

Lupin is an emerging new protein crop in The Netherlands. Cultivation has gradually increased, with an acreage of ca. 58 ha in 2019. Both white, broad-leafed (*L. albus*) and blue, narrow-leafed lupins (*L. angustifolius*) are cultivated, White lupin is characterized by large white, flat seeds; blue lupin has small round seeds, either white or coloured. Lupin is cultivated for both food and feed, and contains a balanced source of protein. Protein content of lupins is high (av. 36% in DM) and with yields up to 4 t/ha, the protein yield can be more than 1000 kg/ha. The variety choice has increased over the last couple of years. As a nitrogen-fixating and flowering crop, lupin contributes positively to soil quality and biodiversity, as it attracts many wild pollinators.

## Field selection

White lupin can be grown on calcium-rich soils with pH up to 7.8, but calcium tolerance depends on variety. For most blue lupins, pH should not exceed 6.8, with a maximum CaCO<sub>3</sub> content of 0.8%. The full potential of lupin becomes manifest in a nitrogen-poor spot in the crop rotation. Due to the nitrogen-fixating capacity, lupin needs little nitrogen supply from the soil. Lupin should be cultivated in rotation of at least 1:4, and preferably 1:6 with other pulses.

## Sowing

**Sowing time and density** Sowing time of lupins in The Netherlands is early March until the first half of April. As the early crop is vulnerable to damping off, it is important to ensure a dry sowing bed. Sowing densities depend on the desired crop density, TSW and germination rate. Generally, blue and white lupin species can be divided into branching and non (or reduced) branching types, with different recommendations for sowing density (see next page).

**Inoculation** Nitrogen fixation in lupin is based on the symbiotic relation with the bacterium *Bradyrhizobium lupini*. If no lupins have been cultivated before, or >8-10 years ago, inoculation is strongly recommended. The bacterium differs from the bacteria for soy or pea. Commercially available inoculants specific for lupin are HiStick Lupin (BASF) and RADICIN Lupin (Jost GmbH). Inoculation is performed by mixing the inoculant with the seed, shortly before sowing.



**Sowing technique** Both mechanical and pneumatic seeders can be used for sowing. Row distance is 10-12 cm when harrowing, and 25-60 cm when hoeing is preferred. At this distance, non-branching blue lupin species will leave a fairly open canopy, which makes weed control difficult. Branching species have no problem closing the canopy. Sharp coulters are needed to place the seeds at sufficient depth (2-3 cm).

## Management

**Weeds** In conventional lupin cultivation, crop protection is restricted to the use of pre-emergence herbicides. In order to keep the crop weed-free, frequent harrowing is essential. Because of the fast germination and emergence, harrowing before emergence is generally done only one time. Around germination harrowing is possible with a chain harrow. After emergence a tine harrow can be used, with increasing pressure in the growing crop. At least four times harrowing is recommended.

**Diseases** Lupins are especially prone to disease in the germination and early development stages. Soil fungi and larvae of click beetles can cause early crop failure. Several diseases can attack lupins in a later stage, such as *Anthracnosis*, *Pleiochaeta* and *Stemphylium*. Blue lupin tends to

be less susceptible for anthracnosis than white lupin. Healthy seed is important: many fungal diseases are seed-borne.

## Harvesting

**Harvest time** The harvest time depends on lupin species, branching type and variety. The current varieties of blue lupin are earlier than most white lupin varieties. Information on earliness of varieties is included in the table below.

**Threshing** White lupin should be harvested in a fully ripened and dried crop. When harvesting with a high moisture content, part of the beans will stay in the pods, and will be lost. Blue lupins thresh very easily, but are more prone to pod shattering. They should be harvested preferably when 90-95% of the pods are brown. During sharp drying weather, threshing should be done early in the morning or in the evening, to prevent large losses. The combine should perform few revs with a wider adjustment of the drum, applying more wind compared to cereals.

## Contact

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Yield (t/ha, 85% DM) and protein% of sweet cultivars tested (2015-2019) on sandy soil in The Netherlands.

cultivar	species type		plants/m2		early	2015	2016	2017	2018	2019	protein	protein
						t/ha	t/ha	t/ha	t/ha	t/ha	% in DM	kg/ha
Boregine	blue	branching	80-90	+		2.8	2.0 <sup>1</sup>	1.2			38.2-41.7	428-655
Boruta	blue	determinate	120-140	++		3.1	1.5 <sup>1</sup>	1.8	1.5 <sup>2</sup>	3.3	29.1-39.2	376-914
Iris	blue	branching	80-90	+		3.1	2.5 <sup>1</sup>	1.0	2.9	2.3	31.3-39.7	333-813
Primadonna	blue	determinate	120-140	++		2.9	1.3 <sup>1</sup>		3.3 <sup>2</sup>	3.0	28.6-34.4	363-879
Regent	blue	determinate	120-140	+		3.3	3.5 <sup>1</sup>	2.5	2.1	4.0	31.3-37.5	644-882
Boros	white	determinate	80-90	+		2.1	1.3 <sup>1</sup>	3.2	2.4	3.0	32.1-35.3	374-962
Butan	white	branching	40-50	+			0.2 <sup>1</sup>	2.8	3.0	2.4	32.9-35.7	685-890
Dieta	white	branching	40-50	-			0 <sup>1</sup>	0 <sup>1</sup>		2.8	35.0	843
Feodora	white	branching	40-50	+/-			0 <sup>1</sup>	3.3	3.2	2.7	34.6-38.7	786-1064
Figaro	white	branching	40-50	-					2.7	3.2	31.5-38.5	857-887
Sulimo	white	branching	40-50	-					3.8	3.4	31.3-39.6	893-1294
<b>average</b>						<b>2.8</b>	<b>2.0</b>	<b>2.0</b>	<b>2.7</b>	<b>2.8</b>		

<sup>1</sup> yields not representative due to early anthracnosis infection;

<sup>2</sup> Excluding losses by shattering pods (Primadonna 0.4 t/ha loss; Boruta 2.6 t/ha loss)

