

Qualitative Study Agrarian Soil Contaminated by Crude Oil in the Town of the North-East of Algeria

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Abstract

The qualitative study of soils contaminated by crude oil was essentially based on the survey and observation of the different plots from arable cropping patterns. It aims to establish a diagnosis on the state of soil contaminated with crude oil spilled accidentally during a break in a section of the pipeline that runs through farms in the town of Ain Smara in the nord-east Algeria

Keywords: Algeria- Ain Smara- farm- oil- pollution - soil profiles.

Introduction

The qualitative study of soil pollution by crude oil into cultivable land parcels in the municipality of Ain Smara was undertaken to establish in the light of scientific and technical knowledge about the leak of crude oil. It was produced at the farm level individualized, collective and private (EAI - EAC - PP). These farms are located in the area across the pipeline linking Hassi Messaoud - Skikda (oil). Our perimeter of study includes a section between the terminals from 1124 to 1126 where the supposed leaks were found. This conduct is buried in the basement at a depth of 1.20 m [1].

To respond quickly enough to the concerns of farmers and officials of the town that we have made this preliminary study or qualitative whose main objective was to identify the problem in its entirety, without claiming him in such a short time all solutions, practical recommendations stemming

preliminary thoughts on the observations and the data collected. But an analytical phase will be needed as soon as possible to answer or clarify affirm or reverse the results of this qualitative study.

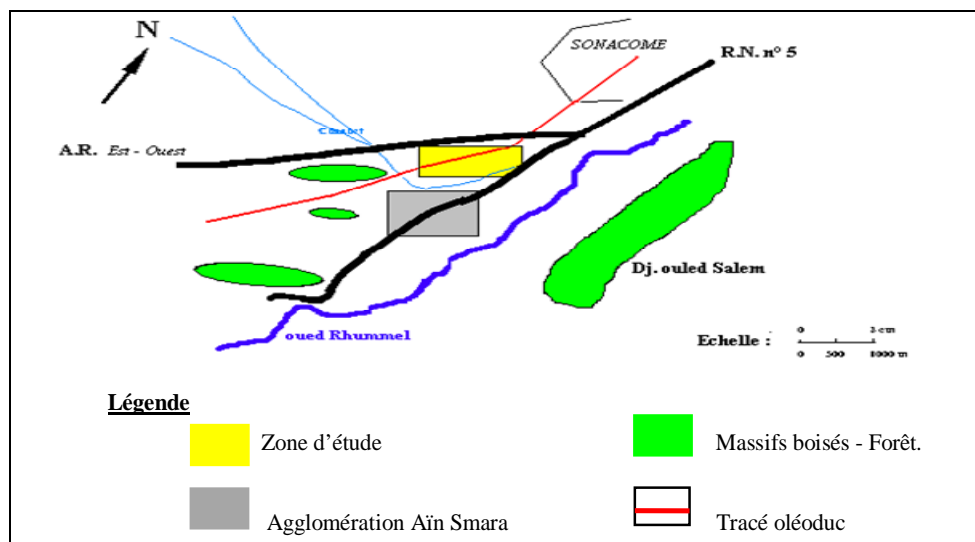
1. Presentation of the Study Area and Land Use

1.1. Presentation of the Study Area

The study area is located approximately twenty kilometres from the city of Constantine, the capital of north-eastern Algeria. It includes the rural commune of Ain Smara and the different neighbouring farms involved in the study. The scope of study is inserted between two roads:

- To the south by the National Highway No. 5 between Constantine, Algiers.
- In the north by the motorway, which by passes the agglomeration of Ain Smara (Figure 1).

Figure 1: Location map of the study area (Landscape Architecture2004 Ltd.)



It is administratively part of the town of Ain Smara, which is at an elevation of 680 meters, located in southwestern Constantine [2,3].

This region is characterized by a micro-climate defined by:

- An irregular rainfall when the total annual rainfall is relatively low.
- A drought that lasts the month of April to September [4]

Topographiquement perimeter study is very heterogeneous. It presents various shaped parcel resulting from variations in slopes. In recent inclinations sometimes present longitudinal oriented west to east, sometimes cross-oriented North-South cooperation. The slopes vary from 0 to 15% (Table 1, figure2).

Figure 2: Pendages piecemeal plan (Landscape Architecture2004 Ltd.)

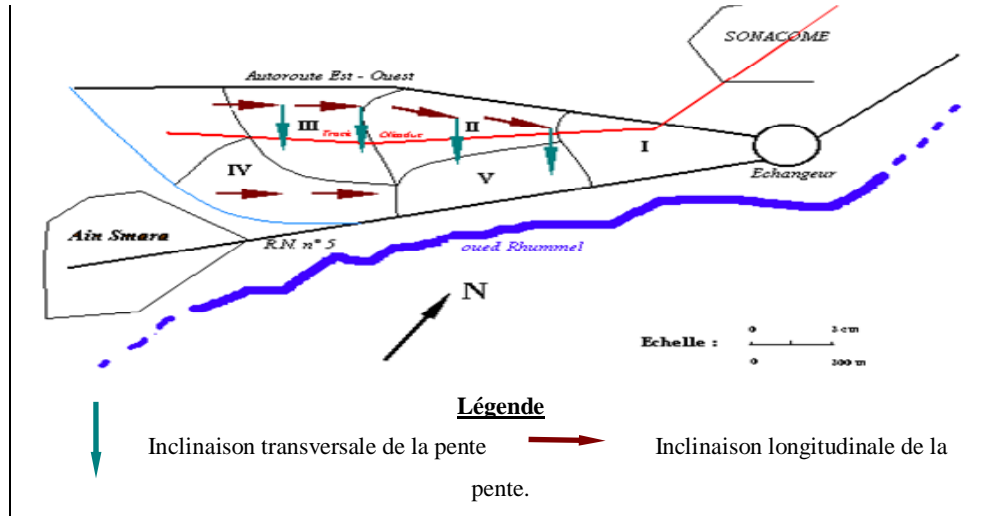


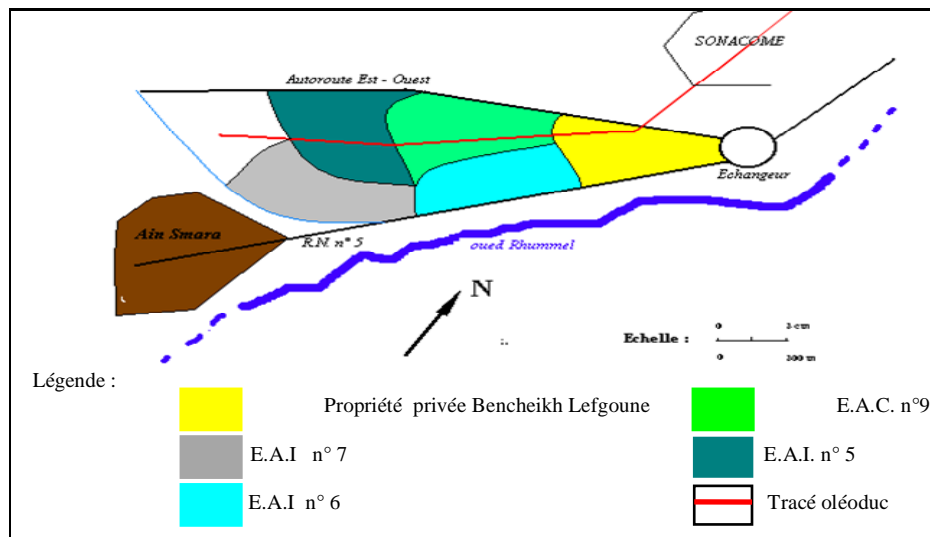
Table 2: Percentage slopes of different farms

Désignation	Type of property	Rate slope
Parcel I	Private property Bencheikh Lefgoune	00 - 02 %
Parcel II	E.A.C. n° 9	05 - 08 %
Parcel III	E.A.I. n° 5	05 - 10 %
Parcel IV	E.A.I. n° 7	05 - 08 %
Parcel V	E.A.I. n° 6	00 - 02 %

1.2. Current Occupation Soil

The scope of study covers an area of about 50 hectares. He left according to plan piecemeal in Figure 3. It consists of collective farms and individualized (EAC - EAI) and private property (PP) [5].

Figure 3: Plan parcel of the study area (Landscape Architecture2004 Ltd.)



The holdings covered by the study are:

- E.A.I No. 5 led by Fodil Boulaïnine
- E.A.I No. 6 led by Rabah Haloufi
- E.A.I No. 7 led by Messaoud Azzizi
- E.A.C No. 9 Belkarfa
- Private ownership of Bencheikh Lefgoune

The land use of these farms is shown in the Table 3 and illustrated on (photos 1-2-3-4)

Table 3: Land use of different cultures.

Type Culture	Area (Hectare)	Percent (%)
Field Crops (Cereal crops)	38	76
Gardening	05	10
Arboriculture (Apple)	1,25	02,5
Earth naked. Surfaces Ploughed	05,75	11,5
Total	50	100

Photo1: Wheat (*Triticum durum* variety WAHA)



Photo 2 : Vegetable crops.

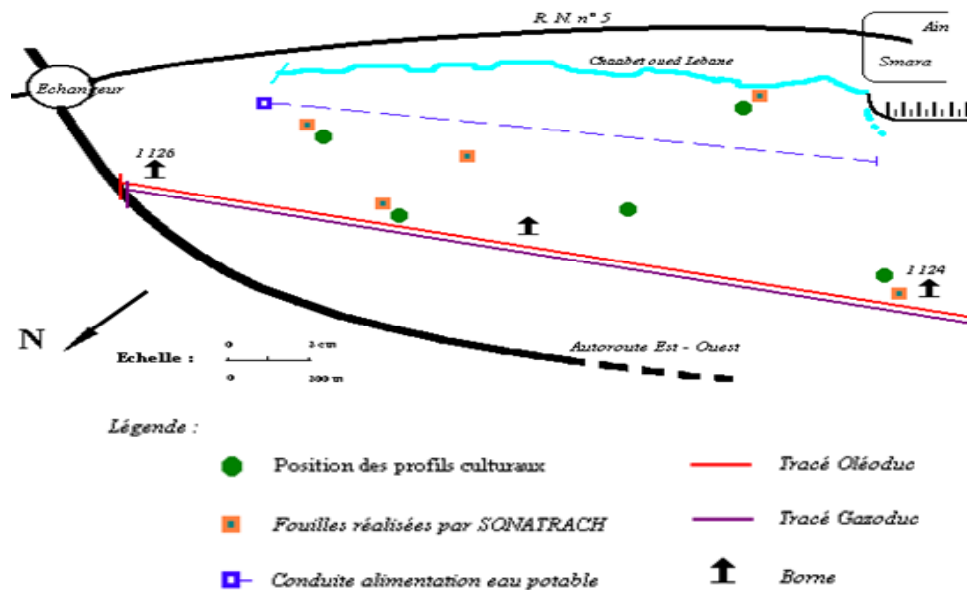


Photo 3: apple orchard of its kind**Photo 4:** Land tilled

2. Study Method

The study soil that we have firm aims to detect the possible presence of crude oil in different backgrounds at the morphological description of cropping patterns. It is based primarily on the statement and visual observation of the different plots from arable cropping patterns. The latter aims to establish a diagnosis of the state of the ground. It enables analysis qualitatively succession of these diverse backgrounds and determine their properties. Using the same cultural profile, we can establish the presence or absence of an exogenous factor that is not part and parcel of ground for a pollutant or contaminant [6]. Choice of positioning Profiles cropping is not random. This choice is dictated more by a concern for soil pollution. It is for this sole reason that we have positioned cropping patterns where the presence of crude oil was discovered during excavations in the basement. These were carried out by SONATRACH (Regional Direction of Transportation Pipeline) (Figure 4). To arrive at a perfect knowledge of the ground, at a farming profile must be added by the quantitative analyses of the ground [7].

Figure 4: Positioning cropping patterns (Landscape Architecture2004 Ltd.)



2.1. Description Morphological Profiles Cultureux

The morphological description of cropping patterns is a qualitative method based on the observation of different profiles [8,9]. It allows us to:

- Detect the possible presence of crude oil in the depths of the cultural profile which is the part of the arable land.
- Describe the physical and biological parameters of the soil can vary in cases where the crude oil was contaminated

In order to achieve a perfect knowledge of the soil, the cultural profile should be added quantitative analyses of the soil.

Position Profile I: (EAI No. 5 Boulaïnine Fodil)

Classification: Sol brown calcium classification according to French.

Coordinates: Latitude: 36 ° - Length: 6 ° -40 East

Altitude: 675 - 680 meters

Geomorphology: Land sloping

Geology: Roche mother slate

Erosion: Erosion moving water with fines in this case the slime

Drainage: Poor

Slope: 8 to 10%

Vegetation: Culture durum wheat (*Triticum durum* varieties) WAHA.

Comments: Presence of an old excavation of the basement directed by SONATRACH. Lack of crude oil on the tillable soil.

The profile includes two horizons:

1st Horizon

(00-05 cm) Horizon superficial sec - not crude oil - Color 10 YR 5 / 2 (gawish brown) - compact little - silty clay texture - prismatic angular structure - biological activity average - quite low organic matter - with strong reaction HCl, the presence of calcium carbonate (CaCO₃) - pH_{H2O} = 8,14 - pH_{KCl} = 6,88

2nd Horizon

(05 - 30 cm) deep Horizon cooler - not crude oil - 10 color YR 4 / 2 (dark brown grawish) - very compact presence felting root - moderately rich in organic matter - silty clay texture - prismatic structure - activity Biological not apparent - positive reaction with HCl demonstrating the presence of calcium in the form of calcium carbonate (CaCO_3) - $\text{pH}_{\text{H}_2\text{O}} = 7,89$ - $\text{pH}_{\text{KCl}} = 6,86$

Position Profile II: (EAI No. 6 Haloufi Rabah)

Classification: Sol brown calcium classification according to French.

Coordinates: Latitude: 36 ° -16 North - Length: 6 ° - East 38

Altitude: 670 meters

Geomorphology: Terrain fairly flat

Geology: Roche mother slate

Erosion: Absent

Drainage: Very badly drained - presence of a merdja (swamp)

Slope: <02%

Vegetation: Culture durum wheat (*Triticum durum*)

Comments: Presence of crude oil on the surface of the soil. The contaminated surface is not more than 1000 square meters (photo 5)

Photo No. 5: Parcel superficially contaminated by oil

**1st Horizon**

(00-03 cm) Horizon very oily surface by crude oil - Color 7.5 YR 3 / 2 (dark brown) - compact little - texture silt and clay - little apparent structure - crusts drying on the surface - no activity Biological - low organic matter - positive reaction with HCl attesting to the presence of calcium in the form of calcium carbonate (CaCO_3) - $\text{pH}_{\text{H}_2\text{O}} = 7,18$ - $\text{pH}_{\text{KCl}} = 6,76$

2nd Horizon

(03 - 25 cm) Horizon oil cooler and by crude oil - 10 color YR 6 / 2 (light brownish gray) - compact - low organic matter - silty clay texture - polyhedral structure weak - no activity Biological - positive reaction with HCl demonstrating the presence of calcium in the form of calcium carbonate (CaCO_3) - $\text{pH}_{\text{H}_2\text{O}} = 7,25$ - $\text{pH}_{\text{KCl}} = 7,02$

3rd Horizon

(> 25 cm) deep and Horizon costs - lack of crude oil - 10 color YR 5 / 2 (grayish brown) - very compact - low in organic matter - silty clay texture - polyhedral structure - no biological activity - positive reaction HCl with demonstrating the presence of calcium in the form of calcium carbonate- (CaCO_3) - $\text{pH}_{\text{H}_2\text{O}} = 7,35$ - $\text{pH}_{\text{KCl}} = 7,06$

Position profile III: (EAI No. 7 Azzizi Messaoud)

Classification: Sol brown calcium classification according to French.

Coordinates: Latitude: 36 ° -18 North - Length: 6 ° - East 39

Altitude: 675 meters

Geomorphology: Plot average slope

Geology: Roche mother slate

Erosion: Absent

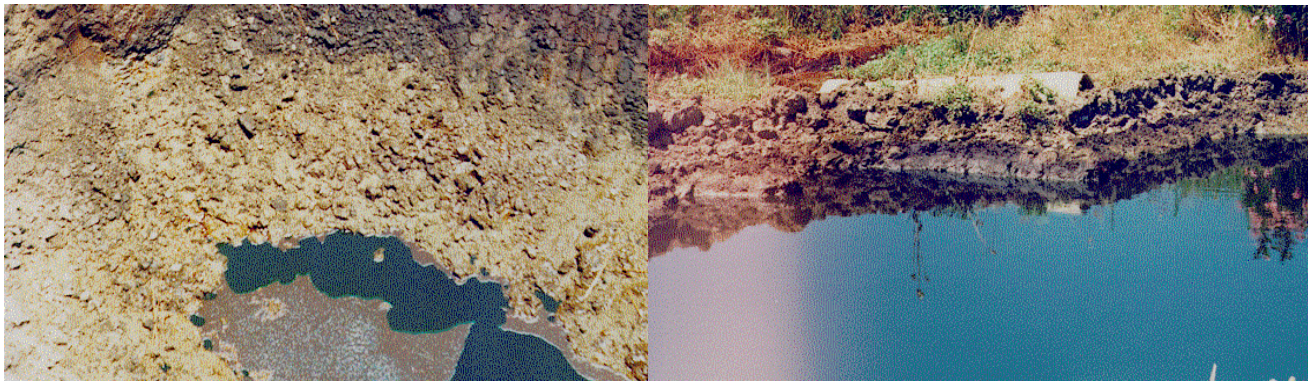
Drainage: Poor

Slope: 03 - 05%

Vegetation: Orchard apple Malus genus.

Comments: None presence of crude oil along the cultural profile by the excavation of the basement conducted by SONATRACH, to a depth of 3 to 4 meters, evidenced by its presence. Crude oil is much more present on the surface of the water in the wadi chaabet Lebane adjacent to the farm. (Photos 6-7)

Photo N° 6 -7: Presence of crude oil in the excavation conducted in the basement and in the wadi



The profile includes two horizons:

1st Horizon

(00-10 cm) Horizon very dry - not crude oil - Color 10 YR 5 / 2 (gawish brown) - compact little - texture silt and clay - prismatic structure - the presence of cracks - some roots - biological activity average - relatively poor organic matter - very strong reaction with HCl demonstrating the presence of calcium in the form of calcium carbonate (CaCO_3) - $\text{pH}_{\text{H}_2\text{O}} = 7,89$ - $\text{pH}_{\text{KCl}} = 7,20$

2nd Horizon

(10 - 30 cm) Horizon sec - not crude oil - 10 color YR 6 / 1 (gray) - very compact - low organic matter - silty clay texture - polyédrique angular structure - no roots - apparent biological activity - very strong reaction with HCl demonstrating the presence of calcium in the form of calcium carbonate(CaCO_3)- $\text{pH}_{\text{H}_2\text{O}} = 7,96$ - $\text{pH}_{\text{KCl}} = 6,95$

Position profile IV: Private property Bencheikh Lefgoune

Classification: Sol brown calcium classification according to French

Coordinates: Latitude: 36 ° -14 North - Length: 6 ° - East 39

Altitude: 670 - 672 meters

Geomorphology: Land flat

Geology: Roche mother slate

Erosion: Absent

Drainage: Mal drained

Slope: <02%

Vegetation: Lack of vegetation

Comments: Presence of crude oil at a depth of 03 to 04 metres from the excavation of the basement directed by SONATRACH (photo 8)

The profile contains two horizons:

1st Horizon

(00-05 cm) Horizon superficial costs with a limited presence of crude oil - Color 10 YR 5 / 1 (gray) - fairly porous - silty clay texture - polyhedral structure and fine granular - horizon with felting roots - biological activity average -- horizon moderately rich in organic matter - effervescence with HCl attesting to the presence of calcium in the form of calcium carbonate(CaCO_3) - $\text{pH}_{\text{H}_2\text{O}} = 7,57$ - $\text{pH}_{\text{KCl}} = 6,87$

2nd Horizon

(05 - 30 cm) Horizon deeper and fees - no crude oil - 10 color YR 5 / 2 (grayish brown) - less porous than the horizon surface - less rich in organic matter than the surface horizon - clay texture - silty - prismatic structure - absent biological activity - effervescence with HCl attesting to the presence of calcium in the form of calcium carbonate (CaCO_3) - $\text{pH}_{\text{H}_2\text{O}} = 7,53$ - $\text{pH}_{\text{KCl}} = 7,03$

Position profile V: (E.A.C Belkarfa)

Classification: Sol brown calcium classification according to French.

Coordinates: Latitude: 36° -15 North - Length: 6° - East 40

Altitude: 675 - 680 meters

Geomorphology: Land sloping

Geology: Roche mother slate

Erosion: Moving items purposes - erosion claws

Drainage: Fairly badly drained

Vegetation: Culture durum wheat (*Triticum durum*)

Comments: Presence of an old excavation of the basement directed by SONATRACH. Contamination by crude oil would be possible during the winter period but not visible at the time of our study.

The profile has two horizons:

1st Horizon

(00-10 cm) Horizon superficial sec - the alleged presence of crude oil has been detected in the observation - Color 10 YR 5 / 1 (gray) - compact little - texture silt and clay - prismatic structure - activity Biological absent - low organic matter - positive reaction with HCl demonstrating the presence of calcium in the form of calcium carbonate(CaCO_3) - $\text{pH}_{\text{H}_2\text{O}} = 7,57$ - $\text{pH}_{\text{KCl}} = 6,87$

2nd Horizon

(10 - 30 cm) Deep Horizon - rather cool - not crude oil - 10 color YR 5 / 2 (grayish brown) - compact - silty clay texture - prismatic structure angular non-biological activity apparent - positive reaction with HCl, presence of calcium in the form of calcium carbonate(CaCO_3) - $\text{pH}_{\text{H}_2\text{O}} = 7,53$ - $\text{pH}_{\text{KCl}} = 7,03$

3. Results and Discussion

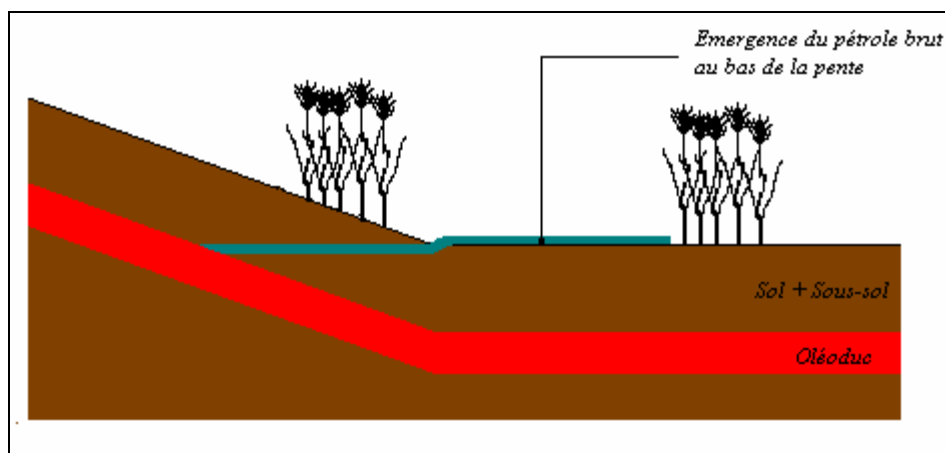
3.1. Interpretation Comments Cropping Profiles

In view of comments from crop profiles positioned, we can say that:

- plan on soil: the plots have studied brown soil calcium. The profile has a limestone base reaction in all walks of life. The limestone is now active both at the surface and in depth. The texture profiles crop is quite heterogeneous. It is sometimes silt and clay in plots located at the

- bottom of slopes, sometimes silty clay in the parcels located at the top of the slopes. The profiles revealed cropping poverty in organic matter. These soils are brown calcium for cereals.
- in terms of pollution caused by crude oil: Crude oil leakage in the basement can be considered as a source of chemical contamination of the fringe cultivable. The latter consists of two or three top-layers to a depth of 0.45 meters. According to the observations made on cropping patterns, we note the complete absence of capillary rise of crude oil in the surface soil horizons. The increase capillary physical phenomenon is applicable only for fractions viscosity liquids having a very low or zero like water [10,11,12]. Farms E.A.I. No. 6, E.A.C. No. 9 and private property Lefgoune Bencheikh, located at the bottom of slopes have a limited emergence of crude oil. The latter is probably due to the rise in the water table during the winter period. She is also encouraged by the model of the field as evidenced in Figure 5.

Figure 5: Schematic of the emergence of crude oil (Landscape Architecture 2004 Ltd.)

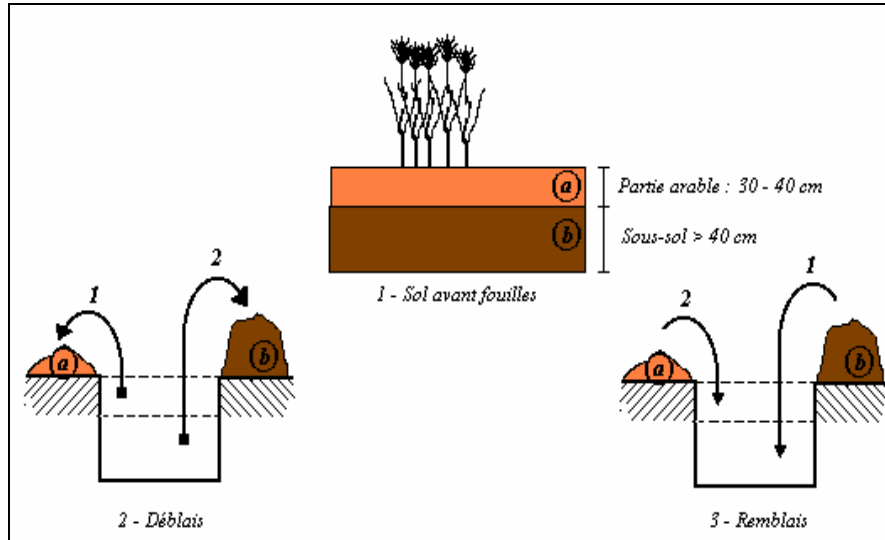


We have also noted the presence of crude oil in Lebane chaabet wadi next to the operating EAI No. 7. Being less dense than water, crude oil formed on the surface a thin layer oily.

3.2. Recommendation

This recommendation is addressed to (SONATRACH - Regional Direction of Transportation Pipe Skikda). In cases where searches are undertaken to detect leakage of crude oil, or perform other work, it is desirable that the excavation operations are conducted according to the diagram in Figure 6.

- 1 In the rubble: strip the top layer, which represents the portion of arable 30 to 40 cm deep. The drop left of the trench. Then strip the basement and file on the right side of the trench.
- 2 At embankments: Bridging the basement of the land by right. Then fill the hole with the left.

Figure 6: Outline on the operations of searching (Landscape Architecture 2004 Ltd)

4. Conclusion

The qualitative study based on observations of soil and different cultures we were able to draw the following conclusions. On the chemical leak of crude oil is not a source of contamination of the arable. Indeed, crude oil is a natural product degradable (photodegradable - biodegradable) from the Millennium decomposition of organic matter [13]. It is mainly composed of carbon and hydrogen. These two elements are part of major minerals returning to the constitution normal soil. They can not be seen as polluting chemical soil. By contrast the physical, the emergence superficial crude oil has temporarily altered certain physical parameters, such as soil porosity - permeability and structural stability. Tillage, represented by ploughing and how superficial healed the physical parameters generated.

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