Diesel usage machinery

How to calculate the diesel usage for machinery for the grape varieties **Cabernet Sauvignon** and **Merlot**.

The vineyard includes two grape varieties; Cabernet Sauvignon and Merlot, with the area distribution: 18 ha of Cabernet Sauvignon, 12 ha of Merlot.

The tractor model used in the vineyard: **New Holland T4.85**.
Fuel consumption: Drawbar: 16.3 l/h, PTO: 16.7 l/h.
(Find specifications for tractor models here: Tractors technical specs, fuel economy, dimensions, price, performance and equipment)

SCENARIO 1

The two grape varieties are cultivated under comparable agronomic and mechanised management. Tractor operations (soil cultivation, mowing, spraying, canopy management, and transport) are identical across varieties and are therefore modelled using a common set of tractor working hours, allocated per hectare.

Operation time Scenario 1:

Soil cultivation & mechanical weed control

Period: March–June (+ possible late summer pass)
Fuel consumption: **Drawbar**

Pass	Type of operation	Operation time (h/pass)
1	Spring cultivation	15
2	Mechanical weed control	15
3	Follow-up interrow cultivation	15

Operation time: 3 passes × 15 h = 45 h/year

Inter-row mowing / flail mowing

Period: May–August
Fuel consumption: **PTO**

Pass	Type of operation	Operation time (h/pass)
1	Early-summer mowing	12
2	Mid-summer mowing	12

Pass	Type of operation	Operation time (h/pass)
3	Late-summer mowing	12
4	Extra mowing (wet year)	4

Operation time: 40 h/year

Crop protection spraying

Period: April–August
Fuel consumption: **PTO**

Pass	Type of operation	Operation time (h/pass)
1-10	Crop protection spraying	5

Operation time: 10 × 5 h = 50 h/year

Leaf removal / canopy management

Period: June–July
Fuel consumption: **PTO**

Pass	Type of operation	Operation time (h/pass)
1	First leaf removal	15
2	Second leaf removal	10

Operation time: 25 h/year

Internal transports (field & farm)
Fuel consumption: **Drawbar**

Period	Type of operation	Operation time (h/pass)
Aug–Sep	Harvest-related transport	20
Other	Materials & internal logistics	10

Operation time: 30 h/year

Total Operation time:

- **Drawbar**: 45 + 30 = 75 h/year
- **PTO**: 40 + 50 + 25 = 115 h/year

Diesel usage Scenario 1:

Diesel usage [L/ha/yr] = Fuel consumption rate [L/hr] × Hours of operation [h] ÷ Hectare [ha]

Diesel usage = ((fuel consumption rate drawbar × Hours of operation drawbar) + (fuel consumption rate PTO × Hours of operation PTO)) ÷ Hectare

Diesel usage = ((16.3 × 75) + (16.7 × 115)) ÷ 30 = 104.77

Diesel usage Cabernet Sauvignon = 104.77 L/ha/yr

Diesel usage Merlot = 104.77 L/ha/yr

Note! The diesel usage per hectare and year, will be 104,77 l/ha/yr for both grape varieties. Since the tractor operations are identical across grape varieties (which is stated by Area covered), no allocation is needed. Instead the yield per grape variety will effect the total carbon emissions from diesel usage for a certain wine product where the grapes are used.

SCENARIO 2

Tractor operations differ between grape varieties due to differences in canopy vigor, mowing frequency and harvest-related transport.

Operation time Scenario 2:

Soil cultivation & mechanical weed control

Period: March–June (+ possible late summer pass)
Fuel consumption: **Drawbar**

Pass	Type of operation	Operation time (h/pass)	Comment
1	Spring cultivation	15	Applies to both grape varieties
2	Mechanical weed control	15	Applies to both grape varieties
3	Follow-up interrow cultivation	15	Applies to both grape varieties

Operation time: 45 h/year

Interrow mowing / flail mowing

Period: May–August
Fuel consumption: **PTO**

Pass	Type of operation	Operation time (h/pass)	Comment
1	Early summer mowing	12	Applies to both grape varieties
2	Midsummer mowing	12	Applies to both grape varieties
3	Late summer mowing	12	Applies to both grape varieties
4	Extra mowing (vigorous canopy)	4	**Only applied to Cabernet Sauvignon**

Operation time: 40 h/year + 4 h extra for Cabernet Sauvignon

Crop protection spraying

Period: April–August
Fuel consumption: **PTO**

Pass	Type of operation	Operation time (h/pass)	Comment
1–10	Crop protection spraying	5	Applies to both grape varieties

Operation time: 10 × 5 h = **50 h/year**

Leaf removal / canopy management

Period: June–July
Fuel consumption: **PTO**

Pass	Type of operation	Operation time (h/pass)	Comment
1	First leaf removal	15	Applies to both grape varieties
2	Second leaf removal	10	**Only applied to Cabernet Sauvignon**

Operation time: 15 h/year + 10 h extra for Cabernet Sauvignon

Internal transports (field & farm)

Fuel consumption: **Drawbar**

Period	Type of operation	Operation time (h)	Comment
Aug–Sep	Harvest-related transport	20	Three times as high intensity for Cabernet Sauvignon
Other	Materials & internal logistics	10	Applies to both grape varieties

Operation time: 0,25 × 20 + 10 = **15 h/year + 15 h extra for Cabernet Sauvignon**

Total Operation time:

- **Drawbar**: 45 + 15 = 60 h/year + 15 h for Cabernet Sauvignon
- **PTO**: 40 + 50 + 15 = 105 h/year + 14 h for Cabernet Sauvignon

Diesel usage Scenario 2:

Diesel usage [L/ha/yr] = Fuel consumption rate [L/hr] × Hours of operation [h] ÷ Hectare [ha]

Diesel usage = ((fuel consumption rate drawbar × Hours of operation drawbar) + (fuel consumption rate PTO × Hours of operation PTO)) ÷ Hectare

- Cabernet Sauvignon:
  Diesel $usage_{shared}$ = ((16.3 × 60) + (16.7 × 105)) ÷ 30 = 91.05
  Diesel $usage_{unique}$ = ((16.3 × 15) + (16.7 × 14)) ÷ 18 = 26.57
  Diesel $usage_{total}$ = 91.05 + 26.57 = 117.62

- Merlot:
  Diesel $usage_{shared}$ = ((16.3 × 60) + (16.7 × 105)) ÷ 30 = 91.05

Diesel usage Cabernet Sauvignon = 117.62 L/ha/yr

Diesel usage Merlot = 91.05 L/ha/yr