



Leibniz-Institute of Vegetable and Ornamental Crops (IGZ)

Nitrogen fertilization according to the Nmin-System

Nmin target values for field vegetables

Crop name	Soil layer for Nmin analysis	Date for Nmin analysis and fertilizer application	N in above ground crop parts	Required Nmin residue	Nmin target value
	cm	Weeks after planting/ Crop growth stage		kg N ha ⁻¹	
Black salsify	90	6	119	0	75
Broccoli	60	0	260	40	310
Broccoli, early	60	0	260	40	310
Broccoli, big leaf mass	60	0	300	40	360
Brussels sprouts, fast growth	90	0	423	0	310
Brussels sprouts, medium growth	90	0	423	0	305
Brussels sprouts, slow growth	90	0	423	0	290
Bush bean, manual harvest	60	0	121	20	110
Bush bean, processing	60	0	121	20	110
Carrot, bunching	60	4	119	20	115

Crop name	Soil layer for Nmin analysis	Date for Nmin analysis and fertilizer application	N in above ground crop parts	Required Nmin residue	Nmin target value
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Carrot, bunching, early	60	4	102	20	115
Carrot, bunching, late	60	4	119	20	110
Carrot, processing	90	6	207	0	165
Carrot, wash	60	6	151	0	125
Carrot, wash, early	60	6	138	0	125
Carrot, wash, late	60	6	151	0	110
Cauliflower	60	0	251	40	300
Cauliflower, early	60	0	251	40	315
Cauliflower, big leaf mass	60	0	292	40	350
Celeriac, root tuber, bunching	30	0	173	40	205
Celeriac, root tuber, bunching, early	30	0	147	40	185
Celeriac, root tuber	60	0	238	40	220
Celeriac, stalks	30	0	200	50	230
Chicory roots	90	4	188	0	135
Chicory roots, early forcing	90	4	163	0	105
Chinese cabbage, planted	60	0	195	20	215
Chinese cabbage, planted, early	60	0	195	20	225
Chinese cabbage, planted, late	60	0	195	20	195
Chinese cabbage, sown	60	0	195	20	200
Chinese cabbage, sown, late	60	0	195	20	185
Chives, sown	30	6	100	50	110
Chives, planted	30	0	100	50	110
Chives	30	After a cut	100	50	130
Chives, sown, rhizome for forcing	30	6	238	20	180
Cucumber, pickling, sown	30	0	205	40	190

Crop name	Soil layer for Nmin analysis	Date for Nmin analysis and fertilizer application	N in above ground crop parts	Required Nmin residue	Nmin target value
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Cucumber, pickling, planted	30	0	205	40	195
Cucumber, pickling, big leafmass	30	0	245	40	230
Dill, processing	30	0	90	40	105
Dill, leaves	30	0	66	40	85
Fennel, planted	60	0	170	40	205
Fennel, planted, early	60	0	170	40	205
Fennel, planted, late	60	0	170	40	200
Fennel, sown	60	4	135	40	135
Fennel, sown, late	60	4	135	40	135
Kale, manual leaf harvest	60	0	208	20	175
Kale, mechanical harvest	60	0	231	20	210
Kohlrabi	30	0	179	40	230
Kohlrabi, early	30	0	179	40	230
Kohlrabi, late	30	0	179	40	220
Kohlrabi, tuber size >12 cm Ø	30	0	217	40	270
Lamb's lettuce	15	0	45	40	85
Lamb's lettuce, early	15	0	45	40	100
Lamb's lettuce, late	15	0	45	40	75
Lamb's lettuce, overwinter, autumn	15	0	21	20	20
Lamb's lettuce, overwinter, spring	15	Begin of growing period	24	40	80
Leek, planted	60	0	227	40	240
Leek, planted, early	60	0	202	40	235
Leek, planted, late	60	0	246	40	250
Leek, sown	60	6	246	40	235
Leek, overwinter, autumn	30	0	94	40	85

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Leek, overwinter, spring	60	Begin of growing period	108	40	140
Lettuce, baby leaf	30	0	53	50	95
Lettuce, baby leaf, early	30	0	53	50	100
Lettuce, baby leaf, late	30	0	53	50	90
Lettuce, lollo/oak leaf, green	30	0	86	40	130
Lettuce, lollo/oak leaf, green, early	30	0	86	40	135
Lettuce, lollo/oak leaf, green, late	30	0	86	40	120
Lettuce, lollo/oak leaf, red	30	0	76	40	115
Lettuce, lollo/oak leaf, red, early	30	0	76	40	125
Lettuce, lollo/oak leaf, red, late	30	0	76	40	100
Lettuce, eisberg	30	0	134	40	175
Lettuce, eisberg, early	30	0	110	40	150
Lettuce, eisberg, late	30	0	134	40	165
Lettuce, endive, frisee	60	0	113	40	150
Lettuce, endive, frisee, early	60	0	113	40	155
Lettuce, endive, frisee, late	60	0	113	40	145
Lettuce, endive, smooth leaves	60	0	160	40	190
Lettuce, endive, smooth leaves, early	60	0	160	40	205
Lettuce, endive, smooth leaves, late	60	0	160	40	185
Lettuce, butterhead	30	0	108	40	150
Lettuce, butterhead, early	30	0	108	40	150
Lettuce, butterhead, late	30	0	108	40	140
Lettuce, radicchio	60	0	125	40	145
Lettuce, radicchio, early	60	0	125	40	155
Lettuce, radicchio, late	60	0	125	40	135

Crop name	Soil layer for Nmin analysis	Date for Nmin analysis and fertilizer application	N in above ground crop parts	Required Nmin residue	Nmin target value
	cm	Weeks after planting/ Crop growth stage		kg N ha ⁻¹	
Lettuce, romaine	60	0	110	40	145
Lettuce, romaine, early	60	0	110	40	145
Lettuce, romaine, late	60	0	110	40	135
Lettuce, romaine hearts	30	0	107	40	150
Lettuce, romaine hearts, early	30	0	107	40	155
Lettuce, romaine hearts, late	30	0	107	40	140
Lettuce, sugar loaf	60	0	160	40	190
Lettuce, sugar loaf, early	60	0	160	40	205
Lettuce, sugar loaf, late	60	0	160	30	165
Lettuce, different kinds	30	0	110	40	150
Mark pea, early to middle maturity	60	0	188	0	85
Mark pea, middle to late maturity	60	0	208	0	80
Onion, bunching	30	4	160	50	210
Onion, bunching, early	30	4	160	50	200
Onion, bunching, overwinter, autumn	30	0	40	20	20
Onion, bunching, overwinter, spring	60	Begin of growing period	80	50	125
Onion, fast growth	60	6	168	30	165
Onion, medium growth	60	6	168	30	155
Onion, slow growth	60	6	168	30	135
Onion, overwinter, autumn	30	6	30	20	10
Onion, overwinter, spring	60	Begin of growing period	111	30	120
Parsnip	60	4	200	0	140
Parsley, leaves	60	4	132	40	160
Parsley, leaves, early	60	4	132	40	175
Parsley, leaves, planted	60	0	132	60	210

Crop name	Soil layer for Nmin analysis	Date for Nmin analysis and fertilizer application	N in above ground crop parts	Required Nmin residue	Nmin target value
	cm	Weeks after planting/ Crop growth stage		kg N ha ⁻¹	
Parsley, leaves	60	After a cut	72	40	100
Parsley, overwinter, autumn	30	0	34	20	0
Parsley, overwinter, spring	60	Begin of growing period	98	60	150
Parsley, roots	60	6	168	0	130
Pumpkin	60	0	200	0	140
Radish, small	15	0	70	40	110
Radish, small, early	15	0	70	50	125
Radish, small, late	15	0	70	40	100
Radish, bunching,	30	0	102	40	140
Radish, bunching, early	30	0	102	40	145
Radish, bunching, late	30	0	102	40	120
Radish, German	60	0	137	40	175
Radish, German, early	60	0	137	40	185
Radish, German, late	60	0	137	40	160
Radish, Japanese	60	0	184	40	230
Radish, Japanese, early	60	0	153	40	200
Radish, Japanese, late	60	0	184	40	210
Red beet	60	4	268	20	250
Red beet, Baby Beet	60	4	162	20	175
Red beet, bunching	60	4	162	20	165
Red cabbage, fast growth	60	0	193	40	220
Red cabbage, medium growth	60	0	230	20	215
Red cabbage, slow growth	90	0	282	20	260
Rocket, fine leaf, summer	30	0	108	40	155
Rocket, fine leaf, April, May	30	0	108	40	150

Crop name	Soil layer for Nmin analysis	Date for Nmin analysis and fertilizer application	N in above ground crop parts	Required Nmin residue	Nmin target value
	cm	Weeks after planting/ Crop growth stage		kg N ha ⁻¹	
Rocket, fine leaf, early	30	0	108	40	160
Rocket, fine leaf, late	30	0	108	40	140
Rocket, coarse leaf, summer	30	0	160	40	215
Rocket, coarse leaf, April, May	30	0	160	40	205
Rocket, coarse leaf, early	30	0	160	40	220
Rocket, coarse leaf, late	30	0	160	40	200
Runner bean	60	0	207	0	100
Savoy cabbage, slow growth	90	0	300	20	285
Savoy cabbage, medium growth	60	0	263	20	255
Savoy cabbage, fast growth	60	0	225	40	265
Spinach, leaves, fresh market	30	0	100	40	135
Spinach, baby leaves, fresh market	30	0	68	40	100
Spinach, leaves	30	0	144	40	190
Spinach, leaves, early	30	0	126	40	170
Spinach, leaves, late	30	0	144	40	180
Spinach, processing	30	0	162	40	205
Spinach, processing, early	30	0	144	40	185
Spinach, processing, late	30	0	162	40	200
Spinach, overwinter, autumn	30	0	22	20	0
Spinach, overwinter, spring	30	Begin of growing period	122	40	160
Sweet corn, fast growth	60	0	159	40	170
Sweet corn, medium growth	90	0	190	20	165
Sweet corn, slow growth	90	0	190	20	155
Turnip, May-	30	0	136	40	170
Turnip, „Teltow“, late	60	0	130	0	110

Crop name	Soil layer for Nmin analysis	Date for Nmin analysis and fertilizer application	N in above ground crop parts	Required Nmin residue	Nmin target value
	cm	Weeks after planting/ Crop growth stage		kg N ha ⁻¹	
White cabbage, fresh market, medium growth	60	0	270	20	275
White cabbage, fresh market, fast growth	60	0	208	40	245
White cabbage, fresh market, slow growth	90	0	290	20	270
White cabbage, processing, medium growth	90	0	350	20	345
White cabbage, processing, fast growth	90	0	310	20	310
White cabbage, processing, slow growth	90	0	350	20	345
Zucchini, planted	60	0	269	20	255
Zucchini, planted, early	60	0	230	40	245
Zucchini, sown	60	0	230	20	200

Permanent crops

Crop name	Soil layer for Nmin analysis	Date for Nmin analysis and fertilizer application	N in above ground crop parts	Required Nmin residue	Nmin target value
	cm	Weeks after planting/ Crop growth stage		kg N ha ⁻¹	
Rhubarb					
1 st year	30	0	181	30	125
2 nd year	30	Begin of growing period	101	40	100
2 nd year	60	End of harvest	239	0	150
3 rd year	60	Begin of growing period	151	20	125
3 rd year	90	End of harvest	254	0	170
after 3 rd year	60	Begin of growing period	176	20	140
after 3 rd year	90	End of harvest	225	0	135
Asparagus, 15,000 plants ha ⁻¹					
1 st year	60	0	82	40	110
2 nd year	90	Begin of growing period	99	40	130
3 rd year	90	End of harvest	98	40	140
after 3 rd year	90	End of harvest	55	20	80
Asparagus, 20,000 plants ha ⁻¹					
1 st year	60	0	108	40	140
2 nd year	90	Begin of growing period	129	40	160
3 rd year	90	End of harvest	124	40	160
after 3 rd year	90	End of harvest	55	20	80

Calculation of the N fertilizer demand

- Nmin target value
- Nmin in rooted soil layer
 - N mineralization from harvest residues of the same year
 - N mineralization from organic fertilizers

= N fertilizer demand

Increase and decrease of Nmin target values

The given Nmin target values take into account:

- N fluxes into above ground plant parts (as affected by yield expectance)
- N fluxes into storage organs in case of permanent crops
- N fluxes into plant roots and into microbial biomass (estimated at together 20% of the N supply)
- N mineralization from soil organic matter (estimated at $5 \text{ kg N ha}^{-1} \text{ week}^{-1}$)

The Nmin target values should be corrected to site specific mineralization rates and yield expectances if such information is available.

Recommendations for time of fertilizer application

For most vegetable crops we recommend soil sampling for Nmin and subsequent fertilizer application shortly before planting. These cases are marked with "0" in the column Date for Nmin analysis and fertilizer application.

For crops with a long germination period and slow early development we recommend soil sampling and fertilizer application four or six weeks after planting.

The calculated fertilizer demand should be split in two dressings for long growing crops on light soils. Soil should be sampled shortly before fertilizer application. If the soil sample dates back several weeks, we recommend correcting the sample result by adding the estimated mineralization from soil organic matter (e.g. $5 \text{ kg N ha}^{-1} \text{ week}^{-1}$).

Source

Carmen Feller, Matthias Fink, Karin Rather, Hermann Laber, Klaus Strohmeyer und Joachim Ziegler. Düngung im Freilandgemüsebau. In: Fink, M. (Hrsg.): Schriftenreihe des Leibniz-Instituts für Gemüse- und Zierpflanzenbau (IGZ), Heft 4, 4. Auflage. Großbeeren 2013, ISBN 1437-3394
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