is a fairly reliable basis only for a limited number of crops. If the turnovers at the auction market are also taken into consideration we can draw up the following list of desiderata with regard to research in relation to nitrogen dressing:

Brussels sprouts — especially in terms of quality;

Beans — reinforcement of the experimental field results; moreover, distinction to be made between climbing and dwarf French beans;

Carrots — there are too few experimental field data; additionally a closer inspection of the top/root ratio;

With **lettuce** and **endive** there is a need for demonstration fields either in experimental gardens or managed by study clubs, which will entail either a revision of the conclusions drawn from experimental field material or an increase in the rate of fertilization applied in practice. This also holds for dwarf French beans. On a localized basis **gherkins** and perhaps **rhubarb** could be specially considered for further investigation.

As a summary we are quoting a table of recommendations on optimal nitrogen dressings, based on available experimental field results supplemented with other data (table 3).

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