

Spinach (*Spinacia oleracea* L.)

French: Epinard; Spanish: Espinaca; Italian: Spinacio; German: Spinat

Under Temperate Conditions

Crop data

Harvested part: Rosette of smooth or curly, fleshy leaves.

Growth cycle rather short (8 weeks for earlier cultivars). Requires rather low temperatures (15-18 °C optimum) for satisfactory leaf yield.

Root system: main, deep, tap root, numerous shallow rootlets.

Plant density: more than 100 plants/m² with seed rate from 20-40 kg/ha. Yields 15-30 t/ha; hand-picked crops (leaves) can produce up to 50 t/ha.

Suffers from acid soils, prefers pH values between 6 and 7.5; tolerates brackish soils rich in organic matter and well-drained.

Nutrient demand/uptake/removal

In kg/ha; N = 60-100; P₂O₅ = 30-50; K₂O = 100-230; MgO = 10-20; CaO = 20-30 for normally yielding crops; higher yielding crops twice these amounts. Maximum uptake (60 % of the total) only occurs during 2-3 weeks before harvesting.

Fertilizer recommendations

FYM not recommended for hygienic reasons. For a medium yielding crop 100-150 kg/ha N, 70-100 kg/ha P₂O₅ and 150-180 kg/ha K₂O are recommended; doubled for higher yielding crops (hand-picked).

Two or more topdressings of N. Under field conditions highest yields were obtained with ammonium N and five applications up to a total of 200 kg/ha N.

All nutrients should be incorporated in the upper layer of soil (25-30 cm; shallow location of absorbing roots).

Sensitive to Mg deficiency (leaf chlorosis).

Especially during cloudy, winter seasons spinach can accumulate high quantities of nitrate N in its tissues (up to 2 500 ppm on fresh matter basis); N fertilization (doses, form, sharing) to be managed accordingly.

Under Tropical/Subtropical Conditions

Crop data

Direct seeded. Harvested: 37 - 45 days after planting. Plant density: 72 500 to 653 500 plants/ha. Preferably grown in sandy loams but can be grown in a variety of soils with pH between 6 and 7. The crop is adapted to cool growing conditions.

Target marketable yields in intensive commercial production: 9 - 17 t/ha.

Nutrient demand/uptake/removal

Nutrient uptake/removal - Macronutrients					
Yield t/ha	kg/ha				
	N	P2O5	K2O	MgO	CaO
21	131	34	226	42	41

Source: various

Plant analysis data

Plant analysis data - Macronutrients (optimum fertility conditions)						
Plant part	Growth stage	% of dry matter				
		N	P	K	Mg	Ca
Young mature leaf	40 days after planting; harvesting	2.6	0.3	4.7	1.0	1.0

Source: various

Plant analysis data - Micronutrients (optimum fertility conditions)							
Plant part	Growth stage	ppm dry matter					
		Fe	Mn	Zn	Cu	B	Mo
Young mature leaf	40 days after planting; harvesting	189	36	37	4	19	1

Source: various

Fertilizer recommendations

Spinach has a moderate tolerance to salinity, but it is very sensitive to acidity. N demand is great just before harvest because of the flush in growth. When present in the rhizosphere, the N-fixing bacteria *Azospirillum* spp. promote the growth of this crop. It has a relatively high demand for B. In B-deficient soils broadcast 10 kg/ha borax with the initial fertilizer application.

Present fertilizer practices

USA (Florida)

For spinach grown on irrigated mineral soils apply: 90 kg/ha N, 120 kg/ha P2O5, and 120 kg/ha K2O. At planting broadcast all the P2O5 and one-quarter of the N and K2O. The remainder of the N and K2O is sidedressed in split dressings at 20 and 40 days after planting.

USA (North Carolina)

In sandy and sandy loam soils broadcast 130 kg/ha N, 95 kg/ha P2O5, and 160 kg/ha K2O before planting. Follow up with split applications of 50 kg/ha N, soon after planting.

Brazil (Minas Gerais)

Apply, firstly, 60 kg/ha N, 200 kg/ha P₂O₅ and 90 kg/ha K₂O incorporated in the soil at planting and, secondly, 60 kg/ha N broadcast in two applications, 15 and 30 days after planting.

Further reading

MARKOVIC, B.; LAZIC, B.; DJUROVKA, M.: Effect of increasing nitrogen doses on yield and quality of spinach. *Acta Hort.* 220, 297-302 (1987)

SANDERS, D.C.: Spinach. N.C. Coop. Ext. Serv. Leaflet No. 17 (1990)