



LIFE Project Number

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Deliverable "Report on maintenance of the action plans in the demo farms"

Sub-action B2.2 "Implementation of the soil management solutions"

LIFE+ PROJECT Soil4Wine

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Table of contents

Abstract	3
Agricultural machinery used in the implementation of demonstrative actions	4
Maintenance of action plans in demonstrative vineyards (Oct18-Oct19).....	6
DEMO FARM SP1_Az. Vitivinicola Barbuti Giuseppe	6
DEMO FARM SP2_Az. Podere Le Lame.....	8
DEMO FARM SP3_Az.Vitivinicola Visconti Massimo.....	11
DEMO FARM SP4_Az.Vini Colombi.....	12
DEMO FARM VT1_Az.Agr. La Pagliara.....	13
DEMO FARM VT2_Az.Agr. Carrà Stefano (Castello di Montichiario)	15
DEMO FARM TBC1_Az. Monte delle Vigne.....	17
DEMO FARM TBC2_Az. Vitivinicola Palazzo	19
DEMO FARM RES1, RES2 and RES DEMO.....	21
Discussion	25

Abstract

During the first project year SMART (Specific, Measurable, Achievable, Realistic and Time bounded) Action Plans to mitigate soil threats were defined for each demo farm, described in details in Deliverable B2.1 and briefly presented in Table 1. Starting from fall 2017 foreseen soil management actions by the SMART Action Plans were carried out in the demo farms and described in details in Deliverable B2.2. In the present Deliverable the actions (maintenance or corrective) implemented in Demo Farms during the last project year are described.

Table 1: brief description of the SMART Action Plans defined in sub-action B2.1 for each Demo Farm

Demo Farm	SMART Action Plan
SP1	Permanent artificial grassing with a mixture of <i>Festuca</i> , <i>Lolium</i> and <i>Poa</i> seeds (Grass B, Annex 1 of Deliverable B2.1) to reduce erosion in the inter-row, especially in the upper part of the vineyard, and to increase soil organic matter content.
SP2	Temporary grassing with Legumes and Brassica (Green Manure B, Annex 1 of Deliverable B2.1) seed mixture to limit tillage and reduce compaction and hard pan. Water logging at vineyard bottom and erosion on the top would be also reduced. Soil organic matter should be increased.
SP3	Temporary grassing with Legumes and Brassica (Green Manure A and B, Annex 1 of Deliverable B2.1) seed mixture to reduce water logging and soil compaction.
SP4	Permanent artificial grassing with species belonging to <i>Poaceae</i> and <i>Fabaceae</i> families (Grass A, Annex 1 of Deliverable B2.1) to reduce water logging in the bottom part of the vineyard, compaction and hard pan and increase soil organic matter.
VT1	Temporary grassing with Legumes and Brassica (Green Manure A, Annex 1 of Deliverable B2.1) seed mixture to reduce erosion, increase soil organic matter and increase ecosystem biodiversity. To reach this last objective <i>Phacelia tanacetifolia</i> was sown in a buffer area near the vineyard.
VT2	Temporary grassing with Leguminouse and Brassica (Green Manure A, Annex 1 of Deliverable B2.1) seed mixture to reduce erosion, increase soil organic matter and increase ecosystem biodiversity
TBC1	Permanent artificial grassing with species belonging to <i>Poaceae</i> and <i>Fabaceae</i> families (Grass A, Annex 1 of Deliverable B2.1) to reduce erosion, effects of drought and low organic matter on vine vigor. The cut biomass was then moved under the row to control weeds.
TBC2	Permanent grassing with Legumes (Grass C, Annex 1 Deliverable B2.1) to increase soil organic matter, promote vine vigor and water movement in soil.
RES1	Preliminary superficial water control followed by underground drainage within the vineyard and permanent grassing of headlands (different species, pure or in mixture, see Deliverable B2.1) to control water logging and soil compaction.
RES2	Preliminary superficial water control followed by underground drainage and restoration of damaged inter-row due to severe erosion processes
RES DEMO	Permanent and temporary grassing with different seed mixtures (sowed in Demo Farms and additional ones) to compare seed mixtures features and behavior in same environmental conditions and verify changes in trafficability using several permanent grass solutions (microthermal and macrothermal species) to track movement.

Agricultural machinery used in the implementation of demonstrative actions

To perform the actions described in Table 1 specific agricultural machinery were rent from a subcontractor. In particular a combined machine, composed by a power harrow, a seeding bar and a rear roller (*Figure 1*), specifically designed for inter-row sowing was used. When soil was hard and compact, a subsoiler was used to lightly till the inter-row before sowing.



Figure 1: sowing machine used in Soil4Wine demonstrative vineyards

Cutting of green manure was performed with a mower (*Figure 2 a and b*). After partial drying, biomass was incorporated into the ground with a rotary tiller (*Figure 2 c*) down to a 10 cm depth.



Figure 2: a,b) mower c) soil incorporation with rotary tiller

Maintenance of action plans in demonstrative vineyards (Oct18-Oct19)

DEMO FARM SP1_Az. Vitivinicola Barbuti Giuseppe

Activities		Notes
Sowing	16 th October 2018	Manual sowing (<i>figure 3</i>) performed only in vineyard portions where the grass did not grow last year; sowing dose was 110 kg/ha, higher than the previous to guarantee a better coverage.
Cut	2019: May, beginning of July and beginning of August	Three cuts were performed: in May 2019, beginning of July 2019 and beginning of August 2019, one time more than the previous year confirming that it was a more favorable growing season.



Figure 3: Demo Farm SP1 - Manual sowing October 2018

UCSC and HORTA visited the Demo Farm SP1 demonstrative vineyard 5 times after sowing (28/03/19, 16/04/2019, 07/05/19, 17/06/19, 16/07/2019) (*Figure 4 and 5*) to evaluate the growth of the grass and management actions. The corrective action, i.e. manual sowing in October 2018 in the upper part of the vineyard enabled to enhance grass covering and reduce erosion during rainy seasons.



Figure 4: Demo Farm SPI- Demonstrative vineyard, innovative plot with permanent grass (left) compared to traditional plot with interrow tillage (right) on 28 March 2019.



Figure 5: Demo Farm SPI- Demonstrative vineyard (left) and innovative plot with permanent grass during the floristic evaluation (right) performed on the 7th of May 2019.

DEMO FARM SP2_Az. Podere Le Lame

Activities		Notes
Sowing	17 th October 2018	Green Manure B was sowed in demonstrative vineyard to reduce erosion, enhance soil organic matter content and vine vigor (<i>Figure 6</i>). Sowing dose was 90 kg/ha
Cut	23 rd May 2019	<i>Figure 8</i>
Soil incorporation	10 th June 2019	Cut biomass should have been left on the soil for just a few days to semi-dry before soil incorporation. Unfortunately, a rainy period started just after biomass cut and incorporation into the soil (<i>Figure 9</i>) could only be performed on the 10 th of June.



Figure 6: Demo Farm SP2 demonstrative vineyard sowing October 2018

UCSC and HORTA visited Demo Farm SP2 demonstrative vineyard three times after sowing (28/03/19, 16/04/2019, 07/05/19) for monitoring the grass growth and two times for management actions (cut on 23/05/2019 and soil incorporation on 10/06/2019) (*Figure 7*). Since first monitoring visit the growth of seeded species was evident, especially that of *Pisum sativum*, *Brassica nigra* and horse radish.



Figure 7: Demo Farm SP2 demonstrative vineyard at different monitoring dates in 2019; In the right corner a particular of a horse radish taproot and the consequent creation of holes in the soil to reduce water stagnation.



Figure 8: cut of green manure in Demo Farm SP2 – May 2019



Figure 9: soil incorporation of fresh and dried biomass in Demo Farm SP2 – June 2019

DEMO FARM SP3_Az.Vitivinicola Visconti Massimo

Unfortunately, this demonstration vineyard was lost: the farmer decided to eradicate the plot because of the high incidence of wood diseases that compromised production. A letter with the justifications of the farmer was sent to prof. Stefano Poni (Project Coordinator -UCSC) in May 2019 (the letter is attached to Final Report).

DEMO FARM SP4_Az.Vini Colombi

Activities		Notes
Sowing	16 th October 2018	Manual sowing of Grass A was performed in October 2018 only in vineyard portions in which the grass did not grow last year; sowing dose was 65 kg/ha, higher than the previous to guarantee a better coverage (<i>figure 10</i>).
Cut	30 th May 2019	Only one cut was performed by the farmer at the end of May



Figure 10: Demo Farm SP4 demonstrative vineyard during manual sowing October 2018

UCSC and HORTA visited Demo Farm SP4 demonstrative vineyard 4 times after sowing (on 28/03/19, 16/04/2019 and 16/07/2019 for the evaluation of grass growth and on 07/05/2019 for the floristic evaluation - *Figure 11*) and one time for management action (cut on 30/05/2019).

During visit the covering of grass was visually assessed. Covering was uniform in inter-rows not affected by machine passage. No water logging was detectable in the area with higher incidence of the threat as identified in the action plan.



Figure 11: Demo Farm SP4 demonstrative vineyard during monitoring visits.

DEMO FARM VT1_Az.Agr. La Pagliara

Activities		Notes
Sowing	17 th October 18	Green Manure A was sowed to reduce soil erosion, soil compaction and hard pan and to increase soil organic matter content. Sowing dose was 90 kg/ha (Figure 12) The biodiversity buffer area with <i>Phacelia tanacetifolia</i> was sown manually at the same time (Figure 13)
Cut	29 th May 2019	Grass cut was performed by the farmer
Soil incorporation	10 th June 2019	Cut biomass should have been left on the soil for few days to semi- dry before soil incorporation. Unfortunately, a rainy period started just after biomass cut and incorporation into the soil could only be performed on the 10 th of June.



Figure 12: Demo Farm VT1 demonstrative vineyard during sowing – October 2018



Figure 13: Demo Farm VT1 demonstrative vineyard during sowing of the biodiversity buffer area with *Phacelia tanacetifolia* – October 2018

Deliverable B2.3

Report on maintenance of action plans in the demo farms

Soil4Wine LIFE15 ENV/IT/000641

UCSC and HORTA visited Demo Farm VT1 demonstrative vineyard 3 times after sowing (on 28/03/19 and 19/04/2019 for grass growth monitoring and on 02/05/18 for the floristic evaluation - *Figure 14 and 15*) and one time for management actions (green manure incorporation on June).



Figure 14: Demo Farm VT1 demonstrative vineyard at different monitoring dates in 2018

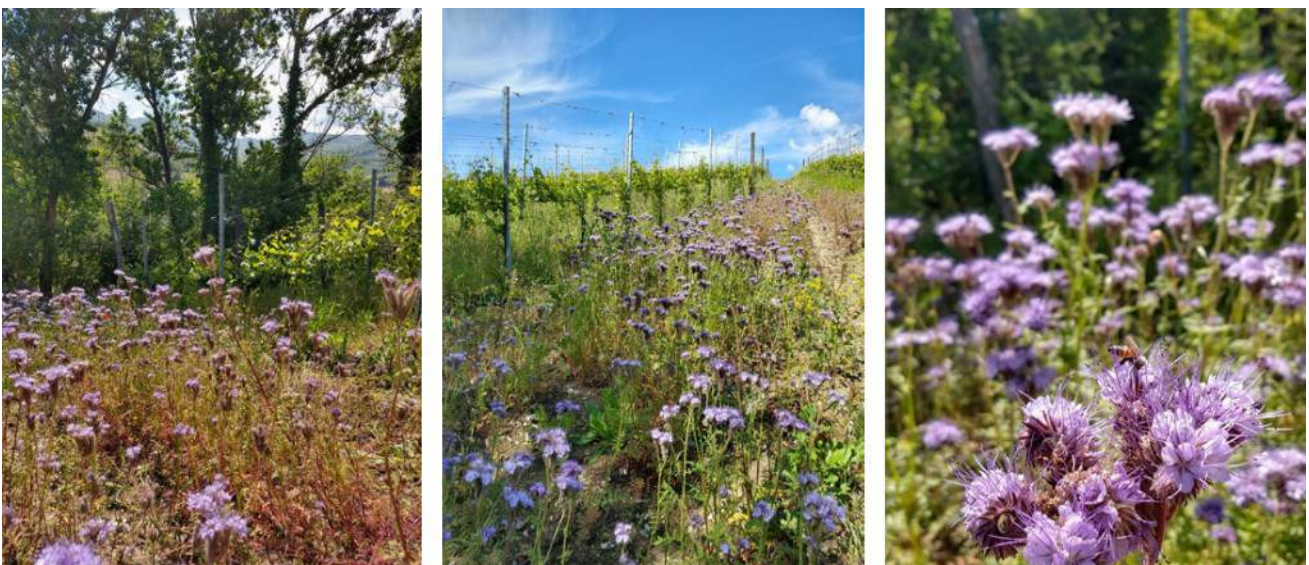


Figure 15: Demo Farm VT1 biodiversity buffer area in Summer 2019

DEMO FARM VT2_Az.Agr. Carrà Stefano (Castello di Montichiaro)

Activities		Notes
Sowing	17 th October 2018	Green Manure A was sown to reduce soil erosion, soil compaction and hard pan and to increase soil organic matter content (<i>Figure 16</i>). Sowing dose was 90 kg/ha (<i>Figure 16</i>)
Cut	23 rd May 2019	<i>Figure 18 a,b</i>
Soil incorporation	10 th June 2019	Cut biomass should have been left on soil for a few days to semi-dry before soil incorporation. Unfortunately, a rainy period started just after biomass cut and incorporation into the soil could only be performed in the 10 th of June (<i>Figure 18c</i>).



Figure 16: Demo Farm VT2 demonstrative vineyard during soil management before sowing – October 2018

UCSC and HORTA visited Demo Farm VT2 demonstrative vineyard 5 times after sowing (on 28/03/19 and 19/04/2019 for grass growth monitoring, on 02/05/18 for the floristic evaluation - *Figure 17*- and on 23/05/19 and 10/06/19 for management actions).

Growing of biomass was uniform along slope. In early monitorings (28/03/2019) *Grasses* were dominant and *Faba minor* was recognizable. From May biodiversity increased and all species of the seed mixture were identified in the vineyard.



Figure 17: Demo Farm VT2 demonstrative vineyard on 2nd May 2019.



Figure 18: Demo Farm VT2 demonstrative vineyard during cut of green manure in Demo Farm VT2 on 23rd May 2019 (a,b) and soil incorporation of dried biomass on 10th June 2019 (c).

DEMO FARM TBC1_Az. Monte delle Vigne

Activities		Notes
Sowing	1 th October 2018	Due to weak grass growth during season 2018 a new sowing was performed in autumn 2018 with a higher sowing dose (65 kg/ha) (<i>Figure 19</i>)
Cut	6 th June 2019	One cut was performed in June 2019 using a special mulcher that moved the biomass cut under the row to control weeds.



Figure 19: Demo Farm TBC1 demonstrative vineyard during sowing 2018.

UCSC and HORTA visited Demo Farm TBC1 demonstrative vineyard 4 times after sowing (26/03/2019, 15/04/2019, 07/05/2019 and 15/07/2019) (*Figure 20*) for interrow grassing monitoring and on the 6th of June for the grass cutting and biomass moving under the row (*Figure 21*).



Figure 4: Demo Farm TBC1 demonstrative vineyard at different monitoring dates in 2019.



Figure 21: Demo Farm TBC1 demonstrative vineyard during grass cutting and biomass moving under the row on the 6th of June 2019 – a) before cutting, b) during cutting, c) detail of moved biomass under the row.

DEMO FARM TBC2_Az. Vitivinicola Palazzo

Activities		Notes
Sowing	16 th October 2018	sowing was performed in autumn 2018 (dose 50 kg/ha) (<i>Figure 22</i>)
Cut		No cuts were performed since the growth of the sown species was quite poor.



Figure 22: Demo Farm TBC2 demonstrative vineyard during sowing 2018.

UCSC and HORTA visited Demo Farm TBC1 demonstrative vineyard 4 times after sowing (26/03/2019, 15/04/2019, 07/05/2019 and 15/07/2019) (*Figure 23*).



Figure 53: Demo Farm TBC2 demonstrative vineyard at different monitoring dates in 2019.

DEMO FARM RES1, RES2 and RES DEMO

Activities		Notes
RES1 – Drainage		No maintenance actions were needed, only monitoring of the efficacy of the drainage was performed (<i>Figure 24</i>)
RES2 - Drainage	18-19 th October 2018	Positioning of drains and reestablishment of damaged row (<i>Figure 25</i>).
	26 th March 2019	Monitoring of the efficacy of the drainage (<i>Figure 26</i>)
RES DEMO - sowing	23 rd October 2018,	Only green manures were sown, since the other mixtures are permanent (<i>Figure 27</i>).
	24 th May and 3 rd June 2019	Green manures cut and incorporation into the soil



Figure 24: RES1 demonstrative vineyard in November 2018; a) inter-row with drain, b) inter-row without drain, c) detail of drain presence.



Figure 25: Drainage installation in RES2 demonstrative vineyard in October 2018



Figure 26: Monitoring of the drain, March 2019



Figure 27: Sowing of different green manures at RES_DEMO demonstrative vineyard in October 2018

UCSC and HORTA visited RES_DEMO demonstrative vineyard 3 times after sowing (28/03/2019, 07/05/2019 and 16/07/2019) for interrow grassing growth monitoring (*Figure 28 and 29*).



Figure 28: different inter-row grassing at RES_DEMO demonstrative vineyard in March 2019; a) and c) *Cynodon*, b) *Medicago sativa* and d) *Vicia faba*



Figure 28: different inter-row grassing at RES_DEMO demonstrative vineyard in May 2019.

Discussion

Considering difficulties encountered in the first year, sowing of green manures was anticipated to obtain early growing in more favorable conditions. In general, all inter-row sowed mixtures developed better than the first year. Permanent grasses were completely sown again or integrated by performing hand sowing in bare soil areas and these corrective actions did successfully improve grass growth and soil coverage in the second year.

For other consideration related to all factors monitored during the season see Deliverable “*Second report on SWOT analysis of soil and plant data in the considered vineyards*”.