

# Hops (*Humulus lupulus L.*)

French: Houblon; Spanish: Lupolo; Italian: Luppolo; German: Hopfen

## Crop data

Harvested part: umbels (cones) which develop from unpollinated flowers.

Rhizome cuttings, or young plants cultivated in the greenhouse, are used as planting material. Rootstocks develop during the first year, when little or no yield is produced.

Flowers July in northern hemisphere, December-January in southern hemisphere.

Harvested late August - early September (northern hemisphere), March - April (southern hemisphere). Whole plants are removed and then processed in a stationary picking machine; wastes (leaves, petioles, vines) are chopped and, in part, brought back to the field. Because the cones are immediately dried to 12 % moisture, yields are expressed in terms of dried hops.

Rootstocks sprout anew each year, life expectancy: 10-20 years.

Plant density: 1 800-2 200 plants/ha, with two vertical wires to each plant (variations depending on variety and site).

Preferably grown on medium soils (Sandy Brown Soil or Loess Brown Soil) with pH 5-7.

Without irrigation, in temperate climates with adequate precipitation during the vegetation period (Europe); or, with irrigation, in arid climates (USA, etc.).

## Nutrient demand/uptake/removal

Nutrient removal (cones, plus leaves, petioles and vines) - Macro- and micronutrients								
Yield* t/ha	Source	kg/ha					g/ha	
		N	P2O5	K2O	MgO	CaO	Zn	Fe
1.86	Zattler, 1954/56	117	38	110	-	154	-	-
2.84	Marocke, 1957	204	60	167	-	296	-	-
2.42	Roberts, 1961	272	74	257	-	-	-	-
2.00	Rossbauer, 1978	150	45	160	40	190	600	1 630

\* dried hops

## Plant analysis

Plant analysis data (average nutrient content of aerial parts) - Macronutrients				
% of dry matter				
N	P	K	Mg	Ca
2.58	0.34	2.21	0.39	2.35

## Fertilizer use

**Germany** (example of temperate climate, without irrigation):

Planting year (baby hops):

- first N application when growth begins (late June), at 5-7 kg N/1 000 plants;
- second N application when plants are well developed (end of July), 5-7 kg N/1 000 plants.
- P and K fertilizer needed only on soils of low to medium content

Subsequent years - strung for harvest (for expected yield of 2 t/ha):

N at 180-200 kg/ha, which may be reduced if Nmin test in early March indicates more than 80 kg/ha (nitrate + ammonium) in top 90 cm of soil. For early-maturing varieties this is applied one-third in March, one-third in April, one-third late May; and for late-maturing varieties one-third in March, one-third late May, one-third early July. Usually given in ammonium nitrate form (e.g.CAN). Occasionally as 1-2 spray applications of urea ammonium nitrate solution (15-30 % concentration) from late May to mid-June to the soil and to the plants up to a height of 1 m, thereby simultaneously destroying excessive shoots.

**P, K, Mg:**

Nutrient levels in soil (mg/à g)			Recommended fertilizer rates* kg nutrient per ha		
P2O5	K2O	Mg	P2O5	K2O	MgO
15-25	15-35	7-25	45	160	40
*Rates may be increased by up to 100 % on soils lower in these nutrients or may be progressively reduced to zero at higher nutrient levels.					

Basal fertilization is generally applied in one operation (March).

- lime (where required, liming is done in the autumn):

Type of soil	Desired pH	Maximum single application	
		CaO (t/ha)	CaCO3 (t/ha)
Sand	5.3-5.7	-	2.0
Loamy sand	5.8-6.2	-	2.5
Sandy loam/silty loam	6.3-6.5	1.5	3.0
Clayey loam/clay	6.5-6.9	2.0	-

Micronutrients: hops are sensitive to Zn deficiency, which is generally associated with high soil pH and excessive soil P; it may be controlled by foliar sprays of 0.1-0.2 % zinc sulphate or chelate (3-5 sprays from tying to flowering), or Zn-containing fertilizers may be applied to the soil.

**USA** (example of arid climate, with irrigation):

**N:**

where soil N = 10 ppm, 160 kg/ha N  
 where soil N = 20 ppm, 110 kg/ha N

**P2O5:**

where soil P2O5 = 46 ppm, 126 kg/ha P2O5

**K2O:**

where soil K<sub>2</sub>O = 72 ppm, 216 kg/ha K<sub>2</sub>O

These rates may be increased by up to 50 % on soils where nutrient contents are lower, or reduced where they are higher than the amounts stated.

N is applied in three split dressings; P and K in a single application.

**Zn:** applied, where necessary, as foliar sprays of 0.15-0.18 % zinc sulphate or chelate.

### **Further reading**

ROBERTS, S.; NELSON; C.E.: Hop Nutrient Uptake and the Relationship between Quality and Nutrient Content of Hop Cones. Washington Agricultural Experiment Stations, Institute of Agricultural Sciences, Washington State University, Bulletin 630, USA (1961)

ROSSBAUER, G.; ZWACK, F.: Versuche zur Stickstoffduengung im Hopfen. Hopfen Rundschau No. 5/85, Germany (1985)

ROSSBAUER, G. et al.: Hopfen: Anbau, Duengung, Pflanzenschutz - Hinweise fuer das Jahr 1991. Hopfen Rundschau No.3/91, Germany (1991)

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