Productions: ☑ Grains for Food ☐ Grains for Feed ☐ Forage ☑ Crop benefits

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Lentil: develop the crop from field to market

Authors:
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Objectives: growing a pulse with high added-value by managing marketing in short circuits

- Fix nitrogen for supplying the next crop
- Improve weed control over the rotation
- High selling price for food

Eure-et-Loir, FRANCE

- farm of 45 ha
- Clay-limestone soils
- Soil sensitive to crusting
- Temperate climate

Tillage

- 1 ploughing before combined seed drill.
- Prefer the use of tine cultivator than disc cultivator to eradicate perennial weeds and to reduce the risk of soil crusting.

Sowing

- As early as possible after winter to limit heat stress in spring: between 1 March and 1 April.
- Rate 80-100 kg/ha to ensure a crop competing with weeds.
- Prefer a flat field to facilitate harvesting
- ANICIA variety fertilized with 200 kg/ha of 0.25.25

Weeding and pest management

- Herbicide CHALLENGE : 2L at sowing + 1L max at 3-4 leaves when necessary.
- AMISTAR applied as soon as disease is visible.
- CYTHRINE MAX as soon as a flight of weevils appears.

Harvest

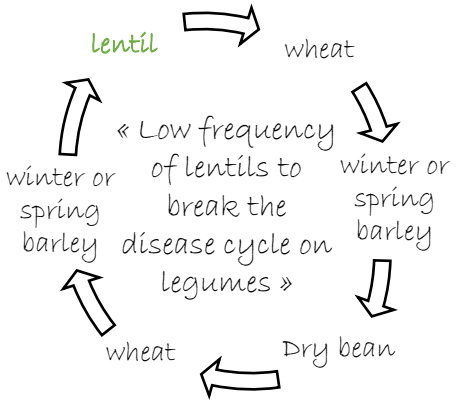
- 1.5 t/ha on average.
- Avoid mixing dirty and clean areas of the field to facilitate weeds sorting and obtain a clean lentil batch for sale.
- Axial rotary harvester that drops off the lentils rather than the thresher which breaks the grains.

Sorting and storage

- Several tools successively used to sort = separator + de-stoner + densimetric table + optical sorter
- Cold storage at -20°C for 3 weeks to prevent weevils development.

Outlets

- Hand-bagged lentils are sold by the farmer to local supermarkets, shops, restaurants.
- Unsold and lower quality batches are sold to wholesalers or canneries.



Benefits for the rotation:

- Saving min 20 U N/ha fertiliser on the following wheat.
- Higher wheat yield than wheat grown after a cereal.
- Alternating spring and winter crops contributes to the control of the weed flora in the rotation, resulting in a reduction of about 50% of pesticide use on wheat.

Evaluation by the farmer:

☺ Economic interest with a selling price of around 3 € per kg, compared to 0.40 or 0.50 €/kilo for a lentil sold in a traditional long circuit.

☺ Stable clientele from one year to the next with a gain in independence (no contracts).

😐 High workload to maintain good lentil quality throughout the production chain.

Success conditions and risks:

- Regularly observe fields to control weevils' flights, and diseases as soon as possible after rainy weather.
- Take care of the harvest to maximize good quality batches.
- Prefer low surfaces (5 or 6 ha) to control the interventions.

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Soybean in OF: technical ease combined with a good selling price

Authors:
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Objectives: introduce diversity into the rotation thanks to a crop that is easy to grow and has good selling value

- **Simple mechanical weeding and no inputs**
- **Interesting and stable gross margins**

Gers, FRANCE

- **Farm of 70 ha in organic farming.**
- **45 ha of crops, the rest in grassland with a herd of 25 Blonde d'Aquitaine cows.**
- **Humus-rich loam + crusting-sensitive soils**

Tillage

- Rotary harrow + vibrocultivator.
- Avoid numerous soil tillage passes **in crusting-sensitive soils.**

Sowing

- 2nd half of May.
- Sowing at **430 000 plants/ha.**
- 80 cm row spacing to **allow for hoeing machine passage.**
- ISIDOR **variety** (group I), not very sensitive to lodging, with large grains easy to sort.
- **Inoculation of the seeds** to ensure root nodules.

Weeding and pest management

- **harrows** 2 to 3 days after sowing.
- **2 to 3 passes of the rotary hoe** over the entire soil surface until the cotyledons open.
- **2 inter-row hoeing passes** when the crop is more developed.

Harvest

- Harvested by a contractor around 150 €/ha.
- Maturity reached when the grains "ring in the pods". **Start harvesting** as soon as the plant is dry, **after the dew** in the morning and **stop when the evening humidity increases.**

Sorting and storage

- Post-harvest cleaning with a co-owned sorter to **eliminate weed seeds that retain moisture.**
- Second sorting of the grains kept for seed to **eliminate broken grains.**
- No drying, but ventilation during storage on the farm.

Outlet

- Valuation for human food or animal feed **depending on the quality of the batches.**
- In 2019, soybean valued at around **730 €/t for food** and around **660 €/t for feed** in 2020.
- Trades with **cooperatives**, and sometimes with a regional agricultural cooperative organized as a **C.E.T.A.** (Centre for Agricultural Technical Studies) or with **brokers.**

Benefits for the rotation:

- Few residues on the ground, and a good soil quality in autumn which facilitates the establishment of the following crop, in particular a cereal or a cover crop.
- Good behaviour of the crop with mechanical equipment, which allows a good control of weeds and results in a clean field after harvest.

Evaluation by the farmer:

☺ One of the best gross margins of the farm with farm-produced seeds and no inputs.

☺ Possible adjustment with short-cycle varieties on a few hectares to ensure easier harvesting conditions at the end of the summer.

☺ Easy to store and ventilate.

😐 Limited duration for harvest in a day.

Success conditions and risks:

- Sow the crop in warm and dry soil to stimulate a quick emergence and avoid weed problems.
- Pay attention to humidity and rainfall at the end of the cycle, which can disturb harvesting.
- Avoid numerous legumes in the rotation to lower Sclerotinia risks.

Productions: ☑ Grains for Food ☑ Grains for Feed ☐ Forage ☑ Crop benefits

Credits: Terres Inovia

Soybean: an alternative to maize monoculture in the Southwest

Authors:
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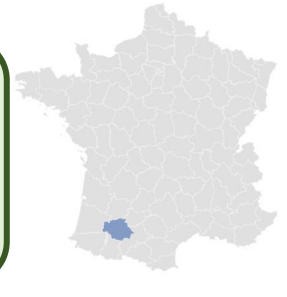
LEGVALUE

Objectives: limit inputs and erosion + value the economic margin rather than maximize yields

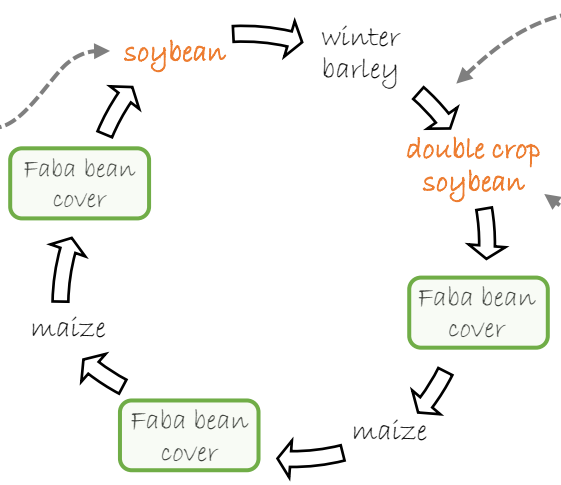
- Direct seeding to maintain high-quality soil
- Diversified rotation to break the weed cycle
- Good economic margins for soybean and barley

Gers, FRANCE

- Farm with 70 ha of arable crops and 25 ha of fruit and vegetable crops.
- Boulbènes + soils prone to crusting and erosion.
- Previously in monoculture of maize



- **Direct sowing** in a warm and dry soil, at the beginning of May or even at the end of April, with the aim of **harvesting** by 15 October.
- **Variety** ISIDOR (group I).
- **Yield** around 4 t/ha on average.
- **Faba bean cover crop it's a good technical solution :** easy to sow ; easily rolled at the time of maize or soybean sowing. But it's not the best agronomic solution before an other legumes.
- Faba bean **supply 25 to 30 U N/ha**



- **Collected straw** to facilitate direct seeding of double crop soybean (⚠ remaining straws can hide weeds: it possible to trigger an irrigation to enhance weed emergence and to treat them or two passages of PULSAR 40).
- **Direct sowing of soybean** at the end of June or beginning of July, within 2 days after the harvest of the winter barley.
- **Harvest** between 15 and 20 October at the latest
- **Varieties** 00 or 000; often MENTOR (00).
- 2.5 to 3 t/ha depending on the earliness group.

Inputs

- 1L ha of **glyphosate** after sowing the soybean in main crop to finish destroying the cover crop; in post-emergence, **PULSAR 40** in 1 or 2 times 0.5 L at the 1st trifoliate to avoid impacting the soybean crop.
- 1 year out of 3, **P-K fertilization** (15.15.15) on soybean in main crop.
- 4 applications of 25 mm **irrigation.**

Post-harvest

- **Grains stored and ventilated** on the farm before delivered to the cooperative.
- The grain is used for human food if the quality criteria (protein content, impurities) are met, generally at around **350 euros** per ton, otherwise it is used for animal feed.

Benefits for the rotation:

- Interesting soybean root system: in addition to providing the soil with part of the fixed nitrogen, soybean allows a soil "tilled" by the rootlets and of good quality, which favours the establishment of a barley in direct seeding.
- Change in the weed flora compared to the former maize monoculture.

Evaluation by the farmer:

☺ Direct seeding solves the very strong problem of erosion and crusting on these soils.

☺ A more diversified and less aggressive system allowing to improve soil quality and to increase the OM level that had become very low.

😐 Small harvest window and limited duration for harvest in a day.

Success conditions and risks:

- Sow as early as possible without rushing.
- Avoid threshing the seeds too hard and favour a flattened soil or a flex cutter bar for a successful harvest.
- Be careful to soil compaction in the first cm after 6 or 7 years of direct seeding.
- Work on water drainage in the fields to avoid water accumulation where the soil is too compact.

Productions: ☑ Grains for Food ☑ Grains for Feed ☐ Forage ☑ Crop benefits

Credits: Terres Inovia

Lentil in OF: a good previous crop for wheat with simple technical management

Authors:
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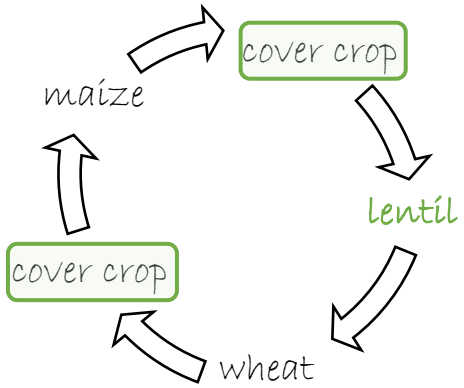
Objectives: lengthen the rotation with a good previous crop for wheat

- Few operations required between sowing and harvesting
- Diversification allowed over the rotation
- Selling price still attractive in organic farming

Vendée, France

- 185 ha in OF arable crops
- All the farm can be irrigated
- Very heterogeneous soils: plain loam + red soil + very clayey soils



Sowing

- From March 1st, as soon as the soil is dry enough, variety **ANICIA at 110 kg/ha** without fertilization.
- **Ploughing,** then seedbed cultivator to flatten the soil, then sowing with combined seed drill and rolling behind.
- **When no ploughing**: maize residues are crushed and then rotavator is used before the cover crop is sown. In the spring, the rotavator is used to destroy the cover crop. After drying, the seedbed cultivator can be used and lentil is sown with a combined seed drill. This method requires more patience to avoid too greasy soil layers.

Weeding and pest control

- Harrow is not efficient, as plants are too fragile.
- 2 passes **with weeds surfer** of 12 m wide in May and June + manual weeding if necessary.
- Few pest and disease problems. Weevils are managed in post-harvest by the storage organization.

Post harvest

Harvest **pre-cleaned** and installed in a bushel for a departure to the coop the next day (CAVAC).

Harvest

- Harvested in July, average yield of 1.6 t/ha (min: 1.2 t/ha ; max 2.5 t/ha).
- Cut of 6.70 m with use of crop lifters if there are few stones on the soil, otherwise the stones can go into the harvester.
- Possibility **of harvesting in windrows** when there is a lot of weeds (polygonum, bindweed) at harvest or when the end of the cycle is too wet: lentils mowed in swaths, left to dry and then harvested with a pick-up.

Benefits for the rotation:

- Good previous crop for wheat because of the nitrogen supplied to the soil after harvest.
- Efficient lever to break the cycles of diseases, pests and weeds of other crops in the rotation.
- Zero input crop.

Evaluation by the farmer:

☺ Simple technical management that does not require specialized agricultural machinery.

☺ Small market in OF with high selling prices, around 1500 euros/ton.

😐 Successful harvest depends on weather conditions at the end of the cycle and on successful weeding.

😐 In OF, the crop tends to soil the plots.

Success conditions and risks:

- Careful seeding, as early as possible in conditions that are not too wet to facilitate the work of farm machinery and promote a good seedbed.
- Crop that "hits the ground" so target flat fields to facilitate harvesting.
- Plots with stones can complicate the harvest.

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Lucerne to improve feed autonomy

Authors:
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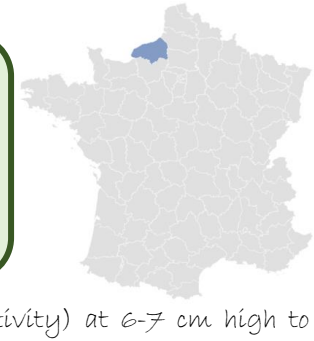
Credits: Arvalis

Objectives: reinforce the protein autonomy of the farm by a crop with a good longevity and a good protein tonnage

- **Lucerne yield is secured in dry soil due to its deep roots**
- **Restructures the soil thanks to its pivotal root system**

Seine Maritime, France

- **92 ha in crop-livestock with reduced tillage**
- **Transforms 450 000 L of milk**
- **"petite Sibérie de l'Oise", 700 to 900 mm**
- **Clay with flint and sandy-silty with flint**



False seed bed after barley to limit the competition of volunteers with young lucerne shoots:

- Passage of a tine implement at 7cm.
- Let the volunteers regrowth.
- Passage with discs.
- Let the volunteers regrowth.
- 2nd passage with discs.

Organic amendment before sowing, 25t of lightly composted manure + in winter, if the conditions allow it, try to bring every year 15 t of manure + **complementation the first year** with 60 to 90 units of potash in spring.

- 15 may
- 20 to 25 june
- 25 july
- 1er september

Mowing every 30 to 45 days, when the flower buds arrive (optimum between protein content and productivity) at 6-7 cm high to promote ramification and tillering of the plant. At the 2nd cut, he lets the flowers bloom longer to promote the exchange of carbon between the soil and the plant and to ensure the longevity of the lucerne. Then destroy with a stubble cultivation in the spring of the 4th year.

winter barley → lucerne → lucerne → lucerne → lucerne → maize → wheat

Must be sown before August 15:

- 22 kg/ha of lucerne.
- 4 to 6 kg/ha of red clover.
- at 1 cm max with 2 passes of roller to increase the contact of the seed with the soil + a glyphosate between 0.8L and 1.2L.

If weed pressure are too high during winter, application of a NIRVANA and HARMONY SX (30g/ha)

Harvest with a classic mower, no conditioner to avoid destroying the leaves:

- Mowing then spreading with a tedder.
- **Drying between 24 to 72 hours** (depending on air and soil hygrometry) **to reach 35%** DM before windrowing and harvesting with a self-loading trailer.
- Yield of 3 to 4 tons of DM per cut.

Post-harvest: fodder stored in silos with a **tamping stage to be carried out properly** + hermetic closure with 3 layers (1st polyane tarpaulin, 2nd black protective tarpaulin and a net with ballast bags).

Benefits for the rotation:

- Return of 40 to 60 U N/ha the first year of cultivation and 20 to 30 U N/ha the second year.
- + 15% increase in yields on the following maize and wheat crops.
- Very effective lever to fight thistle shoots: thanks to the competition and smothering phenomena, he no longer has thistle regrowth in his plots with lucerne.

Evaluation by the farmer:

☺ Clover takes the place of lucerne where it disappears.
☺ Regular cutting helps to control some of the weeds, as they have difficulty to regrowth.
☺ This system offers many possibilities for evolution (associations, sowing under cover, barn drying).
😐 Management of dock, capsella and bluegrass.
😐 Guarantee a good emergence of seedling can be tricky.

Success conditions and risks:

- Ideally, sow just before a rain in order to favor the establishment.
- Target a variety that adapts to the soil and climate, with a good protein tonnage per hectare and good longevity (disease resistance, drought).
- Avoid the return of lucerne too quickly in the rotation, favor a delay of 6 or 7 years.

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Shared mobile sorter, to autonomously grow and sort triticale/pea mixture

Authors:
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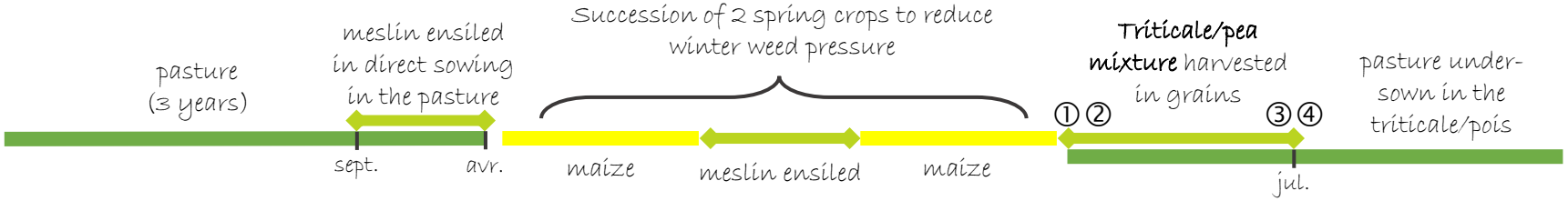
Credits: farm chamber of Pays de la Loire

Objectives: Improve the efficiency of production and use of mixture on the farm

- Regular reduction in the use of correctors N
- Seed autonomy and securing yields thanks to the mixture
- Performance of associations that can be easily valorized

Vendée, France

- Produces 1 million liters of milk
- 196 ha in reduced tillage
- Clayey loam soils, deep loam, fine, rather fragile with hydromorphic zones



① Sowing and weeding strategy:

- Around 20 grains/m² of pea farm-produced seeds.
- 110 kg/ha of farm-produced triticale (renewal after 3 years).
- Obj at emergence = 15 plants/m² of pea and 300 of triticale.
- **Aim for maximum competition from establishment** by working on seeding density and the covering power of the under-sown pasture (⚠ avoid high pea densities to limit the lodging in the spring).

② fertilization:

- Before: 3t of compost in the autumn.
- Today: tested without fertilization because he remains doubtful about the efficiency of use of his compost at the end of winter after leaching.

③ Harvest and average yield:

- Mowing with a drying time of 8-10 days before threshing.
- 4 t/ha in total but the **proportion between triticale and pea can vary greatly** between years depending on disease pressure and climate.

④ Sorter and uses:

- Flat storage with drying by ventilation before taking the mixture for sorting.
- **Rotary sorter with 4 adjustable grids**, placed on an agricultural trailer and equipped with lifting chains that allow 1 skip to charge the sorter and 2 others to recover the products at the exit + Possibility of pouring directly the seeds resulting from the sorting into big bags.
- The sorted **peas are consumed by his cows** and for the **triticale, 20% of the harvest is sold** (to the CAVAC, from 220 to 300 €/t) **and 80% for self-consumption.**
- Sorting rate for a triticale/pea = 7 to 8 t/hour
- He sorts triticale-pea but also his pure faba bean and his harvested clovers to make his seed, his vetch-oats...
- Sorter and its trailer + lifting chain = 65 000 €.

Benefits for the rotation:

- Triticale/pea mixture with 0 inputs and no interventions except sowing and harvesting.
- no depreciating effect of the undersown pasture.
- The sorting waste (pea or triticale fragments), which cannot be sold, can be consumed on the farm.
- TCS improves the biological activity of the soil.
- Allows to consider more diversification of the mixtures.

Evaluation by the farmer:

😐 Management of wild vetch and ravenella...

☺ ... but whose pressure can be limited by the 2 years of spring crops, interspersed by a meslin that he ensiles, in which the vetch and ravenella are harvested and can be feed cows.

☺ With the sorter he systematizes the triticale/pea and no longer makes a pure triticale by default which was sold or self-consumed.

☺ More control on the outlets of his harvests.

Success conditions and risks:

- Be careful not to have homogeneous seed diameters which can complicate sorting with a grid separator. ex: vetch-oats.
- Follow the numerous references on the management of triticale/pea.
- Try to control as much as possible the weed pressure.